

APPENDIX 29-A
Changes to Components of the Environment
within Federal Jurisdiction

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Appendix 29-A Changes to Components of the Environment within Federal Jurisdiction

Appendix 29-A Changes to Components of the Environment within Federal Jurisdiction				Residual Effects		Incremental Cumulative Effects	
Environmental Component	Valued Component	Potential Effect (before mitigation)	Mitigation Applied	Residual Effect (after mitigation)	Significance	Cumulative Effect	Significance
"Fish" and "fish habitat" as defined in the <i>Fisheries Act</i> and "aquatic species" as defined in the <i>Species at Risk Act</i>	Marine Vegetation (Section 11.0)	Productivity loss for macroalgae during construction and operation phases.	<p>Avoidance Measures:</p> <ul style="list-style-type: none"> - Optimised Project design including terminal placement in subtidal waters, reduced footprint for causeway widening, terminal rounded corner, and incorporation of rocky shoreline in portions of the terminal and causeway perimeters. <p>Reduction Measures:</p> <ul style="list-style-type: none"> - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Dredging and Sediment Discharge Plan; Sediment and Erosion Control Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. - Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Environmental Training Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. <p>Offsetting Measures:</p> <ul style="list-style-type: none"> - Implementation of Offsetting Plan 	None	Not applicable	Not applicable	Not applicable
	Marine Vegetation (Section 11.0)	Changes in biofilm assemblage composition during freshet during construction and operation phases.	No known measures to mitigate temporary changes in salinity.	Changes in biofilm assemblage composition during freshet during construction and operation phases.	Not Significant	No cumulative interaction expected	Not applicable
	Marine Invertebrates (Section 12.0)	Productivity loss for bivalve shellfish, Dungeness crabs and orange sea pens during construction and operation phases.	<p>Avoidance Measures:</p> <ul style="list-style-type: none"> - Optimised Project design including terminal placement in subtidal waters, reduced footprint for causeway widening, terminal rounded corner, and incorporation of rocky shoreline in portions of the terminal and causeway perimeters. - Alignment of construction activities to avoid fisheries-sensitive windows for Dungeness crabs. <p>Reduction Measures:</p> <ul style="list-style-type: none"> - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Dredging and Sediment Discharge Plan; Sediment and Erosion Control Plan; Marine Species Salvage Plan (i.e., crab salvages and sea pen transplants); Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. - Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Environmental Training Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. <p>Offsetting Measures:</p> <ul style="list-style-type: none"> - Implementation of Offsetting Plan 	Productivity loss for bivalve shellfish, Dungeness crabs and orange sea pens during construction and operation phases	Not Significant	No cumulative interaction expected	Not applicable
	Marine Fish (Section 13.0)	Loss of productivity for marine fish sub-components during construction and operation phases.	<p>Avoidance Measures:</p> <ul style="list-style-type: none"> - Optimised Project design including terminal placement in subtidal waters, reduced footprint for causeway widening, terminal rounded corner, and incorporation of rocky shoreline in portions of the terminal and causeway perimeters. - Alignment of construction activities to avoid fisheries-sensitive windows for juvenile salmon. - Incorporation of fish refuge habitat within caisson face. <p>Reduction Measures:</p> <ul style="list-style-type: none"> - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Dredging and Sediment Discharge Plan; Light Management Plan; Underwater Noise Management Plan; Sediment and Erosion Control Plan; Marine Species Salvage Plan (i.e., fish salvages); Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. - Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Light Management Plan; Environmental Training Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. <p>Offsetting Measures:</p> <ul style="list-style-type: none"> - Implementation of Offsetting Plan 	Productivity loss for forage fish and flatfish during construction and operations.	Not Significant	Negligible cumulative effect	Not applicable

Appendix 29-A Changes to Components of the Environment within Federal Jurisdiction

Appendix 29-A Changes to Components of the Environment within Federal Jurisdiction				Residual Effects		Incremental Cumulative Effects	
Environmental Component	Valued Component	Potential Effect (before mitigation)	Mitigation Applied	Residual Effect (after mitigation)	Significance	Cumulative Effect	Significance
"Fish" and "fish habitat" as defined in the Fisheries Act and "aquatic species" as defined in the Species at Risk Act	Marine Mammals (Section 14.0)	Change in acoustic environment resulting in behavioural effects or acoustic masking for southern resident killer whale, North Pacific humpback whale, and Steller sea lion during construction and operation phases.	Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Underwater Noise Management Plan; Marine Mammal Observation Plan; Environmental Training Plan.	Change in acoustic environment resulting in behavioural effects or acoustic masking during operation phase.	Not Significant	Residual cumulative effect expected	Significant (considering past, present and future cumulative effects)
	Marine Mammals (Section 14.0)	Physical disturbance from vessel strikes for southern resident killer whale and North Pacific humpback whale during construction and operation phases.	Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan. - Implementation of Operation Environmental Management Plan and supporting plan: Environmental Training Plan. - Distribution of a marine mammal awareness pamphlet, "Marine Mammals of the Roberts Bank Area" to marine pilots working within PMV jurisdiction.	None	Not applicable	Not applicable	Not applicable
"Migratory birds" as defined in the <i>Migratory Birds Convention Act, 1994</i>	Coastal Birds (Section 15.0)	Productivity loss for coastal bird subcomponents during construction and operation phases.	Avoidance Measures: - Optimised Project design including terminal placement in subtidal waters, reduced footprint for causeway widening, terminal rounded corner, and incorporation of rocky shoreline in portions of the terminal and causeway perimeters. - Alignment of construction activities to avoid periods when diving birds are abundant in the area (coincides with Dungeness crab least-risk timing window). Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Light Management Plan; Dredging and Sediment Discharge Plan; Sediment and Erosion Control Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan; Noise Management Plan; Underwater Noise Management Plan; Land and Marine Traffic Management Plan. - Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Environmental Training Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan; Noise Management Plan; Light Management Plan. - Work collaboratively with appropriate transportation authorities and CWS to develop and implement measures to mitigate effects to barn owl from vehicle collisions. Offsetting Measures: - Implementation of Offsetting Plan	Productivity loss for diving birds during construction and operation phases.	Not Significant	Negligible cumulative effect	Not applicable

APPENDIX 29-B

**Changes to the Environment that would occur
on Federal or Transboundary Lands
(Intermediate Components)**

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Appendix 29-B Changes to the Environment on Federal or Transboundary Lands (Intermediate Components)

Intermediate Component	Project-Related Change	On Federal Lands	On Trans-boundary Lands	Project Mitigation Measures Related to ICs	Incremental Cumulative Change
Air Quality (Section 9.2)	<p>Construction:</p> <ul style="list-style-type: none"> - Increases in particulate matter (PM) are predicted over water in the vicinity of the construction works and near the B.C. Ferries terminal. - No exceedances of criteria for PM, CO, NO₂, SO₂, or formaldehyde are predicted at locations on land, except potentially at the eastern end of the Roberts Bank causeway for PM10 concentrations. - During peak construction activity, air quality criteria may be exceeded for 1-h and 24-h average NO₂ concentrations in the immediate vicinity, and for PM, PM10 and PM2.5 concentrations over water near the Roberts Bank causeway and terminals. <p>Operation:</p> <ul style="list-style-type: none"> - PM, CO, NO₂, SO₂, and formaldehyde are not predicted to exceed criteria at locations on land. - 1-h average NO₂ concentrations in the immediate vicinity of the Roberts Bank terminals are predicted to exceed air quality criteria. - Compared to existing conditions, PM, CO, NO₂, SO₂, and formaldehyde are expected to decrease at locations on land, with the exception of localised increases for PM, CO, NO₂, and formaldehyde - Compared to future conditions without the Project, all criteria air contaminants are predicted to increase at both land locations and over water, with the exception of NO₂, SO₂, and PM for some criteria averaging periods at the B.C. Ferries Terminal. - A negligible effect on future ozone levels is expected. - Greenhouse gases and black carbon emission concentrations are predicted to increase relative to expected future conditions without the Project. - Compared to existing conditions, black carbon is expected to decrease due to equipment fleet turnover to newer engines that meet more stringent emission standards. 	Yes	Yes	<p>Reduction Measures:</p> <p>Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Air Quality and Dust Control Plan; Land and Marine Traffic Management Plan.</p> <p>Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Environmental Training Plan.</p>	Minor changes in overall air quality levels because implementation of new vehicle emission standards will reduce emissions from all traffic.
Noise and Vibration (Section 9.3)	<p>Construction: During peak periods of construction activity, perceptible increase in noise levels.</p> <p>Operation: Project operation is expected to result in incremental changes in average daily noise levels and low-frequency noise levels. Changes in average daily noise levels are not expected to be perceptible. Low-frequency noise will increase to a slightly higher, and potentially perceptible, degree. In addition, Project operation is estimated to approximately double the rates of occurrence of transient and impulsive noise events associated with material handling and this increase is expected to be perceptible.</p>	Yes	Yes	<p>Reduction Measures:</p> <p>Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Noise Management Plan; Land and Marine Traffic Management Plan.</p> <p>Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Environmental Training Plan; Noise Management Plan.</p>	Increases in noise levels in areas near Deltaport Way and the upland rail corridor within the study area
Light (Section 9.4)	<p>Construction and Operation - Minimal increases in light trespass and sky glow levels</p>	Yes	Yes	<p>Reduction Measures:</p> <p>Implementation of Construction Environmental Management Plan and supporting plans: Light Management Plan.</p> <p>Implementation of Operation Environmental Management Plan and supporting plans: Light Management Plan.</p>	None anticipated

Appendix 29-B Changes to the Environment on Federal or Transboundary Lands (Intermediate Components)

Intermediate Component	Project-Related Change	On Federal Lands	On Trans-boundary Lands	Project Mitigation Measures Related to ICs	Incremental Cumulative Change
Coastal Geomorphology (Section 9.5)	<p>Construction - During construction of the causeway, formation of temporary drainage channels from drainage of tidal waters through the causeway dyke prior to infilling.</p>	Yes	No	<p>Reduction Measures: Construction: Diversion of flow laterally along the toe of the causeway dyke, to mitigate channel formation related to drainage of tidal waters through the causeway dyke (changes to be incorporated in detail design).</p>	None anticipated
	<p>Construction and Operation - Project terminal footprint-related changes in coastal processes include: - Sediment scouring and deposition near northwest edge of the terminal; - Increased flow exchange in relict tidal channel west of the terminal from flow acceleration; - Localised decreases in tidal currents and creation of wave shadow, leading to increased fine sediment deposition north of the terminal - Deflection by the terminal of saline waters during rising tide, leading to lower salinities shoreward of the terminal on the north side of the causeway and modification of the movement of the Fraser River plume, and increasing turbidity and fine sediment deposition - Local tidal flat area at the tug basin will be converted to subtidal waters.</p>	Yes	No	<p>Avoidance Measures: Construction and Operation: Optimised Project design including terminal placement in subtidal waters, terminal rounded corner.</p>	
Surficial Geology and Marine Sediment (Section 9.6)	<p>Construction - All changes are related to increases in sediment deposition following sediment re-suspension, and are anticipated to be minimal relative to the natural variation and dynamic environment at Roberts Bank. - Deposition of fine sediments from construction activities including ITP use, dredging at the terminal dredge basin and tug basin, vibro-densification, and disposal-at-sea discharges are predicted to be a maximum of 1.7 mm, less than the lowest natural sedimentation rate for Roberts Bank (range is 2 to 30 mm/year). - The spatial extents of sediment deposition from disposal at sea to -45 m CD range from 0.1 km² to 170 km² for sediment-laden water from fill material sourced from the Fraser River and dredge basin, respectively. - The spatial extents of sediment deposition range from 26 km² for dredging at tug basin and surface disposal of material to 31 km² for dredging at the terminal dredge basin. - Localised and temporary re-distribution of sediments (scour and subsequent deposition) following terminal dyke construction and altered currents.</p> <p>Construction and Operation - from altered coastal processes shoreward of the terminal: - Deposition of fine sediments from increases in turbidity shoreward of the terminal on the tidal flats (changes expected to be negligible).</p>	Yes	Yes	<p>Avoidance Measures: Construction and Operation: Optimised Project design including terminal placement in subtidal waters, terminal rounded corner, and use of Fraser River dredge material (with low fines content) for fill material used in land development.</p> <p>Reduction Measures: Construction: - Diversion of flow laterally along the toe of the causeway dyke, to mitigate channel formation (and associated erosion and sediment deposition) related to drainage of tidal waters through the causeway dyke (changes to be incorporated in detail design); - Implementation of Construction Environmental Management Plan and supporting plans: - Construction Compliance Monitoring Plan; - Dredging and Sediment Discharge Plan - Sediment and Erosion Control Plan - Hazardous Materials and Waste Management Plan - Spill Preparedness and Response Plan</p> <p>Operation: - Operation Compliance Monitoring Plan - Hazardous Materials and Waste Management Plan - Spill Preparedness and Response Plan</p>	None anticipated

Appendix 29-B Changes to the Environment on Federal or Transboundary Lands (Intermediate Components)

Intermediate Component	Project-Related Change	On Federal Lands	On Trans-boundary Lands	Project Mitigation Measures Related to ICs	Incremental Cumulative Change
Marine Water Quality (Section 9.7)	<p>Construction - All changes are related to TSS and turbidity due to sediment resuspension, and are anticipated to be minimal relative to the natural variation and dynamic environment at Roberts Bank (highest observed TSS levels are 260 mg/L during freshet).</p> <ul style="list-style-type: none"> - Increases in total suspended solids (TSS) levels of greater than 5 mg/L (lowest federal guideline limit) above background conditions are predominantly in areas close to dredging sties, ITP, and disposal-at-sea discharge sites, with the exception of disposal-at-sea to -45 m CD of sediment-laden water from fill material sourced from the dredge basin, with increases up to 20 mg/L along delta foreslope. - The spatial extents of TSS increases greater than 5 mg/L range from 0.5 km² to 90.5 km² for sediment-laden water from fill material sourced from the Fraser River and dredge basin, respectively. 	Yes	Yes	<p>Avoidance Measures- Construction:</p> <ul style="list-style-type: none"> - Optimised Project design including use of Fraser River dredge material (with low fines content) for fill material used in land development. <p>Reduction Measures - Construction:</p> <ul style="list-style-type: none"> - Construction Compliance Monitoring Plan -Dredging and Sediment Discharge Plan - Sediment and Erosion Control Plan - Hazardous Materials and Waste Management Plan - Spill Preparedness and Response Plan 	None anticipated
	<p>Construction and Operation - Changes in salinity from altered coastal processes are anticipated to be minimal relative to the natural variation and dynamic environment at Roberts Bank.</p> <ul style="list-style-type: none"> - Deflection of saline waters by the terminal during rising tide, leading to lower salinities shoreward of the terminal on the north side of the causeway and modification of the movement of the Fraser River plume, increasing turbidity, but within levels naturally experienced in this area. Changes are greatest during the freshet period. 	Yes	No	No known measures to mitigate temporary changes in salinity	
Underwater Noise (Section 9.8)	<p>Construction - Predicted noise levels range from 170 dB re 1µPa less than 20 m from vibratory piling at the mooring dolphin to 120 dB re 1µPa about 22 km from vibratory sheet piling at the west end of the caisson.</p> <ul style="list-style-type: none"> - Underwater noise levels may at times exceed current existing levels, but they are generally comparable. <p>Operation - Predicted underwater noise levels during the operation phase ranged from 170 dB re 1 µPa less than 20 m from berthing to 117 dB re 1 µPa approximately 29 km during berthing.</p> <ul style="list-style-type: none"> - Increases in underwater noise over existing conditions are predicted to occur for 3% of the year for container ship berthing and unberthing noise and 2% of the year for container ship approach and departure in the local assessment area.. 	Yes	Yes	<p>Reduction Measures:</p> <p>Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Underwater Noise Management Plan; Marine Mammal Observation Plan.</p>	Minor increase in overall underwater noise levels.

APPENDIX 29-C

**Changes to the Environment that would occur
on Federal or Transboundary Lands
(Valued Components)**

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Appendix 29-C Changes to the Environment on Federal or Transboundary Lands (Valued Components)

Appendix 29-C Changes to the Environment on Federal or Transboundary Lands (Valued Components)					Residual Effects		Incremental Cumulative Effects	
Environmental Component	Potential Effect (Before Mitigation)	On Federal Lands	On Trans-boundary Lands	Mitigation to Be Applied	Residual Effect (after mitigation)	Significance	Cumulative Effect	Significance
Marine Vegetation (Section 11.0)	Productivity loss for macroalgae during construction and operation phases.	Yes	No	Avoidance Measures: - Optimised Project design including terminal placement in subtidal waters, reduced footprint for causeway widening, terminal rounded corner, and incorporation of rocky shoreline in portions of the terminal and causeway perimeters. Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Dredging and Sediment Discharge Plan; Sediment and Erosion Control Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. - Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Environmental Training Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. Offsetting Measures: - Implementation of Offsetting Plan	None	Not applicable	Not applicable	Not applicable
	Changes in biofilm assemblage composition during freshet during construction and operation phases.	Yes	No	No known measures to mitigate temporary changes in salinity.	Changes in biofilm assemblage composition during freshet during construction and operation phases.	Not Significant	No cumulative interaction expected	Not applicable
Marine Invertebrates (Section 12.0)	Productivity loss for bivalve shellfish, Dungeness crabs and orange sea pens during construction and operation phases.	Yes	No	Avoidance Measures: - Optimised Project design including terminal placement in subtidal waters, reduced footprint for causeway widening, terminal rounded corner, and incorporation of rocky shoreline in portions of the terminal and causeway perimeters. - Alignment of construction activities to avoid fisheries-sensitive windows for Dungeness crabs. Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Dredging and Sediment Discharge Plan; Sediment and Erosion Control Plan; Marine Species Salvage Plan (i.e., crab salvages and sea pen transplants); Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. - Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Environmental Training Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. Offsetting Measures: - Implementation of Offsetting Plan	Productivity loss for bivalve shellfish, Dungeness crabs and orange sea pens during construction and operation phases	Not Significant	No cumulative interaction expected	Not applicable

Appendix 29-C Changes to the Environment on Federal or Transboundary Lands (Valued Components)

Appendix 29-C Changes to the Environment on Federal or Transboundary Lands (Valued Components)					Residual Effects		Incremental Cumulative Effects	
Environmental Component	Potential Effect (Before Mitigation)	On Federal Lands	On Trans-boundary Lands	Mitigation to Be Applied	Residual Effect (after mitigation)	Significance	Cumulative Effect	Significance
Marine Fish (Section 13.0)	Loss of productivity for marine fish sub-components during construction and operation phases.	Yes	No	<p>Avoidance Measures:</p> <ul style="list-style-type: none"> - Optimised Project design including terminal placement in subtidal waters, reduced footprint for causeway widening, terminal rounded corner, and incorporation of rocky shoreline in portions of the terminal and causeway perimeters. - Alignment of construction activities to avoid fisheries-sensitive windows for juvenile salmon. - Incorporation of fish refuge habitat within caisson face. <p>Reduction Measures:</p> <ul style="list-style-type: none"> - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Dredging and Sediment Discharge Plan; Light Management Plan; Underwater Noise Management Plan; Sediment and Erosion Control Plan; Marine Species Salvage Plan (i.e., fish salvages); Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. - Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Light Management Plan; Environmental Training Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. <p>Offsetting Measures:</p> <ul style="list-style-type: none"> - Implementation of Offsetting Plan 	Productivity loss for forage fish and flatfish during construction and operations.	Not Significant	Negligible cumulative effect	Not applicable
Marine Mammals (Section 14.0)	Change in acoustic environment resulting in behavioural effects or acoustic masking for southern resident killer whale, North Pacific humpback whale, and Steller sea lion during construction and operation phases.	Yes	Yes	<p>Reduction Measures:</p> <ul style="list-style-type: none"> - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Underwater Noise Management Plan; Marine Mammal Observation Plan; Environmental Training Plan. 	Change in acoustic environment resulting in behavioural effects or acoustic masking during operation phase.	Not Significant	Residual cumulative effect expected	Significant (considering past, present and future cumulative effects)
	Physical disturbance from vessel strikes for southern resident killer whale and North Pacific humpback whale during construction and operation phases.	Yes	Yes	<p>Reduction Measures:</p> <ul style="list-style-type: none"> - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan. - Implementation of Operation Environmental Management Plan and supporting plan: Environmental Training Plan. - Distribution of a marine mammal awareness pamphlet, "Marine Mammals of the Roberts Bank Area" to marine pilots working within PMV jurisdiction. 	None	Not applicable	Not applicable	Not applicable

Appendix 29-C Changes to the Environment on Federal or Transboundary Lands (Valued Components)

Appendix 29-C Changes to the Environment on Federal or Transboundary Lands (Valued Components)					Residual Effects		Incremental Cumulative Effects	
Environmental Component	Potential Effect (Before Mitigation)	On Federal Lands	On Trans-boundary Lands	Mitigation to Be Applied	Residual Effect (after mitigation)	Significance	Cumulative Effect	Significance
Coastal Birds (Section 15.0)	Productivity loss for coastal bird subcomponents during construction and operation phases.	Yes	Yes	<p>Avoidance Measures:</p> <ul style="list-style-type: none"> - Optimised Project design including terminal placement in subtidal waters, reduced footprint for causeway widening, terminal rounded corner, and incorporation of rocky shoreline in portions of the terminal and causeway perimeters. - Alignment of construction activities to avoid periods when diving birds are abundant in the area (coincides with Dungeness crab least-risk timing window). <p>Reduction Measures:</p> <ul style="list-style-type: none"> - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Light Management Plan; Dredging and Sediment Discharge Plan; Sediment and Erosion Control Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan; Noise Management Plan; Underwater Noise Management Plan; Land and Marine Traffic Management Plan; Marine Species Salvage Plan (for fish). - Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Environmental Training Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan; Noise Management Plan; Light Management Plan. - Work collaboratively with appropriate transportation authorities and CWS to develop and implement measures to mitigate effects to barn owl from vehicle collisions. <p>Offsetting Measures:</p> <ul style="list-style-type: none"> - Implementation of Offsetting Plan 	Productivity loss for diving birds during construction and operation phases.	Not Significant	Negligible cumulative effect	Not applicable

APPENDIX 29-D

**Changes to the Environment that are Directly
Linked or Necessarily Incidental to
Federal Decisions
(Intermediate Components)**

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Appendix 29-D Summary of Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions (Intermediate Components)

Legislation	Responsible Authority	Federal Decision	Intermediate Component	Project-Related Change	Project Mitigation Measures Related to ICs	Incremental Cumulative Change
Canada Marine Act , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Air Quality (Section 9.2)	<p>Construction:</p> <ul style="list-style-type: none"> - Increases in particulate matter (PM) are predicted over water in the vicinity of the construction works and near the B.C. Ferries terminal. - No exceedances of criteria for PM, CO, NO₂, SO₂, or formaldehyde are predicted at locations on land, except potentially at the eastern end of the Roberts Bank causeway for PM10 concentrations. - During peak construction activity, air quality criteria may be exceeded for 1-h and 24-h average NO₂ concentrations in the immediate vicinity, and for PM, PM₁₀ and PM_{2.5} concentrations over water near the Roberts Bank causeway and terminals. <p>Operation:</p> <ul style="list-style-type: none"> - PM, CO, NO₂, SO₂, and formaldehyde are not predicted to exceed criteria at locations on land. - 1-h average NO₂ concentrations in the immediate vicinity of the Roberts Bank terminals are predicted to exceed air quality criteria. - Compared to existing conditions, PM, CO, NO₂, SO₂, and formaldehyde are expected to decrease at locations on land, with the exception of localised increases for PM, CO, NO₂, and formaldehyde - Compared to future conditions without the Project, all criteria air contaminants are predicted to increase at both land locations and over water, with the exception of NO₂, SO₂, and PM for some criteria averaging periods at the B.C. Ferries Terminal. - A negligible effect on future ozone levels is expected. - Greenhouse gases and black carbon emission concentrations are predicted to increase relative to expected future conditions without the Project. - Compared to existing conditions, black carbon is expected to decrease due to equipment fleet turnover to newer engines that meet more stringent emission standards. 	<p>Reduction Measures:</p> <p>Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Air Quality and Dust Control Plan; Land and Marine Traffic Management Plan.</p> <p>Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Environmental Training Plan.</p>	Minor changes in overall air quality levels because implementation of new vehicle emission standards will reduce emissions from all traffic.
Canada Marine Act , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Noise and Vibration (Section 9.3)	<p>Construction: During peak periods of construction activity, perceptible increase in noise levels.</p>	<p>Reduction Measures:</p> <p>Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Noise Management Plan; Land and Marine Traffic Management Plan.</p>	Increases in noise levels in areas near Deltaport Way and the upland rail corridor within the study area
				<p>Operation: During operation, perceptible increase in rates of occurrence of transient and impulsive noise events associated with material handling.</p>	<p>Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Environmental Training Plan; Noise Management Plan.</p>	
Canada Marine Act , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Light (Section 9.4)	<p>Construction and Operation - Minimal increases in light trespass and sky glow levels</p>	<p>Reduction Measures:</p> <p>Implementation of Construction Environmental Management Plan and supporting plans: Light Management Plan.</p> <p>Implementation of Operation Environmental Management Plan and supporting plans: Light Management Plan.</p>	None anticipated
Canada Marine Act , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Coastal Geomorphology (Section 9.5)	<p>Construction - During construction of the causeway, formation of temporary drainage channels from drainage of tidal waters through the causeway dyke prior to infilling.</p>	<p>Reduction Measures:</p> <p>Construction: Diversion of flow laterally along the toe of the causeway dyke, to mitigate channel formation related to drainage of tidal waters through the causeway dyke (changes to be incorporated in detail design).</p>	None anticipated
				<p>Construction and Operation - Project terminal footprint-related changes in coastal processes include:</p> <ul style="list-style-type: none"> - Sediment scouring and deposition near northwest edge of the terminal; - Increased flow exchange in relict tidal channel west of the terminal from flow acceleration; - Localised decreases in tidal currents and creation of wave shadow, leading to increased fine sediment deposition north of the terminal - Deflection by the terminal of saline waters during rising tide, leading to lower salinities shoreward of the terminal on the north side of the causeway and modification of the movement of the Fraser River plume, and increasing turbidity and fine sediment deposition - Local tidal flat area at the tug basin will be converted to subtidal waters. 	<p>Avoidance Measures:</p> <p>Construction and Operation: Optimised Project design including terminal placement in subtidal waters, terminal rounded corner.</p>	

Appendix 29-D Summary of Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions (Intermediate Components)

Legislation	Responsible Authority	Federal Decision	Intermediate Component	Project-Related Change	Project Mitigation Measures Related to ICs	Incremental Cumulative Change
Canada Marine Act , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Surficial Geology and Marine Sediment (Section 9.6)	<p>Construction - All changes are related to increases in sediment deposition following sediment re-suspension, and are anticipated to be minimal relative to the natural variation and dynamic environment at Roberts Bank.</p> <ul style="list-style-type: none"> - Deposition of fine sediments from construction activities including ITP use, dredging at the terminal dredge basin and tug basin, vibro-densification, and disposal-at-sea discharges are predicted to be a maximum of 1.7 mm, less than the lowest natural sedimentation rate for Roberts Bank (range is 2 to 30 mm/year). - The spatial extents of sediment deposition from disposal at sea to -45 m CD range from 0.1 km² to 170 km² for sediment-laden water from fill material sourced from the Fraser River and dredge basin, respectively. - The spatial extents of sediment deposition range from 26 km² for dredging at tug basin and surface disposal of material to 31 km² for dredging at the terminal dredge basin. - Localised and temporary re-distribution of sediments (scour and subsequent deposition) following terminal dyke construction and altered currents. <p>Construction and Operation - from altered coastal processes shoreward of the terminal:</p> <ul style="list-style-type: none"> - Deposition of fine sediments from increases in turbidity shoreward of the terminal on the tidal flats (changes expected to be negligible). 	<p>Avoidance Measures: Construction and Operation: Optimised Project design including terminal placement in subtidal waters, terminal rounded corner, and use of Fraser River dredge material (with low fines content) for fill material used in land development.</p> <p>Reduction Measures: Construction: <ul style="list-style-type: none"> - Diversion of flow laterally along the toe of the causeway dyke, to mitigate channel formation (and associated erosion and sediment deposition) related to drainage of tidal waters through the causeway dyke (changes to be incorporated in detail design); - Implementation of Construction Environmental Management Plan and supporting plans: <ul style="list-style-type: none"> - Construction Compliance Monitoring Plan; - Dredging and Sediment Discharge Plan - Sediment and Erosion Control Plan - Hazardous Materials and Waste Management Plan - Spill Preparedness and Response Plan </p> <p>Operation: <ul style="list-style-type: none"> - Operation Compliance Monitoring Plan - Hazardous Materials and Waste Management Plan - Spill Preparedness and Response Plan </p>	None anticipated
Canada Marine Act , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Marine Water Quality (Section 9.7)	<p>Construction - All changes are related to TSS and turbidity due to sediment resuspension, and are anticipated to be minimal relative to the natural variation and dynamic environment at Roberts Bank (highest observed TSS levels are 260 mg/L during freshet).</p> <ul style="list-style-type: none"> - Increases in total suspended solids (TSS) levels of greater than 5 mg/L (lowest federal guideline limit) above background conditions are predominantly in areas close to dredging sties, ITP, and disposal-at-sea discharge sites, with the exception of disposal-at-sea to -45 m CD of sediment-laden water from fill material sourced from the dredge basin, with increases up to 20 mg/L along delta foreslope. - The spatial extents of TSS increases greater than 5 mg/L range from 0.5 km² to 90.5 km² for sediment-laden water from fill material sourced from the Fraser River and dredge basin, respectively. 	<p>Avoidance Measures- Construction: <ul style="list-style-type: none"> - Optimised Project design including use of Fraser River dredge material (with low fines content) for fill material used in land development. </p> <p>Reduction Measures - Construction: <ul style="list-style-type: none"> - Construction Compliance Monitoring Plan - Dredging and Sediment Discharge Plan - Sediment and Erosion Control Plan - Hazardous Materials and Waste Management Plan - Spill Preparedness and Response Plan </p>	None anticipated
				<p>Construction and Operation - Changes in salinity from altered coastal processes are anticipated to be minimal relative to the natural variation and dynamic environment at Roberts Bank.</p> <ul style="list-style-type: none"> - Deflection of saline waters by the terminal during rising tide, leading to lower salinities shoreward of the terminal on the north side of the causeway and modification of the movement of the Fraser River plume, increasing turbidity, but within levels naturally experienced in this area. Changes are greatest during the freshet period. 	<p>No known measures to mitigate temporary changes in salinity</p>	
Canada Marine Act , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Underwater Noise (Section 9.8)	<p>Construction - Predicted noise levels range from 170 dB re 1µPa less than 20 m from vibratory piling at the mooring dolphin to 120 dB re 1µPa about 22 km from vibratory sheet piling at the west end of the caisson.</p> <ul style="list-style-type: none"> - Underwater noise levels may at times exceed current existing levels, but they are generally comparable. <p>Operation - Predicted underwater noise levels during the operation phase ranged from 170 dB re 1 µPa less than 20 m from berthing to 117 dB re 1 µPa approximately 29 km during berthing.</p> <ul style="list-style-type: none"> - Increases in underwater noise over existing conditions are predicted to occur for 3% of the year for container ship berthing and unberthing noise and 2% of the year for container ship approach and departure in the local assessment area. 	<p>Reduction Measures: Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Underwater Noise Management Plan; Marine Mammal Observation Plan.</p>	Minor increase in overall underwater noise levels.

Appendix 29-D Summary of Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions (Intermediate Components)

Legislation	Responsible Authority	Federal Decision	Intermediate Component	Project-Related Change	Project Mitigation Measures Related to ICs	Incremental Cumulative Change
Canadian Environmental Protection Act, 1999	Environment Canada	Disposal at Sea Permit	Marine Water Quality (Section 9.7)	<p>Construction - All changes are related to TSS and turbidity due to sediment resuspension, and are anticipated to be minimal relative to the natural variation and dynamic environment at Roberts Bank (highest observed TSS levels are 260 mg/L during freshet).</p> <ul style="list-style-type: none"> - Increases in total suspended solids (TSS) levels of greater than 5 mg/L (lowest federal guideline limit) above background conditions are predominantly in areas close to dredging sties, ITP, and disposal-at-sea discharge sites, with the exception of disposal-at-sea to -45 m CD of sediment-laden water from fill material sourced from the dredge basin, with increases up to 20 mg/L along delta foreslope. - The spatial extents of TSS increases greater than 5 mg/L range from 0.5 km² to 90.5 km² for sediment-laden water from fill material sourced from the Fraser River and dredge basin, respectively. 	<p>Avoidance Measures- Construction:</p> <ul style="list-style-type: none"> - Optimised Project design including use of Fraser River dredgeate material (with low fines content) for fill material used in land development. <p>Reduction Measures - Construction:</p> <ul style="list-style-type: none"> - Construction Compliance Monitoring Plan -Dredging and Sediment Discharge Plan - Sediment and Erosion Control Plan - Hazardous Materials and Waste Management Plan - Spill Preparedness and Response Plan 	None anticipated
				<p>Construction and Operation - Changes in salinity from altered coastal processes are anticipated to be minimal relative to the natural variation and dynamic environment at Roberts Bank.</p> <ul style="list-style-type: none"> - Deflection of saline waters by the terminal during rising tide, leading to lower salinities shoreward of the terminal on the north side of the causeway and modification of the movement of the Fraser River plume, increasing turbidity, but within levels naturally experienced in this area. Changes are greatest during the freshet period. 	<p>No known measures to mitigate temporary changes in salinity</p>	
Fisheries Act	DFO	Authorisation	Coastal Geomorphology (Section 9.5)	<p>Construction - During construction of the causeway, formation of temporary drainage channels from drainage of tidal waters through the causeway dyke prior to infilling.</p>	<p>Avoidance Measures:</p> <p>Construction and Operation: Optimised Project design including terminal placement in subtidal waters, and terminal rounded corner.</p> <p>Reduction Measures:</p> <p>Construction: Diversion of flow laterally along the toe of the causeway dyke, to mitigate channel formation related to drainage of tidal waters through the causeway dyke (changes to be incorporated in detail design).</p>	None anticipated
				<p>Construction and Operation - Project terminal footprint-related changes in coastal processes include:</p> <ul style="list-style-type: none"> - Sediment scouring and deposition near northwest edge of the terminal; - Increased flow exchange in relict tidal channel west of the terminal from sediment scouring; - Localised decreases in tidal currents and creation of wave shadow, leading to increased sediment deposition north of the terminal - Deflection by the terminal of saline waters during rising tide, leading to lower salinities shoreward of the terminal on the north side of the causeway and modification of the movement of the Fraser River plume, and increasing turbidity and fine sediment deposition - Local tidal flat area at the tug basin will be converted to subtidal waters. 	<p>Avoidance Measures:</p> <p>Construction and Operation: Optimised Project design including terminal placement in subtidal waters, terminal rounded corner.</p>	
Fisheries Act	DFO	Authorisation	Surficial Geology and Marine Sediment (Section 9.6)	<p>Construction - All changes are related to increases in sediment deposition following sediment re-suspension, and are anticipated to be minimal relative to the natural variation and dynamic environment at Roberts Bank.</p> <ul style="list-style-type: none"> - Deposition of fine sediments from construction activities including ITP use, dredging at the terminal dredge basin and tug basin, vibro-densification, and disposal-at-sea discharges are predicted to be a maximum of 1.7 mm, less than the lowest natural sedimentation rate for Roberts Bank (range is 2 to 30 mm/year). - The spatial extents of sediment deposition from disposal at sea to -45 m CD range from 0.1 km² to 170 km² for sediment-laden water from fill material sourced from the Fraser River and dredge basin, respectively. - The spatial extents of sediment deposition range from 26 km² for dredging at tug basin and surface disposal of material to 31 km² for dredging at the terminal dredge basin. - Localised and temporary re-distribution of sediments (scour and subsequent deposition) following terminal dyke construction and altered currents. <p>Construction and Operation - from altered coastal processes shoreward of the terminal:</p> <ul style="list-style-type: none"> - Deposition of fine sediments from increases in turbidity shoreward of the terminal on the tidal flats (changes expected to be negligible). 	<p>Avoidance Measures:</p> <p>Construction and Operation: Optimised Project design including terminal placement in subtidal waters, terminal rounded corner, and use of Fraser River dredgeate material (with low fines content) for fill material used in land development.</p> <p>Reduction Measures:</p> <p>Construction:</p> <ul style="list-style-type: none"> - Diversion of flow laterally along the toe of the causeway dyke, to mitigate channel formation (and associated erosion and sediment deposition) related to drainage of tidal waters through the causeway dyke (changes to be incorporated in detail design); - Implementation of Construction Environmental Management Plan and supporting plans: <ul style="list-style-type: none"> - Construction Compliance Monitoring Plan; - Dredging and Sediment Discharge Plan - Sediment and Erosion Control Plan - Hazardous Materials and Waste Management Plan - Spill Preparedness and Response Plan <p>Operation:</p> <ul style="list-style-type: none"> - Operation Compliance Monitoring Plan - Hazardous Materials and Waste Management Plan - Spill Preparedness and Response Plan 	None anticipated

Appendix 29-D Summary of Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions (Intermediate Components)

Legislation	Responsible Authority	Federal Decision	Intermediate Component	Project-Related Change	Project Mitigation Measures Related to ICs	Incremental Cumulative Change
Fisheries Act	DFO	Authorisation	Marine Water Quality (Section 9.7)	<p>Construction - All changes are related to TSS and turbidity due to sediment resuspension, and are anticipated to be minimal relative to the natural variation and dynamic environment at Roberts Bank (highest observed TSS levels are 260 mg/L during freshet).</p> <ul style="list-style-type: none"> - Increases in total suspended solids (TSS) levels of greater than 5 mg/L (lowest federal guideline limit) above background conditions are predominantly in areas close to dredging sties, ITP, and disposal-at-sea discharge sites, with the exception of disposal-at-sea to -45 m CD of sediment-laden water from fill material sourced from the dredge basin, with increases up to 20 mg/L along delta foreslope. - The spatial extents of TSS increases greater than 5 mg/L range from 0.5 km² to 90.5 km² for sediment-laden water from fill material sourced from the Fraser River and dredge basin, respectively. 	<p>Avoidance Measures- Construction:</p> <ul style="list-style-type: none"> - Optimised Project design including use of Fraser River dredge material (with low fines content) for fill material used in land development. <p>Reduction Measures - Construction:</p> <ul style="list-style-type: none"> - Construction Compliance Monitoring Plan - Dredging and Sediment Discharge Plan - Sediment and Erosion Control Plan - Hazardous Materials and Waste Management Plan - Spill Preparedness and Response Plan 	None anticipated
				<p>Construction and Operation - Changes in salinity from altered coastal processes are anticipated to be minimal relative to the natural variation and dynamic environment at Roberts Bank.</p> <ul style="list-style-type: none"> - Deflection of saline waters by the terminal during rising tide, leading to lower salinities shoreward of the terminal on the north side of the causeway and modification of the movement of the Fraser River plume, increasing turbidity, but within levels naturally experienced in this area. Changes are greatest during the freshet period. 	<p>No known measures to mitigate temporary changes in salinity</p>	
Fisheries Act	DFO	Authorisation	Underwater Noise (Section 9.8)	<p>Construction - Predicted noise levels range from 170 dB re 1µPa less than 20 m from vibratory piling at the mooring dolphin to 120 dB re 1µPa about 22 km from vibratory sheet piling at the west end of the caisson.</p> <ul style="list-style-type: none"> - Underwater noise levels may at times exceed current existing levels, but they are generally comparable. <p>Operation - Predicted underwater noise levels during the operation phase ranged from 170 dB re 1 µPa less than 20 m from berthing to 117 dB re 1 µPa approximately 29 km during berthing.</p> <ul style="list-style-type: none"> - Increases in underwater noise over existing conditions are predicted to occur for 3% of the year for container ship berthing and unberthing noise and 2% of the year for container ship approach and departure in the local assessment area. 	<p>Reduction Measures:</p> <p>Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Underwater Noise Management Plan; Marine Mammal Observation Plan.</p>	Minor increase in overall underwater noise levels.

APPENDIX 29-E
Changes to the Environment that are Directly
Linked or Necessarily Incidental to
Federal Decisions (Valued Components)

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Appendix 29-E Summary of Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions (Valued Components)

Appendix 29-E Summary of Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions (Valued Components)						Residual Effects		Incremental Cumulative Effects	
Legislation	Responsible Authority	Federal Decision	Valued Component	Potential Effect	Mitigation Applied	Residual Effect (after mitigation)	Significance	Cumulative Effect	Significance
Canada Marine Act , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Marine Vegetation (Section 11.0)	Productivity loss for macroalgae during construction and operation phases.	Avoidance Measures: - Optimised Project design including terminal placement in subtidal waters, reduced footprint for causeway widening, terminal rounded corner, and incorporation of rocky shoreline in portions of the terminal and causeway perimeters. Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Dredging and Sediment Discharge Plan; Sediment and Erosion Control Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. - Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Environmental Training Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. Offsetting Measures: - Implementation of Offsetting Plan	None	Not applicable	Not applicable	Not applicable
Canada Marine Act , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Marine Vegetation (Section 11.0)	Changes in biofilm assemblage composition during freshet during construction and operation phases.	No known measures to mitigate temporary changes in salinity.	Changes in biofilm assemblage composition during freshet during construction and operation phases.	Not Significant	No cumulative interaction expected	Not applicable
Canada Marine Act , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Marine Invertebrates (Section 12.0)	Productivity loss for bivalve shellfish, Dungeness crabs and orange sea pens during construction and operation phases.	Avoidance Measures: - Optimised Project design including terminal placement in subtidal waters, reduced footprint for causeway widening, terminal rounded corner, and incorporation of rocky shoreline in portions of the terminal and causeway perimeters. - Alignment of construction activities to avoid fisheries-sensitive windows for Dungeness crabs. Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Dredging and Sediment Discharge Plan; Sediment and Erosion Control Plan; Marine Species Salvage Plan (i.e., crab salvages and sea pen transplants); Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. - Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Environmental Training Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. Offsetting Measures: - Implementation of Offsetting Plan	Productivity loss for bivalve shellfish, Dungeness crabs and orange sea pens during construction and operation phases.	Not Significant	No cumulative interaction expected	Not applicable
Canada Marine Act , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Marine Fish (Section 13.0)	Loss of productivity for marine fish sub-components during construction and operation phases.	Avoidance Measures: - Optimised Project design including terminal placement in subtidal waters, reduced footprint for causeway widening, terminal rounded corner, and incorporation of rocky shoreline in portions of the terminal and causeway perimeters. - Alignment of construction activities to avoid fisheries-sensitive windows for juvenile salmon. - Incorporation of fish refuge habitat within caisson face. Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Dredging and Sediment Discharge Plan; Light Management Plan; Underwater Noise Management Plan; Sediment and Erosion Control Plan; Marine Species Salvage Plan (i.e., fish salvages); Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. - Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Light Management Plan; Environmental Training Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. Offsetting Measures: - Implementation of Offsetting Plan	Productivity loss for forage fish and flatfish during construction and operations.	Not Significant	Negligible cumulative effect	Not applicable
Canada Marine Act , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Marine Mammals (Section 14.0)	Change in acoustic environment resulting in behavioural effects or acoustic masking for southern resident killer whale, North Pacific humpback whale, and Steller sea lion during construction and operation phases.	Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Underwater Noise Management Plan; Marine Mammal Observation Plan; Environmental Training Plan.	Change in acoustic environment resulting in behavioural effects or acoustic masking during operation phase.	Not Significant	Residual cumulative effect expected	Significant (considering past, present and future cumulative effects)
Canada Marine Act , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Marine Mammals (Section 14.0)	Physical disturbance from vessel strikes for southern resident killer whale and North Pacific humpback whale during construction and operation phases.	Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan. - Implementation of Operation Environmental Management Plan and supporting plan: Environmental Training Plan. - Distribution of a marine mammal awareness pamphlet, "Marine Mammals of the Roberts Bank Area" to marine pilots working within PMV jurisdiction.	None	Not applicable	Not applicable	Not applicable

Appendix 29-E Summary of Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions (Valued Components)

Appendix 29-E Summary of Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions (Valued Components)						Residual Effects		Incremental Cumulative Effects	
Legislation	Responsible Authority	Federal Decision	Valued Component	Potential Effect	Mitigation Applied	Residual Effect (after mitigation)	Significance	Cumulative Effect	Significance
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Coastal Birds (Section 15.0)	Productivity loss for coastal bird subcomponents during construction and operation phases.	<p>Avoidance Measures:</p> <ul style="list-style-type: none"> - Optimised Project design including terminal placement in subtidal waters, reduced footprint for causeway widening, terminal rounded corner, and incorporation of rocky shoreline in portions of the terminal and causeway perimeters. - Alignment of construction activities to avoid periods when diving birds are abundant in the area (coincides with Dungeness crab least-risk timing window). <p>Reduction Measures:</p> <ul style="list-style-type: none"> - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Light Management Plan; Dredging and Sediment Discharge Plan; Sediment and Erosion Control Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan; Noise Management Plan; Underwater Noise Management Plan; Land and Marine Traffic Management Plan. - Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Environmental Training Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan; Noise Management Plan; Light Management Plan. - Work collaboratively with appropriate transportation authorities and CWS to develop and implement measures to mitigate effects to barn owl from vehicle collisions. <p>Offsetting Measures:</p> <ul style="list-style-type: none"> - Implementation of Offsetting Plan 	Productivity loss for diving birds during construction and operation phases.	Not Significant	Negligible cumulative effect	Not applicable
Fisheries Act	DFO	Authorisation	Marine Vegetation (Section 11.0)	Productivity loss for macroalgae during construction and operation phases.	<p>Avoidance Measures:</p> <ul style="list-style-type: none"> - Optimised Project design including terminal placement in subtidal waters, reduced footprint for causeway widening, terminal rounded corner, and incorporation of rocky shoreline in portions of the terminal and causeway perimeters. <p>Reduction Measures:</p> <ul style="list-style-type: none"> - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Dredging and Sediment Discharge Plan; Sediment and Erosion Control Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. - Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Environmental Training Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. <p>Offsetting Measures:</p> <ul style="list-style-type: none"> - Implementation of Offsetting Plan 	None	Not applicable	Not applicable	Not applicable
Fisheries Act	DFO	Authorisation	Marine Vegetation (Section 11.0)	Changes in biofilm assemblage composition during freshet during construction and operation phases.	No known measures to mitigate temporary changes in salinity.	Changes in biofilm assemblage composition during freshet during construction and operation phases.	Not Significant	No cumulative interaction expected	Not applicable
Fisheries Act	DFO	Authorisation	Marine Invertebrates (Section 12.0)	Productivity loss for bivalve shellfish, Dungeness crabs and orange sea pens during construction and operation phases.	<p>Avoidance Measures:</p> <ul style="list-style-type: none"> - Optimised Project design including terminal placement in subtidal waters, reduced footprint for causeway widening, terminal rounded corner, and incorporation of rocky shoreline in portions of the terminal and causeway perimeters. - Alignment of construction activities to avoid fisheries-sensitive windows for Dungeness crabs. <p>Reduction Measures:</p> <ul style="list-style-type: none"> - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Dredging and Sediment Discharge Plan; Sediment and Erosion Control Plan; Marine Species Salvage Plan (i.e., crab salvages and sea pen transplants); Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. - Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Environmental Training Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. <p>Offsetting Measures:</p> <ul style="list-style-type: none"> - Implementation of Offsetting Plan 	Productivity loss for bivalve shellfish, Dungeness crabs and orange sea pens during construction and operation phases.	Not Significant	No cumulative interaction expected	Not applicable

Appendix 29-E Summary of Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions (Valued Components)

Appendix 29-E Summary of Changes to the Environment that are Directly Linked or Necessarily Incidental to Federal Decisions (Valued Components)						Residual Effects		Incremental Cumulative Effects	
Legislation	Responsible Authority	Federal Decision	Valued Component	Potential Effect	Mitigation Applied	Residual Effect (after mitigation)	Significance	Cumulative Effect	Significance
<i>Fisheries Act</i>	DFO	Authorisation	Marine Fish (Section 13.0)	Loss of productivity for marine fish sub-components during construction and operation phases.	<p>Avoidance Measures:</p> <ul style="list-style-type: none"> - Optimised Project design including terminal placement in subtidal waters, reduced footprint for causeway widening, terminal rounded corner, and incorporation of rocky shoreline in portions of the terminal and causeway perimeters. - Alignment of construction activities to avoid fisheries-sensitive windows for juvenile salmon. - Incorporation of fish refuge habitat within caisson face. <p>Reduction Measures:</p> <ul style="list-style-type: none"> - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan; Dredging and Sediment Discharge Plan; Light Management Plan; Underwater Noise Management Plan; Sediment and Erosion Control Plan; Marine Species Salvage Plan (i.e., fish salvages); Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. - Implementation of Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan; Light Management Plan; Environmental Training Plan; Hazardous Materials and Waste Management Plan; Spill Preparedness and Response Plan. <p>Offsetting Measures:</p> <ul style="list-style-type: none"> - Implementation of Offsetting Plan 	Productivity loss for forage fish and flatfish during construction and operations.	Not Significant	Negligible cumulative effect	Not applicable
<i>Fisheries Act</i>	DFO	Authorisation	Marine Mammals (Section 14.0)	Change in acoustic environment resulting in behavioural effects or acoustic masking for southern resident killer whale, North Pacific humpback whale, and Steller sea lion during construction and operation phases.	<p>Reduction Measures:</p> <ul style="list-style-type: none"> - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Underwater Noise Management Plan; Marine Mammal Observation Plan; Environmental Training Plan. 	Change in acoustic environment resulting in behavioural effects or acoustic masking during operation phase.	Not Significant	Residual cumulative effect expected	Significant (considering past, present and future cumulative effects)
<i>Fisheries Act</i>	DFO	Authorisation	Marine Mammals (Section 14.0)	Physical disturbance from vessel strikes for southern resident killer whale and North Pacific humpback whale during construction and operation phases.	<p>Reduction Measures:</p> <ul style="list-style-type: none"> - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan. - Implementation of Operation Environmental Management Plan and supporting plan: Environmental Training Plan. - Distribution of a marine mammal awareness pamphlet, "Marine Mammals of the Roberts Bank Area" to marine pilots working within PMV jurisdiction. 	None	Not applicable	Not applicable	Not applicable

APPENDIX 29-F
Effects of Changes to the Environment
on Aboriginal Peoples

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29-F Effects of Changes to the Environment on Aboriginal Peoples

29-F Effects of Changes to the Environment on Aboriginal Peoples				Residual Effects		Incremental Cumulative Effects	
Aspect Potentially Affected	Related VC	Potential Effect	Mitigation Applied	Residual Effect (after mitigation)	Significance	Cumulative Effect	Significance
Health and socio-economic conditions	Labour Market (Section 19.0)	Change in employment during construction and operation	No mitigation required	No adverse residual effects anticipated			
Health and socio-economic conditions	Labour Market (Section 19.0)	Change in labour income during construction and operation	No mitigation required	No adverse residual effects anticipated			
Health and socio-economic conditions	Labour Market (Section 19.0)	Change in training opportunities during construction and operation	No mitigation required	No adverse residual effects anticipated			
Health and socio-economic conditions	Labour Market (Section 19.0)	Change in unemployment and participation rates during construction and operation	No mitigation required	No adverse residual effects anticipated			
Health and socio-economic conditions	Economic Development (Section 20.0)	Change in materials, goods and services contracting revenues during construction and operation	No mitigation required	No adverse residual effects anticipated			
Health and socio-economic conditions	Economic Development (Section 20.0)	Increase in induced output (revenue) during construction and operation	No mitigation required	No adverse residual effects anticipated			
Health and socio-economic conditions	Economic Development (Section 20.0)	Consistency with economic development plans during operation	No mitigation required	No adverse residual effects anticipated			
Health and socio-economic conditions	Marine Commercial Use (Section 21.0)	Displacement of commercial crab harvesting and reduction in harvest levels and associated revenue during construction and operation	Avoidance Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Communications Plan. Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Marine Species Salvage Plan (i.e. crab salvages). - Work with DFO to ensure necessary consultation with commercial crab harvesters concerning the proposed navigational closure expansion. Where identified and agreed upon, implement feasible mitigation.	Changes in area, harvest and revenue for seafood harvesting during construction and operation	Not Significant	Residual cumulative effect expected	Not Significant
Health and socio-economic conditions	Services and Infrastructure (Section 23.0)	Constraint on healthcare services capacity and supply during construction and operation	Avoidance Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Health and Safety and Emergency Response Management Plan; Land and Marine Traffic Management Plan. - Implementation of Operation Environmental Management Plan and supporting plans: Health and Safety and Emergency Response Management Plan; Land and Marine Traffic Management Plan.	No adverse residual effects anticipated			
Health and socio-economic conditions	Services and Infrastructure (Section 23.0)	Constraint on emergency services capacity and supply during construction and operation	Avoidance Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Health and Safety and Emergency Response Management Plan; Land and Marine Traffic Management Plan; Communications Plan. - Implementation of Operation Environmental Management Plan and supporting plans: Health and Safety and Emergency Response Management Plan; Land and Marine Traffic Management Plan. Reduction Measures: - Communication with emergency services on operational plans, activities, timelines, service requirements, and management of emergency service utilisation. - Police and security management, including site security services, site security systems, and equipment.	No adverse residual effects anticipated			

29-F Effects of Changes to the Environment on Aboriginal Peoples

29-F Effects of Changes to the Environment on Aboriginal Peoples				Residual Effects		Incremental Cumulative Effects	
Aspect Potentially Affected	Related VC	Potential Effect	Mitigation Applied	Residual Effect (after mitigation)	Significance	Cumulative Effect	Significance
Health and socio-economic conditions	Services and Infrastructure (Section 23.0)	Constraint on municipal infrastructure capacity and supply during construction and operation	Avoidance Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Hazardous Materials and Waste Management Plan	No adverse residual effects anticipated			
Health and socio-economic conditions	Outdoor Recreation (Section 24.0)	Displacement of recreational crab harvesting and reduction in harvest levels during construction and operation	Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Marine Species Salvage Plan (i.e. crab salvages), Communications Plan. - Work with DFO to ensure necessary consultation with recreational crab harvesters concerning the proposed navigation closure expansion. Where identified and agreed upon, implement feasible mitigation.	No adverse residual effects anticipated			
Health and socio-economic conditions	Visual Resources (Section 25.0)	Change in daytime visual resources during construction and operation	Reduction Measures: - Crane colour optimisation to reduce contrast and enhance blending with the landscape.	Change in daytime visual resources during construction and operation	Not Significant	Residual cumulative effect expected	Not Significant
Health and socio-economic conditions	Visual Resources (Section 25.0)	Change in nighttime visual resources during construction and operation	Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plan: Light Management Plan. - Implementation of Operation Environmental Management Plan and supporting plan: Light Management Plan.	Change in nighttime visual resources during construction and operation	Not Significant	No cumulative interaction expected	Not applicable
Health and socio-economic conditions	Land and Water Use (Section 26.0)	Consistency with land use planning designations during construction	Avoidance Measures: - Engagement with land and water users, including dialogue and communications through a mechanism for two-way dialogue and communications about port-related issues in Delta - Land Use Planning Approach: Engagement with local governments, Aboriginal groups and other land use authorities per objective in PMV Land Use Plan, when updating or amending Land Use Plan, or determining land use designations.	No adverse residual effects anticipated			
Health and socio-economic conditions	Land and Water Use (Section 26.0)	Disturbance to marine-related industrial uses during construction	Reduction Measures: - Engagement with land and water users, including dialogue and communications through a mechanism for two-way dialogue and communications about port-related issues in Delta, and use of Community Feedback Line. - Implementation of Construction Environmental Management Plan and supporting plans: Communications Plan; Land and Marine Traffic Management Plan.	No adverse residual effects anticipated			
Health and socio-economic conditions	Land and Water Use (Section 26.0)	Disturbance to protected area (Roberts Bank WMA) during construction	Reduction Measures: - Engagement with land and water users, including dialogue and communications through a mechanism for two-way dialogue and communications about port-related issues in Delta, and use of Community Feedback Line. - Implementation of Construction Environmental Management Plan and supporting plans: Communications Plan; Land and Marine Traffic Management Plan.	No adverse residual effects anticipated			
Health and socio-economic conditions	Land and Water Use (Section 26.0)	Changes in access to TFN community lease lands during construction	Reduction Measures: - Engagement with land and water users, including dialogue and communications through a mechanism for two-way dialogue and communications about port-related issues in Delta, and use of Community Feedback Line. - Implementation of Construction Environmental Management Plan and supporting plans: Communications Plan; Land and Marine Traffic Management Plan.	Disturbance to community lease lands during construction	Not Significant	No cumulative interaction expected	Not applicable

29-F Effects of Changes to the Environment on Aboriginal Peoples

29-F Effects of Changes to the Environment on Aboriginal Peoples				Residual Effects		Incremental Cumulative Effects	
Aspect Potentially Affected	Related VC	Potential Effect	Mitigation Applied	Residual Effect (after mitigation)	Significance	Cumulative Effect	Significance
Health and socio-economic conditions	Human Health (Section 27.0)	Adverse health effects related to air emissions during construction	Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Air Quality and Dust Control Plan, Construction Compliance Monitoring Plan.	Adverse health effects related to air emissions during construction	Not Significant	No cumulative interaction expected	Not applicable
Health and socio-economic conditions	Human Health (Section 27.0)	Adverse health effects related to noise during construction and operation	Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Noise Management Plan, Construction Compliance Monitoring Plan, Communications Plan . - Implementation of the Operation Environmental Management Plan and supporting plans: Noise Management Plan, Operation Compliance Monitoring Plan	Adverse health effects related to noise during construction and operations	Not Significant	Negligible cumulative effect	Not applicable
Health and socio-economic conditions	Human Health (Section 27.0)	Adverse health effects due to stress and annoyance during construction and operation	Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Light Management Plan, Noise Management Plan, Construction Compliance Monitoring Plan, Construction Communications plan. - Implementation of the Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan, Operation Noise Management Plan, Operation Communications Plan. - Mitigation measures noted above regarding visual resources. - Awareness and education measures regarding results of contaminant sampling of edible shellfish.	No adverse residual effects anticipated			
Health and socio-economic conditions	Human Health (Section 27.0)	Adverse health outcomes due to changes in health inequity during construction and operation	Reduction Measures: - Accommodation measures related to Aboriginal employment, training, and contracting opportunities.	No adverse residual effects anticipated			
Current use of lands and resources for traditional purposes	Current Use (Section 32.2)	Changes in access to preferred Current Use locations	Reduction Measures: - Continue to abide by the Memorandum of Agreement in place with Tsawwassen First Nation to accommodate the Tsawwassen First Nation for effects from the Project - Work with Musqueam First Nation to draft Terms of Reference to guide future discussions related to accommodation for effects from the Project - Mitigation measures noted above regarding marine commercial use and outdoor recreation. - Work with DFO to ensure necessary consultations with Aboriginal domestic or FSC crabbers concerning the Navigational Closure extension - Support only Aboriginal domestic or FSC crabbing within extended Navigational Closure area - Mitigation measure noted above regarding Land and Water Use relating to marine access to Tsawwassen First Nation community lease lands (Tsawwassen Water Lots) - Develop communications protocol to inform appropriate Aboriginal groups of planned or unplanned events relating to Project construction or operations that might affect Current Use access - Work with appropriate Aboriginal groups to develop and implement a communications mechanism that will support dialogue between PMV and Aboriginal groups on topics of concern that arise during the construction phase and initial operation phase	No adverse residual effects anticipated			

29-F Effects of Changes to the Environment on Aboriginal Peoples

29-F Effects of Changes to the Environment on Aboriginal Peoples				Residual Effects		Incremental Cumulative Effects	
Aspect Potentially Affected	Related VC	Potential Effect	Mitigation Applied	Residual Effect (after mitigation)	Significance	Cumulative Effect	Significance
Current use of lands and resources for traditional purposes	Current Use (Section 32.2)	Changes in availability of preferred Current Use resources	Reduction Measures: - Mitigation measures noted above regarding changes in access to Current Use locations - Mitigation measures noted elsewhere in the EIS to reduce Project-related effects to marine resources, including marine vegetation, marine invertebrates, marine fish, marine mammals, and coastal birds. - Share, with appropriate Aboriginal groups, information gained through environmental monitoring and follow-up programs to support monitoring, by Aboriginal groups, of environmental conditions related to Current Use. - Work with appropriate Aboriginal groups to identify opportunities to participate in environmental monitoring and follow-up programs.	No adverse residual effects anticipated			
Current use of lands and resources for traditional purposes	Current Use (Section 32.2)	Changes in quality of preferred Current Use resources	Reduction Measures: - Mitigation measures noted above regarding changes in access to Current Use locations and changes in availability of Current Use resources. - Mitigation measures noted above regarding Human Health to address perceived contamination of traditional food sources.	No adverse residual effects anticipated			
Current use of lands and resources for traditional purposes	Current Use (Section 32.2)	Changes in wuality of preferred Current Use experience	Reduction Measures: - Mitigation measures noted above regarding changes in access to Current Use locations, changes in availability of Current Use resources, and changes in quality of Current Use resources. - Mitigation measures noted above regarding Visual Resources, Human Health, and Archaeology and Heritage Resources.	No adverse residual effects anticipated			
Physical and cultural heritage; - and - Any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.	Archaeological and Heritage Resources (Section 28.0)	Crushing or biological degradation of potential fish trap stakes during construction	Reduction Measures: - Excavate a test trench, or series of trenches, across the area of archaeological potential to locate potential fish trap stakes, if present.	Crushing or biological degradation of potential fish trap stakes during construction phase.	Not Significant	No cumulative interaction expected	Not applicable
Physical and cultural heritage; - and - Any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.	Archaeological and Heritage Resources (Section 28.0)	Reduced access for future archaeological study or preservation of potential fish trap stakes during construction	Reduction Measures: - Excavate a test trench across the area of archaeological potential to locate potential fish trap stakes, if present, and sample/investigate fish trap stakes if found.	Reduced access for future archaeological study or preservation of potential fish trap stakes.	Not Significant	No cumulative interaction expected	Not applicable
Physical and cultural heritage; - and - Any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.	Archaeological and Heritage Resources (Section 28.0)	Exposure of potential fish trap stakes during construction	Reduction Measures: - Annually monitor, for a period of 4 years, predicted tidal erosion and sample/investigate fish trap stakes if found.	Exposure of potential fish trap stakes during construction phase.	Not Significant	No cumulative interaction expected	Not applicable

APPENDIX 29-G
Effects of Changes to the Environment
that are Directly Linked or
Necessarily Incidental to Federal Decision

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29-G Effects of Changes to the Environment Directly Linked or Necessarily Incidental to Federal Decisions

29-G Effects of Changes to the Environment Directly Linked or Necessarily Incidental to Federal Decisions							Residual Effects		Incremental Cumulative Effects	
Legislation	Responsible Authority	Federal Decision	Aspect Potentially Affected	Related VC	Potential Change or Effect	Mitigation Applied	Residual Effect (after mitigation)	Significance	Cumulative Effect	Significance
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Labour Market (Section 19.0)	Change in employment during construction and operation	No mitigation required.	No adverse residual effects anticipated			
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Labour Market (Section 19.0)	Change in labour income during construction and operation	No mitigation required.	No adverse residual effects anticipated			
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Labour Market (Section 19.0)	Change in training opportunities during construction and operation	No mitigation required.	No adverse residual effects anticipated			
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Labour Market (Section 19.0)	Change in unemployment and participation rates during construction and operation	No mitigation required.	No adverse residual effects anticipated			
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Economic Development (Section 20.0)	Change in materials, goods and services contracting revenues during construction and operation	No mitigation required.	No adverse residual effects anticipated			
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Economic Development (Section 20.0)	Increase in induced output (revenue) during construction and operation	No mitigation required.	No adverse residual effects anticipated			
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Economic Development (Section 20.0)	Consistency with economic development plans during operation	No mitigation required.	No adverse residual effects anticipated			
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Marine Commercial Use (Section 21.0)	Displacement of commercial crab harvesting and reduction in harvest levels and associated revenue during construction and operation	Avoidance Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Communications Plan. Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Marine Species Salvage Plan (i.e. crab salvages). - Work with DFO to ensure necessary consultation with commercial crab harvesters concerning the proposed navigational closure expansion. Where identified and agreed upon, implement feasible mitigation.	Changes in area, harvest and revenue for seafood harvesting during construction and operation	Not Significant	Residual cumulative effect expected	Not Significant
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Local Government Finances (Section 23.0)	Change in local government property tax and PILT revenue and expenditures during construction and operation	No mitigation required.	No adverse residual effects anticipated			
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Services and Infrastructure (Section 23.0)	Constraint on healthcare services capacity and supply during construction and operation	Avoidance Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Health and Safety and Emergency Response Management Plan; Land and Marine Traffic Management Plan. - Implementation of Operation Environmental Management Plan and supporting plans: Health and Safety and Emergency Response Management Plan; Land and Marine Traffic Management Plan.	No adverse residual effects anticipated			
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Services and Infrastructure (Section 23.0)	Constraint on emergency services capacity and supply during construction and operation	Avoidance Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Health and Safety and Emergency Response Management Plan; Land and Marine Traffic Management Plan; Communications Plan. - Implementation of Operation Environmental Management Plan and supporting plans: Health and Safety and Emergency Response Management Plan; Land and Marine Traffic Management Plan. Reduction Measures: - Communication with emergency services on operational plans, activities, timelines, service requirements, and management of emergency service utilisation. - Police and security management, including site security services, site security systems, and equipment.	No adverse residual effects anticipated			
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Services and Infrastructure (Section 23.0)	Constraint on municipal infrastructure capacity and supply during construction and operation	Avoidance Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Hazardous Materials and Waste Management Plan	No adverse residual effects anticipated			

29-G Effects of Changes to the Environment Directly Linked or Necessarily Incidental to Federal Decisions

29-G Effects of Changes to the Environment Directly Linked or Necessarily Incidental to Federal Decisions							Residual Effects		Incremental Cumulative Effects	
Legislation	Responsible Authority	Federal Decision	Aspect Potentially Affected	Related VC	Potential Change or Effect	Mitigation Applied	Residual Effect (after mitigation)	Significance	Cumulative Effect	Significance
<i>Canada Marine Act</i> , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Outdoor Recreation (Section 24.0)	Displacement of recreational crab harvesting and reduction in harvest levels during construction and operation	Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Marine Species Salvage Plan (i.e. crab salvages), Communications Plan. - Work with DFO to ensure necessary consultation with recreational crab harvesters concerning the proposed navigation closure expansion. Where identified and agreed upon, implement feasible mitigation.	No adverse residual effects anticipated			
<i>Canada Marine Act</i> , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Visual Resources (Section 25.0)	Change in daytime visual resources during construction and operation	Reduction Measures: - Crane colour optimisation to reduce contrast and enhance blending with the landscape.	Change in daytime visual resources during construction and operation	Not Significant	Residual cumulative effect expected	Not Significant
<i>Canada Marine Act</i> , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Visual Resources (Section 25.0)	Change in nighttime visual resources during construction and operation	Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plan: Light Management Plan. - Implementation of Operation Environmental Management Plan and supporting plan: Light Management Plan.	Change in nighttime visual resources during construction and operation	Not Significant	No cumulative interaction expected	Not applicable
<i>Canada Marine Act</i> , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Land and Water Use (Section 26.0)	Consistency with land use planning designations during construction	Avoidance Measures: - Engagement with land and water users, including dialogue and communications through a mechanism for two-way dialogue and communications about port-related issues in Delta - Land Use Planning Approach: Engagement with local governments, Aboriginal groups and other land use authorities per objective in PMV Land Use Plan, when updating or amending Land Use Plan, or determining land use designations.	No adverse residual effects anticipated			
<i>Canada Marine Act</i> , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Land and Water Use (Section 26.0)	Disturbance to marine-related industrial uses during construction	Reduction Measures: - Engagement with land and water users, including dialogue and communications through a mechanism for two-way dialogue and communications about port-related issues in Delta, and use of Community Feedback Line. - Implementation of Construction Environmental Management Plan and supporting plans: Communications Plan; Land and Marine Traffic Management Plan.	No adverse residual effects anticipated			
<i>Canada Marine Act</i> , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Land and Water Use (Section 26.0)	Disturbance to protected area (Roberts Bank WMA) during construction	Reduction Measures: - Engagement with land and water users, including dialogue and communications through a mechanism for two-way dialogue and communications about port-related issues in Delta, and use of Community Feedback Line. - Implementation of Construction Environmental Management Plan and supporting plans: Communications Plan; Land and Marine Traffic Management Plan.	No adverse residual effects anticipated			
<i>Canada Marine Act</i> , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Land and Water Use (Section 26.0)	Changes in access to TFN community lease lands during construction	Reduction Measures: - Engagement with land and water users, including dialogue and communications about port-related issues in Delta, and use of Community Feedback Line. - Implementation of Construction Environmental Management Plan and supporting plans: Communications Plan; Land and Marine Traffic Management Plan.	Disturbance to community lease lands during construction	Not Significant	No cumulative interaction expected	Not applicable
<i>Canada Marine Act</i> , Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Human Health (Section 27.0)	Adverse health effects related to air emissions during construction	Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Air Quality and Dust Control Plan, Construction Compliance Monitoring Plan.	Adverse health effects related to air emissions during construction	Not Significant	No cumulative interaction expected	Not applicable

29-G Effects of Changes to the Environment Directly Linked or Necessarily Incidental to Federal Decisions

29-G Effects of Changes to the Environment Directly Linked or Necessarily Incidental to Federal Decisions							Residual Effects		Incremental Cumulative Effects	
Legislation	Responsible Authority	Federal Decision	Aspect Potentially Affected	Related VC	Potential Change or Effect	Mitigation Applied	Residual Effect (after mitigation)	Significance	Cumulative Effect	Significance
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Human Health (Section 27.0)	Adverse health effects related to noise during construction and operation	Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Noise Management Plan, Construction Compliance Monitoring Plan, Communications Plan . - Implementation of the Operation Environmental Management Plan and supporting plans: Noise Management Plan, Operation Compliance Monitoring Plan	Adverse health effects related to noise during construction and operations	Not Significant	Negligible cumulative effect	Not applicable
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Human Health (Section 27.0)	Adverse health effects due to stress and annoyance during construction and operation	Reduction Measures: - Implementation of Construction Environmental Management Plan and supporting plans: Light Management Plan, Noise Management Plan, Construction Compliance Monitoring Plan, Construction Communications plan. - Implementation of the Operation Environmental Management Plan and supporting plans: Operation Compliance Monitoring Plan, Operation Noise Management Plan, Operation Communications Plan. - Mitigation measures noted above regarding visual resources. - Awareness and education measures regarding results of contaminant sampling of edible shellfish.	No adverse residual effects anticipated			
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Health and socio-economic conditions	Human Health (Section 27.0)	Adverse health outcomes due to changes in health inequity during construction and operation	Reduction Measures: - Accommodation measures related to Aboriginal employment, training, and contracting opportunities.	No adverse residual effects anticipated			
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Physical and cultural heritage; - and - Any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.	Archaeological and Heritage Resources (Section 28.0)	Crushing or biological degradation of potential fish trap stakes during construction	Reduction Measures: - Excavate a test trench, or series of trenches, across the area of archaeological potential to locate potential fish trap stakes, if present.	Crushing or biological degradation of potential fish trap stakes during construction phase.	Not Significant	No cumulative interaction expected	Not applicable
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Physical and cultural heritage; - and - Any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.	Archaeological and Heritage Resources (Section 28.0)	Reduced access for future archaeological study or preservation of potential fish trap stakes during construction	Reduction Measures: - Excavate a test trench across the area of archaeological potential to locate potential fish trap stakes, if present, and sample/investigate fish trap stakes if found.	Reduced access for future archaeological study or preservation of potential fish trap stakes.	Not Significant	No cumulative interaction expected	Not applicable
Canada Marine Act, Port Authorities Operations Regulations	Port Metro Vancouver	Project Permit	Physical and cultural heritage; - and - Any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.	Archaeological and Heritage Resources (Section 28.0)	Exposure of potential fish trap stakes during construction	Reduction Measures: - Annually monitor, for a period of 4 years, predicted tidal erosion and sample/investigate fish trap stakes if found.	Exposure of potential fish trap stakes during construction phase.	Not Significant	No cumulative interaction expected	Not applicable