DELTAPORT THIRD BERTH EXPANSION PROJECT

COMPREHENSIVE STUDY REPORT

With Respect to
The Requirements of a Comprehensive Study
Pursuant to the *Canadian Environmental Assessment Act, SC 1992, c. 37*

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Prepared by

Fisheries and Oceans Canada
and
Environment Canada

Government of Canada | Gouvernement du Canada | Canada

EXECUTIVE SUMMARY

PURPOSE OF THIS REPORT

This Report is designed to describe the Deltaport Container Terminal Third Berth Project (Project), assess its potential environmental effects, identify the measures required to mitigate any adverse environmental effects of the Project and evaluate the significance of any residual adverse environmental effects following the implementation of appropriate mitigation.

This Report constitutes a **Comprehensive Study Report** (CSR) to satisfy the requirements of the *Canadian Environmental Assessment Act* (CEAA). This Report has been prepared jointly by Fisheries and Oceans Canada (DFO) and Environment Canada (EC) as federal Responsible Authorities (RAs). The basis for this Report was developed through a cooperative assessment conducted with British Columbia Environmental Assessment Office (EAO).

PROJECT DESCRIPTION

The Project has been proposed by the Vancouver Port Authority (the Proponent) to expand the existing Deltaport Container Terminal (Deltaport) at Roberts Bank in Delta, British Columbia (see Figure A).

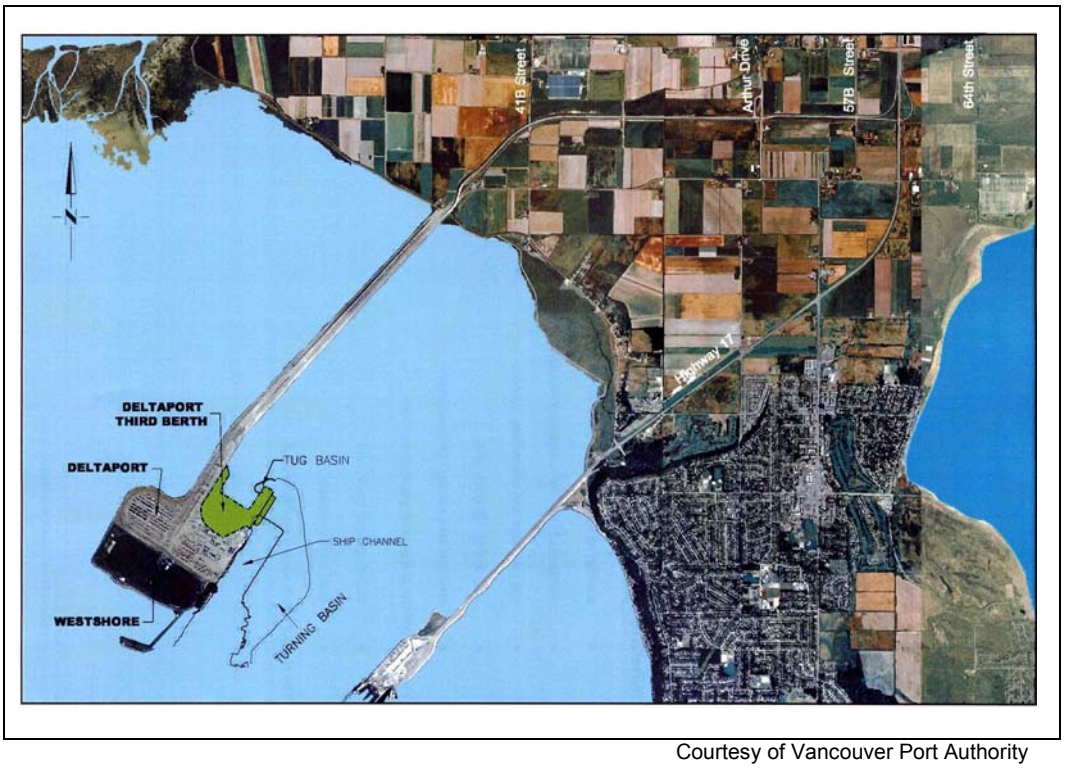
The Project consists of construction and operation of a caisson supported wharf to accommodate an additional berth and approximately 22 ha of fill to accommodate an expanded container storage yard. The Project also includes dredging to deepen the existing ship channel and create a tug moorage area adjacent to the terminal. Rail upgrades are proposed within existing rail rights-of-way and upgrades to existing roads and highways have also been proposed.

The estimated capital cost of the Project is approximately $272 million. Construction is expected to take about 32 months to complete. The Proponent has proposed starting construction in the fall of 2006.

PURPOSE OF PROJECT

The primary purpose of the Project is to provide additional container terminal facilities to increase the Proponent's competitiveness in the Pacific Northwest container market. The Proponent predicts that North American container volumes will grow at a rate greater than the economy through 2020, and Pacific Northwest ports, including the Port of Vancouver, are expected to capture an increasing share of west coast container traffic.

The Proponent has an overall expansion strategy that consists of: increasing production at existing terminals, expanding existing facilities, and exploring options for new facilities. The Proponent has provided details on the proposed Vancouver container port expansions and the rationale for the specific third berth expansion at Roberts Bank. The Project also constitutes a significant component of the federal *Pacific Gateway Strategy that was* announced in October 2005.



Courtesy of Vancouver Port Authority

Figure A: Location of Project

PROVINCIAL AND FEDERAL ENVIRONMENTAL ASSESSMENTS

The Project triggers a federal EA under CEAA because Fisheries and Oceans Canada (DFO) and Environment Canada (EC) will be required to issue statutory or regulatory approvals for various aspects of the Project, which are listed on the *Law List Regulations* of CEAA. Specifically required would be an authorization pursuant to section 35(2) of the *Fisheries Act* and a permit under section 127(1) of the *Canadian Environmental Protection Act (*CEPA*)* for disposal at sea.

The Project type is included in section 28(c) of the *Comprehensive Study List Regulations* under CEAA, pursuant to the proposed construction, decommissioning or abandonment of a marine terminal designed to handle vessels larger than 25,000 DWT. Subsequent to a public consultation period, the federal Minister of the Environment confirmed on December 17, 2004 that the assessment would be conducted by means of a comprehensive study.

Natural Resources Canada (NRCan), Transport Canada (TC), and Health Canada (HC) all provided specialist advice to the assessment, in their role as Federal Authorities (FAs).

An environmental assessment is also required under the *Canada Port Authority Environmental Assessment Regulations*, SOR/99-318. Because the Project is described in the *Comprehensive Study List Regulations*, a comprehensive study and the preparation of a comprehensive study report is also required. By virtue of s. 8 of the *Canada Port Authority Environmental Assessment Regulations* and s. 2(1) and (2) of CEAA, the VPA, DFO and EC have agreed to follow the process set out in CEAA for the purpose of the environmental assessment of the DP3 Project. This Report will also be referred to the federal Minister of Transport to fulfill the requirements of the *Canada Port Authority Environmental Assessment Regulations.*

The Project also triggered a provincial EA under the *British Columbia Environmental Assessment Act* (BCEAA) and the provincial and federal assessment processes have been harmonized in

accordance with the Canada/British Columbia Agreement for Environmental Assessment Cooperation (March 2004).

SCOPE OF THE COOPERATIVE ASSESSMENT

The cooperative federal/provincial environmental assessment (EA) includes consideration of the potential environmental, socio-economic, heritage, and health effects of the Project, taking into account mitigation measures to prevent or reduce any potential adverse environmental effects.

The environmental assessment under CEAA considered the following factors:

- the environmental effects of the Project, including:
    - the environmental effects of malfunctions or accidents that may occur in connection with the Project;
    - any cumulative environmental effects that are likely to result from the Project in combination with other projects or activities that have been or will be carried out; and
    - any change that the Project may cause to listed wildlife species, its critical habitat, or the residences of individuals of that species, as those terms are defined in section 2(1) of the *Species at Risk Act* (SARA), (species also include those identified by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)).
- the significance of the environmental effects referred to above;
- comments from the public;
- measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the Project;
- the purpose of the Project;
- alternatives to the Project;
- alternative means of carrying out the Project that are technically and economically feasible and the environmental effects of any such alternative means;
- the need for, and the requirements of, any follow-up program in respect of the Project;
- the capacity of renewable resources, that are likely to be significantly affected by the Project, to meet the needs of the present and those of the future;
- the effects of the Project on the environment that may impact social, economic, heritage and human health; and
- community knowledge and Aboriginal traditional knowledge.

PUBLIC CONSULTATION AND ISSUES

The first opportunity for public input into the federal EA was provided under section 21(1) of CEAA, when the RAs invited members of the public to review and comment on the proposed scope of the Project, the proposed factors to be considered in the environmental assessment, the proposed scope of those factors, and the ability of a comprehensive study to address issues relating to the Project.

A second opportunity for public input was provided as a part of the cooperative provincial/federal review of the Project; the RAs shared the formal comment period on the Application that was used for BCEAA.

A third opportunity for public input on the Project and the associated environmental assessment is through commentary on this report. All comments submitted will be provided to the RAs and will become part of the public registry for the Project. The RAs will be asked by the Agency to advise whether their conclusions have been altered as a result of the public comments received. This public input, along with comments received during the development of the CSR, will be taken into account by the Minister of the Environment when issuing an environmental assessment decision statement.

Apart from two public written submissions in general support of the Project, all other submissions received during the cooperative provincial/federal review of the Project, expressed concerns over and/or objections to the Project. The key concerns and objections voiced by the public included:

- Need for the Roberts Bank container port expansion;
- Scoping of the Project and the assessment under federal and provincial legislation;
- Environmental assessment by agencies rather than a federal panel;
- Inadequacy of assessment documentation and dissemination of such information;
- Too few public meetings and absence of useful consultation;
- Inadequate time to prepare public comments;
- Negative impacts on and loss of wildlife habitat in the Fraser River estuary;
- Project's adverse impacts on COSEWIC listed species;
- The cumulative effects assessment and the need to include container Terminal 2 (T2) in the Project assessment;
- Long-term status of geomorphology stability and degradation of inter-tidal habitat;
- Adverse impacts on marine habitats and inadequate habitat compensation plans;
- Adverse visual and lighting impacts at Roberts Bank and in Tsawwassen;
- Transportation and construction noise;
- Negative impacts on regional and local air quality;
- Road crossings of emergency and farm vehicles, connectivity and inconvenience;
- Negative impacts of rail/road crossings in Surrey and Langley and public safety;
- Traffic congestion due to an increase in container truck traffic; and
- Increased risk of accidents and malfunctions.

All issues raised by the public during the review and within the scope of the Project have been considered in the review process.

GOVERNMENT CONSULTATION AND ISSUES

Proponent consultation on the Project with federal, provincial and local government agencies occurred primarily through use of a Project working group (WG), comprised of representatives of federal, provincial and local government agencies and First Nations. The WG and sub-groups were used to identify, document and resolve Project-related issues.

All technical issues raised by federal, provincial, local government agencies, and First Nations during the review of the Project have been considered in the EA review process and the documents generated as part of the review.

FIRST NATIONS CONSULTATION AND ISSUES

The Project falls within or close to the asserted traditional territories of the following First Nations groups:

Lower Mainland

- Tsawwassen First Nation;
- Musqueam Indian Band;
- Katzie First Nation;
- Sto:lo Nation;
- Sto:lo Tribal Council;
- Semiahmoo Nation;

Vancouver Island

- Sencot'en Alliance; and
- Hul'qumi'num Treaty Group.

Throughout the cooperative Project review, all relevant review documents were made available to the identified First Nations.

Early in the Project review (April 2003), EAO issued letters to the Lower Mainland based First Nations referenced above, advising them of the Project and the EA review, and requesting confirmation of their interest in the Project. The EAO invited these First Nations' to participate in the cooperative EA review and to provide information about the Project's potential effects on asserted Aboriginal rights and title and traditional uses.

The EAO, RAs, and the Proponent continued their efforts to engage all the identified First Nations during the EA review and in the working group meetings. The First Nations were provided with the meeting notes and the agenda for future meetings. The Tsawwassen First Nation, the Sencot'en Alliance and the Hul'qumi'num Treaty Group all attended a number of working group meetings and provided comments on the Application and its supporting documents.

KEY POTENTIAL ENVIRONMENTAL EFFECTS CONSIDERED DURING THE ASSESSMENT

Key potential environmental effects considered during the Project review included:

Coastal Geomorphology

- Potential higher flow concentration at the end of the proposed wharf extension;
- Potential for new tidal drainage channels forming in response to planned navigation dredging; and
- Based on the information in the Application, potential for localized disturbance of the tidal flats near the proposed tug basin, which could induce shallow, small-scale channel formation.

Water Quality

- Increases in suspended solids (elevation of turbidity and TSS levels) in the water column during dredging, ocean disposal and terminal filling operations;
- Increases in contaminant levels (heavy metals and PAHs) in the water column during dredging and disposal at sea;
- Small increases in treated sewage and stormwater discharged into the marine environment from terminal operations;
- Discharges including ballast water and bilge water discharges, from ships calling at the DP3 Project; and
- Potential accidents and malfunctions.

Sediment Quality and Dredging

- Potential disturbance (including effects of increased turbidity) of killer whales and their food sources, such as chinook salmon;
- Potential for dredge spoil disposal at sea to cause underwater slides;
- Potential for stormwater releases from DP3 to effect the quality of the surrounding sediments; and
- Potential increases in contaminant levels (heavy metals and PAHs) in waters and sediments during dredging and disposal at sea operations.

Marine Environment

- Permanent loss of approximately 22 hectares of marine habitat;
- Terminal construction and operation effects on water quality from stormwater releases into intertidal habitat;
- Potential effects of dredging and placement of fill on fish, invertebrates, and marine mammals and their food sources such as chinook salmon;
- Potential effects of marine construction and dredging (underwater noise) on marine mammals;
- Marine vessel traffic effects (underwater noise and collision) on marine mammals;
- Terminal and construction illumination affecting juvenile salmon;

- Introduction of non-indigenous species from ballast water discharge; and
- Accidental spills and malfunctions affecting the marine environment.

Waterfowl and Coastal Seabirds

- The permanent loss of approximately 22 hectares of marine habitats that provide roosting, resting and foraging habitat including: approximately 5 hectares of eelgrass habitat; 300 m^2 of salt marsh habitat; 12.7 hectares of intertidal mudflat and 3.4 hectares of subtidal mudflat;
- The potential effects of tug basin dredging on eelgrass habitat and the potential for erosion of intertidal mudflat habitat;
- Potential effects of additional lighting during Project construction and operation;
- Potential effects of additional noise and related disturbance activities during Project construction and operation;
- Potential effects of the release of contaminants and deleterious materials during Project construction and operation;
- Potential for marine eutrophication to effect inter-causeway migratory bird habitats; and
- Potential for an increase in dendritic channelization.

Terrestrial Wildlife and Vegetation

- A small level of effect to nesting habitat of killdeer and dabbling ducks may occur as a result of the proposed rail construction on Deltaport Way;
- Some temporary sensory disturbance to waterfowl and shorebirds;
- Potential disturbance of ground-nesting raptors such as the northern harrier;
- Some temporary sensory disturbance to the Townsend's big-eared bat during the construction phase of the Project is likely;
- Potential siltation and polluted runoff from construction activities into the drainage ditches indirectly having the potential to effect amphibians, reptiles and aquatic invertebrates;
- Habitat loss and habitat disturbance during the construction of the expanded rail bed and gravel access road;
- Potential introduction of non-indigenous species;
- The potential for sensory disturbance to wildlife during the construction period or operation of the Project: within the study area;
- Potential wildlife mortality during construction resulting in mortality for small mammals that inhabit grass areas, and upper soil layers, or if done during the breeding season this may result in bird mortality, particularly to nestlings;
- Changes in wildlife movement due to the construction;
- Potential for an increase in barn owl collisions with vehicles during construction and operation along Deltaport Way; and
- Potential accidents and unplanned events such as spills and leaks of hazardous materials.

Air Quality

- Effect of Project emissions on ambient sulphur dioxide (SO_2) levels;
- Effect of Project nitrogen oxide (NO_x) emissions on ambient nitrogen dioxide (NO_2) levels;
- Effect of Project emissions on ambient carbon monoxide (CO) levels;
- Effect of Project emissions on ambient particulate matter (PM) concentrations;
- Effect of Project emissions on secondary ozone and PM formation;
- Project contribution to greenhouse gas (GHG) emissions; and
- Human and wildlife health risk due to Project air emissions.

Noise

- Noise due to construction activities;
- Rail induced noise from diesel engines, train shunting, and whistles;
- Noise associated with vibrations caused by moving trains;

- Increased noise due to container terminal activities; and
- Alarms for the additional ship-to-shore gantries and terminal equipment.

Visual

- Changes to the visual landscape through alterations of views and aesthetics.

Lighting

- Increase in light trespass;
- Increase in nuisance glare;
- Sky brightness due to enlarged lighted area; and
- Effects of additional light on marine life, migratory birds and wildlife.

Socio-economic

- Relocation of some construction workers to local area;
- Effect on existing local use, such as rental of office space;
- Traffic delays associated with railway construction;
- Traffic increases associated with construction trucks and workers;
- Increased demand on local hospitals and medical services;
- Relocation of some facility workers to local area;
- Increased noise associated with additional trains; and
- Increased traffic on road network due to additional truck traffic.

Heritage and Archaeological Resources

- Potential effects on archaeological resources from road and rail upgrades.

Accidents and Malfunctions

- Potential degradation of water quality;
- Contamination of marine sediments;
- Toxicity/mortality to fish and marine mammals;
- Toxicity/mortality to waterfowl and coastal seabirds;
- Effects on the terrestrial environment;
- Effects on workers;
- Effects on neighbouring communities; and
- The potential for non-indigenous species to be transported in ballast water and be deposited to establish in the local environment as a pest species affecting the native species.

Effects of the Environment on the Project

- Seismic events;
- Tsunami events;
- Extreme storm events;
- Climate change; and
- Sea level rise.

Cumulative Effects Assessment

Cumulative environmental effects are defined as residual effects that, when combined with the impacts of other past, existing or imminent projects and activities, may have a compounding or interactive effect.

- Change in marine habitat types;
- Inter-causeway marine eutrophication;
- Change in marine habitats;
- Alteration to bird habitat;
- Marine mammal population effects;

- Human health effects through noise;
- Increased traffic delays; and
- Human health effects through air quality.

Sustainable Development

- Potential habitat loss in the marine environment;
- Potential loss of habitat for coastal seabirds and waterfowl; and
- Potential changes to future air quality.

KEY FIRST NATIONS INTERESTS RAISED DURING THE ASSESSMENT

First Nation interests considered during the EA review of the proposed Project were:

- Accessibility to water area for Aboriginal use of the inter-causeway marine environment;
- Impacts on bio-physical effects such as water quality, dendritic channel expansions;
- Increased sedimentation and potential for eutrophication in the inter-causeway area;
- Cumulative effects on marine resources; and
- Cumulative effects on noise, traffic and air quality on human health.

MONITORING AND FOLLOW UP

The purpose of a follow-up program is to verify the accuracy of the environmental assessment and determine the effectiveness of measures taken to mitigate the potential adverse environmental effects of the Project. The following elements will be used to verify the accuracy of impact predictions and determine the effectiveness of measures taken to mitigate the potential adverse environmental effects of the Project:

Proponent's Environmental Management Plans

In the Application the Proponent committed to the adoption of appropriate Environmental Management Plans as an important component of the Project. The Environmental Management Plans are to outline the commitments of the Proponent, the Terminal Operator (currently Terminal Systems Inc., TSI), and contractors to address monitoring and mitigation measures identified in the *Owner's Table of Commitments (Appendix A).*

Adaptive Management Strategy

As part of the DP3 Project, an Adaptive Management Strategy (AMS) has been developed, to provide practical advance warning of any potential emerging negative ecosystem trends during Project construction and operation, and to establish actions that the Proponent would undertake to prevent or mitigate negative trends which are linked to DP3 and found to exceed thresholds.

The objective of the DP3 AMS is to undertake a science-based systematic approach to monitoring and managing the Roberts Bank inter-causeway ecosystem specifically to reduce uncertainty and assess the potential for future marine eutrophic events and dendritic channelization leading to erosion that result in negative trends in the ecosystem. Further the AMS details the commitments that the Proponent would undertake to evaluate, prevent or mitigate those negative trends attributable to the DP3 Project.

Habitat Compensation Plan

Ensuring no net loss of productive capacity, as outlined in the Fisheries and Oceans Canada (DFO) *Policy for the Management of Fish Habitat*, is essential to ensuring sustainability of the marine environment of Roberts Bank. The Deltaport Third Berth Project must meet the requirements of the DFO no net loss guiding principle. The Proponent recognizes that fish and wildlife habitat requirements are inextricably linked in the overall context of the Roberts Bank ecosystem and therefore synergies are gained by incorporating fish and migratory bird values into the Habitat Compensation Plan. As such, the Proponent has committed to implementing the Marine Environment Management Plan, which will be developed to meet the requirements of a *Fisheries Act* authorization that will be produced for the Project.

COMMITMENTS MADE BY THE PROPONENT FOR MITIGATION OF POTENTIAL EFFECTS

The Proponent proposes to mitigate potential effects through commitments made in its Application, as well as modified and new commitments to address issues raised during the EA review. Key commitments include:

- A full conceptual fish habitat and migratory bird compensation plan dated March 12, 2006;
- An Adaptive Management Strategy for the Roberts Bank inter-causeway area to provide practical advance warning of any potential emerging negative ecosystem trends, including marine eutrophication events, marine environment and waterfowl and coastal seabird concerns and effects on water quality during DP3 Project construction and operation;
- Participation in a wider reaching Roberts Bank Stewardship Program;
- Reduction of the project footprint from the original proposed 32 hectares to approximately 22 hectares;
- Monitoring of migratory birds as outlined in the Adaptive Management Strategy;
- Silt curtains or booms will be deployed to minimize silt plume impacts on the biotic marine environment during dredging if required;
- Mitigation to reduce turbidity during dredging and disposal will be employed, and dredging and disposal operations will be stopped if killer whales enter the immediate area;
- The relocation of all stormwater outfalls to the southeast side of the terminal (off the wharf face); stormwater treatment prior to discharge;
- A phased program to undertake stabilization of the existing dendritic channels in the inter-causeway area as part of the Habitat Compensation Plan;
- All sewage will be directed to the existing Deltaport secondary sewage treatment plant which has an existing provincial effluent permit and sufficient capacity to adequately treat the additional effluent;
- Modifying the dredge program to source terminal fill from the Fraser River, eliminating the need for additional dredging in the turning basin and substantially reducing the overall marine dredging program;
- Adhering to DFO dredging guidelines as well as Best Management Practices during construction to minimize disruption of habitat or losses of individual adult Dungeness crabs, fishes and lingcod and their egg masses which are also food for waterfowl and coastal seabirds that use the study area;
- Concentrating construction phases in the intertidal zone to winter months to minimize disruption to eelgrass and to intertidal mudflats, which makes these habitats less susceptible to increased TSS levels;
- Prior to placement of fill in the intertidal area for the terminal footprint, surveying the intertidal area and relocating juvenile and adult crabs to a suitable adjacent area away from construction;
- If monitoring indicates juvenile salmon are present in areas where work is occurring in water less than five metres CD, bubble or silt curtains will be deployed to keep fish away from the works area or to isolate the works area from fish;
- Minimizing light and noise effects and related disturbance impacts to fishes, marine mammals and birds, including modifications to the marine dredge lighting systems and setting maximum allowable noise emissions from each type of machinery prior to construction;
- Working with BC Pilots to develop an education and awareness program about marine mammals;
- Assessing additional mitigation for potential underwater noise effects to marine mammals, which may include lowering vessel approach to 10 km/h or less when approaching the port area and encouraging proper maintenance of ship propellers;

- Consultation with the appropriate regulatory agencies and non-government agencies/organizations to establish pelagic cormorant resting/roosting structures away from port industrial structures;
- A Wildlife and Vegetation Environmental Management Plan and mitigation measures to address barn owl collision with vehicles;
- Incorporating the infrastructure for shore power for ships in Project design and construction, and conducting a feasibility study for shore based power;
- Reducing overall air emissions from the Project as well as from all port operations wherever it is technically and economically feasible to do so;
- Implementing air quality initiatives in the tendering process for the construction of the Project and during operation to reduce emissions where possible;
- Establishing an air quality monitoring station in Delta;
- Development of a Noise Management Plan that will be incorporated into the construction and operation Environmental Management Plans;
- A Community Liaison Committee to address public generated concerns including noise, lighting and visual impacts;
- Modifications to the marine dredge lighting systems and terminal lighting system to minimize light trespass to the environment and surrounding community;
- Implementing a complaint tracking and response mechanism for the construction phase of the Project;
- A Traffic Management Plan and working with relevant agencies to address transportation related issues;
- A Construction Environmental Management Plan with sub-plans to address dredging, surface water quality and sediment control, hazardous waste management and spills, health and safety, emergency response, waste management, noise, wildlife and vegetation impacts, marine environment, marine water quality, air quality impacts and traffic concerns; and
- An Operational Environmental Management Plan that will include sub-plans for the Deltaport Terminal, Vancouver Port Authority Environmental Management Plan and TSI Emergency Response Plan.

OVERALL CONCLUSION

Pursuant to the requirements of the CEAA, the federal RAs have determined that, on the basis of the information summarized in the CSR, the general conclusion of the environmental assessment is that provided the proponent:

1) fulfills its commitments, including compliance and effects monitoring and follow-up measures as outlined in *Appendix A*, and

2) implements the Adaptive Management Strategy and the Habitat Compensation Plan (including follow-up environmental management and monitoring program agreements) as the Proponent and the RAs have agreed,

the DP3 Project is not likely to cause significant adverse effects.

TABLE OF CONTENTS

EXECUTIVE SUMMARY II

LIST OF ABBREVIATIONS XX

GLOSSARY OF TERMS XXII

PART A – GENERAL REVIEW BACKGROUND 1

1. INTRODUCTION 1

1.1 BACKGROUND *1*

1.2 PURPOSE OF THE COMPREHENSIVE STUDY REPORT *1*

1.3 FEDERAL AND PROVINCIAL EA REVIEW *1*

1.3.1 Federal Process and CEAA Requirements 1

1.3.2 Provincial Process 3

1.3.3 Other Federal Involvement 3

1.4 COOPERATIVE ENVIRONMENTAL ASSESSMENT OF THE PROJECT *4*

1.4.1 Advisory Working Groups 4

1.4.2 Public Consultation 7

1.4.3 EA Review Conclusions 7

2. PROJECT DESCRIPTION AND SCOPE OF REVIEW 8

2.1 PROJECT OVERVIEW *8*

2.2 SCOPE OF PROJECT *8*

2.3 SCOPE OF ASSESSMENT *9*

2.4 PROJECT JUSTIFICATION AND DESCRIPTION *10*

2.4.1 Purpose of Project 10

2.4.2 Project Components and Description 10

2.4.3 Project Construction 15

2.4.4 Project Capital Cost and Job Creation 15

2.4.5 Project Operations 15

2.5 APPLICATION FOR PROJECT ENVIRONMENTAL ASSESSMENT *16*

3. INFORMATION DISTRIBUTION AND CONSULTATION 17

3.1 ACCESS TO REVIEW DOCUMENTATION *17*

3.2 NOTIFICATION *17*

3.2.1 Public Review of Application and Technical Volumes 17

3.2.2 Public Review of New and Amended Review Material 19

3.3 CONSULTATION *19*

3.3.1 Public Consultation Measures Undertaken by the Proponent 19

3.3.2 Proponent Consultation Prior to Application Submission 19

3.3.3 Proponent Consultation Following Application Submission 22

3.3.4 Public Consultation Measures Undertaken by EAO and the RAs 23

3.3.5 First Nations Consultation 24

3.4 RESPONSES AND RESULTS FROM PROJECT'S PUBLIC CONSULTATION *27*

3.4.1 Public Consultation on Application 27

3.4.2 Public Consultation on Four Documents 29

3.4.3 Summary of Public Comments 30

3.5 SUMMARY AND CONCLUSIONS – INFORMATION DISTRIBUTION AND CONSULTATION *30*

3.5.1 Public Consultation 30

3.5.2 First Nations Consultation 30

PART B – ASSESSMENT OF ENVIRONMENTAL EFFECTS 32

INTRODUCTION 32

1 ASSESSMENT OF ALTERNATIVES 36

1.1 GENERAL *36*

1.2 BACKGROUND *36*

1.2.1 Port of Vancouver Terminal Capacity 37

1.2.1.1 Current Capacity 37

1.2.1.2 Capacity Expansion ... 38
1.3 ANALYSIS ... *38*
1.3.1 Alternatives to the Project ... 38
1.3.1.1 Do Nothing (Status Quo) ... 38
1.3.1.2 Increase Production of Existing Terminals Without Site Expansion ... 39
1.3.1.3 Develop Terminals at Other Sites in the Port of Vancouver ... 39
1.3.1.4 Other Canadian West Coast Container Terminal Expansion Projects ... 40
1.3.1.5 "Alternatives To" Conclusion and Site Selection ... 40
1.3.2 Alternative Means of Carrying Out the Project at Roberts Bank ... 40
1.3.2.1 Planning Criteria ... 40
1.3.2.2 Site Options ... 41
1.3.2.3 Preferred Site Option – Option 1 Revised ... 42
1.3.3 Alternative Means for Construction ... 42
1.3.4 Alternatives for Terminal Fill ... 45
1.4 CONCLUSIONS ... *46*
2. COASTAL GEOMORPHOLOGY ... 47
2.1 GENERAL ... *47*
2.2 BACKGROUND ... *47*
2.2.1 Study Area ... 47
2.2.2 Existing Environment ... 47
2.2.3 Proponent's Assessment of Impacts ... 50
2.3 ANALYSIS ... *52*
2.3.1 Potential Effects ... 52
2.3.2 Issues ... 52
2.3.3 Mitigation ... 53
2.3.4 Residual Effects ... 54
2.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS ... *54*
3. WATER QUALITY ... 55
3.1 GENERAL ... *55*
3.2 BACKGROUND ... *55*
3.2.1 Study Area ... 55
3.2.2 Existing Environment ... 55
3.2.3 Proponent's Assessment of Impacts ... 56
3.3 ANALYSIS ... *57*
3.3.1 Potential Effects ... 58
3.3.2 Issues ... 58
3.3.3 Mitigation ... 59
3.3.4 Residual Effects ... 60
3.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS ... *60*
4. SEDIMENT QUALITY, DREDGING AND OCEAN DISPOSAL ... 61
4.1 GENERAL ... *61*
4.2 BACKGROUND ... *61*
4.2.1 Study Area ... 61
4.2.2 Existing Environment, Sediment Quality ... 62
4.2.3 Proponent's Assessment of Impacts ... 63
4.3 ANALYSIS ... *63*
4.3.1 Potential Effects ... 63
4.3.2 Issues ... 63
4.3.3 Mitigation ... 64
4.3.4 Residual Effects ... 64
4.4 CONCLUSION ON SIGNIFICANCE OF EFFECTS ... *64*
5. MARINE ENVIRONMENT ... 66
5.1 GENERAL ... *66*
5.2 BACKGROUND ... *66*
5.2.1 Study Area ... 66
5.2.2 Existing Marine Environment ... 66
5.2.3 Proponent's Assessment of Impacts ... 72
5.3 ANALYSIS ... *73*
5.3.1 Potential Effects ... 73
5.3.2 Issues ... 74

5.3.3 Mitigation ... 74
5.3.4 Residual Effects ... 77
5.4 CONCLUSION ON SIGNIFICANCE OF EFFECTS ... *77*
6. WATERFOWL AND COASTAL SEABIRDS ... 78
6.1 GENERAL ... *78*
6.2 BACKGROUND ... *78*
6.2.1 Study Area ... 78
6.2.2 Existing Environment ... 78
6.2.3 Proponent's Assessment of Impacts ... 88
6.3 ANALYSIS ... *91*
6.3.1 Potential Effects ... 91
6.3.2 Issues ... 91
6.3.3 Mitigation ... 92
6.3.4 Residual Effects ... 94
6.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS ... *94*
7. TERRESTRIAL WILDLIFE AND VEGETATION ... 95
7.1 GENERAL ... *95*
7.2 BACKGROUND ... *95*
7.2.1 Study Area ... 95
7.2.2 Existing Environment ... 96
7.2.3 Proponent's Assessment of Impacts ... 97
7.3 ANALYSIS ... *100*
7.3.1 Potential Effects ... 100
7.3.2 Issues ... 100
7.3.3 Mitigation ... 102
7.3.4 Residual Effects ... 102
7.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS ... *102*
8. AIR QUALITY ... 104
8.1 GENERAL ... *104*
8.2 BACKGROUND ... *104*
8.2.1 Study Area ... 104
8.2.2 Existing Environment ... 105
8.2.3 Proponent's Assessment of Impacts ... 107
8.2.4 Cumulative Effects Assessment ... 120
8.2.5 Impact of DP3 Operations on Greenhouse Gases ... 120
8.2.6 Human Health and Wildlife Risk Assessment ... 121
8.2.7 Assessment of Residual Effects ... 122
8.3 ANALYSIS ... *123*
8.3.1 Potential Effects ... 123
8.3.2 Issues ... 124
8.3.3 Mitigation ... 129
8.3.4 Residual Effects ... 130
8.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS ... *131*
9. NOISE IMPACTS ... 132
9.1 GENERAL ... *132*
9.2 BACKGROUND ... *132*
9.2.1 Study Area ... 132
9.2.2 Existing Environment ... 132
9.2.3 Proponent's Assessment of Impacts ... 133
9.2.4 Construction Noise Impacts ... 134
9.2.5 Operation Noise Impacts ... 135
9.3 ANALYSIS ... *136*
9.3.1 Potential Effects ... 136
9.3.2 Issues ... 136
9.3.3 Mitigation ... 137
9.3.4 Residual Effects ... 138
9.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS ... *138*
10. VISUAL IMPACTS ... 139
10.1 GENERAL ... *139*

10.2 BACKGROUND 139
10.2.1 Study Area 139
10.2.2 Existing Environment 139
10.2.3 Proponent's Assessment of Impacts 140
10.3 ANALYSIS 141
10.3.1 Potential Effects 141
10.3.2 Issues 142
10.3.3 Mitigation 142
10.3.4 Residual Effects 142
10.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS 142
11. LIGHTING EFFECTS 143
11.1 GENERAL 143
11.2 BACKGROUND 143
11.2.1 Study Area 143
11.2.2 Existing Environment 143
11.2.3 Proponent's Assessment of Impacts 144
11.3 ANALYSIS 146
11.3.1 Potential Effects 146
11.3.2 Issues 146
11.3.3 Mitigation 147
11.3.4 Residual Effects 148
11. 4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS 148
12. SOCIO-COMMUNITY ISSUES AND ECONOMICS 149
12.1 GENERAL 149
12.2 BACKGROUND 149
12.2.1 Study Area 149
12.2.2 Study Methodology 149
12.2.3 Existing Socio-community Environment 150
12.2.4 Existing Economic Environment 151
12.2.5 Socio-community Impact Assessment 151
12.2.6 Economic Impact Assessment 152
12.3 ANALYSIS 154
12.3.1 Potential Effects 154
12.3.2 Issues 154
12.3.3 Mitigation Measures 155
12.4 CONCLUSIONS AND RECOMMENDATIONS 156
13. ARCHAEOLOGICAL ASSESSMENTS 157
13.1 GENERAL 157
13.2 BACKGROUND 157
13.2.1 Study Area 157
13.2.2 Archaeological Overview 157
13.2.3 Archaeological Impact Assessment 157
13.2.4 Proponent's Assessment of Impacts During Construction 158
13.2.5 Proponent's Assessment of Impacts During Operation 158
13.3 ANALYSIS 158
13.3.1 Potential Effects 158
13.3.2 Issues 158
13.3.3 Mitigation 159
13.3.4 Residual Effects 159
13.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS 159
14. ACCIDENTS AND MALFUNCTIONS 160
14.1 GENERAL 160
14.2 BACKGROUND 160
14.2.1 Assessed Effects During Construction 160
14.2.2 Assessed Effects During Operation 161
14.3 ANALYSIS 162
14.3.1 Potential Effects 162
14.3.2 Issues 163
14.3.3 Mitigation 163
14.3.4 Residual Effects 164

14.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS 164
15. EFFECTS OF THE ENVIRONMENT ON THE PROJECT 165
15.1 GENERAL 165
15.2 BACKGROUND 165
15.2.1 Seismic Events 165
15.2.2 Tsunamis 165
15.2.3 Sea Level Rise 166
15.2.4 Summary 166
15.3 ANALYSIS 166
15.3.1 Potential Effects 166
15.3.2 Issues 167
15.3.3 Mitigation 167
15.3.4 Residual Effects 167
15.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS 167
16. CUMULATIVE EFFECTS ASSESSMENT 168
16.1 GENERAL 168
16.2 BACKGROUND 168
16.2.1 Study Area for Potential Cumulative Effects 168
16.2.2 Existing Environment 170
16.2.3 Proponent's Assessment of Impacts 174
16.2.4 Proponent's Detailed Assessment of Impacts 175
16.3 ANALYSIS 183
16.3.1 Potential Effects 183
16.3.2 Issues 183
16.3.3 Mitigation 184
16.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS 185
17. SUSTAINABLE DEVELOPMENT 187
17.1 GENERAL 187
17.2 BACKGROUND 187
17.2.1 Legislative Requirements and Background to Sustainable Use Assessments 187
17.2.2 Assessment Criteria 187
17.2.3 Biophysical 187
17.2.4 Socio-community 188
17.2.5 Economic 188
17.2.6 Conclusion of Proponent's Analysis 189
17.3 ISSUES AND POTENTIAL EFFECTS 189
17.3.1 Potential Effects 189
17.3.2 Issues 190
17.3.3 Mitigation 190
17.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS 191
18. FOLLOW-UP PROGRAM 192
18.1 GENERAL 192
18.2 BACKGROUND 192
18.2.1 Legislative Requirements 192
18.2.2 Proponent Commitments and Obligations 192
18.2.2.1 Adaptive Management Strategy (AMS) 195
18.2.2.2 *Fisheries Act* – Habitat Compensation Plan (HCP) 196
18.2.2.3 Roberts Bank Environmental Stewardship Program 197
18.2.2.4 Follow-up Program Reporting 198
18.3 CONCLUSIONS 198
19. FIRST NATIONS CONSIDERATIONS AND INTERESTS 199
19.1 GENERAL 199
19.2 BACKGROUND 199
19.3 DISCUSSIONS BETWEEN FIRST NATIONS, PROVINCIAL AND FEDERAL GOVERNMENT REPRESENTATIVES 200
19.4 OVERVIEW OF FIRST NATIONS CONCERNS 201
19.5 TRADITIONAL USE AND KNOWLEDGE 201
19.5.1 Traditional Use 201
19.5.2 Traditional Knowledge 201

19.5.3 Potential Project Effects, Mitigation and Traditional Knowledge 201
19.6 CURRENT USE OF LANDS AND RESOURCES FOR TRADITIONAL USES BY FIRST NATIONS *202*
19.6.1 General 202
19.6.2 Subsistence Activities 202
19.7 RELEVANT PROJECT EFFECTS POTENTIALLY IMPACTING FIRST NATIONS ASSERTED TRADITIONAL USE OF RESOURCES *203*
19.8 POTENTIAL PROJECT EFFECTS ON ASSERTED ABORIGINAL FISHING AND HARVESTING OF MARINE RESOURCES *204*
19.8.1 General 204
19.8.2 Specific Issues Raised by First Nations 204
19.8.3 Associated Mitigation Measures 206
19.9 ONGOING DEVELOPMENT OF DRAINAGE CHANNEL NETWORK IN THE INTERCAUSEWAY *207*
19.9.1 Issue 207
19.9.2 Mitigation 207
19.10 ACCESS TO RESOURCES OF ABORIGINAL INTEREST *208*
19.10.1 Issue 208
19.10.2 Mitigation 208
19.11 PROTECTION OF THE HEALTH OF MARINE RESOURCES AND THE SURVIVABILITY OF MARINE MAMMALS *208*
19.11.1 Health Issue 208
19.11.2 Mitigation 208
19.11.3 Survivability Issue and Mitigation 208
19.12 GATHERING OF ABORIGINAL FOOD RESOURCES *209*
19.12.1 Potential Project Effects 209
19.13 OTHER ISSUES RAISED BY FIRST NATIONS *210*
19.14 CONCLUSIONS ON SUBSISTENCE HUNTING, FISHING AND GATHERING *210*
19.15 SUMMARY AND CONCLUSIONS *210*

PART C REVIEW CONCLUSIONS 211

REFERENCES 212

APPENDIX A – OWNER'S TABLE OF COMMITMENTS AND ASSURANCES 214

APPENDIX B – ADAPTIVE MANAGEMENT STRATEGY 215

APPENDIX C – HABITAT COMPENSATION PLAN 216

LIST OF TABLES

Table 1 Comparison between original dredge volumes and revised volumes (in cubic metres) 11
Table 2 Advertisements for the public information events 18
Table 3 Summary of public comment submissions..... 27
Table 4 Summary of public comment submissions on four documents..... 29
Table 5 Definition of significance criteria used for the analysis of residual adverse environmental effects 34
Table 6 Projected North American and west coast container traffic growth (as of January 2005) 37
Table 7 Capacity of existing Port of Vancouver container terminals 38
Table 8 Comparison between original dredge volumes and revised volumes (in cubic metres) 62
Table 9 Core sediment sampling results compared to levels set out in the *Disposal at Sea Regulations, 2001*..... 62
Table 10 Surface sediment sampling results compared to levels set out in the *Disposal at Sea Regulations, 2001* 62
Table 11 Waterbird species at risk that potentially occur in the study area 81
Table 12 Vegetation species at risk potentially occurring in the study area..... 96
Table 13 Wildlife species at risk potentially occurring in the study area or the vicinity 98
Table 14 Representative background values (µg/m^3) **a**dded to predicted concentrations ... 107
Table 15 Summary of air quality assessment approach..... 108
Table 16 Relevant air quality objectives, standards and guidelines for SO_2 (µg/m^3) 111
Table 17 Relevant air quality objectives, standards and guidelines for NO_2 (µg/m^3) 111
Table 18 Relevant air quality objectives, standards and guidelines for CO (mg/m^3) 112
Table 19 Relevant air quality objectives, standards and guidelines for particulate matter (µg/m^3) 113
Table 20 Relevant air quality objectives, standards and guidelines for ozone (µg/m^3) 114
Table 21 Summary of emissions (t/yr) included in the existing baseline model scenario 114
Table 22 Summary of Project construction emissions (t/yr) 115
Table 23 Maximum SO_2, NO_2, CO and VOC concentrations predicted to occur on land for the construction scenario (including 98th percentile ambient background values)..... 116
Table 24 Maximum $PM_{2.5}$, PM_{10} and TSP concentrations predicted to occur on land for the construction scenario (including 98th percentile ambient background values)..... 116
Table 25 Summary of emissions (t/yr) included in the Project operation scenario 2011 117
Table 26 Maximum SO_2, NO_2, CO and VOC concentrations predicted to occur on land for the Project operation scenario (including 98th percentile ambient background values)..... 118
Table 27 Maximum $PM_{2.5}$, PM_{10} and TSP concentrations predicted to occur on land for the Project operation scenario (including 98th percentile ambient background values)..... 119
Table 28 Contribution of Project operation GHG emissions to total emissions in the Regional Study Area 121
Table 29 Container vessel forecast 126
Table 30 Annualized human health effects of $PM_{2.5}$ and PM_{10} 128
Table 31 Annoyance criteria and the resulting impact on residents..... 134
Table 32 Summary of visual impact assessment ratings 140
Table 33 Corporation of Delta census data 1996 and 2001 150
Table 34 1:475 year seismic event, criteria for building code standards..... 165
Table 35 VEC and ecosystem receptors scoped for the cumulative effects assessment of the Deltaport Third Berth Project. 175
Table 36 Interactions of effects from Deltaport Third Berth with other projects, and the ecosystem receptors 176
Table 37 Identified potential cumulative effects on each ecosystem receptor 183

LIST OF FIGURES

Figure 1 Location of DP3 Project 9
Figure 2 DP3 Project site plan 12
Figure 3 Re-positioning of the tug basin 14
Figure 4 Tentative Project construction schedule 15
Figure 5 DP3 Project configuration options 43
Figure 6 Coastal geomorphology study area 48
Figure 7 Historical development of tidal channels – 1995 and 2002 49
Figure 8 Schematic diagram of head cutting process 51
Figure 9 Water quality study area and sampling locations 56
Figure 10 Marine impact assessment study area for DP3 Project 67
Figure 11 Marine habitats in the inter-causeway area 69
Figure 12 Waterfowl and coastal seabird study area with transects and point counts 79
Figure 13 Terrestrial wildlife and vegetation study area 95
Figure 14 Air quality assessment Local Study Area 105
Figure 15 Local Study Area air quality monitoring stations 106
Figure 16 Noise assessment study area 133
Figure 17 Visualization of Deltaport from the BC Ferries Causeway, including the site of the DP3 Project 141

LIST OF ABBREVIATIONS

A	
AMS	Adaptive Management Strategy
ATOR	Approved Terms of Reference
B	
BBCC	Boundary Bay Conservation Committee
BC	British Columbia
BCEAA	British Columbia *Environmental Assessment Act,* S.B.C. 2002, c.43
C	
CCME	Canadian Council of Ministers of the Environment
CD	Chart Datum
CDC	Conservation Data Centre
CEA	Cumulative Effects Assessment
CEAA	*Canadian Environmental Assessment Act* SC 1992, c. 37
CEA Agency	Canadian Environmental Assessment Agency
CN	Canadian National Railway
CO	Carbon Monoxide
COD	Corporation of Delta
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CR	Concentration Ratio
CRF	Concentration-Response Factor
CSR	Comprehensive Study Report
CWS	Canadian Wildlife Service
D	
dB	Decibel
dBA	A-weighted decibel
Deltaport	Deltaport Container Terminal
DFO	Fisheries and Oceans Canada
DO	Dissolved Oxygen
DP3	Deltaport Third Berth Project
DWT	Dead Weight Tonne
E	
EA	Environmental Assessment
EAO	British Columbia Environmental Assessment Office
EC	Environment Canada
EMP	Environmental Management Plan
EMS	Environmental Management System
ER	Exposure Ratio
F	
FA	Federal Authority
FHA	Fraser Health Authority
FTE	Full-time-Equivalent (jobs).
FVRD	Fraser Valley Regional District
G	
GDP	Gross Domestic Product
GVRD	Greater Vancouver Regional District
H	
ha	Hectare
HA	Highly Annoyed
Hazmat	Hazardous Materials
HCP	Habitat Compensation Plan
HEI	Health Effects Institute (a non-profit US corporation chartered in 1980 as an independent research organization)

HHRA	Human Health Risk Assessment
HOV	High Occupancy Vehicle
h	Hour
HTG	Hul'qumi'num Treaty Group representing the Chemainus, Halalt, Hwlitsum, Lyackson, and Lake Cowichan First Nations, and the Penelakut and Cowichan Tribes
Hz	Hertz
	I
IARC	International Agency for Research on Cancer
IMO	International Maritime Organization
ISO	International Organisation for Standardization
ISPS	International Ship and Port-facility Security
IUCN	International Union for the Protection of Nature
	K
km	Kilometre
	L
L_{eq}	The Equivalent Sound Level (L_{eq}) is commonly used to indicate the average sound level over a period of time. L_{eq} represents the steady level of sound which would contain the same amount of sound energy as does the actual time-varying sound level. Although it is an average, it is strongly influenced by the loudest events occurring during the time period because these loudest events contain most of the sound energy.
L_d	L_d is L_{eq} measured throughout daytime hours (7:00am to 10:00pm).
L_n	L_n is L_{eq} measured throughout night time hours (10:00pm to 7:00am).
L_{dn}	The Day Night Equivalent Level (L_{dn}) is the $L_{eq}(24)$ calculated after increasing the night time noise levels by 10dB to account for greater sensitivities to noise during the hours from 10:00pm to 7:00am.
L_{Rdn}	The Day/Night Rating Level (L_{Rdn}) results from adjustments made to the L_{dn} to account for the characteristics of certain sounds (e.g., tonal qualities). Such adjustments are referred to as "normalizing factors".
LFV	Lower Fraser Valley
LLW	Lowest Low Water (level).
LRSP	Livable Region Strategic Plan
LSA	Local Study Area
	M
m	Metre
MARPOL	International Convention for the Prevention of Pollution from Ships
MELP	Ministry of Environment, Lands and Parks
MIB	Musqueam Indian Band
MOT	Ministry of Transportation
MWLAP	Ministry of Water Land and Air Protection
	N
NBCC	National Building Code of Canada
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxide
	O
O_3	Ozone
OCP	Delta Official Community Plan
	P
P	Phosphorus
PAH	Polycyclic Aromatic Hydrocarbons
PM	Particulate Matter
PM_{10}	Particulate Matter of 10 Microns or Less in Diameter
$PM_{2.5}$	Particulate Matter of 2.5 Microns or Less in Diameter
PSEP	Puget Sound Estuary Program
the Port	The Port of Vancouver

the Project	Deltaport Third Berth Project
R	
RA	Responsible Authority
RAAD	Remote Access to Archaeological Data
RMG	Rail Mounted Gantries
RSA	Regional Study Area
RTG	Rubber-Tired Gantry
RWDI	RWDI West Inc.
S	
Sencot'en Alliance	Representing the Pauquachin, Tsartlip, Tsawout, and Semiahmoo First Nations
SARA	*Species at Risk Act* (2002, c. 29)
SECA	SO_x Emission Control Area
SEWG	Socio-economic/Community Working Group
SO_2	Sulphur Dioxide
SO_x	Sulphur Oxide
T	
TBWG	Technical/Biophysical Working Group
TEU	Twenty-foot Equivalent Units
TFN	Tsawwassen First Nation
TOC	Total Organic Carbon
TOR	Terms of Reference
TSI	Terminal Systems Inc.
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
U	
USA	United States of America
V	
VEC	Valued Ecosystem Component
VOC	Volatile Organic Compounds
VPA	Vancouver Port Authority
W	
WHO	World Health Organization
WHRA	Wildlife Health Risk Assessment
WHSRN	Western Hemisphere Shorebird Reserve Network

GLOSSARY OF TERMS

A	
accreting	Build up or rise relative to a fixed height (e.g., chart datum) of a landform due to sedimentation.
ambient	Surrounding environment.
ambient noise	The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.
amphibian	A cold-blooded, smooth-skinned vertebrate of the class Amphibia, such as a frog or salamander, that characteristically hatches as an aquatic larva with gills. The larva then transforms into an adult having air-breathing lungs.
archaeological site	A place where physical remains or modification of the natural environment indicate past and 'traditional' activities by First Nations

	people. Site types include isolated artefacts, burials, shell middens etc.
a-weighted decibel	"A-weighting" networks are commonly employed in sound level meters to simulate the frequency response of human hearing. A-weighted sound levels are designated dBA rather than dB.
B	
biota	All animal and plant life in a given area.
bioturbated	Movement of sediments by organisms.
birds	Any of the class Aves of warm-blooded, egg-laying, feathered vertebrates with forelimbs modified to form wings.
Blue-listed species	Species vulnerable to human activity or natural events. Provincial listing.
brackish	Mixture of seawater and fresh water.
C	
coastal geomorphology	The study of the forms and processes of the coast.
conservation	The management of natural resources in a way that will benefit both present and future generations.
Construction Environmental Management Plan	An element of an Environmental Management Plan that addresses the control, training and monitoring measures to be implemented during the construction phase of a project in order to avoid, minimize or ameliorate potentially adverse impacts identified during environmental assessments.
D	
decibel	Measurement of sound made on a logarithmic scale.
degradation	Reduction (usually in height relative to a fixed chart datum) by erosion.
delta	A usually triangular alluvial deposit at the mouth of a river.
dendritic	A branching pattern.
E	
ecosystem	An interdependent system of interacting plants, animals and other organisms together with the non-living (physical and chemical) components of their surroundings.
Endangered species	A species facing imminent extirpation or extinction. Federal listing.
Environmental Management Plan (EMP)	The control, training and monitoring measures to be implemented during the design, construction and operation phases of a project in order to avoid, minimize or ameliorate potentially adverse impacts identified during environmental (being socio-economic, cultural, physical, biological) assessments.
epifauna	Animals living on the surface of a substrate.
eutrophic event	an environmental adverse perturbation caused by an excess rate of supply of organic matter, including excess primary production
Extinct species	A species that no longer exists. Federal listing.
Extirpated species	A species that no longer exists in the wild in Canada, but occurs elsewhere (for example, in captivity or in the wild in the United States). Federal listing.
F	
fauna	Animals.
flora	Plants.
fluvial	of, or pertaining to, a river or riverine environment.
G	
geotechnical	Relating to the form, arrangement and structure of the geology.
greenhouse gas	A gas which has an effect on the radioactive absorptivity of the earth's atmosphere and the atmosphere's temperature (e.g., carbon dioxide).
guild	A group of birds that forage in the same way or on the same food.
H	
habitat	The place where plants and animals live and find the food, water, light, shelter, living space, and other essentials they need to survive.
heritage (cultural heritage)	A term which encompasses First Nation sites and material remains (cultural resources).

hydrodynamics	The study of water movement, predominantly caused by tides and wind.
I	
indirect effects	Changes in sales, income or employment within the economy in backward-linked industries supplying goods and services for construction (land and terminal development) and to the new business that is established.
infauna	Aquatic animals that live in the substrate of a body of water, especially in a soft sea bottom.
insect	Any of numerous usually small arthropod animals of the class Insecta, having an adult stage characterized by three pairs of legs and a body segmented into head, thorax, and abdomen and usually having two pairs of wings. Insects include the flies, crickets, mosquitoes, beetles, butterflies, and bees.
intertidal	The region between the high tide mark and the low tide mark.
invertebrate	An animal without a backbone.
M	
mammal	Any of various warm-blooded vertebrate animals of the class Mammalia, including humans, characterized by a covering of hair on the skin and, in the female, milk-producing mammary glands for nourishing the young.
merganser	Any of various fish-eating diving ducks of the genus *Mergus* or related genera, having a slim hooked bill.
midden	A mound or deposit containing shells, animal bones, and other refuse that indicates the site of a human settlement. Evidence of First Nations occupation in an area.
monitoring	The checking of impacts of a proposal or an existing activity in order to improve or evaluate environmental management practices. To check the efficiency and effectiveness of the environmental assessment process. To determine if the requirements of environmental legislation and associated regulations are being met.
N	
native vegetation	A broad term for vegetation comprised of plant species which occur naturally in Canada.
non-indigenous	Species that does not originate and live or occur naturally in an area or environment.
Not at Risk	A species that has been evaluated and found to be not at risk Federal listing.
O	
Operation Environmental Management Plan	An element of an Environmental Management Plan that addresses the control, training and monitoring measures to be implemented during the operation phase of a project in order to avoid, minimize or ameliorate potentially adverse impacts identified during environmental assessments.
ozone	A form of oxygen having three atoms to the molecule. Ozone is a powerful oxidizing agent.
P	
particulate	Small particles, usually in suspension.
passerines	Of or relating to birds of the order Passeriformes, which includes perching birds and songbirds such as the jays, blackbirds, finches, warblers, and sparrows.
piles	Type of foundation using columns of concrete, steel or timber.
piscivorous	Habitually feeding on fish; fish-eating.
R	
raptor	A bird of prey.
reptile	Any of various cold-blooded, usually egg-laying vertebrates of the class Reptilia, such as a snake, lizard, crocodile or turtle, having an external covering of scales or horny plates and breathing by means of lungs.

Red-listed species	Species populations or communities at high risk of extinction or extirpation. Provincial listing.
S	
secondary effects	Changes in economic activity from subsequent rounds of re-spending in the economy. Comprised of indirect and induced effects.
seismic	Of, subject to, or caused by an earthquake or earth vibration.
semi-diurnal tide	Having one high tide and one low tide occurring approximately once every 12 hours or half of the day.
shorebird	Any of various birds, such as the sandpiper, plover, or snipe, that frequent the shores of coastal or inland waters.
silt curtain	A curtain placed around a dredge or spoil disposal site to contain suspended sediments within the area of the screen.
slough	A stagnant swamp, marsh, bog, or pond, especially as part of a bayou, inlet, or backwater.
Special Concern (species)	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events. Federal listing.
subtidal	Waters below the high tide mark.
sustainable use	Use of an organism, ecosystem or their renewable resource at a rate within its capacity for renewal.
T	
terrestrial	Living or growing on land; not aquatic.
terminal operator	Stevedoring company who would operate the container handling operations at the Deltaport Third Berth.
Threatened species	A species likely to become endangered if limiting factors are not reversed. Federal listing.
trend	In the context of the Adaptive Management Strategy, a trend could be judged to be emerging if values of monitored data and biota were to change consistently and predictably over time toward increasing or decreasing values. A formal determination that a trend is emerging would be an evidence-based expert opinion of the Scientific Advisory Committee. Such a determination would likely consider potential causality and statistical theory.
trophic	Of or involving the feeding habits or food relationship of different organisms in a food chain.
turbidity	Liquid's ability to intercept light. Measured in nephelometric turbidity units (NTU). Cannot be consistently correlated with the concentration of suspended matter.
tsunami	A very large ocean wave caused by an underwater earthquake or volcanic eruption.
Twenty-foot Equivalent Unit (TEU)	An internationally recognized measurement for containers. A standard twenty-foot container equals 1 TEU. A forty-foot container equals 2 TEU.
V	
vertebrate	An animal with a backbone.
visibility	Measure of extent to which particular components of a development may be visible from surrounding areas.
W	
waterfowl	A water bird, especially a swimming bird, such as ducks and geese.
woodpecker	Any of various usually brightly coloured birds of the family Picidae, having strong claws and a stiff tail adapted for clinging to and climbing trees and a chisel-like bill for drilling through bark and wood.

PART A – GENERAL REVIEW BACKGROUND

1. Introduction

1.1 BACKGROUND

The Vancouver Port Authority (hereinafter referred to as VPA, the Proponent or the Owner) is an independent federal agency that was created by the Government of Canada in 1999 to manage federal port lands in Vancouver and surrounding municipalities. VPA is proposing to expand the Deltaport Container Terminal (Deltaport) at Roberts Bank in Delta, British Columbia. VPA plans to construct an additional berth and storage yard at its existing Deltaport two-berth container terminal. The proposed third berth, known as the Deltaport Third Berth Project (DP3 or Project), is in response to industry projections that indicate that container traffic at all major container ports on the west coast of North America will double in the next 10 years, and triple in the next 20 years. The location of the Project is depicted in Figure 1 below.

The proposed Project is located 35 km south of Vancouver, at the existing Roberts Bank Port facility. The existing VPA facilities at Roberts Bank include Deltaport, a 65-hectare (160-acre) container terminal operated by Terminal Systems Inc. (TSI) and Westshore Terminals, a 50-hectare (124-acre) bulk handling coal port facility. These terminals are connected to the mainland by a 4.1 km causeway, which supports road and rail infrastructure.

The DP3 Project consists of construction of a wharf to accommodate an additional berth, and approximately 22 hectares (50 acres) of newly created land using dredge spoil for an expanded container storage yard. It will also include dredging to deepen the existing ship channel and create a tug moorage area adjacent to the terminal. Rail improvements will be required on the causeway and along the Gulf Siding, within existing rights-of-way. Road improvements on Highway 17 will be undertaken to minimize the effects of the Project on existing traffic flow.

1.2 PURPOSE OF THE COMPREHENSIVE STUDY REPORT

The purpose of a federal Comprehensive Study Report (CSR) is to:

- identify the potential environmental effects of the Project, including the environmental effects of any accidents or malfunctions that may occur in connection with the Project and any cumulative effects that are likely to result from the Project in combination with other projects or activities that have been or will be carried out;
- describe measures that are technically and economically feasible to mitigate any adverse environmental effects of the Project;
- report on all public concerns raised in relation to the Project and how they have been addressed; and
- provide conclusions with respect to whether the Project is likely to result in significant adverse environmental effects, based on the information received during the environmental assessment including public comments.

1.3 FEDERAL AND PROVINCIAL EA REVIEW

1.3.1 Federal Process and CEAA Requirements

An environmental assessment (EA) of a project is required under the *Canadian Environmental Assessment Act*, SC 1992, c. 37 as amended (CEAA) before a federal authority exercises certain powers or performs certain duties or functions in respect of a project for the purposes of enabling the project to be carried out, in whole or in part.

Under section 5(1) of CEAA, a federal environmental assessment (EA) will be required when, in respect of a project, a federal authority, for the purpose of enabling the project to be carried out in whole or part:

- is the proponent;
- makes or authorizes payment or any other form of financial assistance to the proponent;
- sells, leases or otherwise disposes of lands; or
- issues a permit, or license or other form of approval pursuant to a statutory or regulatory provision referred to in the CEAA *Law List Regulations*.

In June 2004, the Proponent advised Fisheries and Oceans Canada (DFO) in writing of the proposed DP3 Project. The Proponent was advised that the DP3 Project would require an authorization from DFO pursuant to section 35(2) of the *Fisheries Act,* because the Project would likely result in harmful alteration or destruction of fish habitat. The Proponent was also advised that the Project would require a permit issued by Environment Canada pursuant to the disposal at sea provisions in section 127(1) of the *Canadian Environmental Protection Act, 1999* (CEPA 1999), because the Project would involve the disposal of dredged materials in the ocean. The issuance of both an authorization under s. 35(2) of the *Fisheries Act* and a disposal at sea permit under CEPA 1999, trigger an environmental assessment under CEAA because sections 35(2) of the *Fisheries Act* and section 127(1) of CEPA are listed on the *Law List Regulations* under CEAA.

DFO and EC have been identified as Responsible Authorities (RAs) as defined by CEAA, and are required to conduct an EA for the Project before they can issue approvals under their respective legislation. Federal Authorities (FAs), such as Natural Resources Canada, Transport Canada, and Health Canada, have provided expert advice in relation to the Project. The Canadian Environmental Assessment Agency (CEA Agency), acts as the Federal Environmental Assessment Coordinator for the Project, and, with the input and involvement of the RAs, has coordinated federal involvement throughout the cooperative federal-provincial EA.

The Project type is included in section 28(c) of the *Comprehensive Study List Regulations* under CEAA, pursuant to the proposed construction, decommissioning or abandonment of a marine terminal designed to handle vessels larger than 25,000 DWT. The environmental assessments of projects described in the *Comprehensive Study List Regulations* are subject to comprehensive study

The comprehensive study process under section 21(1) of CEAA requires preparation of a “project scoping document” that is distributed to the public for formal review and comment, in order to obtain input on the proposed scope of the project for the purpose of the EA, the factors proposed to be considered, the proposed scope of those factors, and the ability of the comprehensive study process to address the issues related to the project. A report is then made by the RAs to the federal Minister of the Environment, who determines whether the assessment will continue as a comprehensive study, or whether the assessment will be referred to a mediator or a review panel.

From July 27 to August 23, 2004 the public was invited to comment on the proposed scope of the project, factors proposed to be considered in the assessment, proposed scope of those factors and the ability of the comprehensive study process to address issues relating to the project. Following public consultation and review of the proposed Project Scoping Document (dated July 23, 2004), changes were made to the scope of the project to address public comments received and more accurately describe how VPA’s proposed Terminal 2 project was to be considered in the cumulative effects assessment. Subsequent to the public consultation period, on December 17, 2004, the federal Minister of the Environment confirmed that the assessment would be conducted by means of a comprehensive study.

CEAA requires that a CSR be prepared and distributed for public comment. Upon completion of public review, public comments are forwarded to the federal Minister of the Environment.

The Minister of the Environment reviews the CSR and any public comments filed in relation to its contents. If the Minister is of the opinion that additional information is necessary or actions are needed to address public concerns, the Minister may request that the RAs address these concerns. Once any such concerns are addressed, the Minister would issue an environmental assessment decision statement that includes:

- the Minister's opinion as to whether the Project is likely to cause significant adverse environmental effects; and
- any additional mitigation measures or follow-up program that the Minister considers appropriate.

The Minister then refers the project back to the RAs for a course of action.

If the Minister determines that the project is not likely to cause significant adverse environmental effects, an RA may exercise any power or perform any duty or function, such as issuing a permit or authorization, that would permit the Project, or part of the Project, to be carried out.

1.3.2 Provincial Process

On February 24, 2003, the Proponent advised the British Columbia Environmental Assessment Office (EAO) in writing of its intention to proceed with the Project and in a separate letter, informed EAO about a possible future additional Roberts Bank container port expansion project, the Terminal 2 Project (T2). On February 2, 2006, the Proponent withdrew its letter of intent concerning the initiation of a pre-application review of the T2 Project, citing the inadequacy of existing infrastructure to support such a project.

As DP3 is a reviewable project according to Table 14, section 4 of the provincial *Reviewable Projects Regulation,* BC Reg. 370/2002, EAO issued a section 10 Order pursuant to the British Columbia *Environmental Assessment Act*, SBC 2002, c. 43 (BCEAA) on March 18, 2003, stating that DP3 will require an EA certificate, and that the Proponent may not proceed with the project without an assessment.

On September 17, 2004, EAO issued a section 11 Order pursuant to BCEAA, defining the scope of the required assessment and the procedures and methods for conducting the assessment for the purposes of that Act. On January 31, 2005, the Proponent submitted to EAO an application, which included a detailed project description and environmental impact statement, for an EA certificate for the Project (Application) pursuant to BCEAA. Following a conformance reference check against the Application Terms of Reference issued by EAO on October 8, 2004, the Application was accepted for formal review under BCEAA on February 9, 2005.

Following the completion of the EA review under BCEAA, EAO will prepare an Environmental Assessment Report and Project recommendations for the BC Ministers of Environment and Transportation for a decision under section 17(3) of BCEAA.

1.3.3 Other Federal Involvement

An environmental assessment is also required under the *Canada Port Authority Environmental Assessment Regulations*, SOR/99-318. Because the Project is described in the *Comprehensive Study List Regulations*, a comprehensive study and the preparation of a comprehensive study report is also required. By virtue of s. 8 of the *Canada Port Authority Environmental Assessment Regulations* and s. 2(1) and (2) of CEAA, the VPA, DFO and EC have agreed to follow the process set out in CEAA for the purpose of the environmental assessment of the DP3 Project. This Comprehensive Study report will be referred to the federal Minister of Transport for an environmental assessment decision statement, in order to fulfill the requirements of the *Canada Port Authority Environmental Assessment Regulations.*

1.4 COOPERATIVE ENVIRONMENTAL ASSESSMENT OF THE PROJECT

The Canada-British Columbia Agreement for Environmental Assessment Cooperation (2004) provides for coordinated environmental assessment processes to avoid uncertainty and duplication between the provincial and federal systems and to facilitate a "one project – one review" approach when both processes are triggered.

The harmonized assessment of the Project was conducted in accordance with the Agreement, through a joint federal-provincial work plan. The provincial EAO and the federal CEA Agency provided a coordination function for the EA process. The EAO role is to neutrally administer and manage environmental assessments, and exercise the powers and responsibilities of that office. Likewise, the CEA Agency, as the Federal Environmental Assessment Coordinator, is the principal point of contact for federal authorities during the assessment process, consolidating information requirements for the assessment as well as coordinating the actions of federal authorities with those of the EAO.

This report was produced through a collaborative effort intended to provide a common basis for an Assessment Report under BCEAA and a CSR under CEAA. It captures the process followed, the issues raised, the potential environmental effects, and the Proponent's proposed mitigation measures for the purposes of both federal and provincial reviews.

The federal RAs and expert FAs have participated in the development of this report and are satisfied with its conclusions. However, a final federal determination of whether the Project is likely to cause significant adverse environmental effects will be made by the Minister of the Environment in a federal environmental assessment decision statement.

1.4.1 Advisory Working Groups

As part of the harmonized review process, the EAO established working groups to advise the EAO and RAs on the assessment of the Project. A Technical/Biophysical Working Group (TBWG) and a Socio-economic/Community Working Group (SEWG) were organized early in the pre-application stage of the Project review and examined impact issues described in this report.

Specific tasks of the working groups included:

- reviewing the Application; and
- providing advice on the assessment findings to EAO and on its Environmental Assessment Report prepared for Ministers at the conclusion of the EA review.

The federal RAs relied upon the advice of the working groups in developing this report.

Membership

An invitation to participate in the working groups was circulated to:

- federal government departments;
- provincial government ministries and agencies;
- the Corporation of Delta;
- the Greater Vancouver Regional Transportation Authority;
- the Greater Vancouver Regional District (GVRD); and
- the following First Nations:
    - Tsawwassen First Nation;
    - Musqueam Indian Band;
    - Katzie First Nation;
    - Sto:lo Nation;
    - Semiahmoo Nation;

- Sencot'en Alliance; and
- Hul'qumi'num Treaty Group.

Not all members of the working group were involved in every meeting. All First Nations identified as potentially having an interest in the Project were provided with all Project review documents and were invited to join the TBWG and the SEWG and to attend all meetings. The Tsawwassen First Nation participated in the working groups from early in the pre-application review stage. The Sencot'en Alliance and the Hul'qumi'num Treaty Group joined the Project review process after the Application was filed. Proposed agendas were distributed in advance of the meetings to enable members to decide which meetings they wished to attend.

Meetings

During Pre-Application Stage:

Potential members of the two working groups were invited to an orientation meeting with the Proponent and its consultants in Victoria on March 11, 2003. The participants at that meeting discussed the details of DP3, its likely impacts and the EA process. The first formal pre-application meeting, following the issuance of the section 10 Order under BCEAA on March 18, 2003, was arranged in Tsawwassen on May 5, 2003. Participants at this meeting, with TBWG and SEWG members attending, discussed draft study work plans and the public consultation required for the Project review. The working groups also took part in a site tour of the existing container terminal facilities at Roberts Bank.

Subsequent working group meetings on the Project and a series of draft work plans for studies required for the Project were conducted in Vancouver on October 29, 2003 and January 8, 2004. The latter meeting also included discussion on the review of DP3 studies that would later be made available based on the work plans.

The working groups met again in Vancouver on June 10, 2004 to discuss the Project, the impact assessment, the study work plans and the status of the federal/provincial EA review process. The next pre-application stage meeting took place in Vancouver on September 9, 2004. This meeting included discussion of the remaining study work plans, and participants received an orientation to the public consultation process on the comprehensive study review scoping under section 21 of CEAA. A draft of the Terms of Reference (TOR) required for the Application to be submitted by VPA to EAO was also tabled for discussion. The finalization of the TOR was discussed between EAO and federal agencies. Based on comments received, and discussions with VPA, the TOR were subsequently issued as final and Approved Terms of Reference (ATOR) to VPA on October 8, 2004.

The Application was submitted to EAO as a draft on December 10, 2004. EAO, supported by a small team of federal agencies, conducted Application screening meetings on December 17, 2004 and January 6, 2005. A final version of the Application was submitted to EAO on January 31, 2005, and accepted for formal review under BCEAA on February 9, 2005.

Final meeting notes for all TBWG and SEWG meetings are available through EAO's Project Information Centre online at www.eao.gov.bc.ca.

During Application Review Stage:

EAO invited the working groups to meet with the Proponent and its consultants in Vancouver on March 9, 2005 and April 12, 2005. At these meetings, working group members discussed comments on the Application and received an update on the Project and the public open house and public meeting scheduled for March 16, 2005 and April 12, 2005, respectively.

A third review meeting held in Vancouver on May 19, 2005 included discussion of comments received on the Application and the Proponent's responses, as well as input from the third public meeting in Tsawwassen on May 5, 2005 and the supplementary meeting in Langley on May 11, 2005. A fourth working group meeting, scheduled for June 17, 2005 to discuss progress of the

review and issue tracking, was postponed until July 28, 2005. This delay was prompted by VPA's request for more time to address key federal review issues and comments received on the Application from working group members and the public. This time limit suspension was granted by EAO on June 27, 2005. The VPA used this period to:

- develop a conceptual Habitat Compensation Plan (HCP);
- develop a framework for an inter-causeway Adaptive Management Strategy (AMS);
- update air quality data and amend Chapter 13 of the Application;
- amend the Application's cumulative effects assessment (Chapter 23); and
- finalize responses to agency, First Nations and public comments on the Application.

A fifth Application review meeting was arranged for the TBWG and the SEWG on September 22, 2005. The meeting participants received Project updates from VPA, additional to design and dredging changes described in VPA's letter to EAO of July 27, 2005. The meeting participants discussed the progress on additional work required for the inter-causeway Adaptive Management Strategy, habitat compensation measures and air quality and cumulative effects assessments. The meeting also included updates on comments received on the Application and VPA responses to comments from agencies, First Nations and the public.

A sixth Application review meeting took place on November 24, 2005. The four supporting and additional EA review documents identified above were tabled for discussion. Participants at this working group meeting also discussed the consultation process on this review material; and the finalization of the draft Assessment Report and the Comprehensive Study Report procedures under CEAA.

A seventh working group meeting was arranged on December 14, 2005. At this meeting participants discussed the public consultation process on the four supporting documents, received a report on the public open house arranged on December 13, 2005, and discussed the four documents, and progress on the DP3 review.

On January 26, 2006, participants at the eighth working group meeting discussed the results from the public comment period on the four supporting documents, the review of these documents, the commitment table that the Proponent would comply with if the Project proceeded, and the process for finalizing drafts of EAO's Assessment Report and the federal CSR.

The ninth working group meeting was held on February 16, 2006 to discuss comments on the four documents referred to above and the Proponent's commitments and assurances regarding the Project. On February 23, 2006, a tenth working group meeting was organized by conference call to continue the formulation of VPA commitments and assurances, as part of the full mitigation measures required to address any likely Project impacts. EAO thereafter continued to consult with the RAs and other regulatory agencies, as well as with First Nations, in the continuing development of the Assessment Report and attachments to the report such as the *Owner's Table of Commitments and Assurances* (*Appendix A* of this CSR).

On April 6, 2005, EAO distributed the final draft of key sections of the Assessment Report and attachments to the remaining members of the working group and to First Nations with an interest in the Project. The purpose was to obtain advisory input (as per the BCEAA section 11 Order) on the final results of the Project review, the recommended conditions for Project certification and the finalization of the Assessment Report. Discussion ensued on comments received regarding the material issued. EAO consulted with the RAs and finalized the Assessment Report in June 2006.

Final meeting notes from regular working group meetings are available on the EAO website noted above. Additional to regular working group meetings, regulatory agencies and other interested parties also met in sub-groups to discuss the development of the Habitat Compensation Plan

(HCP), the AMS and air quality impact issues. Available notes from these meetings are posted on the EAO website.

1.4.2 Public Consultation

Under section 21(1) of CEAA, for a comprehensive study, RAs must ensure there is public consultation on the proposed scope of the Project, the proposed factors to be considered in the environmental assessment, the proposed scope of those factors, and the ability of a comprehensive study to address issues relating to the Project. An invitation for members of the public to review and comment on a scoping document was advertised in community newspapers and also placed on the Canadian Environmental Assessment Registry (CEAR). The public was made aware, by way of the same advertising, of the availability of participant funding for public participation in the comprehensive study process and review of the CSR.

The notices also provided details concerning how to access the scoping document, and how to provide feedback. Copies of the scoping document were made available at local libraries. The scoping document was posted on the Proponent's website. The Participant Funding Program recipients were also confirmed on March 4, 2005. The CEA Agency provided $15,000 to two applicants to support their participation in the environmental assessment.

In their Environmental Assessment Track Report submitted to the Minister of the Environment, the RAs, in consultation with the expert federal authorities, indicated that the comprehensive study could fully address issues related to the Project. The Minister of the Environment confirmed on December 17, 2004 that the environmental assessment under CEAA would continue as a comprehensive study.

A second opportunity for public input was provided as a part of the cooperative provincial/federal review of the Project; the RAs shared the formal comment period on the Application that was used for BCEAA.

A third opportunity for public input on the Project and the associated environmental assessment is through commentary on this report. Pursuant to section 22(1) of CEAA, the CEA Agency will facilitate public access to the CSR, including administering a formal public comment period. All comments submitted will be provided to the RAs and will become part of the public registry for the Project. The RAs will be asked by the Agency to advise whether their conclusions have been altered as a result of the public comments received. This public input, along with comments received during the development of the CSR, will be taken into account by the Minister of the Environment when issuing an environmental assessment decision statement.

1.4.3 EA Review Conclusions

Part B of this report discusses the major issues arising in the course of this environmental assessment and includes working group support of the review of individual impact issues. Not all members of the working group have formulated opinions on all review comments, on the Proponent's responses to those comments, and on the conclusions drawn. At the end of each chapter in Part B there is a conclusion on the likelihood of the Project to cause significant adverse environmental effects on the specific components of the environment under consideration in that chapter. In Part C of this report, an overall conclusion regarding the significance of any likely adverse environmental effects is reached.

2. Project Description and Scope of Review

2.1 PROJECT OVERVIEW

As noted in section 1.1, VPA plans to construct an additional berth and storage yard at its existing Deltaport two-berth container terminal. The proposed third berth, known as the Deltaport Third Berth Project (DP3 or Project), is in response to industry projections that indicate that container traffic at all major container ports on the west coast of North America will double in the next 10 years, and triple in the next 20 years.

The Project consists of construction of a wharf to accommodate an additional berth, and approximately 22 hectares (50 acres) of newly created land using dredge spoil for an expanded container storage yard. It will also include dredging activities to deepen the existing ship channel and create a tug moorage area adjacent to the terminal. Rail improvements will be required within existing rights-of-way and along Deltaport Way. Road improvements on Highway 17 will be undertaken to minimize the Project impacts on existing traffic flow. The general location of the Project is depicted in Figure 1.

2.2 SCOPE OF PROJECT

The review of the Project was undertaken pursuant to the agreed federal/provincial work plan for the cooperative and harmonized Project review and assessment, and with reference to the Approved Terms of Reference (ATOR) issued to the Proponent.

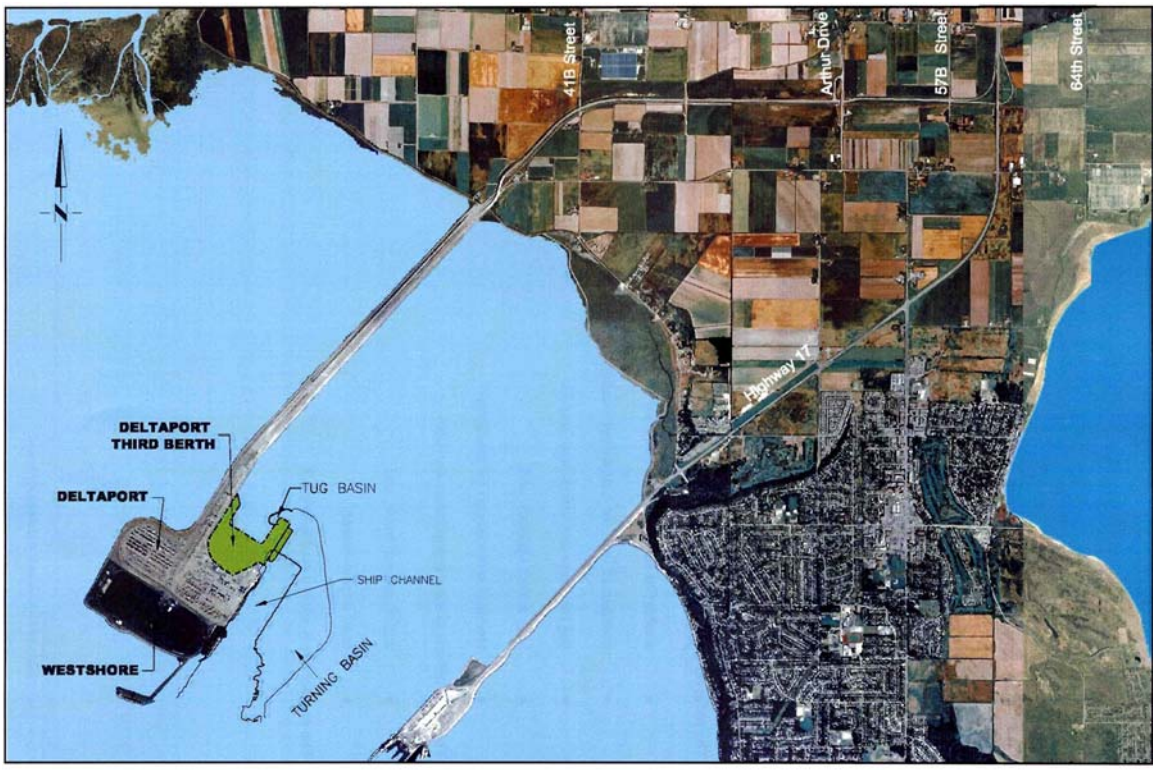
The scope of Project pursuant to CEAA is the following:

Principal components for the DP3:

- construction of a fill area of approximately 22 hectares (50 acres) of land for an expanded container storage yard (dredge and fill);
- construction of a wharf to accommodate a third berth;
- expansion of the existing ship channel to the north;
- disposal of dredged material;
- creation of a tug moorage area adjacent to north side of the third berth;
- relocation of a safety boat launch (currently located on the north side of Deltaport); and
- addition of approximately 7,000 metres (23,000 feet) of rail track, which includes:
    - the extension of the Gulf Siding arrival/departure tracks from east of Arthur Drive to 64th Street, Delta (within BC Rail's right-of-way); and
    - additional track on the causeway, within BC Rail's property.

The operation of the Project's facility:

- increase in associated marine traffic (container vessels and tugs);
- increase in terminal loading and unloading equipment (ship-to-shore gantry cranes, rubber-tired gantries, rail mounted gantries, tractor trailers); and
- increase in associated road and rail traffic.



Courtesy of Vancouver Port Authority

Figure 1 Location of DP3 Project

2.3 SCOPE OF ASSESSMENT

The cooperative federal/provincial environmental assessment (EA) includes consideration of the potential environmental, socio-economic, heritage, and health effects of the Project, taking into account mitigation measures to prevent or reduce any potential adverse environmental effects.

As outlined in the scoping document the following factors were considered:

- the environmental effects of the Project, including:
    - the environmental effects of malfunctions or accidents that may occur in connection with the Project;
    - any cumulative environmental effects that are likely to result from the Project in combination with other projects or activities that have been or will be carried out; and
    - any change that the Project may cause to listed wildlife species, its critical habitat, or the residences of individuals of that species, as those terms are defined in section 2(1) of the *Species at Risk Act* (SARA), (species also include those identified by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)).
- the significance of the environmental effects referred to above;
- comments from the public;
- measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the Project;
- the purpose of the Project;
- alternatives to the Project;

- alternative means of carrying out the Project that are technically and economically feasible and the environmental effects of any such alternative means;
- the need for, and the requirements of, any follow-up program in respect of the Project;
- the capacity of renewable resources, that are likely to be significantly affected by the Project, to meet the needs of the present and those of the future;
- the effects of the Project on the environment that may impact social, economic, heritage and human health; and
- community knowledge and Aboriginal traditional knowledge.

The EA analysis under CEAA is based on the assessment scoping listed above. The Project review material is based on the selected concept of the Project, as presented in the Proponent's Application. Mitigation measures to address potential significant adverse effects of the Project are proposed in light of the Project concept presented in the Application and other review material listed in the Appendices to this report. This report addresses the best efforts in defining the *Owner's Commitments and Assurances* (see *Appendix A*) as pertinent conditions for Project certification pursuant to BCEAA. As the Project proceeds through final design and construction, some Project details may change, but the conditions reflected in this report ensure that the EA of the Project will continue to meet the intent of BCEAA and CEAA.

2.4 PROJECT JUSTIFICATION AND DESCRIPTION

2.4.1 Purpose of Project

The primary objective and purpose of the Project is to provide container terminal facilities to increase British Columbia/Canada competitiveness as a trading partner in the Pacific Northwest container market and to contribute to British Columbia and Canada employment and economic growth. According to VPA, independent market forecasts indicate that North American container volumes are expected to grow at a rate greater than that of the economy through 2020, and Pacific Northwest ports, including the Port of Vancouver, are expected to capture an increasing share of west coast traffic. The Port of Vancouver is well established as the fifth largest container port on the west coast of North America. The Port of Vancouver is positioned to realize growth through 2020.

VPA prepared a container expansion strategy in 2002 in response to potential container growth. VPA's overall expansion strategy consists of a 3-pronged approach: increasing production at existing terminals, expanding existing facilities, and exploring options for new facilities.

The rationale for the Project is further captured in the federal *Pacific Gateway Strategy* announced on October 21, 2005. The Project is also referenced in the major Gateway Program transportation infrastructure announcement the Premier of British Columbia made on January 31, 2006.

2.4.2 Project Components and Description

Wharf to Accommodate the Third Berth:
The DP3 Project is planned to handle a range of vessels including the largest 10,000 twenty-foot equivalent unit (TEU) ships currently being considered for the trans-Pacific container trade. The caisson wharf will be 427 metres (1,400 feet) long, navigable to –16 metres chart datum (CD) and will have a deck elevation of approximately +8.0 metres CD.

Container Storage Yard:
The Project includes the construction of approximately 22 hectares (50 acres) of new land for container operations and storage. This will increase the area of Deltaport from 65 hectares (160 acres) to approximately 85 hectares (210 acres). The new land was to be created through on-site dredging and landfilling operations, with soil densification required along the perimeter berm and under most new structures. However, following redesign, as was stated in a letter of July 27,

2005 from VPA to EAO, the Proponent subsequently determined that the fill for the terminal would be imported from Fraser River dredge operations and existing coastal quarries.

In the above-referenced VPA letter, the Proponent also advised that it had significantly reduced dredge volumes for terminal construction from those outlined in the Application. Based on additional engineering analysis, geotechnical investigations, and integration of environmental criteria and comments from DFO and EC, the Proponent reduced the overall dredging program from an original estimate of 3,470,000 m^3 to 853,600 m^3. The changes and reductions in the dredging program are summarized in Table 1 (this issue is also discussed in Chapter 4 – *Sediment Quality, Dredging and Ocean Disposal*).

Table 1 Comparison between original dredge volumes and revised volumes (in cubic metres)

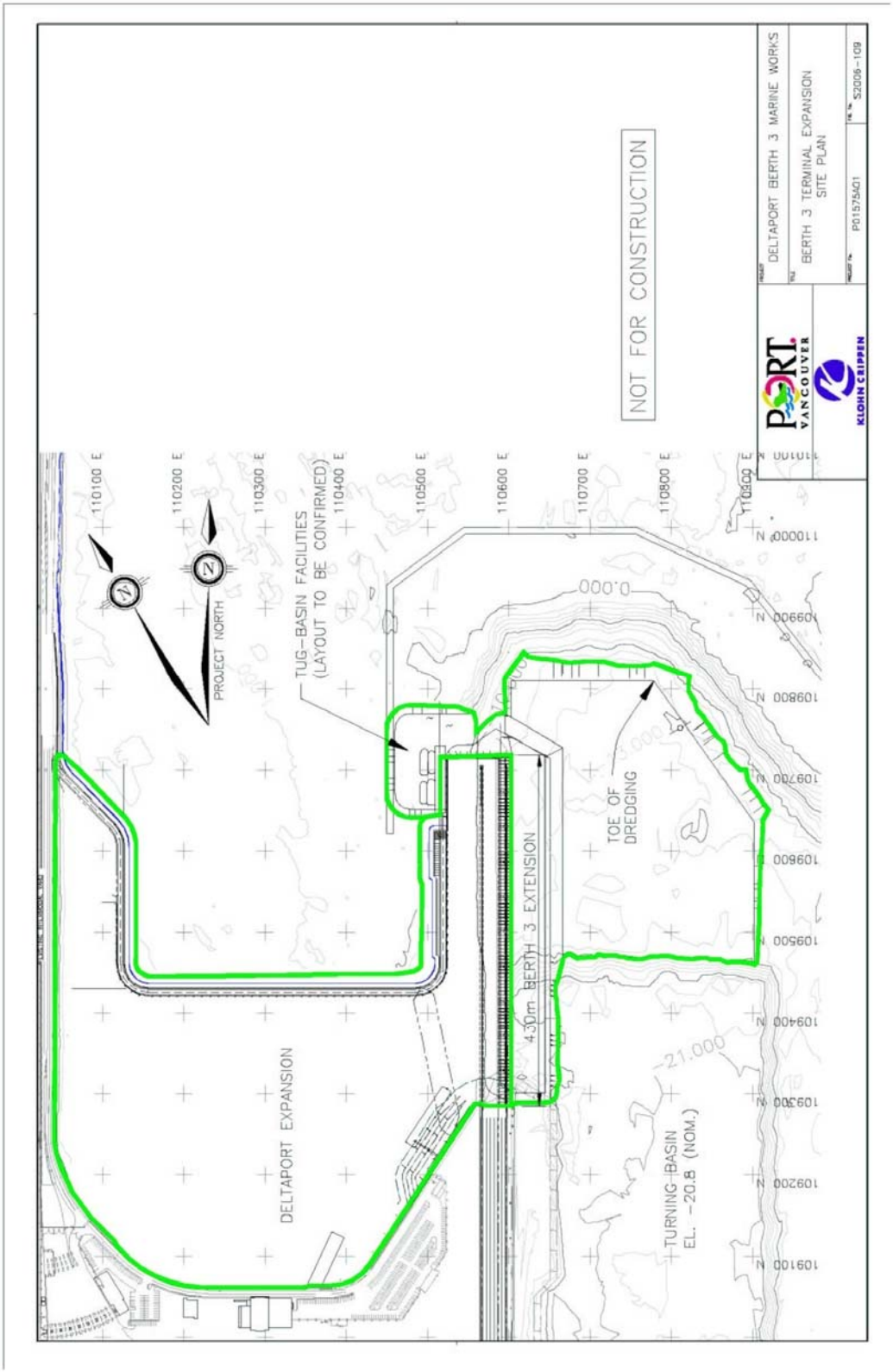
Area	Original Application Dredge Volume	Original Application Disposal Volume	Revised Dredge Volume	Revised Disposal Volume
Dredging of Turning Basin for Fill Material	2,000,000	1,000,000	0	0
Dredging under Caissons and Terminal Area (including tug basin)	1,220,000	1,220,000	603,500	300,000
Dredging of Ship Channel	250,000	250,000	249,500	175,000
TOTAL (estimated)	3,470,000	2,470,000	853,000	475,000

Terminal Infrastructure:
The terminal infrastructure is designed to support terminal operations such as loading and unloading of container ships, container storage, and container transfers to and from rail and road transport. Terminal operations will be supported by terminal components on the proposed new land and wharf for the Project including:

- paved container yard area;
- 24 reefer towers;
- truck out-gate;
- buildings;
- high mast lighting towers;
- electrical power and communication systems;
- storm sewer, sanitary sewer, water distribution and fueling facilities;
- parking;
- terminal roads; and
- rails for ship-to-shore gantry cranes.

A layout of the terminal and infrastructure is depicted in Figure 2.

Tug Moorage and Boat Launch:
The tug moorage area currently located at the northeast corner of the existing Deltaport terminal will be relocated to the northern corner of the third berth. The safety boat launch, currently located in the Deltaport terminal tug moorage area, will be relocated as part of the Project. The original Application concept layout for the tug moorage basin and safety boat access area was to consist of a floating dock, walkway and dredged channel to allow for tug



Courtesy of Vancouver Port Authority

Figure 2 DP3 Project site plan

access. The original tug basin layout had an impact area of 2.6 ha. The Proponent, working with the tug operating company, reviewed design alternatives and the tug basin area was reduced from 2.6 to 1.19 ha in size and the dredge elevation was raised from –6.5 to –6.0 m CD, further reducing dredge volumes. An additional advantage of the reduced tug moorage basin layout is that the existing crest protection can remain in place mitigating potential morphological changes. Further, the tug facility can, according to VPA, also be installed in its permanent location from the start of Project construction. An outline sketch of the tug basin relocation is shown in Figure 3.

Ship Channel:
The existing ship access channel will be extended 350 m to an elevation of approximately –16 metres CD to provide access and adequate draft for container ships.

Rail Components:
Preliminary analysis by VPA indicates that there will be a requirement for approximately 23,000 feet of additional railway track for the Project. This railway track will be located on the causeway and at the Gulf Siding (located south of Deltaport Way) by extending the arrival/departure tracks. All of the rail improvements will be constructed within BC Rail's property on the Roberts Bank causeway and within its existing Gulf Siding right-of-way. The 57B Street at-grade crossing south of Deltaport Way is proposed to be closed to accommodate longer container trains using the extended arrival/departure tracks at the Gulf Siding. This closure will require approval from the Corporation of Delta with input from the various stakeholder groups such as the Delta Farmers' Institute and local residents. Closure of rail crossings is further discussed in Chapter 12 – *Socio-community Issues and Economics*.

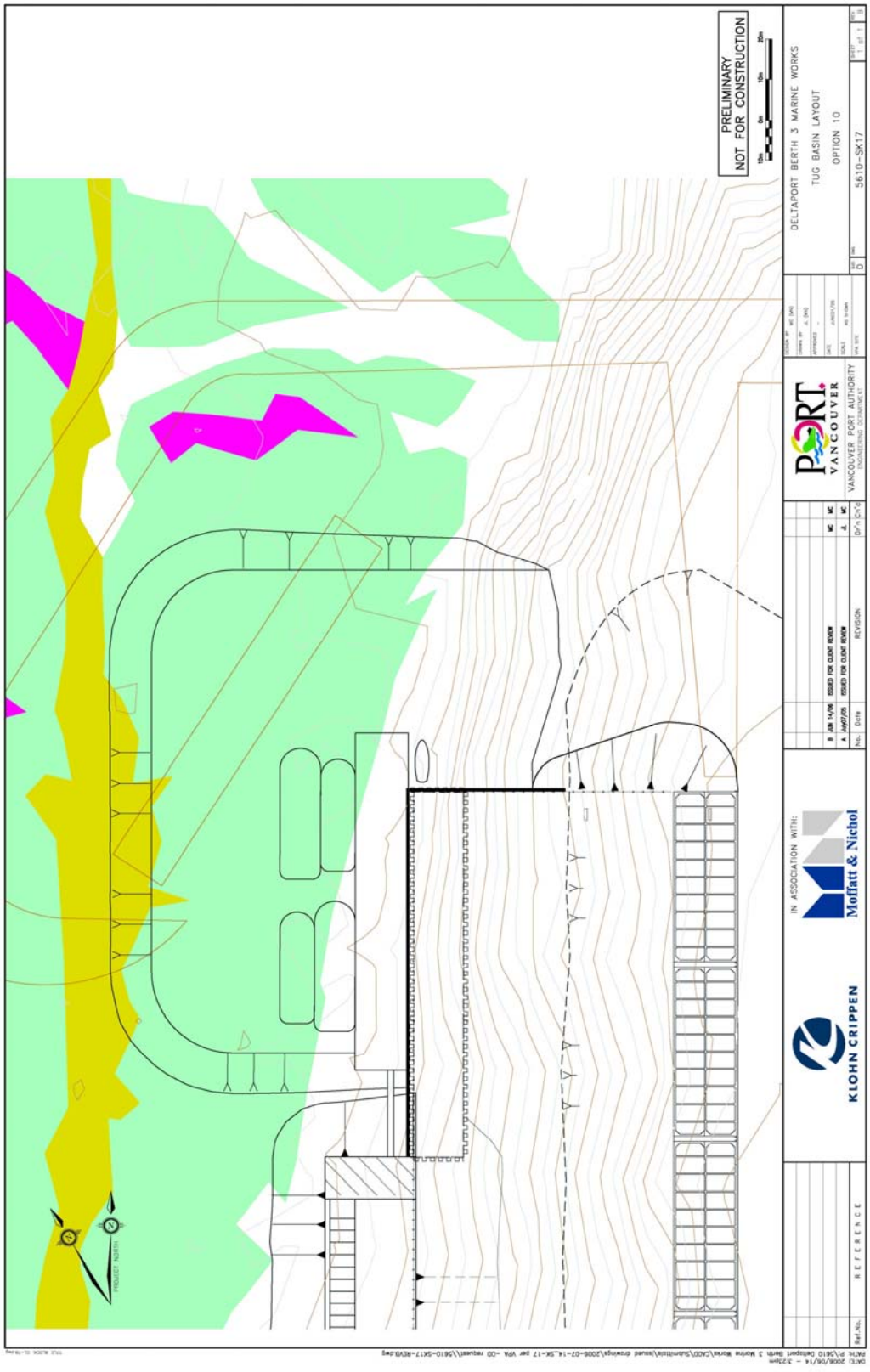
Road Components:
No new road infrastructure along Deltaport Way will be required to support the increased traffic predicted as a result of the Project. With VPA as the funding source, the Ministry of Transportation (MOT) has agreed to implement a number of improvements along Highway 17 to mitigate the impact of additional DP3 container truck traffic. The proposed closure of the 57B Street at-grade crossing south of Deltaport Way is discussed as a rail component since the closure is required to accommodate longer container trains.

Marine:
In 2003, Deltaport recorded 365 vessel calls (container ships that berthed at Deltaport). Vessels ranged in size from 1,600 TEU to 6,300 TEUs with the average size being approximately 4,500 TEUs. Marine traffic at Deltaport is projected to change both in number of vessel calls and in vessel size over the next 20 years. Based on preliminary research carried out by VPA, it is expected that the number of vessel calls will increase to approximately 393 per year at full capacity in 2012. In the long term, it is expected that the size of vessels will continue to increase and at some point, vessels as large as 10,000 TEUs will call at Deltaport.

Site Services:
Construction of new site services for the Project will be limited to on site works (electrical, sewers and water), as the existing Deltaport site services (including electrical, sewage treatment and water) are adequate to meet Project needs with appropriate tie ins to the new Project areas.

Terminal Equipment:
New equipment proposed for the Project includes 3 ship-to-shore gantry cranes, 10 to 12 rubber-tired gantries (RTG), 1 rail mounted gantry (RMG), numerous tractor trailers, and other related equipment.

Security:
VPA is required, for all its container terminals, to meet the International Ship and Port-facility Security (ISPS) Code established July 1, 2004. As such, the Project will be designed and operated to meet the latest security standards.



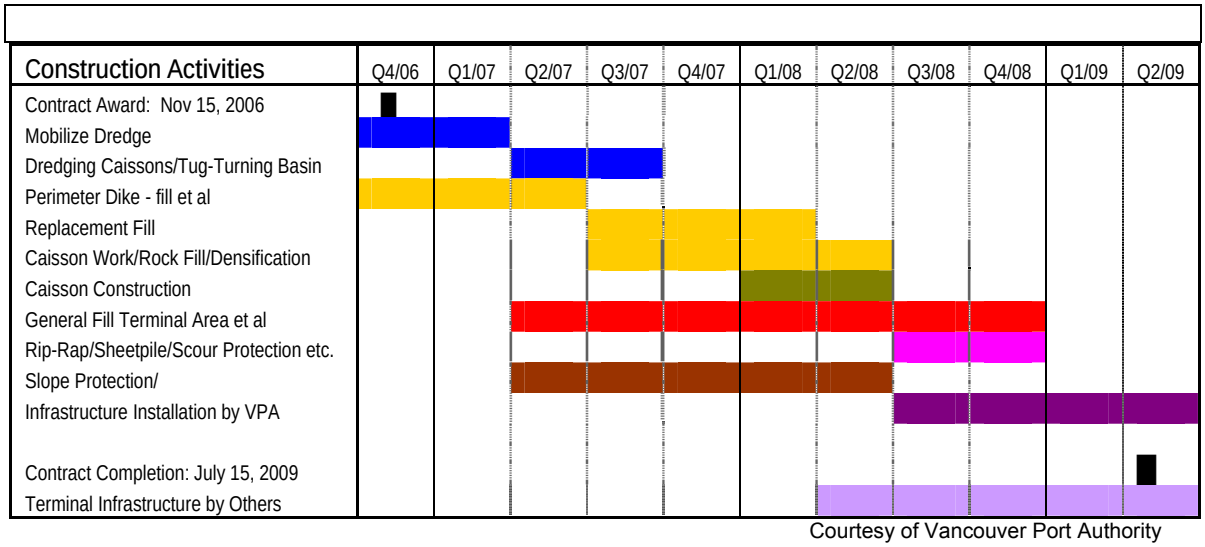
Courtesy of Vancouver Port Authority

Figure 3 Re-positioning of the tug basin

2.4.3 Project Construction

Approximately 249,500 m^3 of material will be dredged to create the ship channel and an additional 603,500 m^3 will be dredged to accommodate the caissons associated with the third berth. Material unsuitable for use as fill will be pumped and disposed of at the nearby Roberts Bank designated disposal at sea site. The material disposed of at sea will comply with the *Disposal at Sea Regulations, 2001*. The additional railway track on the causeway and at the Gulf Siding (located south of Deltaport Way) will be constructed by BC Rail.

VPA assumes that it will commence construction at Roberts Bank in November 2006 and have the Project completed in July 2009. A tentative construction schedule is depicted in Figure 4.



Courtesy of Vancouver Port Authority

Figure 4 Tentative Project construction schedule

2.4.4 Project Capital Cost and Job Creation

The Proponent estimates the capital cost of the Project to be about $272 million. Employment opportunities associated with DP3 were estimated by the Proponent, and include approximately 640 person years of direct jobs during construction and approximately 360 direct full-time-equivalent (FTE) jobs per year during operation. VPA estimates that each container that passes through Deltaport generates $450 in wages, $550 in gross domestic product (GDP) and $1,200 in economic output. These benefits will increase with the development of the proposed Project.

2.4.5 Project Operations

Deltaport operations consist of the loading and unloading of container ships, container storage, and container transfers to and from rail and road transport. The container ships are loaded and unloaded by electric powered ship-to-shore gantry cranes that are rail mounted at the berth face. After the containers are unloaded from the ships, the containers are moved by tractor trailers to the container storage yard and stacked by RTG. The tractor trailers and the RTGs are powered by diesel engines. The containers will be stacked to a maximum of five high in the storage yard. After a brief storage period, the containers are loaded onto trucks for road transport or onto yard based tractor trailers, which will move the containers to the existing Deltaport intermodal yard for rail transport. Electrified RMG are used in the intermodal yard to load the containers onto the rail cars.

Throughout this report, container industry statistics are presented as container volumes, which are measured in TEUs, or twenty-foot equivalent units. The proposed Project will increase the capacity at Deltaport from a current operating capacity of 900,000 TEUs per annum to 1.3 million TEUs per annum. The Deltaport Third Berth Project is planned to handle a range of vessels

including the largest (10,000 TEU) ships currently being considered for the trans-Pacific container trade.

2.5 APPLICATION FOR PROJECT ENVIRONMENTAL ASSESSMENT

The Proponent has submitted an Application and other supporting review material for an environmental assessment certificate under BCEAA. The Project must also undergo a comprehensive study under CEAA before DFO can grant an authorization under the *Fisheries Act* and Environment Canada can issue a disposal at sea permit under CEPA 1999. The Project has been subject to a cooperative federal/provincial review process.

The Proponent must obtain or meet the intent of the following regulatory approvals:

- Project certification under BCEAA;
- Section 35(2) authorization under the *Fisheries Act* for any works or undertakings in or around water bodies that might result in the harmful alteration, disruption or destruction of fish habitat;
- *Canadian Environmental Protection Act, 1999* section 127(1) permit authorizing the disposal at sea of dredge spoil from the Project site or other underwater excavations and dredging;
- Section 14 permit under the British Columbia *Heritage Conservation Act*;
- Section 9 approvals under the British Columbia *Water Act* for any changes in and about a provincial watercourse or water body;
- Corporation of Delta permits, including those related to the design advisory process, construction approval process and applicable bylaws such as those concerning noise, hours of work, street access and traffic disruption; and
- All relevant permits, licenses, approvals or any other authority under any other enactment that may be required by the federal, provincial and local governments or their agents for construction and operation of the Project.

3. Information Distribution and Consultation

3.1 ACCESS TO REVIEW DOCUMENTATION

The EAO maintains an electronic Project Information Centre (ePIC) (formerly known as the Project Registry) in Victoria for the purpose of facilitating public access to records relating to EA and Project reviews. In addition, records and documents related to the review of the Project have been posted on the EAO's website http://www.eao.gov.bc.ca.

The Application, including the supporting 11 Technical Volumes, once accepted for formal review, was made available at the Delta Pioneer Library in Ladner, the George Mackie Library in Delta, the South Delta Library in Tsawwassen, the Cloverdale Library in Surrey, the Strawberry Hill Library in Surrey and the Langley Library in Langley. The public was encouraged to visit the Proponent's Project office in Vancouver to see review material. These review options were referred to in the notifications issued to the public (see section 3.2).

During the review of the Application and supporting documents, EAO made available the 4 review documents discussed in section 1.4.1 available to the public for comment. These documents were posted on the EAO website and paper copies were made available at libraries in the Project area.

Under CEAA, a public registry was established (available at: http://www.ceaa-acee.gc.ca/050/index_e.cfm) concerning DP3 – CEA Registry Reference Number – 04-03-3734, to ensure that the public was or will be provided with an opportunity to review the following:

- the notice of commencement of the environmental assessment;
- the description of the scope of the Project being assessed and the scope of the assessment;
- the notice of decision to continue as a comprehensive study;
- a copy of the CSR (and how a hard copy may be obtained);
- the RAs' decision on the environmental assessment; and
- details on any follow-up programs to be implemented as part of the EA.

3.2 NOTIFICATION

3.2.1 Public Review of Application and Technical Volumes

Pursuant to the BCEAA section 11 Order, EAO arranged for the following notification that the VPA Application had been filed with the Province and that a public review of the Application was to be conducted:

- *Vancouver Sun*: February 14, 2005;
- *South Delta Leader*: February 18, 2005;
- *Delta Optimist*: February 16, 2005;
- *Langley Times*: February 16, 2005;
- *Surrey Leader*: February 16, 2005; and
- Notification on the EAO Website on February14, 2005.

On February 15, 2005 the public could also access the DP3 Application and supporting Technical Volumes on VPA's Project website. In addition, the website provided details on the review process and links to the EAO website.

An information letter was issued by VPA to individuals and organizations (approximately 450) on its Project database to inform them about the EA and public comment period. This letter included

details on where individuals could get a copy of the Application and how they could submit comments to the harmonized review.

To inform the public on the cooperative environmental assessment of the Project, public information sessions, with public presentations, were arranged at the Delta Town and Country Inn on March 16, 2005 and April 12, 2005, and at the Coast Tsawwassen Inn on May 5, 2005. A supplementary public meeting, providing Langley residents with the opportunity to raise rail crossing concerns, was arranged at the Newlands Golf and Country Club on May 11, 2005. This arrangement required EAO to issue a section 13 Order under BCEAA, dated May 4, 2005, to inform the public about the second comment period to capture comments resulting from the Langley event. Advertisements were also placed in the above-referenced media on dates shown in Table 2. These open houses and public meetings provided the public with information on the Project and public comment process relating to the review of the Application.

Table 2 Advertisements for the public information events

Public Information Event	**Media**	**Dates**
March 16, 2005 Public Open House, Delta	*South Delta Leader* *Delta Optimist* *Langley Times* *Surrey Leader* *South Delta Leader* *Delta Optimist* *Langley Times Surrey* *Surrey Leader*	March 4, 2005 March 5, 2005 March 5, 2005 March 6, 2005 March 11, 2005 March 12, 2005 March 12, 2005 March 13, 2005
April 12, 2005 Public Open House and Public Meeting, Delta	*South Delta Leader* *Delta Optimist* *Langley Times* *Surrey Leader* *South Delta Leader* *Delta Optimist* *Langley Times* *Surrey Leader*	April 1, 2005 April 2, 2005 April 3, 2005 April 3, 2005 April 8, 2005 April 9, 2005 April 10, 2005 April 10, 2005
May 5, 2005 Public Meeting, Tsawwassen	*South Delta Leader* *Delta Optimist*	April 29, 2005 April 30 and May 4, 2005
May 11, 2005 Public Meeting, Langley	*Langley Times* *Langley Advance*	May 8, 2005 May 6, 2005

VPA also issued an Application review notification in its March 2005 newsletter. The purpose of the newsletter was to provide the public with an update on the Project, to inform people of the public comment period, and to advertise the public events. The newsletter was sent to individuals and organizations on VPA's Project database and also distributed through a Canada Post mail drop to over 34,000 residents and businesses in Delta.

3.2.2 Public Review of New and Amended Review Material

As discussed in section 1.4.1, VPA provided amendments to Application chapters on air quality assessment and cumulative effects assessment, as well as new material on habitat compensation measures and an Adaptive Management Strategy for the Roberts Bank inter-causeway area.

EAO and the RAs decided to provide the public with the opportunity to review and comment on these 4 documents, thus EAO issued a section 13 Order to that effect on December 1, 2005, providing the public with a 32-day public comment period. A public meeting was arranged at the Coast Tsawwassen Inn on December 13, 2005, providing the public with the opportunity to discuss the 4 referenced documents. A notification to this effect was advertised in the *Surrey Leader* on December 9, 2005 and in the *Delta Optimist* on December 3, 2005 and December 10, 2005. An Information Note to this effect was posted on EAO's Project website on December 2, 2005. The provincial section 13 Order was amended on December 12, 2005, providing 9 more days for public comments on the 4 documents, closing on January 25, 2006.

3.3 CONSULTATION

3.3.1 Public Consultation Measures Undertaken by the Proponent

The geographic focus of the public information and consultation program for the DP3 Project was within the Corporation of Delta and surrounding communities, including the Tsawwassen First Nation reserve.

3.3.2 Proponent Consultation Prior to Application Submission

General

Starting in the spring of 2003, the VPA public consultation process for DP3 proceeded through an Early Notification Phase to a Pre-Application Phase in the summer and fall of 2004. Further details of these two initiatives are presented below.

The consultation process by the Proponent followed the essential elements of the EAO's public consultation policies. The goals of the VPA public consultation program were to ensure that:

- the public was consulted, on both a regional and a community/neighbourhood level, consistent with BCEAA and CEAA requirements;
- the review process was open, accountable and considered regional and local/community interests;
- community support for the overall Project planning process was fostered; and
- existing relations with local communities were strengthened.

VPA submitted a *Consultation and Communications Plan* for the Roberts Bank Container Expansion Program to EAO in June 2003. This plan included an overview of the VPA's proposed program for the time period between 2003 and 2009 and was endorsed by the working group in July 2003.

The stated VPA objectives for the consultation and communications program included the following, as relevant to the Project's cooperative federal/provincial assessment:

- raise public awareness about the scope, necessity, and benefits of the Roberts Bank Container Expansion Program;
- offer a consultation program which is flexible and responsive to the changing needs of interested parties;
- identify interested parties and their Project concerns early on in the planning process;
- identify public issues and interests pertaining to potential environmental, economic, social, heritage and health impacts and benefits of DP3;
- demonstrate how public input contributes to the Project's development; and

- inform interested parties in a timely manner about the results of technical studies, the proposed design for the Project, and possible mitigation measures for the construction, operation and maintenance of the Project.

Information Materials Distributed
Since the inception of Project planning in April 2003, the following VPA information materials were developed and shared with interested parties and the public: (i) 3 program newsletters; (ii) 5 information sheets; and (iii) 2 sets of poster boards for public open houses.

Newsletters regarding the Roberts Bank Container Expansion Program were developed and distributed in May 2003, November 2003, and July 2004. The May 2003 newsletter provided an introduction to the container expansion program, including rationale and benefits. It included details on the proposed DP3 schedule and studies, the regulatory review process, as well as dates and locations of the upcoming public open houses. The November 2003 newsletter provided an update, including findings from the May 2003 open houses. It also included details on the environmental and transportation studies underway, and the locations of libraries holding the DP3 Project public resource files. The July 2004 newsletter provided a program update, including findings from the June 2004 VPA open houses, and a preliminary description and preferred site for the Project. It also included details on the regulatory review process, environmental impact assessment studies and road and rail transportation issues.

In an effort to share Project details with interested parties, 5 information sheets were developed by the Proponent and distributed at public open houses. Topics included:

- proposed socio-economic studies (May 2003 open houses);
- proposed environmental studies (May 2003 open houses);
- proposed physical and engineering studies (May 2003 open houses);
- regulatory review process (May 2003 open houses); and
- update on impact assessment studies (June 2004 open houses).

The information sheets were also distributed to individuals and organizations, as requested, and subsequent to the open houses, they were posted on the Proponent's website.

Poster boards were developed and presented at the May 2003 and June 2004 public information events. As well, additional materials, including maps and VPA brochures, were made available at the events.

Communication
Program Information Line
A program telephone information line (604.665.9337) was established in late April 2003 to enable interested parties to provide input, ask questions and/or request information from VPA regarding expansion of the container port at Roberts Bank. The voicemail received on the line was monitored daily (Monday – Friday). An outgoing message provided callers with updates on the program as well as the website address. The telephone information number was referenced in communications materials, including newsletters, info sheets and advertisements. Questions or requests for information were responded to by VPA.

Program Website
A Roberts Bank Container Expansion Program page has been established and maintained on the VPA website www.portvancouver.com/container_expansion which provides information to the public. As new communications and technical materials have been developed, the site has been updated and includes the additional information on DP3. Specifically, the site includes information on the regulatory process, the Application, public consultation details, Project studies and design developments, Project maps, and frequently asked questions.

T2 is on separate website at http://www.portvancouver.com/the_port/terminal2.html, which states "The Port has not advanced the Terminal 2 proposal beyond the point of identifying a potential site location and desired capacity. The terminal configuration, on-site services, and offsite road and rail requirements have not been established and will require extensive studies before they can be confirmed."

Media Relations Program

A targeted program of outreach to various media outlets was initiated in March 2003 regarding the Roberts Bank Container Expansion Program and continued through the pre-application phases. The program focused on local media in the vicinity of the DP3 Project. The two key local news outlets are the bi-weekly *Delta Optimist* and the weekly *South Delta Leader*. Media briefings were arranged in March 2003 with the *Optimist* and the *Leader* resulting in detailed coverage. The Delta newspapers were also contacted in advance of the May 2003 open houses. Both of them sent reporters to the open houses and carried additional coverage shortly thereafter.

Public Consultation

Open Houses

The 4 open houses hosted by the Proponent before the Application was filed (pre-application consultation) had attendance levels of more than 385 people. A number of the same individuals attended both the 2003 and 2004 events. Twenty-seven comment forms were received at the May 2003 open houses and 54 were received at the June 2004 events.

Participation at Meetings and Presentations

In May 2003, and again in November 2003, approximately 100 letters were sent by the Proponent to ratepayers associations, environmental organizations, Delta business and social associations and resource industries (agriculture and fishing). These letters provided information on the Roberts Bank Container Expansion Program and invited representatives of these organizations to meet with the Proponent to learn about the Project and discuss issues of interest to them. The Proponent and/or its technical consultants conducted more than 18 meetings/presentations with interested organizations and individuals.

Participation via Correspondence and Telephone Calls

During the pre-application phases of the consultation program, more than 100 pieces of correspondence were received and responded to by VPA, either via mail, fax or email. Also, more than 70 telephone calls were received on the program information line and responded to by VPA. Some individuals and organizations have regularly corresponded with, or telephoned, VPA and their requests for information have, according to VPA, been attended to.

Issues Raised by the Public

The issues raised by the public during the pre-application consultation phase are outlined as follows:

- regulatory framework;
- information distribution and consultation;
- Project rationale;
- alternatives to the Project;
- Project description;
- Project location;
- capital costs;
- off-site facilities (transportation requirements);
- construction phase;
- operations phase;
- environmental assessment methodology;
- review scope and study area;
- impact assessment methodology;

- air quality;
- coastal geomorphology;
- socio-economic impacts;
- visual and light;
- noise;
- water quality;
- sediment quality;
- marine environment;
- waterfowl and coastal seabirds;
- terrestrial wildlife;
- traffic;
- health;
- emergency services;
- land use;
- environmental management, mitigation and compensation;
- effects of the environment on the project; and
- cumulative effects assessment.

3.3.3 Proponent Consultation Following Application Submission

Following the submission of the Application in January 2005, VPA assisted the harmonized review in advertising the availability of the Application for public review, and providing notification of the public comment period. Further, VPA supported the harmonized review by responding to public inquiries at 3 public consultation events in Delta and one in Langley (see section 3.2 above).

The Proponent attended the 3 Delta meetings and provided its key consultants for the benefit of the public attending these events and for discussions of issues raised by the public. VPA also attended the special public event in Langley on May 11, 2005 to allow Langley residents to inform federal agencies and VPA on the rail issues. Further details of the public consultation undertaken during the first 2 public comment periods are included in a VPA report provided to the harmonized review dated October 20, 2005 (Summary of Public Consultation Activities and Input Application Review Phase 24 February 2005 to 31 August 2005 for the Deltaport Third Berth Project Roberts Bank Container Expansion Program). A summary of consultation measures follows.

The objectives of the consultation and communications program for the Application Review Phase were to:

- provide information regarding the Project and the Environmental Assessment Certificate Application;
- conduct discussions with interested parties and the broader public regarding issues, as well as opportunities to avoid or minimize adverse effects, where possible;
- respond to issues raised with the EAO during the formal public comment periods; and
- continue to obtain and record input.

The following materials were used to notify and inform stakeholders in Delta and other municipalities in Greater Vancouver of the availability of the Application, opportunities for input, details of public events, and other Project information:

- harmonized review public comment period notice;
- information letters;
- Project newsletter;
- public event advertisements;
- information advertisement; and
- information sheets.

Information letters were sent by VPA on February 15, 2005 to over 700 individuals or organizations on the Project database to inform them of the availability of the Application and the formal public comment period. The letter included information on the EAO public comment period and details on where individuals could view a copy of the Application and how they could submit their comments.

A newsletter was provided to the public with an update on the Project, including summaries of the impact assessment findings. It also included information on the public comment period on the Application and details of the March 16, 2005 public open house and the April 12, 2005 public open house/information meeting. The newsletter was sent the week of March 7, 2005 to over 700 individuals or organizations on the Project database and was mail dropped via Canada Post during the same time period to over 34,500 residences, farms and businesses in Delta.

The public comments on the Application are summarized in section 3.4 below. VPA provided written responses to all public comments on the Application and the Technical Volumes, including comments from stakeholder groups, and provided presentations to and responses to inquiries from municipalities and municipal organizations. The Proponent also continued to meet with municipalities, public interest groups and other stakeholders following Application submission.

Information letters were sent by VPA on December 5, 2005 to over 700 individuals or organizations on the Project database to inform them of the availability of the four supporting documents submitted by VPA to EAO, the third formal public comment period and the December 13, 2005 public open house in Delta.

During the third formal EAO public comment period on the 4 supporting documents, the Proponent also engaged the public actively in the community, attending the open house in Tsawwassen on December 13, 2005 and the public meeting organized by the stakeholder group Against Port Expansion in Delta on January 18, 2006.

The Proponent's commitments to liaising with the public during DP3 final design and construction are further confirmed in *Appendix A* and Part B of this report.

3.3.4 Public Consultation Measures Undertaken by EAO and the RAs

Representatives of EAO and the CEA Agency attended a number of the Proponent's open houses during the pre-application consultation period in 2003-2004. The EA process pursuant to the harmonized review process was presented and questions from the public were responded to. From April 2003 until the Application was submitted in January 2005, the EAO entertained a number of requests from the public and interest groups for Project material and a description of the EA process. EAO and CEA Agency frequently met with the Proponent to discuss a targeted public consultation process pursuant to government policy and regulation. All relevant Project material was posted on the EAO's Project website. This process started with the issuance of the section 10 Order on March 18, 2003.

The EAO, CEA Agency and RAs participated in the public meetings described in section 3.3.3 above and discussed the Project and its EA with the public. EAO and CEA Agency also followed up with written responses to issues raised by the public. EAO acknowledged directly to the submitters the receipt of all public comments, shared all comments with the RAs and the CEA Agency, and forwarded such comments to the Proponent for individual responses.

During the harmonized review, the EAO, CEA Agency and RA's shared review material and process details, such as the temporary suspension of the review timeline, directly with interested public stakeholder groups.

The RAs also acknowledge that numerous letters and emails were received by federal agencies during the review. This correspondence was considered in the RA's assessment of potential adverse environmental effects for the Project.

3.3.5 First Nations Consultation

General

This section of the report generally describes the nature of the consultations that took place among First Nations, the Proponent, the EAO and the RAs concerning the DP3 Project. For the RAs, these consultations were a source of information about the effect of any changes in the environment, caused by the Project, on the current use of land and resources by Aboriginal persons for traditional purposes. The results of those consultations are discussed in Chapter 19 – *First Nations Considerations and Interests*. The potential adverse effects of the Project on the current use of lands and resources by Aboriginal persons for traditional purposes are also discussed in relevant bio-physical and socio-community sections of Part B.

Consultation Prior to Application Submission

DP3 falls within the asserted traditional territories of the following First Nations groups, as referenced in section 1.4.1 of Part A of this report:

- Tsawwassen First Nation;
- Musqueam Indian Band;
- Katzie First Nation;
- Sto:lo Nation;
- Semiahmoo Nation;
- Sencot'en Alliance; and
- Hul'qumi'num Treaty Group.

Early in the Project planning process, the first 5 First Nations referenced above were identified by the EAO and VPA as the First Nations with whom consultation efforts should be undertaken because their communities or asserted traditional territories are situated within the vicinity of the proposed Project site. The asserted traditional territories for each of the first 4 First Nations are depicted in the maps contained within those First Nations Statements of Intent filed with the British Columbia Treaty Commission.

Early in the Project review process (April 2003), EAO sent letters to the first 5 identified First Nations referenced above advising them of the Project and the harmonized EA review process under BCEAA and CEAA. Those letters solicited information on the First Nations' interest in the Project, and invited them to participate in the harmonized EA review working group. The letter also asked those First Nations how they wished to be consulted about the Project. The EAO and RAs subsequently met with the same First Nations to discuss the Project and the harmonized EA pursuant to BCEAA and CEAA. Throughout the harmonized EA review, the EAO and RAs have made all documents relevant to the Project available to the identified First Nations, either by electronic mail, by fax or by courier/surface mail. At the end of the pre-application phase, but before the VPA submitted its Application, the EAO was also alerted to the potential interest of the Sencot'en Alliance in the EA review of the Project. During the late summer of 2004, the Semiahmoo Nation advised the EAO that further consultation with it on the Project should be directed to the Sencot'en Alliance, of which it is a member nation.

The Sencot'en Alliance, comprised of the Semiahmoo, the Tsartlip, the Tsawout and the Pauquachin First Nations, is – as a group – not yet in the British Columbia Treaty Process. However, acknowledging the Semiahmoo's asserted use of Roberts Bank land and resources, the EAO and RAs initiated consultation with the Sencot'en Alliance in November 2004.

The Proponent initiated an extensive Pre-Application Consultation Process early in the Project review, designed to identify concerns and interests of First Nations potentially affected by the

proposed Project. The First Nations consultation and communication framework implemented for the DP3 Project was developed by the VPA in conjunction with the EAO and RAs. The consultation program was based on VPA's *First Nations Consultation and Communications Plan* provided to the harmonized review working group in June 2003.

The development of the VPA consultation program was based on a number of principles central to the First Nations consultation policies of the provincial Government. In keeping with those policies, the consultation approach taken by VPA would:

- include First Nations in identification and design of a meaningful First Nations consultation plan;
- be flexible and designed to meet the needs of each First Nation;
- be inclusive of all First Nations that identified that their interests may be affected by the Project;
- provide an opportunity for First Nations to effectively participate; and
- promote accountability.

The Proponent undertook two pre-Application consultation phases as follows:

Phase I: Early Notification (Spring 2003)
The main objectives for this phase were to notify Chief and Council of the Project by letter; to conduct telephone discussions with them to identify First Nation interests and issues associated with the Project; to establish a relationship with the administrative contact person for each First Nation for the distribution of Project information; and to meet with Chiefs and Councils to provide them with an overview of the Project and obtain from them more details of First Nation interests, and to receive direction from First Nations on how they wish to see future consultation sessions to proceed.

Phase II: Pre-Application (Summer 2003 – Fall 2004)
The main objectives for this phase were to present more detailed technical information about the Project (as it became available) and to solicit input on it through an agreed-upon process to provide regular Project updates to the communities or Band Councils, to respond to Project inquiries, to continue to identify issues and provide responses, and to continue to document and summarize input received.

The Proponent also anticipated that the Tsawwassen, Musqueam, and Katzie First Nations would continue to engage in consultation meetings with VPA representatives to:

- identify any asserted Aboriginal rights which may be potentially affected by the Project, as identified in studies or Project background material developed during the pre-application stage and shared with First Nations; and
- suggest actions and measures to be taken to avoid, mitigate or, where appropriate, otherwise accommodate Aboriginal interests.

The Sto:lo Nation requested information updates from VPA on the Project; the Proponent maintained regular contact with this First Nation. VPA first met with the Sencot'en Alliance in December 2004, when they raised issues with the Project and requested copies of the Application.

The Proponent's consultation chronology demonstrates a significant effort to engage the identified First Nations that assert they have Aboriginal rights or title in the Project area. Apart from the Tsawwassen First Nation, there was limited response from First Nations during the early consultation phase (i.e., prior to the Proponent submitting its Application to EAO in January 2005). Although VPA had concluded agreements with the Tsawwassen First Nation, the Musqueam Indian Band and the Sencot'en Alliance for their participation in the EA review

process, only the Tsawwassen First Nation attended working group meetings during the pre-application phase. Representatives from the other First Nations did not attend any pre-application meetings. While these First Nations have indicated that they continue to enjoy traditional practices in and adjacent to the Project area, they have not indicated how the Project will impact those activities.

VPA provided funding support for those First Nations which expressed an interest in reviewing the Application. VPA met with the Tsawwassen First Nation, Musqueam Indian Band, Katzie First Nation, Sto:lo Nation, Sto:lo Tribal Council, Semiahmoo Nation, and Sencot'en Alliance during the pre-application phase of the DP3 Project in 2004. The Tsawwassen First Nation, Musqueam Indian Band and the Sencot'en Alliance (which includes the Semiahmoo Nation) requested, and received, funding from VPA to provide capacity for participation in the Application review process.

Consultation Following the Submission of the Application

The EAO and federal agencies, with the support of VPA, continued their efforts to engage First Nations during the review of the Application and other relevant Project EA material distributed to the members of the working groups, including the First Nations identified above. EAO notified all First Nations of the DP3 harmonized review process pursuant to BCEAA and CEAA and, invited the First Nations to the review meetings described in section 1.4.1 above. All of the identified First Nations as referenced in section 1.4.1 of Part A of this report were provided with meeting notes and agendas for future meetings.

The Proponent offered to provide funding to First Nations to enable them to participate in the harmonized environmental assessment of the Project. Funding agreements were made between the Proponent and the Tsawwassen First Nation, the Musqueam Indian Band and the Sencot'en Alliance. The Hul'qumi'num Treaty Group has not yet accepted the Proponent's offer to provide funding. The funding agreements in place with the other First Nations contemplate that those First Nations would: (i) review the Application; (ii) continue to consult with the Proponent; (iii) provide comments to EAO; and (iv) participate in the harmonized EA review, within the timelines agreed to by EAO, by identifying how their asserted Aboriginal rights may potentially be adversely affected by the Project by suggesting measures to be taken to avoid or mitigate those adverse effects. and where those adverse effects cannot be avoided or mitigated, by suggesting how the First Nations may be accommodated for those adverse effects on their Aboriginal rights.

Following Application submission by VPA in early 2005, the Hul'qumi'num Treaty Group expressed an interest in the Project. VPA met with the Hul'qumi'num Treaty Group and offered similar capacity funding to support a review of the DP3 Project. VPA is awaiting formal acceptance of the offer of funding support from the Hul'qumi'num Treaty Group.

As part of this process, the Proponent contacted each First Nation with an offer to meet to review the Application and to discuss matters of interest and concern to the First Nation. Based on these meetings, the First Nations were able to better define the issues which they wished to address in their comments to the EAO.

As discussed above, the Sencot'en Alliance has been added to the working groups and has received all review documents and relevant EA correspondence on the Project. The EAO and federal authorities met with executives of the Sencot'en Alliance and their Administrator on July 21, 2005 to discuss DP3 and the Project's potential impacts on asserted traditional use of resources at Roberts Bank. EAO also met with the Sencot'en Alliance Administrator and EA consultant in Vancouver on December 6, 2005 to discuss the Project review and consult on Sencot'en Alliance issues relating to the Project.

VPA and EAO were also alerted to the Hul'qumi'num Treaty Group's (HTG) interest in the Project. EAO and VPA contacted the HTG's Chief Treaty Negotiator in January 2005 and provided the Application to the group for its review. The HTG, comprising the Chemainus, Lyackson, Penelakut, Hait, Lake Cowichan and Cowichan First Nations, all Vancouver Island

based, are engaged in the British Columbia Treaty process and has filed a Statement of Intent. The HTG was invited to be part of the Project working groups and has also received all subsequent Project review material and correspondence. EAO and VPA met with the HTG in Victoria in May 2005 and EAO, VPA and federal agencies met with the HTG in Ladysmith on July 28, 2005 and September 27, 2005. Federal agencies met with the HTG on May 31, 2006 to discuss the harmonized environmental assessment and potential effects of the Project on their asserted Aboriginal rights.

Following the separation of the Sto:lo Tribal Group from the Sto:lo Nation both organizations have been provided with the materials relating to the harmonized environmental assessment of the Project.

The following comments on the Application, the Technical Volumes, and additional Project material issued for comments in December 2005, were provided by First Nations to EAO:

- First preliminary comments by the Sencot'en Alliance, dated 19 May 2005;
- Second preliminary comments by the Sencot'en Alliance dated June 13, 2005;
- Preliminary comments by the Hul'qumi'num Treaty Group dated July 28, 2005;
- Third preliminary comments by Sencot'en Alliance dated January 24, 2006;
- Tsawwassen First Nation comments dated July 5, 2005 and February 13, 2006; and
- Final Project review comments by the Sencot'en Alliance, dated March 24, 2006.

VPA has provided responses to these comments. EAO has solicited input from the Sencot'en Alliance and the Hul'qumi'num Treaty Group and requested these First Nations to identify any adverse effects the DP3 Project may have on their asserted Aboriginal rights that could not be reasonably exercised after the construction of the Project.

Details of issues raised and VPA's responses to First Nations' concerns, and those reflected in mitigation and accommodation measures, are covered in Part B of this report.

3.4 RESPONSES AND RESULTS FROM PROJECT'S PUBLIC CONSULTATION

3.4.1 Public Consultation on Application

The public was invited to provide comments to EAO on specific public issues as they relate to the technical review of the Application and the Technical Volumes. The first public comment period ran from February 24, 2005 until May 9, 2005. A second formal public comment period, tailored to the Langley open house on May 11, 2005 was conducted in the period of May 11-18, 2005. EAO received a total of 607 comments by letter, fax or email concerning the review documents during the public comment periods. A breakdown of public comments is presented in Table 3.

Table 3 Summary of public comment submissions

Type of Submission	Number of Submissions
Individual signed letters or emails	236
Four different form letters or emails:	
• Including selected individual comments	18
• Signed, prepared forms	171
• Ibid, but with some comments	159
• Form emails	23
Total of form letters and form emails	371
Grand Total	**607**

Most of the form letters and form faxes described in the table above (171+159 = 330) pertain to the railway crossings and associated impact issues in Langley. The majority of the individual letters and emails noted in Table 3 also pertained to rail issues in Langley. In spite of the Project scoping as a non-linear Project, the EAO and CEA Agency agreed to conduct a special public meeting in Langley to provide the opportunity for the local residents to discuss their concern with the regulatory agencies and the VPA. That decision was prompted by the level of Langley public interest and not a result of Project re-scoping.

Included in the submission referenced in Table 3 above, were a number of sets of comprehensive comments provided by interest groups such as:

- Boundary Bay Conservation Committee;
- Federation of BC Naturalists;
- BC Great Blue Heron Society;
- West Panorama Ridge Ratepayers Association; and
- Delta Farmers' Institute.

Their submissions are posted on the EAO Project website and included in the CEAA project file. The Proponent also provided individual responses to these interest groups and these responses were posted on the EAO website.

The Proponent emailed and mailed a circular dated August 31, 2005, to all members of the public who commented on Langley rail issues. The letter referenced the bilateral Task Force organized to evaluate and make recommendations on Langley rail corridor issues. This process, outside the federal/provincial EA review, is supported by the federal *Pacific Gateway Strategy.*

In addition, comprehensive review comments were provided by municipal and local governments not part of the review working groups (restricted to the Corporation of Delta as a function of Project scoping). Such comments were submitted to EAO by:

- City of Surrey;
- City of Langley;
- Township of Langley; and
- Greater Vancouver Transportation Authority (TransLink).

VPA provided responses to these comments by way of letters dated August 31, 2005.

Apart from 2 public written submissions in general support of the Project, all other submissions expressed concerns over and/or objections to the Project. The key concerns and objections voiced by the public focused on:

- need for the Roberts Bank container port expansion;
- scoping of the Project and the assessment under federal and provincial legislation;
- environmental assessment by agencies rather than a federal panel;
- inadequacy of assessment documentation and dissemination of such information;
- too few public meetings and absence of useful consultation;
- inadequate time to prepare public comments;
- adverse visual and lighting impacts at Roberts Bank and in Tsawwassen;
- transportation and construction noise;
- negative impacts on regional and local air quality;
- road crossings of emergency and farm vehicles, connectivity and inconvenience;
- negative impacts of rail/road crossings in Surrey and Langley and public safety;
- traffic congestion due to increased container truck traffic;
- increased risk of accidents and malfunctions;

- negative impacts on, and loss of, wildlife habitat in the Fraser River estuary;
- Project's adverse impacts on COSEWIC listed species;
- flaws in the cumulative effects assessment and need to include Terminal 2 (T2) in the assessment; and
- long-term status of geomorphological stability and degradation of intertidal habitat in the Roberts Bank causeway area.

3.4.2 Public Consultation on Four Documents

EAO decided to provide the public with an opportunity to comment on the amended Application chapters and new Project material (see section 3.2.2 above). A 41-day provincial public comment period closed on January 25, 2006 and EAO received 50 submissions directly related to the 4 documents.

A total of 41 other emails and 6 open house forms were also received, but deemed out of scope as they did not specifically address the content of the 4 documents. A number of public comments were also received after the deadline and, unless they raised specific new issues, they could not be accepted by EAO as formal public comments and forwarded to VPA for response. The EAO decision to accept only part of the public comments caused public challenges, but the review process was laid out in compliance with provincial legislation and policy.

Included in the submissions referenced in Table 4, are a number of comprehensive comments offered by interest groups such as:

- Against Port Expansion;
- Boundary Bay Conservation Committee;
- Federation of BC Naturalists;
- BC Great Blue Heron Society;
- Western Canada Wilderness Committee; and
- Delta Residents for a Healthy Community.

Table 4 Summary of public comment submissions on four documents

Type of Submission	Number of Submissions
Individual signed letters or emails	31
Form emails based on Against Port Expansion input forms	10
Submitted at open houses	9
Total	**50**

It should also be noted that the Corporation of Delta, represented on the working group for the review of the Project, submitted a Council Resolution of December 6, 2005 providing comments on the 4 documents and a request for VPA mitigation commitments. However, by its letter of February 23, 2006, COD advised EAO that it would withdraw from the working group given that the municipality perceived staff's involvement and the restricted public access to working group material as a conflict of interest.

The main public and stakeholder comments focused on:

- cumulative effects assessment (CEA) not satisfactorily reflecting the contemplated second container terminal (T2);
- temporal baseline of 2003 chosen for the CEA being inappropriate;
- lack of historical information in CEA;
- no consideration of lighting issues in CEA;

- stated rationale for the Adaptive Management Strategy (AMS);
- conclusions from AMS monitoring not available for Project's EA decision;
- potential for eutrophication not properly addressed in AMS and in CEA;
- AMS footprint coverage inadequate;
- AMS self-assessment concept does not work;
- low AMS monitoring thresholds;
- inadequate funding for the Habitat Compensation Plan (HCP);
- using existing offsite conservation lands as an element of the HCP;
- HCP lacking species habitat losses and compensation measures;
- HCP not addressing marine mammals and CEA not addressing endangered southern resident orcas;
- Proponent not being in control of air quality mitigation measures;
- air quality update not reflecting existing container port specifically, but comparing Project to total Local Study Area emissions; and
- inadequate attention to particulate matter, especially from diesel emissions.

3.4.3 Summary of Public Comments

The public has shown considerable interest in the Project and its EA review. Public interest was particularly intense during the review of the Application, at which time VPA, EAO and CEA Agency arranged public open houses, and during additional review of the 4 documents referred to in section 3.4.2.

VPA has responded to all public comments received during the formal public comment periods, either in a compendium format posted on EAO's Project website or individually to public stakeholder groups identified above.

3.5 SUMMARY AND CONCLUSIONS – INFORMATION DISTRIBUTION AND CONSULTATION

3.5.1 Public Consultation

The notification for the public consultation process complied with the provincial section 11 procedural Order issued by EAO. The consultation program also met the outline defined in the Proponent's *Consultation and Communications Plan* issued in June 2003 and endorsed subsequently by the working group.

Public comments on the Project and its review pursuant to BCEAA and CEAA did not raise any additional substantive issues in relation to the EA not addressed as part of the environmental assessment process. However, EAO and RAs acknowledge the public concerns over the impacts of the additional container trains on level crossings and connectivity in Langley, but this issue cannot be resolved though the Project's EA review because it was determined to be beyond the Scope of Project.

3.5.2 First Nations Consultation

The First Nations consultation process meets the terms of the section 11 provincial procedural Order issued by EAO for the Project. The consultation process also meets the requirements outlined in the Proponent's *First Nations Consultation and Communications Plan* released in June 2003 and reviewed by the EAO and RAs.

EAO assessed the Proponent's consultation plan that was contained in the Application for adherence to the provincial First Nations consultation policy and applicable legal requirements. EAO accepted the First Nations consultation plan as outlined in the Application in a letter to the Proponent dated February 28, 2005.

The RAs have been informed by the Proponent's consultations and are satisfied that those consultations have been adequate in the circumstances. The RAs accept that the Proponent has

attempted in good faith on a number of occasions to consult with those First Nations which have not been participating in the harmonized review process.

PART B – Assessment of Environmental Effects

Introduction

Information Considered
For the purpose of assessing the potentially significant environmental effects of the Project, the Proponent's Application and supporting Appendices, as well as relevant documentation and correspondence provided by the Proponent after submission of the Application, have been considered. These documents can be accessed on the EAO website (http://www.eao.gov.bc.ca).

The Proponent's documents provided information about the Project and considered the Project's possible effects on the atmospheric environment, marine environment and marine mammals, terrestrial environment, wildlife and wildlife habitat, local communities and economy, public safety and health, heritage and archaeological resources, effects on First Nations, alternative means of carrying out the Project, effects of accidents and malfunctions, effects of the environment on the Project, cumulative environmental effects, and effects on the capacity of renewable resources to meet present and future needs.

During the working group's initial review of the Proponent's application it was determined that material contained in the Application regarding air quality, habitat compensation and cumulative effects assessment needed to be revised. To address these concerns the Proponent produced revised Air Quality and Cumulative Effects Assessment Chapters along with a revised Habitat compensation Plan and an Adaptive Management Strategy for the inter-causeway area. During the development of this report the revised application material was used.

This report and its conclusions are based on a review of the information, commitments and proposals identified in the documents considered as Application components.

Environmental Assessment Methodology
The following six-step process has been used by the Proponent and RAs to ensure that the Deltaport Third Berth Project components and setting are adequately described and any environmental effects were assessed so any residual effects could be identified:

Step 1. *Describe the Project activities.*
Step 2. *Identify and describe the existing environment that will be effected (baseline conditions).*
Step 3. *Identify and describe the impact of Project-environment interactions, also known as potential environmental effects (include construction and operation).*
Step 4. *Describe the mitigation measure(s).*
Step 5. *Identify any residual environmental effects after mitigation measures are applied.*
Step 6. *Determine the significance and likelihood of residual effects after mitigation measures applied (see Table 5).*

The effects on the environment are presented as effects on selected Valued Ecosystem Components (VECs). VECs are environmental components which have importance in the study area or which may be at risk in the study area. VECs were identified through the consideration of:

- rarity or uniqueness;
- fragility/vulnerability/sensitivity;
- contribution to diversity;
- sustainable use of species or ecosystems; and
- ecosystem function.

The Proponent used the factors above and assigned associated criteria to each factor to determine what habitats or species would be considered as VECs. An explanation of habitats or species that met these criteria, along with the rationale for their inclusion as VECs, was discussed in the Application.

For the purposes of the comprehensive study, the RAs identified the following VECs as having the potential to be affected by the Project:

- coastal geomorphology;
- water quality;
- sediment quality;
- marine environment habitats and species;
- waterfowl and coastal seabirds;
- terrestrial habitats and species;
- air quality;
- noise;
- visual;
- lighting; and
- archaeological resources.

The significance of environmental effects after mitigation measures are implemented was assessed for each VEC in relation to all project elements. A determination is made whether the severity of impact (high, medium or low) is likely, and whether the potential effect is significant.

The evaluation of the nature and extent of the residual adverse effects and whether the adverse effects are significant involved utilizing a number of criteria including: extent (magnitude and geographic extent); duration; frequency; reversibility; and ecological context (see Table 5).

With reference to Table 5:

- magnitude refers to the severity of the adverse effects. Minor or inconsequential effects may not be significant. On the other hand, if the effects are major or catastrophic, the adverse environmental effects will be significant.
- areal extent of the adverse effects refers to the spatial effect anticipated. Localized adverse environmental effects may not be significant. Alternatively, widespread effects may be significant. - duration and frequency of the adverse effects refer to the length of time the effect is expected and how often is may occur. Long-term and/or frequent adverse effects may be significant.
- reversibility refers to the degree to which the adverse effects are reversible or irreversible. Reversible adverse effects may be less significant than adverse environmental effects that are irreversible.
- ecological context refers to the degree that the environment has already been adversely affected. The effects of projects may be significant if they occur in areas or regions that have already been adversely affected by human activities, and/or are ecologically fragile and have little resilience to imposed stressors.

Where residual effects were identified despite the application of mitigation, cumulative effects assessment was undertaken for the appropriate valued ecosystem component (VEC).

Because the considerations involved vary substantially from discipline to discipline, it is not possible to develop a general Project-based method on how to analyze the severity of impacts, characterize VECs, or to establish and apply significance criteria. Separate criteria were developed for each study component (for example the marine environment significance criteria are different from the coastal seabird and waterfowl criteria). The kinds of factors involved in establishing these criteria may include:

Standards: Quality standards (e.g., air quality, water quality) can be used to specify thresholds above which an impact is considered significant.

Importance: A VEC can have inherent ecological, cultural or economic value based on, for example, its function, use, rarity and/or integrity. An impact in a context where a VEC is very important will be more significant than the same impact where the VEC is less important.

Resilience: Depending on its status and the context within which it exists, a VEC may be more or less resilient to changes caused by the Project. The same impact in situations of low resilience will be more significant than in situations of high resilience.

Table 5 Definition of significance criteria used for the analysis of residual adverse environmental effects

	Extent	Magnitude	Duration	Reversibility	Ecological Context	Probability	Frequency
Definition	Geographic extent of the environmental effect	Size of the environmental effect relative to baseline conditions.	Likely duration of the potential environmental effect.	Potential for the environmental effect to be reversed or naturally return to baseline level after effect is over.	Ability for the environment to absorb the change that the effect is causing.	Likelihood of environmental effect occurring if the Project proceeds.	Nature of the occurrence of the environmental effect.
Range of Significance Criteria	*Local* – Project site and beyond to 2 km.	*Negligible* – no change over the baseline.	*Short* – less than 60 days.	*Reversible* – environment will return to baseline after effect is removed.	*Intact* – a near pristine ecological environment or social situation which will not absorb change un-noticed.	*Low* – up to 25 % chance of predicted effect occurring.	*Isolated* – the effect occurs infrequently.
	Municipal – Project site and beyond to 5 km.	*Low* – impact above baseline, but within relevant and accepted standards.	*Medium* – 60 to 90 days.	*Irreversible* - environment will not return to baseline after effect is removed	*Developed* – developed or altered landscape, ecological environment or social situation.	*Moderate* – 25 to 50 % chance of predicted effect occurring.	*Periodic* – the effect occurs occasionally, often in conjunction with other factors.
	Regional – Project site and greater than 5 km.	*Moderate* – impact considerably above baseline or could cause a change in environmental parameters.	*Long* – greater than 90 days.	*Change* – baseline will change after impact, but the effect on the environment will reverse to a new baseline.	*Well-developed* - Intensely modified, developed or altered landscape, ecological situation or social situation.	*High* - over 75 % chance of predicted effect occurring.	*Continuous* – the effect occurs at all times.
	No further terminology used	*High* – impact will exceed accepted criteria and cause a measurable, non-natural change.	No further terminology used	No further terminology used.	No further terminology used	No further terminology used.	No further terminology used

Chapter Outline

For most chapters, this report is organized in the following manner:

1. General information about the topic such as regulatory requirements and explanations for the factors under consideration.
2. Background information provided in the Application including study area, existing environment and assessment of potential effects, as provided by the Proponent.
3. Analysis of potential effects including issues associated with identified environmental effects and proposed mitigation For this section the RAs considered the information

provided by the Proponent, including the Proponent's conclusions on potential effects and the method used to reach those conclusions as outlined above in sections 1 and 2. The RAs also considered comments from working group members, First Nations and the public, along with the Proponent's responses to issues raised. The RAs then conducted their own analysis of the potential effects and proposed mitigation measures before independently reaching conclusions on the residual effects.

4. RA's conclusions regarding the significance and likelihood of predicted residual effects after the application of appropriate mitigation.

In order to make the analysis of information provided in Chapter 6 of the CSR – *Waterfowl and Coastal Seabirds* more straightforward, reviewing agencies have transformed the analysis provided in the Proponent's Application to more accurately represent the information. This was done to facilitate the federal assessment of the data provided in the relevant chapters of the Proponent's Application.

1 Assessment of Alternatives

1.1 GENERAL

The analysis of "alternatives to" is intended to validate that the preferred alternative is a reasonable approach to meeting the need and purpose. This analysis should identify the alternatives to the Project, and identify the preferred alternative to the Project based on the relative consideration of the environmental, economic and technical benefits and costs. Alternatives to a Project are defined as functionally different ways to meet the Project need and achieve the Project purpose.

The Proponent conducted an assessment of Project alternatives and site selection for the DP3 Project for increasing container terminal capacity in the Port of Vancouver. The alternatives to the DP3 Project that were considered include: a do nothing (status quo) scenario, increase production of existing terminals, and develop terminals on other sites in the Port of Vancouver. The Proponent also conducted an assessment of alternative means of carrying out the DP3 Project at Roberts Bank, which was used to determine the preferred location and footprint, and an assessment of alternative means of construction.

1.2 BACKGROUND

The Vancouver Port Area includes three terminals in the Port of Vancouver (Centerm, Vanterm and Deltaport), as well as one terminal in the Fraser River Port Area (Fraser Surrey Docks). Container traffic in the Vancouver Port Area increased from 0.18 million TEUs in 1985 to 1.79 million TEUs in 2003. Between 1985 and 2003, year-to-year increases ranged between –3% and +32%. In 2003, the annual increase was approximately 15% (Seaport 2004).

The Proponent has cited that increasing global trade and containerization are forecast to sustain long-term growth in trans-Pacific container traffic. All of the major container ports on the west coast of North America are expected to double in container traffic in the next 10 years, with a tripling in 20 years. The Proponent conducted the most recent market study for the Port of Vancouver's container forecast to 2020, starting with an analysis of North American and west coast growth. This was followed by an assessment of the Vancouver Port Area's market share and competitive strengths to arrive at a container traffic forecast for both the Vancouver Port Area and the Port of Vancouver.

Two projections were developed for North American and west coast port container traffic to 2020. Scenario 1 is the best estimate of future traffic. Scenario 2 was developed to provide a reasonable upper bound for the traffic projection. The growth rates for these scenarios were based on the following factors:

- forecast US and Canada GDP growth rates;
- general cargo growth versus GDP growth:
- container penetration of general cargo trades; and
- Asian trade growth, particularly with China, as a direct result of the globalization of manufacturing.

Growth rates for North America and west coast port container traffic are forecast to gradually decline over the study period to reflect maturing conditions in some of the above factors. Growth rates were also marginally higher for the west coast than for North America overall, based on the assumption that west coast container traffic will continue to grow as a percentage of North

American traffic. West coast container traffic accounted for 54% of North American traffic in 2003 and is expected to reach 56% by 2020.

The projected growth of US and Canadian and west coast container traffic is summarized in Table 6.

Table 6 Projected North American and west coast container traffic growth (as of January 2005)

Year or Period	Basis	U.S. and Canada		West Coast		Vancouver Port Area		
		Scenario 1	Scenario 2	Scenario 1	Scenario 2	Low Case	Base Case	High Case
Port Throughput (million TEU)								
2003	Actual	35.6	35.6	19.2	19.2	1.8	1.8	1.8
2005	Projected	40.4	42.3	21.5	22.6	2.0	2.1	2.2
2010	"	51.5	57.9	28.0	31.5	2.8	3.1	3.5
2015	"	62.7	73.9	34.6	40.8	3.6	4.3	5.1
2020	"	76.2	94.3	42.7	52.8	4.7	5.3	6.6
Growth Rates (%/year)								
2003-05	Projected	6.5%	9.0%	5.8%	8.3%	7.0%	8.9%	11.5%
2005-10	"	5.0%	6.5%	5.4%	6.9%	6.5%	8.2%	9.7%
2010-20	"	4.0%	5.0%	4.3%	5.3%	5.3%	5.4%	6.4%
2003-20	"	4.6%	5.9%	4.8%	6.1%	5.8%	6.6%	8.0%

Courtesy of Vancouver Port Authority

The market study projected container traffic for the Vancouver Port Area based on the North American and west coast traffic forecasts. The forecast assumed that Vancouver Port and Fraser Port will provide sufficient terminal capacity with efficient road and rail connections. It was also assumed that terminals in the Vancouver Port Area will continue to offer competitive advantages such as terminal service and cost, berth depth for larger vessels, and balanced imports and exports, and provide a strategic alternative to US ports.

Three traffic projections were prepared for the Vancouver Port Area including the best estimate or base case as well as a low and high case. The 3 cases assume that Vancouver Port Area's west coast market share will continue to increase but at different rates and to different levels. For example, the base case assumes that market share will increase from 9.3% in 2003 to 12.5% in 2015 and remain constant thereafter.

1.2.1 Port of Vancouver Terminal Capacity

1.2.1.1 Current Capacity

The Port of Vancouver's existing container terminals include Deltaport, located at Roberts Bank, and Centerm and Vanterm, located in Vancouver's Inner Harbour along the south shore of Burrard Inlet. Table 7 provides a summary of the existing capacity at Port of Vancouver container terminals.

Table 7 Capacity of existing Port of Vancouver container terminals

Terminal	Location	Size	Berth Depth (m)	2003 Capacity (TEUs)
Centerm	South Shore Burrard Inlet, Vancouver, BC	29 ha, 2 berths	15.2 m 15.5 m	340,000
Vanterm	South Shore Burrard Inlet, Vancouver, BC	30 ha, 2 berths	12.2 m, 15.5 m	435,000
Deltaport	Roberts Bank, Delta, BC	65 ha, 2 berths	15.8 m	900,000
Total Port of Vancouver		**124 ha, 6 berths**		**1,675,000**

Courtesy of Vancouver Port Authority

1.2.1.2 Capacity Expansion

In 2002, the VPA prepared a container terminal expansion strategy to facilitate the forecast traffic growth in container shipments. The strategy was established after extensive analysis of Project options on the North and South Shore of Burrard Inlet as well as Roberts Bank.

The following framework was established for the selection of potential projects based on the objective of maximizing utilization of existing terminals before building new facilities:

- increase production of existing terminals;
- convert existing terminals that may be underutilized for other cargo;
- expand existing terminals; and
- build new terminals.

1.3 ANALYSIS

The RAs considered the information provided by the Proponent, including the Proponent's conclusions on potential effects and the method used to reach those conclusions as outlined above in sections 1 and 2 of this chapter. The RAs then conducted their own analysis of the potential effects and proposed mitigation measures before independently reaching conclusions on the residual effects.

1.3.1 Alternatives to the Project

1.3.1.1 Do Nothing (Status Quo)

The first alternative VPA considered was to "do nothing" beyond the current productivity increases at the Vanterm and Centerm container terminals. This would limit container terminal capacity in the Port of Vancouver to 2.2 million TEU.

Under this "base case" forecast, Port of Vancouver terminals will reach full capacity by early 2008. The Proponent's analysis suggests that failure to expand capacity in time to meet customer needs will result in lost economic and employment benefits as customers move to US ports. The "do nothing" alternative is also inconsistent with VPA's mandate as a Canada Port Authority to facilitate and expand the movement of cargo and passengers through the Port of Vancouver in the best interests of Canadians. The VPA considered the "do nothing" alternative as not a viable option as long as container expansion can be done in a sustainable manner without significant negative residual effects on the environment or community.

1.3.1.2 Increase Production of Existing Terminals Without Site Expansion

The second alternative the Proponent considered was to increase the production of existing container terminals without expanding the terminal areas. This was the first priority for VPA's container expansion strategy.

Container terminals have four major components that determine capacity, including the berth, container storage yard, rail yard and truck gate. The overall capacity of the terminal is governed by the component with the lowest capacity.

The first production enhancement option VPA considered was at Vanterm and Centerm, the existing container terminals in Vancouver Harbour. For Vanterm and Centerm, the container and rail yards were the limiting components for capacity. Projects for both terminals were designed to improve the capacity of these components to match the capacity of other components thereby increasing the overall terminal capacity without increasing the size of the terminal. Deltaport's capacity is however limited by the available berth space and container storage yard area. Increasing the capacity of any other component will not affect the overall Deltaport terminal capacity unless a third berth is also added with additional container storage yard area.

The Proponent considered a second production enhancement option with the conversion of the existing Lynnterm forest products terminal to a container terminal. VPA's goal is to achieve maximum utilization of existing facilities before expanding terminal areas. VPA and the Lynnterm terminal operator have prepared a phased development plan to convert operations from forest products to containers. However, the Project has been delayed to approximately 2010 while efforts are underway to find an alternative facility for the shipment of forest products.

Maximum utilization of existing terminal facilities without site expansion, including the proposed Lynnterm Project, will limit container terminal capacity in the Port of Vancouver to 3 million TEU.

Under the "base case" forecast, Port of Vancouver terminals will reach full capacity in early 2008 and be restricted to 2.2 million TEU until Lynnterm is converted to container operations in 2010. The four terminals will then have capacity to grow for another four years and will reach full capacity again in 2014. The Port of Vancouver will lose approximately 400,000 TEU of potential business between 2008 and 2010.

1.3.1.3 Develop Terminals at Other Sites in the Port of Vancouver

The third alternative VPA considered was development of terminals on other sites in the Port of Vancouver. VPA has authority to plan and develop terminal facilities within three geographic regions of the Port including Burrard Inlet between the First and Second Narrows, east of the Second Narrows, and Roberts Bank.

On the North Shore of Burrard Inlet, between the First and Second Narrows, there are no vacant sites on which to develop a container terminal. The only opportunity to develop container capacity on the North Shore is to redevelop the existing Lynnterm Forest Products Terminal that is currently underutilized. A Lynnterm redevelopment plan has been prepared and the Project is included in VPA's container expansion strategy but has been deferred to 2010, as noted above. There are no other underutilized terminals on the North Shore.

On the South Shore of Burrard Inlet there are no vacant sites or practical options to expand the Centerm or Vanterm terminals. Options to expand the terminal area of Centerm and Vanterm were considered. However, both terminals are constrained by other port terminal facilities that cannot be relocated.

Terminal development east of the Second Narrows Bridge (Iron Workers Memorial Bridge) was also considered. However, there are no potential development sites on either the north or south shores east of the Second Narrows and significant tidal currents through the Narrows restrict shipping movements to periods of slack tide each day.

1.3.1.4 Other Canadian West Coast Container Terminal Expansion Projects

Fraser River

The Proponent noted that Fraser River Port Authority recently (March 2004) announced its plans to expand container facilities at Fraser Surrey Docks to meet the growing demand. The expansion plans include two new ship-to-shore gantry cranes, a new streamlined truck gate, a 7.5 ha intermodal yard, infrastructure improvements and a 2.8 km extension of the railway from the rail holding yard. These improvements will increase the existing capacity of 300,000 TEUs to approximately 400,000 TEUs by 2005, and up to 600,000 TEUs by 2010.

VPA's container growth forecast for the Vancouver Port Area indicated that there is an opportunity for Fraser Surrey Docks to grow to 700,000 TEU by 2020. Further growth is limited due to the relatively shallow berth depth of the facility and the Fraser River shipping channel (11.5 metres). The depth limits the container vessels calling on the Fraser River Port to Panamax sized vessels, leaving a demand in the Vancouver area for container terminal facilities able to handle post-Panamax sized vessels.

Prince Rupert

The Port of Prince Rupert is planning the development of a new container terminal to be in operation in early 2007. The Prince Rupert terminal will be operated by Maher Terminals Inc. and will have an initial capacity of approximately 550,000 TEUs. The terminal could be expanded to a total capacity of 1.2 million TEUs that would involve filling the seabed to create a total site area of 60 hectares (150 acres).

The container growth forecast conducted for the Proponent for the Vancouver Port Area did not include the Port of Prince Rupert, however, on-going congestion in the ports of Los Angeles and Long Beach indicates that there is an opportunity for the Port of Prince Rupert to attract even more business to the Pacific Northwest than previously forecast.

The Port of Prince Rupert has potential advantages as a container terminal, being the shortest sea route between Asia and North America. Rail access is supplied by CN Rail's North Line, which feeds into the international CN network reaching directly into the US Midwest. As a result, the Port of Prince Rupert is well positioned to serve eastern Canada and US Midwest business.

The Proponent concluded that based on the projected container forecasts, the Canadian container industry will require all of the terminal initiatives proposed by the Vancouver, Fraser River, and Prince Rupert ports. This conclusion is also supported by recent information published by the Province in the BC Ports Competitive Profile (2005) for development of the BC Ports Strategy.

1.3.1.5 "Alternatives To" Conclusion and Site Selection

The Proponent concluded that Roberts Bank was the best location to expand the existing Deltaport container terminal in the Port of Vancouver. The Deltaport terminal has the required water depth to handle post-Panamax sized vessels as well as the existing road and rail network to handle additional inland transportation.

1.3.2 Alternative Means of Carrying Out the Project at Roberts Bank

The Proponent considered alternative means for carrying out the DP3 Project at Roberts Bank. The process for determining the preferred Project location and footprint at Roberts Bank is presented in the following sections.

1.3.2.1 Planning Criteria

Vessel approach and berth requirements:

- ship channel and turning basin with a minimum depth requirement of approximately 16 metres to allow for "post-Panamax" sized vessels.

Terminal wharf requirements:

- length of 427 metres (1400 feet) long;
- connected to the existing container wharf;
- allowance for provision for a tug basin; and
- a minimum width of 55 metres (180 feet) for container handling adjacent to the wharf.

Container yard requirements:

- a minimum of 32 hectares (80 acres) of land to support container terminal operations;
- be adjacent to the wharf; and
- be integrated with the existing Deltaport container storage yard.

1.3.2.2 Site Options

Based on the above planning criteria, the Proponent developed 3 conceptual plans showing potential Project site selection at Roberts Bank. All of these plans showed the main container yard area located north of the existing Deltaport terminal and on the east side of the causeway. However, the plans differed in the location of the wharf. The 3 concept plans are described as:

- Option 1: Wharf Adjacent;
- Option 2: Wharf at Westshore; and
- Option 3: Wharf Perpendicular.

Each of the DP3 options was evaluated based on potential effects to: marine habitat, coastal seabirds and waterfowl, socio-community and First Nations, terminal operations, coastal geomorphology and development costs. This information was used by the Proponent to assess the site footprint alternatives based on design criteria and to select the DP3 Project alternative that was an operationally efficient container expansion footprint that took into consideration the environment, community and First Nations concerns, and development issues.

Option 1 (Wharf Adjacent)

Option 1 consisted of construction of a wharf to accommodate the additional berth adjacent to approximately 32 hectares (80 acres) of land for the expanded container storage yard (see Figure 5). Option 1 required dredging to lengthen the existing ship channel, deepening the turning basin and the creation of a tug moorage area adjacent to the terminal.

The Proponent noted that Option 1 was preferred from a terminal operations perspective as it provided the greatest operational efficiency for container handling and storage at Deltaport. However, Option 1 had a relatively large potential effect on the marine environment due to the location of the 32 hectares of fill and the additional impact of the tug basin to be located behind the berth. Some of the identified marine habitats that would be affected due to the construction of Option 1 are the eelgrass beds and a crab nursery area, as well as the associated shorebird/waterfowl use of these habitats.

Option 2 (Wharf at Westshore)

The Proponent considered Option 2 consisting of construction of the new container wharf at the present location of Westshore's existing Berth 2 coal loading facilities (Figure 5). The Westshore Berth 2 coal loading facilities would then have to be relocated into deeper water in line with Westshore's existing Berth 1 loading facility. The area required for the expanded container yard would still be approximately 32 hectares (80 acres) of land but for this option the container storage yard would now be spatially removed from the new berth. Option 2 would not require the dredging to lengthen the existing ship channel but a tug moorage area would still be required adjacent to the container terminal.

The Proponent determined that Option 2 did not provide for efficient container terminal operations. The operation area behind the berth would be inadequate and the new berth would be removed from the container storage area adding time and distance for shuttle carriers to transport containers to the dockside. In addition to increasing operating costs, the Proponent predicted that Option 2 would result in an increase in terminal equipment emissions. The Proponent also identified that there would be significant disruption to Westshore's existing coal handling operations. Option 2 had similar impacts on the marine environment as Option 1 due to the location of the Project fill and the tug basin, and the Proponent noted that there might be additional potential effects to consider for the relocation of the coal berth. Option 2 would also require more marine construction efforts and would cost more than Option 1.

Option 3 (Wharf Perpendicular)
The Proponent assessed Option 3, which consisted of construction of a wharf perpendicular to the existing Deltaport (Figure 5). The land area required to support the expanded container handling facilities would still be approximately 32 hectares (80 acres) but some of the land area would be placed behind the proposed perpendicular berth. Option 3 would require dredging to expand the existing ship channel, the turning basin would have to be widened, and the tug moorage area would still have to be adjacent to the terminal.

Option 3 reduced the terminal footprint impacts on some sensitive marine habitats located along the causeway. However, the extension of the new berth towards the BC Ferries causeway would reduce tidal flushing and would potentially create geomorphologic impacts. The Option 3 berth location also has potentially greater visual and noise impacts on adjacent communities. From an operational perspective the Proponent also noted that a berth perpendicular to the container yard area is a challenging configuration to operate as an efficient container terminal. The location of the perpendicular berth also orientates ships into the prevailing winds with increased wave exposure resulting in increased downtime for the terminal.

1.3.2.3 Preferred Site Option – Option 1 Revised
The Proponent determined that Option 1 was the preferred footprint for container terminal operations as it would provide the greatest operational efficiency for container handling and storage at Deltaport. However, based on the alternatives analysis, the Proponent determined that Option 1, as initially proposed, had the potential for relatively more effects on marine habitat, notably on an existing crab nursery and on eelgrass. Based on preliminary results of the marine resources study assessment program, a review of the evaluation criteria, and consultation with the DFO, EC, the public and First Nations, the Proponent reduced the footprint for the DP3 Project.

The Proponent revised the DP3 Project to reduce the terminal footprint to approximately 22 hectares (50 acres) in area, as shown on Figure 5. The reduced terminal footprint was achieved through improvements in terminal operations but was done primarily to minimize the potential effects to existing fish and wildlife habitats. The coastal geomorphology assessment undertaken by the Proponent (see Chapter 2 – *Coastal Geomorphology*) further indicated that an "embayment" shoreline configuration enhanced the tidal action and water exchange reflecting the tidal conditions of the existing smaller embayment adjacent to Deltaport. While potential effects on terrestrial habitat did not influence the option design, this assessment indicated that, where possible, there is benefit in retaining, replacing or creating riparian vegetation along the shoreline to serve as a transition zone to the marine environment. The Proponent also noted that the revised 20 hectare DP3 footprint and associated terminal operations was located further from the neighbouring communities than the proposed 32 hectare footprint thereby reducing noise and light effects on neighbouring residents and the Tsawwassen First Nation.

1.3.3 Alternative Means for Construction
The Proponent conducted an assessment of two alternative means for construction of the DP3 wharf. The construction methods for the wharf included an east facing caisson structure or alternatively, an east facing pile and deck structure. The following section describes each

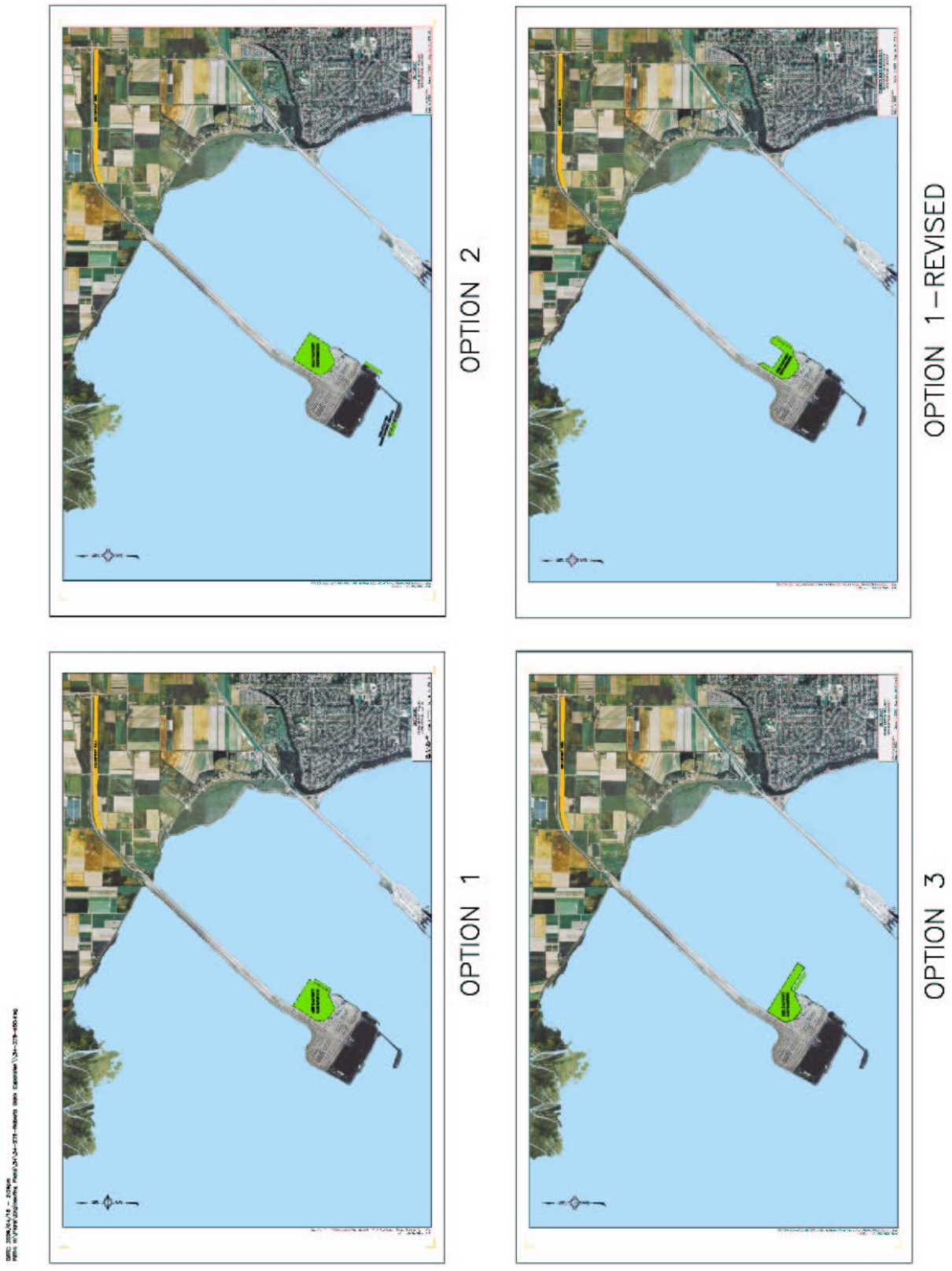


Figure 5 DP3 Project configuration options

proposed construction method and provides a description of the environmental and engineering benefits and effects.

Caisson Wharf Structure
Caissons are chambers, usually of concrete but sometimes of wood or steel, used in the construction of foundations or wharves in or near a body of water. In situations in which the depth from ground level to the final dredged bottom is not excessive and the bottom is of good self-supporting qualities, before or after densification, the wharf can be constructed of precast concrete caissons floated into position and sunk onto a prepared bed. The existing Deltaport container terminal wharf is constructed of caissons as are the wharf structures of the Vanterm, Centerm and Lynnterm terminals located in the Port of Vancouver's Inner Harbour. All of the terminal caissons have been constructed locally and this would be the case for the DP3 Project as well. For the Project, 15.5 m wide reinforced concrete caisson structures would be employed. The soils underlying the proposed caisson structure would require densification.

Pile and Deck Wharf Structure
During the preliminary engineering assessment, the Proponent considered a pile and deck structure as an alternative means of construction for the wharf. Conceptually the pile and deck structure would consist of a pile-supported, cast in place concrete deck measuring 427 m by 65 m. The container yard fill area would extend out under the deck with a rip rap protected shoreline at a 2.5:1 slope, for a total width of deck and berm of approximately 100 metres. Based on the Proponent's preliminary engineering assessment, a total of 890 concrete piles (each 610 mm in diameter) and 89 steel piles (each 1727 mm in diameter) would be required to support the cast in place concrete deck. The Proponent noted that these piles are not available locally.

The Proponent also considered an alternative to constructing all or a portion of the container yard using a pile and deck structure. However, as the load bearing capacity requirements for container storage and equipment are so great, the size and number of piles would be quite large, effectively infilling the area under the deck with piles, and making it cost prohibitive for such a structure to be constructed. The soils underlying the proposed pile supported structure and the fill area would still require the same level of densification as the caisson construction method.

The Proponent determined that the proposed pile and deck construction schedule would take longer to complete than the caisson construction method due to the length of time required to drive the piles. The Proponent estimated that the pile driving would take approximately 14 months to complete based on driving five piles per day over a 10-hour construction day.

The impact of the pile driver hammer on the piles would result in substantial noise energy propagation within the water column and at surface. The effects of elevated sound pressure levels could be detrimental to both marine mammals and fish in the area during construction. In addition to the impacts on the marine mammals and fish due to pile driving, the sound energy generated by pile driving also has the potential to impact the numerous migratory birds using the Roberts Bank area.

Preferred Construction Means: Caisson Structure
The Proponent considered the pile and deck wharf structure as an alternative means of construction of the DP3 wharf to the caisson structure. The Proponent considered that the pile and deck structure provided for more potential water column space as well as providing hard substrate within the water column for sessile intertidal and subtidal marine organisms. However, the Proponent predicted that the potential effects of the pile driver hammer on the piles would result in substantial noise energy propagation within the water column and at surface. The Proponent noted that during pile driving, the size and maximum operating energy level of the hammer, the size and length of the piles, soil conditions, water depth, bathymetry, salinity, and temperature will all affect the level of sound produced in the water column from the impact hammering. Although there will be attenuation of the noise energy due to a number of factors, the Proponent noted that the attenuation level is impossible to accurately predict. As a result the

Proponent identified possible effects on marine mammals that may include avoidance of an area, tissue rupture, hearing loss, disruption of echolocation, habitat abandonment, aggression, pup/calf abandonment, and annoyance. The Proponent also identified potential effects of pile driving on fish and the numerous migratory birds using the Roberts Bank area. The Proponent assessed pile driving for the pile and deck wharf as representing a potential acoustic effect during construction on the residents in the adjacent communities of Tsawwassen, Ladner and the Tsawwassen First Nation. While the acoustic effects from pile driving can be mitigated with known methods and appropriate timing windows, the pile and deck structure will cost more that the caisson method, take longer to construct and use less locally available materials.

The environmental benefits of the caisson construction method assessed by the Proponent are less intrusive acoustic effects on marine mammals, fish, migratory and coastal seabirds and on the surrounding communities during construction. Further, the caisson construction method can be completed in a shorter period of time than the pile and deck method reducing the temporal disturbance to the environment due to construction. The Proponent noted that the caisson structure does result in slightly more loss of water column and fish habitat compared to the pile and deck option but the habitat impacts of the caisson structure can be fully mitigated.

The engineering benefits of the caisson construction method include the shorter construction period necessary for Project completion, thus bringing the DP3 Project on line sooner and for less cost. The Proponent also preferred caissons as a construction medium because these structures can be constructed in British Columbia with locally available materials. The Proponent noted that the caisson structure was favoured to the pile and deck method for seismic resiliency. As part of the seismic assessment conducted by the Proponent both structures would survive a seismic event but the caisson structure could be more easily repaired, whereas the pile and deck structure might require demolition and replacement to return it to operation.

Based on the environmental and engineering benefits and impacts, the Proponent selected the caisson construction method for the DP3 wharf structure.

1.3.4 Alternatives for Terminal Fill

“Borrow” Dredging of the Turning Basin to Provide Fill for Terminal Land

The proponent assessed creating the necessary terminal land through dredging of adjacent marine sediments in the Roberts Bank ship turning basin, commonly referred to as borrow dredging. Through this process the land filling would be completed by transporting dredged material by pipeline from the designated borrow dredge areas in the ship turning basin. The type of dredge that would likely to be used would be a cutter-suction type. The borrow dredging of marine sediments to create land using cutter-suction dredges was used as a cost effective method for the construction of previous projects at Roberts Bank. The terminal area to be filled would be surrounded by a containment dyke system. Dredge material would be pumped into the contained area where the solids settle out. Decant water and suspended silt material would be contained during the landfill process and would be re-pumped via submerged pipeline to an approved disposal at sea site.

The Proponent estimated that approximately 2 million cubic metres of seabed material would require dredging from the existing Roberts Bank turning basin area to produce the necessary fill for the terminal. The Proponent estimated approximately 50% of this material would be unsuitable for fill and would have to be re-pumped from the terminal fill area to deep-water disposal. The total in-place volume of reclaimed material is estimated to be 1 million cubic metres.

The dredging of the existing Roberts Bank turning basin area, for fill material, would cause marine habitat disturbance and disruption, associated with the dredging and sedimentation of adjacent areas.

Imported Fill for Terminal Construction

The Proponent also considered importing fill material to construct the terminal as an alternative to borrow dredging of the turning basin. The imported fill could come from a number of potential "off site" sources including clean geotechnically suitable soils from uplands excavations, quarry rock, and clean sediment from existing or ongoing dredging operations in the Lower Mainland. In the spring during the snow melt runoff the Fraser River carries a large load of sediment downstream to its lower reaches, which is continually deposited on the river bed. Without dredging, this sediment would gradually accumulate until the river reached its natural depth and configuration. This deposition of sediment is particularly pronounced in the deepest dredged areas used for commercial navigation. According to the Fraser River Port Authority the total amount of sediment load in the Fraser River is estimated at 3.8 million cubic metres, of which only about 930,000 cubic metres is carried out to the ocean via the north and south arms of the river. Thus approximately 2.87 million cubic metres is deposited in the river annually. The Fraser River dredged sediment is clean sand, suitable for deposit in the ocean, and for use as construction fill. For the construction alternative of using imported fill the terminal area would also require a containment dyke system. According to the Proponent the cost to import fill to the project site is slightly higher than the borrow dredging alternative for construction.

Preferred Construction Means

Based on the proponent's assessment the borrow dredging of the existing ship turning basin was more cost effective than the imported fill alternative. However, the borrow dredging option of the turning basin resulted in a longer dredging program, more potential effects to marine environment and more waste sediment requiring ocean disposal. On the basis of an assessment of the potential environmental effects, and consideration of comments from agencies, the public and First Nations, the Proponent decided to eliminate the dredging of the Roberts Bank turning basin alternative. The Proponent selected the alternative to import fill to the project site for construction of the DP3 Project. The imported fill will come primarily from Fraser River dredged sediment with some construction materials coming from existing coastal quarries. This fill and construction materials will be delivered to the project site via water borne transport such as tug and barge operations.

1.4 CONCLUSIONS

During the harmonized environmental assessment, the EAO and the RAs have considered: the Application; comments from the public, government agencies and First Nations; responses by the Proponent; and the discussions of the WG.

Based on the information summarized in this CSR, the federal RAs are satisfied that the preferred alternative is a reasonable approach to meeting the need and purpose of the Project.

2. Coastal Geomorphology

2.1 GENERAL

Coastal geomorphology is the study of land forms and physical processes of the coast which is influenced by winds, waves, currents, and sea-level changes. The study of water movement, predominantly caused by tides, winds and wind-induced waves, is termed "hydrodynamics". Hydrodynamics generates sediment transport and land forms, and the habitats that they support are either stable, eroding or accreting depending upon the coastal zone process. Consideration of hydrodynamics is important when major development is proposed in coastal settings, because these developments may alter coastal processes, which can affect areas both adjacent to, and remote from, the development site. This chapter of the CSR describes the existing hydrodynamics and coastal processes at Roberts Bank and assesses the potential of the DP3 Project to affect those processes.

2.2 BACKGROUND

2.2.1 Study Area

The study area for the coastal geomorphology study is delimited by Steveston Jetty to the north, Point Roberts to the south, the 100 m water depth contour to the west and the top of the bank along the eastern Roberts Bank shoreline (see Figure 6). Additional field investigations and studies were carried out in Boundary Bay to provide complementary information on tidal channel formation and beach processes. The limits of many numerical models were extended beyond the study area boundaries to improve the quality of the results.

2.2.2 Existing Environment

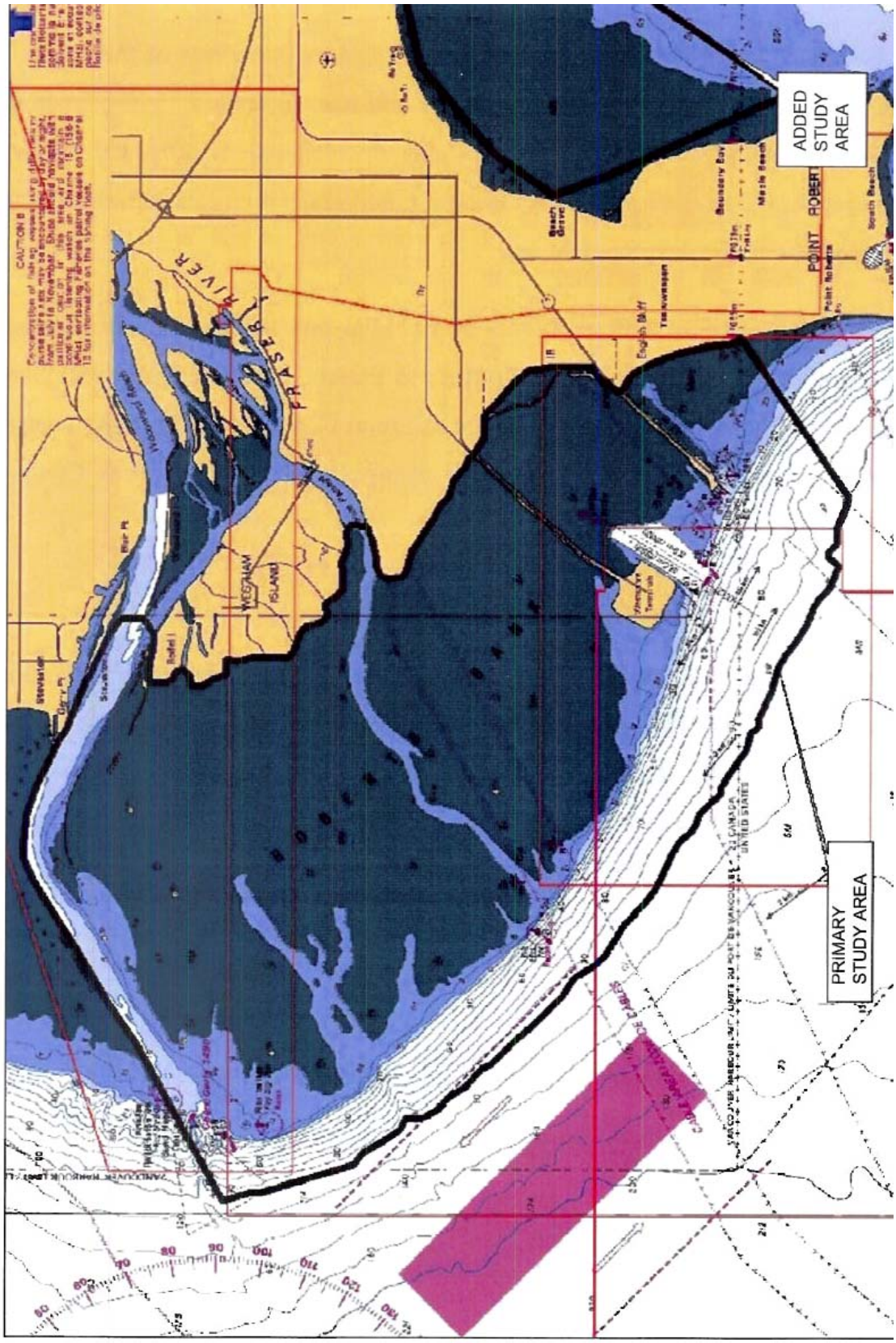
Geomorphic Processes

The Strait of Georgia between the mainland and Vancouver Island influences tidal flows, and therefore sediment erosion, transportation and deposition in the study area. The Strait is linked to the Pacific Ocean on its north end by several long, narrow channels and at the southern end by Juan de Fuca Strait. Although water is transported into and out of the Strait of Georgia from both ends, the exchange through the south end is about 15 times greater than through the north end. Tidal flows are relatively strong in the south end and setting to the northwest along the eastern shore. The tidal currents decrease to the north of Point Roberts due to the increase in cross-sectional area of the channel.

The "modern" or recent Fraser River delta commences below New Westminster and is a broad plain, which encompasses Richmond, Ladner and Tsawwassen. It extends approximately 27 km into the Strait of Georgia along its western margin and includes Sturgeon Bank and Roberts Bank. Boundary Bay is on the southern side of the delta and does not receive any sediment.

Virtually all of the fine sand, silt and clay is transported through the distributary channels to the Fraser River mouth as "wash load" and is distributed into the Strait of Georgia by the action of waves and currents. A portion of the coarse sand fraction (approximately one half of the bed material load) is deposited in the main channel below New Westminster and is generally removed by dredging.

Gently sloping tidal flats (average gradient of 0.0004 to 0.0019) extend for up to 6 km on Sturgeon and Roberts banks. The width of the tidal flats is governed primarily by the mean tidal range (approximately 4 m), the wave climate, and sediment characteristics. The tidal flats generally consist of medium to fine sand, with silty sand. The Roberts Bank tidal flats are generally featureless except for the development of dendritic (branching) tidal channels analogous to a typical terrestrial-fluvial drainage network.



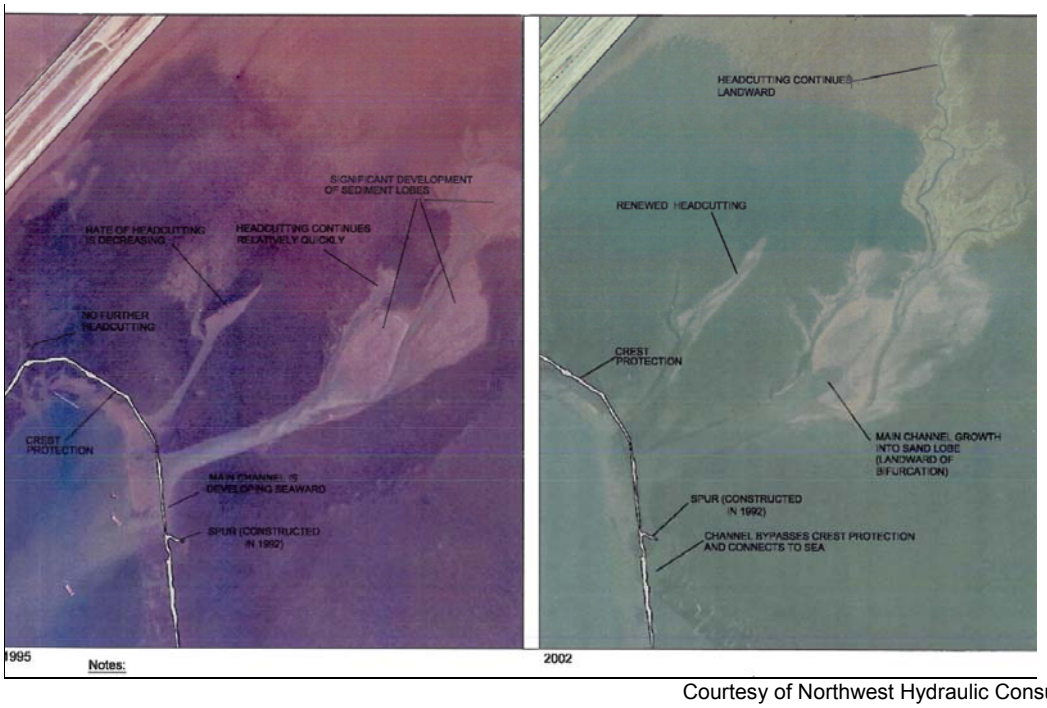
Courtesy of Northwest Hydraulic Consultants/VPA

Figure 6 Coastal geomorphology study area

Prior to any substantial marine developments at Roberts Bank, a distributary channel flowed from the Main Arm of the Fraser River near Ladner south through the Tsawwassen First Nation (TFN) Reserve, eventually discharging into the inter-causeway area near the present marsh. This channel was eventually closed off, although local drainage flows into the inter-causeway area through a pump station.

In 1949 the tidal flat near the present Deltaport causeway had northwest trending lineations indicating that tidal currents swept across the flats between Canoe Passage and the present location of the BC Ferries terminal. A navigation marker on the tidal flats, visible as a white triangle, was causing an accumulation of sediment in the lee of the structure indicating that dominant drainage and sediment transport was northwest to southeast. Sub-parallel lineations were visible near the top of the beach, indicating the direction of drainage away from the coarser beach sediments at the top of the beach. Behind the beachfront, drainage from the salt marsh created a more complex pattern of small channels and deposits. To the southwest, deeper grooves indicate that drainage from the tidal flats became slightly channelized near the lower limit of the tide. Some drainage channel features existed on Roberts Bank before major developments occurred. However, the network of channels that is present in the inter-causeway area today, was absent.

The drainage channel system within the existing coastal geomorphic environment at Roberts Bank is characterized by a trunk (main) channel that extends from the crest protection structure up the tidal flats (see Figure 7). Two main tributaries and a series of small channels drain water off the tidal flats on the ebb tide, conveying flow into the trunk channel. The channels have a sinuous form (shape viewed from above) and are connected in a dendritic pattern. At low tide, the large channels have defined banks while the small channels are shallow depressions in the tidal flat.



Courtesy of Northwest Hydraulic Consultants/VPA

Figure 7 Historical development of tidal channels – 1995 and 2002

Construction of the BC Ferries causeway in 1959 and the Roberts Bank port causeway in 1969 and related dredging altered several processes governing tidal flat morphology and physical habitat, including: tidal flow direction and magnitude, wave climate, and influx of the Fraser River

sediment plume. One of the major results of these changes, according to the Proponent, has been the development of drainage channels (also known as dendritic channels), which were driven by two main factors: dredging of the ship turning basin, triggering head cutting and expansion of eelgrass over the flats, promoting flow concentration.

Dredging of the Roberts Bank ship turning basin has lowered the erosional base level within the tidal range. Prior to dredging, the tidal flats extended out to approximately elevation –4.5 m at a nearly constant slope appearing to be in equilibrium, before dropping off to the sea floor. Excavations of a borrow pit in 1969, and the Roberts Bank ship turning basin in 1982 created a step in the tidal flat profile. The excavation extended into the flats above the lowest low water level so flow off the tidal flats at the lower part of the tide intersected the edge of the excavation causing channel formation to be initiated through a process of head cutting up the tidal flats. This process is illustrated in Figure 8.

Tidal Flow, Winds and Waves
The Strait of Georgia occupies the inundated portion of the northwest-southeast trending Georgia Depression that lies between the mainland and Vancouver Island. It is approximately 220 km long and 28 km wide and has an average depth of 155 m (Thomson 1981). Most of the total volume of water enters and leaves the Strait of Georgia through Juan de Fuca Strait. Within the main portions of the Strait of Georgia including Roberts Bank, the flood tidal stream sets to the northwest. The tidal flows are relatively strong in the southern portion of the Strait of Georgia, and typically reach 0.5 m/s on normal tides. The tidal currents decrease to the north of Point Roberts due to the increase in cross sectional area of the channel.

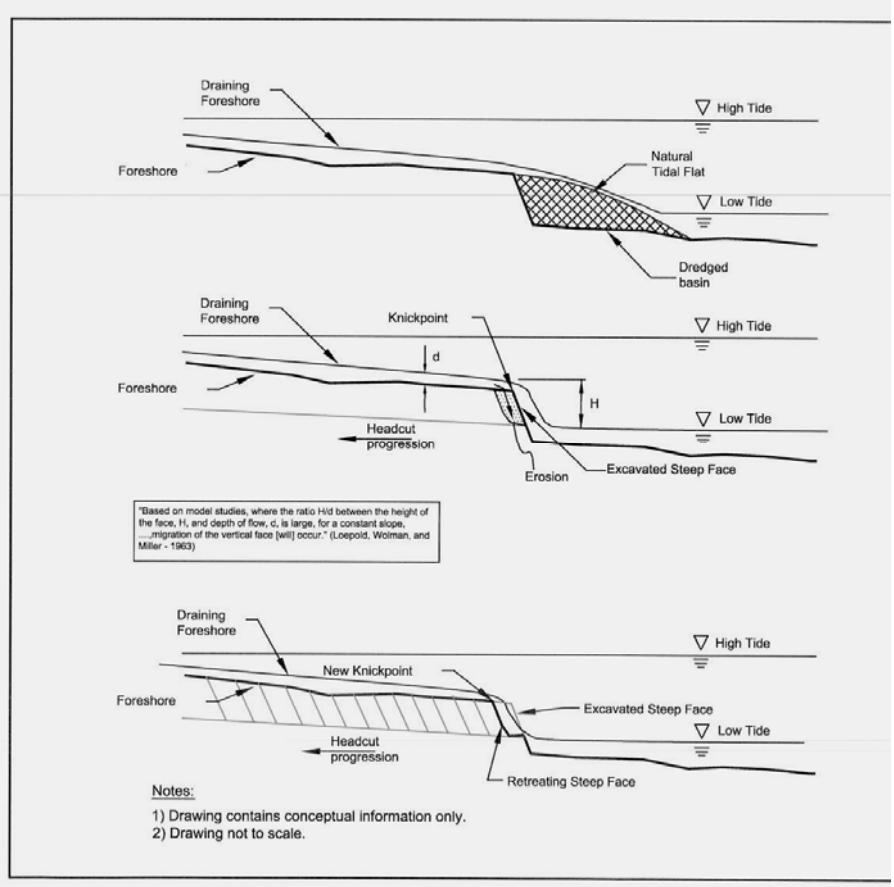
Tides are predominantly mixed, and mainly semi-diurnal, with a range of up to 5 m near Tsawwassen. The mean tidal height is about 3.1 m.

The winds across the Vancouver region consist of westerly winds from the Strait of Georgia, outflow and easterly winds from Howe Sound and the Fraser Valley, and southerly winds from Juan de Fuca Strait and Puget Sound. The easterly winds occur most frequently, but some of the strongest winds are from the west. Easterly winds are generally backed into the east and northeast near the North Shore Mountains, but are more frequently from the southeast over the southern sections of the region. The frequency of westerly winds in Burrard Inlet is much less than over more southern areas. Wave direction and height is based on local wind speed and direction, and tidal flows.

2.2.3 Proponent's Assessment of Impacts

The coastal geomorphology assessment outlined in the Proponent's Application used 3 complementary methods to assess the physical response to the proposed DP3 Project:

- interpretive geomorphic studies, using historical data, site observations and measurements;
- analytical computations, using empirical or theoretical relations describing sediment transport, erosion and deposition processes; and
- numerical computer modeling of waves and tidal currents.



Courtesy of Northwest Hydraulic Consultants/VPA

Figure 8 Schematic diagram of head cutting process

According to the Proponent's technical consultants this approach is consistent with experience and recommendations based on similar types of projects where it was concluded that available numerical modeling techniques are limited, and more than one method was required to describe the major active processes.

The major processes are, however, reflected in the morphology, and can be quantified and assessed using a range of interpretive methods including historical mapping, field observations and other analytical computations. These geomorphic investigations can, to some degree, overcome the limitations of numerical models. The approach adopted with the DP3 Project coastal geomorphology study integrates hydrodynamics, sedimentation, and geomorphology and focuses on developing an understanding of the long-term physical and biological (e.g., eelgrass) processes that drive morphological change in the Project area.

The factors governing morphological change include the construction of the two causeways and related dredging which altered several processes governing tidal flat morphology and physical habitat. These include: tidal flow direction and magnitude, wave climate, and influx of the Fraser River sediment plume. One of the major results of these changes has been the development of drainage channels, which were driven by two main factors: dredging of the ship turning basin triggering head cutting, and expansion of eelgrass over the flats (eelgrass increases tidal flow resistance reducing flow velocity in the eelgrass, and a drainage lag that causes a head differential between the tidal flats and the tide level in open water).

The Proponent has produced a summary of existing geomorphology trends at Roberts Bank. This qualitative assessment is based primarily on historical observations made over the last 75

years, and on an understanding of the physical processes occurring on Roberts Bank. It predicts likely changes on the tidal flats if the existing conditions persist, (i.e., no further developments on Roberts Bank). Historical evidence and results from the numerical models indicate that sediment transport rates on most of Roberts Bank are relatively low.

Based on the combined analysis of the numerical modeling and geomorphic investigations, the Proponent presents six conclusions regarding the proposed DP3 Project. Three of these conclusions relate specifically to the proposed Project and are summarized below. The remaining 3 conclusions included in the Application relate to ongoing effects from existing developments at Roberts Bank and are not potential effects from the proposed Project but are considered in Chapter 16 – *Cumulative Effects Assessment*. The coastal geomorphology conclusions that apply to the DP3 Project are as follows:

(1) Impacts of the DP3 Project on tidal currents and waves will be small and confined to the immediate flow field around the projected wharf extension and the dredged channel. Tidal velocities will increase locally along the front of the wharf extension, and decrease behind it. The magnitude of the velocities in the impact zone is well below the threshold for any significant sediment transport. No significant morphological impacts are expected to develop in response to changes in tidal flow magnitude or direction.

(2) The end of the existing Deltaport wharf extends into the current flow, which causes a zone of flow divergence and a weak eddy to form behind the wharf during flood tides. Extending the wharf shifts the flow pattern landward, but does not significantly change the overall pattern. During the ebb tide, flow accelerates and concentrates at the end of the wharf. Extending the wharf will create higher flow concentration at the end of the proposed wharf extension, however the absolute magnitude of the peak velocities remains very low and similar to the present situation.

(3) The risk of new tidal drainage channels forming in response to planned navigation dredging is assessed to be very low. The proposed channel excavation would occur below the height of low low water (LLW), and is not anticipated to induce significant head cutting on the tidal flats. Based on the Application, there is potential for localized disturbance of the tidal flats near the proposed tug basin, which could induce ongoing shallow, small-scale channel formation, although this can be controlled and mitigated if the existing crest protection structure is modified in advance of any dredging works.

2.3 ANALYSIS

The RAs considered the information provided by the Proponent, including the Proponent's conclusions on potential effects and the method used to reach those conclusions as outlined above in sections 1 and 2 of this chapter. The RAs then conducted their own analysis of the potential effects and proposed mitigation measures before independently reaching conclusions on the residual effects.

2.3.1 Potential Effects

- Higher flow concentration at the end of the proposed wharf extension;
- New tidal drainage channels forming in response to planned navigation dredging; and
- Based on the information in the Application, potential for localized disturbance of the tidal flats near the proposed tug basin, which could induce shallow, small-scale channel formation.

2.3.2 Issues

Review agencies, working group members, the TFN and the public raised similar issues that included:

- The construction of the BC Ferries and Roberts Bank Port causeways and related dredging altered geomorphologic processes resulting in increased eelgrass beds and the development of tidal drainage channels on the mudflats in the inter-causeway area.
- The inter-causeway area is still undergoing coastal zone change, specifically with the ongoing dendritic channelization, based on the Proponent's technical studies that indicate that equilibrium has not been reached and thus morphological changes continue to shape the area.
- A request for a longer-term coastal geomorphology monitoring program to assess ongoing coastal zone processes.
- Concerns pertaining to altering of the existing and functional crest protection structure in the tug basin and the triggering of new dendritic channels.

These issues and potential effects are addressed in the following section on Mitigation, which includes the implementation of longer-term coastal geomorphology studies.

In addition some members of the public raised concerns about the validity of the coastal geomorphology model's ability to predict coastal zone processes.

2.3.3 Mitigation

Design

- The Proponent has reduced the size of the tug basin to a practicable minimum and has reduced the total dredge area such that the existing crest protection structure remains unaltered. This has reduced the potential for localized disturbance of the tidal flats near the proposed tug basin (potentially as a result of the dredging), thus minimizing the risk of shallow, small-scale channels forming.
- The DP3 Project shoreline configuration has been designed to reproduce the existing hydrodynamic conditions as much as possible. The end of the present wharf extends into the current flow, which will cause a zone of flow divergence and a weak eddy to form behind the wharf during flood tides. Extending the wharf shifts the flow pattern landward but does not significantly change the overall pattern. During the ebb tide, flow accelerates and concentrates at the end of the wharf. The DP3 Project will extend the wharf and create higher flow concentration at the end of the proposed structure, however the absolute magnitude of the peak velocities remains very low and is very similar to the existing current regime.
- The proposed dredging areas and volumes have been reduced by 75% (from 3,470,000 to 853,000 m^3) (see Chapter 4 – *Sediment Quality, Dredging and Ocean Disposal* for further details). This change was made for multiple reasons (i.e., to reduce the need for ocean disposal, to lower construction costs, and to reduce environmental effects) and it minimizes sediment transport during dredging operations.
- The current DP3 Project, as noted above, has been redesigned to retain the existing crest protection structure.

The proposed fish and migratory bird Habitat Compensation Plan, described in Chapter 5 – *Marine Environment*, also includes a phased program to stabilize existing dendritic channels in the inter-causeway area to restore productive marine habitat. The initial phase will be a relatively small-scale intervention in the sandbar area located within the inter-causeway area, followed by a period of monitoring to gauge the channel response and if necessary, modify the mitigative measures. This approach will minimize the risk of any adverse effects to adjacent eelgrass habitat.

The Proponent has also prepared an Adaptive Management Strategy (AMS, see *Appendix B*) for the DP3 Project. The DP3 AMS includes a long-term coastal geomorphology monitoring program and mitigation measures as key strategy components. The objective of the AMS is to undertake a science-based systematic approach to monitoring and managing the Roberts Bank inter-causeway ecosystem, specifically to reduce uncertainty and assess the potential for negative

trends in the ecosystem. The AMS details the commitments that VPA would undertake to evaluate, prevent or mitigate those negative trends attributable to the DP3 Project before they become significant adverse environmental effects. The AMS program includes monitoring of any changes arising from DP3 or, other sources, to coastal zone processes in terms of increased erosion (dendritic channels) or reduced flushing, and which could contribute to potential eutrophication in the inter-causeway area.

The results of the AMS coastal geomorphology study will be evaluated for trends and potential effects. Should a negative ecosystem trend in the coastal geomorphology be detected that is attributable to the DP3 Project, VPA commits to the design and construction of the following mitigation measures:

Dendritic channelization – VPA would immediately design and construct engineered structures such as "crest protection" structures to arrest new dendritic channel processes.

Reduced tidal flushing leading to marine eutrophication – VPA commits to constructing an appropriate engineered mitigation measure to increase flushing of the inter-causeway area.

Increased scour and erosion – VPA would immediately initiate an assessment of the localized habitat effects, and in consultation with EC and DFO, design and implement engineered scour and erosion protection to mitigate effects as required.

2.3.4 Residual Effects

Based on the implementation of the proposed mitigation the RAs have determined that there will be no residual effects of the Project on coastal geomorphology.

2.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS

During this cooperative environmental assessment the EAO, the RAs and the working groups have considered: the Application; comments from government agencies, First Nations and the public on the potential effects of the Project; responses by the Proponent; and the discussions of the working groups.

Based on the information summarized in this CSR and provided that the Proponent implements the actions described in the *Owner's Commitments and Assurances* as listed in *Appendix A* of this report, the RAs are satisfied that the DP3 Project will not likely result in significant adverse environmental effects on the coastal geomorphology in the vicinity of Roberts Bank.

3. Water Quality

3.1 GENERAL

Water quality is a description of the physical, chemical and biological characteristics of water, usually in the context of the support of beneficial uses and/or ecological function. Water quality can be degraded such that, for example, there are restrictions placed on fish consumption, fish reproductive problems occur, there is degradation of benthos, eutrophication, drinking water consumption restrictions, beach closures, aesthetic issues, or the loss of fish and/or wildlife habitat.

A baseline water quality sampling program was carried out to characterize the pre-Project water quality conditions, such that impacts on receiving water quality from construction and operation of the DP3 Project could be predicted and monitored. The impacts of the proposed Project on water quality in the study area were assessed, and mitigation measures identified to offset any potential impacts.

3.2 BACKGROUND

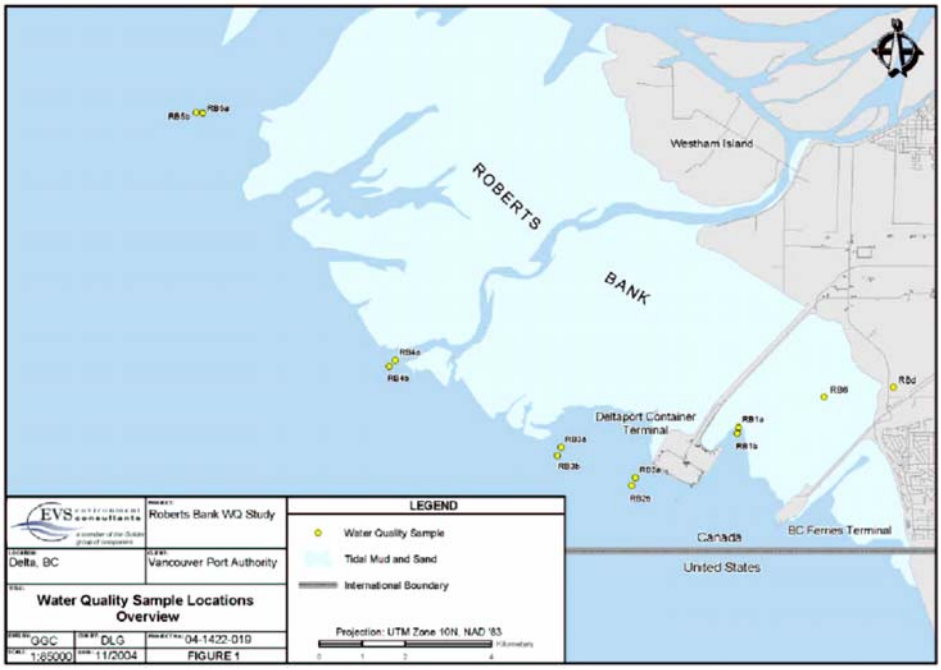
3.2.1 Study Area

The water quality study area was within a 5 to 7 km radius of the existing port facilities, including reference sites. It was limited to the northwest by the influence of the Main Arm of the Fraser River and to the southeast by the existing BC Ferries terminal causeway. Figure 9 shows the DP3 Project water quality study area.

3.2.2 Existing Environment

The existing water quality conditions at Roberts Bank were described from eight monitoring sites near the Deltaport container terminal and were augmented by two reference sites off Westham Island (remote from the terminal). Samples were collected using standard methodology, the following water quality parameters were analyzed, and the results were interpreted.

- dissolved oxygen (DO);
- pH;
- water temperature;
- turbidity;
- salinity;
- total suspended solids (TSS);
- ammonia nitrogen;
- nitrate nitrogen;
- nitrite nitrogen;
- dissolved ortho-phosphorus (ortho-P, which includes ortho-phosphate);
- chlorophyll *a;* and
- polycyclic aromatic hydrocarbons (PAHs), October monitoring only



Courtesy of EVS Environmental Consultants/VPA

Figure 9 Water quality study area and sampling locations

Temperature and DO were lower at depth than near the surface. In the absence of mixing, this is likely due to the less dense, and typically warmer, fresh water overlying salt water. Reduced photosynthetic activity at depth in the Fraser River is likely due to reduced light penetration caused by high turbidity in Fraser River surface waters. Turbidity and TSS were highest in surface waters and at monitoring sites closest to the Fraser River, and highest during May to late June (i.e., freshet). Salinity was greatest at depth, because less dense freshwater floats on heavier saltwater; salinity varied most at nearshore monitoring sites. Ammonia-nitrogen (N) and ortho-P were generally similar across all sites (although ortho-P decreased slightly from north to south). Nitrate nitrogen levels were five times higher at farshore sampling sites, but nitrite nitrogen was below laboratory detection limits. Chlorophyll *a* levels did not appear to be strongly related to any nutrient concentrations, but were consistently higher at nearshore sampling sites. PAHs in all water samples were below laboratory detection limits and provincial guidelines.

To assess water quality data, the Proponent compared monitoring results to British Columbia water quality guidelines (BC WLAP 1998).

Twenty-four of the 99 DO measurements (all from deep water) were below the chronic guideline of 8.0 mg/L, but none was below the instantaneous minimum of 5.0 mg/L. Harm to DO-sensitive species (e.g., salmonids) is not expected under existing conditions. All measured ammonia-N concentrations were non-detectable, or below half of the 30-day average guideline.

3.2.3 Proponent's Assessment of Impacts

In the Application, VPA conducted the following assessment:

Construction:

Landfill operations to create the proposed container terminal area will be surrounded by a system of containment dykes constructed to an elevation above expected high tide water levels, which would fully contain decant water and suspended silt, and prevent spills into surrounding foreshore areas. Dredged material would be transported via suction cutter or clam shell dredge barge into the containment area where the solids would settle out before supernatant is pumped via a submerged pipeline to approved disposal at sea sites.

Levels of total organic carbon (TOC), sulphur and sulphides in the study area sediments were not of concern. Concentrations of PAHs and metals were below the maximum allowable levels specified in the *Disposal at Sea Regulations, 2001* under the *Canadian Environmental Protection Act, 1999* (CEPA 1999) (see Chapter 4 – *Sediment Quality, Dredging and Ocean Disposal* for more details). Therefore disturbance of sediments during the proposed dredging operations, and potential remobilization of these low concentrations of contaminants into the water column, according to the Proponent, poses a negligible risk to human health or the environment. While dredging operations and construction activities have the potential to increase TSS levels in the water column, guidelines have been established by the Fraser River Estuary Management Program for the protection of marine resources susceptible to elevated TSS levels in the Fraser River estuary. Following is the weblink for general shallow water (less than –5m CD) timing windows. Deep water (greater than –5m CD) work windows are specific to Roberts Bank and were developed by DFO for previous dredging activities on the bank to protect female Dungeness crab. http://www-heb.pac.dfo-mpo.gc.ca/decisionsupport/os/timing_marine_e.htm

Operation:
During DP3 Project operation, treated sewage and stormwater effluent will be discharged from the Deltaport terminal. While there is potential for such discharges to impact ambient water quality, similar measures to those being used for the existing terminal will be instituted to minimize impacts. Domestic and industrial wastewater generated in building facilities and wash down areas will be collected and will undergo secondary treatment at the Deltaport sewage treatment plant before being discharged. The proposed increase in sewage output generated by the DP3 Project will be within the operating capacity of the existing Deltaport sewage treatment plant, which is permitted under a Provincial Ministry of Water Land and Air Protection (WLAP, now Ministry of Environment, MOE) effluent permit PE-14865.

Stormwater from the Deltaport container terminal will pass through an oil water separator with sediment retention baffles to trap suspended solids, prior to the discharge of stormwater into the ocean. The eight existing storm outfalls, located along the northern perimeter of Deltaport, will be decommissioned and replaced by five new stormwater outfalls.

During operation, effluents from ships, including ballast water and bilge water discharges, have the potential to impact on water quality.

Accidents and malfunctions that could occur during DP3 Project operation have the potential to impact on water quality. These accidents and malfunctions could include:

- spills and leaks (which include those from DP3 Project fueling operations and from terminal operations);
- accidents related to the transportation and storage of dangerous goods; and
- accidents or malfunctions related to waste management.

Potential accidents and malfunctions, including measures to minimize the potential effects, are discussed in more detail in Chapter 14 – *Accidents and Malfunctions*.

3.3 ANALYSIS

The RAs considered the information provided by the Proponent, including the Proponent's conclusions on potential effects and the method used to reach those conclusions as outlined above in sections 1 and 2 of this chapter. The RAs then conducted their own analysis of the potential effects and proposed mitigation measures before independently reaching conclusions on the residual effects.

Construction works that could impact water quality include dredging, landfilling, and disposal at sea. Operational activities that could impact water quality include the collection, treatment and disposal of stormwater and sewage, potential discharges of bilge and ballast waters, and possible accidents and malfunctions.

3.3.1 Potential Effects

Construction:
The potential effects to water quality during construction are:

- increases in suspended solids (elevation of turbidity and TSS levels) in the water column during dredging, ocean disposal and terminal filling operations; and
- increases in contaminant levels (heavy metals and PAHs) in the water column during dredging and disposal at sea.

Operation:
Potential effects to water quality during operation include degradation from:

- small increases in treated sewage and stormwater discharged into the marine environment from terminal operations;
- discharges including ballast water and bilge water discharges, from ships calling at the DP3 Project; and
- potential accidents and malfunctions.

3.3.2 Issues

Review comments from the community groups, First Nations and agency reviewers focused on the characteristics of the study area and sampling program used to determine effects from the proposed DP3 Project. The comments included:

- the potential for degradation of the Fraser River delta, and estuarine water quality;
- inadequate assessment of background temporal and spatial variability in water quality, specifically concerning the proliferation of eelgrass beds in the inter-causeway area and the potential for a marine eutrophication event to occur; and
- rationale for sample site selection and methodology for water quality data collection.

Each of the above issues and their resolutions are addressed below.

The geographic scope of the water and sediment quality study, as defined in the ATOR issued by EAO and endorsed by the Project's working group, was bounded by a 5 to 7 km radius from the existing Roberts Bank port facilities, and limited to the northwest by the Main Arm of the Fraser River and to the southeast by the existing BC Ferries terminal causeway. Agencies within the working group process concurred with the Proponent's assessment that water quality issues in the Fraser River delta and estuary outside of the Project study area have a high potential to be affected by activities other than those from the Roberts Bank port operations or the DP3 Project. The objective of the water quality study was to characterize pre-Project baseline water quality conditions, and to do this, the Proponent followed the methodology outlined in the draft study work plan, which included a detailed literature review, according to the ATOR.

Sample sites for water quality data collection were selected in order to characterize pre-Project baseline ambient water conditions. Samples were collected and processed according to standard procedures described by Environment Canada (EC 1994) and the Puget Sound Estuary Program (PSEP) protocols (PSEP 1987, 1997). Concerns were raised that sampling was not confined to the same tidal cycle, thus limiting the applicability of the data; however, this issue was addressed by the Proponent by sampling at or near the time of high tide during all sampling events.

Agency reviewers also identified that potential ecosystem changes, related or unrelated to the DP3 Project, are occurring or could occur, and that the current level of scientific understanding of potential marine eutrophication processes at Roberts Bank is inadequate. To address this issue the Proponent has developed an Adaptive Management Strategy (AMS). The AMS is the Proponent's approach for addressing EC's proposal that VPA develop a scientifically rigourous adaptive management plan to conserve fish, migratory birds and habitats for the Roberts Bank inter-causeway area. The intent of the AMS is to provide practical advance warning of any potential emerging negative ecosystem trends, including marine eutrophication events and effects on water quality during DP3 Project construction and operation. The AMS also establishes actions that the Proponent will undertake to prevent or mitigate negative trends which are a result of the DP3 Project before they become significant adverse environmental effects.

3.3.3 Mitigation

Design:

Redesign of the footprint (surface area) of the terminal, led to a reduction in stormwater volumes for collection and treatment.

- The eight existing stormwater outfalls, located along the northern perimeter of Deltaport, are to be decommissioned by the Proponent and replaced by five new stormwater outfalls. All outfalls are to be relocated to the southeast side of the terminal (off the wharf face) to discharge into the subtidal marine environment. These outfall locations are designed to prevent stormwater from being discharged into the embayment area, and would thus allow for greater flushing in the receiving waters. In addition, the new stormwater outfalls would have shut-off valves to terminate flow from the Project should a sizeable spill occur.
- The proposed volume of material to be dredged was reduced by 75% (from 3,470,000 to 853,000 m^3), and the amount of material proposed for disposal at sea was reduced by 80% (from 2,470,000 to 475,000 m^3, see Chapter 4 – *Sediment Quality, Dredging and Ocean Disposal* for further details). This will reduce the turbidity and corresponding ecological effects associated with dredging and disposal activities. Levels of TOC, sulphur and sulphides in the study area sediments were not of concern based on historical data available to EC. Concentrations of PAHs and metals were below the maximum allowable levels specified in the *Disposal at Sea Regulations, 2001* under CEPA 1999.

Construction:

- Mitigation to reduce turbidity during dredging and dredge spoil discharge at a designated disposal at sea site will be employed. Dredging would be conducted in adherence with DFO dredging timing windows and guidelines identified in any future *Fisheries Act* authorization http://www-heb.pac.dfo-mpo.gc.ca/decisionsupport/os/timing_marine_e.htm.
- If turbidity were to increase to an unacceptable level at the disposal site, pump flow volumes would be reduced. In the event of storm conditions causing turbidity, pumping would be shut down until the storm passed. Dredging and disposal operations will be stopped if killer whales enter the zone of acoustic influence and the construction schedule will adhere to DFO dredging windows for the protection of female Dungeness crabs and fish (see Chapter 5 – *Marine Environment* section 5.3.3 Mitigation).

Operation:

- Stormwater discharges are addressed in the proposed Environmental Management Program (see Chapter 18 – *Follow-up Program*). Mitigation involves passing all stormwater through an oil water separator with sediment retention baffles, prior to discharge into the ocean.
- All sewage from the DP3 Project will be directed to the existing Deltaport sewage treatment plant that provides secondary treatment and has the design capacity to

adequately treat the additional effluent. The Terminal Operator will provide regular maintenance to ensure compliance with the provincial effluent permit.

- Under the Proponent's existing Bilge Water Protocol it is an offence to discharge into the Port of Vancouver harbour, including Roberts Bank, any oil or other liquids containing oil (bilge water). Thus the discharge of bilge water from ships is prohibited at Roberts Bank.
- The VPA implemented a mandatory Ballast Water Management Program in January 1998. The purpose of the program is to limit the possibility of transferring non-indigenous species into Canadian waters while protecting the safety of ships. All operators of deep-sea vessels arriving at the Port of Vancouver intending to discharge ballast water within port limits, including Roberts Bank are required to carry out a mid-ocean ballast water exchange. The VPA's ballast and bilge water controls are vested under the authority of section 5 of the *Port Authorities Operations Regulations* made pursuant to the *Canada Marine Act.*

These undertakings are reflected in the *Owner's Table of Commitments and Assurances*, enclosed as *Appendix A* to this report.

The Proponent has developed an AMS for the Roberts Bank inter-causeway area to provide practical advance warning of any potential emerging negative ecosystem trends, including marine eutrophication events and effects on water quality during DP3 Project construction and operation. The objective of the AMS is to undertake a science-based systematic approach to monitoring and managing the Roberts Bank inter-causeway ecosystem specifically to reduce uncertainty and to assess the potential for future marine eutrophic events and dendritic channelization leading to erosion that could result in negative trends in the ecosystem. Further, the AMS details the commitments that VPA would undertake to evaluate, prevent or mitigate those negative trends attributable to the DP3 Project before they become significant adverse environmental effects. Surface water quality is a key indicator of potential changes from DP3 or other causes in terms of potential eutrophication in the inter-causeway area.

3.3.4 Residual Effects

Based on the application of the proposed mitigation the RAs have determined that residual effects of the Project on water quality associated with construction will be localized and temporary, and for operations, the magnitude of effects will be low. Because there has been a residual effect identified for this component, it has been included in the cumulative effects assessment (see Chapter 16).

3.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS

During this cooperative environmental assessment, the EAO, the RAs and the working groups have considered: the Application; comments from government agencies, First Nations and the public on the potential effects of the Project; responses by the Proponent; and the discussions of the working groups.

Based on the information summarized in this CSR and provided that the Proponent implements the actions described in the *Owner's Commitments and Assurances* as listed in *Appendix A* of this report, the RAs are satisfied that the DP3 Project will not likely result in significant adverse effects on the water quality in the vicinity of Roberts Bank.

4. Sediment Quality, Dredging and Ocean Disposal

4.1 GENERAL

The Proponent's January 2005 Environmental Assessment Application indicated that development of the DP3 Project would require dredging and ocean disposal. The dredging volumes in the Application were described as preliminary, pending further engineering assessment. In July 2005, the Proponent revised original dredging estimates based on additional engineering analysis, geotechnical investigations, and integration of environmental criteria and comments from EC and Fisheries and Oceans Canada (DFO).

Disposal at Sea permit applications require the provision of comprehensive information, as described on EC's website: http://www.pyr.ec.gc.ca/disposal_at_sea/index_e.htm.

In addition, a permit application involves a public review and comment process that begins after successful completion of an environmental assessment for the overall Project. If approved, the disposal of dredge spoil would be via a submerged pipeline to a designated Disposal at Sea site. EC is responsible for monitoring the environmental effects of dredge spoil disposal.

Aquatic habitat issues are addressed in Chapter 5 – *Marine Environment*.

4.2 BACKGROUND

4.2.1 Study Area

As summarized in Table 8, the dredging of the turning basin for terminal fill has been eliminated to reduce impacts on the marine environment. The fill for the terminal will now be imported from Fraser River dredge operations and coastal quarries. Dredging under the caissons and terminal area has been reduced by using in situ densification technology. The dredging proposed for the navigation channel remains unchanged. The Roberts Bank Disposal at Sea site was not included within the study area because it has been designated by regulatory agencies (DFO, EC, MOE) for disposal of approved substances under CEPA 1999. EC's Disposal at Sea Program is responsible for monitoring designated disposal sites.

It is estimated that up to 475,000 cubic metres of the total dredge volume required for the DP3 Project (approximately 853,000 cubic metres) (VPA letter to EAO dated July 27, 2005) would be unsuitable for use as onsite fill. The Proponent intends to apply for a permit to discharge a large portion of the waste silt at a designated Disposal at Sea Site. In addition to meeting the information requirements for the Disposal at Sea permit, the sediment sampling information generated by the Proponent was also used in order to assist with assessing potential impacts on sediment quality associated with the construction and operation of the DP3 Project. The study area for the sediment quality sampling and assessment covers the proposed dredging areas.

The revised dredging and disposal volumes are summarized in Table 8.

Table 8 Comparison between original dredge volumes and revised volumes (in cubic metres)

Area	Original Application Dredge Volume	Original Application Disposal Volume	Revised Dredge Volume	Revised Dredge Disposal Volume
Dredging of Turning Basin for Fill Material	2,000,000	1,000,000	0	0
Dredging under Caissons and Terminal Area (including tug basin)	1,220,000	1,220,000	603,500	300,000
Dredging of Ship Channel	250,000	250,000	249,500	175,000
Total (estimated)	**3,470,000**	**2,470,000**	**853,000**	**475,000**

4.2.2 Existing Environment, Sediment Quality

The Proponent carried out a sediment sampling program with input from EC. A total of 45 sediment samples were collected, including 25 core samples and 20 surface grab samples. The results are presented in Tables 9 and 10 below. All core and surface samples met the *Disposal at Sea Regulations, 2001* levels for metals and PAHs.

Table 9 Core sediment sampling results compared to levels set out in the *Disposal at Sea Regulations, 2001*

	Parameter	Minimum Result (µg/g dry weight)	Maximum Result (µg/g dry weight)	*Disposal at Sea Regulations, 2001* levels (µg/g dry weight)
Metals	mercury	0.01	0.05	0.75
	cadmium	<0.2	0.5	0.6
Organics	PAHs	0.06	0.12	2.5

Core samples collected in the study area had concentrations of total organic carbon (TOC) that were generally low, ranging from <0.5% to 1.39%. Most core sediment samples contained less than 0.5% TOC. Sediment grain size varied from sand with some silt to sandy silt. The total sulphide concentrations in the core samples ranged from 8.6 to 315 µg/g and sulphur content ranged from 0.06 to 0.16%

Table 10 Surface sediment sampling results compared to levels set out in the *Disposal at Sea Regulations, 2001*

	Parameter	Minimum Result (µg/g dry weight)	Maximum Result (µg/g dry weight)	*Disposal at Sea Regulations, 2001* levels (µg/g dry weight)
Metals	mercury	0.02	0.07	0.75
	cadmium	<0.2	0.4	0.6
Organics	PAHs	0.06	0.12	2.5

Surface samples collected in the study area had concentrations of TOC that were generally low, ranging from <0.5% to 1.55%. Grain size analyses indicated that surface sediment ranged from sand with trace levels of silt to sandy silt. The total sulphide concentrations ranged from 87.4 to 1160 µg/g and sulphur content ranged from 0.11% to 0.48%. The total sulphide and sulphur concentrations in the surface grab samples were higher than those in the core samples.

4.2.3 Proponent's Assessment of Impacts

As stated above, and as established by the Proponent, the concentrations of metals and PAHs were below the maximum allowable levels specified in the *Disposal at Sea Regulations, 2001.* Similarly, TOC, sulphur and sulphides were low. Potential impacts to sediment quality during construction could result from accidents and malfunctions, namely spills and leaks from construction equipment. These potential impacts are discussed in Chapter 14 – *Accidents and Malfunctions*.

In addition to accidents and malfunctions during the DP3 Project container terminal operations, stormwater may contain contaminants, and therefore has the potential to impact sediment quality near the terminal outfalls.

4.3 ANALYSIS

The RAs considered the information provided by the Proponent, including the Proponent's conclusions on potential effects and the method used to reach those conclusions as outlined above in sections 1 and 2 of this chapter. The RAs then conducted their own analysis of the potential effects and proposed mitigation measures before independently reaching conclusions on the residual effects.

4.3.1 Potential Effects

During the environmental assessment, the following potential effects were considered regarding the volumes and timing of dredging and dredge spoil disposal, and the potential for stormwater discharges to affect ambient sediment quality.

- Potential disturbance (including effects of increased turbidity) of killer whales and their food sources, such as chinook salmon;
- Potential for dredge spoil disposal at sea to cause underwater slides;
- Potential for stormwater releases from DP3 to effect the quality of the surrounding sediments; and
- Potential increases in contaminant levels (heavy metals and PAHs) in waters and sediments during dredging and disposal at sea operations.

4.3.2 Issues

Issues and their resolution are identified below.

- Potential contamination of reference sites being used by Greater Vancouver Regional District (GVRD) in its Iona Island discharge study was raised. The disposal of approved dredge spoil would take place at a designated Disposal at Sea Site that has been used a number of times over the last 20 years.
- It was also suggested that broad studies of sediment quality on Roberts Bank to assess changes over time, and to compare sediment quality with established effects thresholds, were needed. The RAs determined this to be beyond the scope of the Project. The Proponent's objective was only to characterize sediment quality in a manner sufficient to obtain a Disposal at Sea permit under CEPA 1999. EC's Disposal at Sea Program is responsible for monitoring designated disposal sites. The AMS includes sediment quality as a key area for monitoring in the inter-causeway area.

4.3.3 Mitigation

Design

- The volume of dredged material for disposal at sea is much reduced from the original planned amount. Transportation of dredge spoil would be via a submerged pipeline. Disposal at sea sites are monitored by EC, and the disposal of dredged material at the designated site is not expected to affect the slope or stability of Roberts Bank.

Construction

- Silt curtains or booms will be deployed to minimize silt plume effects on the biotic marine environment (see Chapter 5 – *Marine Environment*) during dredging if excessive sediment plumes are observed during environmental monitoring. Any deployment of silt curtains, while primarily for mitigating effects on marine organisms, will also act to retain the silt plumes within the immediate work area and reduce sediment transport as a result of construction.
- Dredging and disposal operations will be stopped if killer whales enter the zone of acoustic influence. The construction schedule will adhere to DFO dredging windows for the protection of female Dungeness crabs and fish. (More information on habitat issues is provided in Chapter 5 – *Marine Environment)*.
- If approved, dredge spoil disposal would occur at a designated site in accordance with a Disposal at Sea permit pursuant to CEPA 1999, the issuance of which is the responsibility of EC. The concentrations of metals and polycyclic aromatic hydrocarbons in the study area were below maximum allowable levels specified in the *Disposal at Sea Regulations, 2001.* Similarly, TOC, sulphur and sulphides were not of concern based on historical data available to EC. If approved, disturbance of sediment during the proposed dredging operations and remobilization of these low concentrations of contaminants is likely to cause negligible risk to human health or the environment. Once the sediment is deposited at the Disposal at Sea Site, EC's Disposal at Sea Program is responsible for monitoring the disposal site.

Operation

- Stormwater discharges are to be addressed in the proposed Environmental Management Program. Mitigation would involve passing all stormwater through an oil water separator with sediment retention baffles, prior to discharge into the ocean. The eight existing stormwater outfalls, located along the northern perimeter of Deltaport, are to be decommissioned by the Proponent and replaced by five new stormwater outfalls. All outfalls are to be relocated to the southeast side of the terminal (off the wharf face) to discharge into the subtidal environment. These outfall locations are designed to prevent stormwater from being discharged into the embayment area, and would thus allow for greater flushing in the receiving waters. In addition, the new stormwater outfalls would have shut-off valves to terminate flow from the Project should a sizeable spill occur. (More information on these subjects is provided in Chapter 3 – *Water Quality*; and Chapter 14 – *Accidents and Malfunctions*).

4.3.4 Residual Effects

Based on the implementation of the proposed mitigation the RAs have determined that there will be no residual effects of the Project on sediment quality.

4.4 CONCLUSION ON SIGNIFICANCE OF EFFECTS

During this cooperative environmental assessment the EAO, the RAs and the working groups have considered: the Application; comments from government agencies, First Nations and the public on the potential effects of the Project; responses by the Proponent; and the discussions of the working groups.

Based on the information summarized in this CSR and provided that the Proponent implements the actions described in the *Owner's Commitments and Assurances* as listed in *Appendix A* of this report, the RAs are satisfied that the proposed disposal at sea activities related to the DP3 Project will not likely result in significant adverse effects on sediment quality.

5. Marine Environment

5.1 GENERAL

The Proponent's application provided a comprehensive description of the marine environment within the study area. The impacts of the proposed DP3 Project on the marine environment in the study area are assessed and mitigation measures identified to reduce or eliminate any potential adverse environmental impacts. The Habitat Compensation Plan in the Application was described as preliminary, pending further review in the Application review period. In November 2005, the Proponent revised the original Habitat Compensation Plan based on additional engineering analysis, achieving Fisheries and Oceans Canada's Habitat Policy's guiding principle of no net loss and integration of environmental criteria and comments from EC and Fisheries and Oceans Canada (see *Appendix C*).

5.2 BACKGROUND

5.2.1 Study Area

Definition of the study area for assessment of potential effects on the marine environment was based on the areal extent of the Project activities and their likely effects. The study area included: (i) areas proposed for the placement of fill; (ii) the immediate dredge area including ship channels and turning basins; (iii) the specific areas in which the effects of the Project may be felt; and (iv) a wider area for comparison purposes when assessing the significance of likely effects.

In addition to the assessment of impacts within the footprint of the proposed expansion, the geographic scope of the assessments was limited to the northwest by the influence of the Fraser River through Canoe Passage and to the southeast by the existing BC Ferries terminal causeway. VPA expected that outflows from the Fraser River would prevent any sediments or operational effects from influencing habitats to the north of this point. The existing ferry terminal causeway would limit potential marine effects to the southeast, while they are bounded to the northeast by the existing shoreline. Due to increasing depth and the turbid waters from the Fraser River, the Proponent concluded that a study area within 1 to 5 km of the existing port facilities would be sufficient to document potential Project effects on most marine resources.

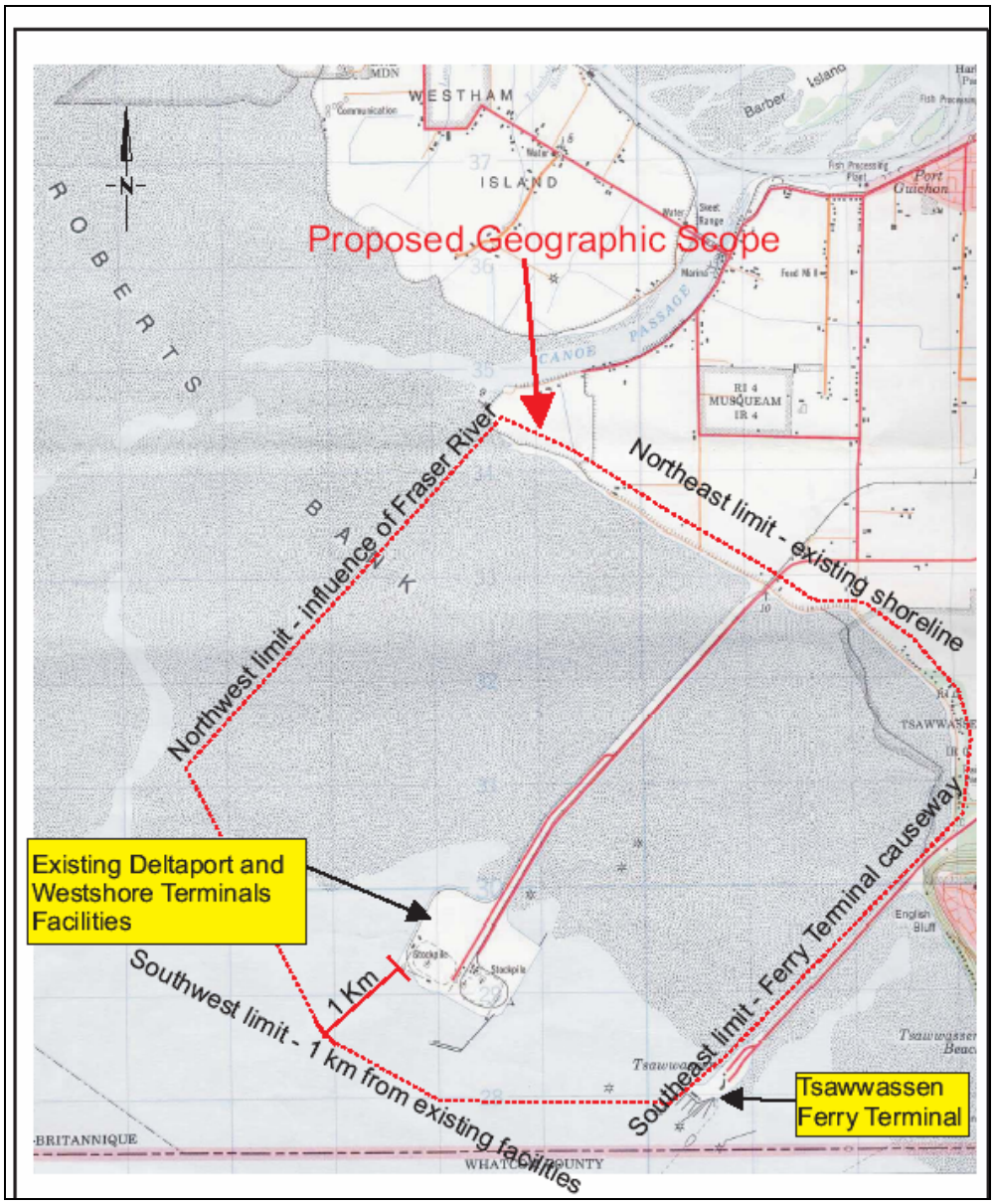
The marine study area was also reviewed through the Project Biophysical/Technical Working Group, as part of the Study Work Plan review process coordinated by the EAO. The study area is shown in Figure 10.

5.2.2 Existing Marine Environment

An important step in the marine environment study program was the synthesis of the various habitat study components into a functional ecological assessment to identify the critical interrelationships that may be affected by the proposed Deltaport Third Berth Project. The Roberts Bank study area, set on the outer edge of the Fraser River estuary, provides habitat for Pacific salmon and other fish species, as well as for commercially important invertebrates such as Dungeness crabs. It is also a critically important wintering and a staging area for millions of migratory birds. The intertidal flats, salt marshes, eelgrass beds, and subtidal delta front are all critical components that support this diverse marine ecosystem. The previous construction of the BC Ferries and the Roberts Bank causeways has affected the estuarine/marine processes of the study area. Most notably, it has reduced any direct influence of the Fraser River plume on the inter-causeway area. Geomorphologic processes and impacts are described and discussed Chapter 2 – *Coastal Geomorphology*.

Roberts Bank contains a diverse array of marine habitats and associated species which could potentially be affected by the proposed DP3 Project. The Proponent has provided a

comprehensive inventory and description of the existing marine environment, including backshore/marine riparian areas; intertidal marshes; intertidal sand/mud flats; eelgrass/macrophyte cover; intertidal/subtidal rocks; subtidal sand/mud; dredge basins; macro-invertebrates; fish, marine mammals; and habitat functions. The distribution of marine habitats in the inter-causeway area is shown on Figure 11.



Courtesy of Triton Environmental Consultants/VPA

Figure 10 Marine impact assessment study area for DP3 Project

Backshore/Marine Riparian:

Backshore vegetation above the high tide mark along the Tsawwassen dyke and Roberts Bank causeway consists of two main zones: the mean high tide line and a grass-herbaceous community above it. The zone at the mean high tide line consists of dunegrass, silver burweed, with less abundant species such as beach pea, spotted cat's-ear, and American searocket. This zone also contains perennial accumulations of logs carried up to higher elevations during storms. Above this zone is a grass-herbaceous community, which in the study area does not support

appreciable woody vegetation. Backshore vegetation provides habitat for birds and other wildlife such as small rodents (mice and voles).

Salt Marshes:
Salt marshes along the Roberts Bank causeway and the BC Ferries compensation area are comparatively new, having developed since construction of the causeway. The salt marshes along the Delta dyke, including the Tsawwassen salt marsh, are more mature having developed from around the beginning of the 1900s when the dykes were constructed to convert wetlands into agricultural land. The dominant vegetation in the salt marsh changed to more salt tolerant species such as pickleweed, saltgrass and orache. The only salt marsh located within the proposed Project footprint area is a small patch, approximately 300 m^2 in area, found in a cobble, gravel and mud beach at the base of the rip rap. The Tsawwassen salt marsh is the largest area of salt marsh within the inter-causeway area. The entire marsh is contained by dykes with two culverted openings that allow tidal flushing of the marsh. The marsh vegetation is characterized by pickleweed, saltgrass and orache. Several tidal channels dissect the marsh and large accumulations of rafted log debris were noted in the northeastern section. Tidal channel flows are impeded by log debris and the culvert elevation appeared to be limiting tidal discharge at low tide.

Macrophyte Cover:
The two main macrophytes present in the Project footprint are eelgrass (*Zostera marina and Z. japonica*) and *Enteromorpha* sp. (the latter in patches). The green filamentous alga *Enteromorpha* occupies the mid intertidal on both sides of the causeway, at usually higher elevation than the native eelgrass, *Z. marina*. The distribution of *Enteromorpha* appeared to be partially limited by that of *Z. marina* in the DP3 Project footprint.

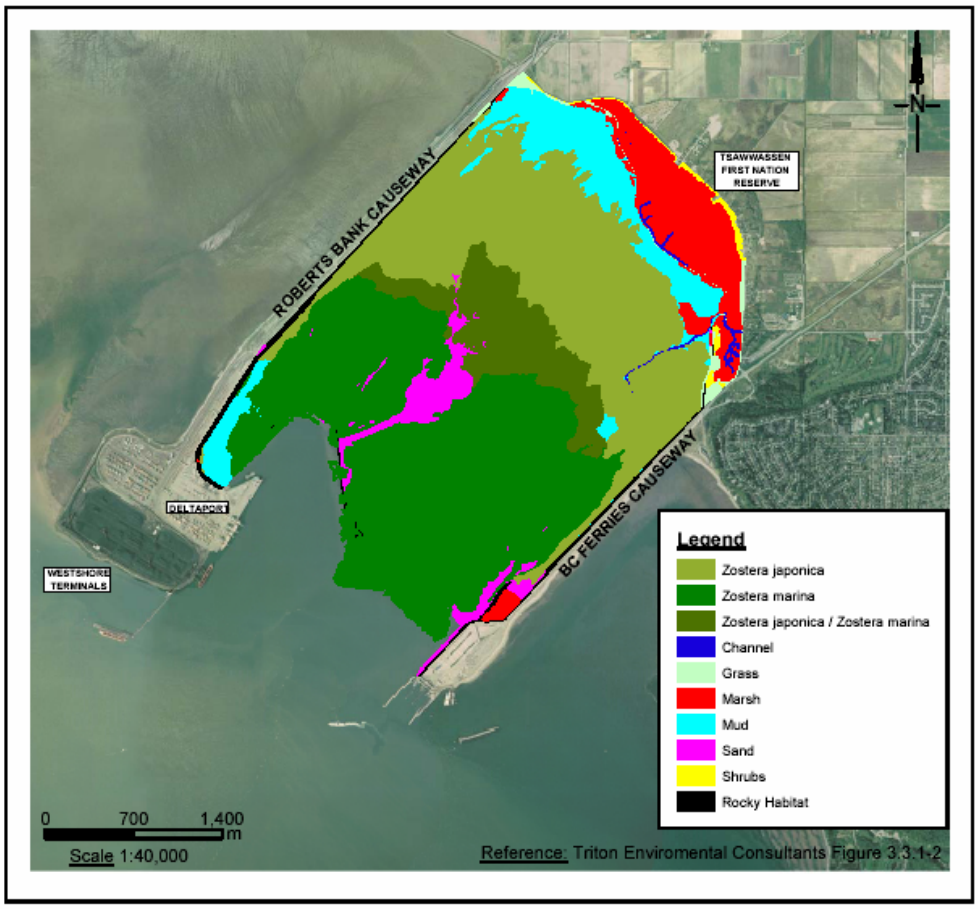
There are two species of eelgrass within the study area: the native species, *Z. marina* and an introduced species, *Z. japonica*. The first occurs between -0.5 and +2.0 m (CD) in the inter-causeway area. The lower limit of *Z. marina* growth is often determined by light availability. Exposure (desiccation) at low tide limits the growth of *Z. marina* at higher elevations. The second species tends to be a much smaller plant; the shorter, narrow leaves enable the species to survive in intertidal areas where *Z. marina* cannot survive. *Z. japonica* is common within the study area between +2.0 m (CD) to a height beyond which bathymetric data is currently available in the inter-causeway area (estimated by VPA to be between +3.0 and +3.5 m (CD)). The upper limit of *Z. japonica* is controlled by desiccation while the lower limit is controlled by the density of *Z. marina*. The density of *Z. marina* in the intertidal zone decreased with increasing elevation as the habitat became less suitable, thus there is often a transition area between areas of dense *Z. marina* and areas of dense *Z. japonica* where the two species co-exist.

Z. marina's distribution within the study area extends from the BC Ferries causeway to approximately 2.5 km northwest of the Roberts Bank causeway. *Z. japonica* is distributed from the BC Ferries causeway to Canoe Passage. *Z. japonica* formed a band along a bathymetric gradient in the inter-causeway area that extended along each of the causeways and the shore. The distribution of *Z. marina* and *Z. japonica* in the inter-causeway area is shown on Figure 11.

Intertidal Sand/Mudflats:
The mudflats on the west and east sides of the Roberts Bank causeway are heterogeneous habitats and host several small ecosystems and species. The most visible of these are the green filamentous alga, bivalves, and Dungeness crabs. Although two eelgrass species (*Z. marina* and *Z. japonica*) are found on the mudflats, they are considered separate ecosystems.

The west side of the Roberts Bank causeway is dominated by sand/mudflats (60% of the available substrate within the study area) while eelgrass occupies 66% of the inter-causeway area. Most of the biophysical processes (sediment accretion and consequent ecological zonation) on the west side are along a north northwest-southeast axis, reflecting the influence of the Fraser River plume, whereas they are along a northeast-southwest axis towards the shore in

the inter-causeway area. The footprint of the proposed DP3 Project is subject to sediment accretion in its southwest corner, which partly explains the large portion of that area covered by mudflats (75% versus 14% for the whole east side). During the August 2003 marsh surveys, a new marsh plant for the Fraser River estuary was discovered in this area colonizing the mudflat up to 100 m from the shore. The new introduced species was identified as *Spartina anglica* (English cordgrass), an aggressive invader of mudflats.



Courtesy of Triton Environmental Consultants/VPA

Figure 11 Marine habitats in the inter-causeway area

A thin layer, referred to as biofilm, covers the surface of the intertidal, unvegetated mudflat on Roberts Bank. While biofilm is more widely distributed north of the Roberts Bank causeway, biofilm is also present on mudflat within the inter-causeway area. Biofilm consists of bacteria, diatomaceous algae, small invertebrates and detritus in a mucous matrix. See Chapter 6 – *Waterfowl and Coastal Seabirds* for a description of biofilm and its importance to shorebird species.

Intertidal/Subtidal Rock

Intertidal/subtidal rock was identified along the causeway and embayment shoreline of the existing terminal and the rock crest of the turning basin. Algal and invertebrate community compositions are similar along most of the shoreline rip rap, with differences in species present dependent on elevation, concentration and orientation of the rip rap. There is a diverse algal cover (moderate to dense) on the rock crest protection. This area is likely to be used by a diverse group of invertebrate species and several species of nearshore fishes (both juvenile and adults) for refuge and foraging.

Subtidal Sand/Mud:
The substrate in the subtidal area is classified as predominately sand or muddy sand (sand with less than 10% mud content). Vegetation is limited to the shallow subtidal zone (<1.5m depth) and included eelgrass to 0.5 m depth and sparse to low cover of foliose green algae (primarily sea lettuce with some *Enteromorpha* sp.) to 1.5 m depth. Flatfishes appear to be partitioned by depth and substrate. The most abundant flatfishes are starry flounders, which occur in the sand (both inside and outside the eelgrass beds) usually in depths shallower than 3 m. Crab density appears to be greater in the tug basin and upper dredge cut than in other locations.

The substrate in both the upper (10-15 m depth) and lower (>20 m depth) dredged basins in the inter-causeway area (including the dredge slope) is predominantly mud with some sand content. This area is likely depositional. The benthic component is probably poorly flushed and the sediments slightly anoxic as indicated by the presence of sulphur reducing bacterial mats (*Beggiatoa*). No vegetation was observed. A dense diatom mat was observed on the east side of the existing dredge cut. The finer mud substrate below 10 m depth supports predominantly either eelpouts (Zoarcidae) and/or prickleback (Stichaeidae). Most of the flatfishes that could be identified from the imagery below 10 m were English and Dover soles, while flatfishes in shallower depths (<10 m) were a mixture of these species and starry flounder. Lingcod, greenling and a juvenile yelloweye rockfish were observed in the rock along the base of the proposed third berth. The accumulation of detritus in the basin provides food for Dungeness crabs and the fine sediments likely support epifaunal communities (such as worms, clams, shrimp, brittle stars) that are consumed by flatfishes. Mud stars, spiny pink stars and sea cucumbers are also present in this habitat.

Macroinvertebrates:
Based on a literature review of twelve studies carried out in the area in the last 30 years, more than 200 invertebrate species live on Roberts Bank near the port development. Polychaetes and amphipods are the most commonly reported taxa. As part of the marine habitat study program quadrat and beam trawl sampling were conducted, the most common taxa sampled include amphipods, gastropods, small shrimp (mainly Crangonidae), crabs, bivalves, isopods, nudibranchs, salps, and ctenophores. Overall, many of the macroinvertebrate species found in the intertidal area along both sides of the Roberts Bank causeway are typical of low energy level environments. The area hosts numerous introduced or invasive species, most of which are common to the Pacific Northwest. No SARA, or blue or red-listed species were observed during the field surveys. Based on quadrat and beam trawl sampling, the inter-causeway area harbours a more diverse macroinvertebrate fauna and has more biomass than the west side of the Roberts Bank causeway. This is probably due to a combination of a more mature and denser eelgrass bed and different, overlapping habitats such as eelgrass, *Enteromorpha* patches, mudflats, and rocky habitats and the transition zones (edges) between these habitats.

Juvenile Dungeness crabs were collected on both sides of the Roberts Bank causeway during the field sampling. They are common in the proposed DP3 Project footprint where they were collected in September and December 2003 and in May 2004. Their densities ranged from 4 to 16 per m^2 on the west side of the causeway, to 4 to 120 per m^2 (median of 24 per m^2) in some areas of the proposed DP3 Project footprint.

The DP3 Project footprint area appears to be rich in biodiversity. Because of the nature and ecological function of that general area as nursery habitat, the periods most sensitive to anthropogenic disturbances are late winter (period of Dungeness egg release in the inter-causeway area) and spring (recruitment and settlement of juvenile invertebrates).

Fish:
Based on a review of twelve studies conducted in the last 25 years in the Roberts Bank area (1979 to 2004), the Proponent concluded that at least 72 fish species use the habitats surrounding the proposed DP3 Project. The most common species in the Roberts Bank subtidal and intertidal areas are staghorn sculpins, followed by starry flounders, threespine sticklebacks,

chum salmon and shiner perch. As part of the marine habitat study program, the Proponent carried out beach seining, catching 4,419 fishes belonging to at least 16 species. Sixteen beam trawl surveys were also carried out, with a total catch of 4,379 fishes of 27 species. No *Species at Risk Act* (SARA), or blue or red-listed species were observed during the field surveys.

Pink, chum and chinook were the only juvenile salmon reported in the area immediately adjacent to both sides of the Roberts Bank causeway in the last four years. Chinook juveniles were caught in the summer (June and July) whereas pink (primarily on even years), and chum abundance peaked in the winter and spring. Surf smelt were one of the most commonly reported species in the area and were common through all four seasons' catches. There were indications of a winter spawning population in the area as there were two cohorts of surf smelt larvae caught, in August and in April. Attempts by the Proponent and its consultants to find study area spawning sites were unsuccessful.

The intertidal habitats on both sides of the Roberts Bank causeway cover a large area characterized by a shallow slope, and are thus submerged intermittently by tidal waters. As such the general area provides a refuge for many small euryhaline fishes (fish capable of tolerating a wide range of salt water concentrations). The literature review, observations and data from the present study showed the area to be a nursery area for fishes such as sculpins, flounders and salmonids. The periods of highest fish productivity and diversity are spring and summer. The period of highest vulnerability to anthropogenic disturbances, due to the abundance of larval fishes, is spring.

Marine Mammals:
The distribution of marine mammals has been characterized by the Proponent in three areas: a 5-km radius around the Project site (to reflect the likely zone of influence of construction operations); the southern Strait of Georgia (Fraser River and eastern Gulf Islands); and Georgia Basin (to reflect the context of increased ship traffic due to operations). Of the 23 species of marine mammals living in British Columbia waters, 16 species inhabit the southern Strait of Georgia/Georgia Basin area and 9 are considered common to the area. Marine mammal diversity in this region is relatively high, with 5 of the 7 representative marine mammal sub-order/families present on a seasonal or annual basis. This includes 7 odontocete (toothed whale) and 4 mysticete (baleen whale) cetaceans; 2 species of otariids (eared seals) and phocids (true seals); and 2 mustelid (otter) species.

Seasonal occurrence data suggest that only common dolphin, fin whales and elephant seals do not frequent the local area, but the presence of humpback whales and sea otters is believed to be highly sporadic. Harbour seals are distributed evenly throughout the study area and porpoises were the next most abundant species. Southern resident killer whales are a small declining (listed as Endangered on Schedule 1 of SARA) and red listed population, and are known to use both the proximate and local area for foraging. Their use of the study area appeared to be seasonal, with regular use through April to October, the heaviest period being late summer (coinciding with the Fraser River salmon runs). During this period, they make frequent foraging excursions to the mouth of the Fraser River, usually passing close to shore at Point Roberts and close to Tsawwassen ferry terminal and the existing facility at Roberts Bank. Steller sea lions and sea otters both have growing populations and the proximate area does not appear to be an important habitat for them.

Marine Resource Use:
The productive and diverse marine resources within the Roberts Bank inter-causeway area are important for recreational, commercial and First Nations (subsistence, cultural and commercial) purposes. Recreational fisheries in the area are limited primarily to Dungeness and red rock crabs and salmon in the deeper areas. The TFN has identified salmon, crab, shellfish and sturgeon as important species, traditionally harvested within the inter-causeway area. The only commercial fishing activity identified within the inter-causeway area (DFO statistical area 29-7) is for Dungeness crab. There is a restricted fishing area in the Deltaport/Roberts Bank area to

provide a channel for navigation. The restricted area includes the turning basin adjacent to the container terminal and approaches to the coal berths. Recreational and commercial harvest of shellfish in the inter-causeway area, Roberts Bank and Boundary Bay is prohibited (no harvesting for any purpose) under a permanent contamination closure.

5.2.3 Proponent's Assessment of Impacts

An assessment of the impacts of the Project on the marine environment was undertaken by the Proponent in a systematic fashion, proceeding from the identification of potential impacts through an analysis of their severity to an assessment of their significance and the development of required mitigation and compensation measures. The Proponent described the impact analysis framework in five steps and discussed the Valued Ecosystem Components (VECs), addressing federal guidelines under CEAA (see Part B – Introduction). The criteria used for VEC selection included rarity or uniqueness, fragility/vulnerability/sensitivity, contribution to diversity, sustainable use of species or ecosystems and ecosystem function. The habitats or marine species selected for consideration using these criteria included: eelgrass; foreshore and salt marsh; intertidal mudflats; juvenile salmonids; Dungeness crabs (adult and juvenile); intertidal/subtidal rocky habitats; subtidal mud; lingcod; rockfish; and marine mammals. The Proponent conducted an analysis for each VEC to assess potential Project impacts for the footprint, construction and operation components. An impact assessment in regard to migratory birds in the marine environment is discussed in Chapter 6 – *Waterfowl and Coastal Seabirds*.

Footprint Impacts:

The Proponent's assessment of Project impacts on the selected VECs within the footprint of the Project, approximately 22 hectares over the existing intertidal and shallow subtidal marine habitat, include: the permanent loss of approximately 5 hectares of eelgrass, 300 m^2 of salt marsh, 10 hectares of intertidal sand/mudflat, and 6.9 hectares of subtidal mud. These permanent impacts have the potential to effect the distributions and productivity of marine and terrestrial species, in particular invertebrates (juvenile and adult Dungeness crab), fishes (salmon and lingcod).

The proposed Project terminal construction would create an additional 0.15 ha of rip rap, thereby providing functional intertidal fish habitat for juvenile salmonids. This component of the Project would have a positive impact on this VEC. Fish using the intertidal habitat (salmon, stickleback) subtidal habitat (sculpins and flatfishes) are mobile and would move out of the area prior to construction. They would likely relocate in similar habitat adjacent to the footprint. Disruptions to spawning lingcod would be minimized through the observation of DFO guidelines identified in any future *Fisheries Act* authorization. The Proponent's assessment of other identified VECs (rockfish, marine mammals) concluded that they would not be affected by the footprint of the proposed Project.

Construction Impacts:

The DP3 Project construction schedule outlined in the Application has been revised; the new construction schedule is described in section 2.4.3 of Part A in this report. The Proponent foresees the marine construction components of the Project divided into four phases: (i) dredging of the berth; (ii) construction of dykes; (iii) dredging and importing of material for the terminal; and (iv) placement of clean sand and gravel under the berth and caisson.

The main impacts associated with dredging and fill placement are expected to be physical disturbance of the seabed, direct impacts to marine organisms, impacts on water and sediment quality and noise impacts on marine fauna. All construction phases would directly or indirectly affect eelgrass beds in the vicinity of the construction works through either habitat disturbance or a potential increase in water turbidity. These effects are, however, suggested to be temporary. Dredging in the intertidal mudflats may only cause potential short-term disruptions of habitat as most of the dredging operations would be concentrated in approved fisheries work windows to mitigate impacts to juvenile fish and crabs. There would, however, be some loss of habitat following construction of dykes and terminal fill as the footprint of the Project is used by many juvenile vertebrates and invertebrates, such as bivalves.

As assessed by the Proponent, the effects of the construction phases on juvenile Dungeness crabs include a low potential for short-term disruption of habitat or animals during dredging, as most dredging activities would be outside the construction footprint area. A medium to high potential for losses of some juveniles exists during construction of dykes and terminal fill as these animals would still be in the substrate. The placement of sands/gravels and densification activities should have minimal effects on juveniles, as their habitat would not be directly affected. For adult Dungeness crabs there is potential for the short-term disruption of females during late winter migration and losses of individuals through entrainment during dredging activities and potential for losses of individuals during dyke construction, placement of gravel/sand, densification and terminal fill. There are potential short-term disruptions of pink and chum salmon habitat use during dredging activities, dyke construction, placement of gravel and sand and during densification and terminal fill. The main effects of construction activities on marine mammals are underwater noise and the possibility of release of environmental contaminants from dredging.

Operation Impacts:
Impacts from operation of the DP3 Project on eelgrass beds, the foreshore, salt marsh, intertidal mudflats, subtidal mud and rocky habitat, and adult and juvenile Dungeness crabs are considered negligible by the Proponent. The effects of the container terminal operations are expected to be continuous once construction is completed. Most operational effects relate to potential increased risk of collision of marine mammals with vessels. The expected increase in ship traffic once the proposed Project becomes operational would increase the probability of introduction of non-indigenous marine species in the Roberts Banks area.

5.3 ANALYSIS

The RAs considered the information provided by the Proponent, including the Proponent's conclusions on potential effects and the method used to reach those conclusions as outlined above in sections 1 and 2 of this chapter. The RAs then conducted their own analysis of the potential effects and proposed mitigation measures before independently reaching conclusions on the residual effects.

5.3.1 Potential Effects

During the cooperative environmental assessment process the public, working group members and federal agencies identified the following potential environmental effects and key issues concerning potential environmental effects of the Project on the marine environment:

- The permanent loss of approximately 22 hectares of marine habitats that include: 5 hectares of eelgrass habitat; 300 m^2 of salt marsh habitat; 10 hectares of intertidal mudflat and 6.9 hectares of subtidal mudflat;

The potential effects of:

- Terminal construction and operation on water quality from stormwater releases into intertidal habitat;
- Dredging and placement of fill on fish, invertebrates, and marine mammals and their food sources such as chinook salmon;
- Marine construction and dredging (underwater noise) on marine mammals;
- Vessel traffic and associated underwater noise and risk of collision on marine mammals;
- Terminal and construction illumination on juvenile salmon;
- Ballast and bilge water discharges and the introduction of non-native species; and
- Accidental spills and malfunctions on the marine environment.

5.3.2 Issues

Concerns were raised that the Habitat Compensation Plan originally outlined in the Application was not acceptable in terms of meeting the DFO Habitat Policy's conservation goal for the proposed loss of 22 hectares of marine habitats.

In reviewing a proposed project, DFO determines whether after applying available mitigation measures to avoid impacts to fish habitat, a harmful alteration, disruption or destruction (HADD) of fish habitat will result from the construction of the Project. If a HADD is likely to occur, DFO may, if appropriate, authorize the proponent to commit the HADD subject to conditions, including the construction of compensation in the context of DFO's guiding principle of no net loss of fish habitat. To address compensation for the HADD, the Proponent undertook a thorough review of all possible Project mitigation (relocation/redesign) and compensation measures and developed a revised Project design mitigation and Habitat Compensation Plan consistent with DFO's *Policy for the Management of Fish Habitat* (1986). The revised Habitat Compensation Plan strategically includes habitat compensation concepts that are beneficial to both fish and wildlife.

Concerns were raised regarding the lack of studies and quantitative information available to assess the existing underwater noise conditions in Georgia Strait and the potential effects of underwater noise and vessel traffic on marine mammals, in particular, southern resident killer whales. The Proponent recognizes this and together with the Terminal Operator, commits to prepare a report on orca pods in the vicinity of the Project and to assess avoidance measures when pods are traversing the offshore areas of Roberts Bank. DFO marine mammal scientists will be consulted to ensure the report complements the southern killer whale draft recovery strategy and marine mammal monitoring requirements identified in the *Fisheries Act* authorization.

5.3.3 Mitigation

This section describes the measures that the Proponent has undertaken, or has agreed to undertake, to mitigate any significant adverse environmental effects of the Project. Specific details describing all Project mitigation measures are outlined in *Appendix A – Owner's Table of Commitments and Assurances.*

Design

In the early phases of Project development and environmental assessment review the Proponent went through a comprehensive process of Project justification and design option review aimed at mitigating potential environmental effects associated with the Project footprint. This process resulted in the following Project design changes:

- From 2003-5 the Proponent redesigned the Project to reduce the terminal footprint from the originally proposed 32 ha to 20.67 ha. This was achieved by optimizing container operations to a state-of-the-art facility. The terminal layout was redesigned into a horseshoe shape to minimize footprint effect on sensitive intertidal habitat. The geomorphological modeling (Chapter 2 – *Coastal Geomorphology***)** shows that the tidal current direction and velocity would be very similar to the present conditions supporting similar habitat functions.
- The tug moorage/basin was redesigned to reduce its footprint from 2.6 to 1.19 ha, resulting in a reduction of dredging effects (26,000 m^3 to 14,600 m^3) and risk of intertidal mudflat erosion.
- Modification of the dredge program to source terminal fill from the Fraser River, eliminating dredging in the turning basin and substantially reducing the need for marine dredging (final dredge area of 12.71 ha). Changes to the dredge program are also discussed in Chapter 4 – *Sediment Quality, Dredging and Ocean Disposal*; the proposed volume of material to be dredged was reduced by 75% (from 3,470,000 to 853,000 m^3).
- Redirecting stormwater outlets to deep water off the berth face to protect sensitive intertidal habitat in the embayment area.

Construction
Below is a summary of the mitigation measures identified by the Proponent to minimize effects associated with Project construction.

- Timing of dredging will adhere to the required DFO dredging guidelines and BMPs to minimize disruption of habitat or losses of individual adult Dungeness crabs, fishes and lingcod and their egg masses;
- Construction phases in the intertidal zone will be concentrated during winter to minimize disruption to killer whales as well as to eelgrass and intertidal mudflats, which makes these habitats less susceptible to increased TSS levels;
- Prior to placement of fill in the intertidal area for the terminal footprint, the intertidal area will be surveyed and juvenile and adult crabs will be relocated to a suitable adjacent area away from construction;
- If monitoring indicates juvenile salmon are present in areas where work is occurring in water less than five metres CD, bubble or silt curtains will be deployed to keep fish away from the works area or to isolate the works area from fish;
- An underwater noise inventory of all equipment proposed for the Project will be developed. A marine noise-monitoring program will be established to measure acoustic frequencies of all marine construction equipment (dredge equipment, vibro-flotation equipment, other marine construction equipment). An interim theoretical zone of audibility having a radius of 7.5 km will be applied at the outset of construction activity. Once construction has begun, the marine noise-monitoring program will assess the actual noise emissions resulting from dredging and other associated activities to determine the true zone of audibility. The marine noise-monitoring program will be used to adjust the zone of audibility to avoid impacts to killer whales and meet the requirements of a *Fisheries Act* authorization;
- If a pod of killer whales is sighted within 7.5 km of the Project site, the environmental monitor has authority to stop noise generating construction equipment until the whales have moved outside the true zone of audibility;
- A marine mammal monitoring /surveillance system will be prepared to satisfy DFO habitat authorization requirements and will include:
    - Dedicated observers stationed at a high vantage point on the site, scanning the area of concern with large (e.g., 20 x 100) pedestal-mounted binoculars;
    - A camera system to augment dedicated observers;
    - Underwater acoustic monitoring so that whales can be detected before they enter the zone during periods of reduced visibility; and
    - Communication protocols to ensure observers are connected to the whale-watch industry's pager notification system, so that they can remain informed regarding the location of southern resident killer whales when known.
- In-water noisy construction activities will be ramped up slowly to prevent startling of marine mammals and allow them to leave the area.
- Outline procedures to ensure the vibro-flotation vibrating head is shut down while it is being relocated to a new location to minimize underwater noise;
- Stormwater discharges for construction and operation are addressed in the proposed Environmental Management Program. Mitigation involves passing all stormwater through an oil water separator with sediment retention baffles, prior to discharge into the ocean. The 8 existing stormwater outfalls, located along the northern perimeter of Deltaport, are to be decommissioned by the Proponent and replaced by 5 new stormwater outfalls. All outfalls are to be relocated to the southeast side of the terminal (off the wharf face) to discharge into the subtidal environment. These outfall locations are designed to prevent stormwater from being discharged into the embayment area, and would thus allow for greater flushing in the receiving waters. In addition, the new stormwater outfalls would have shut-off valves to terminate flow from the Project should a sizeable spill occur.

(More information on these subjects is provided in this report's Chapter 3 – *Water Quality*; and Chapter 14 – *Accidents and Malfunctions*); and

- Modifications to the terminal and dredge lighting systems would be specified to shield light from spilling outside the basic working footprint of the dredge and terminal, minimizing the potential effects from construction illumination to juvenile salmon.

Operation

- The VPA has a mandatory Ballast Water Management Program and Bilge Water Protocol to limit the possibility of transferring non-indigenous species into Canadian waters while protecting the safety of ships. The VPA's ballast and bilge water controls are vested under the authority of section 5 of the *Port Authorities Operations Regulations* made pursuant to the *Canada Marine Act;*
- To reduce the risk of boat collision with marine mammals the Owner and the Terminal Operator will work with BC Pilots to develop an education and awareness program about marine mammals and have pilots of vessels transiting to Roberts Bank steer away from observed marine mammal pods when vessel safety is not compromised;
- To evaluate vessel speeds and marine mammal interactions to assess and reduce the potential risk of marine vessel mammal collisions when ships approach the Roberts Bank port area during operation;
- To assess ways to encourage proper maintenance of deep sea ship propellers during operation; and
- To reduce the incidence of liquid contaminant, oil and material spills, the VPA will ensure the preparation of Construction and Operation EMPs for the Project (*Appendix A).*

As noted above, in addition to the referenced construction and operation mitigation the Proponent has committed to the development of and adherence to Construction and Operation Environmental Management Plans, including, but not limited to, Marine Water Quality and Hazardous Waste Management and Spill Control.

Compensation

The development of the conceptual habitat compensation plan (HCP) was required for the EA. The Proponent accepts that the DP3 Project, after applying all applicable mitigative measures, will displace approximately 22 hectares of existing intertidal and shallow subtidal marine habitat (section 5.3.1 Potential Effects). To compensate for these effects a comprehensive and diverse Habitat Compensation Plan has been developed consistent with DFO's Habitat Policy, and includes 6 components as follows:

1. East causeway salt marsh and barrier island: the creation of salt marsh, mudflat and backshore habitat on approximately 6.7 hectares of upland located along the eastern shoreline of the Roberts bank causeway. Final habitat designs will be selected to offset loss in eelgrass, salt marsh and intertidal mudflat habitats from the Project footprint;
2. Log debris removal and salt marsh tidal channel: the enhancement of 4.5 hectares of the Tsawwassen salt marsh through the selective removal of excessive log debris, installation of culverts through the dyke and creation of tidal channels. The habitat enhancement designs will increase salt marsh productivity and salmonid use by improving conditions for salt marsh expansion and tidal flushing;
3. Subtidal reef: the expansion of existing subtidal reef habitat adjacent to the southwest shore of the coal port. Reefs will be created to increase the productive capacity and habitat diversity in the subtidal environment;
4. Sandbar stabilization by dendritic channel modifications: to stabilize areas (minimum of 5 ha) within the current sandbar/dendritic channel area of the inter-causeway area through a phased and adaptive approach. The objective is to enhance the habitat productivity by providing stable habitat for eelgrass and invertebrate re-colonization;
5. Caisson habitat and shoreline complexity: construct the caissons and berth face using designs that increase habitat complexity and enhance fish migration and feeding; and

6. Offsite compensation: the VPA in partnership with Pacific Salmon Foundation, Ducks Unlimited Canada, DFO and EC will secure and develop a minimum of 7.5 hectares of intertidal fish and wildlife habitat in the Fraser River estuary.

The proposed habitat compensation features, although conceptual, meet the requirements of the federal-provincial harmonized environmental review process. Subsequent to the conclusion of the environmental assessment and prior to initiating the Project, the Proponent would be required to develop detailed compensation plans and monitoring programs to meet DFO habitat authorization requirements consistent with DFO's goal of conserving fish habitat. The Proponent recognizes that fish and wildlife habitat requirements are inextricably linked in the overall context of the Roberts Bank ecosystem and therefore synergies are gained by incorporating fish and migratory bird values in the Habitat Compensation Plan.

5.3.4 Residual Effects

Based on the implementation of the proposed mitigation measures, including the HCP, the RAs have determined that there will be no residual effects of the Project on the marine environment, with the exception of marine mammals, where the effects associated with construction are temporary and reversible, and the effects associated with the operation of the Project are low. Because there has been a residual effect identified for this component, it has been included in the cumulative effects assessment (see Chapter 16).

5.4 CONCLUSION ON SIGNIFICANCE OF EFFECTS

During this cooperative environmental assessment the EAO, the RAs and the working groups have considered: the Application; comments from government agencies, First Nations and the public on the potential effects of the Project; responses by the Proponent; and the discussions of the working groups.

Based on the information summarized in this CSR and provided that the Proponent implements the actions described in the *Owner's Commitments and Assurances* as listed in *Appendix A* of this report, the RAs are satisfied that the DP3 Project will not likely result in significant adverse environmental effects to the marine environment.

6. Waterfowl and Coastal Seabirds

6.1 GENERAL

The assessment of impacts to migratory birds and bird habitat is based on all of the baseline data and field observations reported in the Application.

The waterfowl and coastal seabird impact assessment examined bird species composition, abundance, and habitat use as well as the presence and likelihood of occurrence of federally and/or provincially listed species at risk in the Roberts Bank Study Area. Impacts of the proposed DP3 Project on waterfowl and coastal seabirds are assessed based on existing knowledge and seasonal bird presence and habitat studies undertaken for the study area. Measures are identified to mitigate any of these potential impacts in the study area.

Prior to initiating the field study, the Proponent reviewed the federal Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Canadian Species at Risk list, the federal *Species at Risk Act* (SARA) list (Schedules 1, 2 and 3), and the provincial Conservation Data Center (CDC) red and blue lists, to determine the suite of federally and/or provincially listed species likely to occur within the study area, and their present status. COSEWIC assesses and designates which wildlife species are under threat in Canada. Additionally, the CDC maintains tracking lists of rare vertebrates, plants and plant communities for each Forest District in BC.

Federal and provincial legislation, along with Federal-Provincial Accords and Agreements, determine which species is primarily managed by either the federal or provincial government. Provincially managed species, populations or communities at high risk of extinction or extirpation are placed on the red list, and are candidates for formal Endangered Species status. Taxa considered vulnerable to human activity or natural events are placed on the blue list. Red and blue listed species or communities are sometimes referred to as species “at risk.” Federally managed species, populations or communities at risk have their status evaluated as either Extinct, Extirpated, Endangered, Threatened, or of Special Concern.

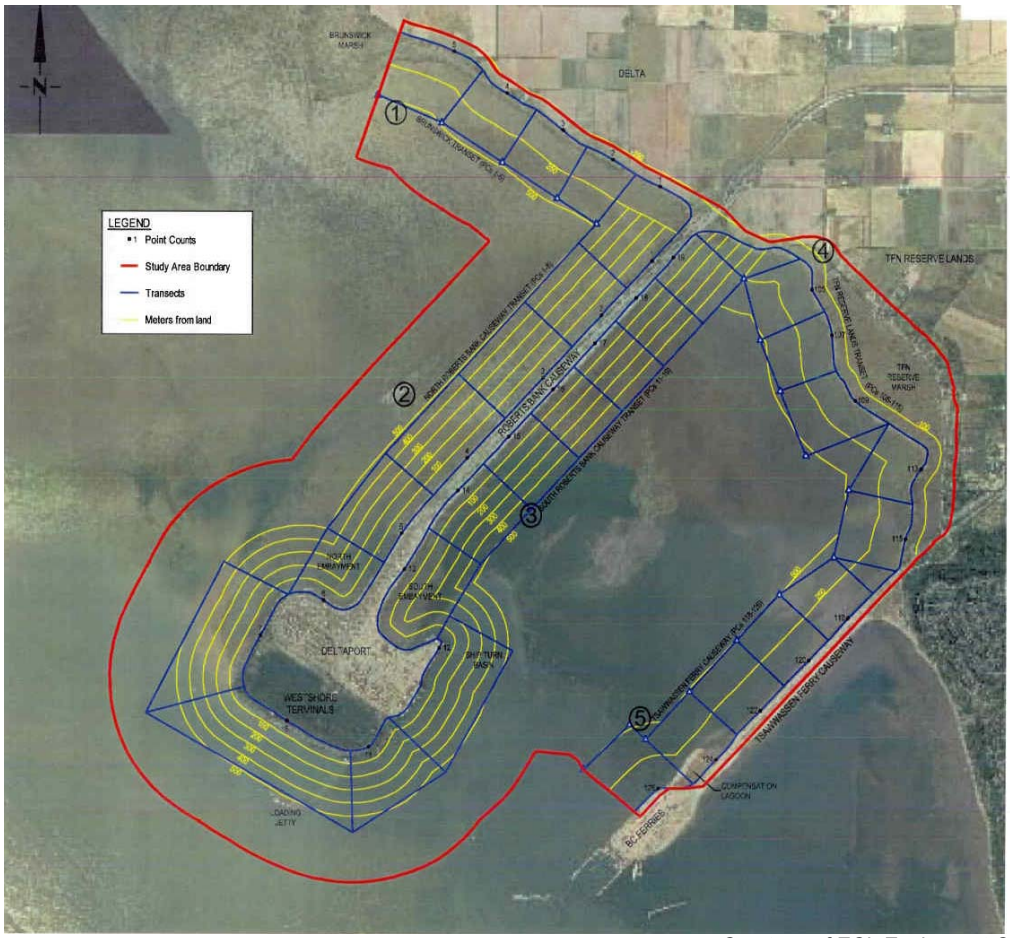
6.2 BACKGROUND

6.2.1 Study Area

The study area, as depicted in Figure 12, extends from Canoe Passage of the Fraser River to the base of the Roberts Bank causeway along the Brunswick Marsh shoreline; from the base to the tip of the Roberts Bank causeway (north side); from the base to the tip of the Roberts Bank causeway and terminal (south side); along the shoreline between the bases of the Roberts Bank causeway and the BC Ferries causeway on the TFN Reserve Lands; and along the north of the BC Ferries causeway to the tip (BC Ferries Terminal).

6.2.2 Existing Environment

A combination of literature review and year long bi-weekly field surveys was used to identify a total of 101 bird species in the study area. Of these 101 species, 31 were defined as terrestrial birds and not considered further in this chapter but are assessed in the terrestrial wildlife and vegetation study (Chapter 7 – *Terrestrial Wildlife and Vegetation*).



Courtesy of ECL Envirowest Consultants/VPA

Figure 12 Waterfowl and coastal seabird study area with transects and point counts

COSEWIC is a group of experts that assesses and designates which wildlife species are in some danger of disappearing from Canada. The provincial Conservation Data Center (CDC) maintains tracking lists of rare vertebrates, plants and plant communities for each Forest District in BC. Species, populations or communities at high risk of extinction or extirpation are placed on the red list, and are candidates for formal Endangered Species status. Taxa considered vulnerable to human activity or natural events are placed on the blue list. Red and blue listed species or communities are sometimes referred to as species "at risk." Prior to initiating the field study the Proponent reviewed the COSEWIC Canadian Species at Risk list, the federal *Species at Risk Act* (SARA) list (Schedules 1, 2 and 3), and the CDC red and blue lists, to determine the suite of federally and/or provincially listed species likely to occur within the study area, and their present status.

The federal and provincial conservation status for non-terrestrial species potentially occurring in the study area is defined as follows:

Federal:

Extinct	A species that no longer exists;
Extirpated	A species that no longer exists in the wild in Canada, but occurs elsewhere (for example, in captivity or in the wild in the United States);
Endangered	A species facing imminent extirpation or extinction;
Threatened	A species likely to become endangered if limiting factors are not reversed;

Special Concern	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events;
Not at Risk	A species that has been evaluated and found to be not at risk; and
Data Deficient	A species for which there is insufficient scientific information to support status designation.

Provincial:

Red listed	Species populations or communities at high risk of extinction or extirpation; and
Blue listed	Species vulnerable to human activity or natural events.

Based on a review of the federal COSEWIC Canadian Species at Risk list, the federal SARA list (Schedules 1, 2 and 3) and the provincial CDC red and blue lists, 34 bird species listed as either federally or provincially at risk potentially occur within the study area (see Table 11). Of these 34 bird species, 13 were recorded in the study area during the survey period.

Table 11 Waterbird species at risk that potentially occur in the study area

Species	Conservation status*		Likely occurrence	Species recorded during surveys
	Federal	Provincial		
Aechmophorus occidentalis western grebe	-	Red	Overwinter, Migrant	√
Ardea herodias fannini great blue heron, fannini subsp.	Special Concern (1997)	Blue	All Year	√
Bartramia longicauda *upland sandpiper	-	Red	Migrant	×
Botaurus lentiginosus American bittern	-	Blue	Breeder	×
Brachyramphus marmoratus marbled murrelet	Threatened (Nov 2000)	Red	Migrant	√
Branta canadensis leucopareia Canada goose, *leucopareia* subsp.	-	Blue	Migrant, Winter	×
Branta canadensis occidentalis Canada goose, *occidentalis* subsp.	-	Blue	Migrant, Winter	×
Butorides virescens green heron	-	Blue	Migrant	×
Clangula hyemalis long-tailed duck	-	Blue	Overwinter, Migrant	√
Fratercula cirrhata **tufted puffin	-	Blue	Accidental	×
Fratercula corniculata **horned puffin	-	Red	Migrant	×
Grus canadensis sandhill crane	Not At Risk (1979)	Blue	Migrant	×
Heteroscelus incanus wandering tattler	-	Blue	Migrant	×
Larus californicus California gull	-	Blue	Overwinter, Migrant	√
Limnodromus griseus short-billed dowitcher	-	Blue	Migrant	×
Limosa haemastica hudsonian godwit	-	Red	Migrant	×
Melanitta perspicillata surf scoter	-	Blue	Overwinter, Migrant	√
Numenius americanus long-billed curlew	Special Concern (Nov 2002)	Blue	Migrant	×
Pelecanus erythrorhynchos American white pelican	Not At Risk (1987)	Red	Migrant	×
Phalacrocorax auritus Double-crested cormorant	Not At Risk (1987)	Red	All Year	√
Phalaropus lobatus red-necked phalarope	-	Blue	Migrant	×
Phalacrocorax pelagicus pelagicus Pelagic cormorant, *pelagicus* subsp.	-	Red	All Year	√
Phalacrocorax penicillatus Brandt's cormorant	-	Red	All Year	√
Phoebastria albatrus short-tailed albatross	Threatened (Nov 2003)	Red	Accidental	×
Pluvialis dominica American golden-plover	-	Blue	Migrant	×
Ptychoramphus aleuticus **Cassin's auklet	-	Blue	Accidental	×
Puffinus creatopus pink-footed shearwater		Red	Accidental	×
Recurvirostra americana **American avocet	-	Red	Migrant	×
Rhodostethia rosea Ross's gull	Threatened (Nov 2001)	-	Accidental	√
Sterna caspia Caspian tern	Not At Risk (1999)	Blue	Summer non breeder, Migrant	√
Sterna forsteri **Forster's tern	Data Deficient (1996)	Red	Migrant	×
Synthliboramphus antiquus ancient murrelet	Special Concern (1993)	Blue	Accidental	×
Uria aalge common murre	-	Red	Migrant	√
Uria lomvia **thick-billed murre	-	Red	Migrant	×

* Conservation status is as follows:
Extinct - A species that no longer exists;
Extirpated - A species that no longer exists in the wild in Canada, but occurs elsewhere;
Endangered - A species facing imminent extirpation or extinction;
Threatened - A species likely to become endangered if limiting factors are not reversed;
Special Concern - A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events;

***Not at Risk* -** species that has been evaluated and found to be not at risk;
Data Deficient - species for which there is insufficient scientific information to support status designation;
Red listed - species populations or communities at high risk of extinction or extirpation; and
Blue listed - species vulnerable to human activity or natural events.
****** Considered a rare sighting by the Vancouver Natural History Society's Rare Bird Alert and requires a sighting confirmation.
√ Species recorded.
× Species not recorded.

Excluded species:

American bittern:
The American bittern (*Botaurus lentiginosus*) potentially breeds in the Brunswick and TFN marsh habitats of the study area, and it is not expected to be affected by the DP3 Project as the potential nesting sites are far removed from the Project area (over four kilometres). American bittern was not observed during the year-long field study. The remaining species listed in Table 11 would occur as migrants or accidentals; consequently, the Proponent did not consider that they would be impacted by the Project, and thus they were not included in the EA review documentation.

The Proponent separated the bird species recorded in the study area into the following taxonomic groups:

Shorebirds:
Eighteen species of shorebird (over 500,000 individuals) were identified in the study area including: dunlin, black-bellied plover, greater yellowlegs, killdeer, least sandpiper, marbled godwit, red knot, semi-palmated plover, western sandpiper, black oystercatcher, black turnstone, common snipe, long-billed dowitcher, Pacific golden plover, red phalarope, rock sandpiper, spotted sandpiper, whimbrel, and Wilson's phalarope.

Between November and April the numbers were dominated by dunlin and, to a lesser extent, black-bellied plovers. Diversity and distribution of shorebirds increased in spring, peaking in late April to May. In May and late July to August, western sandpipers were abundant (foraging) throughout the study area. Foraging and resting/roosting was the primary use of the study area. Semi-palmated plover, killdeer and other shorebirds (e.g., dowitchers, knots, yellowlegs and godwits), were more frequently associated with the marsh and stubble grass shoreline of Brunswick Marsh, Roberts Bank causeway (north and south), the TFN Reserve Lands marsh and the wetland compensation lagoon at the tip of the BC Ferries causeway. While the Calidrid (sandpiper) species were primarily associated with habitats north of the Roberts Bank causeway; foraging was documented along mudflat intertidal habitats and receding tide levels (preferring low tides) as well as resting/roosting areas.

Dabbling ducks:
Ten species of dabbling duck were recorded (approximately 500,000 individuals) in the study area, including mallard, American widgeon, Eurasian widgeon, gadwall, green-winged teal, northern pintail, American coot, blue-winged teal, hooded merganser and northern shoveler. Their primary activities were foraging and resting. Resting and roosting occurred along Brunswick Marsh or shoreline of the Roberts Bank causeway, the TFN Marsh, the wetland compensation lagoon at the tip of the BC Ferries causeway, at the tip of the Deltaport causeway, and along the two embayment areas (north and south of the Roberts Bank tip). They foraged during low tides and transition tides along the dendritic channels and shorelines. They were most abundant between October and December, and decreased in number between June and August, probably due to migrations to breeding grounds. None of the 10 species of dabbling ducks identified during the field survey was observed to be breeding within the Study Area. Foraging and resting/roosting is the primary use of the Study Area for this guild. The field observations are supported by the literature and past observations. A total of 69% of dabbling duck use of the

delta front is in Roberts Bank (McKelvey and Summers 1985). Highest use of the Study Area was recorded along the marshes (*ibid.*).

Diving ducks:
Ten species of diving ducks (approximately 44,000 individuals) were identified in the study area including greater scaup, bufflehead, surf scoter, Barrow's goldeneye, black scoter, common goldeneye, common merganser, harlequin duck, long-tailed duck, and white-winged scoter. Numbers remained relatively constant throughout the year, except during breeding season (June to September), when they declined sharply, before increasing again in September, and peaking in May consistent with historical sightings conducted by Butler and Cannings (1989). Foraging and resting/roosting is the primary use of the study area, with most activity in deeper water associated with dendritic channels and eelgrass beds. Diving ducks used the southern tip of the Roberts Bank causeway at high and low tides throughout the year.

Piscivorous diving birds:
Twelve species of piscivorous birds were identified (over 6,000 individuals) in the study area, including common loon, horned grebe, red-breasted merganser, common murre, pelagic cormorant, Brandt's cormorant, pigeon guillemot, red-necked grebe, red-throated loon, western grebe, marbled murrelet, pied-billed grebe, unidentified diver, loon, grebe, cormorant, merganser and murre. The greatest numbers of individuals were observed from July to October, likely due to natal (breeding) dispersal and migration. Field observations suggest that foraging and resting was the primary use of the study area by diving ducks, particularly along the Roberts Bank causeway (north and south) in areas of deeper water, where they were observed swimming and diving for food along the ship turning basin and over eelgrass beds associated with dendritic channels. Closer to shore many were recorded swimming and resting in areas of low wind and wave action.

Geese and swans:
Brant goose**,** snow goose, Canada goose, and trumpeter swan were identified in the study area (over 30,000 individuals). The field survey program determined that numbers peaked in November, but scattered groups occurred in December, January and April. Low numbers were observed in February and May to October. Foraging and resting/roosting was the primary use of the study area, particularly intertidal marshes, which are used extensively through the winter for foraging and shelter. Brant goose was the most abundant goose recorded south of the Roberts Bank causeway.

Gulls:
Nine species of gull (over 90,000 individuals), predominantly glaucous-winged gulls, were identified in the study area. Numbers were observed to be highest from June to October, and lowest during April and May. During the winter, more individuals were observed in February. Gulls primarily used the study area for foraging and resting/roosting, often opportunistically foraging during high tides along shorelines and roost locations along the base and embayment areas of the Roberts Bank causeway. During low tides they were observed scattered throughout the study area, opportunistically foraging along tide pools and following receding tide lines scavenging/hunting for food with shorebirds and dabbling ducks along the dendritic channels

The following species at risk, and their behaviours and distribution, were recorded in the study area:

Brandt's cormorant:
This species of piscivorous diving bird is not listed by COSEWIC but it is red listed by the CDC in the Chilliwack Forest District because small breeding populations are restricted to very few sites (Fraser et al. 1999). There were two sightings (November and December 2003) of three individuals from the BC Ferries causeway. All were recorded 0-250 m from shore during high tide surveys. Brandt's cormorant occurs along the BC coast throughout the year. It is known to frequent mainland inlets. Marine waters are preferred and it tends to avoid land, frequenting

bays, lagoons, harbours and narrows with strong currents where nearby rocks or islets provide roosting sites. Since its occurrence is sporadic and only occasional sightings are made of this bird in the Study Area, Brandt's cormorant is not likely affected by the proposed DP3 Project.

Common murre:
This species is not listed by COSEWIC but is red listed by the CDC in the Chilliwack Forest District as one colony accounts for 95% of the total British Columbian population, making it very vulnerable to catastrophic events (Fraser et al. 1999). Five individuals were recorded during the year-long survey along the Roberts Bank port causeway. Two were observed (October 2003) diving 0-100 m from shore (in the ship turning basin) during high tide. Two were observed swimming and diving 100-200 m from shore in March 2004 during high tide, and on a low tide in April 2004, one was observed swimming 200-300 m from shore. The common murre breeds on coastal islands on the Pacific coast of Alaska, British Columbia, Oregon, and California, and in the Gulf of St. Lawrence in Quebec. This species is usually found in waters free of ice. Since its occurrence is sporadic and only occasional sightings are made of this bird in the Study Area, common murre is not likely to be affected by the proposed DP3 Project.

Marbled murrelet:
The marbled murrelet is listed as Threatened in Schedule I of SARA. It is red listed by the CDC in the Chilliwack Forest District because declines of 20–40% have been documented in Clayoquot Sound and breeding habitat loss continues (Fraser et al. 1999). One individual was seen flying far from shore in November 2003 from north Roberts Bank. The marbled murrelet breeds from the western Aleutian Islands through coastal southern and southeastern Alaska, British Columbia (up to 100 kilometres inland), Washington, and Oregon to central California. The largest populations occur in southeastern Alaska and northern British Columbia. The marbled murrelet does not breed at Roberts Bank. The occurrence of the marbled murrelet is sporadic within the Study Area and it is not likely to be affected by the proposed DP3 Project.

Caspian tern:
This tern species is listed by COSEWIC as Not at Risk and is therefore not listed on Schedule I of SARA. The CDC lists it as blue due to an identified small population vulnerable to human disturbance of colonies (Fraser et al. 1999). This species migrates south during winter, and is only present in the lower mainland from April to October. Highest numbers of tern sightings were recorded between June and September, with approximately 45% of the bird numbers being recorded in August. They were observed flying (hunting) and resting, but not nesting in the study area. Of the 1,584 individuals recorded during the study, most were seen from Brunswick Marsh, the Roberts Bank causeway, and areas fronting the TFN community. This species was observed overflying (hunting) or resting in these areas. The entire study area (2,350 ha) has a potential to be used for resting/roosting and feeding/hunting by the tern, but the majority of individuals were observed using a total of 329 ha of available habitat during high tide and 219 ha of habitat during low tide.

Great blue heron:
The great blue heron is listed by COSEWIC as a species of Special Concern. It is listed on Schedule III of SARA, which indicates this species must be reassessed by COSEWIC prior to consideration for its inclusion on Schedule I of the Act. The CDC lists this species as blue because populations on the coast of the *Ardea herodias fannini* subspecies are in decline (Gebauer and Moul 2001). Great blue heron was present throughout the year in the study area, but was most numerous between June and August (74% of the 12,000 sightings were between June and October). Of the sightings most were recorded from the Roberts Bank causeway where the herons from were observed resting and foraging along the shoreline during high tides and in the dendritic channels. Numerous sightings of great blue heron were also recorded in the area in front of the TFN community, the TFN Reserve Lands, and Brunswick Marsh where the birds were observed foraging, resting and roosting, especially in inclement weather. Some herons were also observed from the BC Ferries causeway foraging along dendritic channels during low tides. No nests were identified in the study area, but the Proponent does reference a known nesting colony

south of the BC Ferries causeway, approximately 8 kilometres from the proposed Project site. The Proponent assessed that there would be no impacts to the colony due to the distance from the proposed Project area. Many of the birds from this colony do, however, forage in the eelgrass and dendritic channels in the Study Area.

Pelagic cormorant:
The pelagic cormorant is not listed by COSEWIC, and is therefore not found on any of the SARA schedules. The CDC lists this species as red due to declining population numbers (Fraser et al. 1999). The pelagic cormorant is present year round in the Study Area; less than 50 individuals per month were recorded outside the peak months of July and August. Of the 575 individuals recorded during the survey period, over 96% were recorded from the Roberts Bank causeway, swimming and diving at high tides, and swimming in deeper waters at low tides. The remaining individuals were observed from the BC Ferries causeway, other than two individuals which were recorded in front of the TFN lands. Distribution of the pelagic cormorant in the study area is highest during the summer (July to August), due to a breeding colony located on the Westshore coal loading jetty located approximately about 2 kilometres south of the Project area.

Double-crested cormorant:
The double-crested cormorant is listed by COSEWIC as Not At Risk and is therefore not found on any of the SARA schedules. Of the four subspecies of *Phalacrocorax auritus* recognized in North America, *P. a. albociliatus* breeds in British Columbia and *P. a. cincinatus* winters along the coast (Cannings 1998). Fraser et al. (1999) state that the subspecies, *P. a. albociliatus* of cormorant is provincially blue listed because there are small numbers of colonies, with recent serious declines in reproductive success along the coast. Further, the primary cause of the decline at coastal sites is believed to be increased nest predation by glaucous-winged gulls and northwestern crows, which in turn may be the result of increased bald eagle disturbance at these colonies. They also state that double-crested cormorant colonies are threatened in a similar manner by human disturbance. No breeding colonies of this species were identified in the Study Area during the survey period.

The double-crested cormorant was observed to be most abundant during October, with numbers decreasing from January, to a low in July, as birds move to breeding sites. No breeding colonies of this species were identified in the study area. Of the approximately 4,000 individuals recorded during the survey period 25% were flyovers. Most of the individuals (approximately 70%) were recorded from the Roberts Bank causeway foraging, diving and feeding at high tides in dendritic channels and eelgrass beds, and in dendritic channels at low tide through the entire year. A total of 27% of individuals were recorded from the BC Ferries causeway in the late summer to winter period from where they were observed swimming and diving in the headwaters of the dendritic channels in the inter-causeway area. The remaining individuals were recorded from Brunswick Marsh in the late summer to winter period, where they were observed diving and swimming in algae and eelgrass habitat at high tides, and from the area fronting the TFN community where they were observed swimming and diving in the headwaters of the dendritic channels.

Western grebe:
COSEWIC has not assessed the western grebe and consequently this species is not found on any of the SARA schedules. The CDC lists this species as red because a small breeding population is restricted to only three regular sites, and because it is vulnerable to human disturbance (Fraser et al. 1999). During the project field survey program, the largest congregations were recorded in April and October. During the summer period (June to August) no grebes were observed which is expected as this species has departed for the breeding grounds during that time. Of the 1,000 individuals recorded, only 1% was observed passing overhead, the remaining ones were observed swimming. Of all the observations made, 74% were from the Roberts Bank causeway; 25% from the area fronting the TFN community and only 1% from the Brunswick Marsh. From these locations, at high tides, western grebes were seen swimming over eelgrass beds; at low tides, they were also observed over eelgrass beds, but in deeper water areas.

Surf scoter and long-tailed duck:
The surf scoter has not been listed by COSEWIC and is therefore not on any of the SARA schedules. The CDC lists this species as blue in the province because there are few known nesting sites in BC and, in the winter and spring, very large concentrations can occur on the coast that are susceptible to catastrophic events such as oil spills (Fraser et al. 1999).

COSEWIC has not assessed the long-tailed duck and it is therefore not listed on any of the SARA schedules. The CDC lists this species as blue because a small breeding population is located in northwestern BC. While long-tailed duck habitat is not threatened, migrant and winter populations are vulnerable to oil spills (Fraser et al. 1999). Both of these species use the study area for resting/roosting and foraging. Movement and distributions of the surf scoter and long-tailed duck are similar to the other diving ducks and their habitats in the study area. Diving duck numbers remained consistent throughout the year except during breeding season (June-August), when they exhibit a drastic decline in numbers in the Study Area. Populations increased again in September and peaked in May. Peak numbers in the survey were recorded in early May, consistent with historical sightings conducted by Butler and Cannings (1989).

California gull:
The California gull is a blue-listed species because it is currently in low numbers in the province (Fraser et al. 1999); it has not been assessed by COSEWIC and therefore is not found on any of the SARA schedules. This gull does not breed in the Study Area, preferring the interior habitats of BC (Campbell et al. 1990). It nests in colonies, often with other species, on islands in lakes, rivers and marshes (Godfrey 1986; Winkler 1996). The California gull use the Study Area primarily for resting and foraging with other *Larus* (gull) species. It is opportunistic in its foraging and adapts to anthropogenic effects well (Elphick and Rubega 1995). It is observed in the lower mainland as a winter resident and occurs widely on the coast of BC frequenting beaches, bays, estuaries, lagoons, agricultural fields, airports, garbage dumps, sewage outlets and less often, brackish sloughs and freshwater lakes (Campbell et al. 1990). Survey results indicate this is an opportunistic bird which follows the movements of other *Laurus* species.

Ross's gull:
The Ross's gull is listed as Threatened in Schedule 1 of SARA and COSEWIC but is not found on the provincial red and blue lists. Ross's gull is an Arctic species with a circumpolar distribution. One individual was observed in October 2003 roosting with a group of other gulls during high tide. This observation was characterized as an extremely rare sighting.

Nesting Species:
Surveys confirmed the nesting of three species in the Study Area. All three were associated with the Roberts Bank causeway. They include the osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus*), red-tailed hawk (*Buteo jamaicencis*) and pelagic cormorant (*Phalacrocorax pelagicus*). The osprey nest was located along the Roberts Bank causeway in the south embayment area established on a set of pilings. A bald eagle nest and red-tailed hawk nest were identified at the base of the Roberts Bank causeway. The pelagic cormorant colony was identified nesting on the loading jetty at the southwestern tip of Westshore Terminals. This nesting colony is situated on scaffolding that supports the coal loading conveyor belt. More than twenty-four nests were identified during the May-June surveys.

Aquatic habitats considered critical for supporting waterfowl and coastal seabird diversity and abundance in the Study Area are:

Eelgrass beds:
Dense eelgrass beds in the study area, both north and south of the Roberts Bank causeway, are considered of importance for waterfowl and coastal seabird prey items such as Dungeness crabs

(adults and juveniles), isopods, amphipods and many juvenile fishes. Eelgrass beds are particularly important for piscivorous birds as well as many species of dabbling and diving ducks such as mallard, scaup and herons. Brant geese feed mainly on eelgrass. The eelgrass beds south of the Roberts Bank causeway have been identified as a prerequisite for coastal staging for this bird.

Foreshore and intertidal marshes:
Intertidal brackish and saline marshes in the study area developed after the installation of dykes to create agricultural land. Brackish marshes (Brunswick Point) provide critical habitat for fish, waterfowl and coastal seabirds using the outer section of the Fraser River estuary. Salt marshes in the study area occur along the Roberts Bank causeway, the wetland compensation lagoon at the tip of the BC Ferries causeway compensation wetland, and along the Delta dyke and the inter-causeway area. Salt marshes are important for primary production, and provide critical foraging and shelter for fish, waterfowl and coastal seabirds. They are particularly important to dabbling ducks for feeding, resting/roosting and nesting. Foreshore marshes provide primary productivity, plants and seeds, which are utilized by dabbling ducks, geese and swans, gulls and some shorebirds. Foreshore marshes also offer security and shelter for waterfowl and coastal seabirds as well as for terrestrial birds.

Intertidal mudflats:
Intertidal mudflats are important habitat for many foraging birds, particularly for shorebirds during migration. Herons and gulls use this habitat to scavenge along tide pools during low tides and for foraging in exposed eelgrass. Shallow water and abundant refuges also make intertidal mudflats a good nursery habitat for juvenile fish, which are used as prey by diving ducks and piscivorous birds. Primary food production is low, but the algal and benthic production used by shorebirds and dabbling ducks is high. The shoreline of this habitat is important for the growth of plants, which are used by dabbling ducks, geese and swans.

Biofilm:
A thin layer, referred to as biofilm or microalgae, covers the surface of the intertidal unvegetated mudflat on Roberts Bank. While biofilm is more widely distributed north of the Roberts Bank port causeway, biofilm is also present on unvegetated mudflat within the inter-causeway area along the dyke that separates the Tsawwassen salt marsh from the intertidal area. Biofilm consists of bacteria, diatomaceous algae, small invertebrates and detritus in a mucous matrix. Recent published research, involving the Canadian Wildlife Service and Simon Fraser University indicates that this nutrient-rich layer is fed on by the western sandpiper. Although it is well known that shorebirds feed on invertebrates in and on the mud, indications are that western sandpiper, and perhaps other shorebird species, can target and ingest biofilm. Further, biofilm likely contributes a significant amount of the energy that western sandpipers require to fuel migration.

Subtidal mudflats:
Subtidal mudflats in the dredge basin provide habitat for Dungeness crabs, flatfishes, pricklebacks, eelpouts, eelgrass and green algae, all of which are used by plovers, dabbling ducks and shorebirds. Mud and sand habitat in the Project footprint provides habitat for fish species favoured by diving ducks and piscivorous birds. Shorebirds feed along the rocky shore and water margins of subtidal mudflats during high and low tide. Eelgrass in these areas provides habitat for invertebrates, which are important food for shorebirds and dabbling ducks.

Intertidal/subtidal rocky habitats:
Rocky habitats (crest protection and the rip rap) provide diversity and complexity that support a variety of fishes, invertebrates and migratory birds. Smaller fishes favoured by herons, terns, gulls, diving ducks and piscivorous birds use the crest protection for foraging and refuge. Pelagic and double-crested cormorants use underwater rocky habitats for foraging along shallower waters.

The Proponent noted that all bird groups, as described above, were observed in intertidal mudflat habitat. In particular, intertidal mudflats are an important habitat used by shorebirds during migration. Herons and gulls utilize this habitat to forage along tide pools during low tides and amongst the exposed eelgrass for polychaetes, ghost shrimp, isopods, amphipods, clams, cockles and shrimp. Shallow water and the abundance of spatial and temporal refuges also make intertidal mudflats a good nursery habitat for juvenile flounders, pricklebacks, surf smelt, salmonids, sculpins and crabs. These species are used as prey by diving ducks and piscivorous birds. While primary food production of this habitat may be low, epibenthic, epiphytic, epifaunal, diatom and benthic production used primarily by shorebirds and dabbling ducks is high. The shoreline of this habitat is important for the growth of plants such as *Salicornia virginica, Distichlis spicata, Z. japonica* and *Z. marina* which are utilized by dabbling ducks, geese and swans.

6.2.3 Proponent's Assessment of Impacts

Approximately 22 ha of existing intertidal and shallow subtidal habitat for coastal seabirds and waterfowl would be directly affected by the Project. The following are the bird species and habitats, assessed as VECs, that could be potentially affected by the proposed DP3 Project.

Great blue heron:
Potential impacts to great blue heron are associated with the displacement of resting/roosting and foraging habitat. During high tide from March-October, 13 herons were recorded in an area of approximately 18 ha of the DP3 Project footprint, primarily resting and hunting. During low tide 23 herons were observed using roughly 5 ha of habitat within the proposed Project area, primarily foraging over dendritic channels, at distances greater than 300 metres from shore. From November-February, the season with the lowest number of herons (only 43) recorded in the Study Area, the total habitat used by most individuals during high tide within the proposed DP3 Project footprint was estimated to be about 10 ha. The shoreline was used primarily for resting while the dendritic channels were used by this bird for hunting during times of shallow water. Within the Project footprint the heron likely uses the eelgrass, salt marsh, intertidal mudflat and shallow subtidal areas for hunting while it likely uses the salt marsh, foreshore, and intertidal/subtidal rocky habitat for resting. Project footprint impacts on great blue heron are considered minimal as there remains large areas of these habitats, and the proposed Habitat Compensation Plan will result in additional resting/roosting and foraging habitat for this species.

Caspian tern:
Potential impacts to Caspian tern are associated with the displacement of resting/roosting and foraging habitat. Results of the survey indicate that the Caspian tern uses the DP3 Project footprint area primarily for resting and flyby foraging (hunting), along with the entire shoreline of the Study Area. Caspian tern is primarily present in the Lower Mainland during the months of approximately May-September, migrating south for the winter. During high tide from May-September, the 8 terns were estimated to be using about 19 ha of the DP3 Project footprint for resting and roosting. Individual terns were observed resting in the intertidal area approximately 100 metres from shore. During low tide, approximately 10 ha of habitat within the proposed footprint was observed being used by 6 terns resting over the intertidal mudflat within the proposed Project area. The intertidal rocky shoreline and eelgrass areas within the DP3 Project footprint were also identified as potential hunting habitat. The Proponent considered the impacts of the loss of these habitats as a result of the DP3 Project footprint as minimal, based on the availability of much similar habitat in the Study Area. Impacted habitats would be replaced with a new rip rap embankment around the footprint, which would be colonized with similar invertebrates, which in turn would attract small fish that are prey for the Caspian tern. The Proponent also considers that the proposed habitat compensation features described in Chapter 5 – *Marine Environment* would provide additional resting/roosting and low tide foraging habitat for this species.

Pelagic cormorant:
Potential impacts to the pelagic cormorant are associated with the displacement of resting/roosting and foraging habitat. During high tide from October-May, 15 pelagic cormorants

were recorded using approximately 2 ha of shallow subtidal habitat within the DP3 Project footprint with most individuals associated with the ship channel and turning basin swimming and diving less than 400 metres from shore when the water was relatively calm. During low tide, in the same 2.0 ha of shallow subtidal habitat within the proposed DP3 footprint, no cormorants were observed less than 300 metres from shore foraging/diving. During high tide from June-September, 6 cormorants were recorded using less than 0.5 ha of the DP3 footprint; mostly along the ship channel, swimming and diving, greater than 500 m from shore over the outflow of dendritic channels. The Proponent concluded that the proposed DP3 footprint impacts to the pelagic cormorant are expected to be minimal because for both high and low tides, actual use of habitat immediately surrounding the proposed footprint, compared to the entire Study Area use is very small and the immediate surrounding environment provides habitat for this bird. The pelagic cormorant colony identified during the field study is located outside the DP3 Project footprint area, over two kilometres to the south, and is not impacted by the Project. The Proponent also considers that the proposed habitat compensation features described in Chapter 5 – *Marine Environment* would provide additional resting and foraging habitat for this species.

Eelgrass:
Approximately 5 ha of eelgrass habitat would be lost as a result of the proposed DP3 Project. The eelgrass beds have been identified as very important areas for bird food production and foraging habitat principally affecting piscivorous birds, great blue heron, and dabbling and diving ducks. Brant geese also use the eelgrass beds as foraging areas but based on observations during the survey, this species primarily uses the eelgrass beds located in the inter-causeway area. These eelgrass beds are 1000 metres from the DP3 Project in areas adjacent to sand features and the dendritic channels. Over-wintering populations of geese and swans also utilize eelgrass habitat. The Proponent considered the large area of remaining eelgrass beds and proposed habitat compensation to re-establish eelgrass areas, as described in Chapter 5 – *Marine Environment* to be such that habitat impacts would be temporary in nature and extent.

Salt Marsh:
A narrow band of salt marsh (approximately 300 m^2) along the existing shoreline would be lost as a result of the DP3 Project. The loss of this habitat would impact forage and shelter areas for waterfowl and coastal seabirds. Dabbling ducks in particular may be impacted, as these species rely upon salt marsh habitat for feeding, resting/roosting and nesting. The Proponent considered the large area of the remaining salt marsh within the Study Area, and proposed habitat compensation area to create new salt marsh habitat, as described in Chapter 5 – *Marine Environment*, and assessed the loss of salt marsh from the DP3 Project as a minimal impact.

Intertidal Mudflat:
Approximately 12.7 ha of intertidal mudflat would be lost as a result of the DP3 Project. All foraging birds, particularly shorebirds on migration, herons and gulls, diving ducks, piscivorous birds (which feed on juvenile fish in these areas), dabbling ducks, and geese and swans, would likely be affected. The Proponent considered the displacement of these foraging birds to adjacent intertidal mudflat and the habitat compensation proposal to create new intertidal mudflat, described in Chapter 5 – *Marine Environment*, and assessed the loss attributable to the DP3 Project as a minimal impact on the birds.

Biofilm:
A thin layer, referred to as biofilm, covers the surface of the intertidal unvegetated mudflat on Roberts Bank. Biofilm is more widely distributed north of the Roberts Bank port causeway but is found within the inter-causeway area but not within the DP3 Project footprint. There will be no impact on biofilm.

Subtidal Mudflats:
Approximately 3.4 ha of subtidal mudflats would be lost as a result of the DP3 Project. The loss of this habitat would have a short-term impact on all birds that use this habitat (diving ducks and piscivorous birds). Prey items consumed by birds such as sculpins and flatfishes are mobile and

would move out of the area prior to construction. They would likely relocate in the tug basin, which would be deepened. The sediment grain size in the basin is predicted to remain the same and provide rearing conditions similar to that currently present, therefore maintaining food abundance and availability for birds that make use of this habitat type.

Intertidal/Subtidal Rocky Habitats:
The existing intertidal and subtidal rocky foreshore protection would be displaced during Project construction. This habitat would be compensated for by the new rip rap shoreline around the DP3 footprint. The new Project footprint would result in a net gain of intertidal and subtidal rocky habitats. This rip rap shoreline would likely be colonized by similar invertebrates, and be used by small fishes, that are prey for waterfowl and coastal seabird species.

General Footprint Impacts:
Footprint impacts would result in the loss of either resting/roosting or foraging area for all birds, however, the impacts are predicted to be minimal and temporary in nature. Of the four bird species nesting in the study area, only one osprey nest currently on pilings in the south embayment area would be impacted. This nest would be relocated to a safer location during a period when the nest is not in use.

Construction Impacts:
The proposed DP3 Project construction schedule has been amended (section 2.4.3 of Part A of this report). VPA foresees the marine construction components of the Project divided into four phases: (i) dredging of the berth; (ii) construction of dykes; (iii) dredging for the caissons associated with the third berth; and (iv) placement of clean sand and gravel under the berth and caisson. The effects of these construction activities on the selected VECs are as follows:

Great blue heron:
The Proponent anticipates that impacts of construction on the great blue heron would be in relation to an alteration of resting/roosting and foraging habitat associated with intertidal mudflat, shallow subtidal areas, and eelgrass within the DP3 Project footprint. Resting/roosting and foraging habitat along the embayment area would be impacted by construction of the dykes for terminal fill dredging control and dredging for the terminal. Survey results suggest that there are many other locations in the study area that the great blue heron uses for resting/roosting and foraging that are of better quality. Moreover, VPA reported that the great blue heron may use the dykes for resting/roosting once acclimated.

Caspian tern:
According to VPA, construction impacts on the Caspian tern are expected to be associated with an alteration of resting/roosting and foraging habitat associated with the Project footprint. The Caspian tern is not present in the study area from late October to early April, and would not be impacted during construction of dykes for terminal fill dredging control.

Turbidity resulting from dredging activities may affect Caspian tern foraging capability throughout shoreline areas and eelgrass beds by reducing prey visibility, however, the Proponent has assessed that such effects would be temporary in nature.

Temporary Bird Displacements:
During construction, birds may be disturbed due to the presence of, and noise generated from, dredging equipment until they become acclimated. Dredging operations would displace birds that currently utilize the dredging area for resting, roosting and foraging. Impacts, however, would be temporary. The dredging areas represent a small area of the available resting/roosting and foraging habitat present within the study area.

There would be no direct impact to brant geese foraging areas (eelgrass beds) from the proposed development, however, temporary displacement of brant geese from the Project footprint and dendritic channels may occur from December-March when this goose is most numerous in the

study area. The Proponent anticipates that this temporary disturbance would have minimal impact on brant geese.

Birds may be disturbed during transportation of sediments to the ocean disposal site; however, since birds are already acclimated to the movement of ships in the area, movement of the dredge vessel is not, according to VPA, expected to alter the general activity of birds.

Operational Impacts:
According to the Proponent impacts from terminal operations on all bird species present within the Project area are expected to be minimal. There is a very low likelihood that the expanded DP3 and associated terminal operations would disrupt the use of habitats for resting/roosting or foraging by birds. The effects of the operations of the proposed DP3 Project are expected by VPA to be continuous once construction is completed, that is, they would be equivalent to the existing environment.

Overhead Power Lines:
The DP3 Project does not require any new transmission power lines, nor does it require any modification to the existing power lines on the causeway or on the terminal that would result in any potential environmental effects due to the Project. The Proponent, however, agreed to undertake further studies of the overhead power lines based on a previously initiated bird mortality study program, and as reflected in the Project's ATOR. The results of this study are discussed in Chapter 16 – *Cumulative Effects Assessment*.

6.3 ANALYSIS

The RAs considered the information provided by the Proponent, including the Proponent's conclusions on potential effects and the method used to reach those conclusions as outlined above in sections 1 and 2 of this chapter. The RAs then conducted their own analysis of the potential effects and proposed mitigation measures before independently reaching conclusions on the residual effects.

6.3.1 Potential Effects
During the cooperative environmental assessment process the public, working group members and agencies identified the following potential environmental effects concerning the Project with respect to coastal seabirds and waterfowl:

- the permanent loss of approximately 22 hectares of marine habitats that provide roosting, resting and foraging habitat including: approximately 5 hectares of eelgrass habitat; 300 m^2 of salt marsh habitat; 12.7 hectares of intertidal mudflat and 3.4 hectares of subtidal mudflat;
- the potential effects of tug basin dredging on eelgrass habitat and the potential for erosion of intertidal mudflat habitat;
- potential effects of additional lighting during Project construction and operation;
- potential effects of additional noise and related disturbance activities during Project construction and operation;
- potential effects of the release of contaminants and deleterious materials during Project construction and operation;
- potential for marine eutrophication to effect inter-causeway migratory bird habitats; and
- potential for an increase in dendritic channelization.

6.3.2 Issues
The public, public interest groups, and municipal, provincial, and federal governments raised the following issues concerning the potential effects to coastal seabird and waterfowl populations resulting from the Proponent's assessment of the proposed DP3 Project in the Application:

- Concerns that the field assessment was of too short a duration to adequately assess the effects of a proposed project of such magnitude to wintering bird populations and changes in habitat use by spring and fall migrants. Concerns were also raised about the large heron colony located outside of the study area. These issues are addressed in the AMS and HCP which are briefly referenced below (see *Appendix B* and *Appendix C* for more details).
- Concerns that the effects of bright overhead illumination on migratory bird species were not adequately assessed by the Proponent. The Proponent has committed to measures to shield terminal lighting during construction and operation.
- Concerns were raised that the DP3 Project could act cumulatively with existing and likely future projects resulting in potential eutrophication of bird habitats within the inter-causeway area. Concerns were based on DP3's potential effects on geomorphology, water quality, sediment quality and eelgrass. The Proponent addressed this issue through the development of the DP3 AMS. Elements of the AMS specific to coastal seabirds and waterfowl are discussed in section 6.3.3.
- Concerns were raised that proposed habitat compensation, as reflected in the Habitat Compensation Plan originally outlined in the Application, was not acceptable in addressing effects on habitat to migratory bird populations. This was addressed by the Proponent in the revised Habitat Compensation Plan, described in Chapter 5 – *Marine Environment*. Elements of the Habitat Compensation Plan applicable to coastal seabirds and waterfowl are described below.

6.3.3 Mitigation

The following mitigation measures were either incorporated into the design of the Project, included in the Application, or in the case of the AMS and HCP, have been developed during review of the Application.

Design

To address potential effects to coastal seabird populations and habitat, VPA revised the preliminary terminal design before submitting the Application by:

- Decreasing the Project footprint approximately 30%, from 32 ha to 22 ha to reduce effects at the site;
- During the EA review, VPA also re-designed the tug basin area to reduce the footprint from 2.6 to 1.19 ha as discussed in Chapter 2 – *Coastal Geomorphology* and Chapter 5 – *Marine Environment*;
- Redirecting of stormwater outlets away from the intertidal embayment to discharge into deeper water; and
- Modification of the dredge program to source terminal fill from the Fraser River, eliminating the need for additional dredging in the turning basin and substantially reducing the overall marine dredging program. Changes to the dredge program are also discussed in Chapter 4 – *Sediment Quality, Dredging and Ocean Disposal*.

Construction

A summary of the mitigation measures identified by the Proponent to minimize effects to coastal seabirds and waterfowl and safeguard the environment so that the desired environmental outcomes are achieved for the various components of Project construction is presented below. Specific details describing all Project mitigation measures are outlined in *Appendix A – Owner's Table of Commitments and Assurances*. Generally they include:

- Dredging activities will take place during appropriate windows to minimize effect on fish and invertebrates, which are food for waterfowl and coastal seabirds that use the study area;

- Minimizing light and noise effects and related disturbance effects to birds including modifications to the marine dredge lighting systems and setting maximum allowable noise emissions from each type of machinery prior to construction;
- Preparation of a construction EMP to reduce the incidence of liquid contaminant, oil and material spills and ensure timely and effective spill response;
- Relocation of the osprey nest currently situated on pilings south of the Roberts Bank causeway to a safer location; and
- Monitoring of migratory birds as outlined in the AMS.

Operation
The Proponent proposed mitigation measures to minimize effects to coastal seabirds and waterfowl and safeguard the environment during Project operation as presented below, and given in more detail in *Appendix A – Owner's Table of Commitments and Assurances*. Further, measures to control or address stormwater discharges, and manage ballast water, hazardous materials and associated spill response to reduce effects on coastal seabirds and waterfowl are described primarily in Chapter 14 – *Accidents and Malfunctions*.

- Minimize light and noise effects to birds during operation including using down light luminaries and shielding where appropriate to reduce trespass light in the environment; and
- VPA will consult with the appropriate regulatory agencies and non-government organizations to work to establish pelagic cormorant resting/roosting structures away from port industrial structures.

Adaptive Management Strategy
During the Application review, an Adaptive Management Strategy was proposed as a component for the monitoring and mitigation for the potential effects of the Project. The objective of the DP3 AMS is to undertake a science-based systematic approach to monitoring and managing the Roberts Bank inter-causeway ecosystem. The goal of the AMS is to reduce uncertainty and assess the potential for future marine eutrophic events and dendritic channelization leading to erosion that could result in negative trends in the ecosystem that would have an effect on migratory birds and bird habitat. Further the AMS details the commitments that VPA would undertake to evaluate, prevent or mitigate those negative trends attributable to the DP3 Project. The AMS would be instituted prior to, and continue during, at a minimum, the first five years of operation of the Project.

There are five key areas identified for evaluation in the AMS (see *Appendix B*), and all are relevant to waterfowl and coastal seabirds and their habitat as follows:

1. geomorphology / oceanography;
2. surface water quality;
3. sediment quality;
4. eelgrass; and
5. other biota including monitoring of bird populations and biofilm.

The AMS will focus on the inter-causeway area, but stations located beyond this will be monitored for comparative purposes. Monitoring for a minimum of five years under the AMS will begin prior to construction, and will continue after the Project is operational. Monitoring results will be evaluated and compared against the action thresholds, and a third party external review process will provide comments and recommendations for potential management changes, and adjustments to ongoing monitoring.

The applicable programs in the AMS to monitor coastal seabirds and waterfowl are as follows:

Parameters	Monitoring Frequency	Purpose
Heron density	Annual (June – Aug)	Bird Populations
Brant density	Annual (Feb – Mar)	Bird Populations
Coastal Seabird Survey	Twice/month during DP3 Construction	Bird Populations

Compensation
As discussed in Chapter 5 – *Marine Environment*, a conceptual fish habitat and migratory bird compensation plan was developed, as required for the EA and as part of the joint harmonized federal/provincial Project review. The Proponent accepts that the DP3 Project displaces approximately 22 hectares of existing intertidal and shallow subtidal marine habitat (section 5.3.1 Potential Effects). To compensate for these effects a comprehensive and diverse fish and migratory bird Habitat Compensation Plan has been proposed. With respect to migratory birds, the plan includes five key (5) components:

- East causeway salt marsh, mudflat and barrier island;
- Log debris removal and salt marsh tidal channel;
- Subtidal reef adjacent to the southwest shore of the coal port;
- Sandbar stabilization by dendritic channel modifications; and
- Offsite compensation based on a partnership between VPA, Pacific Salmon Foundation, Ducks Unlimited Canada, DFO and EC to secure and develop a minimum of 7.5 hectares of intertidal fish and migratory bird habitat in the Fraser River estuary.

6.3.4 Residual Effects

Based on the implementation of the proposed mitigation, including the HCP and AMS, the RAs have determined that construction effects of the Project on waterfowl and coastal seabirds would be minimal, and only last until construction is completed. When in operation, the impacts from noise, light and other disturbances are predicted to be low. Because there has been a residual effect identified for this component, it has been included in the cumulative effects assessment (see Chapter 16).

6.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS

During this cooperative environmental assessment the EAO, the RAs and the working groups have considered: the Application; comments from government agencies, First Nations and the public on the potential effects of the Project; responses by the Proponent; and the discussions of the working groups.

Based on the information summarized in this CSR and provided that the Proponent implements the actions described in the *Owner's Commitments and Assurances* as listed in *Appendix A* of this report, the RAs are satisfied that the DP3 Project will not likely result in any significant adverse effects on waterfowl and coastal seabirds in the vicinity of Roberts Bank.

7. Terrestrial Wildlife and Vegetation

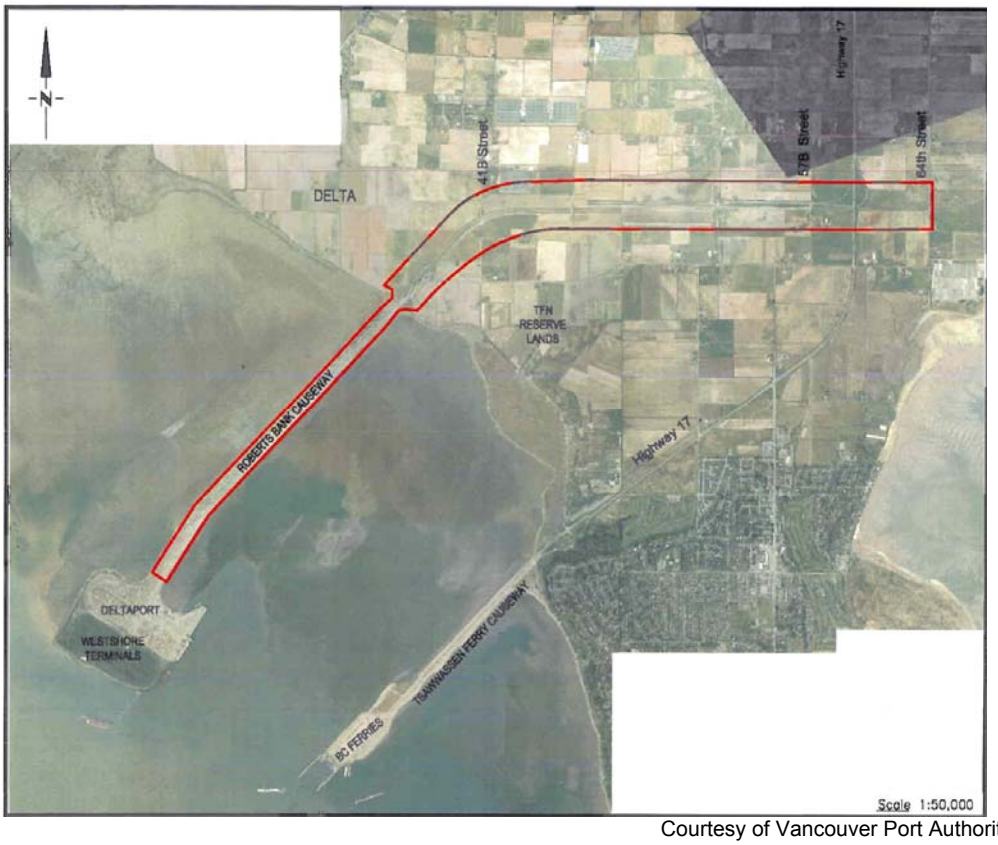
7.1 GENERAL

The purpose of the terrestrial wildlife and vegetation assessment of the study area was to examine the presence/likelihood of occurrence of provincially and/or federally listed species at risk (see Chapter 6), and to assess the impacts of the proposed Project on the terrestrial ecology of the study area. Mitigation measures are also identified to offset potential impacts on the terrestrial ecology of the study area.

7.2 BACKGROUND

7.2.1 Study Area

The terrestrial ecology study area comprises the corridor extending along the length of the Deltaport causeway and east on either side of the BC Rail line as far as 64th Street (see Figure 13). The study area on the causeway was defined as within the dry width at high water. The study area along the BC Rail line was defined as 250 m on either side of the rail line, except for raptors for which it was extended a further 250 m on either side. The study area was generally limited to those areas that would be impacted as a result of the proposed Project development.



Courtesy of Vancouver Port Authority

Figure 13 Terrestrial wildlife and vegetation study area

7.2.2 Existing Environment

Vegetation

Natural vegetation in the study area has been extensively modified over the past 100 years through dyke installation, farming and infrastructure development. There is little remaining naturally-occurring vegetation, and the area is characterized by non-indigenous species.

Six habitats were identified during field surveys in the study area. These include: hedgerow; cultivated fields; ditches; rural infrastructure; road/rail right-of-way; and estuary. Vegetation species diversity in the study area is low due to the disturbed nature of the area. A total of 139 species, 86 of which are non-indigenous, was documented. Nine were trees, 9 shrubs, 84 forbs (mat species), 19 grasses, 2 sedges, 1 rush and 15 were mosses.

Based on a review of the lists developed by COSEWIC under SARA (Schedules 1, 2 and 3) and the CDC (red and blue lists), 14 at-risk species have been identified as potentially occurring within the study area (see Table 12). Although suitable habitat for the 14 at-risk species is present on the backshore area of the Roberts Bank causeway, there has been limited time for these species to colonize this habitat. Additionally, the provincial CDC has not reported these species in the study area, nor were they recorded during field surveys undertaken for the DP3 Project. It was concluded that the likelihood for the 14 at-risk vegetation species to be present within the Project study area was low to none, and they were therefore not considered further in the impact analysis presented below.

Table 12 Vegetation species at risk potentially occurring in the study area

Species	Conservation Status		Habitat Requirements	Species recorded during survey period
	Provincial Status	Federal Status		
Caltha palustris var. *palustris* yellow marsh-marigold	Blue	-	Wet sites	×
Camissonia contorta contorted-pod evening-primrose	Red	-	Sandy backshore	×
Claytonia rubra ssp. *Depressa* redstem springbeauty	Red	-	Sandy backshore	×
Elatine rubella three-flowered waterwort	Blue	-	Ditches, mudflats, shorelines	×
Eleocharis parvula small spike-rush	Blue	-	Coastal salt marshes, mudflats	×
Epilobium ciliatum ssp. *watsonii* purple-leaved willowherb	Blue	-	Disturbed areas, roadsides, fields	×
Juncus oxymeris pointed rush	Blue	-	Wet meadows	×
Leersia oryzoides rice cutgrass	Blue	-	Wet ditches	×
Lilaea scilloides flowering quillwort	Blue	-	Mud flats	×
Lupinus rivularis streambank lupine	Red	-	Wet to moist meadows	×
Myriophyllum ussuriense Ussurian water-milfoil	Blue	-	River channels, lakes, lake margin	×
Polygonum punctatum dotted smartweed	Blue	-	Wet meadows	×
Salix sessilifolia soft-leaved willow	Blue	-	Sandbars (freshwater)	×
Sidalcea hendersonii Henderson's checker-mallow	Blue	-	Tidal marsh	×

Red - Species, populations or communities at high risk of extinction or extirpation.
Blue - Species vulnerable to human activity or natural events.
× - Species not recorded

Wildlife
The following wildlife were concluded to occur in the study area: insects; aquatic insects; amphibians; reptiles; birds; and mammals. Although waterfowl and coastal seabirds may have the potential to be in the study area for this chapter, they are covered in detail in Chapter 6 – *Waterfowl and Coastal Seabirds* and will therefore not be further discussed in this chapter.

Based on a review of the lists produced by COSEWIC, SARA (Schedules 1, 2 and 3) and the CDC (red and blue lists), 27 fauna species federally and/or provincially at risk have been identified as potentially occurring within the study area (see Table 13). Of the 27 at-risk fauna species, 8 (6 birds and 2 small mammals) have a moderate to high likelihood of occurrence in the study area and therefore may be impacted by the proposed Project. If a species had a low likelihood of occurrence and was not recorded during the field surveys, it was assumed that this species would not be present in the study area and was therefore not considered further in the impact analysis presented below. The exception to this is the Pacific water shrew. The Pacific water shrew is identified as having a low likelihood of occurrence in the study area. Moreover, trapping for this species failed to find evidence of it in the study area. Nevertheless, for the purpose of this impact assessment, the potential for Pacific water shrew to occur in the study area was assumed due to the importance of this species and the presence of water in the ditches (important habitat characteristic).

7.2.3 Proponent's Assessment of Impacts
The following species/groups of species were identified as VECs for the study area identified in this chapter and used by the Proponent in the impact assessment:

- vegetation;
- waterfowl and shorebirds;
- raptors; and
- passerines and woodpeckers.

Additionally, the following bird and mammal species at risk were included in the impact analysis based on their life history traits:

- great blue heron;
- short-eared owl;
- barn owl;
- peregrine falcon;
- gyrfalcon;
- double-crested cormorant;
- Pacific water shrew;
- Townsend's big-eared bat; and
- Trowbridge's shrew.

Also considered in the impact analysis below were amphibian, reptile and invertebrate species at risk.

Table 13 Wildlife species at risk potentially occurring in the study area or the vicinity

Species	Conservation Status		Likelihood of Occurrence in Study Area and Comments	Species recorded during surveys
	Provincial	Federal		
Insects				
Omus audouini (Audouin's tiger beetle)	Red	-	**Low**. Suitable habitat not present in study area.	×
Epitheca canis (beaverpond baskettail)	Blue	-	**Low**. Ibid.	×
Pachydiplax longipennis (blue dasher)	Blue	-	**Low**. Ibid	×
Erithemis collocate (western pondhawk)	Blue	-	**Low**[1].	×
Sympetrum vicinum (yellow-legged meadowhawk)	Blue	-	**Low**. Suitable habitat not present in study area.	×
Euphyes vestries (dun skipper)	Blue	Threatened	**Low**. Considered extirpated. Host plant absent.	×
Danaus plexippus (monarch)	Blue	Special Concern	**Low**. Not resident. Host plant absent.	×
Amphibians				
Rana aurora (red-legged frog)	Blue	Special Concern	**Low**. Suitable habitat absent. Species not recorded during survey.	×
Rana pretiosa (Oregon spotted frog)	Red	Endangered	**Low**. Ibid	×
Reptiles				
Chrysemys picta (painted turtle)	Blue	-	**Low**. Suitable habitat not present in study area.	×
Clemmys marmorata (west pond turtle)	Red	-	**Low**. Ibid.	×
Pituophis catenifer (gopher snake)	Red	-	**Low**. Ibid	×
Birds				
Ardea herodias fannini (great blue heron *fannini* subspecies)	Blue	Special Concern	**High**[1]	√
Asio flammeus (short-eared owl)	Blue	Special Concern	**High**[2]	√
Butorides virescens (green heron)	Blue	-	**Low**[3]	×
Eremophila alpestris strigata (horned lark *strigata* subspecies)	Red	pending Schedule 1.	**Low**[4]	×
Falco peregrinus anatum (peregrine falcon *anatum* subspecies)	Red	Threatened	**High**[5]	√
Falco rusticolus (gyrfalcon)	Blue	-	**Low to Moderate**[6]	×
Phalacrocorax auritus (double-crested cormorant)	Red	Not at Risk	**High**. Observed overflying the causeway. One found dead bird also recorded on causeway.	√
Tyto alba (barn owl)	Blue	Special Concern	**High**. Roost in barn near Deltaport Way and 41B Street. Two dead birds found.	√
Mammals				
Corynorhinus townsendii (Townsend's big-eared bat)	Blue	-	**Moderate**. Species may roost on the west side of 41B Street just south of Deltaport Way.	×
Myotis keenii (Keen's long-eared myotis)	Red	Data deficient	**Low**. Suitable habitat not present in study area.	×
Sorex bendirii (Pacific water shrew)	Red	Threatened	**Low**. Suitable habitat absent. None recorded.	×
Sorex trowbridgii (Trowbridge's shrew)	Blue	-	**Low to Moderate**. Species may occur in ditch by the dyke east of the Roberts Bank causeway.	×
Lepus americanus washingtoni (snowshoe hare)	Red	-	**Low**. Suitable habitat not present in study area.	×
Clethrionomys gapperi occidentalis (southern red-backed vole)	Red	-	**Low**. Suitable habitat not present in study area.	×
Mustela frenata (long-tailed weasel)	Red	-	**Low**. Suitable habitat not present in study area.	×

Endangered - A species facing imminent extirpation or extinction.
Threatened - A species likely to become endangered if limiting factors are not reversed.
Special Concern - A species with characteristics that make it particularly sensitive to human activities or natural events.
Not at Risk - A species that has been evaluated and found to be not at risk.
Data Deficient - A species for which there is insufficient scientific information to support status designation.
Red - Species, populations or communities at high risk of extinction or extirpation.
Blue - Species vulnerable to human activity or natural events.
× - Species not recorded)
√ - Species recorded
[1]Occurs regularly in farmland and canals, especially at low tide. One dead on causeway
[2]Occurs regularly in foreshore and nearby fields of Delta. One was recorded during surveys
[3]Suitable habitat not present in study area. Species not recorded during survey.
[4]High suitability habitat not present in study area, but species occasionally recorded.
[5]One to three birds occur regularly along the north side of Deltaport Way.
[6]High suitability habitat absent, but the most-likely area of the Lower Mainland.

Construction

The Project assessment considered potential effects to terrestrial wildlife and vegetation identified as VECs, and to vegetation and wildlife more generally, during the construction period:

- A small level of impact to nesting habitat of killdeer and dabbling ducks may occur as a result of the proposed rail construction on Deltaport Way.
- Some temporary sensory disturbance to waterfowl and shorebirds may occur during the construction period. Note that impacts to waterfowl and shorebirds are further discussed in Chapter 6 – *Waterfowl and Coastal Seabirds*.
- Ground-nesting raptors such as the northern harrier could nest within the existing BC Rail right-of-way where track expansion would occur and may therefore be impacted.
- Increased traffic during construction may result in a low magnitude of indirect impact to barn owl through vehicle collisions.
- Some temporary sensory disturbance to the Townsend's big-eared bat during the construction phase of the Project is likely; however, this species is likely acclimated to existing noise associated with the Deltaport Way and the BC Rail line and, as such, may exhibit less response to sensory disturbance resulting from construction of the proposed Project.
- Siltation and polluted runoff from construction activities have the potential to impact drainage ditches between 57B Street and 64th Street, thereby indirectly having the potential to impact amphibians, reptiles and aquatic invertebrates.
- Habitat loss of approximately 1.9 ha of vegetation between 57B Street and 64th Street during the construction of the expanded rail bed and gravel access road.
- Habitat disturbance: where a plant community is not directly subject to habitat loss, it may still be subject to Project disturbance from the movement of people and machinery through and along the edge of the plant community.
- Introduction of non-indigenous species: newly disturbed ground along the existing corridor can facilitate the establishment of non-indigenous plant species into the ecosystem along the corridor's length. Within the study area, the introduction of a new non-indigenous species has the potential to affect existing grassland plant communities.
- The potential for sensory disturbance to wildlife during the construction period or the Project operation: within the study area, many wildlife species have become acclimated to certain re-occurring sensory disturbances associated with both Deltaport Way and the BC right-of-way. These species may exhibit less of a response to new sensory disturbance resulting from the construction and operation of the proposed Deltaport Third Berth Project.
- Habitat loss or alteration resulting from the construction of the expanded rail bed and gravel access road within the existing right-of-way.
- Wildlife mortality resulting from site preparation resulting in mortality for small mammals that inhabit grass areas, and upper soil layers, or if done during the breeding season this may result in bird mortality, particularly to nestlings.

- Changes in wildlife movement due to the construction of the expanded rail bed and gravel access road within the BC Rail right-of-way between 57B Street and 64th Street.
- Accidents and unplanned events such as spills and leaks of hazardous materials have the potential to affect wildlife and wildlife habitat.

Operation
Operational impacts to terrestrial wildlife and vegetation in the study area relate to the potential for an increase in barn owl collisions with vehicles.

7.3 ANALYSIS

The RAs considered the information provided by the Proponent, including the Proponent's conclusions on potential effects and the method used to reach those conclusions as outlined above in sections 1 and 2 of this chapter. The RAs then conducted their own analysis of the potential effects and proposed mitigation measures before independently reaching conclusions on the residual effects.

During the environmental assessment, the potential for effects on the terrestrial ecology of the study area was examined. Mitigation measures are identified to offset potential effects on terrestrial species.

7.3.1 Potential Effects

Construction

- A small level of effect to nesting habitat of killdeer and dabbling ducks may occur as a result of the proposed rail construction on Deltaport Way;
- Some temporary sensory disturbance to waterfowl and shorebirds;
- Potential disturbance of ground-nesting raptors such as the northern harrier;
- Increased traffic during construction may result in a low magnitude of indirect effect to barn owl through vehicle collisions;
- Some temporary sensory disturbance to the Townsend's big-eared bat during the construction phase of the Project is likely;
- Potential siltation and polluted runoff from construction activities into the drainage ditches indirectly having the potential to effect amphibians, reptiles and aquatic invertebrates;
- Habitat loss and habitat disturbance during the construction of the expanded rail bed and gravel access road;
- Potential introduction of non-indigenous species;
- The potential for sensory disturbance to wildlife during the construction period of the Project: within the study area;
- Potential wildlife mortality during site preparation regarding small mammals that inhabit grass areas, and upper soil layers, or if done during the breeding season this may result in bird mortality, particularly to nestlings;
- Changes in wildlife movement due to the construction; and
- Potential accidents and unplanned events such as spills and leaks of hazardous materials.

Operation

- Potential for an increase in barn owl collisions with vehicles along Deltaport Way.

7.3.2 Issues

General
The public, public interest groups, and municipal, provincial, and federal governments raised the following issues concerning the potential effects on terrestrial wildlife and vegetation resulting from the Proponent's assessment of the proposed DP3 Project.

- the extent of species selected for discussion of effects is too limited;
- the robustness of field surveys is too limited;
- the potential effects to the Pacific water shrew are understated; and
- the scope of the study area (with respect to invasive species) is too small.

Each of the above issues and its resolution is addressed below.

(1) Issues surrounding the limited extent of the species that were investigated (those that were recorded by the Proponent, when other species may occur in the study area) do not reflect the Proponent's approach. The VECs that were studied were selected in consultation with the EAO's Biophysical Technical Working Group. In addition, species not observed during surveys, but known to occur nearby (gyrfalcon, horned lark, green heron) were also considered in the effect assessment.

(2) The terrestrial wildlife and vegetation surveys followed the work plan (which was reviewed by the EAO working group), and surveys were timed based on key seasons for specific species. Year-long monitoring, as proposed in the review comments regarding the lack of adequate surveying effort (specifically bird, plants, and aquatic insects during July and August 2004), was not within the study scope.

(3) No suitable habitat for Pacific water shrew was found in the study area, and both the habitat assessment and subsequent surveys failed to confirm the presence of this species. Regardless, the potential occurrence of Pacific water shrew in this area is assumed.

(4) The introduction of invasive species transported via containers, trucks, and trains has been raised as a potential issue, and to address this issue, reviewers have suggested extending the consideration of effects to vegetation and wildlife beyond the immediate Project area. However, the scope of the study area was reviewed through the EAO working group, and agreed upon in the ATOR. Therefore it was deemed unnecessary to extend the scope of the study area.

Construction
Review comments based on the Application, and relating to the acclimation of wildlife species to sensory disturbances on Deltaport Way and the BC Rail right-of-way, and a lack of mitigation measures to address wildlife mortality were received. The Proponent suggested that many wildlife species in the study area are acclimated to the re-occurring sensory disturbances associated with transportation (road and rail) uses adjacent to the upland areas proposed to be used for DP3 developments. The continued presence of wildlife species such as raptors and mammals, within and adjacent to the study area during periods of both high and low traffic is evidence of this acclimation.

Operation
The projected increase in vehicular traffic associated with DP3 has raised concerns regarding potential increases in barn owl mortality due to road kills. Increased operational activities have also elicited concern regarding the risk and effects associated with the introduction of new mammal species as a result of increased rails/trucks/containers.

VPA identified the potential interaction of barn owls and road traffic as a result of a literature review and observations in the field. Barn owl hunting behaviour puts this species more at risk when its nesting habitat is close to major roadways. The VPA has proposed mitigation to minimize the likelihood of barn owl collision with vehicles which includes: (i) support of environmental stewardship programs to place barn owl nest boxes in areas toward Brunswick Point where they are less vulnerable to major motorways; and (ii) a commitment to becoming involved in barn owl management planning, either through a Barn Owl Management Team, or its ad hoc equivalent.

7.3.3 Mitigation

Design

The Proponent has restricted the proposed activities to already developed (and disturbed) areas. These areas generally have low vegetation and wildlife values because they have been used as rail and road transportation corridors for many years, and preceding that they were developed for agricultural use.

Construction

The following construction mitigation measures are proposed:

- A Wildlife and Vegetation Environmental Management Plan would be prepared prior to any construction activities and complied with throughout the construction of the Project and will include:
    - Vegetation clearing would be undertaken outside of the general bird breeding season (March 15 to July 31);
    - Areas to be cleared of vegetation would be minimized;
    - Areas disturbed by construction activities would be re-vegetated with native species;
    - Potential damage to ditch habitats would be reduced by the placement of silt fences and curtains and other sediment control techniques;
    - Interactions between employees/contractors and wildlife would be managed;
    - Duration of construction would be minimized; and
    - A spill contingency response plan would be developed and implemented.

Operation

Mitigation measures that are proposed to be implemented by VPA during operation of the DP3 Project pertain to barn owl collision with vehicles.

The proposed mitigation measures to minimize the likelihood of barn owl collision with vehicles include the following:

- support of environmental stewardship programs to place barn owl nest boxes in areas towards Brunswick Point where they are less vulnerable to major motorways; and
- VPA's commitment to become involved in barn owl management planning, either through a Barn Owl Management Team, or its ad hoc equivalent.

The Proponent will also work with the appropriate federal and provincial agencies to assist in the control of invasive species transported via containers, trucks, and trains.

The mitigation undertakings for the construction and operation of the Project are reflected in the *Owner's Commitments and Assurances*, enclosed as *Appendix A* to this report.

7.3.4 Residual Effects

Based on the implementation of the proposed mitigation the RAs have determined that there will be no residual effects of the Project on terrestrial wildlife and vegetation.

7.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS

During this cooperative environmental assessment the EAO, the RAs and the working groups have considered: the Application; comments from government agencies, First Nations and public on the potential effects of the Project; responses by the Proponent; and the discussions of the working groups.

Based on the information summarized in this CSR and provided that the Proponent implements the actions described in the *Owner's Commitments and Assurances* as listed in *Appendix A* of this report, the RAs are satisfied that the DP3 Project will not likely result in significant adverse effects on terrestrial wildlife and vegetation.

8. Air Quality

8.1 GENERAL

The Proponent's January 2005 Environmental Assessment Application presents analyses of the air quality and associated human health and wildlife impacts of the proposed Project through an examination of existing air quality in the Project area, and predictions of future air quality and human health and wildlife impacts associated with emissions from DP3 and from other sources in the region.

The assessment consisted of an issue scoping exercise to determine the air quality issues relevant to the DP3 Project. Emission sources were identified, and their associated emission parameters were quantified. A review of ambient air quality observations was also undertaken to define background air quality. Dispersion models were used to predict ambient air quality concentrations due to emissions associated with each assessment scenario, for a total of four different assessment scenarios. Model prediction results were then analyzed to determine the incremental air quality changes due to the DP3 Project (construction and operation), expressed as a percent change and assessed for significance of the predicted air quality changes. Model prediction results were compared to federal, provincial and regional air quality objectives and standards.

During the review of the Application, the Proponent retained additional technical air quality experts to conduct an independent examination of the air quality and human and wildlife health risk assessment. This review identified that wind speeds at one meteorological station (Westshore Terminals) were actually higher in velocity than those used in the air quality model. The Proponent undertook an amendment to the air quality chapter in the Application by remodeling all of the emission scenarios with the correct wind speed. Based on the re-modeling, the Proponent's technical consulting team concluded that the corrected wind speeds did not change the overall environmental assessment conclusion of the Application. The air quality chapter for this report is based on the amended Application chapter that was submitted by the Proponent to the EAO on December 1, 2005, and subsequently made available for public comment in December 2005 and January 2006.

8.2 BACKGROUND

8.2.1 Study Area

The study area for assessing the potential impact of DP3 emissions on air quality was determined in consultation with EAO, EC and GVRD, as reflected in the Application TOR issued on October 8, 2004, following consideration of local meteorology, existing emission sources, local air quality issues and regional topography. The study area was divided into a Local Study Area (LSA) and a Regional Study Area (RSA).

A 30 km by 30 km LSA was defined for the purpose of evaluating predicted overlapping effects associated with the Project and existing sources such as Deltaport, Westshore Terminals, the BC Ferries Terminal and major roadways. The LSA is illustrated in Figure 14 below. Its centre is shifted to the northeast of Roberts Bank port developments to encompass a larger area of land than water. The LSA includes the communities of Tsawwassen, Tsawwassen First Nation, Ladner, Boundary Bay, Beach Grove, Steveston (City of Richmond), and Point Roberts (United States). The ambient air quality monitoring stations in the LSA are also shown in Figure 15.

Courtesy of RWDI West Inc./VPA

Figure 14 Air quality assessment Local Study Area

An RSA was also defined in the event that predicted impacts in the LSA for ozone (O_3) and particulate matter (PM) precursors are significant, in which case regional airshed modeling would be conducted to assess the secondary formation of PM and ozone. The RSA is identical to the Lower Fraser Valley (LFV) airshed, which is bounded by the Coast and Cascade mountain ranges and the Strait of Georgia. The LFV includes the GVRD, the Fraser Valley Regional District (FVRD) and Whatcom County in the United States.

8.2.2 Existing Environment

The Proponent's assessment of baseline air quality conditions is based on the review of ambient monitoring data and the use of dispersion modeling as complementary tools. The monitoring accounts for the sources that were operating during the period when monitoring was conducted (i.e., 1999 to 2003). The Proponent's Existing Baseline Scenario accounts for existing (2003) emissions from background sources whereas the DP3 Projected 2011 Baseline Scenario accounts for future (2011) emissions from these sources.

Courtesy of RWDI West Inc./VPA

Figure 15 Local Study Area air quality monitoring stations

For the air quality study, VPA's technical consultant included Deltaport, Westshore Terminals, and Tsawwassen Ferry Terminal in the modeling. Other point sources within the LSA, as well as area and mobile sources (e.g., space heating, roadways, agricultural sources) and sources outside of the LSA which could impact on the study area, were accounted for by adding the 98th percentile observed ambient concentrations. According to VPA's technical consultants, this is a conservative approach and is consistent with the approach taken in recent air quality impact assessments for major projects in British Columbia, including the Vancouver Island Generation Project (VIGP) and the Golden Ears Bridge (Fraser River Crossing) Project.

For annual averaging periods it was not possible to calculate a 98th percentile value and therefore the five-year annual average was used. According to the Proponent, this approach is likely too conservative for PM because the main sources of PM emissions in the LSA are located at Roberts Bank and at the BC Ferries Terminal. This approach will result in high concentrations on land only when the wind is blowing from the northwest to southwest, but elevated observed PM concentrations are associated with winds from the east. Therefore, it is not physically possible for the worst-case predicted PM concentrations to occur at the same time as the worst-case observed PM concentrations. This Proponent-based argument is also applicable to SO_2 emissions, although the observed concentrations are so low as to not be an issue.

Results of the ambient air quality analysis indicate that observations made at the three continuous GVRD monitoring stations, T2, T17 and T31, are fairly similar (see Figure 15 for

monitoring stations T17 and T31; T2 is located off the figure). The Richmond South station (T17) is the most representative of ambient air quality within the LSA. Therefore T17 data were used to develop representative background values for all contaminants apart from particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), which is not monitored at T17. Data from T31 were used for $PM_{2.5}$. Representative 98th percentile and 5-year annual average background values that were added to predicted concentrations are listed in Table 14.

Table 14 Representative background values (µg/m^3) added to predicted concentrations

Contaminant	1-hr 98th Percentile	8-hr 98th Percentile	24-hr 98th Percentile	Annual 5-year Average
SO_2 [a]	10.5	n/a	6.8	2.4
NO_X [a,d]	431	n/a	330	76.4
CO [a]	2,634	2,276	n/a	610
VOC[e]	n/a[f]	n/a	304	67.7
$PM_{2.5}$ [b]	n/a	n/a	15.6	5.4
PM_{10} [a]	n/a	n/a	26.9	13.3
TSP[c]	n/a	n/a	46.0	22.9

Courtesy of Vancouver Port Authority

[a] Sulphur dioxide (SO_2), nitrogen oxide (NO_x) and particulate matter less than 10 microns in diameter (PM_{10}) data are for 5 years of ambient monitoring between 1999 and 2003 at GVRD station T17.

[b] Particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) data are for 5 years of ambient monitoring between 1999 and 2003 at GVRD station T31.

[c] Total suspended particulates (TSP) non continuous data from 1999 to 2002 at GVRD station T17 were used for a total of 234 24-h average samples.

[d] For NO_2, the background NO_x concentration was added to the predicted NO_x concentration and the resulting total NO_x concentration was converted to NO_2.

[e] Volatile organic compounds (VOC) non-continuous data from 2001 to 2004 at GVRD station T17 were used, for a total of 76 24-hr average samples.

[f] One-hour average monitoring data of total VOC were not available.

8.2.3 Proponent's Assessment of Impacts

Overview

The Proponent assessed air quality and the effects of Project emissions on human and wildlife health within the Project area as a VEC for the environmental assessment. The Proponent undertook an air quality assessment to assess changes in air quality due to the DP3 Project as well conducting a human health and wildlife health risk assessment. A cumulative effects assessment (CEA), defined by emissions from the Project operating at full capacity in addition to emissions from existing, approved and proposed sources where information exists in the LSA projected for the year 2011 (CEA = Project Operation + Projected 2011 Baseline) was also conducted by the Proponent with limited assessments out to 2021 for air quality associated with a proposed Terminal 2 (T2) at Roberts Bank. A detailed evaluation of the cumulative effects on air quality as a VEC is presented in Chapter 16 – *Cumulative Effects Assessment*.

A standard assessment approach was used by VPA to determine air quality changes associated with the DP3 Project. The assessment methodology consisted of the following steps:

(i) An issue scoping exercise was conducted to determine the air quality issues relevant to DP3;
(ii) Emission sources were identified, and their associated emission parameters were quantified for four different assessment scenarios (these scenarios were modeled as part of Step iv);
(iii) A review of ambient air quality observations was undertaken to define background air quality;
(iv) Dispersion models were used to predict ambient air quality concentrations due to emissions associated with each assessment scenario;

(v) Model prediction results were analyzed to determine the incremental air quality changes due to the Project (construction and operation), express them as a percent change and assess the significance of the predicted air quality changes; and
(vi) Model prediction results were compared to applicable air quality objectives and standards.

Table 15 describes the model approach in more detail (study component approaches).

Table 15 Summary of air quality assessment approach

Component of Approach	Description
Source Characterization	Characterization of emission sources focuses primarily on identifying combustion sources and estimating their emissions of SO_2, NO_x, CO, VOC, $PM_{2.5}$, PM_{10}, TSP and diesel $PM_{2.5}$ since emissions of these gases are forecast to increase due to the Project. Combustion source characterization requires information on the source attributes. These include properties such as: area where emissions occur, source height, pollutant emission rates and temporal variation. Source characterization data were produced for the four assessment scenarios.
Terrestrial Characterization	Terrain elevations for the nominal 30 km by 30 km LSA were obtained from two digital elevation databases. Data for the Canadian side was obtained from the Canadian Digital Elevation Database 1:50,000 scale map sheets. At the latitude of the LSA this data has a resolution of approximately 3 arc seconds or about 20 m. Data for the US side was obtained from the US Geological Survey (USGS) Digital Terrain Elevation Data 1:250,000 map sheet archives. This elevation data has a resolution of approximately 12 arc seconds or about 100 m. Each of these resolutions should be sufficient for use in air quality modeling. Land use files for BC were obtained from 1:250,000 scale Baseline Thematic Mapping format files from the BC Ministry of Sustainable Resource Management. Washington State land use information was obtained from 1:250,000 USGS format map sheets.
Representative Meteorology	The CALMET meteorological model was used to predict temporally and spatially dependent wind, temperature and turbulence fields. The CALMET model simulation was based on data from 6 surface stations and soundings from two upper air stations. The surface stations included stations T13, T17, T18 and T31 from the GVRD monitoring network, the MSC station at Vancouver International Airport and local wind speed and direction measured at Westshore Terminals. The two upper air stations included were Port Hardy on Vancouver Island and Quillayute in Washington State.

Component of Approach	Description
Model Ambient Concentrations	The CALPUFF model was used to calculate ambient air quality changes for the assessment scenarios. The code, documentation and guidelines for the selection and application of the model are available from the US EPA website (2004), as well as the applicable model manual (Scire et al. 2000). The CALPUFF model and the associated predictions have been accepted by the BC Ministry of Environment. The CALPUFF model was applied to the 30 km x 30 km LSA. Noteworthy items include: A total of 2,898 receptors with an increased grid density surrounding the Project area were selected. Grid densities vary from 100 m to 1 km, depending on distance from the Project area; An additional 16 community, wildlife and recreation locations were selected; Predicted concentrations are presented as contours superimposed over the LSA base map; and Concentrations of criteria contaminants, VOC and metals predicted at community, wildlife and recreation receptors are presented in tabular formats and are provided for 1-h, 24-h and annual averaging periods.
Presentation Limitations	Model predictions are shown as a series of contours superimposed over base maps to provide an indication of spatial variability. Contours that are presented in the figures have smoothed 100 m resolution. As an artifact of the gridding algorithm there may be differences between peak values given in tables and those inferred from contour plots. Priority is given to values provided in tables.

Courtesy of Vancouver Port Authority

The Air Quality Scenarios were defined in the Application as:

Scenario 1: *Existing Baseline*: Baseline air quality as it exists today is defined by emissions from existing sources in the LSA for the year 2003. (A Projected 2011 Baseline scenario – taking into account changes expected independent of the Project – was also defined.)

Scenario 2: *Project Construction:* This scenario is defined by emissions from all construction equipment at peak activity in 2006.

Scenario 3: *Project Operation*: Defined by emissions from the DP3 Project operating at full capacity in 2011.

Scenario 4: *Cumulative Effects Assessment (CEA):* Defined by emissions from the Project operating at full capacity in addition to emissions from existing, approved and proposed sources where information exists in the LSA projected for the year 2011 (CEA = Project Operation + Projected 2011 Baseline). According to the Proponent, 2011 is representative of the year when the Project will be fully operational and where information exists for background traffic.

Modeling

Following the issue scoping exercise and the development of the emission inventory scenarios, the next step involved modeling the different scenarios for the various air quality parameters identified in the scoping exercise.

The CALMET meteorological model was first used to predict temporally and spatially dependent wind, temperature and turbulence fields. The CALMET model simulation was based on year 2003 data from 6 surface stations and soundings from two upper air stations. The CALPUFF model was used to predict air quality for the various assessment scenarios. The code and documentation for this model are available from the US EPA website (2001).

The Proponent's air quality models were used to generate maximum predicted concentrations (expressed in $\mu g/m^3$) for each contaminant of concern and emission scenario. In the revised

modeling noted above, corrected wind speed data from Westshore Terminals were used and are reflected in the impact assessment discussed below.

Air Quality Assessment Criteria
In this section of the CSR, the ambient air quality objectives and standards for the relevant pollutants are discussed as the basis for assessing the impacts of emissions from the Project. Existing air quality in the LSA is described in terms of baseline values against which to compare the incremental impacts of the proposed container port expansion.

Ground-level concentrations of criteria pollutants (i.e., sulphur dioxide, nitrogen dioxide, carbon monoxide, particulate matter, and ozone) are subject to provincial and national objectives. With the exception of ozone and some particulate matter, all of these air emissions are primary pollutants, meaning that they are emitted directly from the source. There are no air quality criteria for total VOC. The National Ambient Air Quality Objectives under CEPA 1999 provide for three levels of air quality objectives: "Desirable", "Acceptable" and "Tolerable". British Columbia MOE has similar ambient air quality criteria and levels in place referred to as Level A (most stringent), Level B, and Level C (least stringent). The basis for these criteria can be described as follows:

Maximum Desirable: (most stringent) the long-term goal for air quality which provides a basis for an anti-degradation policy for the nation and for the continuing development of control technology.

Maximum Acceptable: intended to provide adequate protection against effects on soil, water, vegetation, animals, visibility, and personal comfort and well-being.

Maximum Tolerable: (least stringent) denotes time-based concentrations of air contaminants beyond which appropriate action is required to protect the health of the general population.

Sulphur dioxide
Sulphur dioxide (SO_2) is produced primarily by the combustion of fossil fuels containing sulphur. Major sources of SO_2 emissions in the study area include marine vessels, motor vehicles and off-road engines. Sulphur dioxide reacts in the atmosphere to form sulphuric acid, a major contributor to acid rain, and particulate sulphates, which can reduce visibility. Table 16 compares air quality objectives, standards and guidelines related to SO_2 for BC, Canada, US, Washington State and the GVRD. The Canadian criteria tend to be more stringent than the US criteria.

Table 16 Relevant air quality objectives, standards and guidelines for SO_2 ($\mu g/m^3$)

Jurisdiction	Level	10-min	1-hour	3-hour	24-hour	Annual
Canada	Maximum Desirable Maximum Acceptable Maximum Tolerable	-	450 900	-	150 300 800	30 60
BC MOE	Level A Level B Level C	-	450 900 900-1,300	375 665	160 260 360	25 50 80
US EPA	Standard	-	-	1,300	365	80
Washington State	Standard	-	1,040	-	260	52
GVRD	Objective	-	450	-	125	30

Courtesy of Vancouver Port Authority

Nitrogen Dioxide

Nitrogen dioxide (NO_2) is produced when fossil fuels are burned at high temperatures. Nitrogen dioxide can also combine with other air contaminants to form fine particulates, which can reduce visibility. It can be further oxidized to form nitric acid, a component of acid rain. Nitrogen dioxide also plays a major role in the secondary formation of ozone.

Air quality objectives, standards and guidelines related to NO_2 for Canada, US, Washington State and the GVRD are compared in Table 17. The GVRD objectives are the most stringent. There are no provincial objectives for NO_2.

Table 17 Relevant air quality objectives, standards and guidelines for NO_2 ($\mu g/m^3$)

Jurisdiction	Level	1-hour	24-hour	Annual
Canada	Maximum Desirable Maximum Acceptable Maximum Tolerable	- 400 1,000	- 200 300	60 100 -
US EPA	Standard	-	-	100
Washington State	Standard	-	-	100
GVRD	Objective	200	-	40

Courtesy of Vancouver Port Authority

Carbon Monoxide

Carbon monoxide (CO) is a colourless, odourless and tasteless gas produced by incomplete combustion of fossil fuels. It is the most widely distributed and commonly occurring air pollutant and comes primarily from motor vehicle emissions from cars, trucks, and buses. Building heating and commercial and industrial operations are also contributors.

Air quality objectives, standards and guidelines for CO in BC, Canada, US, and Washington State are compared in Table 18. The BC objectives are more stringent than the Canadian objectives.

The US 1-hour standards are less stringent than the Canadian objectives. The US and GVRD 8-hour criteria are less stringent than the Canadian Maximum Desirable Objective and more stringent than the Canadian Maximum Acceptable Objective.

Table 18 Relevant air quality objectives, standards and guidelines for CO (mg/m^3)

Jurisdiction	Level	1-hour	8-hour
Canada	Maximum Desirable Maximum Acceptable Maximum Tolerable	15 35 -	6 15 20
BC MOE	Level A Level B Level C	14.3 28 35	5.5 11 14.3
US EPA	Standard	40	10
Washington State	Standard	40	10
GVRD	Objective	30	10

Courtesy of Vancouver Port Authority

Particulate Matter

Fine particulate matter ($PM_{2.5}$) is defined as an atmospheric particle with a diameter of 2.5 microns or less. $PM_{2.5}$ concentrations result directly from combustion emissions (i.e., primary emissions) and indirectly from the formation of sulphates and nitrates in the atmosphere from SO_2 and NO_x emissions (i.e., secondary emissions). Fine particulate plays a primary role in developing regional haze. Inhalable particulate (PM_{10}) is defined as any atmospheric particle with a diameter of 10 microns or less. PM_{10} is emitted from industrial, mobile and area sources, including road dust, which results from travelling vehicles. Natural sources include wind-blown sand, soil, forest fires, ocean spray and volcanic activity. Total suspended particulate (TSP) consists of all size ranges of particulate matter suspended in the atmosphere.

Air quality standards and objectives of various Canadian and US agencies for particulate matter are compared in Table 19 below. The most stringent $PM_{2.5}$ criteria are the GVRD objectives. The Canada-wide Standard (CWS) for $PM_{2.5}$ contains a numerical target of 30 $\mu g/m^3$ as a 24-h average; achievement being based on the average results of monitoring stations within an identified population center, the 98^{th} percentile for a year, averaged over 3 consecutive years. However it is important to note that the Continuous Improvement provisions of the CWS state that, "*There is a need to ensure that the public recognizes that the CWS levels are only a first step to subsequent reductions towards the lowest observable effects levels. It would be wrong to convey the impression that no action is required in* [areas with ambient concentrations below the numerical levels] *or that it would be acceptable to allow pollutant levels to rise to the CWS levels. Jurisdictions should take remedial and preventative actions to reduce emissions from anthropogenic sources in these areas to the extent practicable."*

Table 19 Relevant air quality objectives, standards and guidelines for particulate matter (μg/m^3)

Jurisdiction	Level	24-hour	Annual
Guidelines for $PM_{2.5}$			
Canada-wide Standard	Target*	30	-
US EPA	Standard	65	15
Washington State	Standard	65	15
California Air Resources Board	Draft Standard	-	12
GVRD	Objective	25	12
Guidelines for PM_{10}			
BC MOE	Objective	50	-
US EPA	Standard	150	50
Washington State	Standard	150	50
California Air Resources Board	Standard	50	20
GVRD	Objective	50	20
Guidelines for Total Suspended Particles (TSP)			
Canada	Maximum Desirable Maximum Acceptable Maximum Tolerable	- 120 400	60 70 -
BC MOE	Level A Level B Level C	150 200 260	60 70 75
Washington State	Standard	150	60

Courtesy of Vancouver Port Authority

Ozone

Ozone (O_3) is a reactive form of oxygen that is a strong oxidizer and can irritate the eyes, nose and throat and decrease athletic performance. Ozone is usually not directly discharged into the air. Rather it is produced by photochemical reactions of anthropogenic nitrogen oxides (NO_x), anthropogenic VOC, and biogenic VOC emissions.

Air quality objectives and standards for ozone are listed in Table 20. The Canada-wide Standard (CWS) for O_3 contains a numerical target of 65 ppb (130 μg/m^3) as an 8-hour average; achievement being based on the 4th highest value for a year, averaged over 3 consecutive years. In determining compliance, natural sources or long-range contributions can be discounted. The Continuous Improvement provisions of the CWS (described above) apply equally to O_3 and PM. Ambient ozone concentrations were not predicted for this study; rather the potential formation of ozone was semi-quantitatively assessed based on total emissions of ozone precursors. As such, the potential impact of secondary ozone formation was evaluated relative to total ozone precursor emissions in the RSA.

Table 20 Relevant air quality objectives, standards and guidelines for ozone (μg/m³)

Jurisdiction	Level	1-hour	8-hour	24-hour	Annual
Canada	Maximum Desirable Maximum Acceptable	100 160	- -	30 50	30
Canada-wide Standard	Target*	-	130	-	-
US EPA	Standard	240	160	-	-
Washington State	Standard	240	-	-	-
GVRD	Objective	-	126	-	-

Courtesy of Vancouver Port Authority

* Take Continuous Improvement actions below this target

Existing (2003) Emission Inventory

The primary sources of emissions in the LSA are the BC Ferries Terminal, Westshore Terminals (coal export terminal at Roberts Bank), Deltaport container terminal, railways and major roadways such as Highways 17 and 99. Emissions from the stationary sources were included in the modeling, whereas emissions from railways, roadways and other sources, such as space heating, burning and agriculture, were included by adding a representative background value to model results.

Sources of emissions at the Deltaport container terminal include: dockyard equipment; container trucks; container vessels underway, manoeuvring, and hoteling; tugboats; trains; and employee and service vehicles. Sources at Westshore Terminals include: dockyard equipment; propane heating; bulk carrier ships underway, manoeuvring, and hoteling; tugboats; trains; and fugitive coal dust. The main sources of emissions from the BC Ferries Terminal are ferry ships (cruising and hoteling). Emissions of air contaminants are summarized in Table 21.

Table 21 Summary of emissions (t/yr) included in the existing baseline model scenario

SCENARIO	EMISSION SOURCE	NO_X	CO	SO_2	VOC	PM_{10}	$PM_{2.5}$	TSP
Existing 2003 Baseline	Deltaport Terminal	689	110	328	28	54	54	54
	Westshore Terminals	361	66	218	16	66	25	168
	BC Ferries Terminal	1,199	145	50	46	30	30	30
	Total	**2,249**	**321**	**596**	**90**	**150**	**109**	**252**
LSA 2000 Total[1]	All sources	18,278	58,740	1,827	9,622	2,779	1,489	4,882
Contribution of Existing Baseline to LSA Total (%)		*12.3*	*0.6*	*32.6*	*0.9*	*5.4*	*7.3*	*5.2*
RSA (LFV) 2000 Total[2]	All sources	99,897	481,933	18,769	111,196	15,363	8,964	25,627
Contribution of Existing Baseline to RSA Total (%)		*2.2*	*0.1*	*3.2*	*0.1*	*1.0*	*1.2*	*1.0*

[1] Calculated using LFV emission inventory for 2000 and spatially allocating emissions to LSA.
[2] Based on GVRD information.

The results from the 2003 air quality Existing Baseline Scenario showed that maximum predicted concentrations for SO_2, NO_2, CO, PM_{10}, $PM_{2.5}$ and total suspended particulate (TSP) met the most stringent air quality objectives and standards on land in the immediate area of the DP3 at Roberts Bank. The results for the Existing Baseline Scenario's maximum predicted

concentrations for NO_2, VOC, CO, SO_2 and for PM_{10}, $PM_{2.5}$ and TSP are all less than ambient criteria.

Impact Assessment – Project Construction

Emissions Inventory

The construction of the DP3 Project was scheduled to begin March 2006, with initial dredging operations and continue until the end of 2008 with completion of the terminal expansion. The highest construction activity and emissions would have occurred in 2006 and therefore this year was selected by the Proponent for emission inventory and modeling for the construction scenario. The construction schedule has been altered and peak construction will now occur in 2007 but this does not significantly change the emissions inventory. A summary of DP3 Project construction emissions prepared by the Proponent's technical consultants is presented in Table 22. For modeling purposes, emissions from the existing Deltaport container terminal, Westshore Terminals, and BC Ferries Terminal are assumed to be the same as those for the Existing Baseline.

Table 22 Summary of Project construction emissions (t/yr)

SCENARIO	EMISSION SOURCE	NO_X	CO	SO_2	VOC	PM_{10}	$PM_{2.5}$	TSP
Project Construction	**Construction sources**	**339**	**96**	**6**	**36**	**16**	**16**	**16**
Existing 2003 Baseline		2,249	321	596	90	150	109	252
% Increase Project Construction over 2003 Baseline		*15*	*30*	*1.0*	*40*	*11*	*15*	*6.3*
2000 LSA Total[1]		18,278	58,740	1,827	9,622	2,779	1,489	4,882
% Change Project Construction vs. 2000 LSA Total		*1.8*	*0.16*	*0.3*	*0.4*	*0.6*	*1.1*	*0.3*
2000 RSA Total[2]		99,897	481,933	18,769	111,196	15,363	8,964	25,627
% Change Project Construction vs. 2000 RSA Total		*0.34*	*0.02*	*0.03*	*0.03*	*0.11*	*0.18*	*0.06*

Courtesy of Vancouver Port Authority

[1] Calculated using LFV emission inventory for 2000 and spatially allocating emissions to LSA.
[2] Based on GVRD information.

Maximum Predicted Concentrations

The results from the Project construction air quality scenario showed that maximum predicted concentrations for SO_2, NO_2, CO, PM_{10}, $PM_{2.5}$ and total suspended particulate (TSP) would meet the most stringent Canadian and BC air quality objectives and standards on land. Based on the Applicant's assessment, the contribution of Project construction emissions to air quality in the LSA is considered not significant by VPA. The results for the Project construction maximum predicted concentrations for SO_2, NO_2, VOC and CO, are summarized in Table 23 and for PM_{10}, $PM_{2.5}$ and TSP in Table 24.

Impact Assessment – Project Operation

Emissions Inventory

The additional container dockyard equipment that uses fossil fuels that was modeled for the DP3 operation scenario includes 33 tractors (225 horsepower), 4 tractors (330 horsepower) and 20 rubber-tired gantries (RTGs). According to VPA this represents a conservative overestimation of the equipment requirements for the Project, based on the Application Project Description. For example at full Project capacity it is likely that only 10 to 12 RTGs will be required. The Project will also require 3 additional ship-to-shore gantry cranes and 1 rail mounted gantry (RMG) crane; however these will be electric and therefore are not a source of local emissions.

Table 23 Maximum SO_2, NO_2, CO and VOC concentrations predicted to occur on land for the construction scenario (including 98th percentile ambient background values)

Scenario or Ambient Guideline	Maximum Predicted Concentrations (μg/m³)										
	SO_2			NO_2			CO		VOC		
	1-h	24-h	Annual	1-h	24-h	Annual	1-h	8-h	1-h[2]	24-h	Annual
Existing 2003 Baseline[1]	121	20	4	135	84	39	2,812	2,340	29	308	68
Project Construction[1]	121	20	4	146	87	40	2,930	2,382	73	314	68
% Change Project Construction relative to Existing Baseline	*0%*	*1%*	*1%*	*8%*	*4%*	*1%*	*4%*	*2%*	-	*2%*	*<1%*
BC Level A Objective[3]	450	160	25	-	-	60	14,300	5,500	-	-	-
BC Level B Objective[3]	900	260	50	400	200	100	28,000	11,000	-	-	-
BC Level C Objective[3]	900-1,300	360	80	1,000	300	-	35,000	14,300	-	-	-
GVRD Objective	450	125	30	200	-	40	30,000	10,000	-	-	-
US EPA Standard	-	365	80	-	-	100	40,000	10,000	-	-	-
Washington State Standard	1,040	260	52	-	-	-	40,000	10,000	-	-	-

Courtesy of Vancouver Port Authority

1 98th Percentile observed ambient concentrations were added to represent background sources not included in the model.
2 One-hour average ambient VOC data were not available for the LSA and therefore no background value was added and the percent change was not calculated.
3 The objectives shown for NO_2 are Canadian not provincial as no provincial objective exists
- Indicates no applicable objective or standard

Table 24 Maximum $PM_{2.5}$, PM_{10} and TSP concentrations predicted to occur on land for the construction scenario (including 98th percentile ambient background values)

Scenario or Ambient Guideline	Predicted Concentrations (μg/m³)						
	$PM_{2.5}$			PM_{10}		TSP	
	98th Percentile 24-h	Maximum 24-h	Annual	Maximum 24-h	Annual	Maximum 24-h	Annual
Existing 2003 Baseline[1]	19	23	6	34	14	53	24
Project Construction[1]	19	26	6	38	14	57	24
% Change Project Construction relative to Existing 2003 Baseline	*4%*	*16%*	*3%*	*11%*	*1%*	*7%*	*1%*
Canada-wide Standard[2]	30	-	-	-	-	-	-
BC Level A Objective	-	-	-	-	-	150	60
BC Level B Objective	-	-	-	50	-	200	70
GVRD Objective	-	25	12	50	20	-	-
US EPA Standard	-	65	15	150	50	-	-
Washington State Standard	-	65	15	150	50	150	60

Courtesy of Vancouver Port Authority

1 98th Percentile observed ambient concentrations were added to represent background sources not included in the model.
2. Take Continuous Improvement actions below this target
- Indicates no applicable objective or standard

The average daily truck traffic arriving at Deltaport is expected by VPA to increase by about 300 trucks per day as a result of the Project. Emissions from these trucks were accounted for on site and on roadways within the LSA. The number of container vessel calls at Deltaport is expected to increase from 365 calls in 2003 to 393 calls in 2011. In addition, the size distribution of the vessels is also anticipated to change with larger container vessels (able to carry more containers or TEUs) calling at the port, reducing the rate of increase in the number of ship calls). For the purposes of the emission inventory, an increase of 66 ships per year was used for the Project Operation Scenario, reflected in the Application, representing a conservative estimate of the increase in the number of container vessels for DP3. The number of trains arriving or departing the Deltaport Terminal is also expected to increase by an average of three trains a day due to the Project. For the purposes of modeling predicted emissions, one additional coal train calling at Westshore Terminals has been added to the emissions inventory for the Project Operation Scenario.

According to VPA, the emission inventory for the Project Operation Scenario is an overestimate of the potential emissions and is intended to provide a conservative approach to assessing the impacts on ambient air quality for the LSA. Emissions for the Project Operation Scenario are provided in Table 25. The incremental increase due to DP3 Project operations relative to total emissions in the LSA ranges from 0.16% for VOC, to 3.1% for SO_2. According to VPA, relative to total emissions in the RSA, the incremental increase in emissions due to the Project is 0.3% or less.

Table 25 Summary of emissions (t/yr) included in the Project operation scenario 2011

SCENARIO	EMISSION SOURCE	NO_X	CO	SO_2	VOC	PM_{10}	$PM_{2.5}$	TSP
Project Operation	Container Ships	72.2	7.63	56.2	2.29	7.64	7.64	7.64
	Container Trucks	25.6	4.63	0.05	1.22	0.71	0.55	0.71
	Trains	24.8	2.84	0.36	1.04	0.66	0.66	0.66
	Tugboat Operations	1.70	0.23	0.03	0.07	0.03	0.03	0.03
	Employee/Service Vehicles	2.21	76.5	0.03	5.82	0.12	0.06	0.12
	Dockyard Equipment	61.4	40.6	0.11	4.60	3.99	3.87	3.99
	Total	**188**	**133**	**57**	**15**	**13**	**13**	**13**
Existing 2003 Baseline		2,249	321	596	90	150	109	252
2011 Baseline		2,176	303	507	86	144	103	246
% Increase Project Operation over 2011 Baseline		*8.6*	*44*	*11*	*17*	*9.0*	*13*	*5.3*
2000 LSA Total[1]		18,278	58,740	1,827	9,622	2,779	1,489	4,882
% Change Project Operation vs. 2000 LSA Total		*1.0*	*0.23*	*3.1*	*0.16*	*0.5*	*0.9*	*0.27*
2000 RSA Total[2]		99,897	481,933	18,769	111,196	15,363	8,964	25,627
% Change Project Operation vs. 2000 RSA Total		*0.19*	*0.03*	*0.30*	*0.01*	*0.09*	*0.14*	*0.05*

Courtesy of Vancouver Port Authority

[1] Calculated using LFV emission inventory for 2000 and spatially allocating emissions to LSA.
[2] Based on GVRD information.

Maximum Predicted Concentrations

Maximum predicted ground-level SO_2, NO_2, CO, VOC, and PM concentrations, including Existing Background, during Project operation, are compared to applicable objectives and standards and shown in Tables 26 and 27. According to VPA, with Project operation, air quality in the LSA would meet all of the most stringent ambient air quality standards or objectives. The impacts of Project operation on air quality in the LSA are therefore considered not significant by the Proponent.

Table 26 Maximum SO_2, NO_2, CO and VOC concentrations predicted to occur on land for the Project operation scenario (including 98th percentile ambient background values)

Scenario or Ambient Guideline	Maximum Predicted Concentrations (μg/m³)										
	SO_2			NO_2			CO		VOC		
	1-h	24-h	Annual	1-h	24-h	Annual	1-h	8-h	1-h[2]	24-h	Annual
Existing 2003 Baseline[1]	121	20	4	135	84	39	2,812	2,340	29	308	68
2011 Baseline[1]	114	18	4	132	83	39	2,786	2,331	23	307	68
Project Operation 2011[1]	132	20	4	134	85	40	2,966	2,374	31	310	68
% Change Project Operation relative to Existing 2003 Baseline	*12%*	*9%*	*6%*	*2%*	*1%*	*1%*	*5%*	*2%*	-	*1%*	*1%*
% Change Project Operation relative to Projected 2011 Baseline	*13 %*	*10 %*	*7 %*	*2 %*	*2 %*	*1 %*	*6 %*	*2 %*		*1 %*	*1 %*
BC Level A Objective[3]	450	160	25	-	-	60	14,300	5,500	-	-	-
BC Level B Objective[3]	900	260	50	400	200	100	28,000	11,000	-	-	-
BC Level C Objective[3]	900-1,300	360	80	1,000	300	-	35,000	14,300	-	-	-
GVRD Objective	450	125	30	200	-	40	30,000	10,000	-	-	-
US EPA Standard	-	365	80	-	-	100	40,000	10,000	-	-	-
Washington State Standard	1,040	260	52	-	-	-	40,000	10,000	-	-	-

Courtesy of Vancouver Port Authority

1 98th Percentile observed ambient concentrations were added to represent background sources not included in the model.

2 One-hour average ambient VOC data were not available for the LSA and therefore no background value was added and the percent change was not calculated.

3 The objectives shown for NO_2 are Canadian not provincial as no provincial objective exists

Indicates no applicable objective or standard

Table 27 Maximum $PM_{2.5}$, PM_{10} and TSP concentrations predicted to occur on land for the Project operation scenario (including 98th percentile ambient background values)

Scenario or Ambient Guideline	Predicted Concentrations (μg/m³)						
	$PM_{2.5}$			PM_{10}		TSP	
	98th Percentile 24-h	Maximum 24-h	Annual	Maximum 24-h	Annual	Maximum 24-h	Annual
Existing 2003 Baseline[1]	19	23	6	34	14	53	24
2011 Baseline[1]	18	21	6	33	14	52	24
Project Operation 2011[1]	19	23	6	34	14	53	24
% Change Project Operation relative to Existing 2003 Baseline	*3%*	*6%*	*3%*	*4%*	*1%*	*2%*	*1%*
% Change Project Operation relative to 2011 Baseline	3%	6%	2%	4%	1%	3%	1%
Canada-wide Standard[2]	30	-	-	-	-	-	-
BC Level A Objective	-	-	-	-	-	150	60
BC Level B Objective	-	-	-	50	-	200	70
GVRD Objective	-	25	12	50	20	-	-
US EPA Standard	-	65	15	150	50	-	-
Washington State Standard	-	65	15	150	50	150	60

Courtesy of Vancouver Port Authority

1 98th Percentile observed ambient concentrations were added to represent background sources not included in the model.
2. Take Continuous Improvement actions below this target
- Indicates no applicable objective or standard

Impact Assessment Framework and Results
An overall impact rating was determined by VPA for the Project operation based on the Cumulative Effects Assessment (CEA) scenario (Project Operation in 2011 + Projected 2011 Baseline). The overall impact rating took into consideration impact direction, magnitude, geographic extent, duration, frequency, and reversibility of predicted changes. Significance was determined by the overall impact rating. Low and moderate impact ratings can be interpreted as resulting in "no significant impact", according to VPA. High impact ratings can be interpreted as resulting in "significant impact".

The final impact ratings were determined by the Proponent for Project operation prior to implementing any additional mitigation to reduce air pollutants emissions, and are for a worst case Project operation scenario where the maximum number of ships and trains has been included in the assessment. The VPA concluded that all ratings are considered to be "low" for the Project except for SO_2 where the final rating is "moderate". This is because the increase in ambient SO_2 concentrations relative to the Projected 2011 Baseline varies from 7 to 13%. However, maximum predicted concentrations on land are less than half the British Columbia Level A and GVRD Objectives for all averaging periods. Furthermore, elevated concentrations will occur infrequently, according to VPA. The Proponent concluded that for the Project Operation scenario, the maximum predicted concentrations for emissions occurring on land in close proximity to the Project are all less than the Canadian and British Columbia Desirable Objectives, as well as the GVRD objectives. On the basis of the air quality impact assessment for Project Operation the impact of the DP3 Project on air quality in the LSA is not expected to be significant.

8.2.4 Cumulative Effects Assessment

The VPA modeled an air quality cumulative effects assessment (CEA) scenario in the Application. Emissions included in the modeling for the CEA scenario consisted of emissions from the DP3 operation as well as those estimated for a Projected 2011 Baseline scenario. The combined effect of the Project and all major sources of emissions within the LSA (Deltaport, Westshore Terminals, BC Ferries Terminal, and major roadways) were modeled. The Proponent concluded that for the Project CEA scenario, the maximum predicted concentrations for emissions occurring on land in close proximity to the Project are all less than the Canadian and British Columbia Desirable Objectives, as well as the GVRD objectives. On the basis of the air quality impact assessment for Project Operation under the CEA scenario, the impact of the Project on air quality in the LSA is not expected to be significant. Other reference levels, objectives and American standards were also included in the assessment, where relevant, for comparison purposes. On the basis of the air quality impact assessment, no exceedances of US EPA or Washington State standards were predicted for Point Roberts, USA.

Further discussions on cumulative effects on air quality are included in Chapter 16 – *Cumulative Effects Assessment*.

8.2.5 Impact of DP3 Operations on Greenhouse Gases

The Proponent also assessed the relative contribution of the greenhouse gas (GHG) emissions from Project operation to the total emissions in the RSA, British Columbia and Canada. This information is presented in Table 28. The table shows that the relative contribution of the Project to regional GHG emissions is predicted to be very small. The CO_2 equivalent (CO_2eq) emissions from the Project represent an increase of about 0.2% relative to the CO_2eq emissions in the RSA in 2000 or an increase of about 0.1% when compared to forecast emissions in the RSA for 2010. The incremental increase in GHG emissions due to the Project is less, according to VPA, when considered on a provincial or national basis.

Table 28 Contribution of Project operation GHG emissions to total emissions in the Regional Study Area

Emission Source	CO_2 (kt/yr)	CH_4 (kt/yr)	NO_2 (kt/yr)	CO_2eq (kt/yr)
Project Operation GHG Emissions	24.8	0.002	0.008	27.4
LFV 2000 Total Emissions	23,003	70.3	2.81	25,349
LFV 2010 Total Forecast Emissions	26,505	54.2	2.61	28,453
Canada GHG Emissions	--	--	--	720,000
British Columbia 2001 Provincial GHG Emissions	--	--	--	65,000
Project Operation Emissions as % of Total LFV 2000 Total Emissions	0.2%	0.0%	0.3%	0.2%
Project Operation Emissions as % of Total LFV 2010 Total Forecast Emissions	0.1%	0.0%	0.3%	0.1%
Project Operation Emissions as % of Total British Columbia 2001 Emissions	--	--	--	0.04%
Project Operation Emissions as % of Total Canada 2001 Emissions	--	--	--	0.004%

Courtesy of Vancouver Port Authority

8.2.6 Human Health and Wildlife Risk Assessment

In addition to the air quality impact assessment, a human health risk assessment (HHRA) and a wildlife health risk assessment (WHRA) was undertaken by the Proponent to fully characterize the Project's potential adverse impacts.

The primary objective of an HHRA is to evaluate the likelihood of occurrence of adverse human health effects in relation to potential exposures to chemicals in light of what is known regarding the toxicity of those chemicals. The HHRA follows a conventional study approach, in accordance with formal and informal procedures recommended by regulatory agencies including Health Canada, Environment Canada, the provincial Ministry of Environment, Canadian Council of Ministers of the Environment (CCME), United States Environmental Protection Agency (U.S. EPA) and the World Health Organization (WHO).

Potential human and wildlife health impacts as a result of the estimated air quality changes were characterized by the Proponent using a conventional risk assessment approach.

A high degree of conservatism was utilized by the Proponent to ensure that health risks would not be underestimated. The work relied on the results of the air dispersion modeling in which ground-level air concentrations of the emitted chemical constituents were predicted based on a conservative modeling method. The predicted air concentrations were expressed as a function of different averaging times (i.e., 10-minute, 1-hour, 8-hour, 24-hour, and annual averages) to allow for the estimation of acute and chronic health risks. Special consideration was given to individuals who might be particularly vulnerable to air emissions. Wildlife health impacts were assessed by determining the likelihood of population effects occurring in nearby ecological receptors as a result of the DP3 Project's air emissions.

The human health risk assessment (HHRA) was augmented by Health Canada's Health Determinants approach. This multi-factorial approach considers other factors that can influence

health such as residency, the state of the environment, genetics, income and education level, and relationships. As well, the HHRA was extended to include examination of potential daily mortality and morbidity related to exposures to PM_{10} and $PM_{2.5}$. It has been recommended by Health Canada (1999) and Bates et al. (2003) that, in addition to comparing predicted ground level PM concentrations to health based exposure limits, an incremental risk analysis be employed. These methods attempt to provide an indication of the increased number of hospitalizations and deaths per year that can be attributed to an incremental increase of PM concentrations above ambient concentrations as a result of the Project.

Risk estimates were calculated by comparing the estimated exposures to the various "chemicals of potential concern" to exposure limits or safe levels of exposure determined for each. Risks were expressed as either Concentration Ratio (CR) or Exposure Ratio (ER) values depending on the nature and duration of exposure. All CR and ER values were referenced to 1.0. Values less than 1.0 signified negligible health risks, since conservatively estimated exposures were lower than exposure limits. Conversely, values greater than 1.0 signified the possibility of health effects, the significance of which generally increased as the value became greater. In all instances, the interpretation of the significance of the risk estimates considered the high degree of conservatism incorporated into the exposure assessment, as well as safety factors incorporated into the exposure limits. Conservatism was incorporated into the exposure assessment to accommodate the uncertainty associated with the health risk assessment. This was achieved through the use of assumptions, which reflected "worst-case" conditions that would tend to exaggerate any health risks.

Potential human health risks were assessed in relation to air emissions from the DP3 Project and other emission sources in the study area. The overall conclusions drawn by VPA from the HHRA and WHRA are that the health risks are negligible at selected receptor locations from acute or chronic inhalation exposures, or from ingestion of food grown or raised within the local study area. These findings applied to all chemicals, all receptor locations, and all exposure scenarios. The overall health risks as they relate to PM were characterized by the Proponent as being "low", as no guideline exceedances were predicted for PM.

8.2.7 Assessment of Residual Effects

All maximum concentrations predicted for Project Operation, including ambient background values, are less than applicable federal and provincial standards and objectives and less than or equal to regional objectives. Increases in maximum predicted concentrations due to Project Operation relative to the Existing 2003 Baseline vary from a maximum of 12% for 1-hour SO_2 to around 1% for annual NO_2, 2% for 8-hour CO and 1% for annual PM_{10}. When Project Operations are modeled with the Projected 2011 Baseline, the maximum predicted concentrations for emissions occurring on land in close proximity to the Project are all less than the most stringent ambient air quality objectives and standards. Increases relative to the Projected 2011 Baseline vary from a maximum of 13% for 1-hour SO_2 to around 1% for annual NO_2, 2% for CO and 1% for annual PM_{10}. The majority of the increases in predicted concentrations of the criteria contaminants are confined to the area immediately surrounding the Roberts Bank Port. Small increases in ambient CO and VOC concentrations are predicted along major roadways resulting from increased truck traffic due to Project Operation.

All maximum predicted concentrations due to air emissions from Project Construction, including ambient background values are less than applicable federal and provincial ambient air quality objectives and standards and less than or equal to regional objectives. Maximum 24 hour $PM_{2.5}$ concentrations for construction, without the application of any emission reductions measures or mitigation, were predicted to be 26 $\mu g/m^3$, which exceeded the GVRD objective for 24 hour $PM_{2.5}$ of 25 $\mu g/m^3$. According to the Proponent the reported values for the maximum 24 hour $PM_{2.5}$ concentrations are within the detection limits of the air quality model.

On the basis of the air quality assessment the VPA concluded that there are no significant residual effects on ambient air quality as a result of construction and operation of the DP3 Project.

The relative contribution of the emissions from the Project Operation compared to the total emissions in the RSA is projected to be very small due to the large emission background in the Lower Fraser Valley (LFV). For example, total annual NO_x emissions from the Project Operation represent an increase of 0.19% relative to total NO_x emissions in the RSA in 2000 and 0.23% relative to projected total NO_x emissions in 2010. The relative increase in SO_2 emissions is about 0.3% in the LFV. The incremental increase in emissions of other pollutants, including primary PM and NH_3, is 0.1% or less.

The relative contribution of the Project to regional GHG emissions is estimated by VPA to be very small. The CO_2 equivalent (CO_2eq) emissions from the Project represent an increase of about 0.2% relative to the CO_2eq emissions in the RSA in 2000 or an increase of about 0.1% when compared to forecast emissions in the RSA for 2010.

Potential human health risks were assessed in relation to air emissions from the Project and other emission sources in the study area. The overall conclusions drawn from the HHRA and WHRA are that the health risks are negligible at the selected receptor locations from acute or chronic inhalation exposures, or from ingestion of food grown or raised within the local study area. These findings applied to all chemicals, all receptor locations, and all exposure scenarios. The overall health risks as they relate to PM were characterized as being low, as no guideline exceedances were predicted for PM.

8.3 ANALYSIS

The RAs considered the information provided by the Proponent, including the Proponent's conclusions on potential effects and the method used to reach those conclusions as outlined above in sections 1 and 2 of this chapter. The RAs then conducted their own analysis of the potential effects and proposed mitigation measures before independently reaching conclusions on the residual effects.

8.3.1 Potential Effects

The following is a list of potential effects to air quality from the DP3 Project:

- *Effect of Project Emissions on Ambient Sulphur Dioxide (SO_2) Levels.* Ambient SO_2 exposures at sufficiently high concentrations can have adverse effects on human health and vegetation. Maximum predicted ambient SO_2 concentrations, primarily from marine vessels but also from container terminal handling equipment, container trucks and trains, are projected to increase by 12% for one hour, 9% for 24 hours, and 6% for annual compared to the existing 2003 baseline; and 13%, 10%, and 7%, respectively, compared to the projected 2011 baseline.
- *Effect of Project Nitrogen Oxide (NO_x) Emissions on Ambient Nitrogen Dioxide (NO_2) Levels.* Ambient NO_2 exposures at sufficiently high concentrations can have adverse effects on human health and vegetation. Nitrogen oxides are produced when fossil fuels are burned at high temperatures. The DP3 Project will increase the volume of fossil fuels burned in the LSA and maximum ambient NO_x concentrations are projected to increase by 2% for one hour, 1% for 24 hour and 1% for annual when compared to the 2003 baseline; and 2%, 2%, and 1%, respectively, compared to the projected 2011 baseline.
- *Effect of Project Emissions on Ambient Carbon Monoxide (CO) Levels.* Ambient CO exposures at sufficiently high concentrations can have adverse effects on human health. Carbon monoxide is a colourless, odourless and tasteless gas produced by incomplete combustion of fossil fuels. Maximum ambient CO concentrations are projected to

increase as a result of the DP3 Project by 5% for one hour and 2% for eight hours when compared to the 2003 baseline; and by 6% and 2% compared to the 2011 baseline.

- *Effect of Project Emissions on Ambient Particulate Matter (PM) Concentrations.* Fine particulate matter ($PM_{2.5}$) is defined as an atmospheric particle with a diameter of 2.5 microns or less. $PM_{2.5}$ concentrations result directly from combustion emissions (i.e., primary emissions) and indirectly from the formation of sulphates and nitrates in the atmosphere from SO_2 and NO_x emissions. Inhalable particulate (PM_{10}) is defined as any atmospheric particle with a diameter of 10 microns or less. PM_{10} is emitted from industrial, mobile and area sources, including road dust, which results from travelling vehicles. Natural sources include wind-blown sand, soil, forest fires, ocean spray and volcanic activity. Total suspended particulate (TSP) consists of all size ranges of particulate matter suspended in the atmosphere. $PM_{2.5}$ emissions are of specific interest relative to human health effects. As a result of the DP3 Project and when compared to the 2003 baseline the maximum projected ambient concentrations are:

    i. $PM_{2.5}$ concentrations are projected to increase by 3% for one hour, 6% for 24 hour and 3% for annual;
    ii. PM_{10}. concentrations are projected to increase by 4% for 24 hour and 1% for annual, and;
    iii. TSP concentrations are projected to increase by 2% for 24 hour and 1% for annual.

    Compared to the projected 2011 baseline:

    iv. $PM_{2.5}$ concentrations are projected to increase by 3% for one hour, 6% for 24 hour and 2% for annual;
    v. PM_{10}.concentrations are projected to increase by 4% for 24 hour and 1% for annual, and;
    vi. TSP concentrations are projected to increase by 3% for 24 hour and 1% for annual.

- *Effect of Project Emissions on Secondary Ozone and PM Formation.* Ambient NO_x emissions can combine with anthropogenic and biogenic VOC emissions to form ground-level ozone (O_3) downwind of the study area. In sufficiently high concentrations, ambient O_3 exposures can have adverse effects on human health and vegetation. Similarly, anthropogenic emissions of SO_2, NO_x and VOC can lead to the formation of secondary particulate, which can have adverse effects on human health and visibility. As a result of the DP3 Project, maximum projected ambient SO_2, NO_x concentrations, as described above, and VOC emissions are projected to increase. Ambient VOC concentrations are projected to increase by 1% for 24 hour and 1% for annual compared to the 2003 baseline, and 1% and 1%, respectively, compared to the projected 2011 baseline.
- *Project Contribution to Greenhouse Gas (GHG) Emissions.* The combustion of hydrocarbon fuels (gas, diesel, propane, fuel oil, etc.) related to the Project will result in the release of greenhouse gases (primarily carbon dioxide, CO_2). The relative contribution of the Project to regional GHG emissions is predicted to be very small. The CO_2 equivalent (CO_2eq) emissions from the DP3 Project represent an increase of about 0.2% relative to the CO_2eq emissions in the RSA in 2000 or an increase of about 0.1% when compared to forecast emissions in the RSA for 2010. The incremental increase in GHG emissions due to the Project is less when considered on a provincial or national basis.

8.3.2 Issues

The public, public interest groups, and municipal, provincial, and federal governments raised the following issues concerning the potential effects to air quality resulting from the Proponent's assessment of the proposed DP3 Project in the Application:

Emissions Inventory
Modeled ambient concentrations – and therefore potential significance of effects – depend on a number of detailed technical assumptions in the emissions inventory. Throughout the EA process, VPA provided detailed clarifications to several of these technical assumptions.

Although the ATOR for the air quality effect assessment identified that the Proponent would compare emissions in the LSA with total emissions in the RSA, concerns were raised that this method may be a potentially misleading comparison, since the estimated emissions from rail and truck are limited to only the LSA. It was suggested that a more appropriate comparison would be to include the emissions that would result from rail and trucks in the RSA. Another option would be to compare the emissions contribution of the DP3 Project to all other emission sources in the LSA only.

According to the Proponent the estimated emissions of the Project for the LSA are all of the emissions that result from port operations at Roberts Bank (container and coal) for trucks, trains, ships, terminal equipment and employee and service vehicles, including the additional emissions generated by the Project. The Proponent did undertake an additional modeling assessment of container truck and train air emission effects within a 200 m corridor of the road and rail lines in the LSA, and projected the effects from these sources onto RSA. The results of this assessment indicated that the emissions of $PM_{2.5}$ from the DP3-related traffic would be indistinguishable from the existing ambient concentrations due to background traffic emissions alone. The same would be true for the low SO_2 concentrations even at 10 metres from the roadways. At a distance of 90 metres from the roadway, only the incremental CO concentrations would be measurable through monitoring.

A key issue was raised that the baseline container vessel calls have been projected to decrease from 365 vessels in 2003 to a projected 327 in 2011 due to an average increase in vessel size from 4065 to 4650 TEU and the DP3 Project will only result in an additional 66 vessel calls a year.

In its response, the Proponent advised that expert consultants conducted a container vessel forecast based on two scenarios. The first scenario assumed an average volume of 2458 TEUs handled per vessel in 2003 at Deltaport, and a growth rate of 3.3% per year in average vessel size. Based on Scenario 1, the expert consultants estimated that there would be 389 vessel calls at Deltaport in year 2011. A second scenario was also assessed based on the arrival of one 8000 TEU vessel per week on a hub port call at Deltaport in which 50% of the vessel is discharged and loaded. This would generate a total count of 306 vessel calls. The Proponent considered the second scenario less probable than Scenario 1, but not unreasonable, and would be a near lower limit of the expected number of vessel calls at Deltaport in 2011. The actual number of forecast vessels used for the 2011 air quality effect assessment was 393 vessels. As a result of a navigational effect assessment, four additional ships calls were added to Scenario 1.

The Proponent provided a breakdown of forecast vessel numbers and vessel size for the last five years to put the projected 2011 vessel calls into perspective. Table 29 provides a breakdown of the Port of Vancouver container vessel call statistics for the last five years.

Table 29 Container vessel forecast

POV Container Vessel Call Stats 2000-2004					
	2000	**2001**	**2002**	**2003**	**2004**
Smallest Container Vessel	1,282	1,022	1,076	247**	1,388
Largest Container Vessel	5,652	6,479	6,332	6,332	7,500
Average TEU Capacity	2,809	3,019	3,258	3,448	3,668
Total Vessel Calls	710	676	737	760	704
Total TEU Throughput*	1,167,489	1,151,654	1,465,292	1,547,371	1,664,906

Courtesy of Vancouver Port Authority

*Adjusted for 45 feet = 2.25 TEUs for all years.

**The next size is a 1,561-TEU vessel.

In its Application review comments EC advised that VPA's assumed sulphur contents for non-road, locomotive and ferry diesel, which were based on 2001 data, may be overly conservative (especially for 2006 and 2011) in light of expected reductions in the sulphur content of various diesel fuels. For example, it was noted that the 2011 baseline and Project emissions inventories could have assumed use of 15 ppm sulphur diesel in dockyard equipment and on-road vehicles, because the federal Minister of the Environment has proposed regulations to require non-rail and non-marine diesel fuels to meet this limit by 2010. The Proponent agreed with this advice and stated that the SO_2 emission rates used for the Project air quality assessment for diesel combustion sources are probably conservative, which is valid when considering the potential health effects.

An issue was also raised about the LSA being 30 km x 30 km, centred to the northeast of Roberts Bank and which captured more land than water. The Proponent responded that shifting the LSA so that the Deltaport Project was not centered in the 30 km x 30 km was done to capture more land based receptors at the request of the working group members that reviewed of the draft Study Plan for the air quality effect assessment. This resulted in more land-based emissions being included in the modeling, but less ship-underway emissions that are located offshore. The shift was approximately 4.1 km north and 4.5 km east. Based on DP3 being centered in the LSA, there would be an increase in BC Ferries underway emissions and small increase in transit vessel emissions to Deltaport and Westshore. Dockside and maneuvering emissions would remain the same. However, considering the distance of these Project emissions from shore and the effect of dispersion, the Proponent concluded that the effect of these additional underway emissions is unlikely to be very significant. This was confirmed by additional air quality dispersion modeling conducted by the Proponent that showed ambient air quality concentrations on land did not change.

Several reviewers stated that a new continuous air monitoring station should be located in the vicinity of the port to measure actual emission levels during construction and operation. The Proponent has committed to establish such a monitoring station working with the local municipality and the regional and federal air quality agencies.

Air Quality and Emission Modeling

Review comments from the public, First Nations and some review agencies raised the issue that the air quality assessment was compared to ambient air quality objectives for the purposes of effect assessment. The issue was also raised in the context of the Proponent meeting the federal requirements for continuous improvement.

The Proponent responded that the modeled emissions were compared to all federal, provincial and regional objectives and standards, including adjacent United States objectives, but the effect assessment was based on relative increase in emissions. In addition, a human health and wildlife health risk assessment was conducted regardless of whether the Project emissions were less than objectives or standards. The Proponent is committed to reducing overall air emissions from the Project as well as from all port operations wherever it is technically and economically feasible. This is demonstrated in the following section on mitigation.

During the review, agencies, First Nations and the public raised whether the air quality model was a representative worst-case modeling scenario. According to EC, DP3 operation emissions could peak significantly with ship arrivals or departures, which might potentially coincide with peaks in ferry and/or rail emissions within the LSA. EC requested VPA provide some discussion or analysis regarding whether the assumptions that ship, tug, dockyard equipment and rail emissions will occur uniformly throughout the day, and that ferry emissions will occur uniformly between 5 am and 1 am, led to genuinely worst-case modeled ambient air quality concentrations over short-term averaging periods (e.g., 1-hour averages).

In its response, the Proponent advised that the arrival and departure of trains and container vessels is not tied to a specific time of day. While it is possible that there may be occasions when arrival/departure time may coincide to create a higher rate of emission for a short time period, any such occurrences would be essentially random events, which may or may not coincide with worst-case meteorological dispersion conditions. As such, modeling only the worst-case emission scenario may result in predicted concentrations that are unlikely to occur, according to the Proponent, or may occur with very low frequency.

Regardless, the Proponent undertook an air quality dispersion modeling sensitivity analysis to address a theoretical worst-case air quality scenario. A theoretical emissions scenario was developed that combines maximum possible emissions with movement scheduling of marine vessels and trains that coincides in time as much as possible. In effect, the scenario matches emissions from the largest ships that are expected to visit Westshore Terminals and Deltaport, including the DP3 Project, with the arrival and departure of ships and trains. All other emission sources in the region were also accounted for, by including BC Ferry movements at the Tsawwassen terminal and background air contaminant concentrations from monitoring data. Emissions were modeled for both the Baseline 2011 case and the Baseline 2011 plus the additional emissions from the DP3 Project.

The revised modeling analysis indicated that the simultaneous arrival/departure of a large marine vessel, several ferries and trains in the same hour, in conjunction with the hoteling of four of the largest bulk carriers and container vessels at the Deltaport and Westshore terminals, in addition to the increased container truck traffic and employee traffic, could hypothetically result in much higher 1-hour average concentrations of NO_2 and SO_2 than indicated by the DP3 air quality assessment. The same conditions could produce somewhat higher 24-hour average NO_2 and SO_2 concentrations. Although it is unlikely that such a conjunction of simultaneous ship and train activity would ever actually occur, the revised analysis results support the conclusions of the original modeling analysis that, with the possible exception of 1-hour NO_2 concentrations at a point on the Roberts Bank causeway near the entrance to the terminals, all ambient air quality objectives would still be met throughout the Local Study Area after the completion of the DP3 Project.

Human Health and Wildlife Health Risk Assessment

The Proponent's technical risk assessment consultant included a central risk estimate, presenting changes in mortality and morbidity events attributable to predicted Project effects, related to increases in $PM_{2.5}$ and PM_{10} concentrations in Ladner and Tsawwassen. In response to concerns about annualized effects, the Proponent's technical consultant provided a revised table reporting with annualized effects of PM (see Table 30).

Table 30 Annualized human health effects of $PM_{2.5}$ and PM_{10}

Health Effect	Ladner		Tsawwassen	
	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}
Mortality (annualized)	0.03 (0.004-0.03)	0.03 (0.007-0.04)	0.03 (0.004-0.03)	0.02 (0.004-0.03)
CHA (annualized)	0.01 (0.01-0.02)	0.01 (0.007-0.01)	0.01 (0.01-0.02)	0.01 (0.007-0.01)
RHA (annualized)	0.02 (0.01-0.02)	0.01 (0.01-0.04)	0.02 (0.01-0.02)	0.01 (0.007-0.04)

Note: All risks are based on central estimates, each of which is accompanied by a range of values (in parentheses) that represent the low to high CRFs.
CHA= cardiac hospital admission.
RHA= respiratory hospital admission.
CRF= concentration-response factor

Courtesy of Vancouver Port Authority.

Addressing the risk assessment, the Proponent stated that although the International Agency for Research on Cancer (IARC) has classified diesel engine exhaust as a probable human carcinogen (Group 2A), the IARC recognized that evidence is limited (IARC 1989). The Health Effects Institute (HEI) and the World Health Organization (WHO) have also evaluated the carcinogenicity of diesel exhaust and found that the epidemiological data demonstrate weak associations between exposure to diesel exhaust and lung cancer (HEI 1995; WHO 1996). HEI concluded that the absence of reliable exposure data, the inability to control for various confounding variables, and the inability to confidently estimate a dose-response relationship in the epidemiological studies limited the data's use in quantitative risk assessments (Office of Environmental Health and Hazard Assessment (California), OEHHA 1999). In its 2003 review of diesel engine exhaust, the U.S. Environmental Protection Agency (EPA) stated, "The absence of adequate data to develop a sufficiently confident dose-response relationship from the epidemiologic studies has prevented the estimation of inhalation carcinogenic risk."
The Fraser Health Authority (FHA) also raised questions about the Application's information on PM. According to FHA, health risks were calculated for mortality, respiratory hospital admissions and cardiac hospital emissions and were found to be generally low. It was not clear to the FHA why some of the other Health Events discussed in the Bates et al. (2003) study were not included in the Application.

In its response to the FHA, the Proponent stated that the Application's health risk assessment and *Technical Volume #8* stated that the Bates et al. (2003) study presented CRFs for a number of health effects associated with $PM_{2.5}$ and PM_{10}, including, "mortality, respiratory and cardiovascular hospitalizations, impaired lung function, restricted activity factors and adverse respiratory symptoms". Following the approach used by Health Canada (1999), the quantitative analysis focused on the potential effects on daily mortality rates and changes in the rates of hospital admissions that can be attributed to cardio-respiratory causes.

Cantox Environmental, the Proponent's public health effects consultant, recognized that the local population likely is not large enough "to produce a reasonably precise estimate of the mortality [and morbidity] effect of PM". The material presented by VPA also acknowledged that assuming a non-threshold response, any increase in PM "will enhance the risk of an outcome" (Bates et al. 2003).

In its April 21, 2005 comments, HC raised a number of issues relating to the Proponent's Human Health Risk Assessment (HHRA). Some of these comments are covered above under the discussion of FHA's Application review comments. Other HC review issues are discussed below.

HC raised the issue of ground-level ozone formation that was semi-quantitatively determined in the Air Quality Assessment, but was not included as a "chemical of potential concern" in the HHRA.

In its responses, the Proponent stated that ozone generation was assessed qualitatively. Quantitative ozone modeling is an extremely complex process and was not undertaken as part of the air quality assessment. Although ambient ozone concentrations were not predicted, the potential formation of ozone was semi-quantitatively assessed based on the total emissions of ozone precursors. The maximum 8-hour ozone concentrations observed at the three stations in the LSA were less than the Canada-wide Standard and GVRD proposed objective of 130 $\mu g/m^3$. The Proponent also predicted the effect of the Project Operation emissions on regional concentrations of ground-level ozone to be less than 0.5%. The effect rating for the regional ozone formation was classified as low by the RAs, and for these reasons, ozone was not included as a "chemical of potential concern" in the HHRA.

8.3.3 Mitigation

General

The effects of emission and concentration changes due to the operation of the Project are evaluated as "low" except for SO_2 which is moderate based on the worst case scenario. The Proponent proposed a number of mitigation measures in the Application to reduce air emissions and, based on the Application review, has agreed to undertake further mitigation measures. These mitigation measures are summarized below. These undertakings are reflected in the *Owner's Commitments and Assurances*, enclosed as *Appendix A* to this report. The mitigation measures that the Proponent has committed to are best available emission-reducing practices and technologies, and satisfy BC and Canada (as decision-making "jurisdictions") that the Continuous Improvement provision of the Canada-wide Standards for PM and Ozone is being met.

Design

The Proponent commits to the incorporation of infrastructure for shore power for ships in the Project design and construction. Further the Proponent commits to complete a feasibility study for shore-based power within 8 months of Project approval. The feasibility study will identify the ships currently calling on the Port of Vancouver capable of connecting to shore power, their power requirements as well as a forecast for the container shipping industry future shore power capabilities and proposed timelines and targets for conversion.

Construction

The Proponent, through the tendering for the DP3 Project, will implement air quality initiatives that will be undertaken during construction to reduce emissions where possible, as follows:

- On-road diesel fuel will be included in bid tenders for use in off-road construction equipment.
- Diesel particulate filters and/or other appropriate retrofits where possible (such as automatic anti-idling shut-offs) will be used on all construction equipment and construction vehicles.
- Covered road vehicles will be used in the transport of bulk fine materials to and from the Project site.
- Paved sections of the worksite and roads that are subject to accumulations of dust will be wetted/cleaned on a regular basis.
- A worksite speed limit will be put in place to further reduce dust.
- An ongoing program of worker education will be implemented to address:
    - Engine idling reduction (including provision for automatic anti-idling shut-off mechanism, if feasible);
    - Operation of equipment at optimum rated loads;

- Routine equipment maintenance procedures;
- Options to reduce construction worker trips (i.e., carpooling, transit, other non-polluting transportation modes);
- Visual inspections of the Project site on a daily basis for potential dust and odour issues; and
- Potential for effects from equipment exhaust, dust and odours.

Operations

- The Proponent will ensure the Terminal Operator uses ultra-low sulphur diesel in off-road terminal equipment. The Proponent will ensure the use of diesel oxidation catalysts in all Deltaport terminal equipment, where practicable.
- The Proponent will ensure the Terminal Operator completes the test of hybrid-powered rubber-tired gantry cranes (RTGs) at Vanterm and if the test is successful, ensure that the Terminal Operator retrofits existing RTGs at Deltaport.
- The Proponent commits to ongoing improvement of the truck reservation system to reduce truck waiting times and idling.
- The Proponent ensures it will continue to require operators of non-reservation trucks to shut down their engines while waiting in queue during times when the Deltaport Terminal gates are closed and to the implementation of extended terminal gate operating hours to reduce congestion and emissions from container trucks calling on Deltaport.
- The Proponent commits to using mechanisms, such as the truck licensing system, to implement strategies to reduce truck emissions such as promoting the use of the newest and cleanest trucks, as well as the use of retrofit technologies for trucks making frequent visits to Deltaport.
- The Proponent commits to working with the railways to develop an Operational Rail Emission Reduction Program for Roberts Bank.
- The Proponent commits to assessing a differential port tariff system where cleaner ships (less emitting) calling on the Port of Vancouver are charged lower fees as a reward system to encourage a reduction in marine vessel air emissions.
- The Proponent commits to undertaking a speed assessment of marine vessels approaching Roberts Bank with the intent of lowering vessel approach speeds to reduce potential effects on marine mammals and air emissions.
- The Proponent confirms its willingness to continue to actively work with other ports, industry, regulators and other organizations to influence the International Maritime Organization (IMO) to create an "SO_x Emission Control Area" (SECA) for the west coast where vessels must use fuel oil with a sulphur content of no more than 1.5% (or use equivalent emission control technology) by 2009.
- The Proponent must ensure the Terminal Operator commits to the incorporation of infrastructure for shore power for ships in the Project Design and construction. Further the Proponent commits to complete a feasibility study for shore based power with in 8 months of the completion of the Project EA determination.

These proposed mitigation measures are also reflected in the *Owner's Assurances and Commitments* (*Appendix A* of this report). In addition, the Proponent has undertaken the commitment to locate a representative air quality monitoring station in Delta, in consultation with GVRD and COD.

8.3.4 Residual Effects

Based on the application of the proposed mitigation the RAs have determined that residual effects of the Project on air quality will be low. The RAs are satisfied that the Proponent has met the provisions for Continuous Improvement under the Canada-wide Standards for PM and Ozone by engaging in best practices to mitigate air emissions from the proposed Project. Because there has been a residual effect identified for this component, it has been included in the cumulative effects assessment (see Chapter 16).

8.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS

During this cooperative environmental assessment, the EAO, the RAs and the working groups have considered: the Application; comments from government agencies, First Nations and the public on the potential effects of the Project; responses by the Proponent; and the discussions of the working groups.

Based on the information summarized in this CSR and provided that the Proponent implements the actions described in the *Owner's Commitments and Assurances* as listed in *Appendix A* of this report, the RAs are satisfied that the DP3 Project will not likely result in significant adverse effects on air quality and human and wildlife health in the study areas.

9. Noise Impacts

9.1 GENERAL

The Proponent identified and analyzed the noise impacts of the DP3 Project by examining: ambient noise levels in the vicinity of the study area; noise emissions from the construction and operation of the Project (including road and rail traffic noise within a defined area); and the measures proposed to mitigate potential noise impacts.

9.2 BACKGROUND

9.2.1 Study Area

The study area used to assess noise emission and impacts from construction and operation of the DP3 Project included the Roberts Bank port facilities and causeway, residential communities adjacent to the BC Rail line extending east as far as 156th Street, Surrey, and residential areas in close proximity to the shoreline extending from the Roberts Bank causeway southward to the Tsawwassen Beach residential area. This study area is depicted in Figure 16.

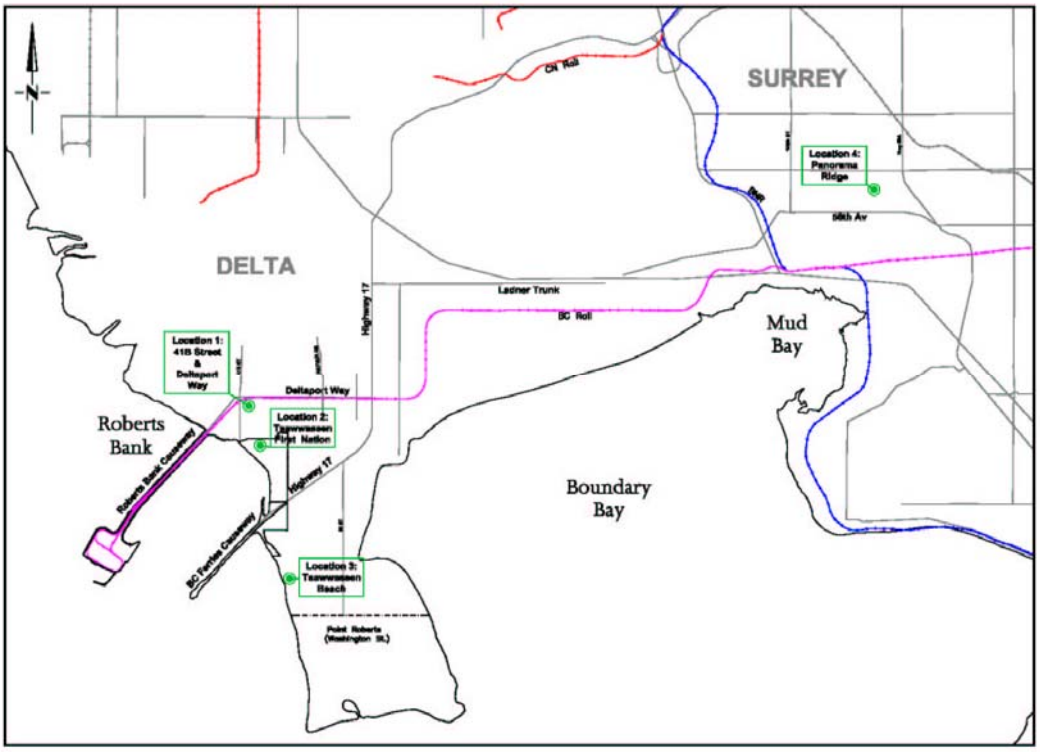
The shoreline north of the Roberts Bank causeway was not included since land use in this area is primarily agricultural rather than residential and therefore it is much less sensitive to noise. Residential communities to the east (Panorama Ridge, Colebrook, Woodwards Hill and Sullivan) were included in the assessment because they overlook the rail line, which serves Roberts Bank almost exclusively. Residential areas further east, such as in Langley, are exposed to a mix of rail traffic serving both Roberts Bank and other areas.

9.2.2 Existing Environment

The study area is currently subject to noise emissions from existing port operations, road traffic, rail traffic from the BC Rail line and from the BC Ferries causeway and terminal. Noise from the existing Deltaport container terminal results from:

- loading and unloading of containers from trucks, trains and ships by quay cranes, straddle carriers, gantries, forklifts and reach stackers;
- movement of containers within the terminals; and
- transportation of containers on trucks and trains to and from the terminal.

The existing noise environment was assessed by the Proponent on the basis of information received from TSI (the existing container terminal operator), from the Corporation of Delta and local residents; a review of previous noise studies undertaken in the vicinity of the study area; and noise measurements undertaken as part of the current DP3 Project EA. According to the Proponent's technical consultant, the basic unit of measurement in acoustics is the decibel (dB) which represents a logarithmic ratio of the pressure variation in air relative to a reference pressure. Audible sound occurs over a wide frequency range from approximately 20 Hertz (Hz) to 20,000 Hz but the human ear is less sensitive to low and very high frequency sounds than to sounds in the mid frequency range (500-4000 Hz). "A-weighting" networks are commonly employed in sound level meters to simulate the frequency response of human hearing and A-weighted sound levels are often designated "dBA" rather than "dB".



Courtesy of Vancouver Port Authority

Figure 16 Noise assessment study area

Ambient noise levels were recorded in the study area at the nearest potentially affected residential receivers and at four identified locations. Ambient noise levels were used to assess impacts of construction and operation of the Project on the noise environment.

Ambient noise levels recorded from the four unattended noise loggers for a continuous 48-hour period ranged from 43 dBA at the BC Ferry causeway on May 19, 2004 to 62 dBA as a result of rail traffic at 41B Street on June 1, 2004.

Noise levels from the alarms on ship-to-shore gantry cranes and on rail mounted gantries were also monitored and were, according to the Proponent, well below the ambient noise levels at both shoreline locations. Virtually all of the sound energy emitted from both types of alarm is in the high frequency range. This provides a very clear and distinguishable signal for nearby workers, but according to the Proponent the resulting levels are very low at shore receiver locations because high frequency sound is attenuated very rapidly by atmospheric absorption.

9.2.3 Proponent's Assessment of Impacts

Noise impacts on people in the vicinity of industrial sources can occur in two ways. Noise levels above a certain threshold can interfere with activities such as communication and sleep. Noise levels that intrude above ambient noise levels can cause annoyance regardless of the ambient noise level. Either of these types of noise impact can cause stress and contribute to physical and/or mental health effects.

Health Canada recommends a L_{eq} noise limit of 45 dBA for interior rooms where speech communication is important. In addition, the former Health and Welfare Canada (1989) recommended a L_{eq} of 40 dBA for bedrooms to avoid sleep disturbance. Modern homes with doors and windows closed attenuate exterior noise levels typically by 20 to 25 dBA or, with windows partially open by about 15 dBA. Based on an attenuation of 20 dBA, these interior criteria would be satisfied as long as the following external L_{eq} noise limits are not exceeded:

- day time (satisfactory communication), L_d ≤65 dBA; and
- night time (sleep disturbance), L_n ≤ 60 dBA.

Increases in ambient noise can cause annoyance even if the values listed above are not exceeded.

One widely accepted method of assessing noise impacts on residential communities is to measure or predict noise levels in terms of the Day-Night Average Noise Level (L_{dn}), which is similar to the $L_{eq}(24)$ except that night time noise is penalized by 10 dB to account for the fact that residents are more sensitive to noise at night. To account for specific characteristics of the noise such as impulsiveness or tonality, the L_{dn} is then adjusted using "normalizing" or "rating" factors and the rated L_{dn} is designated as L_{Rdn}. Finally, the percentage of the community likely to be "highly annoyed" is calculated based on the predicted increase in L_{Rdn}. This approach, supported by the World Health Organization, provides a good overall indication of noise impact.

Table 31 lists increases in ambient noise levels in terms of the L_{Rdn} and the resulting impact in terms of annoyance to residents.

Table 31 Annoyance criteria and the resulting impact on residents

Increase in Ambient Noise Levels due to the Project	Impact Significance
Up to 1 dBA	No Significant Impact
>1 dBA to 3 dBA	Minimal Impact
>3 dBA to 6 dBA	Modest Impact
>6 dBA to 10 dBA	Significant Impact

9.2.4 Construction Noise Impacts

The Proponent's predictions of construction noise emissions from the proposed DP3 Project have been made in accordance with *Transit Noise and Vibration Assessment* (Federal Transit Administration 1995). The noise matrix used to describe construction noise is the L_{eq} (or if night time activity is involved, the L_{dn}). Documented noise levels for various types of equipment, measured at a reference distance of 15 m are adjusted according to their "Usage Factors" to account for the fact that most equipment does not operate continuously at full power. The adjusted L_{eq} values are then combined to give the total source level for all of the equipment. Finally, the total source level at the reference distance is corrected to the actual source-to-receiver distance, taking into account applicable attenuation factors such as geometric spreading, atmospheric absorption, ground effect and shielding by barriers.

According to the Proponent, the predicted noise levels resulting from both night time and day time construction activities would result in an increase of ambient noise levels of less than 1 dBA and have no significant impact at residential receiver locations in terms of the annoyance criteria specified in Table 31. An increase in the ambient noise level of 1 dB would not exceed the external noise thresholds at any of the four residential receiver locations considered in the DP3 Project EA review.

Backup alarms on construction equipment are also expected by the Proponent to have insignificant impact at residences in the vicinity of the study area. Assuming source levels of up to 85 dBA at 15 m with predominant tones in the 1,000 Hz octave band, a backup alarm would produce a noise level of 31 dBA at the nearest receiver location (Tsatsu Shores condominiums) under the sound propagation conditions assumed by International Organization for Standardization (ISO) 9613-2. Propagation of construction noise over water during unusual atmospheric conditions, for example a strong inversion, could result in higher levels than those predicted using ISO 9613-2. Such anomalous conditions are generally short-lived and would have little effect on long-term L_{eq} values according to the Proponent.

Most of the fill material required for construction of the Project would be brought in by barge. The number of trucks required to deliver material to the site would be low relative to the existing container truck traffic serving the existing terminal. The Proponent has predicted that the maximum contribution to ambient noise levels from construction traffic would be less than 1 dBA. An increase of less than 1 dBA would, according to the Proponent, have no significant impact on residential receiver locations in terms of the annoyance criteria specified in Table 31.

9.2.5 Operation Noise Impacts

The following noise sources were considered in the prediction of operational noise levels for the DP3 Project:

Trains:
The number of trains visiting the port is expected to increase from 18 to 21 movements per day. However, 23 trains were modeled as a worst-case scenario. The combined length of trains is also expected to increase.

Traffic:
Truck traffic is expected to increase from 1,800 to 2,400 movements per day by 2011. Passenger car traffic is expected to increase from 2,100 to 2,600 movements per day by 2011.

Container ships:
The number of container ships using Deltaport is expected to increase from 365 in 2003 to 393 per year with the Deltaport Third Berth Project operating at full capacity in 2012.

Additional container handling equipment:
Additional equipment would include ship-to-shore gantry cranes, rubber-tired gantries, rail mounted gantries, numerous tractor trailers and other related equipment.

The Proponent predicts that the only source of Project noise expected to increase the L_{eq}, L_{dn} or L_{Rdn} by a noticeable amount is rail noise. Trucks serving the container terminal operate between 7:30 am and 4:00 pm and since Deltaport Way runs alongside the rail lines, truck noise was considered not significant by the Proponent, relative to rail noise (i.e., truck noise is 10 dB below train noise and therefore would add only 0.1 dB to train noise). Alarms for the additional ship-to-shore gantries might occasionally be audible at shoreline locations even though their sound levels are expected to be below ambient noise levels. Considering the infrequent occurrence and low levels, the Proponent does not expect that this source of noise will increase long term L_{dn} values, even with a 5 dB rating factor applied to account for tonal components.

The Proponent predicts that rail noise level increases will be very small: between 1 dBA and 2 dBA, because additional rail traffic represents a small percentage increase relative to the existing traffic. Although increases of 1 dBA and 2 dBA are not normally perceptible to the human ear, they would marginally increase existing levels that are already considered excessive by some residents.

The Proponent also conducted a sensitive receptors impact assessment. Hospitals, seniors residences, schools, and day care centres are usually considered to be somewhat more sensitive to noise than most other receptors. Although there are no hospitals, seniors residences or schools at locations likely to be affected by noise from the Project, homes that provide day care service are in the proximity of Location 2 (the TFN noise monitoring site). The rationale for considering day care centres to be particularly sensitive to noise is presumably that children would be sleeping during the day time, when noise levels are often higher than at night.

To provide an acceptable sleeping environment, the interior L_{eq} should not exceed 40 dBA (Health and Welfare Canada 1989). The house containing the day care was constructed within the past few years and is likely to provide an exterior to interior noise reduction of 20 to 25 dBA with windows closed. The average day time L_{eq} measured over a 2-day period at this location

was 57 dBA and this is expected to increase to 58 dBA as a result of increased train traffic due to the Project. Interior levels should, therefore, be well below the 40 dBA criterion.

Low frequency noise levels above 85 dB in the 31 Hz and 63 Hz octave bands were observed periodically at Location 2 and this has the potential to excite lightweight building elements such as windows. These noise events may be attributable to rail car impacts although the Proponent was unable to identify the precise source. The susceptibility of any particular house to shaking or rattling due to low frequency noise will depend upon the exact level and frequency of the noise, the construction of the house, location of the house, and in the case of windows, their orientation relative to the noise source. However, the measured noise levels together with reports by residents of window rattling / house shaking, provide a good indication that occasional, relatively severe rail impacts are likely to result in noticeable structural excitation of at least some houses. The closer a house is to the source of these impacts, the more noticeable and frequent the response will be. This phenomenon is likely to occur at locations close to the rail line, such as Location 1, throughout the northern half of the TFN residential community and possibly beyond.

9.3 ANALYSIS

The RAs considered the information provided by the Proponent, including the Proponent's conclusions on potential effects and the method used to reach those conclusions as outlined above in sections 1 and 2 of this chapter. The RAs then conducted their own analysis of the potential effects and proposed mitigation measures before independently reaching conclusions on the residual effects.

9.3.1 Potential Effects

The potential effects due to construction activities related to the DP3 Project including additional noise from construction equipment operating based on a 24 hour, seven day per week schedule. According to the Proponent, the predicted noise levels resulting from both night time and day time construction activities would result in an increase of ambient noise levels by less than 1 dBA at residential receiver locations.

The DP3 Project would result in additional ships, trains, trucks, and terminal activity but the only source of operational noise that is expected to have a potential effect or raise annoyance on residential receiver locations is noise associated with rail operations. Alarms for the additional ship-to-shore gantries and terminal equipment may occasionally be audible at shoreline locations even though their sound levels are likely to be below ambient noise levels.

9.3.2 Issues

Few issues were raised by the public or reviewing agencies pertaining to noise effects from construction activities at the Project site. Most comments submitted by the public, First Nations and agencies regarding noise were related to traffic issues (road and rail) during the construction and operational phases of DP3. This included some views on the Project's potential to produce adverse noise and effects on public health. Residents in the Tsawwassen area mentioned Roberts Bank operational noise effects and most members of the public voiced concern over increased rail noise along the rail corridor and truck noise along Highway #17.

To address noise effect issues, the Proponent has committed to organizing a Community Liaison Committee with a sub-committee to address noise that will include the Proponent, the Terminal Operator and the railways as participants. The specific focus of the sub-committee will be on noise effects and public concerns. The terms of reference for this sub-committee will be developed by the Proponent in consultation with government regulators, First Nations and COD. The sub-committee would assist in the development of a Noise Management Plan containing environmental management measures to assess and minimize noise from construction and operations at Roberts Bank, including the proposed DP3 Project. The Proponent has also

committed to ensure that DP3 is constructed and operated with due attention to measures that will mitigate any adverse public health effects.

9.3.3 Mitigation

Construction

Noise levels from both night and day time construction activities, apart from movement of construction equipment and trucks on Highway #17 and Deltaport Way, are expected to be temporary and low (at residential receiver locations). The distance to residential areas makes the incremental noise effect hardly detectable. Although construction may proceed based on a 24-hour schedule, the Proponent will ensure noise during construction meets acceptable levels outlined in the applicable Delta Community Bylaw and Standards. Further, the Proponent will develop a Noise Management Plan for the construction of the Deltaport Third Berth Project and this would be incorporated into the Construction EMP for the Project and include the following:

- *Machinery noise control* – Given that construction noise effects are predicted to be minimal, no special silencing requirements for diesel-powered machinery are required. However, a maximum allowable noise emission from each type of machinery will be set prior to construction to ensure that contractors do not utilize any excessively noisy equipment (i.e., equipment that is significantly noisier than the typical equipment assumed in the noise prediction calculations).
- *Awareness and training* – Provision of training to ensure that construction workers are aware of the noise created during construction and are appropriately trained to minimize noise where possible.
- *Noise Complaints* – A management procedure, such as a 24-hour helpline, will be put in place to deal with noise complaints that may arise from construction activities. Each complaint would be investigated and appropriate noise amelioration measures established to mitigate future occurrences.

Operation

The main source of operational noise that is expected to have an effect or cause annoyance at residential receiver locations is that associated with rail operations (e.g., noise generated by diesel engines, train shunting and whistles). At the terminal, alarms for the additional ship-to-shore gantries and terminal equipment may occasionally be audible at shoreline locations even though their noise levels are likely to be below ambient noise levels.

A Noise Management Plan would be included in the Operational EMP for DP3. Mitigation measures for terminal operations would include:

- *Equipment Alarms* – Alarms on new ship-to-shore gantry cranes and rail mounted gantries would be purchased with bells that operate at a higher frequency to ensure that the “alarms” would be consistently inaudible on shore.
- *Operator Awareness and Training* – Operator awareness and training would be regularly conducted by the Terminal Operator. Good training and awareness of noise issues would be implemented to minimize noise associated with the operation of the proposed Deltaport Third Berth Project.

To address rail noise, the Proponent has committed to organizing a Community Liaison Committee with a sub-committee to address noise that will include the Proponent, the Terminal Operator and the Railways as participants. The specific focus will be on noise effects and public concerns. The terms of reference for this committee will be developed by the Proponent in consultation with government regulators, First Nations and COD. The sub-committee would assist in the development of a Noise Management Plan which would include environmental management measures to assess and minimize noise from operations at Roberts Bank, including the proposed DP3 Project.

Potential noise effects from increased container truck traffic during operation, including possible traffic congestion and increased engine idling particularly on Highway #17, will be addressed through a highway noise mitigation plan that was approved by the Ministry of Transportation. The mitigation commitments made by the Proponent are detailed in the *Owner's Commitments and Assurances*, enclosed as *Appendix A*. The specific traffic-related commitments for Highway #17 include:

- Implementing signal modifications at Highway 17/Ladner Trunk Road, as appropriate and approved by Ministry of Transportation (MOT) and COD;
- Extending high occupancy vehicle (HOV) lanes on Highway #17: and
- Monitoring of pre-and post construction noise.

9.3.4 Residual Effects

Based on the application of the proposed mitigation, the RAs have determined that residual effects of noise associated with construction of the Project will be temporary and low, and the residual effects of noise during operations of the Project will be low at residential receiver locations. Because there has been a residual effect identified for this component, it has been included in the cumulative effects assessment (see Chapter 16).

9.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS

During this cooperative environmental assessment the EAO, the RAs and the working groups have considered: the Application; comments from government agencies, First Nations and the public on the potential effects of the Project; responses by the Proponent; and the discussions of the working groups.

Based on the information summarized in this CSR and provided that the Proponent implements the actions described in the *Owner's Commitments and Assurances* as listed in *Appendix A* of this report, the RAs are satisfied that the DP3 Project will not likely result in significant adverse noise effects within the Project's study area.

10. Visual Impacts

10.1 GENERAL

The visual impact assessment resulting from the construction and the operation of the DP3 Project was carried out through an analysis of the existing visual environment, the use of visualizations of the proposed Project from representative viewpoints, and the assessment of visual impact from representative viewpoints in the vicinity of the development.

10.2 BACKGROUND

10.2.1 Study Area

The study area, defined by the Proponent, matches that included in the visual landscape inventory that was undertaken as part of the visual landscape impact assessment for the Project. The visual landscape inventory includes the Roberts Bank port facilities; the Roberts Bank terminal causeway; the TFN village; the BC Ferries causeway; the BC Ferries terminal; the North Tidal Flat; the Central Tidal Flat; the South Tidal Flat; the Dyke; the Outer Dyke; the Agricultural Land; the Upper Tidal Grassland; Tsatsu Shores; High English Bluff; and Low English Bluff.

10.2.2 Existing Environment

A visual landscape inventory was undertaken as part of the visual landscape impact assessment for the Project. Several viewpoints representative of the existing view environment were inventoried. These included the existing view of the Roberts Bank port facilities that includes Deltaport, a 65 ha (160 acre) container terminal, and Westshore Terminals, a 50 ha (125 acre) bulk handling coal facility. This is a dominant visual feature from a number of land use areas. From low elevation viewpoints, the most visible features at the facility are the 6 gantry cranes at Deltaport. The second most prominent feature is the ships that occupy the 2 berths at the terminal. The third most visually prominent feature at the facility are the coal piles at the bulk handling coal facility, and the multi-coloured shipping containers stacked up to 5 high at Deltaport. These are even more visible from higher elevation viewpoints. The Roberts Bank causeway is accessed from an elevated road that passes over the railway tracks. The causeway serves rail and truck traffic to the Roberts Bank port facility. There is limited public use of the causeway. The primary visual consideration related to the Roberts Bank causeway is the view of it from public use areas such as the TFN Village. From close to the shoreline the base of the rip rap is obvious. From the shoreline and points farther away, the rail cars are often silhouetted. The overhead power line located along the causeway is also visible from some distance.

The other major view feature is the BC Ferries causeway that accommodates high levels of traffic destined for the BC Ferries terminal. The speed of traffic is typically high and there are open views to the north and south. The Roberts Bank port facility is a dominant feature to the north. There are 2 pullouts along the BC Ferries causeway; 1 near the shore and another just prior to the terminal. The BC Ferries terminal consists of vehicular gates and large paved holding areas for vehicles, a small pedestrian entry building, some small buildings with viewing towers, small patches of grass, paving and play structures for pedestrian use, and the ferry berths connected to the entry building with overhead walkways. The BC Ferries terminal supports high levels of use. Once inside the terminal, views are mostly internal and there is little exposure to the view of the Roberts Bank port facility.

Situated in between the port and ferry causeway is the TFN Village which is a small community including some homes and small businesses, the TFN Band Office, Longhouse, and a Youth Centre. The marine area, the Roberts Bank port facility, and the BC Ferries terminal are most visible from the Band Office and Youth Centre since they are located on the west side of the road that passes through the village. The other major view features are the tidal flats. The North Tidal Flat is located north of the Roberts Bank causeway. It is a large mudflat that is exposed during

low tides and under water at high tides. There is very low public use of this area since it is not close to a large population centre or recreation use area. The South Tidal Flat is the primary public use area in the vicinity. The Central Tidal Flat is located between the Roberts Bank and BC Ferries causeways. It is a large mudflat that is exposed during low tides and under water at high tides. There is very low public use of this area since it is not close to a large population centre or recreation use area.

10.2.3 Proponent's Assessment of Impacts

Methodology

The procedure for assessing visual impact, used by the Proponent, was based on the evaluation of two components:

- Viewer considerations – primary factors are the number of viewers, duration of view, and angle of view; and
- Actual visual impact – primary factors are the distance and the proportional increase in the view occupied by the terminal.

Each factor above was rated individually by the Proponent, and viewer considerations were determined by the number of viewers and duration of the view.

In order to assess the potential visual impacts of the DP3 Project, 4 representative viewpoints based on community and public use areas and on the distance and angle from the proposed development were identified. The 4 viewpoints were selected to provide a representative sampling of the various viewing conditions in the study area:

1. North Dyke – represents views from the north;
2. TFN Band Office – represents the TFN village perspective (based on consultation with the TFN);
3. BC Ferries causeway pullout – closest viewpoint from which the facility is seen by the public; and
4. Fred Gingell Park on the English Bluff hillside – represents views of park users and residents to the south.

Visual Impact Assessment

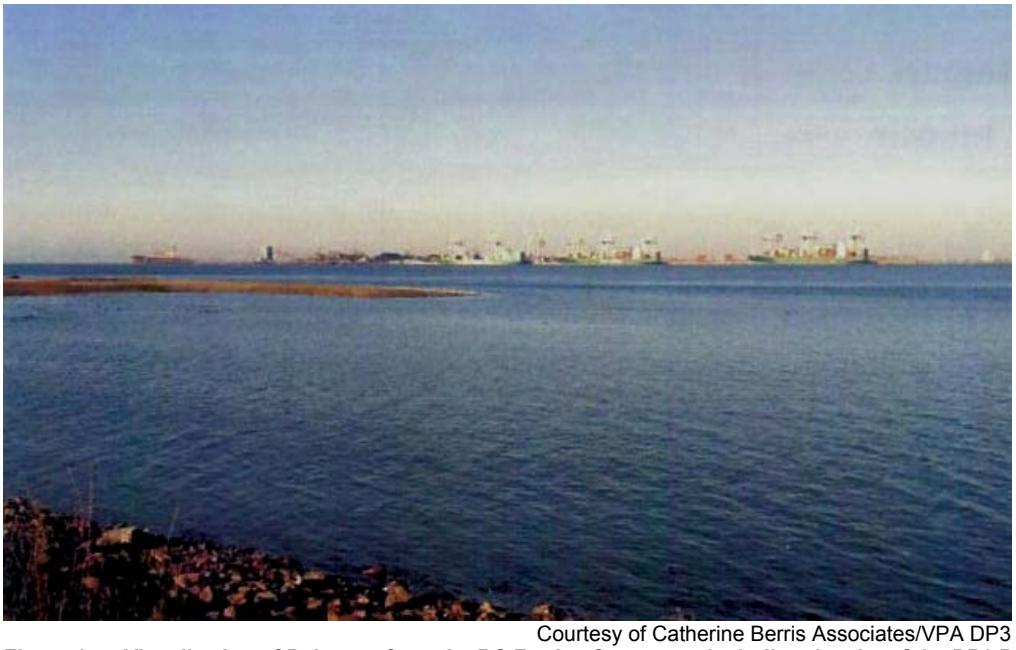
The summary of this visual impact assessment and overall rating, as determined by the Proponent, is included in Table 32 below. The visualization of Deltaport, including the site of the proposed expansion, is included in Figure 17.

Discussion of lighting effects is included in Chapter 11 – *Lighting Effects*.

Table 32 Summary of visual impact assessment ratings

Viewpoint	Viewer Considerations	Actual Visual Impact	Overall Visual Impact
1. North Dyke	Low	Low	Low
2. TFN Office	High	None	Low
3. BC Ferries Causeway	Low	High	Moderate
4. Fred Gingell Park	Low	Moderate	Low

Courtesy of Vancouver Port Authority



Courtesy of Catherine Berris Associates/VPA DP3 EA Application

Figure 17 Visualization of Deltaport from the BC Ferries Causeway, including the site of the DP3 Project

10.3 ANALYSIS

The RAs considered the information provided by the Proponent, including the Proponent's conclusions on potential effects and the method used to reach those conclusions as outlined above in sections 1 and 2 of this chapter. The RAs then conducted their own analysis of the potential effects and proposed mitigation measures before independently reaching conclusions on the residual effects.

10.3.1 Potential Effects

The potential effects of project construction and operation on the visual landscape through alterations of views and aethestics. VPA proposes to have the terminal operator install three additional Super Post-Panamax container gantry cranes for the Project, similar to those already operational at Deltaport. There will also be a need for more rubber-tired gantries and high mast lighting towers. In addition to a third container ship that could berth concurrently with two other vessels at the facility, there will be a changed visual impression looking out at the existing Roberts Bank operations.

The visual effect of the Project would vary depending on the viewing distance, relative number and type of viewers, duration and angle of view, and the increased portion of the view that the expanded terminal would occupy. The visual effect of the Project would be low from north dyke, the TFN Band Office, and from Fred Gingell Park. A low number of the general public would view the Project from north dyke, over a long distance (greater than 3 km), for a moderate duration. A moderate number of the TFN community would view the Project from the TFN Band Office over a long distance (greater than 3 km), for a moderate duration. Similarly, a low number of the general public and a moderate number of residents would view the Project from Fred Gingell Park and High English Bluff over a long distance (greater than 3 km), at an obtuse angle, for a moderate duration.

The visual effect of the Project from the BC Ferries causeway would be moderate largely because the Project would take up more of the view from this viewpoint. While a high number of motorists would view the DP3 from this vantage point, their typical duration of view would be low

(less than 5 minutes). All views of the Project would be seen within the context of the existing Roberts Bank port facility.

10.3.2 Issues

As discussed in section 10.3 above, adverse visual effects resulting from the DP3 Project were raised as an issue by the COD, the Boundary Bay Conservation Committee (BBCC), TFN community members, and interested members of the public, including the Tsatsu Shores Homeowners' Corporation. The visual effects of the proposed Project are varied and include such issues as nuisance glare emitted from the facility and the visual effect that might occur depending on the viewing distance, relative number and type of viewers, duration and angle of view and the increased portion of the view that the terminal would occupy.

The reviewers commented that the methodology used for the assessment was inappropriate, given their opinion that the study area used was too small, the viewpoints were not representative, and the findings and significance of the assessment were invalid or inappropriate.

In its responses to these issues, the Proponent noted that the study area was developed in consultation with agencies, First Nations and members of the public. Further the viewpoints presented the locations with the most viewers and those with the greatest potential for change as a result of the Project using Super Post Panamax container cranes. The Proponent also noted that visual effect assessments are subjective, and rely on relative measures. The Proponent has committed to working with the local community to identify the needs for mitigation of visual effects during operation of the DP3 Project.

10.3.3 Mitigation

The assessment by the Proponent of the potential visual effects during construction concluded that there were no methods available to mitigate visual effects during the construction of the Project. However, the visual effects associated with the finished and operational terminal, including gantry cranes and terminal equipment, ships, high mast terminal light standards and container stacks will be addressed through a proposed Community Liaison Committee (CLC). Mitigation measures suggested by the Proponent which will be discussed by the CLC may include gantry crane colour and the establishment of a landscape buffer strip (consisting of native vegetation) to be established, where practical, along the outer edge of the Roberts Bank causeway.

10.3.4 Residual Effects

Based on the implementation of the proposed mitigation the RAs have determined that there will be no residual effects of the Project on the visual environment.

10.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS

During this cooperative environmental assessment the EAO, the RAs and the working groups have considered: the Application; comments from government agencies, First Nations and the public on the potential effects of the Project; responses by the Proponent; and the discussions of the working groups.

Based on the information summarized in this CSR and provided that the Proponent implements the actions described in the *Owner's Commitments and Assurances* as listed in *Appendix A* of this report, the RAs are satisfied that the DP3 Project will not likely result in significant adverse visual effects in the vicinity of Roberts Bank.

11. Lighting Effects

11.1 GENERAL

An assessment was made of existing lighting at the Roberts Bank port facilities and its impact at various representative viewpoints in the vicinity of the facilities. This information was used to evaluate any potential effects from lighting at the proposed Project.

11.2 BACKGROUND

11.2.1 Study Area

The study area is identical to that used for the visual impact assessment discussed in Chapter 10 – *Visual Impacts*, which includes the Roberts Bank port facilities; the Roberts Bank terminal causeway; the Tsawwassen First Nation (TFN) village; the BC Ferries causeway; the BC Ferries terminal; the North Tidal Flat; the Central Tidal Flat; the South Tidal Flat, the Dyke; the Outer Dyke; the Agricultural Land; the Upper Tidal Grassland; Tsatsu Shores; High English Bluff; and Low English Bluff.

11.2.2 Existing Environment

The present lighting installations at the Roberts Bank port facility consist of two light sources: high pressure sodium lamps; and metal halide lamps.

High pressure sodium lamps have a higher lumen/watt (light out to power in) ratio than other light sources and therefore have a lower operating cost. Some sacrifice is, however, made in colour recognition. This is typically not an issue where visual tasks are restricted to general recognition of shapes and obstructions rather than identification of small items or print. High pressure sodium lamps on high-mast poles are used to illuminate the container yards at Deltaport, the inter-modal yards and portions of the Roberts Bank causeway.

Metal halide lighting has a slightly lower lumen/watt ratio than high pressure sodium lamps, but colour recognition is better, according to the Proponent. This type of lighting is therefore used in areas where critical visual tasks are required. Metal halide lighting is used on container loading equipment at the facility.

The Roberts Bank port facility is illuminated to a calculated average maintained level of 50 lux with an average to minimum uniformity ratio of 2.2:1. This basically meets the minimum requirements set by the Canada Labour Code, which requires a lighting system to provide a 2:1 average to minimum uniformity ratio, and an average maintained illumination of 50 lux. High pressure sodium lamps (floodlights) mounted on 35-m poles are used to illuminate the container and intermodal yards at the Roberts Bank port facility. Red aviation warning lights and surveillance cameras are also mounted on floodlights at the facility. Typically there are 12 to 16 luminaires on each pole, with lights aimed at various angles up to a maximum of approximately 68°. As defined by the manufacturer, the existing luminaires have a cut-off distribution when the aiming angle is set to less than 62.5°, with semi-cut-off and non-cut-off distribution above 63°. The use of floodlights which are aimed at angles greater than the published cut-off angle can cause visual disturbance (light trespass, excessive brightness and glare) at surrounding properties.

The existing lighting systems at the Roberts Bank port facility gives rise to complaints (due mainly to nuisance glare, brightness and light pollution) from the closest neighbours 3 km away and as far as Saturna Island, approximately 25 km to the southwest of the port facility. In order to balance the requirements for the lighting design, economics, and site conditions, lighting designers will sometimes find it necessary to maximize the aiming angles to provide illumination beyond the cut-off angles in order to minimize the number of poles, and locations used.

The ship-to-shore gantry cranes, which are used to load and unload shipping containers, have their own lighting systems mounted on the gantry arms. When the arms are raised or lowered, the view of the facility changes as seen from local residences, causing visual disturbance. The gantry arms are outfitted with red aviation lights, as well as white flashing warning lights, for day use.

The Terminal Operator has installed a lighting control system on the arms of the ship-to-shore gantry cranes to automatically shut the lighting off after 15 minutes when the arm is raised. However, it would appear that these controls have been overridden as field observers have not been able to confirm the automatic shutoff is working. This issue has been reviewed with the Terminal Operator.

Lighting on the gantry crane superstructure (main support column) is used to raise the illumination level around the perimeter of the crane for worker and vehicle safety. This lighting is of a floodlight nature, which spills light around the crane and also reflects off the white paint of the equipment, compounding the brightness effects on the surrounding residents.

The Roberts Bank causeway consists of a 2-lane, undivided road (Deltaport Way) and is for the most part un-illuminated. The exception is at intersections where localized lighting and traffic signals are installed, as well as at the overpass structure, which takes road traffic above the railroad. The marshalling yards for the railroad are also illuminated using low level, pole-mounted, low pressure sodium lamps to provide lighting for safety of rail yard workers and security. The causeway is continuously illuminated from the intersection of Deltaport Way and Westshore Way into the facility.

11.2.3 Proponent's Assessment of Impacts

General

In order to assess the potential lighting impacts of the DP3 Project, the Proponent identified and used 4 representative view points based on community and public use areas as follows:

- Tsawwassen First Nation Village (Longhouse);
- BC Ferries causeway (first pullout);
- Fred Gingell Park on High English Bluff hillside; and
- Low English Bluff.

The methodology for the lighting impact assessment consisted of two phases: inventory and analysis. In order to establish existing night illumination levels, the following preparatory work was undertaken:

- review available as-built drawings for existing lighting systems installed at the Roberts Bank port facility;
- create photometric models for the existing facility to determine the actual lighting levels;
- photograph existing lighting systems from designated viewpoints to record existing conditions;
- review previous Deltaport lighting designs; and
- review lighting recommendations for port and intermodal facilities as published by Illuminating Engineering Society and under the Canada Labour Code.

Once an understanding of the existing night illumination levels was gained, future lighting conditions and their potential impacts were predicted.

Construction

Night time visual impacts would be created by the following elements during construction of the proposed DP3 Project:

- lighting associated with dredging in the berth, terminal, and shipping channel areas; and
- lighting associated with terminal construction activities, which would vary depending on the time of day and season, as well as the construction schedule.

Dredging would be undertaken 24 hours/day, 7 days/week for a period of about 9 months and would be undertaken within the allowable dredging windows established by DFO. Dredging is proposed to start in April 2007. This timeframe would require dredging equipment and ancillary vessels to be illuminated for longer periods of the day due to shorter daylight hours during these months. An estimated construction schedule is provided in Figure 4 of Part A in this report. The dredging lighting impacts discussed in the CSR is therefore a conservative estimate.

Lighting for terminal yard construction works would typically be low level, portable floodlighting until such time as the permanent high mast yard lighting used for operations is available. Other sources of light during construction activities would result from vehicle lights and equipment lighting. These lights would likely have minimal impact on the surrounding environment, according to the Proponent, mainly due to their relatively low intensity and height. Moreover, the effects of terminal yard construction lighting would be lessened because of the overall effects of the existing high mast lighting at the facility.

Operation
The proposed Project would require expansion of the existing Deltaport lighting system. This expansion would be to the east and north of the existing lighting to accommodate the expanded container yard, new wharf, and tug moorage facility. There would also be three new gantry cranes along the waterfront to facilitate the loading of ships. These crane units would have their own lighting, similar to the existing cranes.

A rating system was developed to quantify the additional effect the expansion of the facility lighting system will have over the existing lighting conditions as follows:

Low rating:	no change in the lighting condition is anticipated, other than an enlarged lighted area will be seen, with no overall increase in brightness or glare anticipated;
Moderate rating:	there may be some additional brightness or glare seen from a particular viewpoint, but the overall lighting condition should not worsen; and
High rating:	there will be a significant increase in the lighting system from additional brightness and/or glare from a particular viewpoint.

The proposed Deltaport Third Berth Project would not increase the overall lighting levels at the facility as viewed from off site, however, as the lighting would be extended over an expanded terminal area of approximately 20 hectares, there may be a perception that the overall brightness of the facility is greater.

Photometric measurements were taken from each of the representative viewpoints, however, no measurable readings were attainable, due to the very low level of light at each location and its distance from the source. Extraneous local lighting at each location was all that could be recorded with the instrumentation used. Photometric models were created based on using both the existing floodlight style with cut-off optic luminaires as well as using downlight style cut-off luminaires. The photometric models indicated that the use of downlight cut-off luminaires, which direct the vast percentage of light output downward toward the work area, rather than outward and upward, as is partly the case with the existing installation, would minimize sky glow and light trespass.

The expanded lighting system at the facility would have different effects on the night time visual environment from each of the representative viewpoints. Viewpoint comparisons were made at the following locations:

TFN Village:
The TFN is likely to experience the most impact from the Deltaport Third Berth Project, however the overall additional impact should be low to moderate, depending on the lighting design and equipment chosen during detailed design. The village is low in relation to the lighting system, and is located the closest to the facility. The expanded lighting system would bring the lighted facility even closer to the village than it is at present. The low viewing angle and the height of the proposed poles may afford some vision of the luminaire face, which is the main cause of glare. These issues may be difficult to resolve given present technology, however it is predicted that any glare would mainly be nuisance glare.

BC Ferries Causeway and Low English Bluff:
The view from the BC Ferries causeway and Low English Bluff area would include an enlarged lighting area, extending eastward from the existing facility. The lighting system would not come any closer to these viewpoints, the overall lighting level would not increase and therefore it is predicted the impact of the addition to the lighting system should be low on this area.

Fred Gingell Park (High English Bluff Hillside):
The view from the High English Bluff area would likely be the least affected by the Deltaport Third Berth Project lighting if downlight style cut-off luminaires are employed. Overall, this area looks down on the Roberts Bank port facility, and as the light source would not generally be visible from this vantage point, most issues with the lighting, except perhaps certain reflective glare issues, should be minimized. This viewpoint would also include an enlarged lighting area, but no overall increase in lighting levels, and as a result, it is predicted the impact of the expanded lighting system on this area should be low.

11.3 ANALYSIS

The RAs considered the information provided by the Proponent, including the Proponent's conclusions on potential effects and the method used to reach those conclusions as outlined above in sections 1 and 2 of this chapter. The RAs then conducted their own analysis of the potential effects and proposed mitigation measures before independently reaching conclusions on the residual effects.

11.3.1 Potential Effects

The potential effects with respect to lighting effects during construction and operation of DP3, which included many of the concerns raised from residents in Tsawwassen, public stakeholder groups and the First Nations are as follows:

- increase in light trespass;
- increase in nuisance glare;
- sky brightness due to enlarged lighted area; and
- effects of additional light on marine life, migratory birds and wildlife.

11.3.2 Issues

Concerns were raised that the lighting study did not adequately address potential effects on marine life, migratory birds and wildlife at Roberts Bank and that unnatural lighting is acting as a stressor on the environment.

As part of the comprehensive literature review undertaken for the DP3 Project, the VPA was made aware of studies that made statements about potential night light effects on salmon migration (e.g., Simenstad et al. 1999). However, no quantitative information on the significance of these behavioural responses to juvenile salmon survival was provided in these papers. The DP3 review, with support from DFO, concluded that the Proponent would not be expected to carry out further studies on lighting effects on salmon migration or fish habitats in the Roberts

Bank area. Based on the Proponent's own literature review on lighting effects on fish and migratory birds, and the assessment of lighting conditions anticipated during Project construction and operation, adverse effects to fish and migratory birds are not expected.

However the Proponent, as part of the lighting assessment, considered the potential effects of additional lighting in the marine environment and will incorporate downlight style luminaries in the Project design. These lights will be directed onto the terminal uplands as much as possible to minimize spilled or trespass light into the marine environment.

Further comments were made that nuisance glare will be more pervasive than is represented in the study. There were also public concerns with the current high intensity halide lighting on the underside of the boom arms and that this produces intense light when the arm is raised. These lights are intended to shut down after a short period, but often remain on, producing extreme dazzle and brightness aimed directly at English Bluff residences.

The Proponent, in consultation with the Terminal Operator, has conformed that the existing ship-to-shore gantry cranes have an automatic light shutdown system when the boom is raised and inactive for longer than 15 minutes. This automatic light shut down system will be employed on the new ship-to-shore gantry cranes for the DP3 Project. Nuisance glare is subjective, affecting different people in different ways, and according to the Illuminating Engineering Society of North America, is not a quantifiable entity. However, instituting the proposed mitigation recommendations for the DP3 Project will significantly reduce nuisance glare from the proposed expansion.

11.3.3 Mitigation

Construction

The following mitigation measures would be implemented to reduce potential lighting effects during construction of the proposed Deltaport Third Berth Project:

- modifications to the marine dredge lighting systems would be designed to shield light from spilling outside the basic working footprint of the dredge to minimize trespass light to the environment and surrounding community;
- lighting equipment would be pointed north and west as much as possible (to reduce effects to residents who are typically located east and south of the Roberts Bank port facility);
- shielding would be implemented on construction lighting; and
- a 24-hour environmental helpline for lighting events would be developed so that terminal personnel can identify what operations are causing the most disturbance in the community.

Operation

The following mitigation measures would be implemented to reduce potential lighting effects during operation of the proposed Deltaport Third Berth Project and would be detailed in the lighting design plan as part of the final Project design:

- the use of downlight style cut-off luminaries for the wharf and container yard areas;
- the exclusive use of metal halide luminaries for wharf and container yard areas;
- the use of lighting control systems to reduce of the amount of lighting in selected areas during periods of low activity;
- the incorporation of an automatic light shutdown system when the boom is raised and inactive for longer than 15 minutes for the new ship-to-shore gantry cranes;
- evaluation of the use of innovative mounting systems for the lighting on the ship-to-shore gantry cranes to minimize light throw during raising and lowering of the equipment. This would include examining options for mounting luminaries on the arms of the gantry cranes to prevent them from shining outwards when the arms are raised and lowered;
- the use of downlighting rather than floodlighting on the gantry crane superstructure; and

- development of a 24-hour environmental helpline for lighting events so that terminal personnel can identify what operations are causing the most disturbance in the community.

The Proponent and the Terminal Operator have also reviewed a number of lighting concerns raised by local residents with respect to the existing terminal, and they will continue to work with residents through the Community Liaison Committee (to be established by the Proponent). On-going mitigation measures will be discussed, including a review of lighting equipment, shielding of lighting where appropriate, and training of crane operators on the importance of shutting down high intensity gantry arm lighting when not in use. These specific matters, and broader nuisance glare issues, are recognized as problems but are very subjective and cannot be quantified. As a result, the Proponent's mitigation measures are designed to minimize the potential effects on the community and are included as commitments in the *Owner's Commitments and Assurances* in *Appendix A* of this report.

11.3.4 Residual Effects

Based on the implementation of the proposed mitigation the RAs have determined that there will be no residual effects caused by lighting at the proposed Project.

11. 4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS

During this cooperative environmental assessment the EAO, the RAs and the working groups have considered: the Application; comments from government agencies, First Nations and the public on the potential effects of the Project; responses by the Proponent; and the discussions of the working groups.

Based on the information summarized in this CSR and provided that the Proponent implements the actions described in the *Owner's Commitments and Assurances* as listed in *Appendix A* of this report, the RAs are satisfied that the DP3 Project will not likely result in significant adverse effects from terminal lighting in the vicinity of Roberts Bank.

12. Socio-community Issues and Economics

12.1 GENERAL

The Proponent assessed socio-community and economic impacts and defines: (i) socio-community impacts as affecting community and resident services, facilities, life-style, land use and general well being including traffic, noise, air quality and visual amenity; and (ii) economic impacts as changes in economic activity in various sectors of the economy that can be measured in economic terms (i.e., dollars and employment) and arise positively or negatively, both directly and indirectly, from the Project.

In the course of the harmonized review of this Project, many socio-economic issues were taken into consideration. However, for the purposes of CEAA, only those socio-economic effects resulting from changes in the environment caused by the Project were included in the RA's assessment of environmental effects.

12.2 BACKGROUND

12.2.1 Study Area

The socio-community and economic impact analysis focused on four distinct geographical areas: (i) Canada; (ii) Province of British Columbia; (iii) GVRD; and (iv) the local area, including COD and TFN.

The economic impact assessment adhered directly to the above geographic areas. The socio-community assessment, with a more limited geographic distribution pattern, was assessed in a defined local (COD and TFN) context.

12.2.2 Study Methodology

A review and assessment of existing reports, data and resources were used by the Proponent to obtain baseline data for the study areas. In addition to these, secondary source interviews and discussions were held with municipal staff from the COD, representatives from the TFN, local health, police and emergency service personnel, and representatives from TSI (the existing container terminal operator) and the Deltaport operator.

Both the socio-community assessment and the economic impact assessments identified and assessed only net, new (or incremental) impacts attributed to the DP3 Project. The evaluation addressed both the impacts expected to occur during the construction phase as well as the impacts expected to occur once the new third berth becomes operational.

The Proponent's economic impact assessment model incorporates both Project development (construction and equipment acquisition) and operational considerations. It was prepared for a 20-year period on the assumption that the Third Berth terminal operations would begin in 2008 so that the construction and the timing of its direct and secondary effects can be compared over a reasonable time frame. This enables relative benefits to be expressed in terms of current dollars through the use of net present value analysis.

The economic impact model assessed direct impacts for each geographic area, for the key business expenditure categories. Secondary benefits were estimated for British Columbia and Canada. The direct impact categories included: capital investment to construct and equip the DP3 Project; operational expenditures on wages and salaries for new long-term employees; expenditures on goods and services for ongoing business operations; and municipal taxes and charges as well as corporate and personal income taxes for the development and operational phases.

12.2.3 Existing Socio-community Environment

Corporation of Delta:

COD is a suburban municipality in the southwest corner of the Lower Mainland. Delta has a land mass of about 36,433 ha. The majority of the population is concentrated within three residential areas (Ladner, North Delta and Tsawwassen), with the remainder spread through the rural farm land of Delta. Ladner (population 21,367) is the closest residential neighbourhood to Deltaport, 3 km to the northeast. Ladner is the original farming and fishing village in Delta, and is Delta's administrative centre. Tsawwassen (population 21,337), a residential community with a commercial core is east of Deltaport. North Delta (population 52,115) is the largest residential area in the municipality. It is approximately 15 km northeast of Deltaport.

In the 2001 census, the population of Delta was 97,208 and increased to about 101,843 in 2004 (estimate). The population changes, as included in the Application, are shown in Table 33 below.

Table 33 Corporation of Delta census data 1996 and 2001

Community	2001 Population	1996 Population	% Change
Tsawwassen	21,337	21,170	0.8
Ladner	21,367	21,085	1.3
North Delta	52,108	51,230	1.7
Rural Delta	2,396	2,430	-1.3
Total Delta	**97,208**	**95,915**	**1.3**

Land use and new development within COD is managed according to the policies and directions set out under the Delta Official Community Plan (OCP). The OCP also works toward achieving the goals of the GVRD Livable Region Strategic Plan (LRSP). There are also provincial and federal statutes that impact land use decisions such as the provincial Agricultural Land Reserve and federal fisheries legislation.

Tsawwassen First Nation (TFN):

The TFN Reserve is located between Highway 17 (with some lands south of Highway 17), the Strait of Georgia, 27B Avenue and 48th Street/English Bluff Road. The reserve is not included in the COD land use plans. The reserve is 290 ha in area, of which approximately 98 ha are designated environmentally sensitive foreshore, 72 ha are developed for housing, community facilities and businesses, and 120 ha are undeveloped. In 1999 there were 62 community-housing units on the reserve. In 2001, there were 174 people living on the reserve, 155 were TFN members and 19 were non-members. One hundred fourteen TFN members were not living on the reserve.

As part of the Treaty Negotiation Process with the provincial and federal governments, the TFN outlined a vision to create a sustainable community located around the existing village. Among other things they sought sufficient land for economic development, safe and secure access to the Fraser River and to marine waters and access to lands throughout their asserted territory for traditional use and cultural purposes. An agreement in principle between the TFN, the Government of Canada and the Province of British Columbia has been signed and identifies the TFN lands to include the existing reserve, approximately 365 ha of provincial Crown lands which are generally contiguous with the existing reserve, plus Fraser River and Boundary Bay parcels. Negotiations to reach a Final Agreement are underway.

Greater Vancouver Regional District (GVRD):

The GVRD Livable Region Strategic Plan (LRSP) is the region's growth strategy. The goal of the LRSP is to maintain regional liveability and protect the environment; it is used as the framework for making regional land use and transportation choices. The LRSP has four main objectives: protect the green zone, build complete communities, achieve a compact metropolitan region and increase transportation choice.

Other Existing Socio-community Environment Sectors:
The Proponent noted that there are a variety of existing socio-community environment sectors such as: transportation and traffic; health, emergency and protective services; community and social services and facilities; and TFN community facilities and services

12.2.4 Existing Economic Environment

Labour Force:
The COD labour force in 1991 was approximately 50,400, of which 21% was in the goods producing sectors and 78% in the service sectors. By 2001 the COD labour force was 52,800, with 17% in goods production and 82% in service. COD's relatively small goods production labour force declined, while in the GVRD it grew. Overall, the COD labour force increased by fewer than 5% between 1991 and 2001, while that of the GVRD grew by over 12% in the same period. According to the Proponent and as stated in the Application, sales and services represent the largest occupational group for COD and GVRD, while business, finance and administrative is the second largest category in both jurisdictions.

Local Industrial Base:
In 2001, there were 5,400 manufacturing workers living in COD, 10% of the labour force. Manufacturing as a percentage of the total labour force in the GVRD was 9.2%. The average personal income of manufacturing workers in COD was $52,577 in 2001. Many of these workers who live in COD likely travel to their place of employment in municipalities outside of COD. The number of manufacturing workers in 2001 is a reduction from 1991 when COD had 5,800 manufacturing workers, 20% of the labour force.

The largest 25 manufacturers in COD employ more people than comprise the total COD manufacturing labour force. This indicates that these firms employ many residents of neighbouring municipalities and, therefore, that COD is a net provider of high-paying manufacturing jobs to other areas of the Lower Mainland and neighbouring communities.

Construction activity in the industrial sector is also an important indicator of the area's base and potential. COD accounted for 17% of all industrial construction permits between 1996 and 2002, and maintained a consistent record of development. COD's industrial real estate sector had an occupancy rate of 97% in 2003; this is similar to Vancouver at 98%.

Other Existing Economic Environment Sectors:
The Proponent considered other existing economic environment indicators such as labour force; personal income; building permits; housing starts; incorporations; and bankruptcies.

12.2.5 Socio-community Impact Assessment

Construction Impacts:
The DP3 Project is expected to generate approximately 640 person years of employment during the construction period. At its peak the Proponent expects that there will be a maximum of 100 workers on-site. The jobs and workers will vary over the 33-month construction period, and not all workers will be needed for the full period. Some are expected to come from COD and TFN, but most will come from within the GVRD. Given that some of the jobs may last the extent of construction, the Proponent believes that some of the workers may choose to relocate to COD.

According to the Proponent the Project will comply with many of COD's official community plan (OCP) polices, especially those providing for additional employment for COD residents, for encouraging new industry in existing industrial areas and for municipal transport policies respecting the existing Roberts Bank and Fraser River access. Construction is not expected to interfere with the land use plans in place for the existing TFN Reserve.

The Proponent believes that the DP3 Project construction has either neutral or positive impact on the four main objectives of the GVRD's Livable Region Strategic Plan to: (i) protect the Green

Zone (neutral); (ii) build Complete Communities (neutral); (iii) achieve a Compact Metropolitan Region (positive); and (iv) increase Transportation Choices (neutral).

The bio-physical effects of the Project construction, as described in this report, such as impacts on noise (traffic), air quality, visual and lighting environments, are deemed by the Proponent to be benign. According to the Proponent, Project construction will have either neutral or minimal impact on the existing land use designations or the use of the land. Construction will take place on the existing Roberts Bank causeway and on existing road and rail rights-of-way. Some minor increase in office space rental may occur if space is required for contracted companies involved during construction – generally regarded as a positive effect.

The Proponent recognizes that during construction two road transportation issues will impact on the local community. One will be impacts on local traffic movement from the railway construction (additional tracks) adjacent to Deltaport Way, and the second is the impact on both local and area road networks by additional truck and worker traffic travelling to and from the construction site. The Proponent concludes that apart from traffic and associated noise there are limited and negligible socio-community effects from the DP3 Project.

Operational Impacts:
The Proponent has assessed that the DP3 Project will require an average of 356 full time equivalent (FTE) workers during full operation. This employment will be phased in over 5 years. Some of these workers are expected to live locally in COD, or on the TFN Reserve, but primarily they will live in the overall Greater Vancouver Regional District. Some new workers not presently living in the local area may choose to do so, and there is capacity in the area to accommodate additional workers.

According to the Proponent, the implications of Project operations on land use and land use planning do not differ from those recognized for construction, as discussed above.

Noise in communities adjacent to Roberts Bank is expected to increase proportional to the increase of 3 trains per day serving Deltaport. Noise for communities located close to the port is predicted to come from rail cars, train whistles and idling locomotives. Noise for communities farther from the terminal (e.g., Panorama Ridge) will be from longer trains that take more time to pass by. Predicted noise level increases due to future operations of the DP3 Project are generally estimated by the Proponent to be very small (1 to 2 dBA, see also Chapter 9 – *Noise Impacts*).

Operational Project impacts on the road network will primarily be from increased truck traffic on the major routes (Deltaport Way, Highways 17 and 99, River Road and intersections on these routes); increased worker and supply traffic travelling to and from the expanded terminal; and the proposed closure of the intersection at 57B Street and Deltaport Way. The proposed improvements to Highway 17 will maintain the existing level of service and will not result in any deterioration, according to VPA. Vehicles currently using 57B Street for north-south connectivity would be required to detour via Arthur Drive. This would add approximately 1.1 km to a trip between the intersections of 34B Avenue/57B Street and 28 Avenue/56 Street. This extra trip length would add approximately one minute to the travel time, according to the Proponent. A proposed access road available for farm vehicles between 57B Street and 64th Street is under review. This is expected to reduce some of the impact of the proposed closure of 57B Street, although these issues were raised during the review by many Delta farmers.

The Proponent predicts that operational Project impacts on other socio-community sectors are benign.

12.2.6 Economic Impact Assessment

The assessment of economic impacts associated with the DP3 Project is based on: (i) a 20-year evaluation period once the Third Berth becomes operational (i.e., 2008 to 2027) to effectively

describe ongoing economic benefits of the Project by application of "net present value analysis"; and (ii) 2004 Canadian dollars; all "net present values" have been calculated using a discount rate of 6% per annum.

Construction Impacts:
In the context of the direct economic impacts of Project construction, new capital investment will result directly in positive economic impacts within each of the geographic areas (see section 12.2.1 above) due to contracts concluded and purchases made for labour, goods and services as well as the associated taxes paid and corporate profits realized. The total direct economic impacts are assessed by the Proponent to $223,230,000 (2004).

Construction expenditures have a significant labour component. The Proponent estimates that new job creation over the 3 to 4-year construction period is 60 person-years in Delta, 599 person-years elsewhere in the GVRD, 43 person-years elsewhere in British Columbia and 43 person-years elsewhere in Canada.

Employment and business opportunities associated with DP3 construction are expected for the Lower Mainland. Delta and the TFN members are well placed to take advantage of a number of opportunities because of the proximity of the local labour force and local businesses. The local commercial fishery is expected to experience some negative impact due to the effects on the Dungeness crab population during the construction phase. However, these effects are expected to be temporary, according to the Proponent, and after mitigation, residual habitat losses will be offset through habitat compensation prescribed by DFO and commitments to implement an AMS. The Proponent assumes that the net economic impact on the local fishery will be marginal to non-existent.

Operational Impacts:
New marine terminal operations associated with the Project will generate new employment, purchases of new goods and services and new taxation on an ongoing basis. These represent the "direct economic impacts" of new terminal operations on the economy and will accrue at substantial levels, according to the Proponent, to all geographic areas included in the impact analysis. The Proponent estimates that all economic impacts of new terminal operations from employment, wages and taxes, will total $418,099,000 (2004) over the 20-year period.

Estimated new annual job creations over the 20-year study period is 46 person-years per annum in Delta, 306 person-years per annum elsewhere in the GVRD and 4 person-years per annum elsewhere in British Columbia. The estimated present values of new wages, salaries and benefits earned as a result of these jobs over the 20-year study period are $30 million in Delta, $201 million elsewhere in the GVRD and $2 million elsewhere in British Columbia.

The Proponent suggests that when the DP3 Project is operational, it will directly generate new economic activity within the container industry supply chain. Expanded container throughput will result in new direct economic benefits from an increase in non-Deltaport container business operations that would not otherwise occur. Because of the very existence of the Project, Vancouver is expected to maintain and potentially capture a larger share of the west coast container market, which it would not otherwise be capable of accomplishing due to capacity constraints. Net new economic activity will be generated away from the container terminal itself as this new container traffic moves through Deltaport, the regional container handling network and the national supply chain.

The Proponent believes that new, direct economic impacts expected to be generated in the Canadian container industry supply chain external to DP3 Project operations, but due to the increased container throughput from the Project, are considerable. They include activities such as chandlering, warehousing and container freight service operations, harbour piloting, and the management of shipping operations.

The total economic impact of the DP3 Project, including direct (construction, terminal operations and ex-terminal business activity) and secondary impacts, on the British Columbia economy is $178 million from wages and salaries and $1.7 billion from other business income and taxes.

12.3 ANALYSIS

The RAs considered the information provided by the Proponent, including the Proponent's conclusions on potential environmental effects and the method used to reach those conclusions as outlined above in sections 1 and 2 of this chapter. For the purposes of CEAA, only those socio-economic effects resulting from changes in the environment caused by the Project were included in the RA's assessment of environmental effects. The RAs then conducted their own analysis of the potential effects and proposed mitigation measures before independently reaching conclusions on the residual effects.

12.3.1 Potential Effects

During the environmental assessment, the following potential effects were considered regarding the construction and operation of the Project:

Construction:

- Relocation of some construction workers to the local area;
- Effect on existing use local use of such as office space rental;
- Traffic delays associated with railway construction;
- Traffic increases associated with construction trucks and workers; and
- Increased demand on local hospitals and medical services.

Operation:

- Relocation of some facility workers to the local area;
- Increased noise associated with additional trains; and
- Increased traffic on the road network due to additional truck traffic.

12.3.2 Issues

The public and the municipalities in the area of the Project raised a number of socio-community concerns, also advanced by the TFN and GVRD. These issues and the resolution of each is as follows:

- Noted that assessment suggests there are no significant socio-community effects. Concern that this does not reflect the stated effects of light, noise, transportation and land use.

  The assessment concluded that there are no significant adverse effects from the construction or operation of the Project on socio-community factors. The confidence of these assessments is regarded to be high.

- Concern with congestion and further traffic delays that the increase in truck traffic volume will cause in the Project area. Noted that the existing road network cannot handle the increase and public is concerned about road safety.

  The $3 million proposed Highway 17 improvements will mitigate the effect of the DP3 Project. MOT has acknowledged that these improvements are sufficient to offset additional traffic generated by the Project. These improvements will primarily benefit Delta residents while helping to reduce existing congestion associated with combined local, ferry and port traffic.

- Overpasses should be installed at the at-grade road/rail crossings in Ladner, Tsawwassen and Surrey (e.g., Cloverdale) to alleviate congestion on roads caused by longer and more frequent trains.

  A warrant assessment of at-grade crossing traffic in Delta does not indicate a need for overpasses.

- Concern that increased Deltaport truck traffic will significantly affect traffic in the Massey Tunnel.

  It is forecast there will be an additional 600 trucks per day from the DP3 Project, of which approximately 40%, or 240 trucks per day, would be expected to travel through the Massey Tunnel. Current Massey Tunnel traffic includes 4,600 trucks per day and 86,000 total vehicle trips per day.

- The Proponent should be involved in long-term transportation planning to ensure the needs of local communities are addressed.

  VPA is involved with, and will continue to participate in, long-term transportation planning in the region. The VPA works with MOT, Transport Canada (TC), the Greater Vancouver Transportation Authority, local municipalities and other government agencies involved in transportation planning.

- Noted that assessment should address transportation and infrastructure costs to taxpayers.

  Taxpayers are not required to fund any transportation or infrastructure costs for the DP3 Project. The Proponent is funding Highway 17 improvements to mitigate the effects of the additional truck traffic from the Project.

12.3.3 Mitigation Measures

Many of the mitigation strategies developed in response to socio-community effects are included in existing operations, or have been identified elsewhere in this report. They include those in Chapter 8 – *Air Quality*, Chapter 9 – *Noise Impacts*, Chapter 10 **–** *Visual Impacts*, and Chapter 11 – *Lighting Effects.* These mitigation measures will also be further reflected in the Project's Environmental Management Plan and in the *Owner's Table of Assurances and Commitments* in *Appendix A* to this report. A summary of those commitments is as follows:

- A Noise Management Plan will be developed to ensure identified mitigation measures are implemented.
- The Owner will implement a complaint tracking and response mechanism for the construction phase of the Project.
- The Owner must commit to develop a Construction Air Quality Mitigation Program that addresses all Project construction effects on the ambient air quality in the Project area.
- The Owner will develop a *Traffic Management Plan*. The specific traffic commitments are to be undertaken in consultation with MOT and COD
- The Owner will continue to work with the COD, City of Surrey, City of Langley and Township of Langley to reduce traffic effects.
- The Owner commits to working with relevant authorities and parties to optimize the performance, efficiency and reliability of container truck movements to relieve traffic congestion on local roads.
- The Owner shall ensure that all contractors and the Terminal Operator construct and operate the Project with due attention to adverse public health effects.
- The Owner commits to working with the Railways to develop an Operational Rail Emission Reduction Program.

- A management procedure, such as a 24-hour helpline, will be put in place by the Owner to deal with noise complaints that may arise from construction activities.
- The Owner shall commit to organizing a Community Liaison Committee, whose terms of reference shall include any visual and lighting effects generating public concerns.

In addition to the road and rail mitigation measures discussed above TC is leading a study of the "Roberts Bank Railway Corridor". The study area extends from Roberts Bank to the Abbotsford/Mission border and will be reviewing ways to remediate traffic issues through provision of road/rail grade separation. As part of the Canada Pacific Gateway, Canada has committed 30 million dollars of funding for projects on the corridor, some of which will likely be allocated to remediate road/rail traffic issues along the corridor.

12.4 CONCLUSIONS AND RECOMMENDATIONS

During this cooperative environmental assessment the EAO, the RAs and the working groups have considered: the Application; comments from government agencies, First Nations and the public on the potential effects of the Project; responses by the Proponent; and the discussions of the working groups.

Based on the information summarized in this CSR and provided that the Proponent implements the actions described in the *Owner's Commitments and Assurances* as listed in *Appendix A* of this report, the RAs are satisfied that the environmental effects of the DP3 Project will not likely result in significant adverse socio-community and economic effects in the local communities adjacent to Roberts Bank.

13. Archaeological Assessments

13.1 GENERAL

The archaeological impact assessment resulting from the construction of the DP3 Project was carried out through field work, literature and data searches and with the co-operation of the TFN.

13.2 BACKGROUND

13.2.1 Study Area

The study area for the archaeological overview consisted of the area between the Fraser River delta and the Tsawwassen Upland. This includes the area of the proposed Project's Deltaport terminal, areas of dredging, the Roberts Bank causeway, the railway at Gulf Siding (from 41B Street to 64th Street) and adjacent areas. The relatively large study area for the archaeological overview assessment is narrowed for the archaeological impact assessment (AIA).

13.2.2 Archaeological Overview

Methodology:

An archaeological overview assessment (AOA) was undertaken in accordance with the *BC Archaeological Impact Assessment Guidelines* (British Columbia Archaeology Branch 1998) to identify and assess the nature and likely distribution of archaeological resources in, and immediately adjacent to, the study area. The AOA methodology included the following steps: (i) a review of archaeological literature and maps relating to the site; (ii) a review of past archaeological investigations in the vicinity of the site; and (iii) a search of the online Remote Access to Archaeological Data (RAAD) database to determine whether there are any known archaeological sites within the boundaries of the study area.

An overview precedes an impact assessment and guides the impact assessment process by indicating areas of increased potential to find archaeological sites and recommending how to assess these areas in light of the proposed development.

13.2.3 Archaeological Impact Assessment

Field Work:

The archaeological overview recommended that field inspection, including subsurface testing, be conducted in the area of the development at Gulf Siding, since much of the Gulf Siding route was determined to have at least moderate archaeological potential. Specific areas along the Gulf Siding in the immediate vicinity of the ancient Cohilukthan Slough were determined to have higher archaeological potential than other areas along the Gulf Siding. These areas were also sampled.

A total of 51 auger tests were completed along the 4.6 km of extent of the rail track right-of-way. The testing was undertaken on both sides of the rail tracks, along the service road and in the ditches that run along the right-of-way. The auger tests were concentrated in areas identified in the overview assessment as having high archaeological potential. The rail track was sampled at 100 m intervals and the fields adjacent to the right-of-way were surveyed where possible, particularly in and around Cohilukthan Slough.

The archaeological overview also identified that the tidal flats had potential for archaeological resources (fish traps). The intertidal zone was surveyed for remnants of fish traps or any other archaeological resources. The survey tracks are approximately 6 km in length.

Results of Field Work:

No archaeological deposits were encountered in any of the 51 auger tests along the Gulf Siding or observed during the tidal flats survey. Thus the likelihood of finding substantial archaeological

deposits is low, except in the vicinity of Cohilukthan Slough. Nevertheless, the possibility of recovering isolated discarded artifacts should, according to the Proponent, not be discounted.

13.2.4 Proponent's Assessment of Impacts During Construction

Terminal Dredging and Landfill:

Dredging of the ship channel extension will involve deepening of a previously dredged area. In addition, dredging activities are required for the construction of the caisson wharf structure and include dredging along the sidewalls of a previously dredged area. Both of these activities are therefore unlikely to impact archaeological resources.

The DP3 Project also includes filling in of approximately 22 ha of tidal flats to create the land base for the new terminal. A portion of the tidal flats will also be altered for the proposed tug basin, which will be located adjacent to the new wharf and will extend from a previously dredged area into the tidal flat. No archaeological resources, such as the remains of sturgeon fish traps, were observed by the Proponent during the tidal flats survey. Therefore, the potential for construction works to impact on archaeological resources is predicted to be low.

Rail Construction:

Construction works for the additional rail tracks at Gulf Siding (from 57B Street to 64th Street) would not be expected to impact archaeological resources. Construction works would be confined to the existing right-of-way. No archaeological sites or relics were identified during field surveys along the right-of-way and, in particular, no archaeological sites or relics were identified in the ancient slough and stream crossings at Gulf Siding. These results are consistent with the study undertaken by Arcas (1995) along Deltaport Way. As a result, the Proponent concluded that there are no predicted impacts on archaeological resources for the additional trackage at Gulf Siding (from 57B Street to 64th Street). The Cohilukthan Slough crossing (located just west of 46A Street) retains some archaeological potential, however, there are no current plans for development in this area for the DP3 Project.

13.2.5 Proponent's Assessment of Impacts During Operation

The Proponent concluded that there would be no impacts on archaeological heritage resources in the study area during DP3 Project operations.

13.3 ANALYSIS

The RAs considered the information provided by the Proponent, including the Proponent's conclusions on potential effects and the method used to reach those conclusions as outlined above in sections 1 and 2 of this chapter. The RAs then conducted their own analysis of the potential effects and proposed mitigation measures before independently reaching conclusions on the residual effects.

13.3.1 Potential Effects

The Provincial Archaeology Branch concluded that there are no predicted effects on archaeological resources for the additional trackage at Gulf Siding (from 57B Street to 64th Street). However, the Cohilukthan Slough crossing (located just west of 46A Street) retains some archaeological potential, but there are no current plans for development in this area for the DP3 Project.

13.3.2 Issues

The HTG advised the Proponent and agencies that neither the Proponent nor the government should construe the purpose of archaeological research as being definite identification of traditional Aboriginal use sites in the Project area, nor should the results of these archaeological studies be interpreted to represent the extent of any First Nations' relationship with these lands. The regulatory agencies have acknowledged this position forwarded by the HTG.

13.3.3 Mitigation

As the potential for archaeological artifacts to be found in the study area is predicted to be low (no predicted effects), no specific safeguards are required. However, if any archaeological sites are discovered during the proposed site construction activities, these would be reported to the BC Archaeology Branch and First Nations, and works would cease, pending their consideration. The sites would then be assessed for significance and, if required, protection measures put in place. There are no current plans for development in the Cohilukthan Slough area (west of 46A Street). If construction activities were to occur in this area, an archaeological monitoring program would be developed and implemented to address any effects on archaeological resources, given that the crossing retains some archaeological potential.

First Nations in the vicinity of the Project were invited to participate in the archaeological field work and provided input to the Proponent as well as the BC Archaeology Branch. The Branch has also concluded that the archaeological effect assessments have been properly conducted.

13.3.4 Residual Effects

Based on the implementation of the proposed mitigation the RAs have determined that there will be no residual effects of the Project on archaeological resources.

13.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS

During this cooperative environmental assessment the EAO, the RAs and the working groups have considered: the Application; comments from government agencies, First Nations and the public on the potential effects of the Project; responses by the Proponent; and the discussions of the working groups.

Based on the information summarized in this CSR and provided that the Proponent implements the actions described in the *Owner's Commitments and Assurances* as listed in *Appendix A* of this report, the RAs are satisfied that the environmental effects of the DP3 Project will not likely result in significant adverse archaeological effects within the study area.

14. Accidents and Malfunctions

14.1 GENERAL

Pursuant to CEAA 1999, an assessment of the environmental effects of any potential Project accidents or malfunctions that may occur in connection with its construction and operation is required. This chapter presents the DP3 Project components where accidents and malfunctions could occur, assesses the risk to the environment and identifies the need for environmental management, spill response or emergency response plans.

14.2 BACKGROUND

14.2.1 Assessed Effects During Construction

General:

Potential accidents and malfunctions associated with the construction of the DP3 Project, as determined by the Proponent, are associated with the following construction activities:

- construction equipment mobilization to and from the site (traffic accidents);
- transportation of dangerous goods to and from the Project site;
- dredging (fueling spills and leaks);
- terminal construction (fueling spills and leaks, waste management); and
- worker accidents.

Spills and Leaks:

The primary concern for the environment could arise from an accident or malfunction during refueling of construction equipment on site. Due to the size of the equipment and time required for its mobilization, it would not be reasonable to remove equipment from the Deltaport area for fueling. However, even a small spill on site may have harmful impacts on the marine environment, fish and fish habitat, coastal seabirds and waterfowl. Therefore the Project contractor would be required to meet stringent requirements to conduct all fueling of equipment, and storage of petroleum products (e.g., fuel, oil, lubricants), appropriately, in accordance with all applicable guidelines, legislation, and best management practices to minimize the risk of spills. The contractor would be required to have an appropriate and specific spill prevention, containment and cleanup contingency plan (this forms part of a Construction Environmental Management Plan (EMP) that is reflected in the *Owner's Table of Commitments and Assurances*, enclosed as *Appendix A* to this report.

Transportation of Dangerous Goods:

The transportation and storage of dangerous goods, primarily fuel and lubricating oils for construction equipment is to be carried out in compliance with the federal *Transportation of Dangerous Goods Act.*

Waste Management:

All waste and deleterious materials generated by construction of the DP3 Project will be appropriately contained by the contractor in the immediate work area, collected, and appropriately disposed of in accordance with all applicable legislation, guidelines, and best management practices. Waste management procedures will also be outlined in a Construction EMP, and reflected in the *Owner's Table of Commitments and Assurances*, enclosed as *Appendix A* to this report.

Health and Safety/Emergency Response:

All contractors will be required by VPA to develop a health and safety plan for their component of work prior to the start of construction. The health and safety plan would typically include site location and prime contacts; local emergency and Project contact numbers; description and map

of emergency routes; safety equipment required; list of site hazards and mitigation; and potential waste generation and disposal methods.

14.2.2 Assessed Effects During Operation

General:

Potential accidents and malfunctions during operation of the DP3 Project that may impact on the environment, as determined by VPA, include:

- spills and leaks (which include those from fueling operations, liquid ship emissions (ballast water and bilge water) and terminal operations;
- ship collisions/groundings;
- transportation of dangerous goods;
- waste management;
- health and safety; and
- emergency response.

These can be further categorized into marine (ship), terminal, rail and road components.

Spills and Leaks:

In addition to the potential environmental effects discussed in section 14.2.1 above, the fueling of ships, terminal equipment and vehicles represents a risk of potential adverse impact to the marine environment in the event of a spill. The loading of bunkers and bulk oils (fueling) is not permitted under any circumstances for vessels berthed at Deltaport or at Westshore Terminals. This prohibition is enforced by the Vancouver Port Authority and has been in effect since the expansion of the Roberts Bank port terminal in the early 1980s and was put in place to reduce the probability of oil spills at Roberts Bank. The Terminal Operator has established a Fuel Management and Dispensing Operating Procedure as part of the existing Deltaport Terminal Environmental Management Plan. The purpose of the Fuel Management and Dispensing Operating Procedure is to minimize the potential for impact of hydrocarbons on the environment during fueling of terminal equipment. The Fuel Management and Dispensing Operating Procedure includes requirements for maintenance of the fueling areas, procedures for vehicle fueling and a spill response/emergency response procedure. The DP3 Project does not require the construction of additional fuel storage or fueling facilities as the present ones are adequate. The Terminal Operator's Fuel Management and Dispensing Operating Procedure will be updated to include the Project area.

All fueling for road container trucks or employee vehicles is conducted off-site, away from the existing Deltaport Container Terminal at approved fueling facilities. There will be no fueling of container trucks or employee vehicles as part of the Project.

Three railway companies provide service to Deltaport and Westshore Terminals. Canadian Pacific Railway and Canadian National Railway provide the majority of the service for containers and coal, with the third railway, Burlington Northern Santa Fe, occasionally hauling coal to the Westshore Terminals. The switch engine located on the causeway is fuelled on the causeway with *Transportation of Dangerous Goods Act* certified fuel truck deliveries. A fuel management and spill response plan for fueling operations for the switch locomotive is linked to the BC Rail Emergency Response Plan developed as an earlier plan for the rail yard.

The Vancouver Port Authority implemented a mandatory Ballast Water Management Program in January 1998 that would apply to the DP3 Project. Ballast water refers to water (with its suspended matter) that is taken on board a ship to control trim, list, draught, stability or stresses of a ship. The purpose VPA's Ballast Water Management Program is to limit the possibility of transferring non-indigenous species into Canadian waters while protecting the safety of ships. VPA's Ballast Water Management Program is consistent with the IMO's resolution A.868 (20).

Bilge water release is also a risk factor, and is addressed in the Chapter 3 – *Water Quality* and covered in section 3 of *Appendix A.*

Ship Collisions and Grounding:
By June 2006 there had been no ship collisions or ship groundings related to the existing Deltaport Container Terminal operations. The Project will result in an increase from 365 vessel calls in 2003 to 393 vessel calls in 2012 (an increase of approximately 8%). This relatively small increase in vessel calls is due to the fact that container vessel size is projected to increase. Because of the relatively small increase in traffic, VPA concludes that there is no increased risk of ship collisions or grounding events involved with the additional container ships associated with the DP3 Project.

Fire and Emergency Services:
Delta Fire and Emergency Services provides response for fires, motor vehicle accidents, medical emergency services, rescue and safety, public service calls, emergency measures and planning, fire prevention and public education, fire investigation and community support to Delta. According to the Proponent, there were 2 calls from Deltaport to the Fire Department in 2003 and 3 in 2004 up to the end of October (2004).

The Delta Fire Department responds to those hazardous material (Hazmat) incidents that can be handled by responders in standard-issue protective clothing and breathing apparatus. For incidents requiring a more comprehensive response, Delta has a Mutual Aid Agreement with the Surrey and Vancouver Fire Departments, which have full Hazmat response capability. The terminal operator at Deltaport does not rely on the Delta Fire Department for Hazmat incident response given that it buys clean up services from a private contractor. There were three Hazmat incidents at Deltaport in 2003 that related to a leaking valve on a storage tank.

Waste Management:
The *International Convention for the Prevention of Pollution from Ships* (MARPOL) governs the release of oil, hazardous substances, and garbage into the marine environment. MARPOL Annex V deals with wastes (which include plastics, metal, glass, galley wastes and other materials). This international legislation deals with different types of ship on-board waste and specifies the distances from land and the manner in which they may be disposed of.

The Terminal Operator has established an Environmental Management Plan to ensure environmentally responsible purchase and use of products including proper storage and disposal. The Terminal Operator has also established environmental protection procedures regarding items used at the terminal, including empty drums, pails and other containers, solid non-hazardous waste, used absorbent materials, batteries, ozone depleting substances, including freon and halon, used oil filters, waste antifreeze, waste oil and petroleum products, and waste solvents. The Deltaport Terminal Environmental Management Plan and procedures will be updated for the DP3 Project.

14.3 ANALYSIS

The RAs considered the information provided by the Proponent, including the Proponent's conclusions on potential effects and the method used to reach those conclusions as outlined above in sections 1 and 2 of this chapter. The RAs then conducted their own analysis of the potential effects and proposed mitigation measures before independently reaching conclusions on the residual effects.

14.3.1 Potential Effects
Potential effects that could arise as a result of potential accidents and malfunctions associated with the construction and operation of the DP3 Project, as determined by the Proponent, include the following:

- degradation of water quality;
- contamination of marine sediments;
- toxicity/mortality to fish and marine mammals;
- toxicity/mortality to waterfowl and coastal seabirds;
- effects on the terrestrial environment;
- effects on workers;
- effects on neighbouring communities; and
- the potential for non-indigenous species to be transported in ballast water and be deposited to establish in the local environment as a pest species affecting the native species.

14.3.2 Issues

During review of the Application, the issue was raised that the proposed new storm sewer system must have catch basins of an appropriate size to allow for containment of minor spills and discharges of materials suspected of being deleterious to fish. Further the proposed shut-off valves, in addition to being manually operated, should be electronically linked to allow timely remote operation in the event of an accidental discharge of materials suspected to be deleterious to fish.

The Proponent agreed with the sizing of the catch basin but only manual operation of the shut-off valves is proposed. The inclusion of shut off valves, according to the Proponent, exceeds pollution abatement methods on other comparable facilities. Further, the Proponent has undertaken a redesign of the proposed DP3 Project to:

- reduce the terminal footprint (surface area) of the terminal, and thereby a reduction for collection and resultant stormwater effluent treatment; and
- decommission the eight existing stormwater outfalls, located along the northern perimeter of Deltaport, and replace them with new stormwater outfalls. All outfalls are to be relocated to the southeast side of the terminal (off the wharf face) to discharge into the subtidal environment. These outfall locations are designed to prevent stormwater from being discharged into the embayment area, and would thus allow for greater flushing in the receiving waters. In addition, the new stormwater outfalls would have shut-off valves to terminate flow from the Project should a sizeable spill occur.

Concerns were raised over ballast water releases pertaining to the VPA's Marine Ballast Water Exchange program and possible exemptions to ships. The VPA's Marine Ballast Water Exchange program allows for ships to be exempt from conducting a mid-ocean exchange of ballast water in the event of poor weather or hull stress. The concern that was raised was related to the contingency plan to deal with any required ballast water exchange while at Deltaport. VPA stated that the ballast exchange program is intended as a risk management program. Depending upon the port of origin for the ballast water, the ship may be allowed to discharge into local waters based an inspection of the ballast water and a risk assessment of the ballast water source. Alternatively, the ship may be directed to discharge at a suitable offshore location away from Roberts Bank in an area where tidal currents will take the discharge out to sea. The VPA will continue with its Ballast Water Exchange Program. The VPA's ballast and bilge water controls are vested under the authority of section 5 of the *Port Authorities Operations Regulations* made pursuant to the *Canada Marine Act.*

14.3.3 Mitigation

The Proponent suggests that any potential accident and malfunction can be addressed with appropriate construction and operation environmental management plans and spill response plans. Prior to the start of construction the Construction Environmental Management Plan, Emergency Response Plan, and all other relevant plans will be circulated to review agencies, including EC, for review and comment.

A detailed plan for the decommissioning of the existing storm sewer system at Deltaport will be made available for review by relevant agencies. The new storm sewer system is to be designed and constructed with sampling ports for obtaining environmental samples between the oil/water separator and the portion of the sewer that is subjected to tidal influence.

Before the commencement of Project operation, the Operational Environmental Management Plan, and other specific plans for environmental protection and monitoring will be circulated to relevant agencies, including EC, for review and acceptance.

14.3.4 Residual Effects

Based on the implementation of the proposed mitigation the RAs have determined that there will be no residual effects of the Project on the environment associated with accidents and malfunctions.

14.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS

During this cooperative environmental assessment the EAO, the RAs and the working groups have considered: the Application; comments from government agencies, First Nations and the public on the potential effects of the Project; responses by the Proponent; and the discussions of the working groups.

Based on the information summarized in the federal Comprehensive Study Report and provided that the Proponent implements the actions described in the *Owner's Commitments and Assurances*, the RAs are satisfied that any environmental effects of any malfunctions or accidents that may occur in connection with the DP3 Project are not likely to be significant.

15. Effects of the Environment on the Project

15.1 GENERAL

The following natural events and characteristics have been assessed by the Proponent for their ability to affect the construction and operation of the DP3 Project. These events and characteristics were selected from a review of the literature.

15.2 BACKGROUND

15.2.1 Seismic Events

The criteria used by the Proponent in consideration of potential adverse effects on the Project caused by seismic events, along with the geological conditions at the Project location, influence the geotechnical and structural design of the DP3 Project. Based on previous geotechnical investigations near the Project location, the site geology throughout the general Deltaport area consists of deltaic deposits comprised of layers of silts and sands. The layers generally slope toward the southeast. A thick silt layer appears to be present at the north end of the existing container terminal in the area of the proposed berth extension. This layer would likely undergo deformation under a major earthquake event; possibly as deep as elevation -40 m chart datum (CD) at the south end of the berth extension. The thickness of this silt layer appears to decrease towards the north end of the berth extension to about elevation -30 m CD.

The conceptual wharf design incorporates concrete caissons as the main support structure. Based on 1:475 year seismic design criteria, and the available geotechnical information, the Proponent has determined that 15.5 m wide caissons (wall to wall) with 18 m wide foundation slabs will be required for the Project to be in compliance with the relevant National Building Code. Local and global stability for the 1:475 year seismic event (Table 34) would be maintained by improving soils along the wharf to prevent liquefaction and prevent the flow of weak soils located in the container yard area behind the caissons. Soil improvements will include the replacement of clay materials with sand or gravel fill, the installation of rock berms, and the placement of a rock mattress. All materials will undergo densification.

Table 34 1:475 year seismic event, criteria for building code standards.

Return Period	1:475
Probability of Exceedance per Annum	0.0021
Probability of Exceedance in 50 Years	10%
Peak Horizontal Ground Acceleration (g)	0.26
Peak Horizontal Ground Velocity (m/s)	0.23

The geotechnical review of requirements for the container yard area by the Proponent determined that specific foundation designs such as concrete raft foundations founded on piles will be adequate to support structures in the container yard. An extensive program to replace the silty native soil (similar to the soil replacement program required for the caisson wharf structure) is not necessary for the container yard.

15.2.2 Tsunamis

The Lower Mainland coastline, including Roberts Bank, is not at risk from tsunamis generated in deep oceanic waters. However, the area is prone to tsunamis generated as a result of undersea landslides in unconsolidated sediments within the Strait of Georgia. Five such undersea landslide events have occurred since 1970. The maximum predicted amplitude of waves generated by undersea landslides within the Strait of Georgia is 4 m.

The present freeboard at Deltaport and at the DP3 Project is 3.2 m. Therefore, if a tsunami (maximum amplitude predicted by VPA is 4 m) were to occur at high tide there would be wave overtopping at the site. However, the existing Roberts Bank Port facilities, including Westshore Terminals and the Deltaport Container Terminal, have been in operation during all of the reported five previous submarine landslides at Roberts Bank, generating tsunamis, and no large waves have been recorded that have overtopped these terminals.

15.2.3 Sea Level Rise

Considering climate change effects on the Project, estimates of local sea-level rise in the region of Vancouver, based on analysis of long-term tidal gauge records (Point Atkinson), are in the order of 1 to 2 mm/yr. The recent tectonic history of the Fraser River delta area suggests that a combination of compaction and local down warping has resulted in an average subsidence of approximately 1.2 mm/year (0.0012 m/yr). Rates of subsidence in Boundary Bay of between 0.4 to 1.7 mm/year (0.0004 m/yr to 0.0017 m/yr) were reported, but these rates are relatively small compared to the projected eustatic changes (glacial melt inputs) that may occur.

Based on the predictions from these climate change studies, the Proponent assessed that projected relative sea level rise in the Roberts Bank area will vary. For the purposes of this assessment, it is assumed that the projected sea level rise will be 0.5 m by the year 2100. This is well within the 3.2 m freeboard of the facility, and no effects are predicted.

Extreme Weather Events:

Along with the projected sea level rise there is an anticipated increase in the frequency and magnitude of severe storms. The coincidence of storm surges and high tides would also be compounded by the projected increase in relative sea level. Larger and more frequent waves could result in waves overtopping the wharf, resulting in some terminal downtime and associated financial loss due to terminal shut down or repairs.

15.2.4 Summary

To address seismic risks, the DP3 Project has been designed to the current version of the National Building Code of Canada (1995 NBCC) to resist a 1:475 year seismic event. The Project may also be affected by tsunami and global warming events (sea-level rise and storms). Both of these conditions could result in waves overtopping the wharf, resulting in some terminal downtime and financial loss. The existing Deltaport terminal was designed and constructed, as will the DP3 Project, at appropriate elevations above sea level (+8.0 m chart datum). According to the Proponent, this elevation provides adequate freeboard such that if the potential tsunami and global warming events were to occur there would be only a temporary disruption of terminal activities.

15.3 ANALYSIS

The RAs considered the information provided by the Proponent, including the Proponent's conclusions on potential effects and the method used to reach those conclusions as outlined above in sections 1 and 2 of this chapter. The RAs then conducted their own analysis of the potential effects and proposed mitigation measures before independently reaching conclusions on the residual effects.

15.3.1 Potential Effects

Generally the effects of the environment on the Project will be minimized through the use of a design that adheres to the appropriate building design codes for seismic criteria and to withstand the predicted maximum magnitude tsunami. The Proponent predicted only minor effects on the proposed Project as a result of environmental effects. The potential for waves to overtop the terminal and result in some loss of production were predicted if any increase in extreme storm events (in association with climate change) were experienced at Roberts Bank and in major tsunami events. There are a myriad of potential effects of the environment on the Project.

However, these are mitigated through the design of the Project in adherence to building codes and best management practices.

15.3.2 Issues

No issues regarding potential environmental effects were raised by the working group, public or First Nations in response to the Proponent's assessment of effects of the environment on the Project that could not be mitigated.

15.3.3 Mitigation

Other than the design criteria that the Proponent will adhere to in the construction of the Project, in particular the National Building Code, and designing the Project to have appropriate freeboard, there was no specific mitigation proposed to address any potential effects on the Project due to environmental effects.

In the event that effects of the environment result in an accident, malfunction or spill, the appropriate emergency response plans are triggered and are discussed, along with the appropriate mitigation measures in Chapter 14 – *Accidents and Malfunctions*.

15.3.4 Residual Effects

Based on the implementation of the proposed mitigation the RAs have determined that there will be no residual effects associated with natural events on the Project.

15.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS

During this cooperative environmental assessment the EAO, the RAs and the working groups have considered: the Application; comments from government agencies, First Nations and the public on the potential effects of the Project; responses by the Proponent; and the discussions of the working groups.

Based on the information summarized in this CSR and provided that the Proponent implements the actions described in the *Owner's Commitments and Assurances* as listed in *Appendix A* of this report, the RAs are satisfied that the external environment will not likely result in significant adverse environmental effects on the DP3 Project.

16. Cumulative Effects Assessment

16.1 GENERAL

Section 16(1) of CEAA requires any screening or comprehensive study to include consideration of "any cumulative environmental effects that are likely to result from the Project in combination with other projects or activities that have been or will be carried out". Cumulative environmental effects are changes to the biophysical environment or socio-economic setting (only from a biophysical change) caused by an activity in association with other, past, present and future human activities. Cumulative effects assessment (CEA) is done to ensure the incremental effects resulting from the combined influences of various actions are considered. These combined effects may be significant even though the effects of each action, when individually assessed, are considered insignificant. CEA includes effects that are likely to result from the Project in combination with other projects or activities that have been or will likely be present in a reasonable temporal and spatial scale.

Cumulative environmental effects occur when:

- impacts on the natural and social environments take place so frequently or densely that the combined individual effects cannot be assimilated into the environment; or when
- the impacts of one activity combine with those of another in a synergistic manner creating a cumulative effect that is equal or greater in intensity than the total of the individual effects.

The Proponent's original Application, submitted on February 14, 2005 included a chapter on CEA that was initially reviewed by agencies and the public. Following receipt of initial agency comments it was decided that the CEA chapter would be amended and resubmitted. Materials presented below, including tables and figures, were drawn from the amended version of the CEA chapter that was submitted in November 2005, and made available for agency, First Nations and public comment in December 2005 and January 2006.

16.2 BACKGROUND

Cumulative environmental effects are defined as residual effects that, when combined with the impacts of other past, existing or imminent projects and activities, may have a compounding or interactive effect.

The DP3 Project includes construction of approximately 22 ha of land for container operations and storage, a wharf to accommodate a new ship berth, dredging to accommodate marine traffic adjacent to the terminal and a new tug mooring area. The effect of this Project and the potential for interaction with other historical, existing or future projects or activities is the focus of this CEA.

The CEAA Project Scoping Document (PSD), issued on February 10, 2005 for the DP3 Project outlined the scope of factors to be considered for the CEA. This scope specifically requires consideration of the proposed future development of T2 at Roberts Bank and other proposed future projects in the study area. On February 2, 2006 the Proponent wrote to the EAO withdrawing their request to initiate a provincial review of the T2 Project. The reasons provided for the withdrawal included outstanding infrastructure requirements and the need for consultation with stakeholders in the development of the Project design.

16.2.1 Study Area for Potential Cumulative Effects

Spatial Boundaries:

Spatial boundaries used for CEA are normally based on the "zone-of-influence" beyond which the effects of the action have diminished to an acceptable or negligible state. This approach is taken for each effect on each environmental component examined (e.g., air, water, vegetation, wildlife),

therefore multiple boundaries are required rather than a single study area. Spatial bounds therefore expand and contract according to the unique ecological relationships encountered. The spatial boundaries used for environmental components examined as part of the CEA are described below.

Coastal Geomorphology:
The spatial boundaries of the coastal geomorphology study area are the tidal environments influencing and influenced by Deltaport. These are Roberts Bank from the top of the foreslope to high water, and Canoe Passage to the BC Ferries causeway.

Water Quality:
The study area for potential cumulative effects on water quality and particularly circumstances that might lead to marine eutrophication is a 5 to 7 km radius from the existing Roberts Bank port.

Ecology:
The study area for cumulative effects on ecology extends from Canoe Passage to the base of the BC Ferries causeway along the Brunswick and Tsawwassen marshes shoreline, seaward to the edge of the foreslope of Roberts Bank and along the edge of the foreslope to Canoe Passage. The boundary for the assessment of potential cumulative effects on marine mammals is the Strait of Georgia from a line approximately between Nanaimo (Vancouver Island) and Horseshoe Bay (West Vancouver) to south of the San Juan Islands (USA).

Noise:
The study area is the Deltaport facilities and causeway, residential communities adjacent to the BC Rail railway line east to 156th Street in Surrey, and residential areas in close proximity to the shoreline extending from the Roberts Bank causeway south to Tsawwassen Beach. Residential communities to the east (Panorama Ridge, Colebrook, Woodwards Hill and Sullivan) were included because they overlook the rail line, which serves Roberts Bank almost exclusively.

Traffic:
The study area is Deltaport Way, the Highway 17 corridor to the Highway 99 intersection, Highway 99 from Massey Tunnel to North Delta, River Road and rail lines leading to Deltaport.

Air Quality:
The study area is a 30 km^2 area that includes the communities of Tsawwassen, the TFN, Ladner, Boundary Bay, Beach Grove, Steveston (City of Richmond), and Point Roberts (USA).

Temporal Boundaries:
Temporal boundaries or “how far back in time" and "how far ahead in the future" to consider in an assessment depend on a number of factors. Comparison of incremental changes over time requires the use of historical records for establishing an environmental baseline. The possibility of new actions requires the need to look ahead into the future. However, the further back or ahead in time, the greater the dependence will be on qualitative analysis and conclusions due to lack of descriptive information and increasing uncertainty in predictions. In practice the historical boundary in the past often defaults to the year in which the baseline information for the assessment is collected and the future boundary extends no further than including known actions. For the review of this Project, consultation with federal and provincial agencies was conducted on the rationale for the spatial and temporal boundaries described below.

Historical Temporal Boundary:
All historical temporal boundaries were based on the current studies for the Deltaport Third Berth Project EA Application. Most of these were conducted between 2002 and 2004, however for standardization all are indicated as 2003. This is an appropriate baseline, because prior to this date there is a lack of data that is directly comparable to that obtained in the studies for the DP3 EA, which is the focus of this assessment. By definition, using 2003 as the temporal baseline for this CEA automatically includes the cumulative effects of historic and existing projects and

activities because the baseline environmental conditions are a result of the effects of all these projects and activities.

Future Temporal Boundary:
The future temporal boundaries for this assessment extend to 2011, when it is likely that two of the major proposed projects in the area, Deltaport Third Berth and the South Fraser Perimeter Road (SFPR), are scheduled to be operational. For the air quality assessment, the temporal boundary extends to 2021, when the proposed T2, should it proceed, would likely be fully operational.

16.2.2 Existing Environment

For the purpose of this CEA, the contribution of, and the interactions between, specific historical and current development activities were explored to gauge the extent to which they have contributed to the existing environmental conditions. The following existing projects and ongoing activities have influenced existing baseline conditions:

- the existing Roberts Bank port facilities;
- BC Ferries Corporation ferry terminal;
- the Fraser River Port Authority's Fraser Surrey Docks;
- the dykes in the lower Fraser River floodplain;
- dredging of the Fraser River;
- the marine railway to Roberts Bank;
- Deltaport Way and other local roads;
- residential developments;
- adjacent land use including agriculture; and
- overhead utilities including power transmission lines.

Prior to intensive marine and coastal developments, Roberts Bank consisted of gently sloping, homogeneous sand and mud flats (including eelgrass areas) from near high water into and, beyond, low water. On the coastline were freshwater marsh and bog habitats. Construction of the causeways for the two terminals, introduction of non-indigenous species, dykes for agriculture and controls on the Fraser River have altered habitats at Roberts Bank, and the biota that depend on them. Historical trends and conditions for the relevant ecosystem components are described here.

Geomorphology:
Alteration in coastal processes governing tidal flat morphology and physical habitat such as tide direction and magnitude, waves and influx of the Fraser River sediment plume all caused by causeway development and dredging for the BC Ferries and Roberts Bank Port terminals has resulted in the development of drainage (dendritic) channels. The key actions leading to this were dredging the ship turning basin, which triggered head cutting and expansion of eelgrass over the flats, impeding water flow and concentrating water flow in the channels.

Marine Eutrophication:
For marine eutrophication to arise, a number of factors and conditions have to occur. There has to be a source of increased nutrients in the ecosystem, nitrogen and phosphorous being the most problematic. The second is an impediment to tidal flushing, which would otherwise mix and flush the system, and exchange of water/algal biomass accumulations with "new" marine water.

Municipal and industrial effluents from Vancouver are discharged into the Fraser River, and approximately 85% of the nutrients from the Fraser River end up on Roberts Bank. Discharges into the Fraser River have a long history of pollution, and include wastewater treatment plants and industrial effluent inputs, and agricultural and urban runoff. More recent surveys indicate the nutrient concentrations in the Fraser River meet relevant water quality objectives. Other existing sources of nutrients to the inter-causeway area include:

- the existing Deltaport container terminal with a secondary sewage treatment plant that discharges treated effluent into the ship berth area;
- the TFN wastewater treatment plant located in the inter-causeway area which provides secondary sewage treatment;
- the Brandrith pumping station on the north side of the BC Ferries causeway which drains about 1,000 ha of urban and agricultural land adjacent to Roberts Bank;
- non-point source surface water discharges from urban and agricultural land runoff (fertilizer and animal waste) which occur along the Roberts Bank foreshore;
- liquid discharges from container and bulk cargo ships sewage treatment plants which have the potential to release nutrient-laden effluent;
- nitrogen in air emissions that result from the burning of fossil fuels;
- decomposition of algal biomass in the inter-causeway area; and
- although no longer an existing discharge, the BC Ferries terminal, prior to 1993, discharged treated effluent onto Roberts Bank (now connected to the Delta municipal wastewater collection system).

Ambient water quality objectives are currently being met in the area. Decomposition of eelgrass leading to nutrient enrichment and the triggering of macroalgae growth does not appear to be occurring as the intertidal areas appear to have adequate tidal flushing and mixing. The high levels of tidal flushing along with the health and expansion of the eelgrass beds and the high species diversity in the inter-causeway area support the observation that marine eutrophication is unlikely to be presently occurring in the inter-causeway area.

Ecology – Marine Habitats:
The intertidal (brackish and salt) marshes at Roberts Bank have developed in the last 100 years after dykes were constructed to facilitate the conversion of marshes into agricultural land. Brackish marshes (exclusively around Brunswick Point) support a high diversity of vegetation, fish and birds. Macro-scale oceanographic factors – tides and winds – drive saline and sediment-laden fresh water interactions that, in turn, contribute to the biotic make up of this dynamic system. Species supported by this habitat include juvenile salmonids and waterfowl such as piscivorous and wading birds. Salt marshes are also relatively new at Roberts Bank, having been either formed against the causeways, or after dyke construction. Salt marshes are important for primary production, providing food for other parts of the Roberts Bank ecosystem. They are particularly important year round for the feeding, resting and roosting of dabbling ducks.

Intertidal sand and mud flats are distributed north of the Deltaport causeway, and in the inter-causeway area. They were the dominant habitat on Roberts Bank. However, intertidal sand and mud flats have decreased since dyke construction initiated salt and brackish marsh formation, and causeway developments began the process of eelgrass invasion, dendritic channel formation and tidal flat erosion. Some of this habitat is now covered in eelgrass; the remainder supports filamentous algae, bivalves, Dungeness crabs and other invertebrates and fishes such as sculpins, salmonids and flounder. Intertidal sand and mud flats have the highest diversity of invertebrates, with 120 species being found there. The combination of high primary productivity and a nursery habitat for juvenile fish and invertebrates (cockles and crabs) makes these areas valuable for adult stock recruitment and for providing resources to other parts of Roberts Bank. They are also important habitat for migrating shorebirds; herons and gulls use tide pools to forage on invertebrates.

Eelgrass (*Zostera marina*) has expanded approximately 33% in area, from 377 ha in 1967 to 500 ha in 2003, since the construction of the two causeways. This expansion has taken place at the expense of intertidal mudflat, and has been driven by the erosion of the intertidal mudflat, lowering the base level relative to tides, gradually creating an environment where desiccation intolerant biota (eelgrass) are favoured over other species. This has provided more habitat for fish and invertebrates, and feeding areas for dabbling ducks, geese and swans, piscivorous birds

and coastal seabirds. Some of the expansion of eelgrass has been due to invasion by the exotic eelgrass species, *Z. japonica*, which occupies a higher, and hence drier, position on the intertidal flats than the native *Z. marina*. Eelgrass elsewhere in North America is generally declining in extent.

Subtidal sand and mud have increased on Roberts Bank since causeway construction due to more areas of deeper water being created by dredging of ship basins and the creation of dendritic channels. These areas have limited amounts of eelgrass and seaweed (macrophytes) vegetation, and at greater depths macrophytes cease to be present. In shallow areas dabbling ducks and shorebirds forage among the macrophytes on macroinvertebrates. Dungeness crabs are present, especially in areas with finer sediments. Detritus in these areas provides food for crabs, clams and shrimp. English and Dover sole, flounder and lingcod are present here.

There were no areas of intertidal or subtidal rock on Roberts Bank prior to causeway construction or placement of marine protection devices. Rip rap and other hard substrate construction have provided man-made habitat for fish, including salmonids, lingcod, copper rockfish and many other smaller fishes that use it for refuge and foraging on the diverse algal cover. Piscivorous birds, diving ducks and shorebirds utilize this habitat, particularly terns, cormorants and gulls, feeding on the smaller fish living among the crest protection and rip rap structures.

Ecology – Birds:
Roberts Bank is an ecologically significant area where birds migrating seasonally on the Pacific flyway either overwinter, or stop on their way to other locations north or south. There are also resident coastal and terrestrial birds. The high biological productivity and diversity at Roberts Bank contributes to the value it offers to birds; it has received special designation as part of Western Hemisphere Shorebird Reserve Network (WHSRN) and as a proposed provincial Wildlife Management Area.

Dabbling ducks forage and rest in salt marsh, intertidal mudflats and eelgrass. Shorebirds forage rest and roost in salt marsh, intertidal mudflats and intertidal rocky habitat. Diving ducks forage rest and roost in deeper water habitats such as eelgrass (including in dendritic channels), intertidal mudflats and intertidal rock. Gulls scavenge (forage) opportunistically, rest and roost along the shorelines on salt marshes, intertidal mudflats, and in dendritic channels among eelgrass. Piscivorous (fish eating) diving birds forage and roost from intertidal rock, utilizing the deeper water areas of eelgrass, subtidal and intertidal mudflats and intertidal rock. Geese and swans forage rest and roost in salt and brackish marshes.

Changes to bird habitats on Roberts Bank, as a result of causeways and other developments, have created habitat diversity that may not have been present previously. The introduction of intertidal rock and deeper water foraging habitat may have benefited some bird species at the potential expense of others. Unfortunately there is no historical information available that would enable a quantitative comparison to be made.

Overhead powerlines and utility wires are on the causeway leading to the Deltaport facility, and along roads and railway rights of way on land adjacent to Roberts Bank. Overhead wires cause bird mortalities through collision. The risk to birds from these structures has been present since about 1970 on the causeway and before this on adjacent land.

Ecology – Marine Mammals:
Killer whales (southern resident and transient), harbour porpoises, and humpback, fin and grey whales are the most vulnerable in the study area because they have a combination of low population size, and vulnerability to anthropogenic disturbance or habitat disruption. In addition, many populations of these marine mammals are still recovering from earlier commercial hunting operations, or they have declining population numbers. All these species are identified as species at risk, either provincially (red- or blue-listed), federally (COSEWIC) or internationally (World Conservation Union, International Union for the Protection of Nature (IUCN), red book).

Trends of only those marine mammals that are either already at risk, or are likely to be affected by developments in the marine environment at Roberts Bank were considered as part of the CEA:

- *southern resident killer whale* – a small, declining red-listed population that is listed as Endangered on Schedule 1 of SARA;
- *transient killer whale* – red listed, occurring locally in small numbers;
- *grey whale* – frequent visitors to the southern Strait of Georgia;
- *fin and humpback whales* – usually seen offshore; and
- *harbour porpoise* – population under threat with declining numbers.

Ship movements in the Strait of Georgia associated with Deltaport, Westshore and BC Ferries terminals, Fraser Surrey Docks, ports in Washington State, USA (Seattle and Tacoma) as well as fishing and recreational vessels contribute to the potential for marine mammal collisions and increased marine noise levels.

Most marine mammal collisions occur in open waters, often when feeding areas and shipping lanes coincide. A number of collisions reported from the Strait of Georgia in 1999 were thought to be due to this cause. One incidence of injury to a marine mammal by a ferry has been reported; this incident severely injured a killer whale calf. The collision risk as a result of the existing Roberts Bank Port operations (Deltaport and Westshore) is considered to be low, though it is difficult to be definitive because of the limited data available for marine mammal collisions in the Strait of Georgia. Of the quantifiable vessel movements in the Strait of Georgia, 3.1 per day, or 4% of the total of 75, can be attributed to the existing Roberts Bank port.

Marine mammals employ sound, actively or passively, for a variety of purposes including navigation, communication, and foraging. Noise from human activities can affect marine mammal foraging, cause avoidance behaviours, and in extreme cases cause temporary and permanent losses in hearing. Existing underwater ambient noise conditions in the area around Deltaport, and in the Strait of Georgia, are unknown and there are no empirical measurements of ocean ambient noise conditions prior to the introduction of human generated noise to the marine environment. In the absence of both marine ambient noise levels and vessel noise profiles, the effects of existing vessel traffic could only be qualitatively assessed based on incremental increases of vessel numbers.

Noise:
Ambient noise levels were measured at several locations and were considered excessive by a number of residents. In these locations the noise is attributed to road and or rail traffic associated with residential, Deltaport, BC Ferries and commercial (transport and farming) activities. Numerous studies on noise in and around the Roberts Bank Port between 1978 and 2001 collectively indicate that noise in the study area has increased over the past 25 years. These ambient conditions have been increasing over the years since measurements have been undertaken; but noise analysis in 2000 showed no exceedances of COD bylaws and HC guidelines.

Traffic:
Vehicle traffic has increased in the study area since the ferry and Deltaport terminals were constructed, and due to residential, commercial and agricultural development in the area. Deltaport Way was constructed in 1995 to serve the Deltaport facility, which opened in 1997. During the morning and afternoon peaks northbound traffic on Highway 99 towards Massey Tunnel is congested and exceeds available capacity in the tunnel. Most roadways between intersections are relatively free flowing, while intersection delays are substantial.

Construction of Roberts Bank Port facility in 1970 resulted in a new rail line from Langley to Roberts Bank. Since that time, rail traffic has increased on the Port Subdivision rail line to approximately 18 trains per day (9 inbound and 9 outbound). This traffic is comprised of 12 coal trains and 6 container trains per day and can result in delays at many of the 30 at-grade

crossings that are located along the Port subdivision from Roberts Bank to the Township of Langley.

Air Quality:
Historical air quality studies have found air quality at Roberts Bank to meet all relevant regulatory standards for ambient air quality, with only one exception. Periods of high ozone (O_3) exceeding the applicable objectives occurred when a combination of meteorological conditions and high emissions from mobile (vehicle) sources coincided. Modeling undertaken for that study (Jacques Whitford Environmental Limited 2001) accounted for a worst-case scenario for "increased truck traffic on the causeway," and predicted that the "potential for the source emissions to cause adverse environmental effects, including cumulative environmental effects is negligible". Based on ambient air quality measurements in the study area, air quality is characterized as "Good" for the communities of Ladner, Tsawwassen, and North Delta. The recorded levels for air pollutants are within the relevant objectives and standards. The emissions inventory (2003) modeling (RWDI Air Inc. 2005) found that maximum concentrations for pollutants from all sources in the study area are within the most stringent federal, provincial and regional objectives and standards.

16.2.3 Proponent's Assessment of Impacts

Methodology
The CEA of the DP3 Project carried out by the Proponent used the following steps in its methodology:

1. Scoping to identify:
   - VECs, with ecosystem receptors for each;
   - past, present and future projects; and
   - spatial and temporal boundaries for each VEC.

2. Analysis of effects on the ecosystem:
   - historic trends and existing conditions for each ecosystem receptor;
   - contribution of Deltaport Third Berth and other projects;
   - mitigation of effects on each ecosystem receptor; and
   - significance of effects on the VEC.

3. Evaluation of overall significance of cumulative effects.

Scoping
It is commonly accepted practice to only consider VECs in a CEA if there will be residual adverse environmental effects on them in spite of the implementation of appropriate mitigation measures. For this CEA, VECs were included based upon: an investigation of environmental issues raised in the published literature, environmental assessment documents, regional and local planning documents and consultation with experts knowledgeable about the issues at Roberts Bank.

For each VEC under consideration, one or more ecosystem receptors were identified (see Table 35). Ecosystem receptors are environmental characteristics of the VEC that are affected by projects and activities. Ecosystem receptors are more specific than VECs, and often can be analyzed using information that is, and has been, regularly collected in the appropriate study area. They are measurable and therefore quantifiable, and where possible, this allowed predictive analyses to be undertaken.

Table 35 VEC and ecosystem receptors scoped for the cumulative effects assessment of the Deltaport Third Berth Project.

VEC	Ecosystem Receptor
Coastal Geomorphology	marine habitat types
Water Quality	marine eutrophication
Ecology	marine habitats (fish / crabs / others) birds (especially Pacific flyway) marine mammals
Noise	residents' perceptions
Traffic	traffic delays
Air Quality	human health

The CEA of the Project included consideration of existing projects described in section 16.2.2 of this report as part of the existing environment, and future projects and activities that have a high level of certainty of proceeding as listed below:

- the Roberts Bank Container Expansion Program development of T2;
- BC Ferries addition of three new Super C-class ferries;
- Fraser Surrey Docks upgrade to its facilities;
- T2 Project and Deltaport footprint expansion;
- the additional rail infrastructure, including storage tracks at Roberts Bank and mainline improvements required as part of the potential T2 Project;
- dredging activities that will continue to enable navigation of the Fraser River;
- the proposed South Fraser Perimeter Road (SFPR) Project plus any projected increases in traffic on the rest of the road network; and
- planned residential developments in the area.

Analysis of Effects
In the CEA the contribution of, and the interactions between, specific historical and current development activities, were explored to gauge the extent to which they have contributed to the existing environmental conditions. This assessment was undertaken for those VECs where residual effects were expected to occur as a result of the Project. Any ongoing trend in environmental change or effects was explored in the analysis of effects. This is important for effects that have yet to reach equilibrium in the environment, and or when the effect is continuous.

Other activities where effects occur on the VECs within the temporal and spatial boundaries were outlined and their effects noted. The cumulative effects were then discussed and their magnitude evaluated. The interactions of potential effects of the Project with each of the other activities that were considered were compared with ecosystem receptors in Table 36. These interactions defined the separate effects analyses that were conducted for each ecosystem receptor associated with the VEC.

An assessment of the Project related effects, and the effects of all projects and activities, on the ecosystem receptors was conducted and presented in the Application. Analysis of the cumulative effects was completed by comparing them against available thresholds, standards, trends or objectives relevant to the ecological receptors.

16.2.4 Proponent's Detailed Assessment of Impacts

The following sections describe the analysis of the potential effects, and the interactions identified in the scoping of historic and existing and future projects and activities, for each ecosystem receptor.

The requirement for an analysis of any particular potential cumulative effect was established using a matrix of the ecosystem receptors on one axis, and the interactions of the proposed

Project with each of the other (historic, existing and future) activities that were considered, on the other axis. Any cell with a "yes" indicates the potential for effects on the ecosystem receptor from the interaction of the DP3 Project with other projects, and this defined the need for a separate effects analysis. Other VECs were not considered in this CEA because the environmental impact assessment for the Project assessed them as having no residual environmental impact after mitigation measures were applied.

Table 36 Interactions of effects from Deltaport Third Berth with other projects, and the ecosystem receptors

VEC	Ecosystem Receptor \ Other Projects	Sea terminals	Coastal riparian modification	Railways	Roads	Residential developments	Adjacent land uses	Overhead utilities
Coastal Geomorphology	Change in marine habitat types	yes	yes	-	-	-	-	-
Water Quality	Inter-causeway marine eutrophication	yes	-	-	-	yes	yes	-
Ecology	Change in marine habitats	yes	yes	-	-	-	-	-
	Alteration to bird habitat	yes	yes	-	-	-	-	yes
	Marine mammal population effect	yes	-	-	-	-	-	-
Noise	Increase in highly annoyed by noise	yes	-	yes	yes	-	-	-
Traffic	Increased traffic delays	yes	-	yes	yes	yes	-	-
Air Quality	Increase in air contaminant levels	yes	-	yes	yes	-	-	-

Where there are interactions between ecosystem receptors for each VEC, and past, present or future projects, there is potential for cumulative environmental effects. The following sections are the analysis of these potential effects, and the significance of any of the interactions identified in the scoping of historic, existing and future projects and activities, for each ecosystem receptor.

Coastal Geomorphology:
Changes will continue to occur as a result of earlier developments, but the impact assessment showed no increase in the magnitude or extent of these after the introduction of the Project. While this would generally dictate that no cumulative effects assessment on coastal geomorphology processes was required, the role of these processes in shaping habitat for biota was deemed important enough to justify undertaking a cumulative effects assessment.

The distribution of marine habitat was the ecosystem receptor assessed for cumulative effects on coastal geomorphology. Alterations to the coastal environment are reflected in changes in the distribution of habitat for particular biota.

Of the projects and activities outlined in this assessment, the existing terminals, the proposed Deltaport Third Berth and T2 developments, and dredging activities in the Fraser River affect marine habitats in the CEA study area.

The Project is not expected to initiate any new tidal channels because the planned excavation will be in relatively deep water, well below the low tide line. As a result, there will not be further tidal flat erosion or triggering of head cutting. Furthermore, the main structures associated with the Project are not expected to affect tidal current patterns or waves sufficiently to initiate scour or erosion.

As noted in section 16.2, the T2 Project plan has not been finalized, and as a result an assessment of any potential effects on sediment distribution patterns, currents and waves could not be included in the Application. However, an assessment of any interacting effects on tides, currents and sedimentation, between the Deltaport Third Berth and a conceptual location for the proposed T2 development on the west side of the existing Roberts Bank Port facility has shown that there is unlikely to be a synergistic interaction between the two project locations.

Water Quality:
No residual effects on water quality were identified in the assessment conducted for the EA. However, concern has been raised over the potential for marine eutrophication in the inter-causeway area (between the Roberts Bank Port and BC Ferries terminal) due to the cumulative environmental effect of these structures and associated activities increasing the input of contaminants and nutrients, and limiting mixing and dilution of organic material.

Construction and operation of the Project will generate a small increase in anthropogenic nutrients in effluents, which the existing sewage treatment facility can adequately process. The Proponent has stated that the proposed Project is not expected to alter the tidal flushing that would result in hydrodynamic conditions that would trigger the eutrophication process.

There is potential for increases in nutrient loadings from the Brandrith pumping station, the TFN wastewater treatment facility and non-point sources, as land uses change and population increases in the future. Any increase in population, particularly if the TFN seeks to develop more residential use on its land, is at present unknown. Any such developments should be addressed by Project-specific environmental impact assessments and an increase in the capacity of associated sewage treatment facilities if necessary. The proposed T2 Project, if it proceeds, is likely to have a separate tertiary treatment facility for sewage, or will be connected to the municipal system. Thus, the chance of an increase in eutrophication due to increased nutrient inputs is considered low. The Project, in conjunction with other projects and activities is not expected to alter any factors that could trigger the eutrophication process.

Ecology – Marine Habitats:
The marine habitats on Roberts Bank continue to change as a result of the cumulative effects of the causeway developments, dredging on the Fraser River and coastal protection structures (dykes and stop banks). Associated changes to marine habitats and species that utilize these habitats have also not yet reached equilibrium. Eelgrass continues to expand at the expense of intertidal mud flats, intertidal mudflats are eroding and becoming deeper relative to sea level, and salt marshes may continue to develop against the causeways. The construction of the Project is not predicted to contribute further to these evolving changes as the Project will not result in any alterations to waves and currents that manifest in changes to sediment movement or distribution.

There will be effects on marine habitats as a result of the construction of the DP3 because the footprint will remove intertidal and subtidal mud flat habitat. These losses are not expected to have a serious effect on mobile species such as fish and crabs, as they will likely relocate. In addition, disturbance will only take place during non-critical times in the life cycles of these species. Salt marsh and eelgrass/mudflat habitat will be recreated as compensation for that lost

under the footprint. Habitat compensation proposed ensures no net loss of productive capacity. Intertidal rock habitat will be temporarily lost, but it will be replaced following construction.

The exact footprint and location for the proposed T2 has not been determined, so the effects on marine habitats as a result of the construction of this 80 to 100 ha terminal is somewhat hypothetical. However, for any practical location of T2 the direct footprint effects will mostly be on intertidal sand and mudflats, with some proportion of eelgrass and salt marsh habitats also affected. Under the *Policy for the Management of Fish Habitat* pursuant to the *Fisheries Act,* loss of this habitat would have to be compensated for at the time of T2 development to meet DFO's national no net loss guiding principle in order for the Project to proceed. As was noted earlier there is no predicted tidal, current and sedimentation interactions between the existing Roberts Bank Port facility and the Deltaport Third Berth, and the proposed T2 based on a conceptual design and location on the west side of the existing port facility. Therefore there are no additive or synergistic cumulative effects expected between this Project and the proposed T2 Project.

Although the Project does not contribute to additive or synergistic cumulative effects with the existing structures, the dendritic channel formation in the inter-causeway area that has occurred as the result of previous projects has resulted in a substantial area of unvegetated substrate in the midst of dense eelgrass. The proposed DP3 habitat compensation plan includes stabilization of the sandbars that would then provide habitat for invertebrates and/or eelgrass colonization and further increase the habitat productivity of the inter-causeway area.

Ecology – Birds:
The potential impacts of the Project footprint on birds are expected to be addressed through the HCP and AMS.

Concern has been raised over the potential for marine eutrophication in the inter-causeway area due to the cumulative environmental effect of the Project and associated activities, potentially increasing the concentration of nutrients and contaminants. A eutrophication event in the inter-causeway area, affecting bird habitat, though determined to be highly unlikely, would have a high potential to affect bird use. The AMS proposed by VPA is designed to detect and mitigate any emerging trends toward eutrophication.

Other effects of the DP3 Project and T2 include construction noise, light and impacts on foraging (turbid water decreasing visibility) outside the footprint. These construction impacts would be temporary, and after completion of the Project, birds are expected to once again fully utilize these habitats. Many birds are likely to continue using the area during construction in spite of the additional effects. When in operation, the impacts from noise, light and other disturbances are predicted to be only marginally greater than those from the existing facility.

Collision risk with overhead wires and other aerial structures has been raised as a potential cumulative effect. Past studies have indicated that the overhead power lines that were constructed as part of the original Roberts Bank Port development have impacted birds. Studies conducted between April and November 1983 identified 88 dead or injured birds on the Roberts Bank causeway; 61 birds (70%) showed conclusive evidence of wire collisions; cause of death for the remainder was inconclusive. Western sandpiper, a shorebird, was most susceptible (80% of observed mortalities). These mortalities were small in proportion to the birds observed utilizing habitat on Roberts Bank at that time. In a year-long survey from 1994 to 1995, approximately 710 birds were killed due to the overhead power lines on the Roberts Bank causeway, with the top wire presenting the greatest risk.

In 1996, a section of the upper overhead wire, on the Roberts Bank causeway was marked with spiral vibration dampers (or diverters) to make them more conspicuous to birds. It appeared the markers were effective, as there were fewer collisions on marked sections compared to unmarked (control) sections. Fewer mortalities and less severe impacts were attributed to birds being able to see the dampers and react earlier, possibly avoiding collision risk. Diverters were

installed along the entire length of the Roberts Bank causeway on the upper overhead wires. VPA and EC are currently assessing their effectiveness in reducing bird mortality. Field observers have documented that for all weather conditions to date (May-October 2004), the diverters cause birds to cross the power lines higher above the upper wire. The latest survey results (2005) show birds appear to be noticing and avoiding the wires, and there are weak trends indicating the dampers are reducing the risk of collision for all birds. The Project will not require additional overhead lines and it is possible that if T2 were to proceed, with the widening of the causeway, any new transmission lines would be buried.

Ecology – Marine Mammals:
Marine mammals were considered in this CEA because their presence was considered an indicator of a viable ecosystem with abundant resources ranging from plankton utilized by baleen whales to fish used as killer whale prey.

The main effects of construction of the Project and operation of the expanded facilities on marine mammals are additional noise, the potential release of environmental contaminants from dredging and the increased potential for collisions with vessels. These effects are already present at Roberts Bank; construction will temporarily increase noise, and operations will permanently raise potential for noise and collision risk impacts.

Sounds from dredging and construction are likely to be audible to some marine mammals up to 25 km away, and these could elicit behavioural and physiological responses at closer distances. The theoretical zone of audibility for killer whales has been estimated to be approximately 7.5 km until an underwater noise inventory has been completed. Other ongoing activities in the area (dredging in the Fraser River and movement of vessels) are likely to have similar effects, and the additional effects are likely to be incremental. However, the effects of these construction activities on marine mammals would be temporary and reversible.

Disturbance and re-suspension of marine sediments through dredging and disposal at sea has the potential of releasing contaminants into the environment where they may make their way into the food chain. The potential for environmental contaminants, which can be concentrated in marine mammals at the upper end of the food chain, to be present in the sediments of Roberts Bank is not fully known. However, test results on indicator contaminants such as mercury, cadmium and PAHs are within the maximum allowable levels in the *Disposal at Sea Regulations, 2001*.

The potential cumulative effects of additional vessels visiting Deltaport is likely to be negligible, because predicted additional DP3 and T2 ship numbers are low by comparison with other vessel traffic in the study area. While estimates for Deltaport and T2 operations in the future have been made, there is no corresponding information for future vessel movements to and from other bulk, container and ferry terminals. For this analysis a conservative comparison of the projected DP3 and T2 operations with the quantifiable existing (2003) ship movements in the Strait of Georgia from other operations (no future increase in ship movements) was made.

The Project will introduce some additional residual effects of noise and collision risk from additional ship visits. At Deltaport, ship movements are projected to increase from an average of 3.1 per day to 3.4 per day with the proposed Third Berth in operation. Additional ferry movements are also likely, though the magnitude of the increase from the conservative estimate of 45 ferry movements per day is unknown. T2 in operation at 2021 would also increase Deltaport ship movements to approximately 5.3 per day. It is difficult to project container ship numbers into the future, however, recent trends in container cargo point to more, larger vessels being used in the future.

Projected vessel movements to and from the Deltaport facility with the proposed Project (3.4 per day) are much lower than those from the existing BC Ferries terminal (greater than 45 per day), Fraser Surrey Docks (4.2 per day, but projected to increase after expansions), other VPA

terminals (11.4 per day), Seattle and Tacoma ports (11.1 per day) and an unknown number of fishing and pleasure craft. With the proposed T2 Project the number of visits (5.3 per day) is still lower than the existing ferry movements alone. Vessels traveling to and from the Roberts Bank facility exceed the 80 m length criteria for increased risk of collision with marine mammals, but as they approach the Roberts Bank terminal they are generally traveling below 14 knots. Given the low quantity of vessels and the slow speed (generally under 14 knots when approaching Roberts Bank) from existing and projected future vessels visiting Deltaport, compared to other vessels in the Strait of Georgia, the collision and noise risk to marine mammals is considered to be negligible.

Noise Analysis:
The noise analysis undertaken by the Proponent for the impact assessment also takes into account ambient noise from existing projects and activities in the study area. The anticipated addition of noise associated with the Project is predicted, but the likely addition of other proposed projects, which have yet to be assessed using a rigourous methodology (T2 and South Fraser Perimeter Road), has not been included. In addition the viability of T2 depends on improvements to the road and rail network, and until these are planned, and alignments chosen, a detailed quantitative cumulative effects assessment of noise is not feasible.

The percentage of people that would be highly annoyed (% HA) by noise is the quantitative value that was used to assess potential cumulative effects of noise as a result of the Project. The % HA is calculated using the predicted increase in average day and night noise level (dBA L_{dn}), normalized using a rating for particular types of noise associated with the Project (dBA L_{Rdn}). Some residents already consider ambient noise levels in the study area to be excessive. This included the noise from other projects and activities such as rail and road traffic, and BC Ferries terminal operation, for this reason noise is included in the CEA.

The noise expected from both night and day construction activities for the Project is not predicted to increase enough that the changes will be evident to the human ear, therefore impacts on residents in the study area should be minimal. The majority of the material imported to the site of the proposed Project, such as sand, gravel and crushed rock, will be transported by barge, instead of by truck, so the degree of construction traffic, and its noise contribution, is anticipated to be low.

Trains, road traffic (traffic on Deltaport Way associated with Deltaport only), ships (including tugs) and container handling equipment likely to be used in the operation of Deltaport after the Third Berth is complete (2011) are predicted to make a minimal contribution to ambient noise levels at local receptors. For all modeled locations there were insignificant (imperceptible to the human ear) increases, except one which had minimal (>1 dBA) impact. However, some residents already consider the ambient noise levels at many locations excessive. The major source of this excessive noise is from rail operations (trains and whistles). Other sources such as trucks serving the container terminal would have no significant impact (any change is inaudible) on residents in the study area. Alarms for the additional ship-to-shore gantry cranes may be perceptible at locations on the shoreline, but this increase in noise is considered minimal.

The introduction of other proposed projects that may also contribute to noise, such as the South Fraser Perimeter Road and T2, has the potential to further increase noise levels at these and other locations. Assessment of the potential cumulative effects for these other projects cannot be conducted because parameters required for modeling, such as the precise location and operating characteristics (route location, queuing data, volumes of road and rail traffic), for these future projects has either not been determined (T2), or is not yet detailed enough (South Fraser Perimeter Road). Both projects are likely to increase ambient noise levels further in the study area. Based on previous noise assessments, noise level increases associated with T2 could range from 1 to 3 dBA based on historical noise assessments. Both T2 and the South Fraser Perimeter Road will be subject to separate environmental assessments as required by BCEAA and CEAA, which will likely include a noise impact assessment.

Traffic Analysis:
Future car and truck traffic volumes in 2011 were examined to assess the impact of the Project. Traffic volumes in 2011 without the Project were compared with 2011 traffic volumes that included the Project to illustrate any cumulative effect.

The difference between the predicted future traffic volumes with and without DP3 in operation is considered relatively small. For all intersection movements the Project is predicted to increase traffic by less than 10%, and for most movements the increase is estimated at 1 to 4%. The majority of the traffic volume is expected to be as a result of background commuter traffic from residential and agricultural communities and traffic associated with the BC Ferries terminal (approximately 7% increase by 2011). The potential increase in residential population in the area, and the potential for increased ferry sailings is likely to continue to keep the contribution of these activities to traffic volumes in the area high.

By 2021 it is predicted that both the South Fraser Perimeter Road and T2 projects will be operational, increasing traffic volumes in the study area. T2 is predicted to add 1,860 service and delivery vehicles, 1,034 container trucks and 10 container trains per day. BC Ferries predicts a 42% increase in traffic by 2020. Other increases in traffic volumes (residential, commercial and agricultural) are unknown. No quantitative analysis of traffic delays for 2021 has been undertaken. As such, an analysis is dependent on the details of the future road network, which is likely to be profoundly different from the existing network as a result of the proposed South Fraser Perimeter Road Project.

Air Quality Analysis:
The human health risk assessment identified potential impacts on human health associated with emissions and air quality. Two separate, but complementary analyses were undertaken to establish the potential cumulative effects of existing and future projects on human health. Air quality emissions and dispersion modeling to establish contaminant concentrations (for comparison with ambient air quality objectives) and an associated human health assessment were undertaken up to 2011 for the proposed Project.

T2 (which is not expected to be fully operational until 2021) and the South Fraser Perimeter Road lack this detailed design information, and as a consequence, the T2 air quality analysis is limited to an emissions inventory only. Analyses that attempt to assess contaminant concentrations or human health risk beyond air quality predictions for 2011 cannot be completed until more detailed emission information on T2 and the South Fraser Perimeter Road is available.

The air quality predictions for 2011 were based on a conservative (worst-case) estimate of ship visits to Deltaport in 2011 with the Project. For that analysis, the number of ship visits was assumed to be 393 per year. However, there is a trend toward the use of larger container vessels, which means fewer ship visits may be required for the same volume of cargo. However, there would be similar emissions from ancillary port-related sources (trains and dockside equipment) to service the same cargo volume.

In 2011, with the Project in full operation, there is predicted to be either a slight increase (between 5 and 11% for scenario 1 over 2003 emissions for the pollutants modeled, or a slight decrease (between 0% and – 11% for scenario 2 due to the Project. Impacts to projected ambient air quality for 2011 as a direct result of the Project are therefore predicted to be either a minor increase, or a decrease over the existing situation. All maximum predicted concentrations for the 2011 scenario meet the most stringent ambient air quality guidelines or standards.

By 2021 improvements in technology are predicted to reduce emissions from many of the Deltaport-related sources, and as a result, under either 2021 scenario the emissions are predicted to be similar to the existing situation, or reduced by as much as 44%.

Design details, including location, area and operational procedures for the proposed T2 Project have not, as mentioned in section 16.2, been finalized. As a result, predictions of the potential emissions associated with that Project have limitations. The estimates are conservative, and do not take into account emission reduction measures such as dockside power supplies, and sulphur reduction technologies and procedures that would considerably reduce emissions.

Regarding the potential emissions related to the proposed T2 at full operation in 2021, 3 scenarios relating to the mix of vessel sizes that could be expected to deliver the targeted 1.7 million TEU of cargo per year were modeled. The scenarios range from a high of 462 annual ship calls to a low of 237 annual ship calls. T2, when in full operation is predicted to emit slightly more contaminants than the Deltaport (with or without the proposed Third Berth) operation, depending on the contaminants and the mix of vessel sizes that visit. When the predicted T2 emissions are added to the predicted Deltaport emissions (with the proposed Third Berth) there is approximately 50% more emissions for the low estimate of ship visits compared to the existing situation. For the high estimate of ship visits there is an approximate doubling of predicted emissions.

When emissions for all other modeled projects and activities in the area (Highway 17 and the proposed SFPR Project, the BC Ferries terminal, and Westshore coal terminal) are added to the Deltaport-related activities (DP3 and T2), the following results are predicted by the Proponent:

- for the low scenario in 2011 (fewer larger ships visiting Deltaport, no increase in Westshore emissions, 20% increase in ferry emissions and SFPR relocated Highway 17 option) all contaminants decrease (by 2 to 47%) compared to existing emissions;
- for the high scenario in 2011 (more smaller ships visiting Deltaport, 10% increase in Westshore emissions, 20% increase in ferry emissions, and SFPR relocated Highway 17 option), NO_X, CO and VOC are either the same or decrease (0% to 46%) and SO_2, particulate matter (PM) and total suspended particulate (TSP) increase by 2 to 8% compared to existing emissions;
- for the low scenario in 2021 (fewer larger ships visiting Deltaport and T2, no increase in Westshore emissions, 20% increase in ferry emissions and SFPR relocated Highway 17 option) most contaminants increase, but CO and volatile organic compounds (VOC) decrease compared to existing emissions; and
- for the high scenario in 2021 (more smaller ships visiting Deltaport and T2, 10% increase in Westshore emissions, 20% increase in ferry emissions and SFPR relocated Highway 17 option) most contaminants increase, but as with the low scenario, CO and VOC decrease compared to existing emissions.

Emissions of all gaseous pollutants and particulate matter in the area are similar or less under any 2011 scenario compared with the existing situation. While some pollutants (CO and VOC) decrease in 2021 compared to the existing situation, most air pollutant levels increase. It needs to be stressed that the 2021 predictions suffer from limitations, particularly due to no terminal design elements and operational information for the proposed T2 Project.

On the basis of the air quality impact assessments, the contribution of emissions and impact of the Project on ambient air quality is considered to be either negligible, or to decrease relative to the existing situation. This takes into consideration changes in emissions that have a high probability of occurring by 2011, such as increases in background traffic due to population growth and the implementation of legislation regarding improved engine efficiency and fuel quality. Dispersion modeling for 2021 would be required to compare the predicted emissions from T2 against ambient air quality guidelines and standards, but this is premature until uncertainties with future projects (particularly SFPR and T2) are resolved.

A precautionary approach to human health risk estimates indicates an absence of potential acute or chronic health risks for all 2003 and 2011 scenarios (existing 2003 conditions, and predicted 2011 conditions with and without the Project). Health risks of acute and chronic inhalation and ingestion of food grown in the area were negligible for all contaminants, and at all selected

receptor locations; including the TFN community as the closest receptor in the area. There are no particulate matter (PM) guidelines; however these emissions were characterized as low. No assessment of potential human health impacts was conducted beyond 2011 because there is not enough detailed information available for such an analysis at this time.

16.3 ANALYSIS

The RAs considered the information provided by the Proponent, including the Proponent's conclusions on potential effects and the method used to reach those conclusions as outlined above in sections 1 and 2 of this chapter. The RAs then conducted their own analysis of the potential effects and proposed mitigation measures before independently reaching conclusions on the residual effects.

16.3.1 Potential Effects

The Proponent's amended application chapter on CEA took into consideration the comments of the harmonized environmental assessment working group and the public, so potential environmental effects that were not addressed in the original chapter were included in the revised analysis. Thus, there are no additional potential environmental effects other than those that have been previously described in this chapter.

Potential cumulative environmental effects associated with the Deltaport Third Berth Project in relation to existing and future projects and activities identified during the CEA are summarized in Table 37. For these effects the contribution of Deltaport Third Berth Project is low, or low to moderate, and for two (traffic and noise), the effects are considered reversible.

Table 37 Identified potential cumulative effects on each ecosystem receptor

Potential Cumulative Effect	Extent	Magnitude	Duration	Reversibility	Probability	Frequency	Third Berth Contribution
Change in marine habitat types	local	moderate	long	Irreversible	high	continuous	low
Inter-causeway marine eutrophication	local	low	long	reversible	high	periodic	negligible
Change in marine habitats	local	low	long	irreversible	high	continuous	low
Alteration to bird habitat	local	low	long	irreversible	moderate	continuous	low
Marine mammal population effect	regional	low	long	reversible	low	isolated	low
Increase in highly annoyed by noise	regional	high	long	reversible	high	continuous	low
Increased traffic delays	regional	moderate	long	reversible	moderate	periodic	low-moderate
Increased risk to human health	municipal	negligible	long	reversible	moderate	continuous	negligible

16.3.2 Issues

The Proponent's amended Application chapter on CEA (Chapter 23) took into consideration the comments of the harmonized EA working group and the public, so germane issues that were not addressed in the original chapter were included in the revised analysis of the amended chapter.

The amended Application chapter was subject to agency and public review. Comments on the amended CEA chapter are briefly summarized as follows:

- The scope of the cumulative effects assessment was felt to be too narrow by some members of the public.
- Some members of the public felt the assessment of the T2 Project was not adequate.

- COD commented that the assessment should include land uses associated with industrial development in response to port expansion.
- Some members of the public suggested that issues raised by some review agencies such as EC and the public during the review of the Application were not adequately addressed in the amended CEA.

The Proponent responded to all issues raised by the public, First Nations and reviewing agencies.

16.3.3 Mitigation

Where possible, mitigation for the effects of the identified cumulative effects on ecosystem receptors was identified and is summarized below.

An AMS has been developed by the Proponent with input from regulatory and science-based agencies and technical experts. Its purpose is to monitor key environmental variables and provide practical advance warning of potential negative ecosystem trends emerging in the inter-causeway area during Project construction and operation. Monitoring results will be evaluated and compared against action thresholds, and a Scientific Advisory Committee will review those results, their interpretation, advise on recommendations for any required mitigation, and advise on the effectiveness of the AMS.

Coastal Geomorphology – Mitigation of Effects

- Specific mitigation measures associated with coastal geomorphology and marine habitats are described in Chapter 2 – *Coastal Geomorphology;* and
- Proposed AMS to monitor trends and respond to detected changes through the application of mitigation.

Marine Eutrophication – Mitigation of Effects

- Existing treatment facilities and procedures appear to be adequate for the current level of anthropogenic nutrient inputs; and
- Proposed AMS to monitor trends and respond to detected changes with appropriate mitigation.

Marine Habitats – Mitigation of Effects

- Specific mitigation measures associated with marine habitats are described in Chapter 5 – *Marine Environment*;
- Compensation for the loss of habitat will be undertaken in adherence to DFO's no net loss guiding principle. Monitoring will be used to assess the performance of the compensation habitat designs and to ensure there is no net loss of the productive capacity of fish habitat. If the compensation habitat is not functioning to DFO's satisfaction, by the end of the monitoring period specified in the section 35(2) *Fisheries Act* authorization, additional works and monitoring will be required to ensure the compensation habitat functions as designed, or, if appropriate, additional habitat compensation will be provided; and
- Proposed AMS to monitor trends and respond to detected changes and respond with appropriate mitigation.

Birds – Mitigation of Effects

- Specific mitigation measures associated with marine habitats are described in Chapter 6 – *Waterfowl and Coastal Seabirds*;
- Development of inter-causeway habitat compensation to increase feeding areas and resting areas for birds;
- No additional overhead power lines, nor any modifications to the existing power lines, are required for the Project; and
- Proposed AMS to monitor trends and respond to detected changes with appropriate mitigation.

Marine Mammals – Mitigation of Effects

- Avoid construction activity above the noise thresholds for particular species when they are observed close enough for susceptibility;
- Develop an ambient underwater noise inventory for Roberts Bank that the Proponent will share with regulators and researchers;
- The Proponent will work with the BC Pilots Association to develop an education and awareness program about marine mammals and have pilots of vessels transiting to Roberts Bank steer away from observed pods when vessel safety is not compromised; and
- Mitigation for potential underwater noise effects to marine mammals include adjusting vessel speeds to 10 knots or less when approaching the port area and encouraging proper maintenance of ship propellers.

Noise – Mitigation of Effects

- Specific mitigation measures associated with noise are described in Chapter 9 – *Noise Impacts*; and
- Formation of a Roberts Bank Noise Management Committee with representatives of the VPA, terminal and railway operators, municipality and residents.

Traffic – Mitigation of Effects

- Specific mitigation measures associated with traffic delays are described in Chapter 12 – *Socio-community Issues and Economics*;
- To resolve the long-term transportation requirements, a regional plan is currently being prepared by the BC Gateway Program. This plan is examining a number of projects including the proposed SFPR, which ultimately could reduce congestion in Delta; and
- A detailed rail assessment for T2 will be completed in 2006 and the results of this study will be reviewed with COD, the City of Surrey, and the Township and City of Langley. A coordinated road and rail plan will be prepared with input from the rail companies.

Human Health – Mitigation of Effects

- Specific mitigation measures associated with air quality and human health are described in Chapter 8 – *Air Quality*;
- The Proponent will continue to actively work with other ports, industry, regulators and other organizations to create a sulphur emission control area (SECA) where vessels must use <1.5% sulphur fuel oil or use equivalent emission control technology by 2009;
- Continuous improvements in operational efficiencies for the existing Deltaport Terminal and the Project such as new and improved machinery (possible use of diesel-electric hybrid terminal equipment) and procedures (use of ultra-low-sulphur diesel fuel in equipment, fuel catalysts);
- Providing for the possibility of shore based power at Deltaport for ship auxiliary power when ships are at berth;
- Coordinating air quality improvement efforts with railways;
- Introduction of the proposed South Fraser Perimeter Road is predicted to improve traffic flow, thereby reducing vehicle idling time and emissions; and
- With respect to the proposed T2 Project, the Proponent has indicated it believes substantial emissions mitigation will be necessary for it to proceed.

16.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS

During the harmonized environmental assessment, the EAO and the RAs and the working groups have considered: the Application; comments from the government agencies, First Nations and the public on the potential effects of the Project; responses by the Proponent; and the discussions of the working groups.

Based on the information summarized in this CSR and provided that the Proponent implements the actions described in the *Owner's Table of Commitments and Assurances* as listed in *Appendix A* of this report, the RAs are satisfied that the DP3 Project will not likely to result in any significant adverse cumulative environmental effects.

17. Sustainable Development

17.1 GENERAL

Recent changes to the *Canadian Environmental Assessment Act* (1999) have strengthened the requirement for considering sustainable development, and how proposed projects may impact sustainability. CEAA is now a key legislative tool that is being used to help the Government of Canada "…achieve sustainable development by conserving and enhancing environmental quality and by encouraging and promoting economic development that conserves and enhances environmental quality."

Sustainable development is defined as development that meets the needs of the present, without compromising the ability of future generations to meet their own needs.

This chapter considers – collectively – the range of social, economic and environmental costs and benefits associated with the Project, and presents an overview of how the Project meets the intent and definition of sustainable development, as defined in CEAA. Although, the inclusion of this material is a requirement under CEAA, the Provincial EA review under BCEAA also encourages and endorses a discussion of "project sustainability".

17.2 BACKGROUND

17.2.1 Legislative Requirements and Background to Sustainable Use Assessments

The Proponent developed an environmental management program and community initiatives to deliver the DP3 Project in a sustainable manner as detailed in the Application. CEAA requires that every EA completed as a Comprehensive Study include the environmental sustainability of the Project. The ATOR identified that the sustainability of renewable resources will be considered in the harmonized provincial-federal assessment. Because there is little in the way of specific CEAA guidance or examples to achieve this requirement, the Proponent examined frequently used sustainable use / sustainable development assessment frameworks, including a proposed framework for Canada that was judged to be unsuitable for use in EA at this present time. The Proponent argued that the traditional approach to sustainable development assessments, where the balance between the costs and benefits of bio-physical, socio-community and economic factors were considered, was the best methodology.

17.2.2 Assessment Criteria

As there is no accepted measure for the sustainability of each of the biophysical, socio-community and economic factors, a quantitative analysis was not feasible. Instead a qualitative assessment was conducted, and due to this, the assessment was mainly subjective. How sustainable different components of the Project are, and the ability to balance different components against each other has been taken into consideration. The Proponent noted that the sustainable development chapter is not a definitive presentation of how sustainable the development is, but rather places the Project into context within the GVRD and the southern Strait of Georgia, for consideration of sustainable development within the region.

17.2.3 Biophysical

The Proponent presented information on the general effects of the Project on biophysical parameters. These included: footprint impacts to the marine environment including fish and bird habitats, (which are to be mitigated in accordance with DFO's *Policy for the Management of Fish Habitat* under its guiding principle of no net loss of habitat productive capacity); air quality impacts in the context of human health protection (which remain within the appropriate Canadian objectives and standards); and, water quality impacts (within provincial objectives).

The mitigation for these impacts proposed by the Proponent included:

- the creation and development of habitat to replace that lost during construction of the Project;
- new and existing measures to reduce air emissions, and continually improve air quality associated with operations at Deltaport and the DP3 Project;
- mitigation to reduce the potential DP3 contribution of contaminants to the waters and sediments of Roberts Bank, and ongoing practices to safeguard water and sediment quality from operations at Deltaport;
- mitigation to reduce the potential effects of DP3 construction and operation on marine and terrestrial habitats, species and wildlife; and
- An Adaptive Management Strategy.

The Proponent indicated that there would be no impact on sustainability due to the above described habitat impacts because, despite the Project permanently removing some habitat, new habitat will be created within the area.

With regard to air quality, a number of existing measures are being undertaken at Deltaport which contribute to continuous improvement of air quality within sustainable levels (within relevant air quality standards and objectives).

17.2.4 Socio-community

The Proponent noted that any impacts of the DP3 Project on the community during construction and operation, with mitigation measures applied, are considered to be generally very low (minimal impact on community services such as police, ambulance, fire, medical and social services, and minimal impact on existing land uses), and for some socio-community components there will be benefits (employment generation).

The impact of additional workers commuting to Deltaport is regarded to be insignificant relative to existing, and projected future, traffic volumes, and any workers choosing to locate to the Delta community are not expected to significantly detract from the ability for services to provide for the needs of the existing and future residents. However, there is high potential for the existing road network to be unsustainable in the future, and there is a general recognition that this region-wide issue is not due to this Project alone. Operations at Roberts Bank will increase traffic, but the increase is projected to be minimal compared to the existing and projected future traffic volumes (commuters and traffic to and from the BC Ferries terminal). Specific mitigation for these effects is proposed by the Proponent in the short term, and other plans for an upgraded road network, when implemented, will likely improve this situation in the long term.

Construction and operation of the DP3 Project adheres to objectives in municipal (COD Official Community Plan) and regional (GVRD Livable Region Strategic Plan) planning documents, particularly those revolving around sustainability (e.g., increasing job opportunities in the area and efficiencies from utilizing existing port and transport infrastructure).

17.2.5 Economic

The economic impacts of the proposed DP3 Project are generally recognized to be positive; the Project will add value to the local, regional and wider economies. Economic benefits mean added revenue to individuals, companies, municipalities and the provincial and federal governments. For individuals and companies, the benefits accrue as income, but for local, regional, provincial and federal government the benefits are from higher tax revenues. This provides these entities with the ability to increase spending on items that enhance quality of life.

Benefits will accrue during construction due to capital investment from building the terminal, equipment purchases, and contracts and purchases made for labour, goods and services. The Project will also provide many business opportunities locally and regionally during construction.

In addition there will be benefits into the future from Port operations that will generate an increase in container business, as greater cargo volumes move through the supply chain. This will generate a wide variety of local and regional employment and business opportunities, purchases of goods and services for operations, generation of corporate profits, and payment of property and income taxes.

The economic impact from direct construction, operations and expected terminal business opportunities is $86 million in Delta, $1.5 billion elsewhere in the GVRD, $328 million elsewhere in BC, and $932 million elsewhere in Canada. When secondary impacts are included (unavailable for Delta and the GVRD), the impact on the British Columbia and Canadian economies is $1.7 billion and $3.5 billion respectively.

17.2.6 Conclusion of Proponent's Analysis

The Proponent's first priority for business growth is to increase the capacities of existing facilities through operating efficiencies and new equipment productivity. However, these improvements alone are not sufficient to meet projected container capacity requirements and, as a result, it has an expansion strategy that includes the proposed Project. The Proponent has committed to ensuring that the Project will be a socially and environmentally sustainable development, and the sustainable development assessment presents an balanced picture overall. There are strong positive economic contributions to overall sustainability; direct inputs to local, regional, provincial and national economies through job creation, spending and taxes are high. The secondary or flow-on effects of this will indirectly benefit the local, regional, provincial, and national economies. The effects of this are a clearly positive impact on the sustainability of future generations.

Effects on the sustainability of community infrastructure (community and emergency services) are considered to be neutral. However, air quality, noise and traffic impacts from the Project will contribute to the general trend where capacity of these resources to provide for the future is limited. These Project-related impacts are small relative to the existing background conditions, which are driven by other projects and activities, as well as by Deltaport. The Project will not inhibit community access to clean air, quiet or congestion-free roads, but it is recognized that broad community involvement and support is required to resolve these wider issues. Beyond the mitigation proposed for the Project, the Proponent continues to play a role in alleviating some of these wider issues as a member of the Delta community.

While there will be a permanent loss of marine habitat types under the footprint of the Project, the proposed habitat compensation measures are expected to fully mitigate these effects, resulting in no net loss of habitat productive capacity, consistent with DFO's *Policy for the Management of Fish Habitat*. None of the habitats affected are considered unique in that other similar habitats exist on Roberts Bank and are available for plant, animal and human communities.

Each of the components assessed for its contribution to sustainable development is considered to be either positive or neutral, leading to the interpretation that on balance the DP3 Project presents a sustainable development that does not compromise the availability of renewable resources to future generations.

17.3 ISSUES AND POTENTIAL EFFECTS

17.3.1 Potential Effects

There are potential effects that are both positive and negative on various ecosystem components, which are addressed in other chapters of this report, and that contribute to the balance between biophysical, socio-community and economic sustainability factors. Socio-community and economic sustainability factors are presented above and discussed in detail in the Proponent's application. For the purposes of this report the potential effects on sustainable or renewable resources are focused on the biophysical components, as follows:

Habitat loss in the marine environment – The DP3 Project will permanently remove approximately 22 hectares of existing intertidal and shallow subtidal marine habitat. These permanent effects have the potential to affect the distributions and productivity of fish and fish habitat, in particular, invertebrates (juvenile and adult Dungeness crab), and fishes (juvenile salmon). The potential effects to the marine environment and the proposed mitigation measures, including proposed habitat compensation, are discussed in detail in Chapter 5 – *Marine Environment*.

Coastal seabirds and waterfowl effects related to loss of habitat – The DP3 Project will permanently remove approximately 22 hectares of existing intertidal and shallow subtidal marine habitat that is presently used by coastal seabirds and waterfowl for feeding and resting. The potential effects to coastal seabirds and waterfowl and the proposed mitigation measures, including proposed habitat compensation, are discussed in detail in Chapter 6 – *Waterfowl and Coastal Seabirds*.

Air quality – The DP3 Project will result in more emissions, within the local and regional study areas, that have the potential to effect human and wildlife health. The potential effect on air quality and the proposed mitigation measures are presented in depth in Chapter 8 – *Air Quality*.

17.3.2 Issues

Concerns were raised that the combination of the continuing changes from previous development and at least some degree of risk from the proposed development gives rise to concerns about the Project potentially causing unforeseen morphological changes which may or may not have negative effects on the biological productivity and habitat values of the area.

The Proponent is committed to participating in a wider-reaching Roberts Bank Stewardship Program involving EC and DFO and which is anticipated to include participation by local municipalities, First Nations, other coastal stakeholders such as BC Ferries and ENGOs.

17.3.3 Mitigation

The Proponent initially developed an environmental management program and community initiatives to deliver the Project in a sustainable manner as detailed in the Application. These included the mitigation measures listed in previous chapters of this report, and summarized in *Appendix A*. In addition, during the Application review, the Proponent completed the following:

- A conceptual Habitat Compensation Plan (*The Vancouver Port Authority Deltaport Third Berth Proposed Habitat Compensation Plan*, dated March 12, 2006) was prepared by the Proponent to meet DFO's *Policy for the Management of Fish Habitat* and the guiding principle of no net loss of habitat productive capacity. The Habitat Compensation Plan strategically considered habitat compensation concepts that complement and benefit fish, waterfowl and coastal seabirds. Subsequent to the conclusion of the environmental assessment, and prior to initiating the Project, the Proponent would be required to develop the conceptual Habitat Compensation Plan into more detailed designs to meet DFO habitat authorization requirements consistent with DFO's guiding principle of no net loss. Monitoring will be used to assess the performance of the compensation habitat designs and to ensure there is no net loss of the productive capacity of fish habitat. If the compensation habitat is not functioning to DFO's satisfaction by the end of the monitoring period specified in the section 35(2) *Fisheries Act* authorization, additional works and monitoring will be required to ensure the compensation habitat functions as designed, or, if appropriate, additional habitat compensation will be provided. More details on the Habitat Compensation Plan can be found in Chapter 5 – *Marine Environment*.
- The Proponent has developed a comprehensive AMS document. The objective of the DP3 AMS is to undertake a science-based systematic approach to monitoring and managing the Roberts Bank inter-causeway ecosystem particularly to reduce uncertainty and assess the potential for future marine eutrophic events and dendritic channelization leading to erosion. The AMS details the commitments that VPA would undertake to evaluate, prevent and

mitigate any emerging negative ecosystem or environmental trends attributable to the DP3 Project.

- A proposed air quality program to support the Proponent's commitment to continuous improvement of air quality within the Project area, based on the DP3 emissions meeting all applicable standards and objectives for air quality and with no risks to human or wildlife health.
- The proposed Habitat Compensation Plan, AMS, stewardship program and air quality program are relevant to the mitigation of specific effects and are included under the aegis of sustainable development as they include measures for environmental monitoring, and habitat compensation, restoration and improvement in terms of predicted biophysical effects, thereby further reducing the potential for negative effects of the proposed Project.

17.4 CONCLUSIONS ON SIGNIFICANCE OF EFFECTS

During this cooperative environmental assessment the EAO, the RAs and the working groups have considered: the Application; comments by government agencies, First Nations and the public on the potential effects of the Project; responses by the Proponent; and the discussions of the working groups.

Based on the information summarized in this CSR and provided that the Proponent implements the actions described in the *Owner's Commitments and Assurances* as listed in *Appendix A* of this report, the RAs are satisfied that the Project is not likely to cause any significant adverse effects on the capacity of renewable resources to meet the needs of the present and those of the future.

18. Follow-up Program

18.1 GENERAL

The purpose of a follow-up program is to verify the accuracy of impact predictions and determine the effectiveness of measures taken to mitigate the adverse environmental effects of the Project. During the environmental assessment, the EAO and RAs determine what follow-up program will be implemented and who will be responsible for undertaking it.

Follow-up programs under CEAA serve: 1) to provide information on environmental effects and mitigation resulting from project implementation that can be used to improve or support future EAs, including cumulative effects assessments; 2) to aid in the detection of unanticipated environmental effects; and 3) to support or verify predictions made concerning the likelihood of "no significant adverse environmental effects".

18.2 BACKGROUND

18.2.1 Legislative Requirements

Under section 16(2) of CEAA, the need for, and requirements of, a follow-up program must be considered during a comprehensive study.

Where federal regulatory processes exist for a specific development activity, the mitigation measures and follow-up requirements will be specified as terms and conditions by the federal regulatory instruments (e.g., *Fisheries Act* authorization; Disposal at Sea permit).

A proposed agreement between EC and the Proponent will complement federal regulatory instruments and commit the Proponent to implement the Adaptive Management Strategy for the inter-causeway area. The Adaptive Management Strategy is the Proponent‘s response to EC’s proposal that the Proponent develop a scientifically rigourous adaptive management plan to conserve fish, migratory birds, and habitats in the inter-causeway area potentially impacted by the Project.

The regulatory processes within the Province of British Columbia (e.g., the Project approval certificate pursuant to BCEAA) will also require specific mitigation measures and prescribe specific follow-up program components.

18.2.2 Proponent Commitments and Obligations

In its Application the Proponent committed to the adoption of appropriate Environmental Management Plans as an important component of the Project. The Environmental Management Plans are to outline the commitments of the Proponent, the Terminal Operator (currently Terminal Systems Inc., TSI), and contractors to address mitigation measures identified in *Appendix A*.

As an overriding objective of responsible environmental management, the Proponent will ensure that an Environmental Management System (EMS) will be implemented for the Project. The Proponent will ensure that the design, construction and operation, including maintenance, of the Project are carried out in an environmentally responsible manner, will employ Best Management Practices (BMPs), and will comply with federal, provincial and municipal statutes, where applicable. The Proponent will instruct and advise the selected DP3 terminal operator to abide by all relevant commitments in *Appendix A* and any future Provincial Environmental Assessment Certificate (EAC).

The inclusion of appropriate environmental management measures into the detailed design, construction, and operation of the Project will serve to minimize potential adverse impacts on the

environment. The Environmental Management Plans will outline the commitment of the Proponent, the terminal operator and contractors to address mitigation measures identified in *Appendix A*.

A Construction Environmental Management Plan (EMP) and an Operation EMP will be prepared for the proposed Deltaport Third Berth Project. These EMPs will be reviewed by the appropriate regulatory agencies and must be determined to be acceptable prior to the start of Construction and Operations, respectively.

The Construction and Operation EMPs will include:

- environmental goals and objectives;
- conditions of project approval;
- lists of actions, timing and responsibilities;
- supervision protocols fully identifying areas of responsibility for environmental management;
- statutory requirements – licences and approvals required;
- a structured reporting system detailing all relevant matters on a regular basis;
- procedures and forms for documentation and reporting of issues;
- standard specifications incorporating environmental safeguards;
- requirements for training of personnel in environmental awareness and best practices;
- guidelines for emergencies, contact names and corrective actions for non conformance and notifications to appropriate authorities and affected parties;
- instructions on calibration and measuring of testing equipment;
- process surveillance and auditing procedures;
- review procedures and protocols for modification of the EMPs;
- complaint handling procedures;
- site management and control procedures;
- monitoring procedures; and
- quality assurance procedures.

The various sub-plans that would be included in the Construction EMP for the proposed DP3 Project are listed below.

The ***Construction/Dredging Timing Plan*** will form the basis for an application for a CEPA 1999 Disposal at Sea permit, and must cover or include information on sampling and sediment quality. Disposal at Sea permit applications require the provision of comprehensive information, as described on EC's website: http://www.pyr.ec.gc.ca/disposal_at_sea/index_e.htm. Construction and dredging schedules will be developed to meet the authorization requirements for the Project under section 35(2) of the *Fisheries Act*.

The ***Surface Water Quality Management and Sediment Control Plan*** will be prepared for upland activities, largely associated with construction of an additional rail siding from 57B Street to 64th Street.

A ***Hazardous Waste Management and Spill Control Plan*** will be prepared to describe how the contractor will manage any hazardous waste material generated during Project construction, as well as spill control procedures. Notwithstanding the responsibilities of individual contractors and the terminal operator, the Proponent has overall accountability for legal compliance for the Project during all construction and operation phases within its control.

A ***Health and Safety/Emergency Response Plan*** would outline emergency response procedures during construction. The Proponent will monitor the impact of construction activities on community services such as fire, police and emergency response during construction, and commits to discussing appropriate levels of emergency access for the Project with COD.

A ***Waste Management Plan*** for construction activities will be prepared. The Proponent will ensure that the contractor has an appropriate plan in place to ensure that all waste and deleterious materials generated by construction of the Project are appropriately contained in the immediate work area, collected, and appropriately disposed of in accordance with all applicable legislation, guidelines, and best management practices.

A ***Noise Management Plan*** will be developed to ensure identified mitigation measures are implemented. The Proponent will organize a Community Liaison Committee, with a sub-committee on noise issues, with the participation of the Proponent, the Terminal Operator, COD and the railways, specifically focusing on rail noise impacts and public concerns, such as whistles, train shunting and speed. The terms of reference for this committee will be developed by the Owner and need to be acceptable to government regulators, TFN and COD prior to start of construction. A management procedure, such as a 24-hour help line, will be put in place by the Proponent to deal with noise complaints that may arise from construction activities. Each complaint will be investigated and appropriate noise reduction measures established to mitigate future occurrences.

A ***Wildlife and Vegetation Impact Mitigation Plan*** must be developed by the Proponent to ensure identified mitigation measures are implemented. The Proponent will ensure that the land-based construction works for the off-causeway rail corridor components of the Project are conducted in compliance with applicable legislative requirements and BMPs, with particular attention to stormwater management on the sites during construction (e.g., concrete works), excavation and disposal of fill. Further, the Proponent must ensure that municipal community planning is reflected in mitigation of terrestrial and vegetation impacts along the rail corridor. This is to include securing applicable permits for development along watercourses, permits to deposit or remove soil or other material, and environmental reviews of specific works in and around environmentally-sensitive areas.

A ***Marine Environment Management Plan*** will be developed by the Proponent, and be applicable to the Project's construction and operational phases, to meet the authorization requirements for the Project under section 35(2) of the *Fisheries Act*.

A ***Marine Water Quality Plan*** must be designed by the Proponent to confirm the construction mitigation measures are functioning and no impacts are occurring in the marine environment. The *Marine Water Quality Plan* will form part of the *Fisheries Act* authorization and support the Adaptive Management Strategy for the Project.

The Proponent will develop an ***Air Quality Impact Mitigation Plan***. The Proponent has also committed to working with the GVRD, in consultation with the COD, to fund and locate an air quality station, in the local community to provide for continuous ambient air quality monitoring.

The Proponent will develop a ***Traffic Management Plan.*** The Proponent has committed to work with relevant authorities and the DP3 Community Liaison Committee parties to optimize the performance, efficiency and reliability of container truck movements to relieve traffic congestion on local roads.

The Proponent will ensure that the Terminal Operator updates the existing ***Deltaport Terminal Environmental Management Plan*** (September 2004) to ensure that operation of the DP3 Project is carried out in accordance with the environmental goals and requirements identified in this report. In addition, the Proponent will ensure that the Terminal Operator adds environmental management measures to assess and minimize noise from the operation of the Project. The existing Operation Noise Management Plan must be updated to include mitigation measures identified in this report, and would address equipment alarms and machinery noise, and include operator awareness and training.

The Proponent has committed to undertake a **Vessel Speed Assessment** of ships and tugs approaching Roberts Bank to determine the potential benefit of lowering allowable vessel approach speeds with the intention to reduce potential impacts on marine mammals and air quality.

The Proponent will develop a **Community Liaison Plan** to minimize construction-related impacts. The plan will ensure that adequate notification is provided for meaningful consultation with the local community, COD and First Nations, in order to facilitate input throughout the final design, construction and first year of operation of the Project.

The Proponent will ensure that general environmental monitoring and reporting for the construction and operation phases of the Project will be conducted, with respect to the terms and conditions of the EAC and other regulatory permits, approvals and authorizations, as applicable.

The Proponent will engage an independent Environmental Monitor (such as an environmental monitoring firm) for the construction phase of the Project. The Environmental Monitor will undertake environmental monitoring activities, and will implement each of the environmental monitoring plans developed for the Project as reflected in the appropriate EMP. The Environmental Monitor will review, evaluate, and report to regulators on the construction activities and the effectiveness of the environmental protection strategies and mitigation measures, with respect to the terms and conditions of the EAC and other relevant regulatory instruments (e.g., permits, approvals, authorizations). During marine construction, the Environmental Monitor will report on construction activities and interaction with waterfowl and coastal seabirds, and direct mitigation as appropriate to minimize impacts.

18.2.2.1 Adaptive Management Strategy (AMS)

As part of the DP3 Project, an Adaptive Management Strategy (AMS) has been developed, to provide practical advance warning of any potential emerging negative ecosystem trends during Project construction and operation, and to establish actions that the Proponent would undertake to prevent or mitigate negative trends which are linked to DP3 and found to exceed thresholds.

A proposed agreement between EC and the Proponent will complement federal regulatory instruments to commit the Proponent to the implementation of the Adaptive Management Strategy for the inter-causeway area. In this agreement the Proponent commits to implementing a scientifically rigourous adaptive management plan to conserve fish, migratory birds and habitats in the inter-causeway area potentially affected by the Project.

The objective of the DP3 AMS is to undertake a science-based systematic approach to monitoring and managing the Roberts Bank inter-causeway ecosystem specifically to reduce uncertainty and assess the potential for future marine eutrophic events and dendritic channelization leading to erosion that result in negative trends in the ecosystem. Further the AMS details the commitments that the Proponent would undertake to evaluate, prevent or mitigate those negative trends attributable to the DP3 Project. Based on a review of the information collected for the DP3 Application, two cooperative workshops with scientists and regulators, and a detailed literature review of applicable adaptive management processes, the Proponent has produced the DP3 AMS to:

- plan, monitor, and evaluate the parameters identified for the shared environmental concerns and issues;
- establish appropriate thresholds for action;
- establish potential strategy adaptations; and
- identify possible mitigation steps to address issues if and when they develop.

The five key areas identified for consideration in the AMS include:

1. **Geomorphology/Oceanography** – an indicator of potential changes from DP3, or other causes, to coastal zone processes that would increase erosion (dendritic channels) or reduce flushing contributing to potential eutrophication in the inter-causeway area;
2. **Surface Water Quality** – an indicator in potential changes from DP3 or other causes to potential eutrophication in the inter-causeway area;
3. **Sediment Quality** – an indicator in potential changes from DP3 or other causes to potential eutrophication and to coastal zone processes (sediment transport);
4. **Eelgrass** – an indicator in potential changes from DP3 or other causes to potential eutrophication and to the overall ecosystem health in the inter-causeway area; and
5. **Other Biota** – an indicator of ecosystem health when compared to the other key areas of monitoring.

The Proponent will implement the AMS program beginning with the first monitoring event occurring prior to initiation of DP3 construction activities and extending for a minimum of 5 years upon substantial completion of DP3. Some of the monitoring activities proposed in the planning workshops relate specifically to construction monitoring activities and would be complementary to the monitoring that would indicate negative trends in the environment due to eutrophication or changes to coastal zone processes. Other key monitoring activities would start prior to construction, continue through construction, and extend into operation of the facility. A component of the ongoing monitoring program will be complementary to the AMS and is intended to provide a better understanding of the inter-causeway ecosystem, and thus reduce uncertainty and provide a basis for evaluation so that negative change can be detected and appropriate management actions undertaken.

The adaptive evaluation component of the AMS will consist of a review process whereby the Scientific Advisory Committee will review incoming monitoring results and the Proponent's interpretation of them, and compare them against the thresholds identified through the AMS. Results will be summarized in an annual AMS report (Annual Report) submitted with recommendations to a Scientific Advisory Committee for review and comment. The Annual Report will be submitted by the end of January of the following calendar year for each year of the program. After review by the Scientific Advisory Committee, the Annual Report will be made available to the public on the VPA website http://www.portvancouver.com/ or by request.

The Scientific Advisory Committee (SAC) will consist of at least one independent representative, selected by EC and the Proponent, who has expertise in the key ecosystem components being monitored, plus one scientific representative from each of EC and VPA. The SAC may also consider community knowledge and Aboriginal traditional knowledge when reviewing the AMS monitoring data. The Proponent will serve as the secretariat to the Scientific Advisory Committee. The AMS study design is based on the concepts of weight of evidence and evolving knowledge. A considerable number of parameters has been proposed for monitoring, but the decisions to adapt the plan or trigger mitigation measures will be based on consideration of multiple lines of evidence indicating negative trends towards eutrophication or changes to coastal zone processes rather than a single parameter. This approach is important as it improves the decision-making process and reduces uncertainty potentially resulting from an incomplete understanding of the processes that occur naturally in the marine environment.

18.2.2.2 *Fisheries Act* – Habitat Compensation Plan (HCP)

Ensuring no net loss of productive capacity, as outlined in the Fisheries and Oceans Canada (DFO) *Policy for the Management of Fish Habitat*, is essential to ensuring sustainability of the marine environment of Roberts Bank. The Deltaport Third Berth Project must meet the requirements of the DFO no net loss guiding principle. The Proponent recognizes that fish and wildlife habitat requirements are inextricably linked in the overall context of the Roberts Bank ecosystem and therefore synergies are gained by incorporating fish and migratory bird values in the Habitat Compensation Plan. As such, the Proponent has committed to implementing the Marine Environment Management Plan, which will be developed to meet the requirements of a

Fisheries Act authorization that will be developed for the Project. The Marine Environment Management Plan will:

- Outline the terms and conditions contained in the *Fisheries Act* authorization for the Project, including commitments for habitat compensation;
- Outline a habitat monitoring program to assess the effectiveness of the habitat compensatory features developed. The monitoring program components will describe experimental designs and monitoring frequencies that are appropriate for assessing habitat productivity. Monitoring requirements for the proposed compensation projects are likely to extend beyond 5 years at 4-6 month intervals. The monitoring program will be designed to verify that the Project was implemented as designed and approved and to quantify the net change in habitat productivity to ensure a net gain is achieved.
- Describe objectives for successful habitat compensation, including the evaluation of the success and productivity of the habitat compensation areas for use by fish. Should the compensatory habitat features show poor or limited success at any time during the compensatory habitat monitoring program, further habitat enhancement, remedial measures and/or other compensatory areas would be developed following consultation with the relevant government agencies;
- Outline the DFO dredging guidelines to be followed to minimize disruption of habitat or losses of individual adult Dungeness crab, and fish, including adult lingcod and their egg masses;
- Outline appropriate procedures/schedules so that construction phases adhere to DFO dredging timing guidelines and that construction in the intertidal zone would occur during winter unless work is isolated from fish-bearing waters;
- Include a comprehensive outline of construction monitoring commitments to ensure temporary effects in the marine environment are fully mitigated. If construction monitoring indicates juvenile salmon are present in areas where work is occurring in water less than five metres CD, bubble or silt curtains are to be deployed to keep fish away from the works area or to isolate the works area from fish;
- An underwater noise inventory of all equipment proposed for the Project will be developed. A marine noise-monitoring program will be established to measure acoustic frequencies of all marine construction equipment (dredge equipment, vibro-flotation equipment, other marine construction equipment). An interim theoretical zone of audibility having a radius of 7.5 km will be applied at the outset of construction activity. Once construction has begun, the marine noise-monitoring program will assess the actual noise emissions resulting from dredging and other associated activities to determine the true zone of audibility. The marine noise-monitoring program will be used to adjust the zone of audibility to avoid impacts to killer whales and meet the requirements of a *Fisheries Act* authorization; and
- If a pod of killer whales is sighted within 7.5 km of the Project site, the environmental monitor has authority to stop noise generating construction equipment until the whales have moved outside the true zone of audibility.

Fisheries Act authorization and AMS monitoring requirements may have similar elements and to the extent possible, will be coordinated to ensure that information is shared and duplication of effort is avoided.

18.2.2.3 Roberts Bank Environmental Stewardship Program

The Proponent has committed to participation in a wider-reaching Roberts Bank Environmental Stewardship Program involving EC and DFO, which is anticipated to include participation by local municipalities, First Nations, and other coastal stakeholders and environmental non-government organizations (ENGOs). This stewardship program would enhance understanding of the Roberts Bank ecosystem and inform resource management planning.

18.2.2.4 Follow-up Program Reporting

The Proponent will prepare a follow-up monitoring report for the Deltaport Third Berth Project that will summarize and integrate the results of monitoring from the AMS, the DFO authorization and the EMP monitoring programs. This report will be produced annually and will be used to support the objectives of the follow-up program.

18.3 CONCLUSIONS

During the harmonized environmental assessment, the EAO and the RAs have considered: the Application; comments from the public, government agencies and First Nations; responses by the Proponent; and the discussions of the working groups.

Based on the information in this report, and provided that the Proponent conducts the measures as indicated above and implements the actions described in the *Owner's Table of Commitments and Assurances* listed in *Appendix A*, the federal RAs are satisfied that the follow-up programs developed during the EA will be sufficient to verify the accuracy of impact predictions and determine the effectiveness of measures taken to mitigate the potential adverse environmental effects of the Project.

19. First Nations Considerations and Interests

19.1 GENERAL

This chapter of the report addresses federal CEAA requirements with respect to First Nations current use of land and resources for traditional purposes. As required under CEAA, this chapter of the report addresses potential changes to the environment caused by the Project, and the effect of those changes on the current use of lands and resources for traditional purposes by Aboriginal persons. For the purposes of this report, it is important to keep in mind the scope of the Project as set out in Part A of this report.

During the review of the Project, the Proponent, EAO and the RAs consulted with the First Nations identified in section 3.3.5 of Part A of this report. This chapter addresses First Nations concerns regarding the potential environmental effects of the Project. More detailed technical comments provided by First Nations on the Application and other review material provided by First Nations may also be presented in individual chapters of Part B of this report.

It should be noted that nothing in this report is to be taken as any admission by Canada, for the purposes of this report or for any other purpose, in respect of any statements pertaining to Aboriginal rights, including Aboriginal title.

19.2 BACKGROUND

The Project is situated within or close to the asserted traditional territories of the Tsawwassen First Nation, Musqueam Indian Band, Katzie First Nation, Sto:lo Nation, Sto:lo Tribal Council, Semiahmoo Nation, Sencot'en Alliance, and Hul'qumi'num Treaty Group Member First Nations.

The First Nation communities closest to the Project are the Tsawwassen First Nation Reserve, located between the BC Ferries terminal and the Roberts Bank port facility and the Hwlitsum community located on and around Canoe Passage. Other First Nation communities on the Lower Mainland in close proximity include the Semiahmoo Reserve, which is located approximately 30 km to the east, just south of the City of White Rock, and the main Musqueam community which is located 22 km to the north on the banks of the Fraser River in south Vancouver. The Musqueam Indian Band also has a reserve located one kilometre to the east of the DP3 Project. Musqueam Reserve 4 was established in 1974 in exchange for lands on its Sea Island Reserve 3 with the federal Department of Transport and the land is currently leased to agricultural interests.

The Katzie First Nation community is situated in the Pitt Meadows area of the Fraser Valley, and the Sto:lo Nation, and Sto:lo Tribal Council communities are located along the lower Fraser Valley.

The Hul'qumi'num Treaty Group represents six First Nations, for the purposes of treaty negotiations, including the Chemainus, Halalt, Lake Cowichan, and Lyackson First Nations, the Cowichan Tribes, and the Penelakut Tribe. Recently, the Hwlitsum has petitioned the Hul'qumi'num Treaty Group to join in treaty negotiations. The Sencot'en Alliance membership includes the Semiahmoo, Pauquachin, Tsartlip and Tsawout First Nations. The Paquachin, Tsawout and Tsartlip communities are located on the Saanich Peninsula on the southeast end of Vancouver Island. The Semiahmoo are located in the Lower Mainland.

The Tsawwassen First Nation (TFN) and Musqueam Indian Band (MIB) continue to carry out fisheries and marine resource activities in the vicinity of the proposed Project, but no permanent fishing stations have been established. These groups, plus the Semiahmoo Nation, Sencot'en Alliance, and Hul'qumi'num Treaty Group (HTG), have stated that they maintain a close historical relationship to the Project land, which extends beyond what they describe as the arbitrary/artificial boundaries of their reserve lands. In addition to which, the Hul'qumi'num Treaty Group and

Sencot'en Alliance maintain that they continue to enjoy traditional practices that include fisheries and cultural practices in and adjacent to this area.

To assist First Nations to identify any potential environmental effects of, and take part in the environmental assessment (EA) of the Project, the Proponent provided funding to the TFN, MIB and Sencot'en Alliance. EAO also provided funding to the Sencot'en Alliance for community consultation and finalization of comments on the Project Application.

19.3 DISCUSSIONS BETWEEN FIRST NATIONS, PROVINCIAL AND FEDERAL GOVERNMENT REPRESENTATIVES

EAO and RAs have provided opportunities for the First Nations identified above to participate in the DP3 EA review. EAO invited all the First Nations that were identified early in the process to participate in the working group organized by EAO as well as any sub-committee of the working group. HTG member First Nations were contacted in January 2005.

The TFN was involved in Project-related discussions in the pre-application stage as early as May 2003. Its representatives attended 5 Project working group meetings in Tsawwassen and Vancouver, during the pre-application stage, and 7 working group meetings in Vancouver during the Application review stage (meetings are listed in Part A, section 1.4.1 of this report). First Nation working group members who participated in this pre-application review stage were asked to provide input to the Terms of Reference, the provincial section 11 Order, Application screenings and the review of the Application and supporting documents.

Sencot'en Alliance representatives participated in 5 working group meetings and the HTG participated in 4 working group meetings during the BCEAO Application review stage.

Early in the Project review (April 2003), EAO issued letters to the Tsawwassen First Nation, the Musqueam Indian Band, the Semiahmoo Nation, the Katzie First Nation and the Sto:lo Nation, advising them about the proposed Project and the review process under BCEAA, and solicited their comments on the Project, in participating in the EA review, and on any likely effects of the Project from their perspective on their asserted Aboriginal rights and their traditional uses of lands and resources. EAO and RAs also met with these First Nations to discuss the Project and its EA pursuant to BCEAA and the *Canadian Environmental Assessment Act* (CEAA). During a meeting in October 2003, the Sto:lo advised EAO that it did not have a direct interest in the proposed Project EA review, but would like to be updated as the EA review proceeded. Throughout the Project review, all relevant documents were made available to all identified First Nations, either by electronic mail, fax or courier/surface mail. The Katzie First Nation has been invited to participate in the DP3 EA review and was provided with all the relevant information, but they have not expressed an interest in the proposed Project to date.

The Proponent entered into a Memorandum of Agreement with the TFN in November 2004. The Memorandum of Agreement outlines a set of principles for a mutually beneficial consultation relationship under which VPA and the TFN will work together. The Memorandum of Agreement outlines how the parties will consult with each other and work toward exploration of compensation and mitigation measures; consider the need to explore past infringements; and discuss Project EA review participation, employment and contracting opportunities, and potential business relationships.

See Part A, section 3.3.5 and section 3.4.3 of this report for more detailed information about First Nations consultations during the EA review of the DP3 Project.

19.4 OVERVIEW OF FIRST NATIONS CONCERNS

The First Nations participating in the DP3 Project review raised a broad range of issues with respect to the proposed Project. These issues were both general and technical in nature. Some of the technical issues raised by the First Nations were also raised by other parties, such as government agencies, and were not considered unique to First Nations communities/members. To avoid duplication, those technical issues are discussed elsewhere in this report. Examples of these types of issues include potential impacts of the Project on marine resources, and potential cumulative effects, and issues regarding the inter-causeway Adaptive Management Strategy (AMS).

19.5 TRADITIONAL USE AND KNOWLEDGE

19.5.1 Traditional Use

TFN shared with the Proponent traditional use studies that had been undertaken previously. These studies provided important information dealing with the historical use of land and marine resources within TFN's traditional territory.

The Proponent reports that according to a map produced by the Sencot'en Alliance, the entire Project study area is highlighted as a traditional use site, but it does not delineate individual traditional use sites for each member of the Sencot'en Alliance.

Traditional use is not restricted to archaeological deposits, but also encompasses cultural heritage, including subsistence use and activity areas, spiritual and ceremonial sites, named locations (i.e., place names), cultural landmarks, and other places that do not necessarily contain physical evidence of occupation and use, but which nonetheless the First Nations groups involved in the Project review have identified as culturally significant to them. Traditional knowledge flows from experience gained over centuries by the individuals and families carrying out those practices.

19.5.2 Traditional Knowledge

Traditional knowledge is a very important aspect of First Nations culture. It is knowledge that derives from, or is rooted in the traditional way of life of Aboriginal peoples. This encompasses spiritual relationships, relationships with the natural environment and the use of natural resources, and relationships between people. It is reflected in language, social organization, values, institutions and laws. First Nations groups described traditional knowledge as having its roots firmly in the past and as being both cumulative and dynamic, building upon the experience of earlier generations and adapting to the new technological and socio-economic changes of the present.

The Proponent provided funding to the TFN to complete a *Traditional Knowledge Study*. The TFN comments on the technical/scientific studies submitted during the formal EA review of the Application had traditional knowledge incorporated into them, thus addressing key features of the environment and the TFN's relationship to it.

19.5.3 Potential Project Effects, Mitigation and Traditional Knowledge

The Proponent took into account the traditional use knowledge provided by the TFN into its assessment studies. The Proponent was able to evaluate information concerning resources of significance, both traditionally and currently. Through this approach the Proponent was able to assess potential effects of the Project on marine resources, thus enabling the development of mitigation options to be reviewed with the TFN, which is the First Nation in the immediate vicinity of the Project.

In addition to the funding provided to the TFN by the Proponent to complete a *Traditional Knowledge Study*, the TFN was also provided funding through the Participant Funding Program

under the CEAA. This federal funding enabled the TFN to judge whether the EA has adequately considered its traditional knowledge in the Project's EA and, if necessary, to work with the Proponent to integrate such knowledge into the EA. The TFN has not raised any further concerns in regard to this issue.

In its Project review comments to EAO of March 24, 2006, the Sencot'en Alliance provided a description of traditional knowledge acquired from its historical use of the Project area. The HTG provided a Use and Occupancy Report of the Project area which also provided traditional knowledge as discussed in its preliminary review submission to EAO of July 28, 2005.

The RAs took account of all traditional use knowledge provided during the harmonized review process.

19.6 CURRENT USE OF LANDS AND RESOURCES FOR TRADITIONAL USES BY FIRST NATIONS

19.6.1 General

The RAs, EAO, and the Proponent were supplied with, and reviewed much information regarding traditional land and marine use by the TFN, MIB, HTG, Semiahmoo First Nation, Sencot'en Alliance, and Tseycum First Nation in the Roberts Bank and Fraser River region. This information indicated traditional land and marine use by the Tsawwassen and Musqueam in the immediate proposed Project area. This information was provided by the above First Nations via Proponent consultations, traditional use studies, working group communications, and First Nations-federal agency meetings. The information suggests there is continuing and historic use of the proposed Project footprint area, and surrounding area for First Nations subsistence activities. Although the TFN heavy use areas are closest to the proposed Project site, the MIB, the Semiahmoo First Nation, the Sencot'en Alliance and the HTG also claim historic use of the proposed Project area.

19.6.2 Subsistence Activities

TFN and some other First Nations claim to continue to carry out various traditional activities within the general area of the proposed Project development, with marine resource extraction being the primary focus. The First Nations assert the following uses they describe as traditional:

- collection of crabs, cockles, clams and horse clams
- fishing for various species, including salmon, sturgeon, and eulachon
- hunting for waterfowl, seabirds, deer, bear, sea lions, hair seal and porpoise
- gathering particular plants including camus, wild cranberries and cat-tails.

Aboriginal Access to Resources:

First Nation sustenance activities are supported by having access to fishing areas, crabbing locations and specific fishing sites at Roberts Bank and in the area of the proposed Project. First Nations assert that it is a longstanding practice to have access to the Roberts Bank foreshore and open waters both from the landward side and through the use of boats. In addition, there is archaeological evidence that seasonal village sites in the Roberts Bank area were situated in areas were the First Nations had access to both hunting activities and fishing practices.

Larger recreational and commercial fishing boats can be launched at a number of locations in the Roberts Bank area including Wellington Park on Canoe Passage, and near the Tsatsu Shores condominiums on the south side of the BC Ferry Terminal. Small boats can be launched in front of the Tsawwassen Indian Reserve during high tide for crabbing in the inter-causeway area.

General access to marine resources near the Vancouver Port Authority lands at the Roberts Bank facility is subject to restrictions for safety and security reasons. There is no commercial fin fishing allowed in this area due to navigation restrictions. Recreational or commercial crab fishing is not

allowed in the ship approach channel and along the berths for the same reasons. TFN recreational and commercial crab fishing in the turning basin is subject to float restrictions again related to safety concerns. In its review comments on the Application and four supplementary review documents made available in December 2005, the TFN raised marine access issues, which are reflected in the Project's proposed mitigation measures.

The *Tsawwassen Treaty Process Agreement in Principle*, signed by Tsawwassen First Nation, British Columbia and Canada on March 15, 2004, contemplated that in the Final Treaty Agreement the TFN will have the right to a domestic salmon fishery allocation on the Fraser River.

Allocating and conserving Fraser River salmon stocks is among the most daunting of fisheries management challenges. Not only do approximately 100 First Nation communities in the Fraser River system rely on these stocks but, so do many coastal First Nations, particularly those on Johnstone and Juan de Fuca Straits.

19.7 RELEVANT PROJECT EFFECTS POTENTIALLY IMPACTING FIRST NATIONS ASSERTED TRADITIONAL USE OF RESOURCES

Aboriginal subsistence activities are discussed in section 19.6.2 above. The Project review consequently focused on potential Project effects on the use of marine resources in the Fraser River and at Roberts Bank. This report section covers the specific questions and issues relating to First Nations use and subsistence relating to marine resources, the health of marine resource populations, the availability of marine species for marine resource extraction purposes, and any constraints on the health of the population, availability of marine and wildlife resources or restricted access to populations predicted due to the proposed Project.

Fraser River:
The Deltaport Third Berth Project (Project) is situated between the Fraser River and Boundary Bay. The Fraser River is one of the largest salmon-bearing rivers in the world. First Nations recount that historically, the Fraser has been an important fishing ground. First Nations and Europeans fished the Fraser River and nearby Roberts Bank. The Fraser River today remains an important fishing resource for First Nations, commercial and recreational fishermen.

The salmon species recorded in the literature for the Roberts Bank area include chum, chinook, sockeye, pink and coho.

First Nations explained that Fraser River sockeye is important to them, for food, social and ceremonial purposes, as well as for economic purposes. The First Nations indicate that tens of thousands of Aboriginal people living in the Georgia Basin and along the Fraser River access fish returning to their spawning grounds, including the Thompson, Chilko, Quesnel, and Stuart drainages. Fraser River pink salmon spawning extends into the Seton, Thompson and upper Fraser mainstem, however, the largest populations are concentrated in its lower reaches and the tributaries below Hope. Two groups of coho are recognized in the Fraser River, one is considered to be a more coastal group, found in the lower reaches of the Fraser River; whereas the other is found further upriver, primarily upstream of Hope. Populations of chinook are aggregated similar to sockeye, based on their run timing, spawning location, life histories, and catch distributions in the ocean. Chum salmon are found over wide area of the lower Fraser River including some 121 tributaries below Hope.

Roberts Bank:
Most of the salmonids using the Roberts Bank intertidal area are juveniles; the adults preferring deeper and more open water. Juvenile salmonids use the intertidal and subtidal areas on both sides of the Roberts Bank causeway. Salmon, crabs and shellfish were caught or gathered depending on the location, time of year and other considerations affecting harvest.

Cockles are common on both sides of the Roberts Bank causeway. They are collected in the intertidal zone by recreational fishers and the TFN report extensive traditional use of this resource. Littleneck clams are also present and considered abundant in the Roberts Bank area. Macoma clams are common on both sides of the causeway. However, there are no sport or commercially exploited clam beds near Roberts Bank.

Three crab species, Dungeness, red rock and graceful are present in the Project area, both intertidally and subtidally. Only the Dungeness crab is considered of commercial value throughout the Fraser River estuary, Boundary Bay and the southern Gulf Islands, but the red rock crab is harvested recreationally. Graceful crab is not considered a commercial nor recreational species, although it is likely caught as incidental catch by the Dungeness recreational fishery.

Other marine invertebrates in the Project area which are not considered threatened by the Project include octopi, sea urchins, and sea cucumbers.

19.8 POTENTIAL PROJECT EFFECTS ON ASSERTED ABORIGINAL FISHING AND HARVESTING OF MARINE RESOURCES

19.8.1 General

The First Nations (TFN, HTG, Sencot'en Alliance) raised specific concerns with marine resources and the effect of the Project on marine habitats, birds, marine mammals, salmon, crabs, and eelgrass that are addressed below with responses from the Proponent.

19.8.2 Specific Issues Raised by First Nations

Effects of increased marine traffic on traditional resource usage including concerns around access to resources being restricted. (Sencot'en Alliance)

The Proponent noted that it is not expected that the additional marine traffic will restrict access to marine resources. DP3 operations will result in an additional 2.5 vessel calls per month or an additional 5 vessel movements per month. With this minor increase in ship traffic attributed to the Project, no significant effects on marine traditional resource usage are predicted.

Effects from dredging activities from the Project that could negatively affect marine resources. (Sencot'en Alliance)

The Sencot'en Alliance commented that not all of the proposed DP3 construction activities are necessarily destructive since dredging of the ship turning basin will transform shallow subtidal habitat into a deeper habitat that is connected to a relatively deep ship channel. While this may selectively exclude shallow water species, it will open up the area for deeper water organisms. The Sencot'en Alliance noted that since similar habitat transformations may occur during future projects, a fisheries assessment should be carried out before and after any dredging takes place. The Proponent has made changes to the terminal footprint and tug basin design which reduce the volume of dredge spoil significantly, thus further mitigating potential effects on marine resources.

Influences of the proposed Project on the Fraser River (HTG)

The Proponent has documented, supported by DFO, that the construction and operation of the Project, does not affect the Fraser River. The outflow from the Fraser River (Canoe Passage) would prevent any Project sediments or operations from influencing habitats to the north of this point.

Protection of salmon (and other fish species) from construction activities (HTG/TFN/Sencot'en Alliance)

The TFN asked for clarification on how the dredging will impact fishing activities. The Proponent's dredging schedule will adhere to the appropriate work windows for the protection of juvenile salmon. For juvenile salmon protection, no dredging is permitted in waters less than –5m (CD) deep from March 1 to August 15, unless the work area is adequately isolated from fish-bearing waters.

Protection of crabs (and other invertebrate species) from construction activities (HTG/TFN/Sencot'en Alliance)
The TFN asked for clarification on how the dredging will affect crabbing activity. The Sencot'en Alliance raised concerns over temporary losses to Dungeness female crab migration and juveniles due to dredging entrainment and dyke construction for which there needs to be habitat compensation (Sencot'en Alliance is requesting no net loss of productivity) to maintain productive capacity, consistent with DFO's Habitat Policy.

The Proponent's Application addressed the effects of construction and operational activities on Dungeness crabs. The identification of the juvenile nursery area was a key environmental factor in changing the design of the Project to replicate as much as possible the existing embayment at Deltaport. The tidal currents along with the substrate and algae have created the conditions for the juvenile Dungeness crabs to be deposited in this area at Roberts Bank. The crab nursery is expected to re-establish adjacent to the newly constructed shoreline. This area will be the subject of a DFO-managed follow-up monitoring program and if, for some unforeseen event, the crab nursery does not re-establish, VPA would conduct remedial works at the site, and at adjacent crab nursery areas that were identified as part of the marine habitat survey.

As discussed above, the Proponent has made design changes which reduced significantly the volume of dredge spoil, thus further mitigating potential effects on marine resources. VPA advised that potential juvenile crab losses during construction would be mitigated by pre-construction monitoring and removal of juveniles to an alternate habitat. Also, VPA's dredging schedule will adhere to the appropriate work windows for the protection of Dungeness crab, that is, no dredging is permitted in waters greater than –5m (CD) deep from October 15-March 31.

Restrictions on the disturbance of eelgrass by construction activities (HTG/Sencot'en Alliance)
The Proponent will ensure that construction phases in the intertidal zone are concentrated during winter to minimize disruption to eelgrass and intertidal mudflats, because in winter these habitats are less susceptible to such disruption. First Nations will be given the opportunity to review the construction schedule when it is available.

Habitat compensation required for lost marine, fisheries and wildlife habitat (HTG/TFN/Sencot'en Alliance)

The TFN, HTG and Sencot'en Alliance raised concerns with the potential effects of the proposed Project on fish habitat and the inadequacy of the two proposed habitat compensation measures contained in the application in meeting DFO's Habitat Policy. Since the submission of the Application and subsequent to receiving comments from DFO, EC and First Nations the Proponent revised the Habitat Compensation Plan. An early draft of the revised Habitat Compensation Plan was circulated to First Nations in November 2005. This plan contained more robust compensation measures to address habitat complexity. After consideration of working group and public comments on the revised HCP it was finalized for use in the environmental assessment. The RAs will engage First Nations in the further development of the detailed Habitat Compensation Plan needed for any potential future *Fisheries Act* authorization.

In its submission to EAO of March 24, 2006, the Sencot'en Alliance expressed concerns with the adequacy of the proposed Habitat Compensation Plan (HCP). Whereas the Sencot'en Alliance agrees that the proposed 26.4 ha of marine habitat construction for the replacement of the loss of 21.7 ha appears principally to meet DFO's objective of no net loss, the Sencot'en Alliance speculates that the Habitat Compensation Plan may not meet federal objectives. By and large

such comments are associated with Sencot'en Alliance concerns over the performance record of past habitat compensation plans in the Fraser River delta.

The Proponent will have long term obligations associated with the Plan. For example, if, for some unforeseen event, habitats, including the crab nursery, do not re-establish as expected, the Proponent would be required to conduct remedial works at the site and at adjacent crab nursery areas that were identified as part of the marine habitat survey. The detailed requirements will be part of DFO's *Fisheries Act* authorization.

Inter-causeway proposed Adaptive Management Strategy (AMS) (Sencot'en Alliance)
In its submissions to EAO of January 24, 2006 and March 24, 2006, the Sencot'en Alliance questioned the adequacy and usefulness of the proposed AMS. The Sencot'en Alliance commented that replacing the fact-finding component of the assessment process with a contingency plan to manage future uncertainties is an unacceptable approach to a proper EA. The AMS, discussed in other chapters of Part B of this report, has been developed by the Proponent in consultation with a number of federal agencies, and will be implemented in accordance with an agreement for its design and implementation between VPA and EC. During the Project review, regulatory agencies accepted the AMS as a reasonable approach for identifying the early emergence of negative environmental or ecosystem trends, and taking mitigative actions to address those trends before they become significant adverse environmental effects. The AMS involves on-going monitoring and remedial work relating to potential eutrophication and inter-causeway slope and habitat stability.

DP3 Project cumulative effects assessment (Sencot'en Alliance)
In its submission to EAO of March 24, 2006, the Sencot'en Alliance reiterated its criticism of the Proponent's cumulative effects assessment (CEA), circulated for review in December 2005 to January 2006. From the Sencot'en Alliance's perspective, the CEA is faulty and unacceptable because it does not adequately address the contemplated second container terminal expansion at Roberts Bank (T2), and the longer-term industrial developments at Roberts Bank since 1959. Federal agencies accept the CEA as meeting the intention of CEAA requirements, as it adequately addresses the federal project scoping and reflects the known details of the T2. Review agencies disagree with Sencot'en Alliance's position that the baseline for assessing the DP3 Project cumulative effects must be based on a 1959 situation rather than the existing (2003) infrastructure and environment used by VPA.

19.8.3 Associated Mitigation Measures

The Proponent proposes the following strategies to mitigate effects on fishing opportunities. Specific details on the plans and commitments discussed below are contained in *Appendix A* of this report.

- Prepare a Habitat Compensation Plan that addresses both on-site (5 habitat development options – 18.9 ha) and off-site compensation to develop suitable fish and migratory bird habitat (at least 7.5 ha) within defined geographic areas in the Fraser River estuary to meet the requirements of a section 35(2) *Fisheries Act* authorization. As part of the Habitat Compensation Plan, the Proponent is committed to providing $1.5 million in a funding agreement to ensure the off-site compensation is secured and developed.

- Implement an Adaptive Management Strategy (AMS) that has been developed to provide practical advance warning of any potential emerging negative ecosystem or environmental trends during Project construction and operation, and to establish actions that the Proponent would undertake to prevent or mitigate emerging negative trends which are linked to DP3 and found to exceed thresholds. The objective of the DP3 AMS is to undertake a science-based systematic approach to monitoring and managing the Roberts Bank inter-causeway ecosystem specifically to reduce uncertainty and to assess the potential for future marine eutrophic events and dendritic channelization leading to erosion that result in negative trends in the ecosystem. The AMS details the

commitments that the Proponent would undertake to detect, evaluate, prevent, or mitigate those negative trends attributable to the DP3 Project before these become significant adverse environmental effects. The Proponent will implement the AMS program beginning with the first monitoring event occurring prior to initiation of DP3 construction activities and extending for a minimum of 5 years upon substantial completion of DP3.

- The Proponent commits to the following measures to protect the fish habitat and fisheries:

    - adhere to approved work windows to allow for the protection of juvenile salmon unless the works area is adequately isolated from fish-bearing waters;
    - use bubble or silt curtains to keep juvenile salmon away from specific works in water less than –5 metres CD if monitoring indicates they are present;
    - concentrate construction phases during winter, prior to the period juvenile fish and invertebrates settle, to minimize disruption;
    - ensure construction phases in the intertidal zone are concentrated during winter to minimize disruption to eelgrass and intertidal mudflats.
    - comply with DFO guidelines for dredging or disturbance of the seabed, as well as work windows, to minimize disruption of subtidal mudflat habitat or loss of individual adult Dungeness crabs and fish;
    - make reasonable efforts to relocate adult Dungeness crabs from subtidal areas prior to dredging;
    - monitor to determine whether crab nursery habitat starts to re-establish itself along the newly-created foreshore. If re-establishment is unsuccessful, two adjacent crab nursery areas will be enhanced to ensure full compensation;
    - monitor and evaluate any Aboriginal or commercial fisheries issues during Project dredging and construction;
    - use reasonable efforts to avoid any disruption of Aboriginal or commercial fisheries;
    - as part of the Construction Environmental Management Plan, develop a Marine Environment Management Plan; and
    - as part of the Construction Environmental Management Plan, develop a Marine Water Quality Plan.

19.9 ONGOING DEVELOPMENT OF DRAINAGE CHANNEL NETWORK IN THE INTER-CAUSEWAY AREA

19.9.1 Issue

With respect to fishing and related marine activities, the TFN expressed concern regarding the network of drainage channels that formed after the earlier terminal and causeway developments. This process is still evolving and has not reached a final equilibrium state. The TFN commented that it will be difficult to determine what effect these changes may have on TFN use of the inter-causeway area until some form of equilibrium has been established.

19.9.2 Mitigation

As indicated above, VPA will be implementing an AMS which will focus on the inter-causeway area and include a monitoring and management plan for coastal geomorphology/oceanography (including dendritic channelization in the inter-causeway area).

In addition, VPA's Habitat Compensation Plan has been developed for DFO and identifies a phased approach to the feasibility of stabilizing the sand lobe of the main dendritic channel. First Nations will be consulted on these plans, prior to their finalization and approval by DFO.

19.10 ACCESS TO RESOURCES OF ABORIGINAL INTEREST

19.10.1 Issue

First Nations voiced concern that the DP3 Project development, including the habitat compensation structures or other mitigation measures, must not affect or interfere with access to, and use of, all relevant areas by First Nations.

19.10.2 Mitigation

The Proponent has met with and will continue to meet with the First Nations to discuss the proposed Project. The Proponent has confirmed that access for First Nations to the inter-causeway area will not be affected and the Proponent is committed to including First Nations in the detailed planning and design of the Habitat Compensation Plan.

19.11 PROTECTION OF THE HEALTH OF MARINE RESOURCES AND THE SURVIVABILITY OF MARINE MAMMALS

19.11.1 Health Issue

With respect to harvesting of marine resources, First Nations expressed concern regarding the health of these resources within the Project area. Concerning DP3, First Nations seek to participate in the proposed Adaptive Management Strategy for the inter-causeway area to ensure that their concerns are identified and addressed.

19.11.2 Mitigation

The Proponent commits to the following strategies to mitigate effects and protect the health of marine resources (see *Appendix A*):

- A Ballast Water Management Plan that provides guidance to the operators for the proper handling and treatment of ballast water and sediment to minimize the transfer of harmful aquatic organisms and pathogens in the vessel's ballast water and sediment.
- Bilge Water Management Protocol is in place which prohibits ship discharges containing oil or other deleterious substances.
- As part of the Construction Environmental Management Plan, the Proponent would develop the following subplans:
    - A Construction/Dredging Timing Plan (a requirement under EC's Disposal at Sea permit);
    - A Noise Management Plan that will include mitigation to address construction noise effects on marine mammals;
    - A Waste Management Plan;
    - A Marine Environment Management Plan;
    - Marine Water Quality Plan; and
    - Air Quality Impact Mitigation Plan.

- As stated above, the Proponent is required to implement an AMS to provide advance warning of emerging negative ecosystem and environmental trends during the construction and operation of the Project, and to take mitigation actions to prevent or mitigate emerging negative trends which are linked to DP3 and found to exceed thresholds, before these become significant adverse environmental effects.

The RAs and the EAO are satisfied that VPA's commitments to the Construction Environmental Management Plan and its commitment to implement the AMS for the inter-causeway area and to involve the First Nations in monitoring, where and when feasible, address this issue.

19.11.3 Survivability Issue and Mitigation

The Sencot'en Alliance and the HTG queried the effects of underwater noise pollution from construction activities on the marine environment and marine mammals. The Proponent reported

in the Application that potential effects of construction noise were taken into consideration, specifically for killer and baleen whales (fin whales, grey whales and humpback whales), and mitigation measures were outlined. The key mitigation measures for noise effects include:

- An underwater noise inventory of all equipment proposed for the Project will be developed. A marine noise-monitoring program will be established to measure acoustic frequencies of all marine construction equipment (dredge equipment, vibro-flotation equipment, other marine construction equipment). An interim theoretical zone of audibility having a radius of 7.5 km will be applied at the outset of construction activity. Once construction has begun, the marine noise-monitoring program will assess the actual noise emissions resulting from dredging and other associated activities to determine the true zone of audibility. The marine noise-monitoring program will be used to adjust the zone of audibility to avoid negative effects on killer whales and meet the requirements of a *Fisheries Act* authorization;
- If a pod of killer whales is sighted within 7.5 km of the Project site, the environmental monitor has authority to stop noise generating construction equipment until the whales have moved outside the true zone of audibility;; and
- ensuring that the vibro-flotation vibrating head is shut down while it is being moved to a new location. Vibro-flotation noise frequency and amplitude will be included in the inventory work.

During operations, the Proponent will work with the BC Pilots Association to develop an education and awareness program about marine mammals. The EA review indicates that pilots of vessels transiting to Roberts Bank steer away from observed pods when vessel safety is not compromised. Since enforcement and monitoring are outside of the Proponent's jurisdiction, the Proponent will need to raise these matters with the BC Pilots Association. A licensed Canadian marine pilot boards container ships destined for Deltaport at the pilot boarding station at Brotchie Ledge off Victoria.

19.12 GATHERING OF ABORIGINAL FOOD RESOURCES

19.12.1 Potential Project Effects

The TFN shared with the Proponent its traditional use studies that had been previously undertaken. These studies provided important information dealing with the historic use of land within TFN's asserted traditional territory. The Sencot'en Alliance also queried the effects of the proposed Project on traditional use of shoreline sites.

Based on information contained in the Application and in First Nation traditional use assessments, two areas were identified as areas where berries and plants were traditionally gathered for food purposes. The two sites identified will not be directly affected by the Project. The Proponent's impact assessment on wildlife and vegetation resources (see Chapter 7 – *Terrestrial Wildlife and Vegetation*) confirmed the diversity of species and habitats that could contain plants of interest to First Nations. Since the proposed development is located on an artificially-created landform and the upland portion of the proposed Project is situated within the existing BC Rail right-of-way, remnants of land not affected by agricultural development could potentially still contain sites producing berries, plants and herbs used for food and medicinal purposes. The conditions that produce the plants and berries, that the First Nations indicate are important to them, exist in areas in the vicinity of the proposed Project. It is the RA's assessment that the proposed Project will not affect the identified First Nations current use of land for traditional purposes of gathering food resources.

19.13 OTHER ISSUES RAISED BY FIRST NATIONS

Various First Nations have expressed concerns regarding assurance of long-term funding for the environmental activities that will be required in the implementation of the Habitat Compensation Plan and AMS.

An agreement proposed between EC and the Proponent will require that the Proponent execute the monitoring and mitigation commitments described in the AMS at the Proponent's cost. This agreement includes financial security measures. DFO has financial security measures built into the *Fisheries Act* authorization to ensure habitat compensation is developed and monitored in accordance with the authorization.

19.14 CONCLUSIONS ON SUBSISTENCE HUNTING, FISHING AND GATHERING

It appears that the Project will cause little regional effect on the quantity and quality of marine resources. Habitat function and productivity for individual fish and invertebrate resources that are displaced by the Project or by indirect effects of noise, light and dust will be maintained by, appropriate mitigation actions in the immediate inter-causeway area. There appears to be adequate safeguards and commitments by the Proponent to guard against potential contamination of animals, plants and water. Consequently there is very little likelihood that these issues will significantly affect the First Nations asserted traditional subsistence activities in the Project area.

There will be unavoidable direct effects on specific crab and salmon rearing habitats by the infrastructure and indirect effects of the Project. Opportunities to harvest marine resources in a few locations, such as at the Third Berth location and at the proposed sandbar stabilization area a habitat enhancement feature – will be affected. However, the general availability of marine resources in this area is not expected to diminish and alternative locations to harvest will exist close by. It is expected that First Nations will be able to reasonably continue their current use of resources for traditional purposes in this area for the traditional purposes they have articulated, should the Project proceed. In order to access these resources the First Nations may need to change the location of their harvesting practices for marine resources to local areas which are not directly affected by the Project activities.

Continued monitoring by the Proponent of the effects of the Project on First Nations' subsistence activities will provide the basis for further mitigation actions to protect these subsistence activities. Additional concerns can also be dealt with as they arise throughout further permitting processes required by the Project. The First Nations have articulated that their current use of resources for traditional purposes in the area of the Project is important to the continuation of the cultural practices of these First Nations and to the well being of their communities.

19.15 SUMMARY AND CONCLUSIONS

During this harmonized EA, the RAs and the working groups have considered: the Application; comments from government agencies, First Nations and the public on the potential effects of the Project; responses by the Proponent; and the discussions of the working groups.

Based on the information summarized in this CSR and provided that the Proponent implements the actions described in the *Owner's Commitments and Assurances* as listed in *Appendix A* of this report, the RAs are satisfied that Project will not likely result in significant adverse environmental effects on the current uses of land and resources that the Aboriginal groups indicate they use for traditional purposes.

PART C REVIEW CONCLUSIONS

1. BASIS OF CONCLUSION

The conclusions of the environmental assessment of the Project pursuant to CEAA are based on the following documents, evaluations and assessments:

- The Proponent's Application for a provincial environmental certificate;
- All materials and documents submitted by the Proponent for the purposes of the harmonized review;
- The *Owner's Table of Commitments and Assurances*, as updated and consolidated in *Appendix A*;
- The evaluation of the nature and extent of the residual adverse environmental effects of the Project after mitigation and whether those adverse effects are significant and likely. A number of criteria are outlined in the CSR including: magnitude; geographic extent; duration and frequency; reversibility; and ecological context; and
- The assessment carried out by the working group comprised of federal, provincial and local government agencies and First Nations, with input from the public.

2. COMPLIANCE EFFECTS MONITORING AND FOLLOW UP

As summarized in *Appendix A*, the Proponent has committed to developing for both the construction and operation of the Project, Environmental Management Plans (EMPs) that provide a more detailed description of how various environmental effects will be avoided, managed and mitigated. The Proponent has also committed to undertake measures for compliance, environmental effects monitoring, and follow-up, as summarized in Chapter 18 (Part B) of this Report.

In addition to fulfilling its commitments to undertake environmental management and monitoring as set out in the *Owner's Table of Commitments* (*Appendix A*), the Proponent is also required to undertake habitat compensation operations and to comply with specific mitigation, monitoring and reporting requirements as required by federal authorizations, permits and approvals, and by the agreement for the adaptive management strategy.

3. OVERALL CONCLUSION

The general conclusion of the environmental assessment is that provided the proponent:

1) fulfills its commitments, including compliance and effects monitoring and follow-up measures as outlined in *Appendix A*, and

2) implements the Adaptive Management Strategy and the Habitat Compensation Plan (including follow-up environmental management and monitoring program agreements) as the Proponent and the RAs have agreed,

the DP3 Project is not likely to cause significant adverse effects.

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APPENDIX A – OWNER'S TABLE OF COMMITMENTS AND ASSURANCES

APPENDIX B – ADAPTIVE MANAGEMENT STRATEGY

APPENDIX C – HABITAT COMPENSATION PLAN