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June 11, 2018

Jocelyne Beaudet
Panel Chair, Roberts Bank Terminal 2 Project
C/O Cindy Parker, Panel Manager, Roberts Bank Terminal 2 Project
Canadian Environmental Assessment Agency
22nd Floor, Place Bell
160 Elgin Street
Ottawa, ON K1A 0H3

Dear Mme. Beaudet,

From the Vancouver Fraser Port Authority re: Requirements for Information Pertaining to Changes to the Roberts Bank Terminal 2 Project

The Vancouver Fraser Port Authority (VFPA) is pleased to submit to the Review Panel information regarding changes to the Project description documented in your letter of July 17, 2017 (CEAR Document #995) including the following:

- Detailed revised Project description, including a revised construction schedule;
- Revised Project interaction matrix;
- Preliminary details pertaining to the management and timing of dredging activities and the discharge of sediment-laden water; and
- Revised assessment of environmental effects as required by the Project modifications.

The information, referred to as the Project Construction Update (PCU), is presented in the format outlined by the VFPA to the Review Panel in CEAR Document #1054.

Sections 1.0 and 2.0 of the PCU describe the changes to the environmental impact statement (EIS), including updates to specific construction activities, the construction schedule, and relevant Project Description figures and appendices. In PCU Section 3.0, changes or effects resulting from the construction updates on intermediate and valued components (ICs and VCs) are described. Since the changes to ICs and VCs are generally in a positive direction, the overall conclusions made in the EIS regarding proposed mitigation, residual effect characterisations, significance determinations, or cumulative effects, remain the same.

Yours sincerely,
<Original signed by>

Cliff Stewart, P.Eng., ICD.D
Vice President, Infrastructure

cc Cindy Parker, Panel Manager, Roberts Bank Terminal 2 Project
Douw Steyn, Panel Member
David Levy, Panel Member
Sean Moore, BC Environmental Assessment Office

Encl. (1)
1. *Roberts Bank Terminal 2 – Project Construction Update*

ROBERTS BANK TERMINAL 2 PROJECT

Project Construction Update

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Roberts Bank Terminal 2 Project
Vancouver Fraser Port Authority
100 The Pointe, 999 Canada Place
Vancouver, B.C. Canada V6C 3T4

June 2018

EXECUTIVE SUMMARY

The Vancouver Fraser Port Authority (VFPA) has made updates to Project construction based on optimisation of the design of the Project and feedback from Aboriginal groups, local stakeholders, and regulatory agencies. This document has been prepared in response to a request from the Review Panel in July 2017 (as outlined in CEAR Document #995[1]) to provide an update on the following information:

- Details on the updated construction activities and schedule (documented in **Section 2.0** and **Attachment C1**);
- A revised Project interaction matrix (provided in **Attachment C2**);
- Preliminary details pertaining to the management and timing of dredging activities and the discharge of sediment-laden water (outlined in **Section 2.6**); and
- A revised assessment of environmental effects for the Project construction updates (provided in **Section 3.0**).

The key changes to Project construction are as follows:

- Project construction no longer requires the intermediate transfer pit (ITP) as a temporary sand storage location to support construction activities, based on recent changes in dredging equipment options and further engineering analyses, and in consideration of the concerns of Tsawwassen First Nation (TFN) with respect to the ITP;
- With the elimination of the ITP and temporary storage of material while the containment dykes are being constructed, the construction schedule is extended by eight months to accommodate the filling of the fill sites directly with Fraser River sand and sand from existing quarries;
- The vibro-replacement process in the caisson trench, and subsequent collection and disposal activities of fallout material, is no longer associated with or required for Project construction based on recent geotechnical investigations and improved understanding of the seismic response of the material within the terminal footprint, as well as the adoption of a new seismic performance standard;
- Surface disposal of tug basin dredgeate to the Project-specific disposal site via a dumping barge is no longer being considered, as the tug basin dredgeate material is considered suitable for use as general fill based on recent sediment characterisation investigations in the tug basin area;
- Based on recent geotechnical/seismic investigations within the terminal footprint, the volume of dredged material from the dredge basin is reduced (which decreases the Project footprint). In addition, all dredge basin material is considered suitable for use as general fill, which increases the retention rate of dredge basin dredgeate in the containment basins from 85% to 97%. The overall volume of material to be discharged as supernatant from the containment basins during filling will decrease by 66%;

[1] CEAR Document #995 From the Review Panel to the Vancouver Fraser Port Authority re: Requirements for information pertaining to changes to the Roberts Bank Terminal 2 Project.

- Based on the advancement of the design of the RBT2 overpass on the widened causeway incorporating the latest bridge code, the overpass will be founded on approximately 86 piles; and
- Based on a change in activities, the intensity of equipment use at the peak of construction will be lower, and the overall combined number of dredge equipment and tug/barge movements will decrease.

The changes resulting from the updated construction activities on Project-related interactions with intermediate and valued components (ICs and VCs) are summarised in **Attachment C2** and described in **Sections 3.1** and **3.2**. A summary of the Project construction update (PCU) assessments relative to the interactions and potential effects assessed and presented in the environmental impact statement (EIS) is provided below:

Intermediate Components

- Air quality – Overall, emissions are predicted to be similar or less (**Section 3.1.1**);
- Noise and vibration – Overall, noise levels are predicted to be similar, and will increase or decrease depending on the activity (**Section 3.1.2**);
- Light – No change in light trespass or sky glow from the Project(**Section 3.1.3**);
- Coastal geomorphology – No change in coastal processes (**Section 3.1.4**);
- Surficial geology and marine sediment – Overall, reduction in sediment deposition and dispersion area; no changes in sediment contaminant concentrations (**Section 3.1.5**);
- Marine water quality – No change in coastal processes; overall, reduction in total suspended sediments (TSS) (and turbidity) levels and dispersion area (**Section 3.1.6**);
- Underwater noise – Overall, no change in underwater noise levels (**Section 3.1.7**); and
- Population – Slight increase in employment and associated temporary in-migration (**Section 3.1.8**).

Biophysical Valued Components

- Marine vegetation – Reduction in potential loss of productivity; (**Section 3.2.1**);
- Marine invertebrates – Reduction in potential loss of productivity (**Section 3.2.2**);
- Marine fish – Reduction in potential loss of productivity (**Section 3.2.3**);
- Marine mammals – Reduction in potential behavioural effects or acoustic masking (**Section 3.2.4**);
- Coastal birds – Reduction in potential productivity loss (**Section 3.2.5**); and
- Ongoing productivity of commercial, recreational, and Aboriginal fisheries – Slight decrease in potential negligible effects to fisheries (**Section 3.2.6**).

Social and Economic Valued Components

- Labour market – Increase in employment, and labour income (**Section 3.2.7**);
- Economic development – Increase in contracting revenues, and induced output (revenue) (**Section 3.2.8**);

- Local government finances – Increase in incremental taxes and fees paid to local governments (**Section 3.2.9**);
- Services and infrastructure – Increase in demand for emergency and healthcare services, and increase in duration of demand for municipal infrastructure (**Section 3.2.10**);
- Marine commercial use – Reduction in access-related interactions (**Section 3.2.11**);
- Outdoor recreation – Reduction in access-related interactions (**Section 3.2.12**);
- Visual resources – No change to daytime or nighttime visual character or viewing conditions (**Section 3.2.13**);
- Land and water use – Reduction in disturbance to marine-related industrial lands, and reduction in changes in access to community lease lands (**Section 3.2.14**); and
- Human health – Reduction in exposure to air emissions and noise, and potential for shellfish contamination (**Section 3.2.15**).

Current Use

- Reduction in changes to availability of preferred current use of lands and resources for traditional purposes (Current Use) resources (crab), and reduction in changes in quality of preferred Current Use experience (**Section 3.2.16**).

Overall, these changes to the environmental assessment resulting from construction updates can generally be summarised as follows:

- Reductions in potential adverse changes or effects on ICs, biophysical VCs, social VCs, and Current Use; and
- Increases in positive interactions with socio-economic VCs.

These beneficial changes to ICs and VCs occur at the level of interactions or potential effects, and in most cases are slight changes, and thus do not affect the overall conclusions made in the EIS (as summarised in **Attachments C3** and **C4**, respectively), including proposed mitigation, residual effect characterisations, significance determinations or cumulative effects, as applicable, with one exception. The only component predicted to have a change to residual effects is land and water use, with a reduction of a residual effect on access to TFN community lease lands from a measurable non-significant residual effect to a negligible residual effect, due to elimination of the ITP and associated activities (**Section 3.2.14**).

Table of Contents

List of Tables

List of In-text Figures

List of Attachments

- Attachment D2 RBT2 Project Construction Update Atmospheric Noise and Ground-borne Vibration Levels During Construction
- Attachment D3 RBT2 Technical Memorandum: Underwater Noise Assessment of Trailing Hopper Suction Dredges during Sand Pumping Operations

1.0 INTRODUCTION

This document has been prepared in response to a request from the Review Panel in July 2017 (as outlined in CEAR Document #995[2]) to provide updates to the construction activities with respect to changes to the Roberts Bank Terminal 2 (RBT2 or Project) Project Description described in Section 4.0 and supporting appendices of the RBT2 Environmental Impact Statement (EIS). These updates were previously identified in the *Preamble in Support of Responses to IR3-25 to IR3-40 – General and Disposal at Sea-related Project Construction Update* of CEAR Document #984[3] and in the responses to specific information requests. The Review Panel has requested the following information:

- Detailed revised Project description, including a revised construction schedule;
- Revised Project interaction matrix;
- Preliminary details pertaining to the management and timing of dredging activities and the discharge of sediment-laden water; and
- Revised assessment of environmental effects as required by the Project modifications.

The updated Project construction information provided herein describes the changes to activities relevant to the following:

1) The removal of the intermediate transfer pit (ITP) and the incorporation of Fraser River sand directly into the fill areas;
2) The improved understanding of the seismic response and characteristics of the material within the terminal footprint and the adoption of seismic performance standards from the American Society of Civil Engineers; and
3) The disposal of tug basin dredgeate into the fill areas.

Direct comparisons between this updated information and the description of these activities in EIS Section 4.0 have been made to provide clarity.

1.1 DOCUMENT STRUCTURE AND CONTENT

The structure of this document is in accordance with the VFPA's plan for presentation of the revised information that was submitted to the Review Panel in August 2017 (see CEAR Document #1054[4]). The structure of this document and a brief description of the section content are as follows:

- **Sections 2.1** to **2.5** detail the changes to Project construction activities with respect to the following Project components or features: ITP, wharf structure and berth pocket, terminal and causeway land construction, tug basin, and dyke, building, and overpass structure foundations;

[2] CEAR Document #995 From the Review Panel to the Vancouver Fraser Port Authority re: Requirements for information pertaining to changes to the Roberts Bank Terminal 2 Project.
[3] CEAR Document #984 From the Vancouver Fraser Port Authority to the Review Panel re: Responses to Information Request Package 3 (See Reference Document # 928).
[4] CEAR Document #1054 From the Vancouver Fraser Port Authority to the Review Panel re: Schedule for providing information regarding the revised Roberts Bank Terminal 2 Project description.

- **Section 2.6** presents preliminary details pertaining to the management and timing of dredging activities and discharge of sediment-laden water;
- **Section 2.7** provides the updated construction schedule;
- **Section 2.8** provides the updated construction equipment peak analysis;
- **Section 2.9** describes the change in dredge equipment movements and tug/barge movements as a result of the changes described in **Sections 2.1** to **2.5** and **2.7**;
- **Section 2.10** lists EIS sections, tables, figures, and appendices that have been updated in accordance with changes outlined in **Sections 2.1** to **2.6**;
- **Section 3.0** presents effects assessment results considering the updated Project activity interactions for intermediate and valued components and current use of lands and resources for traditional purposes. Information is provided in tabular format along with supporting rationale to support conclusions; and
- **Section 4.0** summarises information presented and highlights key conclusions of the effects assessments.

Table 1-1 summarises the EIS Project Description tables, figures, and appendices that have been updated and included in this document. Note that for all tables where there are changes to EIS content, blue text indicates new or updated information from EIS content or terminology (in black text), and text that is stricken is no longer applicable.

Table 1-1 Updated Information provided in this Project Construction Update Document

EIS Content Reference and Title	Updated Project Construction Document Reference and Title	Location in Document
Table 4-1 Project Component and Subcomponent Areas	Table 2-1 Project Component and Subcomponent Areas (Updated EIS Table 4-1)	Section 2.0
Table 4-3 Project Fill Volumes	Table 2-2 Project Fill Volumes (Updated EIS Table 4-3)	
Table 4-4 Sources and Quantities of Sand and Miscellaneous Fill	Table 2-3 Sources and Quantities of Sand and Miscellaneous Fill (Updated EIS Table 4-4)	
Table 4-5 Source and Quantities of Material Requiring Disposal at Sea	Table 2-4 Source and Quantities of Material Requiring Supernatant Discharge (Updated EIS Table 4-5)	
Figure 4-2 Project Universal Transverse Mercator (UTM) Coordinates	Updated Figure 4-2 Project Universal Transverse Mercator (UTM) Coordinates	Attachment A
Figure 4-5 Cross-section of Caisson Wharf Structure	Updated Figure 4-5 Cross-section of Caisson Wharf Structure	
Figure 4-7 RBT2 Overpass and Road Connection	Updated Figure 4-7 RBT2 Overpass and Road Connection	
Figure 4-9 Anticipated Project Construction Schedule including Key Construction Activities	Updated Figure 4-9 Anticipated Project Construction Schedule including Key Construction Activities	

EIS Content Reference and Title	Updated Project Construction Document Reference and Title	Location in Document
Figure 4-10 Project Construction Progress Months 1 to 6	Updated Figure 4-10 Project Construction Progress Months 1 to 6	
Figure 4-11 Project Construction Progress Months 7 to 12	Updated Figure 4-11 Project Construction Progress Months 7 to 12	
Figure 4-12 Project Construction Progress Months 13 to 18	Updated Figure 4-12 Project Construction Progress Months 13 to 18	
Figure 4-13 Project Construction Progress Months 19 to 24	Updated Figure 4-13 Project Construction Progress Months 19 to 24	
Figure 4-14 Project Construction Progress Months 25 to 30	Updated Figure 4-14 Project Construction Progress Months 25 to 30	
Figure 4-15 Project Construction Progress Months 31 to 36	Updated Figure 4-15 Project Construction Progress Months 31 to 36	
Figure 4-16 Project Construction Progress Months 37 to 42	Updated Figure 4-16 Project Construction Progress Months 37 to 42	
Figure 4-17 Project Construction Progress Months 43 to 48	Updated Figure 4-17 Project Construction Progress Months 43 to 48	
Figure 4-18 Project Construction Progress Months 49 to 54	Updated Figure 4-18 Project Construction Progress Months 49 to 54	
Figure 4-19 Project Construction Progress Months 55 to 60	Figure 4-19 Project Construction Progress Months 55 to 63	
Figure 4-20 Project Construction Progress Months 61 to 66	Figure 4-20 Project Construction Progress Months 64 to 73	
Figure 4-21 Intermediate Transfer Pit and Disposal at Sea Candidate Locations	This figure content is no longer applicable	N/A
Figure 4-22 Intermediate Transfer Pit Sand Storage Volumes	This figure content is no longer applicable	N/A
Figure 4-23 Representative Cross-Section of a Containment Dyke at the Marine Terminal	Updated Figure 4-23 Representative Cross-Section of a Containment Dyke at the Marine Terminal	Attachment A
Figure 4-24 Plan View of Dredge Basin and Marine Terminal Areas	Updated Figure 4-24 Plan View of Dredge Basin and Marine Terminal Areas	
N/A - New figure added	New Figure 4-32 Terminal 2 Overpass – West Structure Conceptual Layout	
N/A - New figure added	New Figure 4-33 Terminal 2 Overpass – East Structure Conceptual Layout	
N/A - New figure added	New Figure 4-34 Terminal Buildings, Conceptual Cross Section	

EIS Content Reference and Title	Updated Project Construction Document Reference and Title	Location in Document
Appendix 4-A Basis of Design	Updated Appendix 4-A Detailed Tabulated Summary of Changes to Basis of Design	Attachment B
Appendix 4-E Preliminary Construction Schedule and Basis of Schedule Report	Updated Appendix 4-E Preliminary Construction Schedule and Detailed Tabulated Summary of Changes to Basis of Schedule	
Appendix 4-F Construction Equipment Peak Analysis	Updated Appendix 4-F Construction Equipment Peak Analysis	
Appendix 8-B Project Interaction Matrix. Table A. Construction Phase	Table C-1 Overview of Updated Construction Activity Descriptions	Attachment C
Appendix 8-B Project Interaction Matrix. Table A. Construction Phase	Table C-2 Updated Project Interaction Matrix (Updated EIS Appendix 8-B)	
N/A – New table (based on updates to tables in Appendix 29 and in Section 35).	Table C-3 Summary of Changes to the Effects Assessment for Intermediate Components related to Updated Project Description	
N/A – New table (based on updates to tables in Appendix 29 and Section 35).	Table C-4 Summary of Changes to the Effects Assessment for Valued Components related to Updated Project Description	

New analysis conducted to support the effects assessments provided in **Section 3.0** are included in **Attachment D**.

2.0 REVISED PROJECT DESCRIPTION AND SCHEDULE

In review of the Project Construction Update (PCU), please note that all measurements, areas, lengths, volumes, timelines, etc. are estimates only for planning and environmental assessment purposes based on current preliminary data and Project preliminary design. The final numbers may be different based on the detailed design, site investigations, and regulatory requirements. It should be noted that the VFPA makes reference to specific pieces of equipment, such as Fraser River Pile and Dredge's (FRPD's) *FRPD309*, *Columbia*, and *Fraser Titan*, for the purposes of environmental assessment only. For the procurement and actual construction of the Project, the VFPA intends to allow contractors to propose and use alternative pieces of equipment provided these pieces of equipment meet the Project's objectives, constraints, and requirements, which could include foreign dredges.

The following section provides updates to the Project Description and Project preliminary design, as described in EIS Section 4.0, for the ITP; wharf structure and berth pocket design; terminal and causeway land construction; tug basin; dyke, building, and overpass foundations; management and timing of dredging activities; and the discharge of sediment-laden water, as well as construction schedule and construction equipment.

2.1 INTERMEDIATE TRANSFER PIT

2.1.1 Background Information

During Aboriginal consultation undertaken prior to and following the submission of the EIS, Aboriginal groups raised concerns in relation to Project construction activities, and in particular the use of the ITP. Concerns with respect to the ITP included the potential to affect crab populations and crab health, effects on the exercise of Aboriginal/treaty harvesting rights (i.e., crabbing), and effects to access within the Project area.

Tsawwassen First Nation (TFN) noted the Project area is a productive area for TFN fishers and is actively harvested. TFN also stated that they were of the view that there would be a detectable effect to TFN's crab harvesting for traditional purposes in or near the Project area as a result of potential Project-related changes in access during the construction phase of the Project, in particular with respect to the use of the ITP by the VFPA. TFN noted effects would be felt by TFN in ways distinct from others. The VFPA considered these concerns and has determined the ITP to no longer be essential as a temporary storage location to support construction of the Project for the reasons explained below.

As background, the purpose of the ITP was to provide storage for Fraser River sand during the first year of construction while the perimeter dykes of the terminal and west end of the causeway were being built and as a site for receiving sand from the bottom dump hopper dredge throughout land development activities. During the development of the Project Description as described in the EIS, it was assumed that only locally available Canadian-registered dredging equipment would be available for the Project (EIS Sections 4.3.1 and 4.4.1.8). This assumption was based on restrictions outlined in the *Coasting Trade Act*, which limited the use of foreign ships in Canadian waters at that time.

At the time of construction schedule planning, Fraser River maintenance was carried out by local contractor Fraser River Pile & Dredge Inc. (FRPD) with a trailing suction hopper dredge (TSHD) called the *Fraser Titan*, which was the only locally available hopper dredge and was a bottom dump unit (as explained in the response to IR1-11 of CEAR Document #897[5]). This meant that it could only discharge its load by 'dumping' it into the ITP. As a result, the ITP was incorporated as a temporary Project feature for receiving and storing Fraser River sand obtained from the annual Fraser River maintenance dredging program (with subsequent reclamation of material for use as fill material).

Since completion of the preliminary construction schedule (as shown in EIS Figure 4-9 and described in detail in EIS Appendix 4-E), FRPD acquired a newer TSHD with pump-ashore capability, the *FRPD309*, as outlined in EIS Section 4.4.1.8 and IR1-11 of CEAR Document #897. Since it was acquired, the *FRPD309* has been performing the annual maintenance dredging of the Fraser River and pumping ashore, as required. With its proven capability, the VFPA has revised the Project construction sequence to incorporate the discharge of Fraser River sand directly into fill areas[6], eliminating the need for storage in the ITP. It should be noted that other dredge equipment with equivalent proven capability as the *FRPD309* could also perform this work at RBT2.

In addition, the constraints associated with the *Coasting Trade Act* regarding use of foreign dredging equipment in Canadian waters for marine activities of a commercial nature have been relaxed with the approval of the Canadian-European Union Comprehensive Economic and Trade Agreement (CETA) in early 2017. The CETA enables European dredging equipment to work on the Project, thereby providing alternatives to the *FRPD309* (refer to the response in IR1-09 of CEAR Document #897 for more information).

Through recent changes in dredging equipment options and further engineering analyses, and in consideration of the concerns of TFN with respect to the ITP, Project construction no longer requires the ITP as a temporary sand storage location to support construction activities. Removal of the need for the ITP demonstrates further actions taken by the VFPA to avoid potential effects of the Project on the environment. Changes to construction activities and schedule as a result of removal of the need of the ITP are described below.

2.1.2 Update to Construction Activities and Schedule

To eliminate the need for the ITP, the *FRPD309* will transport Fraser River sand to the Project site and pump the material directly into the fill sites[6].

The pump-out time of the *FRPD309* adds up to two hours to the dredger cycle as compared to the bottom dump of the *Fraser Titan* as described in EIS Section 4.0; however, these longer cycle times are offset by the *FRPD309*'s larger hopper. As a result, the amount of Fraser River sand that can be delivered to the site within a single year has not changed from the description in the EIS and remains at 2.0 million (M) m^3/year (or 10,500 m^3/day). However, without the

[5] CEAR Document #897 From the Vancouver Fraser Port Authority to the Review Panel re: Responses to Information Request Package 1 (See Reference Document #559).
[6] Fill sites or fill areas are generally defined as the Project terminal and causeway footprints.

ITP, Fraser River maintenance sand cannot be accessed during the first construction year because it cannot be stockpiled in the ITP for recovery once the containment dykes are complete.

Since Fraser River sand delivery is on the critical path of the Project construction schedule, as described in Updated Appendix 4-E in **Attachment B2**, the loss of the first year of Fraser River sand supply will delay the construction schedule. It is the intention of the Project team to partially mitigate the impact to the construction schedule by increasing the amount of fill material sourced from existing quarries by 2.5 M m^3, from 1.1 M m^3 to 3.6 M m^3 (see **Section 2.3**). By bringing in more fill material from existing quarries, the Project construction schedule will be extended by only eight months. During a Request for Information issued by the VFPA to the market in 2017, existing quarries have indicated that they have sufficient capacity to meet Project needs and, as a result, the commissioning of a new quarry would not be required to support Project construction.

Based on the construction activity and schedule changes described above, resulting from the elimination of the ITP, the following specific changes will occur:

- The task of storing Fraser River sand underwater at the ITP is eliminated, reducing dredger movements as described in **Section 2.6**;
- The task of recovering the Fraser River sand by dredges from the ITP and the associated pipelines are eliminated;
- The number of tug/barge movements from existing quarries will increase (see **Section 2.6**);
- To accommodate additional tug/barge movements, a third temporary barge ramp will be required. This third temporary ramp will be built immediately adjacent to the west basin, and will require the installation of up to eight temporary piles;
- The *FRPD309* will tie-up to an anchored buoy next to the terminal fill site for 2 hours, three to four times per 24-hour period, on average, while it pumps the Fraser River sand from its hopper into the fill sites; and
- Overall construction schedule is extended by eight months.

In **Attachment A**, Updated Figure 4-9 shows the timing of key construction activities based on the updates described herein, while Updated Figures 4-10 to 4-18 illustrate the progress of construction activities in 6-month durations, and Updated Figures 4-19 and 4-20 show progress in 9-month durations.

Changes in dredge equipment movements and operating duration and tug/barge movements, as a result of eliminating the ITP, are further explained in **Section 2.9**.

2.2 WHARF STRUCTURE AND BERTH POCKET

2.2.1 Background Information

The preliminary wharf structure design described in EIS Section 4.2.1.2 was informed by geotechnical analyses of inferred ground conditions at the Project site and a conservative assessment of seismic requirements. Based on these, at the time of preliminary design, both

vibro-densification and vibro-replacement processes[7] were incorporated as soil improvement techniques within the construction sequence (see EIS Section 4.4.1.9 for more information). The VFPA proposed to collect silty fallout material resulting from the vibro-replacement process within the dredge basin with a cutter-suction dredge, pump it into the terminal containment basins, and subsequently discharge supernatant containing unsettled fines to disposal at sea (DAS) locations situated at the -45 m chart datum (CD) level seaward from the terminal.

Further geotechnical analysis using data obtained from the 2016 Supplemental Geotechnical Investigation Program determined that native soil beneath the terminal footprint has a more favourable seismic response than was initially inferred. In addition, seismic performance requirements from the American Society of Civil Engineers (Standards ASCE/COPRI 61-14, Seismic Design of Piers and Wharves) were adopted in 2016 for all non-public marine structures within the Port of Vancouver. This ASCE/COPRI 61-14 standard had previously been adopted for wharves not accessible to the general public by many U.S. west coast ports (e.g., U.S. Navy, Port of Los Angeles, and Port of Long Beach).

With the improved understanding of the seismic response of the material within the terminal footprint, along with the adoption of the ASCE/COPRI 61-14 standard, vibro-replacement activities are no longer required to improve the seismic response of the soil below the base of the dredge basin. Therefore, the creation of the silty fallout and its associated disposal requirement are no longer part of Project construction.

With the adoption of the ASCE/COPRI 61-14 standard and the associated dredge basin changes, the evaluation of current ship draughts was also re-evaluated to accommodate future vessels. The future vessel draught has been reduced to 17.5 m, from 19 m (as stated in EIS Section 4.2.1.1). This results in a reduced berth depth that is considered appropriate for the *New Generation IIA*, 24,000 twenty-foot equivalent (TEU) vessel[8]. The *New Generation IIA* has an anticipated overall length of 450 m, a beam of 59 m, and a design draught of approximately 15.8 metres (see Table 3.1 in Appendix IR1-03-A of CEAR Document #897). Vessels with a deeper draught are not anticipated to call on RBT2 (Appendix IR1-03-A of CEAR Document #897). As a result, the dredge basin finished elevation is revised to El.-18.3 m CD as shown in **Attachment A**, Updated Figure 4-5, compared to El.-21.6 m CD (EIS Section 4.2.1.1 and Figure 4-5). The dredge basin final elevation allows for under keel clearance of 2.5 m, which is well within the PIANC Report No. 121 requirements (PIANC 2014). A shallower berth depth also translates to a reduced caisson height (top of the cope wall to the base of the caisson) of 27 m (compared to 30.3 metres as shown in EIS Figure 4-5). Maintaining the thickness of the foundation mattress rock, the base of the dredged caisson trench is revised to El.-26.7 m CD (compared to El.-30.0 m CD in EIS Figure 4-5). The caisson

[7] The vibro-replacement process is a technique for subsoil improvement that utilises special depth vibrators and coarse material to replace finer material (e.g., clay and sand) with the coarser material. In contrast, vibro-densification also uses a depth vibrator, but it densifies in situ material and is not considered a material replacement technique. As a point of clarification, silty fallout is associated with the vibro-replacement technique, not the vibro-densification technique

[8] This vessel class is not anticipated at RBT2 in the near future, but this class is considered for the purposes of berth depth considerations to potentially accommodate such vessels without wharf modifications in the future.

trench dredge prism slopes have also been flattened (i.e., less steep) from the original Project preliminary design (1.5H:1V shown in EIS Figure 4-5) to 2.25H:1V on the seaward side and 2.5H:1V on the shoreward side, as shown in **Attachment A**, Updated Figure 4-5. These slope changes were made to improve the constructability and stability of the dredge prism slopes, thereby eliminating the need for buttress mattress rock on the shoreward side.

2.2.2 Update to Construction Activities and Schedule

The changes described above result in the following modifications to construction activities and schedule:

- The requirement for vibro-replacement of native soil underneath the caissons is eliminated, along with associated silty fallout; and
- The volume of material being dredged from the dredge basin is reduced from 4.20 M m^3 (as outlined in EIS Section 4.4.1.8) to 3.67 M m^3 (**Table 2-3**), a total reduction of 0.53 M m^3, resulting in the following:
  - A reduction of 3.5 hectares (ha) in the berth pocket and marine approach area (as outlined in **Table 2-1**), shown by the difference from 17.4 ha to 13.9 ha in Updated Figure 4-24 (**Attachment A**);
  - A revised Project area boundary (see Updated Figure 4-24 (**Attachment A**)), as shown by the revised UTM coordinates (highlighted in green) in **Attachment A**, Updated Figure 4-2; and
  - A reduction in dredge basin dredging by approximately one month.

Table 2-1 Project Component and Sub-component Areas (Updated EIS Table 4-1)

Project Component	Sub-component Area (ha)	Component Area (ha)	Reason for Change Compared to EIS Section 4.0 Content / Comments
Marine Terminal		~~**133.5**~~ **130.0**	
• Terminal including slope, toe of slope, and three-berth wharf	116.1		No change
• Berth pocket and marine approach areas	~~17.4~~ 13.9		Decrease in area as a result of shallower berth depth (from El.-21.6m to El.-18.3m), which reduces the dredge footprint, see Attachment A, Updated Figure 4-24.
Widened Causeway		**49.4**	
• Causeway including slope and toe of slope	42.4		No change
• Overpass and road tie-ins on existing causeway	6.0		No change

Project Component	Sub-component Area (ha)	Component Area (ha)	Reason for Change Compared to EIS Section 4.0 Content / Comments
• Rail tie-ins and emergency access road tie-in on mainland	1.0		No change
Expanded Tug Basin		**3.1**	
Total Project Area		~~**186.0**~~ **182.5**	

Note: Original EIS areas appear in black text; those areas that have been updated are shown as a strikethrough and new areas are provided in blue text.

2.3 TERMINAL AND CAUSEWAY LAND CONSTRUCTION

2.3.1 Background Information

Material from the dredge basin was assumed to be used to fill the initial 2 m to 3 m of the area within the terminal containment dykes (EIS Section 4.4.1.8). This was done as it was conservatively assumed the dredge basin material was of low quality, and a 6-m layer of high-quality sand as the top layer for soil densification purposes was required to maintain the seismic design criteria. Approximately 85% of dredged material was assumed to be retained to meet this criterion, and 15% was assumed to be discharged. Field samples obtained during the 2016 Supplemental Geotechnical Investigation Program showed the dredge basin material to be of better quality (i.e., lower fines content than what was originally assumed). As such, it has been confirmed the dredged material from the dredge basin can be combined with Fraser River sand and/or existing quarry sand to create suitable fill material for land development at any height within the terminal and causeway fill sites, thus eliminating the original fill constraints.

The use of combined material does not change the construction schedule or sequence but does enable a greater level of flexibility in the timing of the dredging activities relative to the import of Fraser River and existing quarry sand. Further, based on settling column testing of material collected during the 2016 Supplemental Geotechnical Investigation Program, the amount of retained material is now expected to be 97%. Note that both the 85% fill material retention and 97% fill material retention scenarios have been evaluated in EIS Appendix 9.6-C and the VFPA's response to IR3-30 (CEAR Document #984).

The updated Project fill volumes for the marine terminal area and widened causeway are provided in **Table 2-2**.

Table 2-2 Project Fill Volumes (Updated EIS Table 4-3)

Description	Volume (million m^3)	Source	Reason for Change Compared to EIS Section 4.0 Content / Comments
Marine Terminal Area			
Containment dyke rock, gravel, and rip-rap	1.4	Existing quarries	*No change*
Sand and miscellaneous fill	~~11.7~~ 12.3	(see **Table 2-3** for sources)	Additional 0.4 M m^3 for sand fill, which replaces buttress mattress rock and 0.2 M m^3 to account for loss of fines from the Fraser River and Existing Quarry Sand.
Caisson rock ballast	~~0.4~~ 0.3	Existing quarries	Volume is reduced as a result of shallower berth depth (from El.-21.6 m to El.-18.3 m), which reduces the caisson depth by 3.3 m and required internal rock ballast.
~~Buttress **mattress rock**~~	~~0.3~~ 0.0	~~Existing quarries~~	Volume is eliminated as slope support (purpose of the buttress rock) is no longer required with the revised flatter dredge prism slopes.
Caisson mattress rock and levelling course	1.0	Existing quarries	*No change*
Scour protection rock	0.2	Existing quarries	*No change*
Caisson rock berm and filter rock	~~0.7~~ 0.6	Existing quarries	Volume is reduced as a result of shallower berth depth (from El.-21.6 m to El.-18.3 m), which reduces the caisson depth by 3.3 m and associated rock berm and filter rock.
~~Soil densification sacrificial rock~~	~~0.2~~ 0.0	~~Existing quarries~~	Based on the 2016 Supplemental Geotechnical Investigation findings, sacrificial rock used during vibro-replacement under the caisson trench is no longer needed.
Subtotal	***~~15.9~~ 15.8***		

Description	Volume (million m^3)	Source	Reason for Change Compared to EIS Section 4.0 Content / Comments
Widened Causeway			
Containment dyke rock, gravel, and rip-rap (not including salvaged material from existing causeway)	0.4	Existing quarries	*No change*
Sand fill	0.7	(see **Table 2-3** for sources)	*No change*
Subtotal	***1.1***		
Project Total	~~**17.0**~~ **16.9**		

Note: Original EIS volumes appear in black text; those volumes that have been updated are shown as a strikethrough and new volumes are provided in blue text.

Table 2-3 **Sources and Quantities of Sand and Miscellaneous Fill** (Updated EIS Table 4-4)

Fill Source	Volume (million m^3)	Reason for Change Compared to EIS Section 4.0 Content / Comments
Consolidated volume of useable dredged material from terminal dredge basin (berth pocket, marine approach areas, and caisson trench)	3.2	The shallower berth depth yields a reduced dredged volume of 3.67 M m^3. The consolidated volume of useable dredged material is calculated by multiplying the raw dredged volume with its retention and consolidation percentage. Based on the samples collected from the 2016 Supplemental Geotechnical Investigation and results from the 2017 Sediment Velocity Testing, the retention is 97%. For the consolidation percentage, 90% is used per EIS. Final revised volume is 3.67 M m^3 x 97% x 90% = 3.2 M m^3 (net final volume same as EIS).
Consolidated volume of useable dredged material from Tug Basin Expansion	0.1	Total dredged tug basin material is 0.16 M m^3 x 97% x 90% = 0.14 M m^3.
Fraser River sand from annual maintenance dredging	~~8.1~~ 6.1	Reduced Fraser River sand delivery from 4 years to 3 years. Year 1 delivery is no longer possible with elimination of ITP. Volume accounts for 2% fines loss. More supplementary material from existing quarries will be used to make up for this reduction.

Fill Source	Volume (million m^3)	Reason for Change Compared to EIS Section 4.0 Content / Comments
Existing quarry sand	~~1.1~~ 3.6	Additional 0.4 M m^3 to account for densified sand fill in replacement of buttress mattress rock. Total additional volume is 2 M m^3 to mitigate schedule delays from elimination of ITP [1.1 + 0.4 + 2.0 = 3.5 M m^3 x 1.02 (fines loss) = 3.6M m^3].
Total Sand Supply	**~~12.4~~ 13.0[a]**	

Notes: a. 12.3 M m^3 and 0.7 M m^3 of sand is required for the terminal fill and causeway fill, respectively, as shown in **Table 2-2**.
Original EIS volumes appear in black text; those volumes that have been updated are shown as a strikethrough and new volumes are provided in blue text.

2.3.2 Update to Construction Activities and Schedule

The changes described above mean the following:

- The combined use of dredged material and Fraser River sand enables more flexibility in the timing of the dredging activities relative to the import of Fraser River and existing quarry sand;
- The higher percentage of retained fill material as discussed above, elimination of the ITP (refer to **Section 2.1**), and updates to wharf structure and berth pocket design (refer to **Section 2.2**) have all resulted in changes to the EIS fill volumes as described in **Table 2-2** and **Table 2-3** above; and
- Updates to the construction schedule as described in **Section 2.7**.

2.4 TUG BASIN

2.4.1 Background Information

The original construction program for the management of material dredged from the tug basin (outlined in EIS Section 4.4.1.18) included options to use dredgeate material as general fill or disposal via direct barge dumping to a Project DAS site. Disposal is no longer being considered, as outlined below.

Based on further evaluation of the physical and chemical characteristics of sediment within the tug basin footprint during the 2016 Supplemental Geotechnical Investigation Program, tug basin dredgeate material is considered suitable for use as general fill and will be pumped as a slurry into Project fill sites.

The tug basin will likely be dredged with the use of clamshells and placed on a material scow. Once the material scow is full, both the scow and the crane barge will be towed to the terminal area, where the dredged material will be pumped onshore via a portable pump hung from the end of crane barge and used as general fill.

2.4.2 Update to Construction Activities and Schedule

The changes described above mean the following:

- The tug basin is assumed to be dredged in Year 2 instead of Year 4 (EIS Appendix 4-E[9]). Since this is not a critical path item, there is no net change to the overall Project schedule; and
- No disposal via direct barge dumping to a Project DAS site.

2.5 DYKES, BUILDING, AND OVERPASS STRUCTURE FOUNDATIONS

2.5.1 Background Information

Following the 2016 Supplemental Geotechnical Investigation Program, it was determined the native soil at the Project site has a more favourable seismic response than was originally inferred in the Project preliminary design. As a result, there have been adjustments to the various dyke, building, and overpass foundation preliminary designs.

The original preliminary design for the terminal and causeway dykes (outlined in EIS Sections 4.4.1.7, 4.4.1.12, and 4.4.4.16) included extensive native soil improvement underneath the dykes using vibro-replacement, with the exception of the shallow east causeway dyke, which required no ground improvement. With the improved understanding of the seismic response of the native material, the extent of vibro-replacement has been reduced underneath the dykes by approximately 40% to 45%. **Attachment A**, Updated Figure 4-23 provides a representative terminal containment dyke cross-section showing the ground improvement requirements.

Similarly, the depth of the vibro-replacement underneath the buildings (to be located at the east end of the terminal) has been reduced by approximately 8 m, meaning that this process can now be completed from the newly formed land in the dry. Fines will be captured on the surface and directed into remaining fill sites. (Refer to **Attachment A**, New Figure 4-34 for terminal building conceptual cross section.)

For the overpass, the conceptual design was further advanced incorporating the latest version of the bridge code, CAN/CSA-S6-14, as shown in **Attachment A**, New Figure 4-32 and **Attachment A**, New Figure 4-33. **Attachment A**, Updated Figure 4-7 shows the updated overpass and road connection. Land-based vibro-replacement densification of native and reclaimed soils will be carried out around the piled area and beyond the footprints of the overpass structures. The overpass will be founded on approximately 86 steel pipe piles driven from land to El.-20 m CD. Pile installation may require both a vibrator and a hammer (vibratory for the initial depths and hammer for the final set and blow count testing). Depending on the construction methodology applied, the overall pile installation duration will vary and may take up to 60 days, during daylight hours.

[9] EIS Appendix 4-E showed tug basin expansion occurring in Year 4; however, since the expansion activities are independent of other Project construction activities aside from possible re-use of the dredged material for Project infilling, EIS Section 4.1.1.18 stated that tug basin expansion can occur during any year of the construction schedule.

2.5.2 Update to Construction Activities and Schedule

The changes described above mean the following:

- There will no longer be any vibro-densification in the marine environment for the terminal buildings, as the vibro-densification under the buildings originally scheduled for Year 1 will now happen as land-based vibro-replacement in Year 4;
- There will be approximately 86 piles added to the anticipated Project scope; and
- Since these activities are not critical path activities, there are no changes to the overall Construction schedule.

2.6 PRELIMINARY DETAILS PERTAINING TO THE MANAGEMENT AND TIMING OF DREDGING ACTIVITIES AND THE DISCHARGE OF SEDIMENT-LADEN WATER

To create the Project landmass, fill materials sourced from the Fraser River, existing quarries, the dredge basin, and the tug basin, will either be pumped as a slurry with sea water or transported from the barge ramps and deposited as dry material into containment basins within the Project footprint. The bulk of the fill material (97%, see **Section 2.3**) from the slurry will settle out; however, a supernatant of seawater containing 3% of unsettled fines will be discharged via a pipe to an area anticipated to be located seaward from the terminal at El.-45 m CD. Based on information provided by Environment and Climate Change Canada (ECCC; CEAR Document #564[10]), discharge of supernatant containing unsettled fines from the containment dykes during filling is not expected to be subject to DAS permitting[11]. Therefore, the VFPA no longer anticipates that discharge of supernatant will require a DAS permit, and the location of supernatant discharge (formerly referred to as the candidate DAS area as shown in EIS Figure 4-21), will now be referred to as the discharge area.

The level of total suspended solids in the supernatant discharge that will be pumped out via the pipelines is a function of the fines content of the fill material and the amount of settling time the fines have before exiting the containment dykes.

The original construction program (outlined in EIS Section 4.4.1.8) included the assumption that 15% of dredge basin fill material would be discharged. This has been reduced to 3% loss, as outlined above, due to the elimination of previous fill constraints.

Further details pertaining to the management of sediment and water will be addressed during the development of the Dredging and Sediment Discharge Plan in consultation with ECCC and Fisheries and Oceans Canada (DFO) prior to the start of construction activities, as outlined in EIS Section 33.3.10.

[10] CEAR Document #564 From Environment and Climate Change Canada to the Review Panel re: Comments on the information relating to the environmental assessment of the Roberts Bank Terminal 2 Project.

[11] Discharge of supernatant is not expected to be subject to DAS permitting provided that the VFPA confirms that 1) the dredged material has the physical and chemical characteristics required for construction purposes; and 2) the use of the dredged material for construction purposes including any resulting release of a supernatant must not be contrary to the purposes of Division 3 Part 7 of the *Canadian Environmental Protection Act, 1999* and the aims of the London Convention and Protocol.

Table 2-4 Sources and Quantities of Material in Supernatant Discharge (Updated EIS Table 4-5)

Nature and Source of Material	Volume (million m^3)	Reason for Change Compared to EIS Section 4.0 Content / Comments
Dredged suspended material from terminal dredge basin	~~0.625~~ 0.11	This volume was previously based on 85% of dredged material being retained. Based on the revised dredged volume of 3.67 M m^3 and 97% retention, the loss of material is 110,000 m^3.
~~Silty **fallout** material from the underwater densification process in the dredge basin~~	~~0.128~~ 0.0	Based on the 2016 Supplemental Geotechnical Investigation findings, vibro-replacement in the dredge basin is no longer needed and as a result, silty fallout material will not be generated.
Silty sand dredged from the expanded tug basin	~~0.164~~ 0.01	This original DAS volume was based on surface disposal of all of the tug basin dredge material to a Project DAS site. Dredged material will now be used as fill in fill sites and based on 97% retention of the total 164,000 m^3 tug basin dredged volume, the loss of material is 4,920 m^3.
Fraser River Sand and Existing Quarry Sand	0.19	Previously assumed to be negligible, as the dumping and reclaiming process at the ITP will further reduce percentage of fines loss. Given the ITP is now eliminated, the fines loss in the anticipated sand volume is assumed to be (6.1+3.6) M m^3 x 2% = 194,000 m^3.
Total ~~Disposal at Sea~~ Material in Supernatant Discharge Volume	**~~0.917~~ 0.31**	

Note: Original EIS volumes appear in black text; those volumes that have been updated are shown as a strikethrough and new volumes are provided in blue text.

2.7 CONSTRUCTION SCHEDULE UPDATE

Due to the elimination of the ITP (as outlined in **Section 2.1**) and the requirement for transport of additional quarry materials to the site, the overall construction schedule has been extended by 8 months, as shown in **Table 2-5**.

Table 2-5 Construction Duration Comparison

Project Milestone	Duration (Months)		
	EIS	Updated	Change
Construction Start	1	1	-
Total Construction Complete	65	73	8

Attachment B2 contains updates to EIS Appendix 4-E, including the Updated Preliminary Construction Schedule and a detailed tabulated summary of changes to the Basis of Schedule. Project construction starts in the second half of Project Year 1 (as per the EIS) and will be completed approximately six years later in the second half of Project Year 7 (Month 73). Commissioning of the terminal operator equipment will commence in Month 63.

2.8 CONSTRUCTION EQUIPMENT PEAK ANALYSIS UPDATE

Based on the construction schedule update described in **Section 2.7** above, and updated construction activities described in **Sections 2.1** to **2.5**, **Attachment B4** contains the Updated Construction Equipment Peak Analysis.

In the Updated Construction Equipment Peak Analysis, the horizontal x-axis of the histogram has been modified to show construction months (instead of construction dates) to facilitate a fair comparison between the original and the revised construction equipment peak analyses. In general, the original histogram has a higher peak usage, but shorter overall Project duration compared to the revised histogram:

- Original Peak Equipment Usage in EIS: 363 pieces occurring on June 8 and 9, 2022 (month 47); and
- Revised Peak Equipment Usage in PCU: 349 pieces occurring in month 39.

2.9 CHANGE IN DREDGE AND BARGE / TUG MOVEMENTS

Based on the updates to the construction activities described in **Sections 2.1** to **2.5** above, changes in dredge equipment and barge-tug activities are summarised in **Table 2-6**. In comparison to activities described in EIS Section 4.0, the following changes are anticipated as a result of the updated construction activities described above:

- Decrease of 1,056 dredger movements as a result of using the *FRPD309* in lieu of the *Fraser Titan* to deliver a reduced volume of Fraser River sand;
- Decrease in dredger activity duration of approximately 16 operating months by direct pumping to fill sites using the *FRPD309* compared to reclaiming sand from the ITP with two dredgers, the *Columbia* and an unspecified dredge; and
- A net increase of 666 barge/tug movements resulting from the combination of importing additional quarry sand and requiring less rock volume (see **Table 2-2**).

Table 2-6 Dredge Equipment and Tug-Barge Equipment Use Comparison

Task Description[a]		Dredger Capacity (m^3)	Material Volume (m^3)	Total Movements
EIS PD	Fraser River Sand to ITP (via *Fraser Titan*[a])	3,400	8,100,000	2,382
PC Update	Fraser River Sand to Fill Sites (*FRPD309*)	4,600	6,100,000	1,326
		PC Update Difference	**-2,000,000**	**-1,056**

Task Description[a]		Nominal Rate (m^3/d)	Material Volume (m^3)	Activity Duration	
				days	months
EIS PD	Sand reclaim at ITP by *Columbia*	15,000	6,200,000	441	15
	Sand reclaim at ITP by Second Dredge	3,500	1,900,000	621	20
		Total	*8,100,000*	*1,062*	*35*
PC Update	Direct pumpout by *FRPD309*	10,500	6,100,000	581	19
		PC Update Difference	**-2,000,000**	**-481**	**-16**

Task Description[a]		Barge Capacity[b] (m^3)	Material Volume (m^3)	Total Movements
EIS PD	Tug/barge movements for quarry sand	2,703	1,100,000	407
	Tug/barge movements for quarry rock		4,600,000	1,702
		Total	*5,700,000*	*2,109*
PC Update	Tug/barge movements for quarry sand	2,703	3,600,000	1,332
	Tug/barge movements for quarry rock		3,900,000	1,443
		Total	*7,500,000*	*2,775*
		PC Update Difference	**1,700,000**	**666**

Notes: a. 'EIS PD' refers to level of activity described in EIS Section 4.0 and supporting appendices and 'PC Update' refers to updated level of activity described in this document.
b. Based on 5,000 tonnes (t) barge capacity and a 1.85 t/m^3 for general rock density conversion.

3.0 SUMMARY OF CHANGES TO THE ENVIRONMENTAL IMPACT STATEMENT

For the purposes of assessing changes or effects resulting from the updated construction activities described in **Section 2.0**, **Attachment C1** summarises the following:

- The descriptions of construction activities assessed under the future with the Project case in the EIS;
- The rationale for the change in the EIS description for each activity considering the updated construction description information presented in **Section 2.0**; and
- Updated descriptions for the construction activities being assessed in this section for intermediate components (ICs), valued components (VCs), and current use of lands and resources for traditional purposes (Current Use) and Aboriginal and treaty rights and related interests.

A summary of changes to the assessments for ICs, VCs, and Current Use presented in the EIS are provided in **Sections 3.1**, **3.2**, and **3.3**, respectively. Other assessments provided in the EIS, such as Accidents and Malfunctions in EIS Section 30.0 and Effects of the Environment on the Project in EIS Section 31.0, are not anticipated to change as a result of the updated construction activities and have not been included in this document.

3.1 UPDATED INTERMEDIATE COMPONENT CONSTRUCTION PHASE ASSESSMENTS

Attachment C2 provides the Updated Project Interaction Matrix, which summarises the changes in Project interactions for each of the IC assessments presented below. Based on the change in activities described in **Section 2.0** and summarised in **Attachment C1**, Project-IC interactions described in the following sections are expected to either:

1) Remain the same as those described in the EIS;
2) Change because of activities no longer being required (e.g., removal of interaction with elimination of the ITP); or
3) Change because of activities being modified (e.g., increase or decrease in interaction from different equipment being used, or level of, or timing of activity).

The focus for the IC assessments presented below is on those interactions expected to result in changes to the assessment presented in the EIS. Details about the specific nature of the change, supporting rationale, and assessment conclusions are provided below for each IC. Comparing to the assessments and conclusions provided in the EIS, **Attachment C3** summarises the overall expected changes for each IC assessment.

3.1.1 Air Quality

Appendix E in EIS Appendix 9.2-A describes the evaluation of potential Project-related changes in air quality due to construction activities. The assessment of air quality for the construction phase relied on the construction equipment histogram presented in Figure 2-1 in Appendix E of EIS Appendix 9.2-A (and EIS Appendix 4-F) for both an average day and a peak day scenario.

For the purposes of conservatively evaluating changes resulting from the updated construction activities presented in **Section 2.0**, the assessment conducted by Arcadis Canada Inc. relied upon construction equipment use assumed for peak day use. The scope of the assessment and methodology used in this assessment to assess changes of emissions from peak day activity reflects content previously described in Appendix E of EIS Appendix 9.2-A. Relevant methodological information from Appendix E and updates applicable to this assessment of updated construction activities are as follows:

- Appendix E Section 2.1 Compounds of Potential Concern (EIS Appendix 9.2-A) – criteria air contaminants (CACs) and trace organic contaminants (TOCs) are considered in this assessment[12];
- Appendix E Section 2.2 Temporal Assessment Boundary (EIS Appendix 9.2-A) – the peak day assessment has been revised from June 8 to 9, 2022 or month 47 in the EIS assessment to month 39 for the PCU assessment. The EIS and PCU construction equipment histograms are illustrated in **Attachment B4**;
- Appendix E Section 2.3 Emission Sources (EIS Appendix 9.2-A) – the main activities projected to occur during the updated peak construction scenario (month 39) are shown in the preliminary construction schedule illustrated in Updated Figure 4-9 in **Attachment A** and detailed in **Attachment B2**; and
- Emission calculation methodology is as per Appendix E Table 2-2 and Appendix E Section 3.0, except the list of equipment assumed to be in use on the peak day has been updated (discussed below). All other information (e.g., activity times, emission factors) presented in Section 3.0 is relevant to this assessment.

In order to evaluate changes to emissions resulting from construction activity updates, the peak day scenario EIS and PCU assessments are compared and discussed below for the following[13]:

- Emission sources from construction-related land- and marine-based equipment based on the number of pieces of equipment type projected to be in use and the associated total horsepower;
- Emission estimates for CACs and TOCs for construction equipment operating on and adjacent to the causeway and terminal; and
- Fugitive dust from material handling.

Emission Sources

Comparisons of the peak day construction equipment assessed in the EIS and PCU that contribute to tailpipe emissions while operating on the causeway and terminal, as well as dredge equipment activity near the terminal, are provided in Table 1 in **Attachment D1**.

[12] Greenhouse gases and climate forcing particulate matter (black carbon) were assessed in the RBT2 Study for the average day scenario only, as these emissions are calculated on an annual basis, and peak day activity is not representative for these emissions.
[13] Emissions from asphalt paving, described in Appendix E Section 3.2.8, are not anticipated to change as a result of the updated construction activities.

Table 1 presents engine ratings (in horsepower (hp)), engine tier levels, and load factors as per Table 3-3 in Appendix E (EIS Appendix 9.2-A), with the addition of equipment that is new for the PCU peak day scenario (i.e., this equipment was not projected to be operating on the peak day assessed in the EIS). Based on a calculation of total horsepower[14] for each type of equipment, the total horsepower for the PCU peak day scenario is 17% less than that previously assessed for the EIS peak day scenario, based on a 21% reduction in the number of pieces of equipment operating on the peak day (Table 1 in **Attachment D1**).

With respect to tug tailpipe and locomotive emissions, the EIS assessment considered nine tugs and two aggregate trains, while the PCU assessment considered 29 tugs and zero (0) aggregate trains. This equipment is not listed in Table 1 (**Attachment D1**) as the calculation of emissions is different than the methodology for tailpipe emissions (for further information refer to Sections 3.2.2 and 3.2.3 in Appendix E of EIS Appendix 9.2-A).

Emission Estimates

The emission estimates calculated using the methodology described above are summarised in the following tables in **Attachment D1**:

- Table 2 – For the EIS and PCU assessments, compares CAC and TOC emissions from construction equipment listed in Table 1;
- Table 3 – For the EIS and PCU assessments, compares CAC and TOC emissions from tug tailpipe emissions; and
- Table 4 – For the EIS and PCU assessments, compares CAC and TOC emissions from rail locomotive emissions.

Tables 3.1.1-1 and **3.1.1-2** present peak day CAC and TOC emissions, respectively, from all sources of emissions presented in Tables 2 to 4 (**Attachment D1**; i.e., construction equipment tailpipe, tugs and locomotives), as well as the percentage change in calculated emissions from the EIS assessment to PCU assessment for each parameter.

Table 3.1.1-1 Comparison of EIS and PCU Total Peak Day CAC Emissions (g/s) from All Emission Sources

Air Quality Assessment	Peak Day CACs (g/s)						
	CO	NO_x	SO_2	VOC	PM	PM_{10}	$PM_{2.5}$
EIS[a]	11.76	31.53	0.024	1.75	1.62	1.62	1.57
PCU[b]	10.76	27.87	0.019	1.82	1.51	1.51	1.46
Percent Change from EIS to PCU	-9%	-12%	-20%	4%	-7%	-7%	-7%

Notes: a. Source: CACs emissions from Tables 3-14, 3-16, and 3-18 in Appendix E of EIS Appendix 9.2-A.
b. Source: Tables 2 to 4 in **Attachment D1**.

[14] Total horsepower (hp) was calculated from engine hp x load factor x number of units.

Table 3.1.1-2 Comparison of EIS and PCU Total Peak Day TOC Emissions (g/s) from All Emission Sources

Air Quality Assessment	Peak Day TOCs (g/s)							
	Acrolein	Benzene	1,3-Butadiene	Acetaldehyde	Formaldehyde	Naphthalene	Benzo(a)pyrene	Diesel Particulate Matter
EIS[a]	0.0165	0.0212	0.0052	0.111	0.333	0.0262	$9.1x10^{-5}$	1.57
PCU[b]	0.0170	0.0221	0.0053	0.115	0.344	0.0269	$9.4x10^{-5}$	1.46
Percent Change from EIS to PCU	3%	4%	3%	4%	3%	3%	3%	-7%

Notes: a. Source: TOCs emissions from Tables 3-15 and 3-17 in the Appendix E, EIS Appendix 9.2-A for tailpipe and tug emissions, respectively, and Table 5 in **Attachment D1** for rail emissions.
b. Source: Tables 2 to 4 in **Attachment D1**.

Overall, compared to EIS assessment emission estimates, the PCU assessment emissions estimates are predicted to decrease by 9% for CO, 7% for emissions of particulates (PM, PM_{10}, and $PM_{2.5}$) and diesel particulate matter, 12% for NO_x emissions, and 20% for SO_2 emissions. VOC and TOCs emissions are predicted to increase by 3% to 4% in comparison with the EIS assessment, as a result of the increase from one to nine marine-based vibro-compaction probes, as shown in Table 1 in **Attachment D1**.

As noted at the beginning of **Section 2.0**, the equipment and associated specifications listed in Table 1 in **Attachment D1** have been defined for the purposes of assessing potential effects or changes from updated construction phase activities. Contractors may use alternative pieces of equipment provided these pieces of equipment meet the Project's objectives, constraints, and requirements. With respect to the marine-based vibro-compaction probe, it was assumed to be powered by Tier 0 engines with total power of 1000 hp; however, it would have also been realistic, but less conservative, to assume engine specifications similar to those provided for the land-based vibro-compaction probe (i.e., 500 hp, Tier 0 as shown in Table 1 in **Attachment D1**). Table 6 in **Attachment D1** provides a comparison of CAC and TOC emissions for five different vibro-compaction probes, ranging from 300 hp to 1000 hp, and either Tier 0 or 1). If a less powerful probe had been assumed for the PCU peak day scenario, all CAC and TOC emissions for the PCU assessment would be less than those predicted for the EIS assessment (which was based on the operation of one 1,000 hp Tier 0 probe on the peak day).

Fugitive Dust

Particulate matter will be emitted when material is loaded and unloaded by construction equipment. The methodology for calculating dust particulate emissions from material handling is provided in Section 3.2.5 of Appendix E (EIS Appendix 9.2-A).

Table 3.1.1-3 provides the number of front end loaders and excavators in use for the peak day scenarios assumed for the EIS and PCU assessments, which total 71 and 53 pieces of equipment, respectively. The quantity of bulk material (in tonnes) moved daily by each piece of equipment type is also provided in **Table 3.1.1-3** and is assumed to be the same in both assessments.

Table 3.1.1-3 Comparison of EIS and PCU Equipment Count and Quantity of Material Handled Daily by Each Piece of Equipment

Equipment Type and Size	Peak Scenario Equipment Quantity		Daily Material Movement (tonnes/day/equipment)
	EIS[a]	PCU[b]	
Small FEL	4	16	1,284
Large FEL	48	21	6,940
Small Excavator	14	5	480
Large Excavator	5	11	577

Notes: a. Source: Tables 3-3 and 3-12 in Appendix E, EIS Appendix 9.2-A.
b. Source: Table 1 in **Attachment D1**.

Table 3.1.1-4 presents a fugitive dust emissions (PM, PM_{10}, and $PM_{2.5}$) from the EIS and PCU assessments based on the peak day construction scenarios for equipment moving on unpaved roads, material handling, bulldozing, and grading activities.

Table 3.1.1-4 Comparison of EIS and PCU Peak Day Fugitive Dust Emissions (g/s)

Peak Construction Scenario	Activity	PM	PM_{10}	$PM_{2.5}$
EIS[a]	Unpaved Roads	26.5	7.6	0.76
	Material Handling	4.8	2.3	0.35
	Bulldozing	3.1	0.6	0.33
	Total	**34.4**	**10.5**	**1.44**
PCU	Unpaved Roads	20.3	5.8	0.58
	Material Handling	2.4	1.2	0.17
	Bulldozing	4.0	0.7	0.42
	Grading	4.7	1.3	0.15
	Total	**31.4**	**9.0**	**1.32**

Note: a. Source: Table 3-20 in Appendix E of EIS Appendix 9.2-A. Note that grading was not an activity occurring on the EIS peak day scenario.

For equipment moving on unpaved roads and handling material, all particulate emissions are lower for the PCU assessment compared to the EIS assessment. For bulldozing, emissions of PM, PM_{10}, and $PM_{2.5}$ are higher in the PCU assessment, due to the increase in the number of bulldozers working on the peak equipment use day (i.e., as shown in Table 1 in **Attachment D1**, 15 and 19 dozers were assumed in the EIS and PCU assessments, respectively). Grading was not projected to occur during the peak day scenario for the EIS

assessment, and two graders were assumed to be operational during the PCU peak day scenario. Overall, PM, PM_{10}, and $PM_{2.5}$ emissions are predicted to be lower based on the updated construction activities, compared to the fugitive dust emissions predicted for the EIS.

Conclusion

The assessment of air quality from Project-related construction activities presented in EIS Section 9.2 and Appendix E of Appendix 9.2-A has been updated to reflect the Project construction updates presented in **Section 2.0**. Emission sources (i.e., equipment in use and total horsepower), changes in emissions of criteria air contaminants and trace organic contaminants, and fugitive dust emissions were compared for the EIS and PCU assessments. The updated construction activities are generally predicted to have similar or less emissions than those assessed in the EIS, with overall emissions being lower than what was predicted in the EIS. Hence, based on these comparisons, air dispersion modelling results presented in the EIS are considered conservative for the updated construction activities and ambient concentrations of the assessed pollutants would be lower than what was predicted in the EIS.

3.1.2 Noise and Vibration

Project construction as described in the EIS was not predicted to result in any changes to ground-borne vibration. The updated construction activities are also not expected to contribute to changes in ground-borne vibration, hence this PCU assessment focuses on changes in atmospheric noise levels. The following EIS sections and information requests are relevant to the assessment of atmospheric noise resulting from updates to the Project construction activities:

- EIS Section 9.3.9.2 and EIS Appendix 9.3-A, which describe the methods for assessing noise from construction activities and predictions of noise levels during Project construction; and
- The response to IR7-12 (CEAR Document #1134[15]), which provides an evaluation of noise management and mitigation measures that could be applied during Project construction.

The changes to construction activities, described in **Section 2.0**, and **Attachment C1**, that have the greatest influence on the atmospheric noise assessment are as follows:

- Elimination of the use of the ITP (decrease in dredger activity in the inter-causeway area);
- Pumping of Fraser River sand directly into fill areas (increase in dredger activity at the berth face);
- Increase in delivery of quarry sand by tug and barge (increased vessel activity at barge ramps adjacent to east and west terminal basins);
- Elimination of marine-based vibro-replacement activities in the dredge basin; and

[15] CEAR Document #1134 From the Vancouver Fraser Port Authority to the Review Panel re: Responses to Information Requests IR5-20, IR5-30, IR5-31, IR6-13, IR7-12, IR7-37 & IR7-41). (See Reference Documents #975, #991, & #1000).

- Addition of diesel-powered impact pile-driving for construction of the RBT2 overpass.

For the purposes of evaluating changes in predicted noise levels resulting from the updated Project construction activities, an updated analysis of construction phase noise levels was conducted by RWDI, and a technical report is provided in **Attachment D2**. The changes in construction activities are predicted to result in both increases and decreases in construction phase noise emissions, depending on the activity. A summary of the predicted construction phase noise levels, in upland and marine areas, reflecting the changes in construction activities is provided below.

Construction Noise Levels in Upland Areas

The updated construction phase noise levels for the upland study area are provided to support the assessment of human health (**Section 3.2.15**).

A comparison of the construction phase noise levels between the EIS and the PCU is provided below in **Table 3.1.2-1** for day-night average noise (L_{dn}). **Table 3.1.2-1** presents predicted noise levels for sites 3, 4, and 5 in the upland study area (described in Section 2.3 of EIS Appendix 9.3-A) as a range from lowest to highest monthly average values, and as an overall construction phase average noise level across all 73 months of construction. Predicted noise levels for expected conditions (future conditions without the Project) are shown, along with the 'combined' levels for expected conditions plus incremental construction-related noise levels. Similar tables for daytime (L_d), nighttime (L_n), and maximum (L_{max}) noise levels associated with construction activity for each month are provided in **Attachment D2**.

Table 3.1.2-1 Comparison of Combined Upland L_{dn} (dBA) for the PCU and EIS

Site	L_{dn} for Expected Conditions	Combined Construction L_{dn} (EIS)		Combined Construction L_{dn} (PCU)		Difference in L_{dn} (PCU vs. EIS)	
		Range	Average	Range	Average	Range	Average
3	58.0	58.0 – 60.0	58.5	58.0 – 60.5	58.6	0.0 – 0.5	0.1
4	51.7	51.7 – 56.0	53.0	51.7 – 56.9	53.2	0.0 – 0.9	0.2
5	55.7	55.7 – 56.7	56.0	55.7 – 56.5	55.9	0.0 – (0.2)	-0.1

As shown in **Table 3.1.2-1**, the predicted day-night average noise levels for the PCU are very similar to those in the EIS, with differences of less than 1 dBA at each of the three sites.

Additional details provided in **Attachment D2** shows monthly average construction noise is predicted to increase L_d, L_n, and L_{dn} at sites 3, 4, and 5 by a range of 0.0 dBA to 5.7 dBA over expected conditions (compared to the range of 0.0 to 4.8 dBA in the EIS). Over the duration of the construction phase, Project construction is not expected to increase noise levels (i.e., L_d, L_n, L_{dn}) compared to expected conditions by more than 1.6 dBA. This represents a 0.3 dBA increase from the construction phase noise levels presented in the EIS, which were not anticipated to be more than 1.3 dBA higher than expected conditions (EIS Table 9.3-18). This

0.3 dBA increase from Project-construction related noise levels is within the margin of error for noise measurement instruments (i.e., ±1 dBA).

The highest noise levels are expected to occur from August 2022 to October 2022 during densification of the east widened causeway. In the EIS, dredging in the ITP in the inter-causeway area was also a primary contributor to the highest noise levels during construction, but this activity is no longer planned. As noted in the EIS, these relatively modest increases are primarily a result of the large setback distances of noise-sensitive upland receptors from the RBT2 terminal and causeway construction zones.

Attachment D2 also provides an analysis of the pile driving activity associated with construction of the RBT2 overpass (described in **Section 2.5**). At sites 3, 4, and 5 in the upland study area, the model predicted maximum noise levels (L_{max}) of 34.4 to 39.3 dBA. These noise levels are lower than the L_d for expected conditions at sites 3, 4, and 5, which range from 44.5 to 51.5 dBA, meaning that the noise from pile driving activity is not predicted to be measurably greater than the expected community noise from other sources at that time. Pile driving may still be audible, as its impulsive nature and low-frequency content is sufficiently different from normal community noise that it may be distinguishable from other, nearer sound source.

Construction Noise Levels in Marine Areas

Table A-10 of Appendix A in **Attachment D2** provides the range of L_d that are expected to occur in marine areas during Project construction. When compared to the values presented in Table H-4 of EIS Appendix 9.3-A, maximum predicted L_d have changed by less than 0.5 dBA, which is considered negligible compared to the margin of error of noise measurement equipment (i.e., ±1 dBA).

Table A-11 of Appendix A in **Attachment D2** provides the predicted maximum noise levels (L_{max}) that are expected to occur at various setback distances from diesel pile driving. These predicted noise levels at various setbacks are provided to support the assessment of noise-related effects on coastal birds (**Section 3.2.5**).

Conclusion

The assessment of noise and vibration from Project-related construction activities presented in EIS Section 9.3 and EIS Appendix 9.3-A has been updated to reflect the updated construction activities described in **Section 2.0**. While the changes in construction activities result in both increased and decreased noise levels during certain periods of construction, average noise levels in upland and marine areas are expected to differ by less than ±1 dBA in upland areas, and ±0.5 dBA in marine areas, relative to those predicted in the EIS.

3.1.3 Light

EIS Section 9.4.8 and EIS Appendix 9.4-A describe the anticipated future changes resulting from Project components and activities. The assessment is based on a preliminary lighting design for the Project, on the findings of a field study to characterise current light trespass (as indicated by illuminance levels, measured in lux) and sky glow (as indicated by sky quality

levels, measured in mag/arcsec^2) at identified receptors, and modelling of predicted future light levels at these receptors. The light assessment focuses on the operation phase lighting, which is considered to be representative of construction phase lighting (EIS Section 9.4.2). Light sources and emissions during construction are expected to be lower than those during the operation phase, and an assessment of light from specific construction-related sources was not included.

For the purposes of evaluating changes resulting from the updated construction activities described in **Section 2.0**, the revised construction activity descriptions presented in **Attachment C1** were reviewed.

Project light emissions are not anticipated to change as a result of the Project construction update; therefore, the conclusions of the light effects assessment, including that construction phase light emissions will be lower than operation phase emissions, presented in EIS Section 9.4.8 remain unchanged. As indicated in EIS Section 9.4.8, Project-related lighting is expected to result in a minimal increase in light trespass levels and, while sky glow levels are expected to increase, they are not anticipated to result in a noticeable change from existing conditions.

Conclusion

With consideration of the updated construction activities, the conclusions of the light assessment remain the same as in the EIS.

3.1.4 Coastal Geomorphology

EIS Section 9.5.8.1 and EIS Appendix 9.5-A Section 8.2 describe the anticipated changes following construction of the Project on the coastal landforms, as well as potential changes during construction, based on a synthesis of the geomorphic studies, field observations, hydrodynamic modelling and morphodynamic model results. Short-term construction activities proposed for the berth pocket, marine terminal, expanded tug basin, and widened causeway with the potential to affect morphology were assessed.

For the purposes of evaluating changes resulting from the updated construction activities presented in **Section 2.0**, changes to the terminal footprint area and the revised construction activity descriptions presented in **Attachment C1** were reviewed. The only change that is relevant to the coastal geomorphology effects assessment is the reduction from 17.4 ha to 13.9 ha in the berth pocket and marine approach area footprint (**Table 2-1**). Based on the small reduction (3.5 ha) in footprint and location of the berth pocket and marine approach area, the reduced footprint will not alter the coastal geomorphology assessment presented in the EIS.

Changes resulting from the elimination of ITP use, elimination or reduction in vibro-densification and vibro-replacement activities, and use of all dredgeate material (i.e., from dredge basin and tug basin) as general fill, or changes to the construction schedule do not have the potential to affect coastal geomorphology.

Conclusion

The reduced footprint of the berth pocket and marine approach area will not alter the coastal geomorphology assessment presented in the EIS. As indicated in EIS Section 9.5.8.2, predicted changes in coastal processes on the north side of the Roberts Bank causeway will primarily result from the development of the RBT2 terminal structure, and changes in the design of the terminal structure are not being contemplated as part of the PCU presented in **Section 2.0**, or elsewhere.

3.1.5 Surficial Geology and Marine Sediment

EIS Sections 9.6.5 and 9.6.8 describe the potential changes to surficial geology and marine sediment from altered coastal processes that will arise from the presence of the Project footprint and potential implications of sediment re-suspension and deposition from marine-based construction activities.

To evaluate changes to surficial geology and marine sediment from the updated construction activities, fill material and discharge material volumes and activity descriptions provided in **Section 2.0** and **Attachment C1** were considered, along with the assessment of coastal geomorphology provided in **Section 3.1.4**. In the sections that follow, the Project-derived changes to coastal processes and sediment re-suspension and deposition previously presented in the EIS are updated to include the revised fill and discharge material volumes and activities summarised in **Section 2.0**.

Coastal Geomorphology

As outlined in **Section 3.1.4**, the only Project construction update relevant to the coastal geomorphology effects assessment is the reduction of the berth pocket and marine approach area footprint. This change is not anticipated to alter coastal processes beyond those already assessed in the EIS. Sediment erosion and deposition patterns resulting from altered coastal processes, therefore, will also not change from those assessed in the EIS.

Sediment Dispersion and Deposition

Modelling was conducted for the EIS assessment presented in EIS Section 9.6.8 to determine potential Project-related increases in sediment deposition using a three-dimensional hydrodynamic model for the following scenarios:

- Dredge basin dredging, loading of the ITP via barge dumping, and unloading of the ITP via dredging;
- Discharge of sediment-laden water from dredge basin dredgeate (assuming 15% of material is unusable) and silty fallout material generated by vibro-replacement activities in the dredge basin;
- Discharge of sediment-laden water containing ITP stockpile materials (i.e., sand sourced from the Fraser River and existing quarries); and
- Re-suspension of sediments from tug basin dredging and disposal of dredgeate via surface release to a supernatant discharge site, formerly referred to as a DAS site.

As outlined in the *Information Request Package 3 Preamble to IR3-25 to IR3-40* (CEAR Document #984[16]), since all fill materials can be used for construction purposes and the VFPA expects that the proposed work can be carried out in a manner that does not create marine pollution, the VFPA no longer anticipates that discharge of supernatant will require a DAS permit. Therefore, the location of supernatant discharge that was referred to as the candidate DAS area in the EIS, is referred to as the supernatant discharge area or discharge area.

EIS Figures 9.6-8 to 9.6-15 and EIS Appendix 9.6-C provide the sediment dispersion modelling results for the scenarios outlined above, which subsequently informed VC assessments in the EIS. EIS Appendix 9.6-C also provides results for a scenario relevant to the updated construction activities—the discharge of sediment-laden water from dredge basin dredgeate to -45 m CD assuming that 3% of the material will not be retained (assumption based on numerical model simulation of the settling basins). This scenario is relevant to the Project construction update as the amount of retained material is now expected to be 97% (i.e., 3% non-retention rate) not 85%, based on the outcomes of the 2016 Supplemental Geotechnical Investigation Program (**Section 2.3**). The total volume of material expected to be discharged has been reduced from 917,000 m^3 to 310,000 m^3 (**Table 2-4**; a reduction of 66% by volume). In addition to the use of all dredged material as fill (and retention of 97% of that material), the volume of sediment has also decreased as the amount of material to be dredged from the dredge basin has decreased by 530,000 m^3 (**Section 2.2**).

The following figures sourced from EIS Appendix 9.6-C (provided for ease of reference) illustrate the change in between the 15% and 3% scenarios in depositional thickness (in millimetres (mm)) and median diameter (D50, in microns) of the deposited layer from the advection of the suspended solids plume resulting from the discharge of supernatant to -45 m CD outfall depth for east dredge basin dredgeate modelled over a four-month period (i.e., assumed to be April 1 to July 31, 2019 as shown in the inset of the figures) :

- **Figure 3.1.5-1**: deposition thickness of deposited sediment assuming 15% non-retention rate (sourced from EIS Appendix 9.6-C Figure 5.4.6, and results also illustrated in EIS Figure 9.6-10);
- **Figure 3.1.5-2**: deposition thickness of deposited sediment assuming 3% non-retention rate (sourced from EIS Appendix 9.6-C Figure 5.4.14);
- **Figure 3.1.5-3**: D50 of deposited sediment assuming 15% non-retention rate (sourced from EIS Appendix 9.6-C Figure 5.4.7 and results also illustrated in EIS Figure 9.6-11); and
- **Figure 3.1.5-4**: D50 of deposited sediment assuming 3% non-retention rate (sourced from EIS Appendix 9.6-C Figure 5.4.15).

Comparing sediment deposition model results shown in these figures for the 15% and 3% non-retention rate scenarios, the deposition of sediment is less than approximately 1 mm for both scenarios (noting that natural sedimentation rates are 2 mm to 30 mm per year (EIS Section 9.6.6.1)), but the distance that sediment is predicted to deposit is greatly reduced under the 3% non-retention rate scenario. The median diameter of the deposited material is

[16] CEAR Document #984 From the Vancouver Fraser Port Authority to the Review Panel re: Responses to Information Request Package 3 (See Reference Document # 928).

also reduced under the 3% non-retention scenario, based on the different predictions of settling within the east basin (i.e., non-retention rates of 13.5% and 71.8% for unsettled fines for the 3% and 15% non-retention rate scenarios, respectively). For additional information on the 15% and 3% non-retention rate scenarios, refer to EIS Appendix 9.6-C Sections 5.4.1 and 5.4.2, respectively, and the response to IR3-30 (CEAR Document #984).

Attachment C2 presents construction activity-surficial geology and marine sediment interactions, based on updates to the construction activities summarised in **Attachment C1**. The suspension of sediments will no longer occur with the elimination of the following activities:

- Marine-based vibro-densification of native soil at terminal building foundation areas;
- Dumping of Fraser River and quarry sand to the ITP and subsequent reclaiming via two dredgers to fill and preload terminal basins and the west widened causeway;
- Placement of sacrificial rock and vibro-replacement of native soil in dredged area; and
- Disposal of tug basin dredge material via surface disposal to the disposal site[17].

As concluded in EIS Section 9.6.6.3 and 9.6.10, changes in sediment contaminant concentrations are not expected as sediments that will be re-suspended and deposited as a result of construction activities, including updated construction activities, are not contaminated.

Conclusion

The updated construction activities are anticipated to result in the elimination or reduction of sediment re-suspension and deposition. The effects assessment of surficial geology and marine sediment presented in the EIS, therefore, is considered conservative for the updated construction activities, as the predicted changes in sediment deposition would be lower than what was predicted in the EIS. Changes to surficial geology and marine sediment during Project construction are expected to be minimal or virtually undetectable relative to natural variability.

[17] Dredged material from the tug basin will be pumped into terminal containment basin areas directly from a scow. The supernatant discharge from tug basin material that is not retained in the terminal basins is accounted for in the activity described as 'Install pipelines and pump excess water in terminal basin areas to supernatant discharge site'.

Figure 3.1.5-1 Sediment Deposition over Four-Month Period from Discharge of Supernatant at -45 m CD Depth for East Dredge Basin Dredgeate, Assuming 15% Non-retention Rate (Source: EIS Appendix 9.6-C Figure 5.4.6)

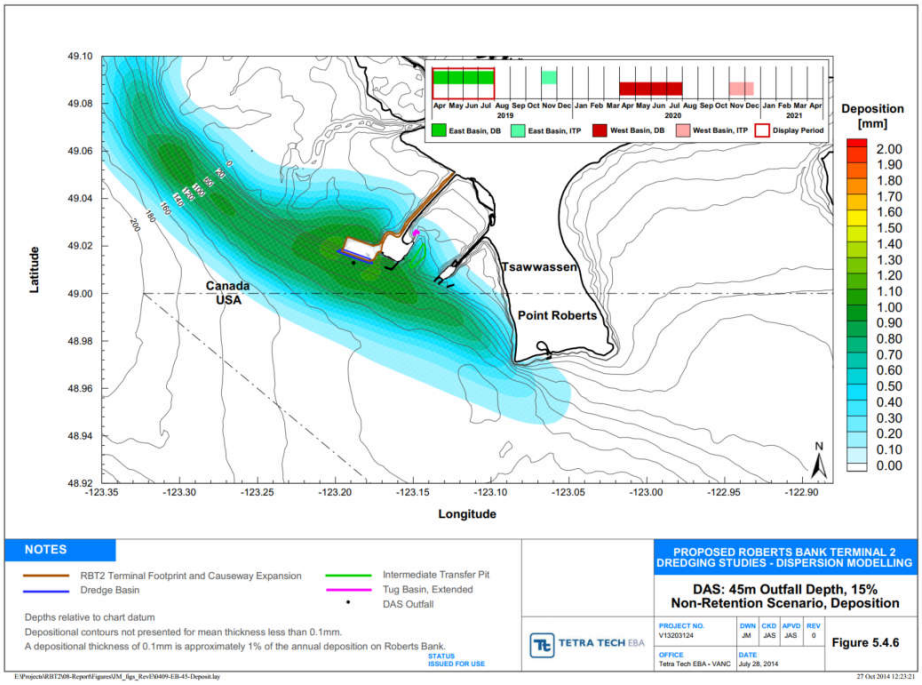


Figure 3.1.5-2 Sediment Deposition over Four-Month Period from Discharge of Supernatant at -45 m CD Depth for East Dredge Basin Dredgeate, Assuming 3% Non-retention Rate (Source: EIS Appendix 9.6-C Figure 5.4.14)

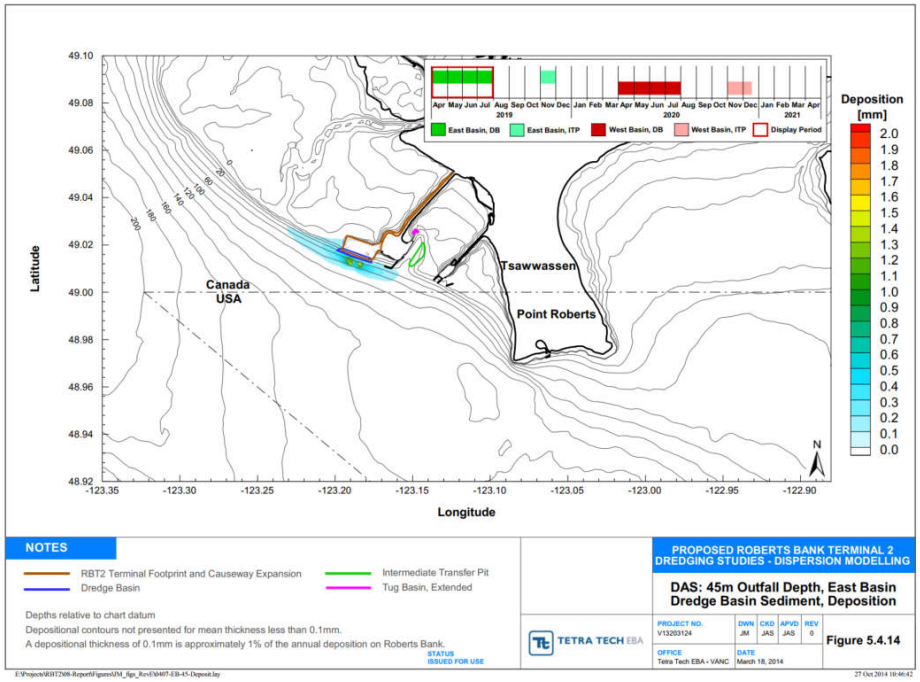


Figure 3.1.5-3 D50 from Discharge of Supernatant at -45 m CD Depth for East Dredge Basin Dredgeate over Four-Month Period, Assuming 15% Non-retention Rate (Source: EIS Appendix 9.6-C Figure 5.4.7)

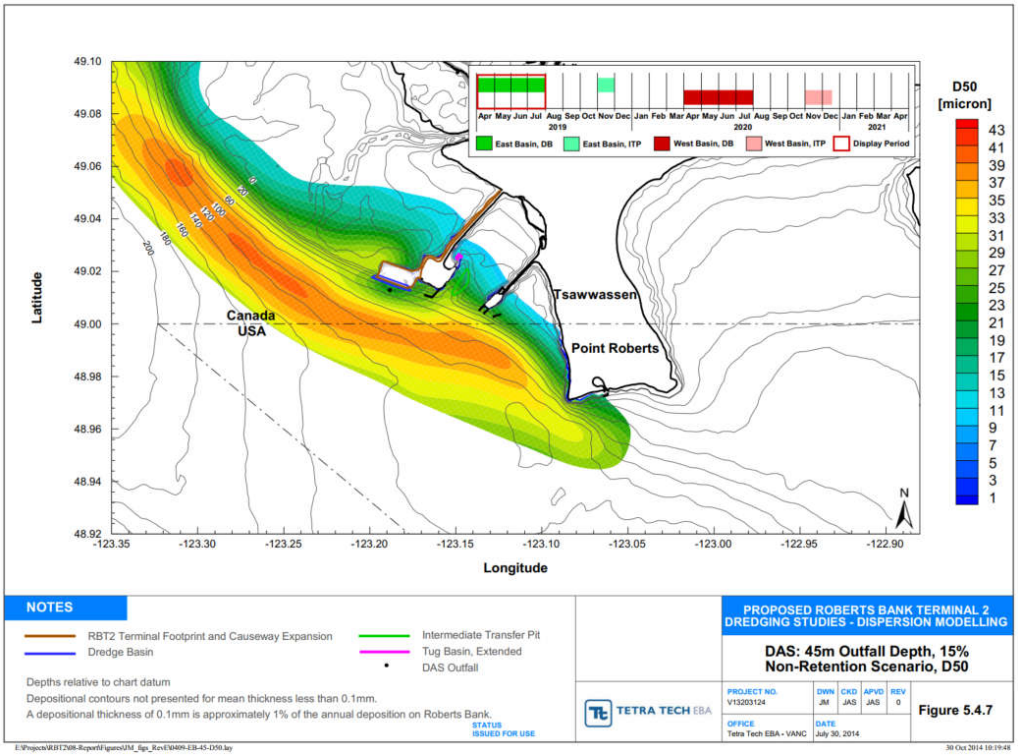
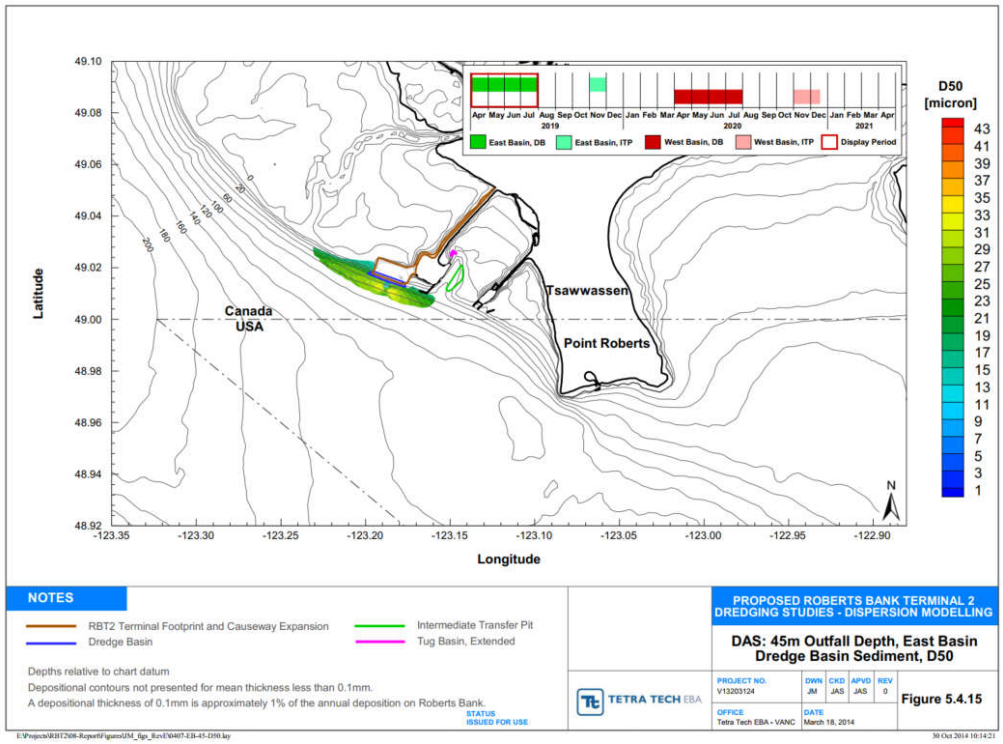


Figure 3.1.5-4 D50 from Discharge of Supernatant at -45 m CD Depth for East Dredge Basin Dredgeate over Four-Month Period, Assuming 3% Non-retention Rate (Source: EIS Appendix 9.6-C Figure 5.4.15)



3.1.6 Marine Water Quality

EIS Sections 9.7.5 and 9.7.8 describe the potential changes to marine water quality influenced by changes to coastal processes (arising from the presence of the Project footprint) and from marine-based construction activities.

To evaluate changes to marine water quality from the updated construction activities, activity descriptions provided in **Section 2.0** and **Attachment C1** were considered, along with the assessments of coastal geomorphology and surficial geology and marine sediment provided in **Sections 3.1.4** and **3.1.5**, respectively. Expected changes are evaluated relative to the changes described in the EIS for both the changes resulting from altered coastal processes and from the increases in total suspended solids (TSS) generated from activities that re-suspend sediment.

Coastal Geomorphology

As outlined in **Section 3.1.4**, the only Project construction update relevant to the coastal geomorphology effects assessment is the reduction of the berth pocket and marine approach area footprint. This change is not anticipated to alter coastal processes, beyond those already assessed in the EIS. Localised changes in salinity and turbidity resulting from altered coastal processes within the intertidal zone, therefore, will also not change from those presented in the EIS.

Sediment Dispersion and TSS Concentrations

Project construction activities have the potential to affect water quality by increasing TSS concentrations and turbidity[18] through the re-suspension of sediment. As outlined in **Section 3.1.5**, sediment dispersion modelling using a three-dimensional hydrodynamic model was conducted for the EIS assessment to predict sediment dispersion and TSS concentrations for various construction activities (i.e., dredging, vibro-replacement, loading and recovery of sand from the ITP, and supernatant discharges). EIS Appendix 9.6-C provides a detailed description of the model, model input values and assumptions, model validation, and modelling results.

EIS Figures 9.7-8 to 9.7-11 and EIS Appendix 9.6-C provide the sediment dispersion modelling results for these activities, which subsequently informed VC assessments in the EIS. As outlined in **Section 3.1.5**, EIS Appendix 9.6-C illustrates model outcomes for TSS concentrations from the advection of the TSS plume resulting from the discharge of supernatant to -45 m CD outfall depth for east dredge basin dredgeate for the 15% and 3% non-retention rate scenarios. Based on the outcomes of the 2016 Supplemental Geotechnical Investigation Program (**Section 2.3**), the 3% non-retention scenario is relevant to the Project construction update as the amount of retained material is now expected to be 97%. The volume of material to be dredged from the dredge basin has decreased by 530,000 m^3

[18] Dispersion modelling results are presented as increases in TSS concentrations in mg/L only, since TSS and turbidity are related parameters (when TSS increases, turbidity would also increase).

(**Section 2.2**), and the total volume of material expected to be discharged has been reduced by 66% (**Table 2-4**).

To illustrate how retention rates can affect advection of the TSS plume resulting from the discharge of supernatant to -45 m CD outfall depth for east dredge basin dredgeate[19], the following figures sourced from EIS Appendix 9.6-C for 15% and 3% non-retention rate modelling scenarios (i.e., peak TSS exceeding 5.0 mg/L modelling scenarios) are provided below:

- **Figure 3.1.6-1**: Predicted TSS levels over a four-month period (as percentage of time that levels exceed 5.0 mg/L), assuming 15% non-retention rate for discharge of sediment-laden water containing dredge basin dredgeate and silty fallout material generated by vibro-replacement activities in the dredge basin (sourced from EIS Appendix 9.6-C Figure 5.4.2 and results also illustrated in EIS Figure 9.7-9);
- **Figure 3.1.6-2**: Predicted TSS levels over a four-month period (as percentage of time that levels exceed 5.0 mg/L), assuming 3% non-retention rate for discharge of sediment-laden water containing dredge basin dredgeate (sourced from EIS Appendix 9.6-C Figure 5.4.10);
- **Figure 3.1.6-3**: Maximum predicted TSS extent (in mg/L), assuming a non-retention rate of 15% during a flood tide occurring July 2019 (sourced from EIS Appendix 9.6-C Figure 5.4.4);
- **Figure 3.1.6-4**: Maximum predicted TSS extent (in mg/L), assuming a non-retention rate of 3% during a flood tide occurring July 2019 (sourced from EIS Appendix 9.6-C Figure 5.4.12);
- **Figure 3.1.6-5**: Maximum predicted TSS extent (in mg/L), assuming a non-retention rate of 15% during an ebb tide occurring July 2019 (sourced from EIS Appendix 9.6-C Figure 5.4.5); and
- **Figure 3.1.6-6**: Maximum predicted TSS extent (in mg/L), assuming a non-retention rate of 3% during an ebb tide occurring July 2019 (sourced from EIS Appendix 9.6-C Figure 5.4.13).

Comparing TSS concentrations shown in these figures for the 15% and 3% non-retention rate scenarios, the predicted dispersion of the TSS plume is greatly reduced under the 3% non-retention rate scenario. For additional information on the 15% and 3% non-retention rate scenarios, refer to the EIS Appendix 9.6-C Sections 5.4.1 and 5.4.2, respectively, and the response to IR3-30 (CEAR Document #984).

[19] As outlined in the response to IR5-13 (CEAR Document #1153), in order to quantify the dispersion of sediments during Project construction activities, TSS content of the sediment plume was tracked in the model as sediments were released during supernatant discharge activities. The representation of data against the 5.0 mg/L threshold illustrates the absolute maximum TSS concentration that could occur in the water column, thereby providing a conservative representation of the TSS concentration in the water column. These illustrated concentrations are referred to as the depth maximum concentration in previous information request responses.

Attachment C2 presents construction activity-marine water quality interactions, based on updated construction activities summarised in **Attachment C1**. Potential increase in TSS will no longer occur with the elimination of the following activities:

- Marine-based vibro-densification of native soil at terminal building foundation areas;
- Dumping of Fraser River and quarry sand to the ITP and subsequent reclaiming via two dredgers to fill and preload terminal basins and the west widened causeway;
- Installation and removal of temporary pipeline between the ITP and marine terminal or causeway fill sites;
- Placement of sacrificial rock and vibro-replacement of native soil in dredged area; and
- Disposal of tug basin dredge material via surface disposal to the disposal site[20].

As concluded in **Section 3.1.4** (and EIS Sections 9.6.6.3 and 9.6.10), changes in sediment contaminant concentrations in the water column are not expected as sediments that will be re-suspended and deposited as a result of construction activities, including updated construction activities, are not contaminated.

Conclusion

The updated construction activities are anticipated to result in the elimination or reduction of sediment re-suspension and TSS plume dispersion. The effects assessment of marine water quality presented in the EIS, therefore, is considered conservative for the updated construction activities, as the predicted changes in TSS levels would be lower than what was predicted in the EIS. Changes to marine water quality during Project construction are expected to be temporary and minimal relative to natural variability.

[20] Dredged material will be pumped into terminal containment basin areas directly from a scow, and the potential changes of supernatant discharge from tug basin material that is not retained in the terminal basins is accounted for in the pumping of excess water in terminal basin areas to supernatant discharge site.

Figure 3.1.6-1 Predicted TSS Levels from Discharge of Supernatant at -45 m CD Depth for East Dredge Basin Dredgeate over Four-month Period, Assuming 15% Non-retention Rate (Source: EIS Appendix 9.6-C Figure 5.4.2)

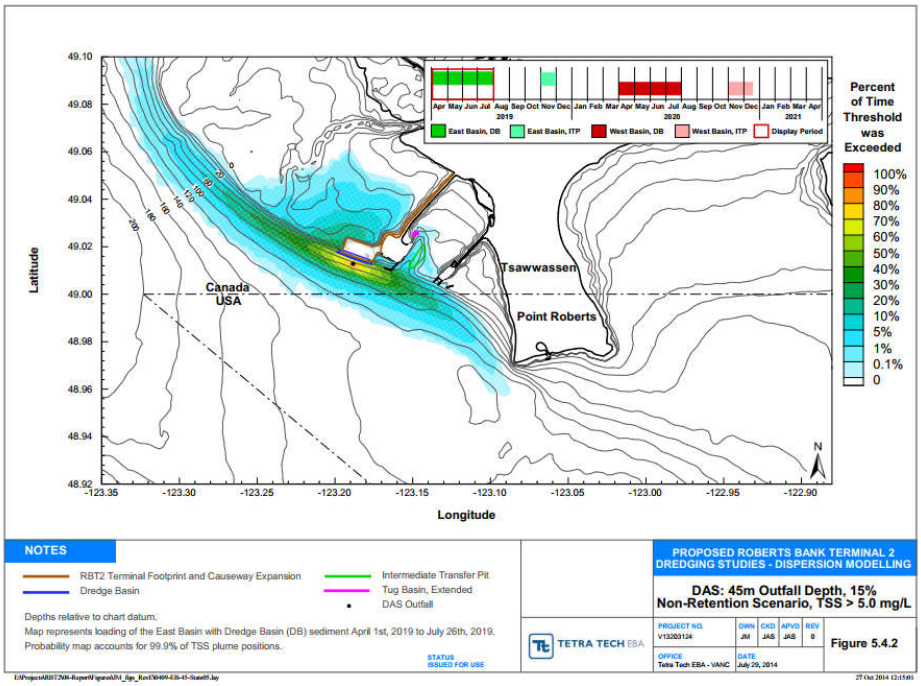


Figure 3.1.6-2 Predicted TSS Levels from Discharge of Supernatant at -45 m CD Depth for East Dredge Basin Dredgeate over Four-Month Period, Assuming 3% Non-retention Rate (Source: EIS Appendix 9.6-C Figure 5.4.10)

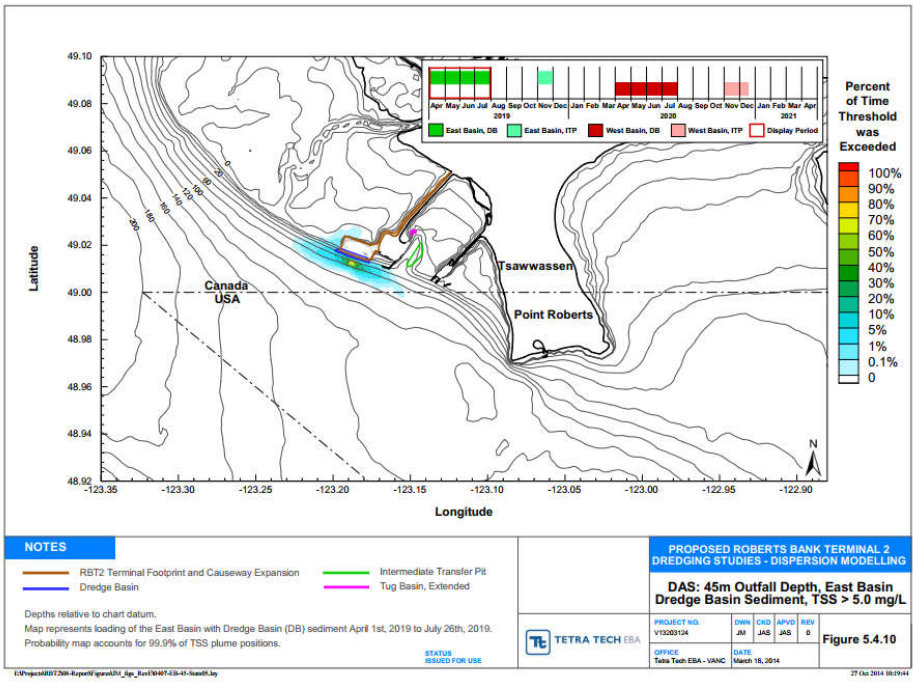


Figure 3.1.6-3 Maximum Predicted TSS Extent from Discharge of Supernatant at -45 m CD Depth for East Dredge Basin Dredgeate, Assuming a Non-retention Rate of 15% during a Flood Tide (Source: EIS Appendix 9.6-C Figure 5.4.4)

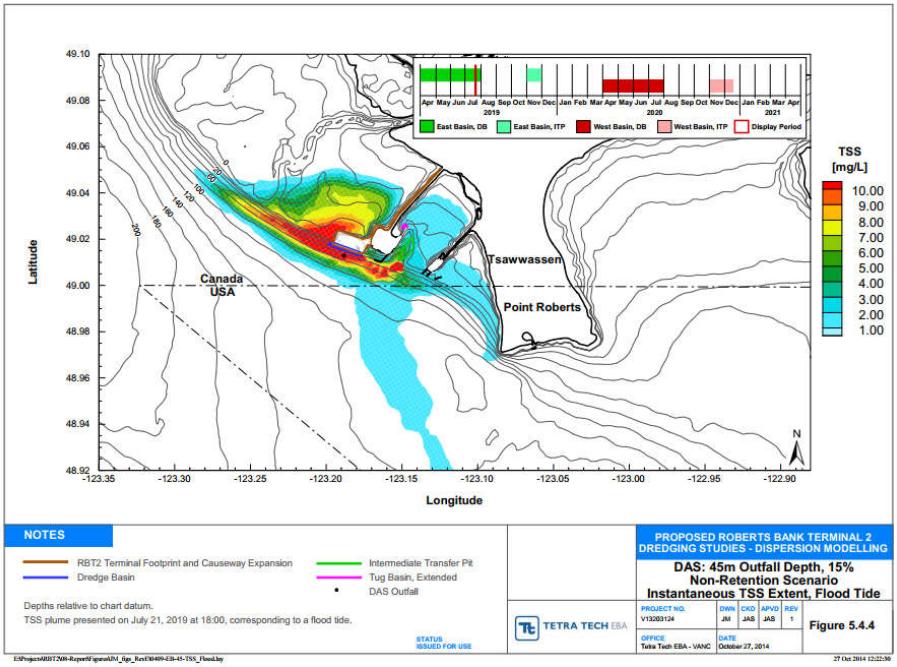


Figure 3.1.6-4 Maximum Predicted TSS Extent from Discharge of Supernatant at -45 m CD Depth for East Dredge Basin Dredgeate, Assuming a Non-retention Rate of 3% during a Flood Tide (Source: EIS Appendix 9.6-C Figure 5.4.12)

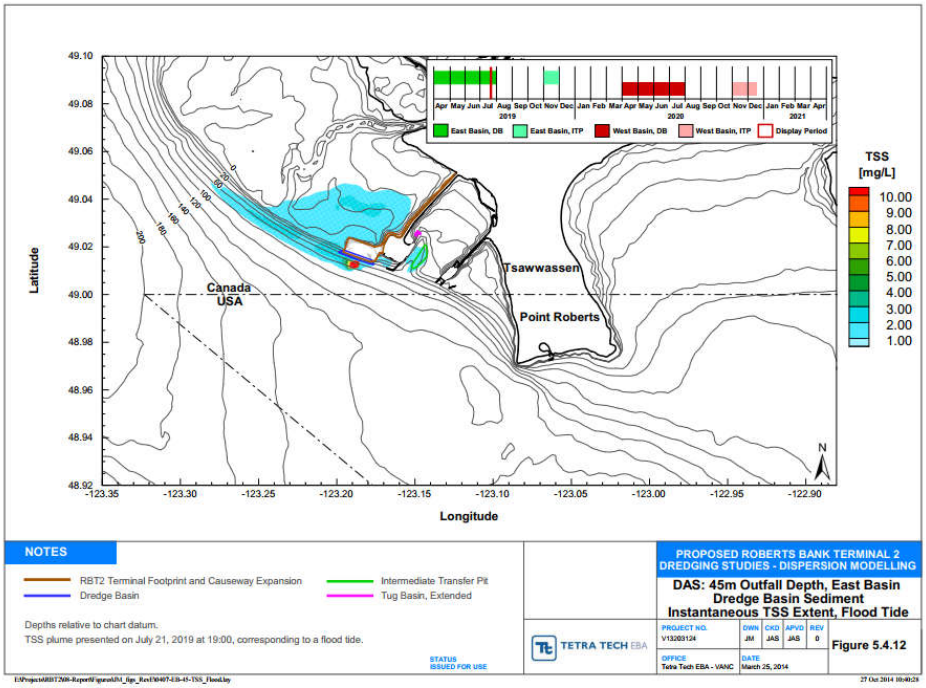


Figure 3.1.6-5 Maximum Predicted TSS Extent from Discharge of Supernatant at -45 m CD Depth for East Dredge Basin Dredgeate, Assuming a Non-retention Rate of 15% during an Ebb Tide (Source: EIS Appendix 9.6-C Figure 5.4.5)

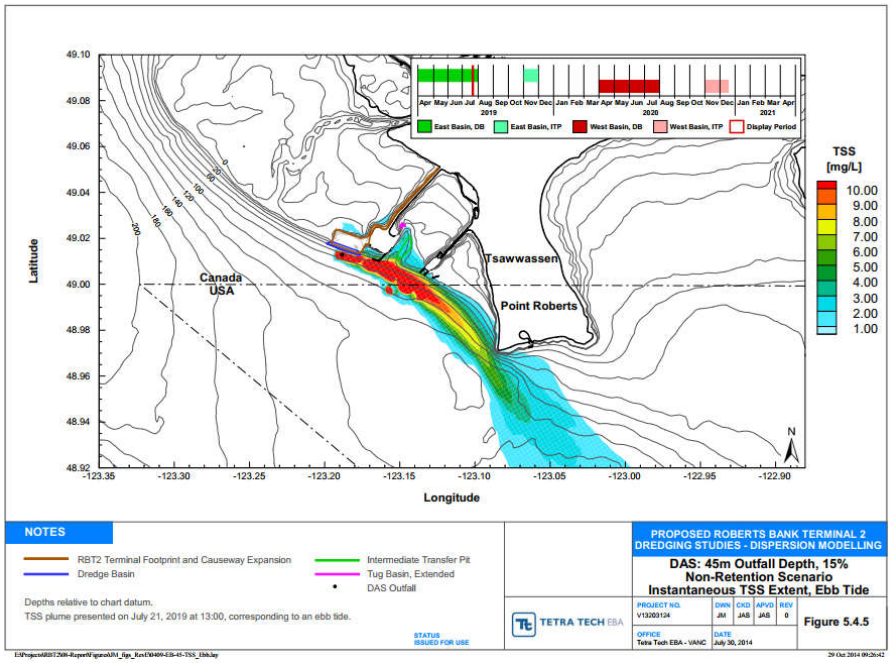
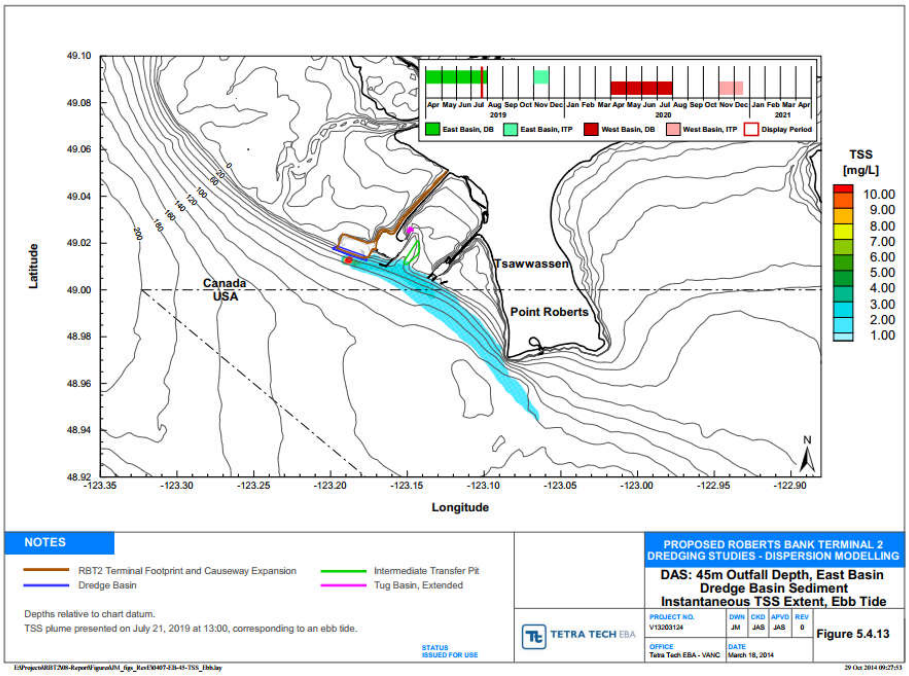


Figure 3.1.6-6 Maximum Predicted TSS Extent from Discharge of Supernatant at -45 m CD Depth for East Dredge Basin Dredgeate, Assuming a Non-retention Rate of 3% during an Ebb Tide (Source: EIS Appendix 9.6-C Figure 5.4.13)



3.1.7 Underwater Noise

The following EIS sections and information requests are relevant to the assessment of underwater noise resulting from the PCU:

- EIS Sections 9.8.5.5 and 9.8.7.1 and EIS Appendix 9.8-A, which describe construction activity scenarios, modelling methods, and predictions of underwater noise generated during Project construction;
- The response to IR5-42 (CEAR Document #1167[21]) describes the types and sizes of support vessels anticipated to be used during construction and clarifies how underwater noise from these support vessels was assessed; and
- The response to IR5-43 (CEAR Document #1153[22]) describes underwater noise from the decommissioning and removal of temporary construction infrastructure, such as barge ramps.

Attachment C1 describes updated RBT2 construction activities; the updated activities that are relevant to the underwater noise effects assessment include the following:

- A third barge ramp is temporarily required adjacent to the west terminal basin to accommodate additional tug-barge deliveries of sand from existing quarries;
- The availability of a local trailing suction hopper dredge (e.g., *FRPD309*) with pump ashore capability allows for terminal basins to be filled with Fraser River sand directly;
- Use of the *FRPD309* thereby eliminates the need for temporary sand storage in the ITP and the associated recovery of Fraser River as well as quarry sand by dredges;
- No marine-based vibro-replacement activities and reduced marine-based vibro-densification activities; and
- An overall net decrease in construction-related vessel traffic throughout the entire construction period due to elimination of dredger trips to the ITP, despite increased tug-barge transport of materials from existing quarries to barge ramps (**Table 2-6**).

Updated underwater noise-construction activity interactions are indicated in **Attachment C2**. Additional information with respect to anticipated changes to underwater noise levels, if any, resulting from each of these updated activities is provided below.

Additional Barge Ramp

A third temporary barge ramp built immediately adjacent to the west basin is expected to require the installation of up to eight temporary piles.

Predicted underwater noise from vibratory and impact pile driving that could occur during the installation of two similar temporary barge ramps adjacent to the east basin was presented

[21] CEAR Document #1167 From the Vancouver Fraser Port Authority to the Review Panel re: Responses to Information Requests IR5-37, IR5-42, IR5-48, IR5-49, IR5-51, IR5-52, IR6-30 and IR8-10 (See Reference Documents #975, #991 and #1071).
[22] CEAR Document #1153 From the Vancouver Fraser Port Authority to the Review Panel re: Responses to Information Requests IR5-02, IR5-11, IR5-13, IR5-17, IR5-18, IR5-22, IR5-25, IR5-26, IR5-27, IR5-43, and IR5-44 (See Reference Document # 975).

in EIS Section 9.8.7.1. These results are representative of the underwater noise that could occur during installation of the third temporary barge ramp. It is important to note that while both underwater noise from vibratory and impact pile driving were modelled and presented in EIS Appendix 9.8-A, these activities will only occur for a short period of time during the installation of the temporary barge ramps and will only occur during daylight hours.

Elimination of the ITP and Use of Pump-ashore Dredge Equipment

With the use of the *FRPD309* (or similar equipment) Fraser River sand will be discharged by the dredger directly into fill areas, eliminating the need for sand storage in, and subsequent sand recovery from the ITP. The elimination of two dredgers recovering sand from the ITP reduces the duration of dredger activity in the local study area by about 16 operating months (see **Table 2-6**).

The *FRPD309* will pump Fraser River sand directly into fill areas from a stationary, anchored position within the dredge basin. At the time of this assessment, no noise source level measurements were available for the *FRPD309*.

Previous modelling was undertaken to predict underwater noise from dredging activity by the cutter suction dredge *Columbia* in the dredge basin (EIS Appendix 9.8-A, Figure A-31) and is used to inform this PCU assessment. Specifically, a qualitative analysis was conducted by JASCO Applied Sciences (Canada) Ltd., who were retained by the VFPA to determine if the *FRPD309* would produce underwater noise levels comparable to those predicted from the *Columbia* in the dredge basin. A surrogate source level measurement (de Jong et al. 2010) of a comparable dredger to the *FRPD309* was compared to the measured source level of the *Columbia*. Source levels of this comparable dredger were generally lower than the loudest construction activities previously modelled, including vibratory piling, vibro-densification, and dredging using the *Columbia* (for more information refer to **Attachment D3**). Underwater noise levels from the *FRPD309* in the dredge basin are therefore not predicted to be greater than the underwater noise levels from the *Columbia* (presented in EIS Appendix 9.8-A) and changes for the assessment of updated construction activities are not required.

Vessel Movements

With the elimination of ITP use and the associated reduction of dredge equipment traffic as a result of using the *FRPD309* in lieu of the *Fraser Titan* to deliver Fraser River sand (i.e., a decrease of 1,056 movements) and an increase of 666 tug-barge movements to deliver sand and rock from existing quarries to the three barge ramps, there is a net reduction of 390 vessels movements (derived from trip data shown in **Table 2-6**) and a re-distribution of vessels between the east and west ramp locations on either end of the terminal basins. Overall, the intensity of traffic in front of the existing terminals would be slightly less.

As stated in IR5-42 (CEAR Document #1167), underwater noise from tug activity during construction is not anticipated to differ from underwater noise from existing vessel movements, including tug activity currently transporting material in the region. As context, Project construction will occur within an established, urban marine port and adjacent waters that are used extensively by marine traffic (i.e., 20,592 vessel movements in 2012 in

Segment A; see Figure IR4-04-A1 of CEAR Document #1051[23], including existing tug traffic), which contribute underwater noise to the acoustic environment. Furthermore, based on measurements of the harbour tug *Seaspan Resolution* (CEAR Document #936[24]), underwater noise produced from tug activity in VFPA jurisdiction during construction is not expected to change existing levels of underwater noise.

Conclusion

The characterisation of underwater noise presented in EIS Section 9.8 is considered sufficient, if not conservative, based on the use of a surrogate source level measurement. Considering the updated construction activities, changes to the conclusions regarding underwater noise presented in EIS Section 9.8 are not required. Overall, although average underwater noise levels during construction may at times exceed average existing levels of underwater noise, they are generally comparable on average.

3.1.8 Population

EIS Section 18.4.8.1 describes the anticipated change in population during the Project construction phase. This analysis considered the predicted direct, indirect, and induced employment from Project construction; the available qualified local labour pool; and estimated local and non-local hiring of construction workers (as described in EIS Section 19.7.2 and EIS Appendix 20-A). This information was used to estimate potential in-migration and associated population change from the Project.

The key determinants of change to the population IC considering the updated construction activities described in **Section 2.0** include the following:

- Change in direct construction employment sourced from outside Metro Vancouver;
- Change in indirect and induced employment sourced from outside Metro Vancouver during the Project construction phase; and
- Revised construction schedule.

The potential changes to non-local direct employment, as well as indirect and induced employment, that could result in in-migration and population change during construction, are discussed below.

The total direct employment during construction is anticipated to nominally increase in relation to that estimated for the EIS, with the changes to construction activities described in **Section 2.0** (as described in **Section 3.2.7**). With the updated construction activities:

- The distribution of construction workers across the construction period would not change from the EIS; and

[23] CEAR Document #1051 From the Vancouver Fraser Port Authority to the Review Panel re: Responses to Information Request Package 4 (See Reference Document #946).
[24] CEAR Document #936 From the Review Panel Secretariat to the Review Panel re: Roberts Bank Terminal 2 Technical Data Report for Underwater Noise - Ship Sound Signature Analysis Study.

- The breakdown of direct construction employment by general occupation category would not change from the EIS.

With updated construction activities a nominal increase in non-local hiring (compared to that estimated in the EIS) for certain specialised construction activities would occur, over a slightly longer construction period. A nominal increase in non-local hiring would result in a nominal increase (compared to that estimated in the EIS) in the estimated number of construction workers that could potentially temporarily in-migrate to Metro Vancouver. However, the overall percentage of direct construction employment expected to be sourced from outside Metro Vancouver (i.e., 5%) would not change from the EIS, and the nominal increase in non-local hiring is not expected to change the conclusion made in the EIS that in-migration during construction will not alter forecasted population growth trends in the local assessment area (LAA).

In the PCU assessment, the total indirect and induced employment during construction is also anticipated to nominally increase (as described in **Section 3.2.6**). This nominally higher indirect and induced employment over a slightly longer construction period is expected to consist of positions that will be able to be filled by Metro Vancouver residents. The conclusions made in EIS Section 19.7.2, indicate that in-migration into Metro Vancouver during construction of the Project, in connection with indirect and induced employment, is not anticipated. This conclusion does not change based on updated construction activities.

Conclusion

In summary, minor changes to direct, indirect, and induced employment during the Project construction phase, and a longer construction schedule, will not alter the findings of the population IC as presented in EIS Section 18.4.

3.2 UPDATED VALUED COMPONENT CONSTRUCTION PHASE ASSESSMENTS

Similar to the assessment of ICs in **Section 3.1**, the focus for the VC effects assessments presented below is on those interactions expected to result in changes to the effects assessment presented in the EIS. As shown in **Attachment C2**, interactions with the marine biophysical VCs (i.e., marine vegetation, invertebrates, fish, and mammals, and coastal birds) and archaeological and heritage resources VC were assessed for each of the updated construction activities, as applicable. For the remaining VCs, activity interactions were aggregated at the construction phase level. For all VCs, information about the nature of any changes from the EIS assessment and assessment conclusions resulting from the updated construction activities are provided, along with supporting rationale.

Attachment C4 summarises the overall changes for each VC assessment with respect to potential effects, mitigation requirements, residual effect characterisation, and significance determination, where applicable.

3.2.1 Marine Vegetation

EIS Section 11.0 describes the anticipated changes both during and following construction of Project components on marine vegetation. The following EIS sections are relevant to the PCU assessment of marine vegetation:

- EIS Table 11-10 identifies potential Project interactions with marine vegetation during the construction phase, and provides a rating for each potential effect from negligible to high along with supporting rationale;
- EIS Section 11.6.1 describes four mechanisms by which the Project interactions listed in EIS Table 11-10 can influence the productivity of marine vegetation, including direct loss and mortality, water quality, sedimentation and coastal processes, and biotic interactions; and
- EIS Sections 11.6.3.1 to 11.6.3.5 document productivity changes, by each of these four mechanisms for each marine vegetation sub-component (i.e., eelgrass, intertidal marsh, macroalgae, biomat, and biofilm).

Attachment C2 presents construction activity-marine vegetation interactions, based on updates to the construction activities summarised in **Attachment C1**. Updated potential effect ratings for the marine vegetation assessment resulting from theses updates are described below, along with any potential implications of a longer construction schedule.

Construction Activity Interactions

Considering the updated construction activities, **Table 3.2.1-1** identifies the activities that are relevant to potential effects to marine vegetation. Of the six updated activities identified in **Table 3.2.1-1**, five activities that are no longer occurring in the marine environment will no longer affect marine vegetation.

The remaining activity of pumping excess water in terminal basin areas to supernatant discharge sites is expected to be negligible, as previously assessed in the EIS. However, as outlined in **Sections 3.1.5** and **3.1.6** the amount of fine material discharged is now assumed to be 3% from all sources, including terminal dredge basin and tug basin dredgeate, and Fraser River and existing quarry sand (i.e., overall 97% retention of fill material during land development); hence, the scenario evaluated in the EIS, which assessed potential effects of TSS concentrations, dispersion, and subsequent sedimentation based on 15% disposal of fines for the dredge basin dredgeate is considered conservative.

Revised Construction Schedule

The extension by eight months to the Project construction phase does not influence the overall ratings of potential effects to marine vegetation provided in EIS Table 11-10 and updated in **Table 3.2.1-1**. This is because individual marine-based activities themselves have been assessed, and the extended schedule resulting from the elimination of the ITP use will not affect these assessments.

Table 3.2.1-1 Updates to the Rating of Potential Effects to Marine Vegetation as a Result of Updated Construction Activities

EIS Project Construction Activity Description	PCU Updated Project Construction Activity Description	EIS Effect Rating[a]	PCU Updated Effect Rating and Supporting Rationale
Marine Terminal			
Vibro-densify native soil at terminal building foundation areas	*Activity eliminated*	Negligible	No effect – activity no longer occurring in the marine environment.
Transport Fraser River sand (and quarry sand if required) to ITP and store	Transport Fraser River sand using a dredge with pump ashore capability and sand from existing quarries via barge to the Project site	Negligible	No effect – underwater sand storage at ITP no longer occurring.
[Install pipelines and] pump excess water in terminal basin areas to disposal at sea (DAS) site	Install pipelines and pump excess water in terminal basin areas to supernatant discharge site	Negligible	Negligible – no change in effect rating, but retention of 97% of dredged material instead of 85% (volume assessed in EIS) will reduce changes associated with suspended sediment dispersion (i.e., changes to TSS concentrations) and deposition.
Vibro-densify [vibro-replace] native soil in dredged area	*Activity eliminated*	Negligible	No effect – activity no longer occurring.
Fill terminal basins to final grade with sand pumped from ITP	Fill terminal basins to final grade with Fraser River sand pumped directly from dredge equipment with pump ashore capability and quarry sand delivered to barge ramps for direct loading	Minor	No effect – pumping of sand from ITP no longer occurring, and there is no marine vegetation in the terminal containment basins where sand fill is deposited.

EIS Project Construction Activity Description	PCU Updated Project Construction Activity Description	EIS Effect Rating[a]	PCU Updated Effect Rating and Supporting Rationale
Expanded Tug Basin			
Dispose of dredge material to DAS site or re-use as general fill	Pump dredge material into terminal containment basin areas	Negligible[b]	No effect – surface disposal of tug basin dredgeate is no longer required. Dredged material will be pumped into terminal containment basin areas directly from a scow. Effects of supernatant discharge is assessed as part of the 'Install pipelines and pump excess water in terminal basin areas to supernatant discharge site' activity above.

Notes: a. Ratings from EIS Table 11-10.
b. EIS rating based on surface disposal of tug basin dredgeate at disposal site.

Conclusion

Overall, Project construction updates reduce the Project footprint and decrease the amount of TSS and sediment deposition generated by Project activities such that potential effects to marine vegetation are expected to decrease in response compared to those presented in the EIS. Hence, with the expected decrease in potential effects from the updated construction activities, the assessment and mitigation measures presented in EIS Sections 11.6 and 11.7 are considered sufficient, if not conservative. The biofilm sub-component of marine vegetation is the only sub-component predicted in the EIS to experience a residual effect[25] during and after the construction phase. Since this sub-component (and all marine vegetation sub-components) will not be adversely affected by the updated construction activities, no changes to the residual effects characterisation or significance determination presented in EIS Sections 11.8 and 11.9, respectively, are required.

3.2.2 Marine Invertebrates

EIS Section 12.0 describes the anticipated changes both during and following construction of the Project on marine invertebrates. The following EIS sections, as well as a construction-related information request, are relevant to this assessment of marine invertebrates:

- EIS Table 12-6 identifies potential Project interactions with marine invertebrates during the construction phase, and provides a rating for each potential effect from negligible to high along with supporting rationale;
- EIS Section 12.6.1 describes five mechanisms by which the Project interactions listed in EIS Table 12-6 can influence the productivity of marine invertebrates, including direct mortality, water quality, sedimentation and coastal processes, habitat availability, and biotic interactions;
- EIS Sections 12.6.3.1 to 12.6.3.4 document productivity changes by each of these five mechanisms for each marine invertebrates sub-component (i.e., infaunal and epifaunal invertebrate communities, bivalve shellfish, Dungeness crabs, and orange sea pens); and
- The response to IR5-04 (submitted to the Review Panel under separate cover) lists the Project activities that have the potential to cause injury/direct mortality to Dungeness crabs and for which salvages are planned.

Attachment C2 presents construction activity-marine invertebrate interactions, based on updates to the construction activities summarised in **Attachment C1**.

Construction Activity Interactions

Considering the updated construction activities, **Table 3.2.2-1** identifies the activities that are relevant to potential effects to marine invertebrates. Potential construction-related effects on marine invertebrates are no longer anticipated for six out of nine updated activities summarised in **Table 3.2.2-1** (rated in EIS Table 12-6 as negligible or minor). To support the conclusions provided in **Table 3.2.2-1** for the activities related to the discharge of

[25] Short-term reversible changes in biofilm assemblage composition (due to salinity), which are similar changes to those that occur naturally, were predicted to be non-significant (EIS Section 11.9).

supernatant and the filling of the terminal basins, additional information is provided below. In addition, the implications of the revised Project construction schedule are also discussed.

Discharge of Supernatant

Pumping of excess water in terminal basin areas to the supernatant discharge sites will remain an interaction with the potential to yield a minor effect. This potential effect rating is conservative since, as outlined in **Sections 3.1.5** and **3.1.6**, the amount of fine material discharged is now assumed to be 3% from terminal dredge basin and tug basin dredgeate, and 2% from Fraser River and existing quarry sand sources. Hence, TSS concentrations and dispersion and subsequent sedimentation based on 15% disposal of fines from dredge basin dredgeate evaluated for potential effects to marine invertebrates in the EIS are conservative.

TSS concentrations, and subsequent sediment deposition, associated with supernatant discharge are not anticipated to exceed ambient conditions (e.g., such as those encountered during spring freshet) in subtidal waters, except in the immediate vicinity of the discharge pipe outlet.

Filling Terminal Basins to Grade

The interaction between marine invertebrate sub-components and the activity of filling terminal basins to final grade has been downgraded from a high potential effect to a minor potential effect, largely based on the elimination of the ITP. Rather than using a bottom-dumping trailing suction hopper dredge (i.e., *Fraser Titan*) to transport Fraser River sand to the Project, a trailing suction hopper dredge with pump-ashore capability (i.e., the *FRPD309*) will be used instead. While the removal of the ITP will lessen the direct mortality and (temporary) loss of habitat availability experienced by marine invertebrate sub-components, initial filling will still result in mortality of individuals within the terminal basins; as such, a rating of 'minor' is warranted. As outlined in the response to IR5-04 (submitted to the Review Panel under separate cover), crab salvages will be conducted after completion of the perimeter dyke and prior to the onset of filling.

Revised Construction Schedule

The extension by eight months to the Project construction phase does not influence the overall ratings of potential effects to marine invertebrates provided in EIS Table 13-6 and Table 3.2.2-1 or change the predicted Project-related productivity losses described and assessed in EIS Sections 12.6 to 12.9. This is because individual marine-based activities themselves have been assessed, and the extended schedule resulting from the elimination of the ITP use will not affect these assessments.

Table 3.2.2-1 Updates to the Rating of Potential Effects to Marine Invertebrates from Updated Construction Activities

EIS Project Construction Activity Description	PCU Updated Project Construction Activity Description	EIS Effect Rating[a]	PCU Updated Effect Rating and Supporting Rationale
Marine Terminal			
Vibro-densify native soil at terminal building foundation areas	*Activity eliminated*	Minor	No effect – activity no longer occurring in the marine environment.
Transport Fraser River sand (and quarry sand if required) to ITP and store	Transport Fraser River sand using a dredge with pump ashore capability and sand from existing quarries via barge to the Project site	Minor	No effect – underwater sand storage at ITP no longer occurring.
Install temporary pipeline between ITP and marine terminal or causeway fill sites	*Activity eliminated*	Minor	No effect – activity no longer occurring.
Install piles and barge ramps	Install piles and three barge ramps	Minor	Minor – potential effect rating has not changed, even though a third temporary barge ramp is proposed to be installed that would require driving of eight additional temporary piles. A minor effect rating is deemed sufficient to assess potential losses in marine invertebrate productivity from the updated construction activity as per rationale provided in the EIS.
[Install pipelines and] pump excess water in terminal basin areas to disposal at sea (DAS) site	Install pipelines and pump excess water in terminal basin areas to supernatant discharge site	Minor	Minor – no change in effect rating, but retention of 97% of fill material from the dredge basin instead of 85% (i.e., volume assessed in EIS) will reduce changes associated with suspended sediment dispersion (i.e., TSS plume) and deposition.
Vibro-densify [vibro-replace] native soil in dredged area	*Activity eliminated*	Minor	No effect – activity no longer occurring.

EIS Project Construction Activity Description	PCU Updated Project Construction Activity Description	EIS Effect Rating[a]	PCU Updated Effect Rating and Supporting Rationale
Fill terminal basins to final grade with sand pumped from ITP	Fill terminal basins to final grade with Fraser River sand pumped directly from dredge equipment with pump ashore capability and quarry sand delivered to barge ramps for direct loading	High	Minor – pumping of sand from ITP is no longer occurring, but filling will result in mortality from burial of marine invertebrate individuals within the basins upon initial filling with dredge basin material and sand from existing quarries.
Expanded Tug Basin			
Dispose of dredge material to DAS site or re-use as general fill	Pump dredge material into terminal containment basin areas.	Minor[b]	No effect – surface disposal of tug basin dredgeate is no longer required. Dredged material will be pumped into terminal containment basin areas directly from a scow. Effects of supernatant discharge is assessed as part of the 'Install pipelines and pump excess water in terminal basin areas to supernatant discharge site' activity above.
Decommissioning of Temporary Construction Infrastructure			
Remove ITP pipelines	*Activity eliminated*	Negligible	No effect – activity no longer occurring.

Notes: a. Ratings from EIS Table 12-6.
b. EIS rating based on surface disposal of tug basin dredgeate at disposal site.

Conclusion

Overall, Project construction changes reduce the Project footprint and decrease the amount of TSS and sediment deposition generated by Project activities such that potential effects to marine invertebrates are expected to decrease in response. Hence, with the expected decrease in potential effects from the updated construction activities, the assessment and mitigation measures presented in EIS Sections 12.6 and 12.7 and the response to IR5-04 (submitted to the Review Panel under separate cover) are considered sufficient, if not conservative. Thus, the assessment of updated Project construction activities yields no changes to the residual effects characterisation or significance determination. As concluded in EIS Section 12.9, the Project is not expected to result in any significant adverse residual effects to marine invertebrates.

3.2.3 Marine Fish

EIS Section 13.0 describes the anticipated changes following construction of the Project on the marine fish, as well as potential changes during construction. The following EIS sections, as well as a construction-related information request, are relevant to this PCU assessment of marine fish:

- EIS Table 13-8 identifies potential Project interactions with marine fish during the construction phase, and provides a rating for each potential effect from negligible to high along with supporting rationale;
- EIS Section 13.6.1 describes seven mechanisms by which Project interactions listed in EIS Table 13-8 can influence the productivity of marine fish, including injury or direct mortality, the acoustic environment, water quality, sedimentation and coastal processes, the light environment, habitat availability, and biotic interactions;
- EIS Sections 13.6.3.1 to 13.6.3.6 document productivity changes, described by these seven effect mechanisms for each marine fish sub-component (i.e., Pacific salmon, reef fish, forage fish, flatfish, and demersal fish); and
- The response to IR5-30 (CEAR Document #1134) clarifies that the potential effect on marine fish from the addition of toe and scour protection rock in the berth pocket is expected to be negligible; information on the nature of the interaction and the effect, as well as rationale for the rating of the effect are also provided.

Attachment C2 presents construction activity-marine fish interactions, based on updates to the construction activities summarised in **Attachment C1**. Considering the updated construction activities, **Table 3.2.3-1** identifies the activities that are relevant to potential effects to marine fish. Of the nine updated activities identified in **Table 3.2.3-1**, the ratings of potential effects on marine fish are as follows:

- Five activities that are no longer occurring in the marine environment or as part of the Project overall will result in no effects on marine fish;
- The activity of transporting Fraser River sand to the Project will result in a minor potential effect; the effect rating remains the same as in the EIS even though material is no longer transported to and stored in the ITP;
- The activity of installing piles and three barge ramps will result in a minor potential effect; the effect rating remains the same as in the EIS even though a third temporary

barge ramp is proposed to be installed that would require driving of eight additional temporary piles;
- The activity of pumping excess water in terminal basin areas to supernatant discharge sites will result in a negligible potential effect (changed from minor in the EIS); and
- The activity of direct filling of terminal basins to final grade with Fraser River sand and quarry sand will result in a minor potential effect (changed from moderate in the EIS).

Additional information is provided below regarding the discharge of supernatant and use of dredge with pump-ashore capability to support the conclusions provided in **Table 3.2.3-1**. In addition, the implications of the revised Project schedule are also discussed.

Discharge of Supernatant

Pumping excess water in terminal basin areas to the supernatant discharge sites is predicted to result in a negligible change to marine fish productivity (see **Table 3.2.3-1**), as opposed to a minor change in EIS Table 13-8. The minor rating in the EIS was influenced primarily by predicted effects on flatfish from 1) changes in water quality associated with the discharge of approximately 15% of dredge basin dredged material and 2) sedimentation following surface disposal of the tug basin dredgeate at the Project's discharge site. For all other marine fish sub-components, the effect was rated in the EIS as negligible.

As outlined in **Sections 3.1.5** and **3.1.6**, the amount of fine material discharged is now assumed to be 3% from terminal dredge basin and tug basin dredgeate, and 2% from Fraser River and existing quarry sand sources; hence, TSS concentrations and dispersion and subsequent sedimentation based on 15% disposal of fines from dredge basin dredgeate evaluated for potential effects to marine fish in the EIS are conservative as all fish sub-components are predicted to be negligibly affected.

Use of Dredge with Pump-ashore Capability

The assessment (presented in EIS Section 13.6.3) of behavioural effects to marine fish from continuous underwater noise generated during Project construction is considered sufficient and no change is proposed in the rating of underwater noise related effects to marine fish. Specifically, a trailing suction hopper dredge with pump-ashore capability (i.e., the *FRPD309*) will be used instead of a bottom-dumping trailing suction hopper dredge (i.e., the *Fraser Titan*) to transport Fraser River sand to the Project.

Source levels for the *FRPD309* pumping ashore were assessed (using surrogates, as outlined in **Section 3.1.7**, and **Attachment D3**) and compared to source levels presented in EIS Appendix 9.8-A for continuous noise activities, namely cutter suction dredging (i.e., via the *Columbia*), vibro-densification, and vibratory piling. Analysis results show that underwater noise levels from *FRPD309* while pumping ashore are comparable to those of cutter suction dredging and vibro-densification activities, and lower than vibratory piling, and would not exceed behavioural thresholds for marine fish. In addition, with the elimination of two dredgers operating in the ITP (see **Table 2-6**), the duration of dredger activity in the local assessment area is reduced by approximately 16 operating months.

Revised Construction Schedule

The extension by eight months to the Project construction phase does not influence the overall ratings of potential effects to marine fish provided in EIS Table 13-8 and in **Table 3.2.3-1**, or change the predicted Project-related productivity losses described and assessed in EIS Sections 13.6 to 13.9. This is because individual marine-based activities themselves have been assessed, and the extended schedule resulting from the elimination of the ITP use will not affect these assessments.

Conclusion

Overall, changes associated with the updated construction activities reduce the Project footprint and decrease the amount of continuous underwater noise and TSS generated by Project activities, such that potential effects to marine fish are expected to decrease in response. Hence, with the expected decrease in potential effects from the updated construction activities, the assessment and mitigation measures presented in EIS Sections 13.6 and 13.7, respectively, are considered sufficient, if not conservative. Considering the updated Project construction activities, changes to the residual effects characterisation or significance determination for predicted Project-related losses in productivity (as documented in EIS Section 13.8 and 13.9), therefore, are not required. The Project is not expected to result in any significant adverse residual effects to marine fish.

Table 3.2.3-1 Updates to the Rating of Potential Effects to Marine Fish from Updated Construction Activities

EIS Project Construction Activity Description	PCU Project Construction Activity Description	EIS Effect Rating[a]	PCU Updated Effect Rating and Supporting Rationale
Marine Terminal			
Vibro-densify native soil at terminal building foundation areas	*Activity eliminated*	Minor	No effect – activity no longer occurring in the marine environment.
Transport Fraser River sand (and quarry sand if required) to ITP and store	Transport Fraser River sand using a dredge with pump ashore capability and sand from existing quarries via barge to the Project site	Minor	Minor – potential effect rating has not changed, even though the ITP no longer required for underwater sand storage; potential to decrease productivity through acoustic disturbance from continuous noise generated during movements of construction vessels.
Install temporary pipeline between ITP and marine terminal or causeway fill sites	*Activity eliminated*	Minor	No effect – activity no longer occurring.
Install piles and barge ramps	Install piles and three barge ramps	Minor	Minor – potential effect rating has not changed, even though a third temporary barge ramp is proposed to be installed that would require driving of eight additional temporary piles. A minor effect rating is deemed sufficient to assess potential losses in marine fish productivity from the updated construction activity as per rationale provided in the EIS.
[Install pipelines and] pump excess water in terminal basin areas to disposal at sea (DAS) site	Install pipelines and pump excess water in terminal basin areas to supernatant discharge site	Minor	Negligible – change in the effect rating from minor to negligible applies to flatfish only. For all other marine fish sub-components, effect rating remains negligible as per EIS rationale, that TSS concentrations associated with unsettled fines in supernatant discharge are not anticipated to exceed ambient conditions characteristic of high flows (spring freshet) in subtidal waters, except in the immediate vicinity of the discharge pipe outlet.
Vibro-densify [vibro-replace] native soil in dredged area	*Activity eliminated*	Minor	No effect – activity no longer occurring.

EIS Project Construction Activity Description	PCU Project Construction Activity Description	EIS Effect Rating[a]	PCU Updated Effect Rating and Supporting Rationale
Fill terminal basins to final grade with sand pumped from ITP	Fill terminal basins to final grade with Fraser River sand pumped directly from dredge equipment with pump ashore capability and quarry sand delivered to barge ramps for direct loading	Moderate	Minor – pumping of sand from ITP no longer occurring. Potential loss in marine fish productivity is predicted from acoustic disturbance associated with underwater noise generated during the operation of pumping equipment and through burial upon initial filling with dredge basin material and sand from existing quarries.
Expanded Tug Basin			
Dispose of dredge material to DAS site or re-use as general fill	Pump dredge material into terminal containment basin areas	Minor	No effect – surface disposal of tug basin dredgeate is no longer required. Dredged material will be pumped into terminal containment basin areas directly from a scow. Effects of supernatant discharge is assessed as part of the 'Install pipelines and pump excess water in terminal basin areas to supernatant discharge site' activity above.
Decommissioning of Temporary Construction Infrastructure			
Remove ITP pipelines	*Activity eliminated*	Negligible[b]	No effect – activity no longer occurring.

Notes: a. Ratings from EIS Table 13-8.
b. EIS rating based on surface disposal of tug basin dredgeate at disposal at sea site.

3.2.4 Marine Mammals

EIS Section 14.0 describes the anticipated changes following construction of the Project on marine mammals, as well as potential changes during construction. The following EIS sections and appendices, as well as construction-related information requests, are relevant to this PCU assessment of marine mammals:

- EIS Table 14-8 identifies potential Project interactions with marine mammals during the construction phase, and provides a rating for each potential effect from negligible to high along with supporting rationale;
- EIS Section 14.6 describes mechanisms by which the Project construction interactions listed in EIS Table 14-8 can potentially influence each representative marine mammal species;
- EIS Section 9.8.7.1 describes underwater noise generated during the construction phase;
- EIS Appendix 14-D describes the exposure of southern resident killer whales (SRKW) to historical polychlorinated biphenyl (PCB) contamination associated with DAS activities during construction;
- IR5-37 (CEAR Document #1167) describes the potential for contaminants other than PCBs to result in adverse effects to marine mammals;
- IR5-42 (CEAR Document #1167) describes the types and sizes of vessels expected to be required to support Project construction and how potential effects to marine mammals from underwater noise from these support vessels were considered in the EIS;
- IR5-43 (CEAR Document #1153) describes potential effects to marine mammals from underwater noise from the decommissioning and removal of temporary construction infrastructure;
- IR5-49 (CEAR Document #1167) describes mitigation measures proposed for implementation during the construction period to avoid and/or reduce potential effects from underwater noise to marine mammals; and
- IR5-51 (CEAR Document #1167) describes mitigation measures proposed for implementation during the construction period (and operation period) to reduce and/or avoid potential effect from vessel strikes to marine mammals.

Attachment C2 presents construction activity-marine mammal interactions based on updates to construction activities summarised in **Attachment C1**. Considering the updated construction activities, **Table 3.2.4-1** identifies the activities that are relevant to potential effects to marine mammals. Of the nine activities identified in **Table 3.2.4-1**, the ratings of potential effects on marine mammals are as follows:

- Five activities that are no longer occurring in the marine environment or as part of the Project overall will no longer have the potential to affect marine mammals; and
- Four activities (transportation of sand to the Project site, installation of piles and barge ramps, installation of pipelines and the discharge of supernatant from basin areas, and filling of terminal basins) are expected to result in the same level of potential effects; additional information for each effect mechanisms is provided below to support the effect ratings and conclusions for these activities.

The implications of the revised Project schedule are also discussed below.

Underwater Noise

As stated in EIS Section 14.6, potential effects to marine mammals during construction activities were assessed based on underwater noise modelling results for vibro-densification, impact and vibratory pile driving, and dredging activities (described in EIS Section 9.8.7.1). For the updated construction activities, the EIS assessment is considered sufficient or conservative for the following reasons:

- With reduced marine-based vibro-densification, potential effects to representative marine mammal species described in the EIS reflect a conservative prediction;
- Underwater noise occurring during installation of a third barge ramp, which includes vibratory and impact pile driving, will be similar to the potential effects to marine mammals assessed in the EIS for the other two barge ramps; and
- As stated in **Section 3.1.7**, sand being pumped via the dredger *FRPD309* while anchored near the terminal is not predicted to result in underwater noise levels greater than the predicted underwater noise levels generated from dredging activities by the dredger *Columbia* (**Attachment D3**). Therefore, underwater noise from *FRPD309* pumping is not expected to exceed behavioural effects predicted in EIS Section 14.6.

With the elimination of ITP use, there is a net reduction of 390 vessel movements and 16 operating months for dredgers over the construction period (**Table 2-6**). As indicated in IR5-42 (CEAR Document #1167), the contributions of construction support vessels to underwater noise—and associated effects to marine mammals—were qualitatively assessed as minor and this conclusion will not change with the updated construction activities.

Overall, underwater noise from support vessels is expected to be comparable to levels of underwater noise from existing marine vessels, including tug/barge activity currently transporting material in the region. Project construction will occur adjacent to operational terminals at Roberts Bank (i.e., Deltaport, Westshore, and BC Ferries), and existing marine traffic (e.g., 20,592 vessel movements in Segment A in 2012[26]) with existing contributions of underwater noise to the acoustic environment and potential effects to marine mammals.

With the implementation of proposed mitigation measures during construction, as described in EIS Section 14.7.1.1 and additional measures proposed in IR5-49 (CEAR Document #1167), no detectable or measurable residual adverse effects from underwater noise during Project construction over and beyond existing conditions are predicted for marine mammals.

Sediment and Water Quality

Project construction activities will result in sediment re-suspension or discharge, leading to increases in turbidity and TSS and subsequent sediment deposition. There is concern that these activities may also disturb historical deposits of sediment-bound contaminants that, when or if re-suspended, may be ingested and magnified through the food chain, ultimately

[26] See response to IR4-04 in CEAR Document #1051.

adversely affecting the health of marine mammals. As stated in **Section 3.1.5**, and concluded in EIS Sections 9.6.6.3 and 9.6.10, changes in sediment contaminant concentrations are not expected as sediment that will be re-suspended and deposited as a result of construction activities, including updated construction activities, are not contaminated. The modelling and conclusions presented in EIS Section 14.6.1.4 and EIS Appendix 14-D are considered conservative; contamination risk for marine mammals is still considered negligible.

Availability of Prey

As stated in EIS Section 14.6.1.3, residual effects relating to productivity losses due to construction of the terminal are expected for some invertebrates (i.e., bivalve shellfish, Dungeness crab) and fish (i.e., forage fish, flatfish) sub-components, but were determined to be minor and not significant. The updated construction activities are predicted to reduce potential effects (see **Sections 3.2.2** and **3.2.3**). The updated construction activities, therefore, are not anticipated to change the quantity, quality, or distribution of prey species or marine mammal foraging. After the implementation of mitigation measures (described in EIS Section 13.7 and **Attachment C4**), effects to the availability of marine mammal prey, including Chinook salmon, are still considered negligible.

Vessel Strikes

With the net reduction of 390 construction vessel movements due to the updated construction activities, a construction-related vessel striking a marine mammal within VFPA jurisdiction and resulting in injury or mortality is very low and would not result in population-level effects. The EIS assessment conclusion of no residual effect remains the same.

Revised Construction Schedule

The extension by eight months to the Project construction phase does not influence the overall ratings of potential effects to marine mammals provided in EIS Table 14-8 and the updates provided in **Table 3.2.4-1**. This is because individual marine-based activities themselves have been assessed, and the extended schedule resulting from the elimination of the ITP use will not affect these assessments.

Conclusion

Overall, changes associated with updates to the Project construction activities (summarised in **Table 3.2.4-1**) decrease the amount of underwater noise and TSS generated by Project activities, such that potential effects to marine mammals are expected to decrease in response compared to those described in the EIS. Hence, the assessment and mitigation measures presented in EIS Section 14.7 are considered sufficient, if not conservative. No changes to the residual effects characterisation or significance determination, therefore, is required based on the updated construction activities.

Table 3.2.4-1 Updates to the Rating of Potential Effects to Marine Mammals from Updated Construction Activities

EIS Project Construction Activity Description	PCU Project Construction Activity Description	EIS Effect Rating[a]	PCU Updated Effect Rating and Supporting Rationale
Marine Terminal			
Vibro-densify native soil at terminal building foundation areas	*Activity eliminated*	Moderate	No effect – activity no longer occurring in the marine environment.
Transport Fraser River sand (and quarry sand if required) to ITP and store	Transport Fraser River sand using a dredge with pump ashore capability and sand from existing quarries via barge to the Project site.	Minor	Minor – potential effect rating has not changed, even though the ITP is no longer required for underwater sand storage; potential for construction vessel movements to result in behavioural disturbance or acoustic masking from continuous underwater noise and potential physical disturbance (i.e., vessel strike) resulting in injury or mortality.
Install temporary pipeline between ITP and marine terminal or causeway fill sites	*Activity eliminated*	Minor	No effect – activity no longer occurring.
Install piles and barge ramps	Install piles and three barge ramps	Moderate	Moderate – potential effect rating has not changed, even though a third temporary barge ramp will likely require eight additional temporary piles to be driven. A moderate effect rating is deemed sufficient to assess potential behavioural disturbance or acoustic masking from this activity as behavioural effects may occur but are not expected to affect individual or population health.
[Install pipelines and] pump excess water in terminal basin areas to disposal at sea (DAS) site	Install pipelines and pump excess water in terminal basin areas to supernatant discharge site	Negligible	Negligible – potential effect rating has not changed, although the volume of material to be discharged has decreased by 66% compared to EIS volume assessed. Potential changes to the availability of prey from changes in fish habitat quality and quantity and potential changes to water and sediment quality resulting in adverse health effects from potential re-distribution of contaminants in sediments (i.e., PCBs) are expected to be negligible.

EIS Project Construction Activity Description	PCU Project Construction Activity Description	EIS Effect Rating[a]	PCU Updated Effect Rating and Supporting Rationale
Vibro-densify [vibro-replace] native soil in dredged area	*Activity eliminated*	Moderate	No effect – activity no longer occurring.
Fill terminal basins to final grade with sand pumped from ITP	Fill terminal basins to final grade with Fraser River sand pumped directly from dredge equipment with pump ashore capability and quarry sand delivered to barge ramps for direct loading.	Moderate	Moderate – pumping of sand from ITP is no longer occurring, but the potential effect rating has not changed. A moderate effect rating is deemed sufficient to assess potential behavioural disturbance or acoustic masking from acoustic disturbance associated with underwater noise generated during the operation of pumping equipment on the *FRPD309*.
Expanded Tug Basin			
Dispose of dredge material to DAS site or re-use as general fill	Pump dredge material into terminal containment basin areas.	Negligible[b]	No effect – surface disposal of tug basin dredgeate is no longer required, and the potential effects of supernatant discharge are assessed as part of the 'Install pipelines and pump excess water in terminal basin areas to supernatant discharge site' activity above.
Decommissioning of Temporary Construction Infrastructure			
Remove ITP pipelines	*Activity eliminated*	Negligible	No effect – activity no longer occurring.

Notes: a. Ratings from EIS Table 14-8.
b. EIS rating based on surface disposal of tug basin dredgeate at disposal at sea site.

3.2.5 Coastal Birds

EIS Section 15.0 describes the anticipated changes following construction of the Project on coastal birds, as well as potential changes during construction. The following EIS sections are relevant to this PCU assessment of coastal birds:

- EIS Table 15-7 identifies potential Project interactions with coastal birds during the construction phase, and provides a rating for each potential effect from negligible to high along with supporting rationale;
- EIS Section 15.7.2.1 describes five effect mechanisms by which Project interactions listed in Table 15-7 can influence the productivity of coastal birds, including effects from changes to habitat quantity, noise and visual disturbance, direct mortality from vehicles, artificial lighting, and biotic and abiotic interactions; and
- EIS Sections 15.7.2.2 to 15.7.2.8 document productivity changes, described by these five effect mechanisms for each coastal bird sub-component (i.e., shorebirds, waterfowl, herons, diving birds, raptors, gulls and terns, and passerines).

Attachment C2 presents construction activity-coastal bird interactions, based on the updated construction activities summarised in **Attachment C1**. Considering the updated construction activities, **Table 3.2.5-1** identifies the activities that are relevant to potential effects to coastal birds. Of the 15 updated activities identified in **Table 3.2.5-1**, the ratings of potential effects on coastal birds are as follows:

- Four activities that are no longer occurring in the marine environment or as part of the Project overall will no longer affect coastal birds;
- Nine activities are expected to result in the same level of potential effects;
- One activity (filling terminal basins to final grade with Fraser River sand) is expected to reduce potential effects; and
- One activity (constructing the RBT2 overpass, including piling and vibro-replacement activities) is expected to increase potential effects.

Additional information for each effect mechanism is provided below to support the effect ratings and conclusions for these activities presented in **Table 3.2.5-1**. The implications of the revised Project schedule are also discussed below.

Water Quality

Project construction activities will result in sediment re-suspension or sediment discharges, leading to increases in turbidity and TSS and subsequent sediment deposition. There is concern that these activities may also cause the following changes:

1) Disturb historical deposits of sediment-bound contaminants that, when or if, re-suspended, may be ingested and magnified through the food chain, ultimately adversely affecting the health of coastal birds; and
2) Reduce access to foraging habitat availability and foraging efficiency in vicinity of the discharge location due to elevated TSS levels.

The potential for the re-suspension of sediments and pumping of excess water in terminal basins to the supernatant discharge sites[27] to affect coastal birds was predicted to be negligible in the EIS (EIS Section 15.7). This assessment was based on a number of factors, including the following:

- Sediment in areas that will be re-suspended are not considered contaminated (**Section 3.1.5**);
- Concentrations of TSS were modelled to be largely within the ambient range naturally occurring in the LAA (**Section 3.1.6**); and
- There is limited spatial overlap between coastal bird use and discharge pipe locations as very few species dive to -45 m CD depth.

As the amount of dredging will be reduced by 530,000 m^3 (**Section 2.2**) and the volume of sediment requiring discharge reduced by 66% (**Section 3.1.5**) the conclusions presented in EIS Section 15.7 are considered adequate, and effects to coastal birds from potential contamination risk or elevated TSS or turbidity levels are expected to remain negligible.

Direct Mortality and Physical Injury from Marine Vessels

As stated in EIS Section 15.7.1.6, effects related to productivity loss due to direct mortality and physical injury from marine vessels during construction of the terminal are considered negligible. This conclusion was based on the lack of the use of lighting by vessels associated with the existing terminals that has been documented to contribute to bird-vessel collisions, and the lack of verbal or written documentation of a single bird-vessel collision occurring at Westshore Terminals and Deltaport Terminal since inception of operation in 1970 and 1997, respectively. If collisions do occur, they likely occur in very low numbers.

With the elimination of ITP use, and use of the larger *FRPD309* dredger in lieu of the *Fraser Titan* to deliver Fraser River sand, plus the additional tugs and barges to deliver quarry sand, there is a net reduction of 390 vessel movements and 16 operating months for dredgers over the construction period. Additionally, as detailed in EIS Sections 15.8 and 33.3.9, vessel traffic will be restricted to designated areas in the vicinity of the Project, which should reduce the potential for bird-vessel interactions. If bird-vessel collisions do occur within the LAA, these changes and measures will likely reduce the potential for effects. Therefore, the conclusions presented in EIS Section 15.7 are considered valid; effects related to productivity loss due to direct mortality and physical injury from marine vessels are expected to remain negligible.

Noise and Other Disturbance

Overall, effects from acoustic and visual disturbance adjacent to the Project area during construction are considered minor (EIS Section 15.7). This conclusion was based on several factors, including the following:

[27] Referred to in the EIS as DAS sites. For further information, refer to **Section 3.1.5**.

- Apparent habituation of each sub-component, with the exception of barn owl, to existing disturbance associated with the operating Deltaport, Westshore, and BC Ferries terminals;
- An assessment of seasonal bird distribution and abundance data within the LAA to investigate potential spatial and temporal overlap with construction activities;
- Documented behavioural responses and habituation by coastal birds associated with the Deltaport Third Berth construction that would likely be similar to RBT2 construction; and
- An evaluation of reported coastal bird responses to underwater and above ground noise levels in association with sound attenuation data indicating coastal birds would possibly initiate a flight response within 60 m to 100 m of construction activities.

With the exception of updated activities associated with RBT2 overpass construction, the assessment of effects to coastal birds from acoustic and visual disturbance presented in EIS Section 15.7 is considered sufficient for the updated construction activities and potential effects due to disturbance are expected to remain minor (**Table 3.2.5-1**).

The rating of potential effects from overpass construction on coastal birds in the EIS was negligible, as disturbance to coastal birds using the marine environment was judged to be minimal based on the conceptual design. The preliminary overpass design described in **Section 2.5** requires approximately 86 steel pipe piles to be driven from land to El.-20 m CD. Diesel-powered impact (hammer) pile driving is likely to produce the loudest impulsive noise levels of all construction activities and may be used for the final set and blow count testing, as outlined in **Section 2.5**. This activity, therefore, has the highest potential to elicit a flight response in coastal birds. Abrupt noise >85 dBA has been documented to cause birds to flee an area, potentially having productivity consequences.

Atmospheric noise levels (L_{max}) emitted from diesel-powered pile driving were modelled (**Attachment D2**) to determine sound levels at 10 m intervals from pile driving and were evaluated to determine at what distances impulsive sound would be ≥85 dBA. Atmospheric noise levels are anticipated to range from 108 dBA at 10 m from piling to 88 dBA at 100 m from piling. Noise levels at distances ≥140 m from piling are predicted to be ≤85 dBA. Therefore, the likelihood of coastal birds encountering impulsive noise >85 dBA is low from this activity, because of the small area requiring piling and large size of the LAA providing suitable habitat to birds. Physical injuries to coastal birds are considered unlikely as noise levels are below injury thresholds (i.e., 140 dBA for single blasts and 125 dBA for multiple blasts) (Dooling and Popper 2007). Also, interactions between coastal birds and impact piling is considered limited, because activities will be temporary and localised. Coastal birds are highly mobile and anticipated to move to more suitable sites in the LAA if disturbed. However, based on the potential use of diesel-powered piling to construct the overpass, the potential effect rating associated with overpass construction was modified from negligible to minor.

Artificial Lighting

As stated in **Section 3.1.3**, Project light emissions are not anticipated to change from the updated construction activities; therefore, the conclusions concerning effects of artificial light on coastal birds remain the same as those presented in the EIS.

Direct Mortality from Vehicles

Road traffic levels are not changing as a result of the updated construction activities; however, the number of pieces of equipment operating at any one time are expected to decrease for a peak day scenario, as documented in Table 1 of **Attachment D1**. Therefore, the conclusions concerning potential mortalities from interactions between coastal birds and vehicles remain the same as those presented in the EIS.

Biotic and Abiotic Interactions

The assessment of potential effects to coastal birds from changes in biotic and abiotic interaction with each VC sub-component during Project construction presented in the EIS is considered sufficient and no changes to potential effect ratings are proposed. This conclusion was informed by the assessment conclusion of no additional changes from the updated construction activities for light (**Section 3.1.3**), coastal geomorphology (**Section 3.1.4**), marine water quality (**Section 3.1.6**), and that the potential effects to marine vegetation (**Section 3.2.1**), marine invertebrates (**Section 3.2.2**), and marine fish (**Section 3.2.3**) are expected to slightly decrease.

Revised Construction Schedule

The extension by eight months to the Project construction phase does not influence the overall ratings of potential effects to coastal birds provided in EIS Table 15-7 and in **Table 3.2.5-1** or change the predicted Project-related productivity changes described and assessed in EIS Section 15.7. This is because individual land- and marine-based activities themselves have been assessed, and the extended schedule resulting from the elimination of the ITP use will not affect these assessments.

Conclusion

Changes associated with the updated construction activities decrease the number of vessel movements and dredger operating hours required to construct the Project, and the amount of suspended sediment generated by construction activities, while leaving coastal geomorphology, traffic volume, light, and noise and vibration largely unchanged. Considering the updated construction activities, mitigation measures presented in EIS Sections 15.8 are considered sufficient to reduce or eliminate effects potentially arising from construction activities. As the residual effects from the Project construction update are not anticipated to change from those described in the EIS assessment, changes to the residual effects characterisation or significance determination are not required. The Project is not expected to result in any significant adverse residual effects to coastal birds.

Table 3.2.5-1 Updates to the Rating of Potential Effects to Coastal Birds from Updated Construction Activities

EIS Project Construction Activity Description	PCU Project Construction Activity Description	EIS Effect Rating[a]	PCU Updated Effect Rating and Supporting Rationale
Marine Terminal			
Vibro-densify native soil at terminal building foundation areas	*Activity eliminated*	Negligible	No effect – activity no longer occurring in the marine environment.
Transport Fraser River sand (and quarry sand if required) to ITP and store	Transport Fraser River sand using a dredge with pump ashore capability and sand from existing quarries via barge to the Project site	Moderate	Moderate – potential effect rating has not changed even though the ITP is no longer required for underwater sand storage. The following effect mechanisms no longer influence the effect rating: direct mortality (burial) of marine invertebrates fed on by diving birds and change in water quality potentially affecting foraging efficiency. Potential to decrease productivity through acoustic disturbance and restricting access to habitats.
Install temporary pipeline between intermediate transfer pit (ITP) and marine terminal or causeway fill sites	*Activity eliminated*	Negligible	No effect – activity no longer occurring.
Install piles and barge ramps	Install piles and three barge ramps	Minor	Minor – potential effect rating has not changed, even though a third temporary barge ramp will likely require eight additional temporary piles to be driven. Potential to decrease productivity primarily through 1) changes in habitat quality and access to diving bird food through acoustic disturbance from underwater and atmospheric noise disturbance; and 2) potential injury from impulsive noise if birds are adjacent to active pile driving.

EIS Project Construction Activity Description	PCU Project Construction Activity Description	EIS Effect Rating[a]	PCU Updated Effect Rating and Supporting Rationale
Transport aggregate, rip-rap, and sand from existing quarries to barge ramps	Transport aggregate, rip-rap, and sand from existing quarries to barge ramps	Minor	Minor – potential effect rating has not changed, although there is a net decrease of 390 vessel movements during construction (**Table 2-6**). Potential to decrease productivity through changes in habitat quality and access to diving bird food through acoustic disturbance, potential mortality due to collision with marine vessels, and increased diving bird and waterfowl energy expenditures through disturbance from vessel traffic.
[Install pipelines and] pump excess water in terminal basin areas to disposal at sea (DAS) site	Install pipelines and pump excess water in terminal basin areas to supernatant discharge site	Minor	Minor – potential effect rating has not changed, although the volume of sediment requiring discharge has been reduced by 66%. Potential to decrease productivity through reduced access to foraging habitat availability and foraging efficiency in vicinity of the discharge.
Vibro-densify [vibro-replace] native soil in dredged area	*Activity eliminated*	Minor	No effect – activity no longer occurring.
Fill terminal basins to final grade with sand pumped from ITP	Fill terminal basins to final grade with Fraser River sand pumped directly from dredge equipment with pump ashore capability and quarry sand delivered to barge ramps for direct loading	High	Minor – Pumping of sand from ITP will not be occurring. Potential to decrease productivity through restricting access to habitats through acoustic disturbance.
Preload east basin with sand from ITP, then vibro-densify dyke and compact sand	Preload east basin with Fraser River sand pumped directly from dredge equipment with pump ashore capability and quarry sand delivered to barge ramps for direct loading, then vibro-replace native material underneath dyke and compact sand	Minor	Minor – potential effect rating has not changed, even though use of the ITP has been eliminated. As with EIS assessment, there is the potential to decrease productivity through acoustic disturbance near vibro-replacement activities. Displacement is likely to be temporary and restricted to areas close to anchored dredge vessel and vibro-replacement activities.

EIS Project Construction Activity Description	PCU Project Construction Activity Description	EIS Effect Rating[a]	PCU Updated Effect Rating and Supporting Rationale
Preload west basin with sand from ITP and preload material from east basin, then vibro-densify dyke and compact sand	Preload west basin with Fraser River sand pumped directly from dredge equipment with pump ashore capability and quarry sand delivered to barge ramps for direct loading, then vibro-replace native material underneath dyke and compact sand	Minor	Minor – potential effect rating has not changed, even though use of the ITP has been eliminated. As with EIS assessment, there is the potential to decrease productivity through acoustic disturbance near vibro-replacement activities. Displacement is likely to be temporary and restricted to areas close to anchored dredge vessel and vibro-replacement activities.
Fill apron area with basin and causeway preload material; vibro-densify closure dykes and compact sand	Fill apron with basin and causeway preload material; vibro-replace closure dykes and compact sand	Minor	Minor – potential effect rating has not changed, with the substitution of vibro-replacement versus vibro-densification. Potential to decreased productivity through acoustic disturbance near vibro-replacement activities. Displacement is likely to be temporary and restricted to areas close to vibro-replacement activities.
Widened Causeway			
Construct RBT2 overpass; install new road from RBT2 overpass to RBT2 terminal and pave	Construct RBT2 overpass including piling and vibro-replacement; install new road from RBT2 overpass to RBT2 terminal and pave	Negligible	Minor – potential effect rated as minor due to the installation of piles to support overpass and potential to decrease productivity through acoustic disturbance. Displacement is likely to be temporary and restricted to areas close to active pile driving.

EIS Project Construction Activity Description	PCU Project Construction Activity Description	EIS Effect Rating[a]	PCU Updated Effect Rating and Supporting Rationale
Expanded Tug Basin			
Dispose of dredge material to DAS site or re-use as general fill	Transport material via scow barge to terminal and pump dredge material into containment basins	Negligible	Negligible – potential effect rating has not changed as potential to decrease productivity through increases in visual and acoustic disturbance will be limited (i.e., activities will be temporary and localised). Coastal birds are highly mobile and anticipated to move to more suitable sites in LAA if disturbed. Discharge of supernatant from containment basins assessed as a potential minor effect under activity 'pump excess water in terminal basin areas to supernatant discharge site' above.
Decommissioning of Temporary Construction Infrastructure			
Remove ITP pipelines	*Activity eliminated*	Negligible	No effect – activity no longer occurring.
Remove temporary piles at barge ramps, ramps, pivot ramp abutments, and navigation markers	An additional barge ramp requires removal.	Negligible	Negligible – potential effect rating has not changed, even though an additional barge ramp and piles require removal. Potential to decrease productivity through disturbance. Displacement is likely to be temporary and restricted to areas close to pile and ramp removal.

Notes: a. Ratings from EIS Table 15-7.

3.2.6 Ongoing Productivity of Commercial, Recreational, and Aboriginal Fisheries

EIS Section 16.0 describes the effects of the Project on the ongoing productivity of commercial, recreational, and Aboriginal (CRA) fisheries. For the purposes of evaluating changes resulting from the updated construction activities described in **Section 2.0**, changes to the terminal footprint area and the revised construction activity descriptions presented in **Attachment C1** were reviewed, as well as updated Project-VC interactions for marine invertebrates and marine fish presented in **Attachment C2**, and described in **Sections 3.2.2** and **3.2.3**, respectively.

As outlined in the assessments of marine invertebrates (**Section 3.2.2**) and marine fish (**Section 3.2.3**), the updated construction activities reduce the Project footprint, decrease the amount of sediment re-suspension and deposition, and reduce the generation of underwater noise, such that predicted potential negligible effects to CRA species are expected to slightly decrease in response.

Conclusion

The CRA fisheries assessment conclusions that all potential effects are negligible are expected remain the same as presented in EIS Section 16.6.2.

3.2.7 Labour Market

EIS Section 19.0 describes the anticipated changes on the labour market during construction of the Project. The following EIS sections and appendices are relevant to this assessment of labour market:

- EIS Table 19-10 identifies potential Project interactions with the labour market during the construction phase;
- EIS Section 19.7 describes mechanisms by which the Project interactions listed in EIS Table 19-10 can results in change in employment, unemployment and participation rates, labour income, and training opportunities; and
- EIS Appendix 20-A presents the economic impact modeling results for Project construction (as well as operations).

For the purposes of evaluating changes resulting from the updated construction activities described in **Section 2.0**, the key determinants of change to the labour market VC include the following:

- Change in direct Project construction expenditures;
- Change in direct Project construction manpower requirements; and
- Revised construction schedule.

Drivers of change in the labour market during Project construction include the following:

- Direct Project employment (i.e., tradespersons, equipment operators, engineers, technicians, managers, and others that are hired by the Infrastructure Developer);

- Indirect employment (i.e., employment at supplier businesses that are recipients of construction expenditures on materials goods and services);
- Induced employment (i.e., employment generated via household spending of the income of workers employed directly or indirectly during Project construction); and
- The available qualified local labour pool, and estimated local and non-local hiring of construction workers (as described in EIS Section 19.7.2 and EIS Appendix 20-A).

With the updated construction activities described in **Section 2.0**, and the extension of the duration of construction by eight months, there is the potential for a nominal increase (compared to that estimated in the EIS) in direct, indirect, and induced employment. This increase, however, would not change overall EIS conclusions to the labour market VC, as explained below and summarised in **Attachment C4**.

A nominal increase in construction expenditures compared to that estimated in the EIS (as described in **Section 3.2.8**) associated with the updated construction activities and longer construction period will result in a nominal increase in total direct construction employment compared to the EIS predictions. As indicated in EIS Section 19.7.2.1, the total construction phase direct employment from the Project was estimated at 4,368 person years over a 65 month construction period. The distribution of total construction phase direct employment (as shown in Figure 4-1 in EIS Appendix 20-A) is similar to that for the EIS, spread over 73 versus 65 months. Peak construction activity and peak employment is projected to occur in year 3 (as reflected in **Attachment B4**) as opposed to year 4 as outlined in the EIS (Figure 4-1 in EIS Appendix 20-A).

A nominal increase in direct construction expenditures compared to that estimated in the EIS on materials, goods, and services will result in a nominal increase in expenditures on both direct and upstream production inputs and, in turn, a nominal increase in total indirect employment compared to that estimated in the EIS. A nominal increase in total construction direct and indirect employment will in turn generate a nominal increase in induced employment compared to that estimated in the EIS (EIS Section 19.7.2.1 and Section 4.1 in EIS Appendix 20-A).

The breakdown of direct, indirect, and induced employment by general occupational categories, and the percentage of direct construction employment expected to be sourced from outside Metro Vancouver (EIS Section 19.7.2.1 and Section 4.1 in EIS Appendix 20-A) do not change from the EIS.

A nominal increase (compared to that estimated in the EIS) in direct, indirect and induced employment over the eight-month longer construction period will not change the EIS findings, which indicate the following:

- The Project is not expected to adversely affect labour market balance in the LAA (EIS Section 19.7.1) (i.e., the nominal increase in employment during the eight-month longer construction period is expected to be within capacity of the existing available and qualified labour pool); and
- Project-associated change in employment will generate a beneficial employment and labour income effect (including those to Aboriginal persons who secure direct, indirect,

or induced employment associated with the Project), and a beneficial effect on unemployment, participation rates, and labour income in the LAA (EIS Sections 19.7.2, 19.7.3, and 19.7.4).

Conclusion

In summary, nominal increases in employment compared to that estimated for the EIS will not alter the labour market assessment conclusions as presented in EIS Section 19.0.

3.2.8 Economic Development

EIS Section 20.0 provides an assessment of Project-related effects on economic development during Project construction. The following EIS sections and appendices are relevant to this assessment of economic development:

- EIS Table 20-6 identifies potential Project interactions with economic development during the construction phase;
- EIS Section 20.6 describes mechanisms by which the Project interactions listed in EIS Table 20-6 can result in change in aggregate availability and price; materials, goods and services contracting revenues; and induced output and consistency of the Project with economic development plans; and
- EIS Appendix 20-A presents economic impact modelling estimates and results for Project construction (and operations).

For the purposes of evaluating changes resulting from the updated construction activities described in **Section 2.0**, the key determinants of change to the economic development VC include the following:

- Updated fill volumes for the marine terminal area and widened causeway; and
- Change in Project construction expenditures.

Updated Fill Volumes for Marine Terminal and Widened Causeway

With the updated construction activities, the overall demand for aggregate is expected to decline from that outlined in the EIS from 17.0 M m^3 to 16.9 M m^3 (a decrease of 0.1 M m^3), sand supply is expected to increase by 0.6 M m^3 from 12.4 M m^3 to 13.0 M m^3 (reflected in **Tables 2-2** and **2-3**). The amount of fill material sourced from existing quarries will increase by 2.5 M m^3 to 3.6 M m^3 as the volume of sand available from Fraser River annual maintenance dredging will be reduced by 2.0 M m^3 (as reflected in **Table 2-3**). As indicated in **Section 2.1**, existing quarries have indicated they have sufficient capacity to meet Project needs and, as a result, the commissioning of a new quarry will not be required to support Project construction.

As there is adequate local supply for sand, the increased requirement for sand identified in the PCU will not change EIS results, which indicate Project demand for sand would have a negligible effect on sand availability and prices in the LAA (EIS Section 20.6.1).

Change in Construction Expenditures

Total direct construction expenditures specified in the EIS were estimated at $1.9 billion (EIS Appendix 20-A, Appendix B). With the updated construction activities, there is a nominal increase (compared to that estimated in the EIS) in total Project construction expenditures from that estimated for the EIS. A nominal increase in direct construction expenditures compared to those specified in the EIS will result in a nominal increase in contracting revenues accrued to direct suppliers and to upstream suppliers compared to that estimated in the EIS (EIS Section 20.6.2.1; EIS Appendix 20-A, Section 4.1 and Appendix C). Similarly, a nominal increase in induced output (revenues) compared to those specified in the EIS (EIS Section 20.6.3; EIS Appendix 20-A, Section 4.1 and Appendix C) will result from a nominal increase in induced employment income (as described in **Section 3.2.6** above) and household spending compared to that estimated in the EIS.

The breakdown of contracting revenues accrued to direct and upstream suppliers from various supplier industries, and the percentage of contracting revenues accrued to direct and upstream suppliers from outside Metro Vancouver (EIS Section 20.6.2.1 and Section 4.1 in EIS Appendix 20-A) do not change from the EIS. Similarly, the sectors that will garner the majority of induced output from household spending do not change from the EIS.

A nominal increase (compared to that estimated in the EIS) in contracting revenues to direct suppliers and upstream suppliers, and in induced output, over the eight-month longer construction period will not change the EIS findings, which indicate the following:

- The estimated change in materials, goods, and service revenues of supply industries in the LAA during Project construction is expected to be beneficial for the general population, and to Aboriginal businesses who secure contracting opportunities with the Project (EIS Section 20.6.2.1);
- The estimated change in induced output in the LAA during Project construction is expected to be beneficial (EIS Section 20.6.3.1); and
- The Project is consistent with municipal and regional development plans and Tsawwassen First Nations Land Use Plan.

Conclusion

In summary, nominal increases in construction expenditures and contracting revenues compared to that estimated in the EIS will not alter the conclusions of the economic development assessment as presented in EIS Section 20.0.

3.2.9 Local Government Finances

EIS Section 22.0 provides an assessment of Project-related effects on local government finances during Project construction. The following EIS sections are relevant to this assessment:

- EIS Table 22-15 for the identification of potential Project interactions with labour market during the construction phase; and

- EIS Section 22.6, which describes mechanisms by which the Project interactions listed in EIS Table 22-15 can result in the following:
    - Changes in local government revenues from payments in lieu of taxes (PILT), Municipal and Regional District Taxes, and permit fees generated during Project construction; and
    - Changes in local government expenditures due to Project use of local government services and infrastructure during Project construction.

For the purposes of evaluating changes resulting from the updated construction activities described in **Section 2.0**, the key determinants of change to the local government finances assessment, including revenues and expenditures include the following:

- Construction phase activities and change in Project capital expenditures; and
- Revised construction schedule.

Local Government Revenues

As indicated in EIS Section 22.6.2, local government revenues generated during Project construction include payments in lieu of taxes (PILT), municipal and regional district taxes and permit fee payments. The eight-month longer construction schedule extends the period of PILT to local governments (EIS Section 22.6.2). There is a nominal increase in estimated incremental taxes and fees paid to municipal, regional, and federal governments compared to that estimated for the EIS from the following:

- Personal income taxes paid by a nominally larger number of direct construction workers and indirect and induced employment generation, compared to that estimated in the EIS (as described in **Section 3.2.7** above);
- Corporate taxes from the nominally higher revenues (compared to that estimated in the EIS) accrued to direct and upstream suppliers (as described in **Section 3.2.7** above); and
- The eight-month longer construction schedule, which will extend the period of payment of incremental taxes and fees to municipal and regional governments associated with Project construction.

Local Government Expenditures

As indicated in **Section 3.2.10** below, the eight-month longer construction schedule will increase the length of time that the Project will use health services, emergency services, and municipal infrastructure. However, the longer construction schedule will not alter the level of Project demand on services and infrastructure compared to that estimated for the EIS as the expenditure outlays directed towards service provision associated with the eight-month longer construction schedule will be supported through local government revenue streams, including those generated by the Project.

Conclusion

In summary, nominal increase in taxes and fees paid to governments compared to that estimated for the EIS will not alter the conclusions of the local government finances assessment as presented in EIS Section 22.0

As with the EIS, assuming that the mitigation measures identified in the services and infrastructure assessment (EIS Section 23.7) are implemented, the EIS assessment results—which indicate a negligible adverse Project effect on local government expenditures from direct Project use of local services and infrastructure—do not change (EIS Section 22.6.1).

3.2.10 Services and Infrastructure

EIS Section 23.0 describes the anticipated changes from Project construction on services and infrastructure. The following EIS sections are relevant to this assessment of services and infrastructure:

- EIS Table 23-21 identifies potential Project interactions with services and infrastructure during the construction phase; and
- EIS Section 23.7.1 describes mechanisms by which the Project interactions listed in EIS Table 23-21 can result in a constraint on municipal service and infrastructure capacity and supply from direct Project utilisation of municipal services and infrastructure during construction.

For the purposes of evaluating changes resulting from the updated construction activities described in **Section 2.0**, the key determinants of change to the services and infrastructure VC include the following:

- Change to in-migration and population during the Project construction phase; and
- Revised construction schedule.

As there would be no change to the EIS population IC assessment results (as described in **Section 3.1.8**), the EIS results for services and infrastructure, which indicate a negligible population-induced effect on housing, health, emergency services, and municipal infrastructure during Project construction, would not change (EIS Section 23.7).

Based on the nominal increase in construction employment with the updated construction activities described in **Section 2.0** compared to the EIS (as described in **Section 3.2.7**), a nominal increase in the estimated number of potential accidents and injuries during the construction period is projected compared to that estimated in the EIS (Section 23.7.1). However, this nominally higher number of accidents and injuries would be low relative to the total annual number of medical services provided by the local health authority service covering the Project area. The EIS results, which identify a minor effect on healthcare services (EIS Section 23.7.1), would not change.

The revised construction schedule would increase the length of time the Project would use health services, emergency services (police and security, fire, ambulance), and municipal infrastructure (potable water, solid waste) by eight months. However, the longer construction

schedule would not alter the level of Project demand on services and infrastructure compared to that estimated for the EIS. The EIS results, which identify a minor effect on services and infrastructure (EIS Sections 23.7.1 to 23.7.5), would not change.

Mitigation measures presented in EIS Section 23.8 are expected to be sufficient to address Project effects on services and infrastructure with the updated construction activities and no changes to overall mitigation measures are required. However, the longer construction schedule will be reflected in the following:

- The service agreements the VFPA has with the City of Delta;
- The private security service agreements implemented by the Infrastructure Developer;
- The Project construction Land and Marine Traffic Management Plan (EIS Section 23.8); and
- The construction Health and Safety and Emergency Response Plan (EIS Section 33.3.14).

With these mitigation measures, no residual effects are anticipated.

Conclusion

In summary, a nominal increase in demand for healthcare and emergency services, and longer duration of demand on municipal infrastructure, will not alter the conclusions of the services and infrastructure assessment, as presented in EIS Section 23.0.

3.2.11 Marine Commercial Use

EIS Section 21.7 describes the anticipated changes following construction of the Project on marine commercial use. The following EIS sections and information requests are relevant to this assessment of marine commercial use:

- EIS Table 21-5 identifies the potential Project interactions with marine commercial use during the construction phase; and
- EIS Sections 21.7.1 to 21.7.5 describe mechanisms, or effect pathways, by which the Project interactions listed in EIS Table 21-5 could affect marine commercial use during construction, including the following:
    - Changes to the following sub-components: marine seafood harvesting; marine fish harvesting; guided sport fishing; and marine based tourism;
    - Via the following indicators or effect pathways as applicable to each sub-component (further outlined in **Table 3.2.11-1**): changes in area use, access, and revenues; changes in marine fish and seafood resource availability and revenues; changes in environmental setting (noise and vibration and visual quality); and changes in presence of marine mammals and coastal birds; and

- IR7-33 (CEAR Document #1172[28]) describes the potential reduction in commercial crab harvest levels as a result of the proposed navigational closure expansion for the Project.

For the purposes of evaluating changes resulting from the updated construction activities described in **Section 2.0**, the key determinants of change to the marine commercial use VC include the following:

- Overall decrease in marine footprint area for the berth pocket and marine approach area components of the Project;
- An overall decrease in construction-related marine traffic, and a decrease in vessel traffic in front of the Project terminal;
- Revised construction schedule; and
- Other construction activities affecting the ICs and biophysical VCs linked to marine commercial use effects.

Rationale for No Change to Negligible Potential Effects

With consideration of the updated construction activities, there are no changes predicted for any of the potential effects on marine commercial use that were rated as negligible in the EIS. Rationale is provided below and summarised in **Table 3.2.11-1**.

Changes to the conclusions of the marine fish, marine invertebrates, marine mammals, and coastal birds assessments, summarised in **Attachment C4**, are also considered. As outlined in marine invertebrates (**Section 3.2.2**), marine fish (**Section 3.2.3**), marine mammals (**Section 3.2.4**) and coastal birds (**Section 3.2.5**), the EIS assessment results for these VCs either a) do not change; b) change to the extent that adverse effect ratings are expected to decrease; or c) change to the extent that effects are no longer anticipated. However, there are no changes to residual effects characterisations or significance determinations identified for the marine fish, marine invertebrates, marine mammals, and coastal birds EIS assessments results. The negligible marine commercial use potential effects that are linked to effects on biophysical VCs would not change as a result of updated construction activities (as shown in **Table 3.2.11-1**).

With respect to the marine commercial use areas where guided sport fishing occurs in the LAA (as described in EIS Section 21.5.3) and where marine-based tourism occurs in the LAA (as described in EIS Section 21.5.4), the updated construction activities are expected to result in changes (increases and decreases) in daytime noise levels of less than 0.5 dBA compared to predicted noise levels for marine areas in the EIS (Table A-10 in Appendix A of **Attachment D2**).

As outlined in the visual resources assessment (**Section 3.2.13**), the EIS results do not change with the updated construction activities. Based on the noise and vibration and visual resources PCU assessment results, as shown in **Table 3.2.11-1**, the negligible potential

[28] CEAR Document #1172 From the Vancouver Fraser Port Authority to the Review Panel re: Responses to Information Requests IR5-50, IR7-07, IR7-33, IR7-34, IR7-35, and IR7-43 (See Reference Documents #975 and #1000).

effects on guided sport fishing and marine-based tourism environmental setting would not change as a result of updated construction activities. Changes to construction activities that could affect available area for, and access to, commercial harvesting were also considered.

With the elimination of ITP use and the associated reduction of dredging vessel traffic (i.e., a decrease of 1,056 movements) and an increase of 666 tug and barge movements (1 additional movement every two days) to the three barge ramps, there is a net reduction of 390 vessels movements (**Table 2-6**) and a re-distribution of vessels between the three ramp locations on either end of the terminal. In the EIS, potential effects on marine commercial use related to access (and linked to vessel traffic during construction) were negligible. Based on the reduction in construction-related vessel numbers, there is no change to the EIS conclusion of negligible effects related to vessel traffic, as shown in **Table 3.2.11-1**.

Rationale for No Change to Measurable Effects

With consideration of the updated construction activities, there are no changes predicted for the measurable potential or residual effect on marine commercial use, related to harvesting area and access for commercial seafood harvesting. Rationale is provided below and summarised in **Table 3.2.11-1**.

Changes to the marine footprint at the terminal area (berth pocket and marine approach areas) as presented in **Table 2-1** result in an overall decrease in the Project area by 3.5 ha (from 186.0 ha to 182.5 ha). With this decrease in Project area, related to underwater components of the terminal footprint, the size of the area no longer available for commercial crab harvesting during Project construction will remain the same as that described in the EIS (EIS Section 21.7.5). Therefore, the potential moderate Project effect of displacement of commercial crab harvesting and reduction in harvest and associated revenues from the Project area (and the proposed commercial crab navigational closure expansion during construction) will not change.

As potential effects will not change from the EIS, changes to proposed mitigation are not required. With no change to the potential effect rating or mitigation, the characterisation of the residual effect remains unchanged, as defined in EIS Table 21-9. The extension of the Project construction phase by eight months does not influence the duration rating of 'medium-term' for this residual effect, because medium-term is defined as '1 year to the life of the Project', as shown in EIS Table 21-8.

Conclusion

In summary, minor changes in terminal footprint and vessel traffic, as well as minor changes to linked IC and VC assessments, will not alter the conclusions of the marine commercial use assessment as presented in EIS Section 21.0.

Table 3.2.11-1 Updates to the Rating of Potential Effects to Marine Commercial Use from Updated Construction Activities

EIS Potential Effect	Sub-component	EIS Potential Effect Rating	PCU Updated Potential Effect Rating and Supporting Rationale
Changes in area, access, and revenues	Commercial marine seafood (crab) harvesting	Moderate	**Potential effect:** Moderate – no change to size of commercial crab navigational closure area; no change in construction activities relevant to crab harvesting areas. **Residual effect:** As characterised in the EIS (no change).
	Commercial marine fish harvesting	Negligible	Negligible – no change in construction activities relevant to fish harvesting areas.
	Guided sport fishing	Negligible	Negligible – no change in construction activities relevant to guided sport fishing areas.
	Marine-based tourism	Negligible	Negligible – no change in construction activities relevant marine-based tourism areas.
Changes in resource availability and revenues	Commercial marine seafood (crab) harvesting	Negligible	Negligible – PCU assessments for marine fish and marine invertebrates indicate no change to EIS conclusions.
	Commercial marine fish harvesting	Negligible	Negligible – PCU assessment for marine fish indicates no change to EIS conclusions.
	Guided sport fishing	Negligible	Negligible – PCU assessment for marine fish indicates no change to EIS conclusions.
	Marine-based tourism	N/A	N/A
Changes in environmental setting (noise and visual resources)	Commercial marine seafood (crab) harvesting	N/A	N/A
	Commercial marine fish harvesting	N/A	N/A
	Guided sport fishing	Negligible	Negligible – PCU assessments for noise and visual resources indicate no change (visual resources), and negligible change (noise) to EIS conclusions.
	Marine-based tourism	Negligible	Negligible – PCU assessments for noise and visual resources indicate no change (visual resources), and negligible change (noise) to EIS conclusions.

EIS Potential Effect	Sub-component	EIS Potential Effect Rating	PCU Updated Potential Effect Rating and Supporting Rationale
Changes in presence of marine mammals and coastal birds	Commercial marine seafood (crab) harvesting	N/A	N/A
	Commercial marine fish harvesting	N/A	N/A
	Guided sport fishing	N/A	N/A
	Marine-based tourism	Negligible	Negligible – PCU assessments for marine mammals and coastal birds indicate no change to EIS conclusions.

3.2.12 Outdoor Recreation

EIS Section 24.6 describes the anticipated changes during and following construction of the Project on outdoor recreation. The following EIS sections are relevant to this assessment of outdoor recreation:

- EIS Table 24-6 identifies potential Project interactions with outdoor recreation during the construction phase; and
- EIS Sections 24.6.1 to 21.6.5 describe mechanisms by which the Project interactions listed in EIS Table 24-6 can affect outdoor recreation during construction including the following:
    - Changes to the following sub-components: recreational boating and windsport activities; recreational marine fish and seafood harvesting; recreational hunting; and other land-based recreation; and
    - Via the following effect pathways or indicators as applicable to each sub-component (further outlined in **Table 3.2.12-1**): changes in area and access; changes in marine fish, seafood, coastal birds resource availability and presence; and changes in environmental setting (noise and visual quality).

The following information requests are relevant to this assessment:

- IR7-41 (CEAR Document #1134) clarifies that potential changes in the quality of environmental setting are not anticipated to affect recreational bird watching and bird tourism industry in the LAA;
- IR7-43 (CEAR Document #1172) confirms the potential residual effects on recreational crab harvesting area use and access are anticipated to be negligible; and
- IR8-10 (CEAR Document #1167) clarifies that Project effects on environmental setting for outdoor recreation are expected to be negligible even though measurable residual effects on visual resources and changes to noise levels were identified.

For the purposes of evaluating changes resulting from the updated construction activities described in **Section 2.0**, the key determinants of change to the outdoor recreation VC include the following:

- Increase in marine terminal area and decrease in berth pocket and marine approach area;
- An overall decrease in construction-related marine traffic;
- Revised construction schedule; and
- Other construction activities affecting the ICs and biophysical VCs linked to outdoor recreation effects.

With consideration of the updated construction activities, there are no changes predicted for the potential effects on outdoor recreation, including all potential effects rated as negligible, and the potential minor effect on recreational crab harvesting that was rated as negligible after mitigation. Rationale is provided below and summarised in **Table 3.2.12-1**.

As indicated in the marine commercial use assessment (**Section 3.2.11**), the PCU assessments for marine fish, marine invertebrates, and coastal birds indicate no change to

EIS conclusions. As shown in **Table 3.2.12-1**, negligible effects on recreational marine fish and seafood harvesting, recreational hunting and land-based recreation (bird watching) resource availability and presence would not change as a result of updated construction activities.

With respect to the marine use areas in the LAA where recreational boating and windsport activity occur (concentrated east of the BC Ferries Terminal causeway), and where recreational marine fishing and crab harvesting occur (within 1 km north and west of the existing Roberts Bank terminals, and further way, in the inter-causeway area and near BC Ferries Terminals and at the mouth of the Fraser River), the updated construction activities are expected to result in changes in daytime noise levels of less than 0.5 dBA compared to predicted noise levels for marine areas in the EIS (Table A-10 in Appendix A of **Attachment D2**). Similarly, with respect to recreational hunting activity (located at western shoreline of Westham Island and surrounding waters at Brunswick Point, located 5 to 10 km north of the Project terminal), and recreational trail use (specifically the Brunswick Point trail and Tsawwassen Outer Dyke—also referred to as the Great Blue Heron Trail—both located along the shoreline greater than 6 km northeast of the Project terminal), noise levels are expected to increase by less than 0.5 dBA from that outlined in the EIS (Table A-10 in Appendix A of **Attachment D2**).

Based on changes in noise levels as described above, and the visual resources results (**Section 3.2.13**), as shown in **Table 3.2-12-1**, the EIS results indicating a negligible effect on the outdoor recreation environmental setting would not change as a result of updated construction activities.

Changes in the marine terminal footprint area, and construction related vessel traffic were also considered. As described in the marine commercial use assessment (**Section 3.2.11**), the Project area will decrease by 3.5 ha, related to changes in underwater components of the marine terminal footprint, but the size of the area no longer available for recreational crab harvesting during Project construction will remain the same as that described in the EIS (EIS Section 24.6.5.2). Therefore, the potential minor Project effect on displacement of recreational crab harvesting and reduction in harvest from the Project area (and the proposed recreational crab navigational closure expansion during construction) will not change. The net reduction of 390 vessels movements in the area (**Table 2-6**) and a re-distribution of vessels between the three ramp locations on either end of the terminal, also does not result in a change to predicted effects on outdoor recreation. The EIS assessment results indicating negligible effects on displacement of recreational crab harvesting area use and access from construction marine vessel traffic (EIS Section 24.6.5.2) do not change.

As potential effects will not change from the EIS, changes to proposed mitigation is not required. With no change to the potential effect rating or mitigation, the rating of the residual effect on recreational crab harvesting as negligible remains unchanged. The extension of the Project construction phase by eight months does not change this negligible residual effect rating.

Table 3.2.12-1 Updates to the Rating of Potential Effects to Outdoor Recreation from Updated Construction Activities

EIS Potential Effect	Sub-component	EIS Potential Effect Rating	PCU Updated Effect Rating and Supporting Rationale
Change in area and access	Recreational boating and windsport activities	Negligible	Negligible – no change in construction activities relevant to recreational boating and windsport activities.
	Recreational marine fish harvesting	Negligible	Negligible – no change in construction activities relevant to recreational marine fish harvesting area access.
	Recreational seafood harvesting	Minor	**Potential Effect:** Minor– no change to recreational crab harvesting closure area; no change in construction activities relevant to recreational marine fish and seafood harvesting. **Residual Effect:** Negligible – no change to proposed mitigation, and duration of construction does not change residual effect characterisation.
	Recreational hunting	No effect	N/A
	Other land based recreation	No effect	N/A
Change in resource availability and presence (marine fish, Dungeness crab, coastal birds)	Recreational boating and windsport activities	No effect	N/A
	Recreational marine fish and seafood harvesting	Negligible	Negligible – PCU assessments for marine fish and marine invertebrates indicate no change to EIS conclusions.
	Recreational hunting	Negligible	Negligible – PCU assessment for coastal birds indicates no change to EIS conclusions.
	Other land based recreation (bird watching)	Negligible	Negligible – PCU assessment for coastal birds indicates no change to EIS conclusions.
Change in environmental setting (noise and visual resources)	Recreational boating and windsport activities	Negligible	Negligible – PCU assessments for noise and visual resources indicate no change (visual resources), and negligible change (noise) to EIS conclusions.

Conclusion

In summary, minor changes in terminal footprint and vessel traffic, as well as minor changes to linked IC and VC assessments, will not alter the conclusions of the marine outdoor recreation assessment as presented in EIS Section 24.0.

3.2.13 Visual Resources

EIS Section 25.6 and EIS Appendices 25-A and 25-B describe the anticipated changes on visual resources for daytime and nighttime viewing conditions. The following EIS sections and information requests are relevant to this assessment of visual resources:

- EIS Table 25-11 identifies potential Project interactions with visual resources during construction;
- EIS Section 25.6 describes mechanisms by which the Project interactions listed in EIS Table 25-11 can result in change in daytime and nighttime visual resources; and
- IR8-13 (CEAR Document #1125[29]) clarifies the sources of information used in the EIS to understand expectations of viewers for daytime points of reception.

For the purposes of evaluating changes resulting from the updated construction activities described in **Section 2.0**, the key determinant of change to the visual resources VC is the additional information regarding construction of the RBT2 overpass structure.

The results of the light IC assessment (**Section 3.1.3**) were also considered to understand potential changes to EIS assessment results on nighttime visual resources. As there are no changes to the EIS assessment results for the light IC, the EIS results indicating a minor effect on nighttime visual resources (EIS Section 25.6.3) from light trespass and sky glow will not change.

For the purposes of evaluating changes to daytime visual resources from the updated construction activities, information in **Section 2.5**, New Figures 4-32 and 4-33 in **Attachment A**, and **Attachment C1** were reviewed related to the additional detail on the design and construction activities for the overpass structure. The advancement of the overall overpass design and construction activities, including land-based vibro-replacement densification, addition of approximately 86 steel pipe piles, and updates to the overpass and road connection design are not anticipated to change the daytime or nighttime visual character or viewing conditions during construction from that identified in EIS Section 25.6. Based on this, EIS results characterising a minor effect on daytime and nighttime visual resources as described in EIS Sections 25.6.1 and 25.6.2 do not change.

[29] CEAR Document #1125 From the Vancouver Fraser Port Authority to the Review Panel re: Responses to Information Requests IR6-18, IR6-20, IR7-06, IR8-11, IR8-12, IR8-13, and IR8-14 (See Reference Documents #991, #1000, & #1071).

Conclusion

In summary, the updated construction activities will not alter the conclusions of the visual resources assessment as presented in EIS Section 25.0.

3.2.14 Land and Water Use

Updates to construction activities described in **Section 2.0** are expected to result in changes to three potential construction-related effects documented in EIS Section 26.6 for the land and water use effects assessment, described below. The relevant changes to construction activities for the assessment of land and water use are as follows:

- Use of the ITP is no longer required;
- A new barge ramp is required adjacent to the west terminal basin; and
- There is an overall decrease in construction-related marine traffic, and a decrease in vessel traffic in front (southwest side) of the Project.

The changes to the predicted effects on land and water use are described below and summarised in **Table 3.2.14-1**.

Disturbance to Marine-related Industrial Uses

The location and intensity of a potential effect on marine-related industrial uses is anticipated to change as a result of a net decrease in the number of vessels that could cause navigation disturbance to marine-related industrial uses (i.e., vessels accessing the existing Deltaport Terminal and Westshore Terminals). With the elimination of ITP use and the associated decrease of 1,056 dredger movements and increase of 666 tug/barge movements to the three barge ramps, there is a net reduction of 390 vessels movements (**Table 2-6**) and a re-distribution of vessels between the two barge ramp locations on either end of the terminal. Overall, the intensity of traffic in front of the existing terminals would be less. Because the marine-related traffic generally accesses the existing terminals from the south, the potential disturbance to the existing vessel traffic is further decreased, and the level of this potential effect is expected to be 'minor', decreased from 'moderate' in the assessment presented in the EIS Section 26.7.

As the overall nature of the potential effect is anticipated to remain the same, and the anticipated level of potential effect is expected to decrease but not be eliminated with these revised construction-related activities, there is no change to mitigation as proposed. The change in location intensity of vessel traffic will be reflected in the measures within the Land and Marine Traffic Management Plan (EIS Section 33.3.9) to ensure this potential effect is mitigated.

As outlined in EIS Section 26.7, a residual effect to marine-related industrial uses is not expected after mitigation is implemented and, as such, neither a determination of significance nor a cumulative effects assessment is required.

Disturbance to Uses in Protected Areas

The new barge ramp adjacent to the west basin of the terminal is located approximately 500 m from the boundary of the Roberts Bank Wildlife Management Area (WMA). With increased vessel traffic to this side of the terminal, the level of disturbance to the WMA from construction-related vessels could increase. However, the disturbance may only affect the southeast corner of the WMA, and the overall level of this potential effect of 'minor to moderate' provided in EIS Table 26-5 would not change.

Tug-barge traffic accessing this barge ramp would be routed to avoid traversing the WMA. Routing details would be included in the Land and Marine Traffic Management Plan (preliminary outline provided in EIS Section 33.3.9).

As outlined in EIS Section 26.7, a residual effect is not expected for disturbance to uses in protected areas after mitigation is applied. As such, determination of significance and cumulative effects assessment are not required.

Access to Community Lease Lands

The use of the ITP was the primary cause of a potential effect on access to community lease lands (see EIS Section 26.6.5), related to navigational disturbance for users of the Tsawwassen First Nation water lot (community lease lands) in the inter-causeway area. The level of this potential effect would be reduced from 'minor to moderate' (EIS Table 26-5) to 'minor' with the removal of the use of the ITP from construction activities. The potential effect remains at a minor level due to dredging activity in the tug basin area and tug-barge access to the barge ramps and associated vessel traffic. Access to barge ramps from the north could potentially cause navigational disturbance to vessels accessing the community lease lands also from the north.

The mitigation proposed in the EIS for this potential effect consisted of engagement, communication, and environmental management plans (EIS Table 26-6). This mitigation is required to address potential effects on other VCs (coastal birds and services and infrastructure), as well as Current Use. However, the final communication and engagement mechanisms, as well as the final Land and Marine Traffic Management Plan, will be specific to the updated potential effects predicted (i.e., will no longer include measures specific to the use of the ITP).

As outlined in EIS Sections 26.8 and 26.9.2, a non-significant residual effect was predicted to remain after mitigating potential changes in access to community lease lands. However, with the elimination of ITP use and the associated reduction of potential effects to a 'minor' level (due to remaining activities in the inter-causeway area, including dredging in the tug basin) a negligible (not measurable or detectable) residual effect is predicted following the implementation of mitigation. Given that the residual effect is anticipated to be negligible with the updated construction activities, neither a determination of significance nor a cumulative effects assessment is required.

Table 3.2.14-1 Updates to Potential and Residual Effects to Land and Water Use from Updated Construction Activities

EIS Potential Effect	EIS		PCU		
	EIS Potential Effect Rating	EIS Residual Effect (Y/N)	Changes from Updated Construction Activities	Updated Potential Effect Rating	PCU Residual Effect (Y/N)
Disturbance to Marine-related Industrial Uses	Moderate	No	No ITP use; reduced construction vessel traffic interactions with existing industrial uses.	Minor	No
Disturbance to Uses in Protected Areas	Minor to Moderate	No	No change to overall level of disturbance.	Minor to Moderate	No
Access to Community Lease Lands	Minor to Moderate	Yes	No ITP use; reduced construction vessel traffic interactions with access to community lease lands.	Minor	Negligible

Conclusion

In summary, changes in vessel traffic volume and location will result in a reduction of the potential effect rating for disturbance to marine industrial users from 'moderate' to 'minor', and a reduction of the residual effect characterisation for changes in access to community lease lands from 'measurable' to 'negligible'. With the updated construction activities, the land and water use effects assessment concludes that the mitigation as proposed in the EIS effectively reduces all potential effects to a negligible or no residual effect level, as summarised in **Table 3.2.14-1** above, and in **Attachment C4**.

3.2.15 Human Health

EIS Section 27.0 describes the potential construction-related effects of the Project on human health. The following EIS sections and information requests are relevant to this assessment of human health:

- EIS Table 27-14 identifies the potential Project interactions with human health during the construction phase;
- EIS Sections 27.6.1 to 27.6.5 describe the mechanisms for potential effects of the Project on human health during construction, including the following:
    - Exposure to air emissions;
    - Exposure to noise and vibration;
    - Exposure to increased shellfish contamination due to re-suspension of contaminated sediment;
    - Stress and annoyance, due to noise, light, and perception of shellfish contamination;
    - Employment and income;
    - Food security; and
    - Health inequity; and
- IR4-33 (CEAR Document #1078[30]) described no existing or predicted health risks associated with consumption of crab hepatopancreas.

For the purposes of evaluated changes resulting from the updated construction activities described in **Section 2.0**, the key determinants of change to the human health VC include the construction activities affecting the ICs and VCs linked to human health effects, including the following:

- ICs – Air quality, noise and vibration, surficial geology and marine sediment, and marine water quality; and
- VCs – Labour market, economic development, marine invertebrates, marine fish, visual resources, and Current Use.

[30] CEAR Document #1078 From the Vancouver Fraser Port Authority to the Review Panel re: Responses to Information Requests IR4-33, IR5-01, IR5-12, IR5-15, IR5-16, IR5-23, IR5-24, IR5-32, IR5-33, IR5-34, IR5-35, IR5-36, IR6-26, IR7-03, and IR7-05 (See Reference Documents #946, #975, #991, and #1000).

All potential effects on human health are predicted to occur indirectly through an initial change to an IC or effect on a VC. Therefore, there are no updated construction activities directly linked to changes in predicted effects on human health. Potential changes in human health associated with the updated construction activities were evaluated for each sub-component by reviewing the outcomes of the PCU assessments for linked ICs and VCs and comparing the incremental increase or decrease in potential and residual effect levels with prior effect predictions and with the health-based thresholds used for the EIS. A summary of the predicted changes due to the updated construction activities is given below.

Exposure to Air Emissions

Overall, predicted air emissions associated with the updated construction activities are expected to decrease relative to those that informed the human health assessment in EIS Section 27.0, as discussed in **Section 3.1.1**. In the EIS, a minor potential health effect was predicted related to exposure to contaminants, specifically NO_2, $PM_{2.5}$, and PM_{10}, as well as the respiratory irritant group[31] (largely driven by NO_2) and eye irritant group[32] (largely driven by VOCs) of contaminants, during peak and average construction day scenarios at a location over water between the existing Westshore Terminals and proposed RBT2 terminal. Public use of this area is considered unlikely.

Considering emissions from the updated peak-day construction equipment (listed in Table 1 in **Attachment D1**), peak day NO_x emissions are predicted to be 12% lower and $PM_{2.5}$ and PM_{10} emissions both 7% lower than predicted in the EIS. The risk of potential health effects associated with these contaminants would similarly decrease. Emissions of some contaminants in the eye irritant and respiratory irritant groups may decrease or be up to 3% to 4% higher for a peak day scenario, depending on the construction equipment used (see **Section 3.1.1**). Given the potential for slight increases in some contaminant emissions, offset by decreases in others, the potential effect predictions and the potential effect ratings are the same as those described in the noted in EIS Section 27.6.2, a 'moderate' potential effect for inhalation, as summarised below in **Table 3.2.15-1**.

Exposure to Noise and Vibration

As summarised in **Section 3.1.2**, the change in noise levels based on the updated construction activities versus the estimates provided in the EIS range from 0.1 to 0.3 dBA (average increase) and 0 to 0.9 dBA (range of maximum increase) for daytime (L_d), day-night (L_{dn}) and nighttime (L_n) noise metrics. Based on the average and maximum predicted sound level increases, no changes to the potential effect predictions or the potential effect ratings noted in EIS Section 27.6.3 are anticipated.

Negligible Potential Health Effects from Noise

For the construction phase, noise levels were predicted for daytime, nighttime, and day-night average noise levels, as well as ground borne-vibration. In EIS Section 27.6.1.3, a rationale

[31] The respiratory irritant group includes acetaldehyde, naphthalene, NO_2, and SO_2.
[32] The eye irritant includes acrolein, formaldehyde, and naphthalene.

is provided for the negligible effect rating for noise-related health effects based on the following indicators that are applicable in the construction phase:

- Percent highly annoyed (using L_{dn});
- Sleep disturbance in marine areas (using L_n);
- Speech comprehension (using L_d); and
- Ground-borne vibration (as measured by vibration decibel (VdB)).

With the minimal changes in noise levels due to updated construction activities, there are no changes to any of these negligible potential effect ratings, as summarised in **Table 3.2.15-1**.

Measurable Potential Health Effects from Noise

In EIS Section 27.6.3, a minor to moderate effect on health, related to sleep impairment, is predicted to occur from nighttime construction noise. As summarised in Table 2 in **Attachment D2**, the updated construction activities will result in an increase in average nighttime noise levels, over the levels predicted in the EIS, of less than 1 dBA. This difference is considered negligible and within the margin of error of noise measurement equipment. When compared to expected conditions (future without the Project), the increase in average nighttime noise levels over the duration of the construction phase are predicted to be a maximum of 1.6 dBA. This increase does not result in the exceedance of a sleep disturbance threshold (L_n 45 dBA) that was not exceeded in expected conditions, or by construction noise levels as predicted in the EIS. Therefore, the updated construction activities do not result in a change to the predicted health effects related to sleep impairment from nighttime noise during construction (see **Table 3.2.15-1**).

Exposure to Shellfish Contamination

EIS Section 27.6.1.4 provides a rationale for the negligible potential effect rating for health risk from consumption of contaminated shellfish (crab and bivalve muscle tissue), on the basis that existing contaminant concentrations, when analysed in a quantitative human health risk assessment, do not result in an increased level of risk. A follow up study to IR4-33 (CEAR Document #1078; crab hepatopancreas consumption health risk) found the same conclusion for crab hepatopancreas; it is unlikely that re-suspension of sediment during construction would result in an elevated level of risk related to consumption of crab hepatopancreas. Since sediment re-suspension with the Project construction update is expected to be lower, as explained in **Section 3.1.5**, the potential risks will be lower and adverse health effects associated with increased shellfish contamination due to construction are not anticipated. The effect rating is negligible and is the same as identified in the EIS.

Stress and Annoyance

EIS Section 27.6.4 describes the potential minor health effects, assessed qualitatively, of stress and annoyance related to Project noise, light, and the perception of shellfish contamination. With the updated construction activities, there will still be periods of higher than average changes in noise levels during certain months, resulting in annoyance. The duration of the loudest construction period has not changed (three months), and the highest predicted monthly average L_{dn} during construction at sites 3, 4, and 5, are predicted to be

slightly higher with the updated construction activities compared to the EIS. Specifically, at sites 3, 4, and 5, noise levels are estimated to be 1.1, 1.9, and 0.3 dBA higher, respectively, than in the EIS. These slightly higher noise levels are associated with higher intensity construction activity in that month, in terms of total numbers of equipment in use, and location of activity relative to receptors. While the highest monthly average noise levels during this louder period are not notably different than as predicted in the EIS (see **Section 3.1.2**), some individuals may become more annoyed during this period of higher construction noise. However, as indicated above in the 'negligible effects' section for noise exposure, the Health Canada threshold for % Highly Annoyed is not exceeded in the EIS, nor with updated construction activities. There are no changes to light (**Section 3.1.3**) as a result of the updated construction activities, and the perception of shellfish contamination is likely to remain unchanged from what was described in the EIS. Given the minimal to no changes to the factors contributing to stress and annoyance, the potential effect rating remains 'minor', and there is therefore no additional mitigation proposed, and no changes to the residual effect rating of negligible, as described in the EIS.

Employment and Income

EIS Table 27-14 provides a rationale for the negligible rating of potential positive health effects related to employment and income during Project construction. Any positive health effects were deemed unlikely to be detectable or measurable. With the updated construction activities, there are no changes to the conclusions of the labour market (**Section 3.2.7**) or economic development (**Section 3.2.8**) assessments. Therefore, there is no change to the residual effect rating for positive health effects from employment and income during construction.

Food Security

EIS Section 27.6.1.5 provides a rationale for the negligible rating for potential health effects related to food security from Project construction. Based on information considered in the Current Use assessment (EIS Section 32.2), there were no residual effects predicted on the access to harvesting locations for traditional food, or on availability of traditional food resources. With the updated construction activities, there will be reductions in productivity losses for all marine biophysical VCs (see **Attachment C4**). However, the effect on food security, as indicated by availability of preferred Current Use resources, is expected to remain negligible (see **Table 3.3-1** and **Table 3.3-2**).

Health Inequity

EIS Section 27.6.5 describes the potential minor adverse effect on health related to health inequity, related to the predicted unequal distribution of Project benefits and risks among sub-populations. As described in the sections above, with the updated construction activities, there is little to no change in overall predicted risks and benefits associated with Project construction. There is the potential for a slight increase in annoyance from noise during certain months of construction, and the potential for decreases in air emissions during peak construction activities. Overall, the distribution of risks and benefits associated with Project construction remain unchanged from the EIS, and the potential effect rating remains

unchanged. As such, no additional mitigation is required for this potential effect, and the residual effect rating of 'negligible' also remains unchanged.

Conclusion

In summary, minor changes in linked IC and VC assessments will not alter the conclusions of the human health effects assessment as presented in EIS Section 27.0, as summarised in **Table 3.2.15-1**.

Table 3.2.15-1 Updates to the Rating of Potential Effects to Human Health from Updated Construction Activities

EIS Potential Effect / Sub-component	Indicator	EIS Potential Effect Rating	PCU Updated Potential Effect Rating and Supporting Rationale
Exposure to air emissions	Direct Exposure – Inhalation	Moderate	**Potential effect:** Moderate - emission reductions (NO_x, $PM_{2.5}$, PM_{10}) and increases (eye and respiratory irritant groups) are not of sufficient magnitude to measurably change potential effects. **Residual effect:** No change – residual effect as characterised in EIS Section 27.8.1.
Exposure to noise and vibration (Quantitative assessment)	Change in percent highly annoyed (%HA)	Negligible	Negligible – no change. The average increase in noise levels (L_{dn}) at the three receptor locations considered does not significantly change the estimated %HA, and all %HA values for average noise levels from construction remain below the 6.5% increase threshold.
	Sleep impairment – Disturbance from intermittent noise	Negligible	Negligible – no predicted increase to nighttime intermittent noise during construction. Pile driving will take place in daytime hours only (**Section 2.5**).
	Sleep impairment – Awakenings	Minor to Moderate	**Potential effect:** Minor to Moderate – nighttime noise level increases are less than 1 dBA. **Residual effect:** No change – residual effect as characterised in EIS Section 27.8.2.
	Speech comprehension	Negligible	Negligible – noise level increases are less than 1 dBA in upland and marine areas. No new exceedance of speech comprehension threshold.
	Annoyance from ground-borne vibration	Negligible	Negligible – no change to vibration levels from updated construction activities (**Attachment D2**).
Exposure to shellfish contamination	Shellfish (crab and bivalve) contaminant levels	Negligible	Negligible – reduction in re-suspension of sediments with updated construction activities, lower potential for shellfish contamination.

EIS Potential Effect / Sub-component	Indicator	EIS Potential Effect Rating	PCU Updated Potential Effect Rating and Supporting Rationale
Stress and annoyance	Noise and vibration, light, and shellfish contamination risk perception	Minor	**Potential Effect:** Minor – slight increase in day-night average noise levels during certain months of construction activity; no change to light emissions from updated construction activities; no change to perception of shellfish contamination from updated construction activities. **Negligible Effect:** No change – residual effect is negligible as described in EIS Section 27.7.3
Employment and income	Project-related employment and income	Negligible	Negligible – no change to conclusions of labour market and economic development assessments from updated construction activities.
Food security	Changes in availability or perceived contamination of traditional foods	Negligible	Negligible – reduction in loss of productivity for marine invertebrates; lower potential for shellfish contamination; no change to overall effects on availability or quality of traditional foods.
Health inequity	Distribution of positive and adverse Project-related effects among vulnerable groups.	Negligible	Negligible – no change to distribution of positive and adverse Project-related effects among vulnerable groups.

3.2.16 Archaeological and Heritage Resources

EIS Section 28.0 describes the potential construction-related effects of the Project on archaeological and heritage resources, including the following:

- Potential crushing or degradation of wooden fish trap stakes, as a result of excavation of the causeway dyke toe, and the weight of preload and dyke materials, across an area of archaeological potential at the east end of the causeway;
- Reduced access to archaeological resources (fish trap stakes) for future study, associated with the placement of containment dyke and preload materials in the area of archaeological potential at the east end of the causeway; and
- Potential exposure (post-construction) of fish trap stakes in the intertidal area near Canoe Passage, as a result of changes in tidal flow in a historic drainage channel that could be caused by the construction of the terminal footprint.

The following EIS sections are relevant to this assessment of archaeological and heritage resources:

- EIS Table 28-5 identifies potential Project interactions with archaeological and heritage resources during construction; and
- EIS Section 28.6 describes mechanisms by which the Project interactions listed in EIS Table 28-5 can result in effects on archaeological and heritage resources.

For the purposes of evaluating changes resulting from the updated construction activities described in **Section 2.0**, there are no updated activities relevant to the assessment of archaeological and heritage resources. As such, there are no changes to the potential effect predictions in the EIS, including the potential effect ratings as noted in EIS Section 28.6. The specific activities expected to cause the effects listed above are unchanged in the updated construction activities, and the coastal geomorphic process related to the Project footprint, which are predicted to cause the third effect above, also remain unchanged (as indicated above in **Section 3.1.4**). There are also no new interactions with archaeological and heritage resources identified to result from changes to the construction activities.

Conclusion

In summary, with the updated construction activities will not alter the conclusions of the archaeological and heritage resources assessment as presented in EIS Section 28.0.

3.3 Updated Construction Phase Assessment of Current Use of Lands and Resources for Traditional Purposes and Aboriginal and Treaty Rights and Related Interests

EIS Section 32.2 describes the potential effects of the Project on current use of lands and resources for traditional purposes (Current Use), and EIS Section 32.3 provides the assessment of potential adverse impacts of the Project on the ability to exercise asserted and established Aboriginal and treaty rights that may or may not be associated with that use. The following EIS sections are relevant to this PCU assessment of Current Use and Aboriginal and treaty rights and related interests:

- EIS Section 32.2.6 identifies potential Project-related effects on Current Use during construction and operation, associated with four indicators: changes in access to preferred Current Use locations, changes in availability of preferred Current Use resources, changes in quality of preferred Current Use resources, and changes in the quality of Current Use experience;
- EIS Section 32.2.7 outlines proposed mitigation measures for Current Use effects; and
- EIS Section 32.3 provides an assessment of adverse impacts on Aboriginal and treaty rights and related interests.

The following information requests are relevant to this assessment:

- Responses to Information Request #29 (IR-7.31.15-29 of CEAR Document #314[33]) and Additional Information Request #29 (AIR-12.04.15-29 of CEAR Document #388[34]) concluded that potential effects on intangible cultural heritage are associated with each of the effects identified on Current Use in the EIS that are measurable with regard to access; and
- Responses to Information Request #30 (IR-7.31.15-30 of CEAR Document #314) and Additional Information Request #30 (AIR-12.04.15-30 of CEAR Document #388) provided rationale for the Current Use assessment conclusions of 'no effect' or 'negligible effect' on a per-group basis.

For the purposes of evaluating changes resulting from the updated construction activities described in **Section 2.0**, the key determinants of change to Current Use and Aboriginal and treaty rights and related interests are as follows:

- Use of the ITP is no longer required;
- Dredging activity, and associated re-suspension of sediment, is reduced;
- There is an overall decrease in construction-related marine traffic, and a decrease in vessel traffic in front (southwest side) of the Project; and
- The construction activities affecting the ICs and VCs linked to the predicted Current Use effects include the following:
    - ICs – air quality, noise and vibration, surficial geology and marine sediment, and marine water quality; and
    - VCs – marine vegetation, marine invertebrates, marine fish, marine mammals, coastal birds, outdoor recreation, marine commercial use, visual resources, land and water use, human health, and archaeological and heritage resources.

Potential changes in effects on Current Use associated with the updated construction activities were evaluated by reviewing the updated activities in **Section 2.0**, and the outcomes of the PCU assessments for linked ICs and VCs, as listed above. A summary of the predicted changes to the Current Use assessment due to the updated construction activities is provided below,

[33] CEAR Document #314 From Port Metro Vancouver to the Canadian Environmental Assessment Agency re: Completeness Review - Responses to Additional Information Requirements (See reference document # 271) for the Environmental Impact Statement

[34] CEAR Document #388 From Port Metro Vancouver to the Canadian Environmental Assessment Agency re: Completeness Review - Responses to Additional Information Requirements Follow-Up (See Reference Document # 345) including 22 Technical Data Reports.

for each indicator, along with a summary in **Table 3.3-1**. In addition, in comparison to the potential effects predicted in the EIS, **Table 3.3-2** provides a summary of the Aboriginal groups for which each potential effect is expected to be measurable or negligible, or for which an effect is not predicted for the PCU. This table is updated from Table IR30-1 in the response to IR-7.31.15-30 (CEAR Document #314) and includes all Aboriginal groups identified in the EIS, as well as the additional five Aboriginal groups considered in the supplemental assessment titled 'Additional Information to the Environmental Impact Statement – *WSÁNEĆ* Nation' submitted in February 2017 (CEAR Document #930[35]). For the Aboriginal groups for which a measurable potential effect on Current Use is identified through any of the four indicators described below, there is also a potential associated effect on intangible cultural heritage, as explained in the responses to IR-7.31.15-29 (CEAR Document #314) and AIR-12.04.15-29 (CEAR Document #388). Any changes to impacts to Aboriginal and treaty rights and related interests, as they may correspond to effects on Current Use, are addressed in the conclusion of this assessment.

3.3.1 Access to Preferred Current Use Locations

EIS Section 32.2.6.1 describes a potential measurable effect of the Project on access to locations for crab harvesting for domestic or food, social and ceremonial (FSC) purposes for two Aboriginal groups (see **Table 3.3-2**). Construction of the terminal footprint is predicted to limit the available area for domestic and FSC crab harvesting at Roberts Bank, and specifically for Tsawwassen First Nation and Musqueam First Nation. With the expansion of the navigational closure area (for commercial and recreational harvesting), and other mitigation measures proposed in the EIS (EIS Section 32.2.7.1), the residual effect on access to preferred Current Use locations was predicted to be negligible.

With the updated construction activities described in **Section 2.0**, there is no predicted change to the area available for domestic FSC crab harvesting at Roberts Bank during construction. Although the overall Project area will decrease by 3.5 ha, the terminal footprint area will not change, and the navigational closure area expansion will also remain as described in the EIS. With the mitigation measures proposed in the EIS (EIS Section 32.2.7.1), the residual effect prediction for access to preferred Current Use locations for the purposes of crab harvesting remains negligible.

Construction of the terminal footprint is also predicted in EIS Section 32.2.6.1 to limit Tsawwassen First Nation's use of waterways for other traditional purposes, and specifically in relation to a canoe route that transits the terminal footprint area. Although the overall Project area will decrease by 3.5 ha, the terminal footprint area will not change. With the elimination of the use of the ITP, there is a net reduction of 390 vessels movements during construction (**Table 2-6**). With the mitigation measures proposed in the EIS (EIS Section 32.2.7.1), the residual effect prediction for access to preferred Current Use locations (i.e., waterways) remains negligible.

[35] CEAR Document #930 From the Vancouver Fraser Port Authority to the Review Panel re: Response to Additional Information on the WSÁNEC Nation requested by the Canadian Environmental Assessment Agency on January 13, 2016 (See Reference Document #383).

EIS Section 32.2.6.1 also refers to the access effect predicted in EIS Section 26.0 Land and Water Use on Tsawwassen Water Lots (i.e., community lease lands south of the Project area, and the lot specifically in the inter-causeway area, as shown on EIS Figure 26-9). Refer to Section 3.2.14 Land and Water Use for a discussion of the revision of that access effect down from 'minor to moderate' to 'minor' given the removal of the use of the ITP from construction activities.

3.3.2 Availability of Preferred Current Use Resources

EIS Section 32.2.6.2 considers the potential of the Project to interact with the availability of preferred Current Use resources. With the mitigation measures proposed in the EIS (EIS Section 32.2.7.2), which included measures for linked VCs (i.e., marine vegetation, marine invertebrates, marine fish, marine mammals, coastal birds) in conjunction with ongoing consultation, the residual effect on availability of preferred Current Use resources was predicted to be negligible.

As reviewed in **Section 3.2**, there is no change to overall residual effects conclusions of the assessments for marine vegetation, marine fish (and ongoing productivity of commercial, recreational, and Aboriginal fisheries), marine mammals, or coastal birds with the updated construction activities. However, the updated construction activities described in **Section 2.0** will result in reductions of potential productivity losses for each of these marine biophysical VCs, as summarised in **Attachment C4**.

In particular, there is a decrease in the potential direct effects on crab (as summarised in **Section 3.2.2**). Five previously 'minor' potential effects have been reduced to 'no effect' due to elimination of the construction activities. Further, with the elimination of ITP use, a previously 'high' potential effect on crab productivity is reduced to 'minor'. While eliminating ITP use will lessen the direct mortality and (temporary) loss of habitat availability experienced by marine invertebrate sub-components, initial filling of the terminal basins will result in mortality of individual marine invertebrates within the terminal basins; as such, a rating of 'minor' is warranted. As described in **Section 3.2.2**, crab salvages prior to filling will reduce this effect, and a negligible residual effect is predicted, as stated in the EIS.

Considering the changes described above, and the mitigation measures proposed in the EIS (EIS Section 32.2.7.2), the residual effect prediction for availability of preferred Current Use resource remains negligible (see **Table 3.3-1** for a summary of potential effect ratings for availability of preferred resources).

3.3.3 Quality of Preferred Current Use Resources

EIS Section 32.2.6.3 considers the potential of the Project to interact with the quality of Current Use resources. No measurable effects on Current Use related to quality of resources were identified in the EIS, based largely on the conclusions of the human health assessment regarding shellfish.

With the updated construction activities, there is reduced dredging (elimination of sand reclamation from the ITP and smaller dredge basin footprint) and reduced sediment

discharges (**Table 2-4**), thereby reducing potential contaminant re-suspension and subsequent potential contamination of shellfish. However, as summarised in the human health assessment (**Section 3.2.15**), there is unlikely to be a change in the perception of shellfish contamination from the updated construction activities.

Considering the updated construction activities, there is no change to the potential effect of Project construction on quality of preferred Current Use resources (see **Table 3.3-1** for a summary of potential effect ratings for quality of preferred resources).

3.3.4 Quality of Current Use Experience

EIS Section 32.2.6.4 describes the various pathways through which the quality of Current Use experience could be affected, including changed sense of place, risk to safety and security, and sensory disturbance. Inherent to each of these, as well as to the other effect pathways on Current Use assessed under other indicators (i.e., access to locations, availability and quality of resources), is a potential effect on intangible cultural heritage (per response to IR-7.31.15-29 of CEAR Document #314), and possibly reduced opportunities to transmit Aboriginal traditional knowledge (ATK). As indicated in the EIS, some individual Aboriginal communities may experience effects on their quality of experience, as this potential effect is community specific. Each effect mechanism is discussed below in relation to the updated construction activities.

Sense of Place

Changes to sense of place were considered in the EIS in relation to visual quality (daytime and nighttime), and in relation to archaeological and heritage resources, in terms of cultural landscape. As indicated in **Section 3.2.13**, there is no change to the conclusions of the visual resources assessment, including daytime and nighttime components, as a result of the updated construction activities described in **Section 2.0**. As indicated in **Section 3.2.16**, the conclusions of the archaeological and heritage resources assessment are also not altered by the updated construction activities. Therefore, the consideration of sense of place and predicted effects on quality of Current Use experience remains unchanged from the EIS.

Risks to Safety and Security

Real and perceived risks to safety and security were considered in the EIS for their potential to affect the quality of Current Use experience. With the updated construction activities, there will be a net reduction in overall construction vessel traffic of 390 movements (derived from **Table 2-6**). The most noticeable decrease, in terms of interaction with Current Use activity, will be the reduction of 1,056 dredger vessel movements that are no longer required to transport sand to the ITP in the inter-causeway area. The contribution of Project vessel traffic to the effect on quality of Current Use experience would be reduced with the updated construction activities.

Sensory Disturbance

Potential sensory disturbance, affecting quality of Current Use experience, was considered in the EIS in areas within 1 km north, south, and west of the proposed terminal and areas up to

3 km east of the terminal (including Current Use in the Tsawwassen Water Lot in the inter-causeway area), where perceptible changes in noise levels could occur. As summarised in **Section 3.1.2**, the average construction phase noise levels based on the updated construction activities are predicted to differ from the levels predicted in the EIS by less than 0.5 dBA, which is considered negligible change, and within the margin of error for noise measurement equipment (±1 dBA). While some periods of construction activity may be louder than predicted, in other periods noise will be less, particularly with the elimination of ITP use, and associated dredging for sand recovery that will no longer take place in the inter-causeway area. No noise-related effects on Current Use in upland areas were identified in the EIS and, with the updated construction activities, average upland noise levels are expected to differ from EIS predictions by ±1 dBA.

Potential sensory disturbance was also considered in relation to changes in air quality. As described in **Section 3.1.1** and **3.2.15**, air contaminant emissions are expected to decrease as a result of the updated construction activities, with no changes to overall assessment conclusions. Similarly, potential sensory disturbance was identified in relation to light and, as described in **Section 3.1.3**, there are no changes to the light assessment with the updated construction activities.

Considering the foregoing, the conclusion of a negligible potential effect on the quality of Current Use experience remains unchanged from the EIS. The conclusion of a potential measurable effect on intangible cultural heritage associated with the potential measurable effect on Tsawwassen First Nation and Musqueam First Nation access (access effect described above) also remains unchanged (per IR-7.31.15-29 (CEAR Document #314) and AIR-12.04.15-29 (CEAR Document #388)).

3.3.5 Conclusion

With consideration of the updated construction activities, the predicted Current Use effects assessment conclusions remain unchanged from the EIS, as reviewed above and summarised in **Table 3.3-1**. This includes potential effect ratings, mitigation, and negligible residual effect characterisations.

EIS Section 32.3.2 provides an assessment of the potential adverse impacts of the Project on Aboriginal and Treaty rights and related interests. As indicated in that section, while rights do not overlap precisely in time and space with Current Use activities, there is a close linkage between the rights discussed in the EIS Section 32.3.2 and the Current Use activities discussed in Section 32.2. Since the updated construction activities are not anticipated to result in any changes to the assessment of effects on Current Use presented in the EIS, and since there are no anticipated direct impacts on rights and related interests resulting from the updated construction activities, the conclusions of the rights assessment in EIS Section 32.3.2 remain unchanged.

Table 3.3-1 Updates to the Assessment of Current Use from Updated Construction Activities

EIS/PCU Potential Effect Indicator	Potential Effect Pathway	EIS Potential Effect Rating	EIS Residual Effect Rating	Summary of Changes Based on Updated Construction Activities	Updated PCU Potential Effect Rating	Updated PCU Residual Effect rating
Access to preferred Current Use locations	Harvesting locations for marine vegetation; marine fish; marine invertebrates (except crab); marine mammals; coastal birds	Negligible	Negligible	No change to Current Use conclusions from updated construction activities.	Negligible[a]	Negligible
	Harvesting locations for marine invertebrates (crab)	Measurable (For Tsawwassen First Nation and Musqueam First Nation)		No change to Current Use conclusions from updated construction activities.	Measurable (For Tsawwassen First Nation and Musqueam First Nation)	
	Other use locations (i.e., waterways)	Measurable (For Tsawwassen First Nation)		No change to footprint area of the physical terminal.	Measurable (For Tsawwassen First Nation)	
Availability of preferred Current Use resources	Marine vegetation; marine fish; marine mammals; coastal birds Marine invertebrates (crab)	Negligible[a]	Negligible	No change to conclusions of assessments for linked VCs.	Negligible[a]	Negligible
				Reduced effects on crab productivity related to elimination of ITP use.		
Quality of preferred Current Use resources	Marine invertebrates (crab and bivalves)	Negligible[a]	Negligible	Decreased dredging, and lower potential for contamination of shellfish from re-suspension of sediments.	Negligible[a]	Negligible

EIS/PCU Potential Effect Indicator	Potential Effect Pathway	EIS Potential Effect Rating	EIS Residual Effect Rating	Summary of Changes Based on Updated Construction Activities	Updated PCU Potential Effect Rating	Updated PCU Residual Effect rating
	Marine mammals			No change to conclusions of marine mammals assessment.		
Quality of Current Use experience	Changed sense of place	Negligible[a]	Negligible	No change to conclusions of visual resources assessment from updated construction activities.	Negligible[a]	Negligible
	Risks to safety and security			Slight decrease in effect due to reduced vessel traffic during construction.		
	Sensory disturbance (air quality, noise and vibration, light)			No change to overall conclusions of air quality, noise and vibration, and light assessments from updated construction activities.		
	Indirect effect on intangible cultural heritage (associated with any other effect pathway for any indicator)	Measurable (for access-related effects for Tsawwassen First Nation and Musqueam First Nation)	Negligible	No change	Measurable (for access-related effects for Tsawwassen First Nation and Musqueam First Nation)	Negligible

Notes: a. For all groups, except those for which there is 'no effect', as shown in **Table 3.3-2.**

Table 3.3-2 Summary of Updates to Current Use Potential Effects by Aboriginal Group

Potential Effect	EIS			PCU		
	Potential Effect Rating	**Aboriginal Groups Potentially Affected**	**Residual Effect Rating**	**Updated Potential Effect Rating**	**Aboriginal Groups Potentially Affected**	**Updated Residual Effect Rating**
Access to preferred Current Use locations	No Effect	Semiahmoo First Nation Stó:lō Nation member bands Stó:lō Tribal Council member bands	Negligible (all groups)	No Effect	Semiahmoo First Nation Stó:lō Nation member bands Stó:lō Tribal Council member bands	Negligible (all groups)
	Negligible	Tsleil-Waututh Nation Cowichan Tribes Halalt First Nation Penelakut Tribe Stz'uminus First Nation Lake Cowichan First Nation Lyackson First Nation Métis Nation of British Columbia Hwlitsum First Nation Tsawout First Nation Pauquachin First Nation Tsartlip First Nation Tseycum First Nation Malahat Nation		Negligible	Tsleil-Waututh Nation Cowichan Tribes Halalt First Nation Penelakut Tribe Stz'uminus First Nation Lake Cowichan First Nation Lyackson First Nation Métis Nation of British Columbia Hwlitsum First Nation Tsawout First Nation Pauquachin First Nation Tsartlip First Nation Tseycum First Nation Malahat Nation	
	Measurable	Tsawwassen First Nation Musqueam First Nation		Measurable	Tsawwassen First Nation Musqueam First Nation	

Potential Effect	EIS			PCU		
	Potential Effect Rating	**Aboriginal Groups Potentially Affected**	**Residual Effect Rating**	**Updated Potential Effect Rating**	**Aboriginal Groups Potentially Affected**	**Updated Residual Effect Rating**
Availability of preferred Current Use resources	No Effect	Semiahmoo First Nation Stó:lō Nation member bands Stó:lō Tribal Council member bands	Negligible (all groups)	No Effect	Semiahmoo First Nation Stó:lō Nation member bands Stó:lō Tribal Council member bands	Negligible (all groups)
	Negligible	Tsawwassen First Nation Musqueam First Nation Tsleil-Waututh Nation Cowichan Tribes Halalt First Nation Penelakut Tribe Stz'uminus First Nation Lake Cowichan First Nation Lyackson First Nation Métis Nation of British Columbia Hwlitsum First Nation Tsawout First Nation Pauquachin First Nation Tsartlip First Nation Tseycum First Nation Malahat Nation		Negligible	Tsawwassen First Nation Musqueam First Nation Tsleil-Waututh Nation Cowichan Tribes Halalt First Nation Penelakut Tribe Stz'uminus First Nation Lake Cowichan First Nation Lyackson First Nation Métis Nation of British Columbia Hwlitsum First Nation Tsawout First Nation Pauquachin First Nation Tsartlip First Nation Tseycum First Nation Malahat Nation	

Potential Effect	EIS			PCU		
	Potential Effect Rating	**Aboriginal Groups Potentially Affected**	**Residual Effect Rating**	**Updated Potential Effect Rating**	**Aboriginal Groups Potentially Affected**	**Updated Residual Effect Rating**
Quality of preferred Current Use resources	No Effect	Semiahmoo First Nation Stó:lō Nation member bands Stó:lō Tribal Council member bands	Negligible (all groups)	No Effect	Semiahmoo First Nation Stó:lō Nation member bands Stó:lō Tribal Council member bands	Negligible (all groups)
	Negligible	Tsawwassen First Nation Musqueam First Nation Tsleil-Waututh Nation Cowichan Tribes Halalt First Nation Penelakut Tribe Stz'uminus First Nation Lake Cowichan First Nation Lyackson First Nation Métis Nation of British Columbia Hwlitsum First Nation Tsawout First Nation Pauquachin First Nation Tsartlip First Nation Tseycum First Nation Malahat Nation		Negligible	Tsawwassen First Nation Musqueam First Nation Tsleil-Waututh Nation Cowichan Tribes Halalt First Nation Penelakut Tribe Stz'uminus First Nation Lake Cowichan First Nation Lyackson First Nation Métis Nation of British Columbia Hwlitsum First Nation Tsawout First Nation Pauquachin First Nation Tsartlip First Nation Tseycum First Nation Malahat Nation	

Potential Effect	EIS			PCU		
	Potential Effect Rating	**Aboriginal Groups Potentially Affected**	**Residual Effect Rating**	**Updated Potential Effect Rating**	**Aboriginal Groups Potentially Affected**	**Updated Residual Effect Rating**
Quality of Current Use experience	No Effect	Semiahmoo First Nation Stó:lō Nation member bands Stó:lō Tribal Council member bands	Negligible (all groups)	No Effect	Semiahmoo First Nation Stó:lō Nation member bands Stó:lō Tribal Council member bands	Negligible (all groups)
	Negligible	Tsleil-Waututh Nation Cowichan Tribes Halalt First Nation Penelakut Tribe Stz'uminus First Nation Lake Cowichan First Nation Lyackson First Nation Métis Nation of British Columbia Hwlitsum First Nation Tsawout First Nation Pauquachin First Nation Tsartlip First Nation Tseycum First Nation Malahat Nation		Negligible	Tsleil-Waututh Nation Cowichan Tribes Halalt First Nation Penelakut Tribe Stz'uminus First Nation Lake Cowichan First Nation Lyackson First Nation Métis Nation of British Columbia Hwlitsum First Nation Tsawout First Nation Pauquachin First Nation Tsartlip First Nation Tseycum First Nation Malahat Nation	
	Measurable (Intangible cultural heritage - access related effect)	Tsawwassen First Nation Musqueam First Nation		Measurable (Intangible cultural heritage - access related effect)	Tsawwassen First Nation Musqueam First Nation	

3.4 REFERENCES

de Jong, C., M. Ainslie, J. Dreschler, E. Jansen, E. Heemskerk, and G. Wim. 2010. Underwater Noise of Trailing Suction Hopper Dredgers at Maasvlakte 2: Analysis of Source Levels and Background Noise. Document Number TNO-DV 2010 C335. TNO. 89 pp.

Dooling, R. J. and A. N. Popper. 2007. The Effects of Highway Noise on Birds. Report prepared for the California Department of Transportation, Sacramento, CA. Report prepared by Jones and Stokes Associates. Available at http://www.dot.ca.gov/hq/env/bio/files/caltrans_birds_10-7-2007b.pdf. Accessed April 2014.

4.0 CONCLUSION

The key changes to Project construction, as described in **Section 2.0**, are as follows:

- Elimination of use of the ITP, resulting in an extension of construction schedule by eight months;
- Elimination of the vibro-replacement process in the caisson trench, and associated collection and disposal activities of fallout material;
- Use of tug basin dredgeate material as general fill (which eliminates surface disposal of dredgeate material;
- Reduction in volume of dredged material from the dredge basin (which decreases the Project footprint) and use of all material as general fill;
- RBT2 overpass on the widened causeway will be founded on approximately 86 piles;
- Lower intensity of equipment use at the peak of construction; and
- Reduction in the overall combined dredge equipment and tug/barge traffic.

The changes resulting from the updated construction activities on Project-IC/VC interactions are summarised in **Attachment C2** and described in **Sections 3.1** and **3.2**. Overall, these changes to the environmental assessment resulting from construction updates can generally be summarised as follows:

- Reductions in potential adverse changes or effects on ICs, biophysical VCs, social VCs, and Current Use; and
- Increases in positive interactions with socio-economic VCs.

These beneficial changes to ICs and VCs occur at the level of interactions or potential effects, and in most cases are slight changes, and thus do not affect the overall conclusions made in the EIS (as summarised in **Attachments C3** and **C4**, respectively), including proposed mitigation, residual effect characterisations, significance determinations or cumulative effects, as applicable, with one exception. The only component predicted to have a change to residual effects is land and water use, with a reduction of a residual effect on access to TFN community lease lands from a measurable non-significant residual effect to a negligible residual effect, due to elimination of the ITP and associated activities (**Section 3.2.14**).

Attachment A: Updated EIS and New Figures

(For list of figures, refer to **Table 1-1**)

Figure	Title	Status
4-1	Project Location and Orientation	No Change
4-2	Project Universal Transverse Mercator (UTM) Coordinates	Updated
4-3	Roberts Bank Bathymetry	No Change
4-4	Conceptual Plan View of Marine Terminal Layout	No Change
4-5	Cross-Section of Caisson Wharf Structure	Updated
4-6	Widened Causeway Layout	No Change
4-7	RBT2 Overpass and Road Connection	Updated
4-8	Expanded Tug Basin Layout	No Change
4-9	Anticipated Project Construction Schedule including Key Construction Activities	Updated
4-10	Project Construction Progress Months 1 to 6	Updated
4-11	Project Construction Progress Months 7 to 12	Updated
4-12	Project Construction Progress Months 13 to 18	Updated
4-13	Project Construction Progress Months 19 to 24	Updated
4-14	Project Construction Progress Months 25 to 30	Updated
4-15	Project Construction Progress Months 31 to 36	Updated
4-16	Project Construction Progress Months 37 to 42	Updated
4-17	Project Construction Progress Months 43 to 48	Updated
4-18	Project Construction Progress Months 49 to 54	Updated
4-19	Project Construction Progress Months 55 to 63	Updated
4-20	Project Construction Progress Months 64 to 73	Updated
4-21	Intermediate Transfer Pit and Disposal at Sea Candidate Locations	Deleted
4-22	Intermediate Transfer Pit Sand Storage Volumes	Deleted
4-23	Representative Cross-Section of a Containment Dyke at the Marine Terminal	Updated
4-24	Plan View of Dredge Basin and Marine Terminal Areas	Updated
4-25	Assembled Ship-to-Shore Gantry Crane Delivery	No Change
4-26	Container Ship and Tug Support Key Locations Map	No Change
4-27	Ship Traffic Annual Ship Movements for 2012 and 2030	No Change
4-28	Terminal Container Flow Diagram	No Change
4-29	Train Traffic Daily Average Movements for 2012 and 2030	No Change
4-30	Container Truck Drayage Daily Average Movements for 2012 and 2030	No Change
4-31	Other Vehicle Traffic Daily Average Movements for 2012 and 2030	No Change
4-32	Terminal 2 Overpass West Structure Conceptual Layout	New
4-33	Terminal 2 Overpass East Structure Conceptual Layout	New
4-34	Terminal Buildings Conceptual X-Section	New

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ROBERTS BANK TERMINAL 2

SECTION 4 FIGURES REVISIONS

DATE: **06/06/2018**

485000 486000 487000 488000 489000 490000 491000 492000

5433000 5432000 5431000 5430000 5429000

Roberts Bank
Strait of Georgia

UTM E: 491308 N: 5433365

UTM E: 491000 N: 5433136

UTM E: 487900 N: 5430350

UTM E: 489247 N: 5430354

UTM E: 485970 N: 5430071

UTM E: 485684 N: 5429498

UTM E: 485511 N: 5429453

UTM E: 486508 N: 5429515

UTM E: 487526 N: 5429403

UTM E: 487076 N: 5428888

17

Legend

BOUNDARY OF PROJECT AREA

ORIGINAL EIS COORDINATES **REVISED PCU COORDINATES**

0 250 500 Metres

N

1:20,000

COORDINATES SHOWN AS UTM NAD83, ZONE 10.
FOR DETAIL ON THE REVISED PCU COORDINATES, PLEASE REFER TO FIGURE 4-24.

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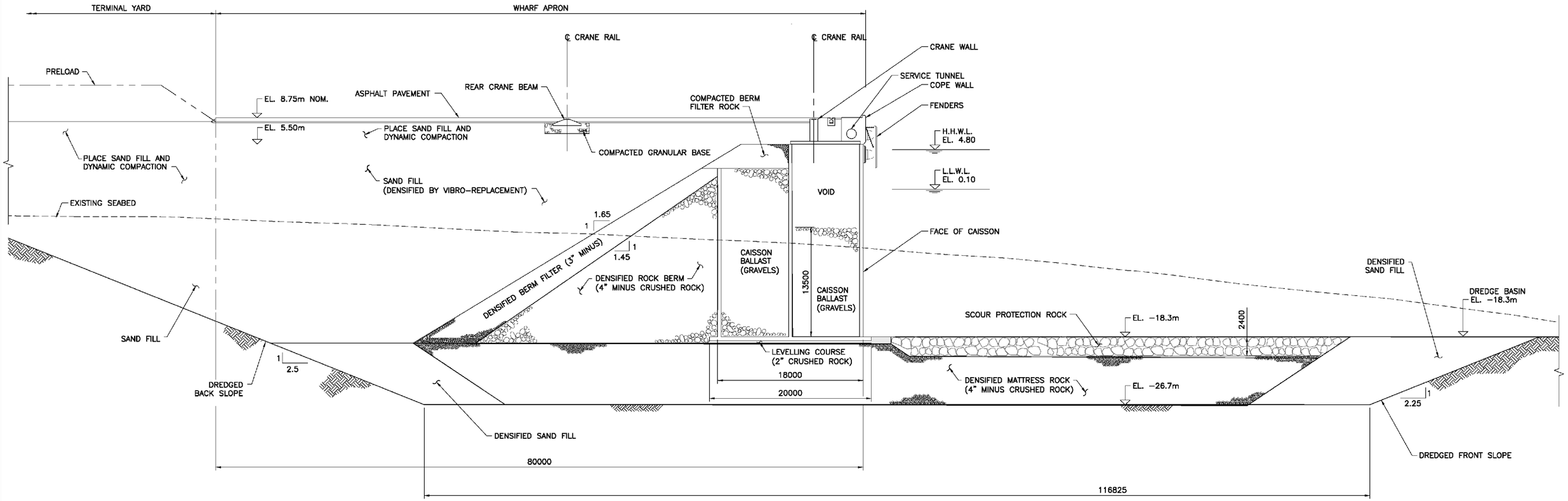
ROBERTS BANK TERMINAL 2

PROJECT UNIVERSAL TRANSVERSE MERCATOR (UTM) COORDINATES

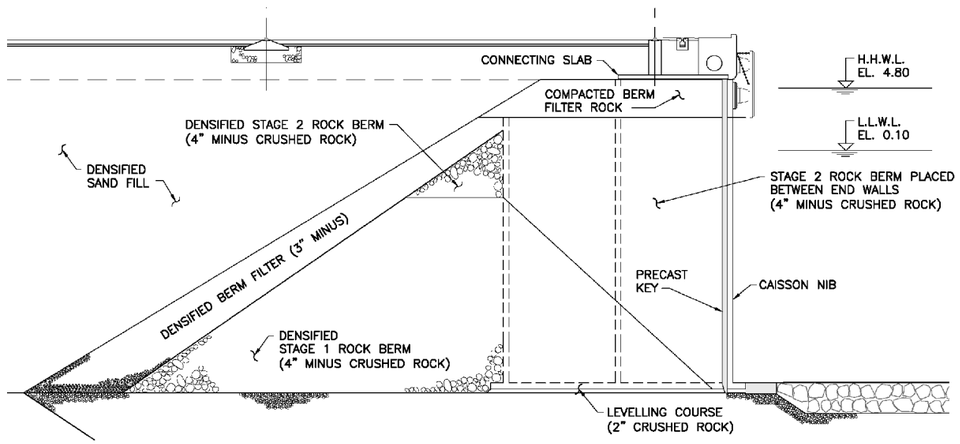
DATE: 06/06/2018

FIG No. 4-2



PROPOSED GI CONFIGURATION

TYPICAL SECTION
1:250



TYPICAL SECTION BETWEEN CAISSONS
1:250

UNITS IN MM UNLESS OTHERWISE STATED

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ROBERTS BANK TERMINAL 2

CROSS-SECTION OF CAISSON WHARF STRUCTURE

DATE: 06/06/2018

FIG No. 4-5

ROBERTS BANK TERMINAL 2

WEST OVERPASS
SEE FIGURE 4-32

S-BEND

EAST OVERPASS
SEE FIGURE 4-33

Roberts Bank
Strait of Georgia

ROBERTS BANK
WAY NORTH

TOE OF SLOPE

T YARD

DELTAPORT TERMINAL

WESTSHORE TERMINALS

ROBERTS BANK
WAY SOUTH

DTRRIP OVERPASS

DELTAPORT WAY

Legend

- RBT2 OVERPASS - ELEVATED
- RBT2 OVERPASS AND ACCESS ROAD - NON-ELEVATED
- RBT2 TRACKS
- WESTSHORE TRACKS
- EXISTING ACCESS/OVERPASS
- EXISTING FEATURE
- BOUNDARY OF PROJECT AREA
- RBT2 WIDENED CAUSEWAY
- RBT2 EMERGENCY ACCESS ROAD
- UTILITY CORRIDOR
- EXTENT OF GROUND IMPROVEMENTS

PROJECT COMPONENT

EXISTING LANDMARK

0 50 100
Metres
1:5,000

NAD 1983 UTM Zone 10N

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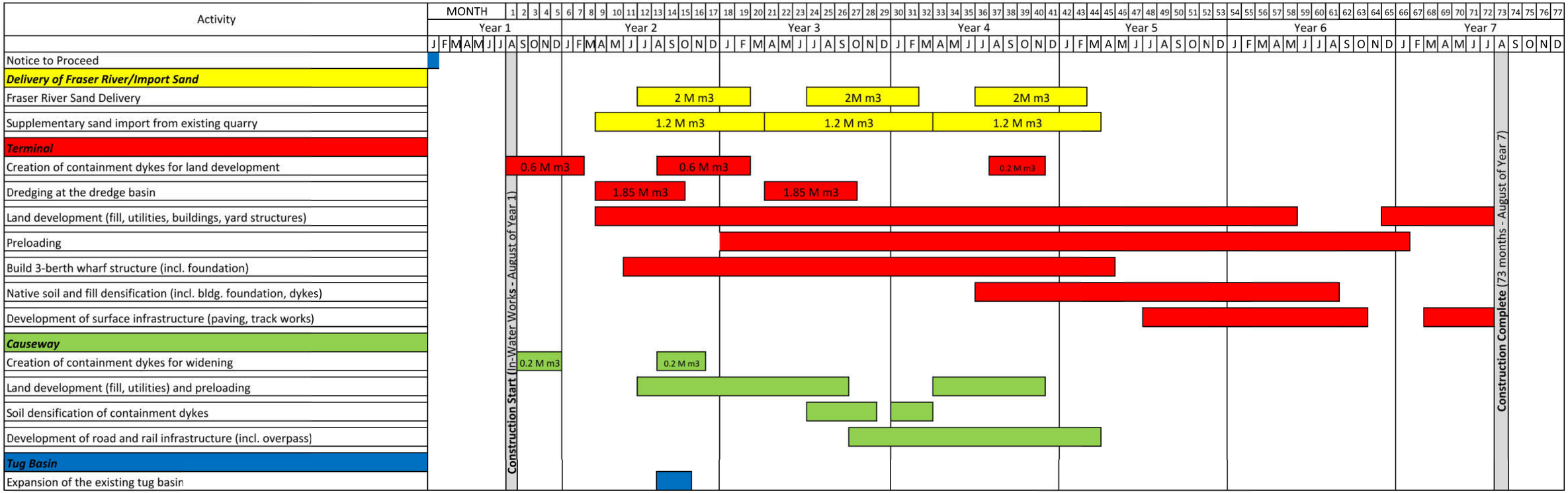
ROBERTS BANK TERMINAL 2

RBT2 OVERPASS AND ROAD CONNECTION

DATE: 06/06/2018

FIG No. 4-7



Notes:

1. The above simplified schedule does not include TO equipment testing, commissioning, and operational system testing and training

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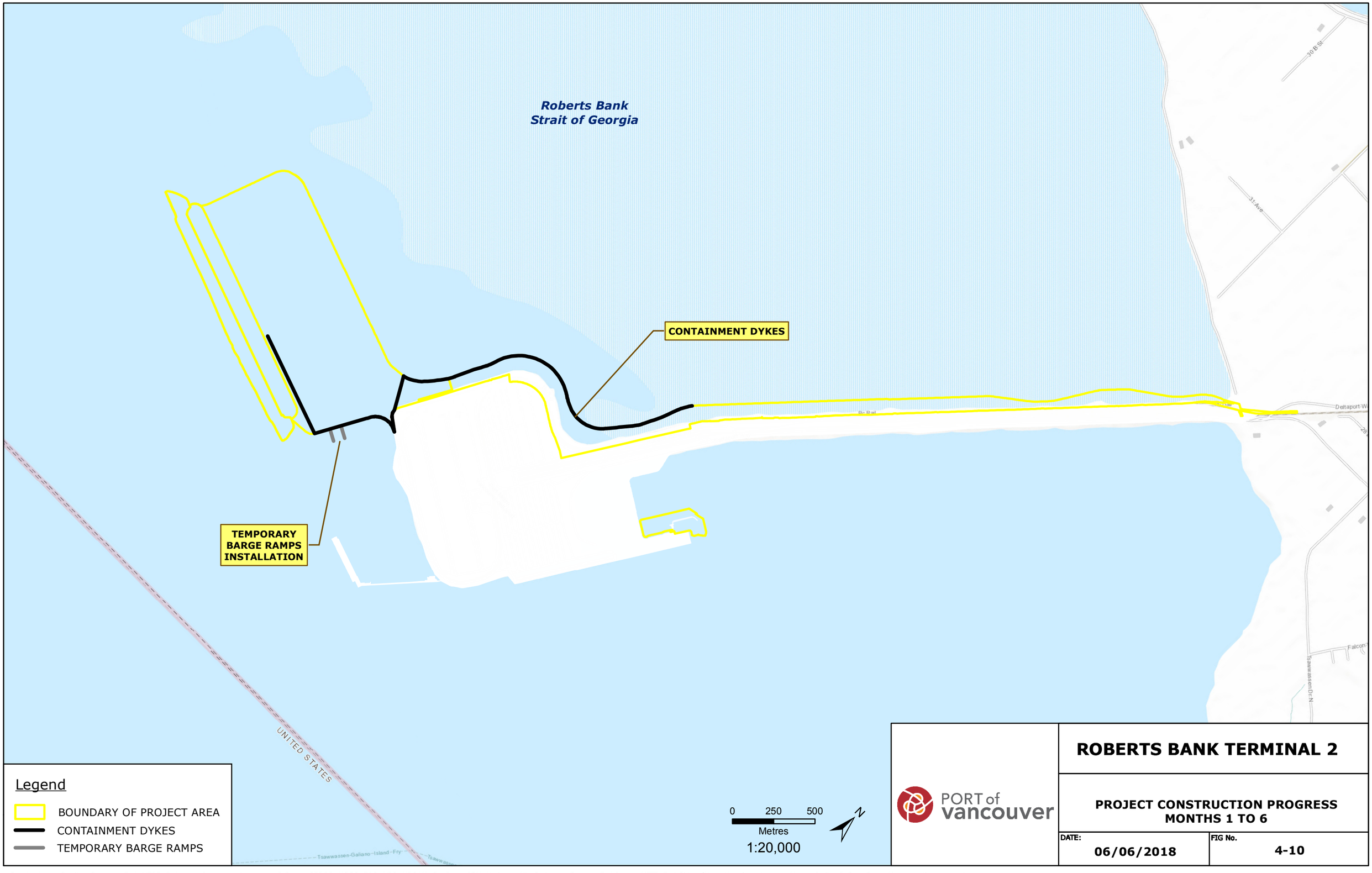
ROBERTS BANK TERMINAL 2

ANTICIPATED PROJECT CONSTRUCTION SCHEDULE INCLUDING KEY CONSTRUCTION ACTIVITIES

DATE:	FIG No.
06/06/2018	4-9



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ROBERTS BANK TERMINAL 2

PROJECT CONSTRUCTION PROGRESS MONTHS 1 TO 6

DATE:	FIG No.
06/06/2018	4-10

Roberts Bank
Strait of Georgia

DREDGED BASIN MATERIAL
AND IMPORTED SAND
FROM EXISTING QUARRY

FRASER RIVER SAND
DIRECT PUMP FROM HOPPER DREDGE
AND IMPORTED SAND FROM EXISTING QUARRY

CONTAINMENT DYKES

EAST BASIN

TEMPORARY STOCKPILE

DREDGE BASIN
DREDGING & PUMP
INTO EAST BASIN

PIPELINE

DREDGE BASIN
FOUNDATION PREPARATION

TEMPORARY
BARGE RAMPS

30 B St

31 Ave

Deltaport Way

Falcon

Tsawwassen Dr N

Legend

- BOUNDARY OF PROJECT AREA
- SUPERNATANT DISCHARGE AREA
- CONTAINMENT DYKES
- TEMPORARY BARGE RAMPS
- PIPELINE
- DREDGED AREA
- INITIAL FILL FROM DREDGE BASIN AND IMPORTED SAND
- DREDGE BASIN FOUNDATION PREPARATION
- SAND FILL
- TEMPORARY SAND STOCKPILE

0 250 500
Metres
1:20,000

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ROBERTS BANK TERMINAL 2

PROJECT CONSTRUCTION PROGRESS MONTHS 7 TO 12

DATE: 06/06/2018

FIG No. 4-11

Roberts Bank
Strait of Georgia

TEMPORARY BARGE RAMP

CONTAINMENT DYKES

WEST BASIN

FRASER RIVER SAND
DIRECT PUMP FROM HOPPER DREDGE
AND IMPORTED SAND FROM EXISTING QUARRY

EAST BASIN

DREDGE BASIN
DREDGING & PUMP
INTO EAST BASIN

PRELOAD FRASER RIVER SAND
DIRECT PUMP FROM HOPPER DREDGE

EAST
CAUSEWAY DYKES

EXPANDED
TUG BASIN

PIPELINE

Legend

- BOUNDARY OF PROJECT AREA
- SUPERNATANT DISCHARGE AREA
- CONTAINMENT DYKES
- TEMPORARY BARGE RAMPS
- PIPELINE
- DREDGED AREA
- INTIAL FILL FROM DREDGE BASIN
- DREDGE BASIN FOUNDATION PREPARATION
- SAND FILL
- PRELOAD
- TUG BASIN FINAL ELEVATION

0 250 500
Metres
1:20,000

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ROBERTS BANK TERMINAL 2

PROJECT CONSTRUCTION PROGRESS
MONTHS 13 TO 18

DATE: 06/06/2018

FIG No. 4-12

Roberts Bank
Strait of Georgia

DREDGE BASIN DREDGING & PUMP INTO WEST BASIN

WEST BASIN

IMPORTED SAND FROM EXISTING QUARRY

PIPELINE

EAST BASIN

DREDGE BASIN FOUNDATION PREP

PIPELINE

30 B St

31 Ave

Deltaport Way

Tsawwassen Dr N

Falcon

STATES

Tsawwassen-Galiano-Island-Fry

Tsawwassen

Legend

- BOUNDARY OF PROJECT AREA
- SUPERNATANT DISCHARGE AREA
- CONTAINMENT DYKES
- TEMPORARY BARGE RAMPS
- PIPELINE
- DREDGED AREA
- INTIAL FILL FROM DREDGE BASIN
- DREDGE BASIN FOUNDATION PREPARATION
- SAND FILL
- PRELOAD
- TERMINAL/CAUSEWAY FINAL GRADE
- TUG BASIN FINAL ELEVATION

0 250 500
Metres
1:20,000

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ROBERTS BANK TERMINAL 2

PROJECT CONSTRUCTION PROGRESS MONTHS 19 TO 24

DATE: 06/06/2018

FIG No. 4-13

Roberts Bank
Strait of Georgia

DREDGE BASIN DREDGING & PUMP INTO WEST BASIN

WEST BASIN

FRASER RIVER SAND DIRECT PUMP FROM HOPPER DREDGE AND IMPORTED SAND FROM EXISTING QUARRY

PRELOAD FRASER RIVER SAND AND IMPORTED SAND FROM EXISTING QUARRY

EAST BASIN

CONTAINMENT DYKES

PIPELINE

BERTH POCKET COMPLETE WITH DENSIFIED MATTRESS ROCK

DREDGE BASIN FOUNDATION PREP

CAISSON PLACEMENT

PIPELINE

WESTSHORE TRACK REALIGNMENT FOR RBT2 OVERPASS

30 B St

31 Ave

Deltaport Way

Tsawwassen Dr N

Falcon

Legend

- BOUNDARY OF PROJECT AREA
- CAISSON
- SUPERNATANT DISCHARGE AREA
- CONTAINMENT DYKES
- TEMPORARY BARGE RAMPS
- PIPELINE
- RAIL TRACK REALIGNMENT
- DREDGED AREA
- INTIAL FILL FROM DREDGE BASIN
- DREDGE BASIN FOUNDATION PREPARATION
- SAND FILL
- PRELOAD
- TERMINAL/CAUSEWAY FINAL GRADE
- BERTH POCKET DENSIFIED MATTRESS ROCK ELEVATION
- TUG BASIN FINAL ELEVATION

0 250 500
Metres
1:20,000

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ROBERTS BANK TERMINAL 2

PROJECT CONSTRUCTION PROGRESS MONTHS 25 TO 30

DATE: 06/06/2018

FIG No. 4-14

Roberts Bank
Strait of Georgia

DREDGE BASIN FOUNDATION PREP

WEST BASIN

PRELOAD FRASER RIVER SAND
DIRECT PUMP FROM HOPPER DREDGE
AND IMPORTED SAND FROM EXISTING QUARRY

PIPELINE

EAST BASIN

CONTAINMENT DYKES

BERTH POCKET
COMPLETE WITH
DENSIFIED MATTRESS ROCK

CAISSON PLACEMENT

WESTSHORE TRACK
REALIGNMENT FOR
RBT2 OVERPASS

30 B St

31 Ave

Deltaport Way

Tsawwassen Dr N

Falcon

Legend

- BOUNDARY OF PROJECT AREA
- CAISSON
- SUPERNATANT DISCHARGE AREA
- CONTAINMENT DYKES
- TEMPORARY BARGE RAMPS
- PIPELINE
- RAIL TRACK REALIGNMENT
- DREDGE BASIN FOUNDATION PREPARATION
- SAND FILL
- PRELOAD
- TERMINAL/CAUSEWAY FINAL GRADE
- BERTH POCKET DENSIFIED MATTRESS ROCK ELEVATION
- TUG BASIN FINAL ELEVATION

0 250 500
Metres
1:20,000

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ROBERTS BANK TERMINAL 2

PROJECT CONSTRUCTION PROGRESS MONTHS 31 TO 36

DATE: 06/06/2018

FIG No. 4-15

WEST CLOSURE DYKE

Roberts Bank
Strait of Georgia

T YARD INSET

BOUNDARY

EMERGENCY ACCESS ROAD

UTILITY CORRIDOR

SPACE FOR 5 TRACKS

4 TRACKS

WEST BASIN

EAST BASIN

COMPLETED BERTH POCKET WITH SCOUR PROTECTION

CAISSON PLACEMENT

CONTAINMENT DYKES

T YARD

EAST CLOSURE DYKE

BUILDING FOUNDATIONS

RBT2 OVERPASS & ACCESS ROAD

WESTSHORE TRACK REALIGNMENT FOR RBT2 OVERPASS

RAIL TIE-INS AND 2 LEADS TO TERMINAL

30 B St

31 Ave

Deltaport Way

Falcon

Tsawwassen Dr N

Legend

- BOUNDARY OF PROJECT AREA
- CAISSON
- SUPERNATANT DISCHARGE AREA
- ROAD CONSTRUCTION
- CONTAINMENT DYKES
- TEMPORARY BARGE RAMPS
- RAIL TRACK REALIGNMENT
- RAIL TRACK ALIGNMENT
- SAND FILL
- PRELOAD
- TERMINAL/CAUSEWAY FINAL GRADE
- BERTH POCKET DENSIFIED MATTRESS ROCK ELEVATION
- COMPLETED BERTH POCKET WITH SCOUR PROTECTION
- TUG BASIN FINAL ELEVATION

0 250 500
Metres
1:20,000

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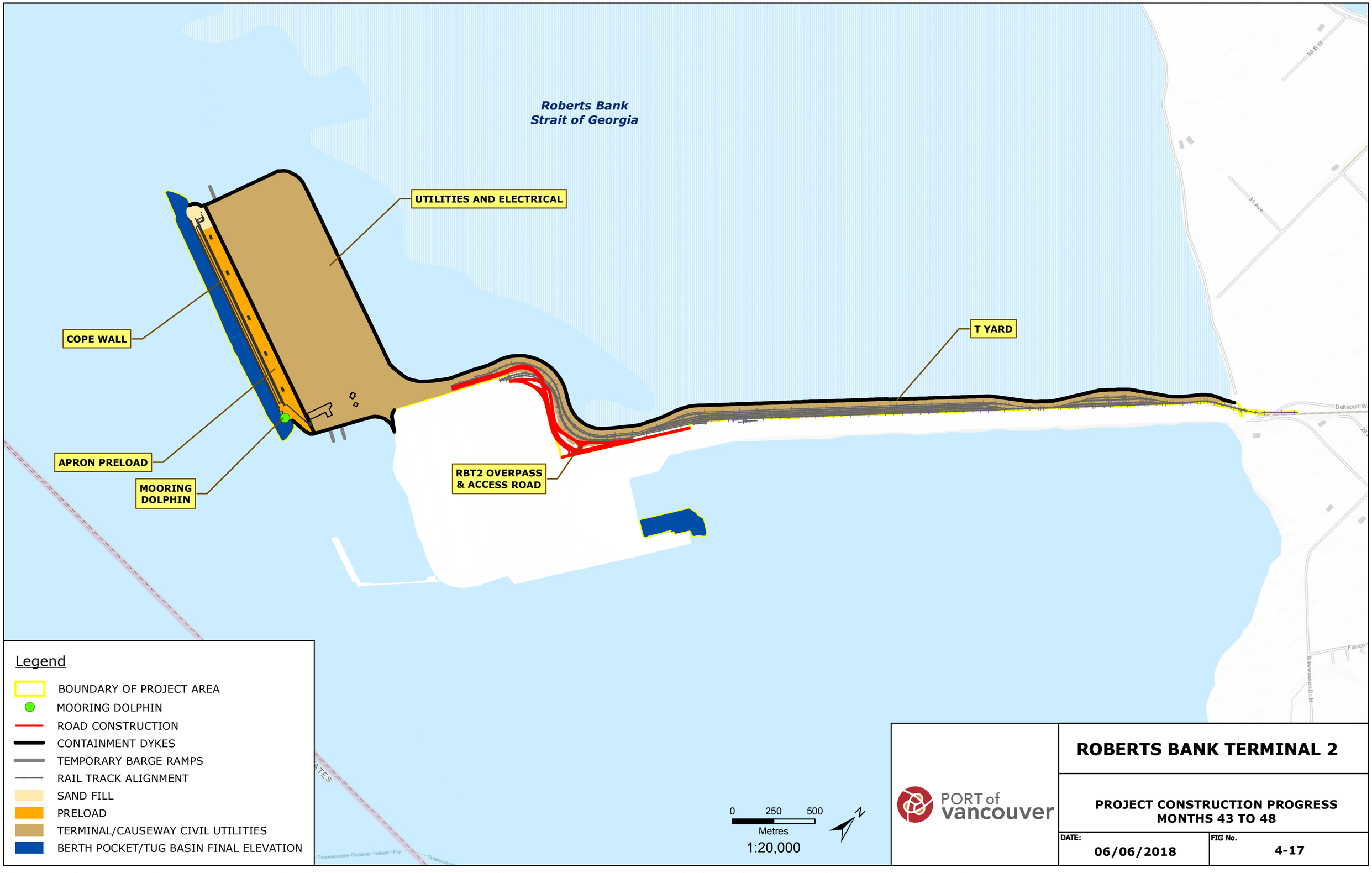
ROBERTS BANK TERMINAL 2

PROJECT CONSTRUCTION PROGRESS MONTHS 37 TO 42

DATE: 06/06/2018

FIG No. 4-16



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Roberts Bank
Strait of Georgia

T YARD INSET

BOUNDARY
EMERGENCY ACCESS ROAD
UTILITY CORRIDOR
9 TRACKS

TERMINAL BUILD-OUT

TRACK WORKS

TERMINAL BUILDING

DPU/BAD ORDER SETOUT YARD

DPU/BAD ORDER SETOUT YARD INSET

BOUNDARY
EMERGENCY ACCESS ROAD
UTILITY CORRIDOR
6 YARD TRACKS
2 MAINLINE TRACKS

Legend

- BOUNDARY OF PROJECT AREA
- MOORING DOLPHIN
- ROAD CONSTRUCTION
- CONTAINMENT DYKES
- TEMPORARY BARGE RAMPS
- RAIL TRACK ALIGNMENT
- PRELOAD
- TERMINAL/CAUSEWAY CIVIL UTILITIES
- BERTH POCKET/TUG BASIN FINAL ELEVATION

0 250 500
Metres
1:20,000

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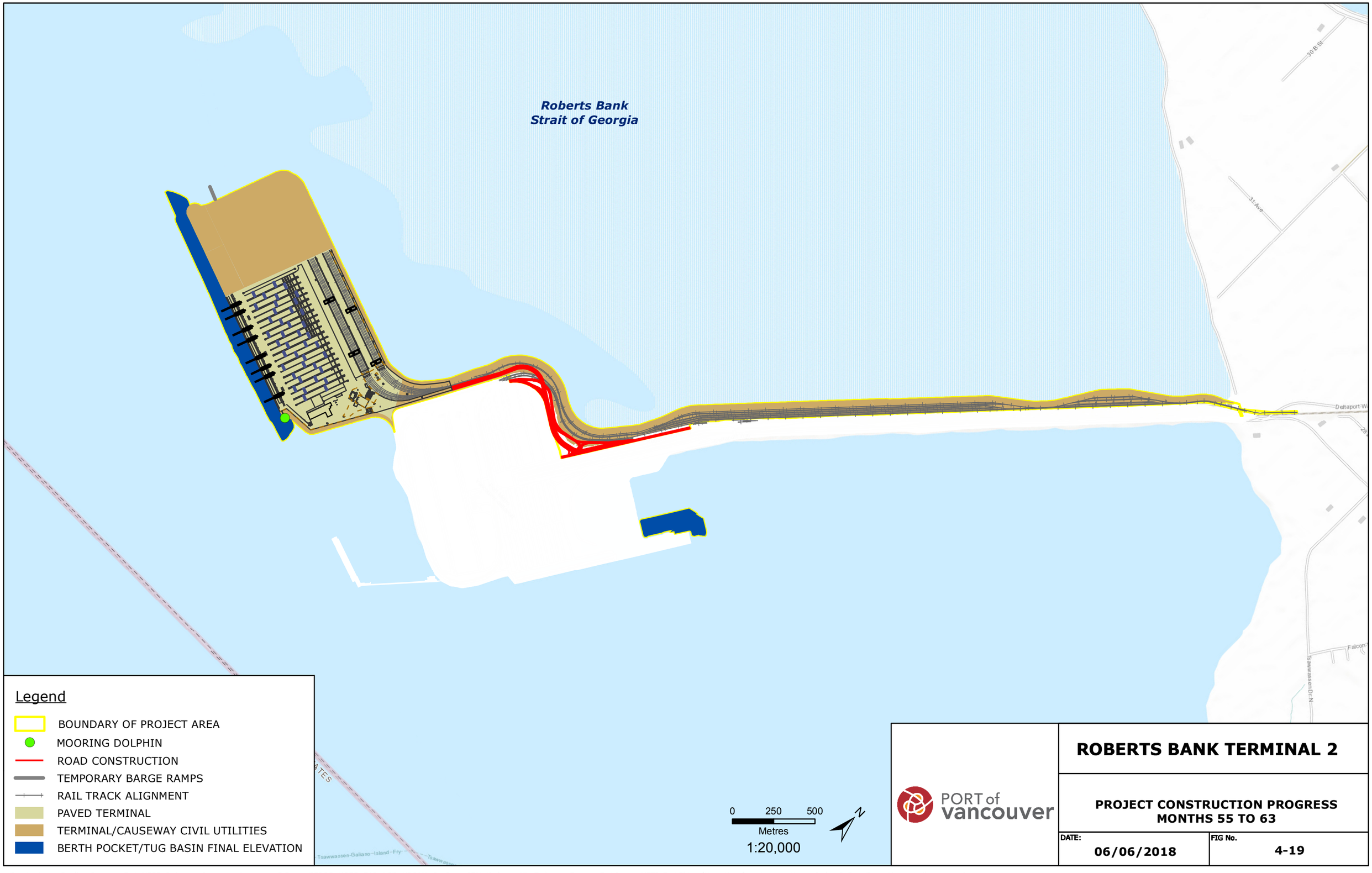
ROBERTS BANK TERMINAL 2

PROJECT CONSTRUCTION PROGRESS MONTHS 49 TO 54

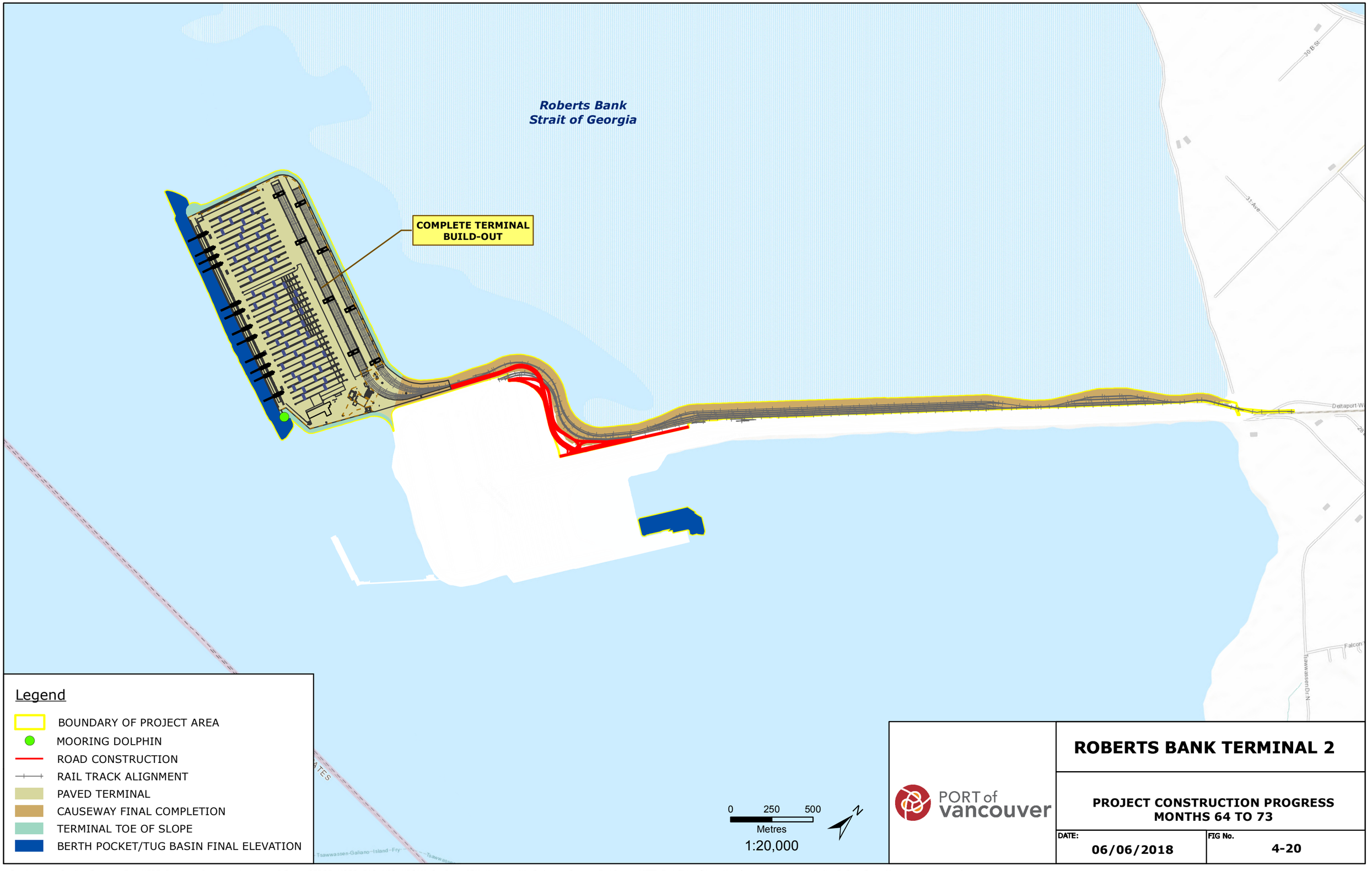
DATE: 06/06/2018

FIG No. 4-18

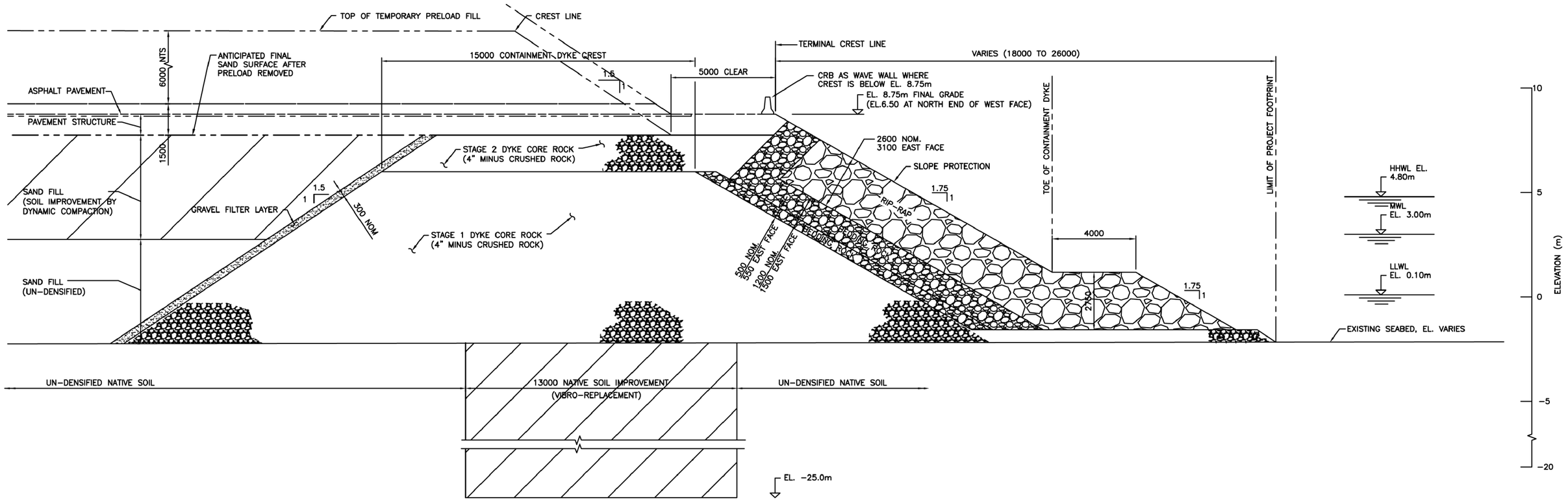
Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community



Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community



Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community



UNITS IN MM UNLESS OTHERWISE STATED

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ROBERTS BANK TERMINAL 2

REPRESENTATIVE CROSS-SECTION OF A CONTAINMENT DYKE AT THE MARINE TERMINAL

DATE: 06/06/2018

FIG No. 4-23

Note:
The dredged basin outline has been updated as shown.
For convenience, the other EIS Figures have not been altered.

ORIGINAL EIS
102.7 ha

(TOTAL MARINE TERMINAL AREA
102.7 + 13.4 = 116.1 ha)

(TOTAL MARINE FOOTPRINT
116.1 + 17.4 = 133.5 ha)

PROJECT CONSTRUCTION UPDATE
101.4 ha

(TOTAL MARINE TERMINAL AREA
101.4 + 14.7 = 116.1 ha)

(TOTAL MARINE FOOTPRINT
116.1 + 13.9 = 130.0 ha)

13.4 ha

WHARF FACE

14.7 ha

17.4 ha

13.9 ha

ORIGINAL EIS DREDGE BASIN OUTLINE

Legend

- DREDGE BASIN OUTLINE (TOTAL AREA 28.6 ha)
- DREDGED BERTH POCKET AND MARINE APPROACHES (13.9 ha)
- DREDGED CAISSON TRENCH (14.7 ha)
- NON DREDGED MARINE TERMINAL (101.4 ha)
- ORIGINAL EIS DREDGE BASIN OUTLINE (2015)

1:5,000
0 100 200
Metres
NAD 1983 UTM Zone 10N

N

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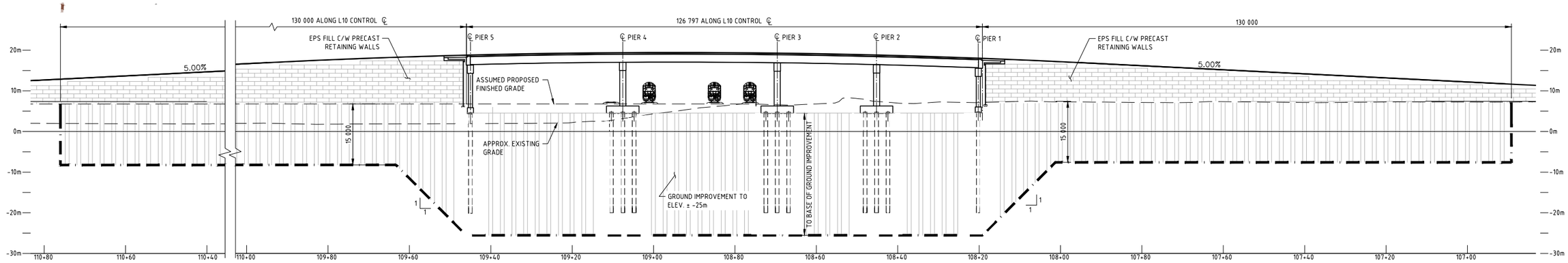
ROBERTS BANK TERMINAL 2

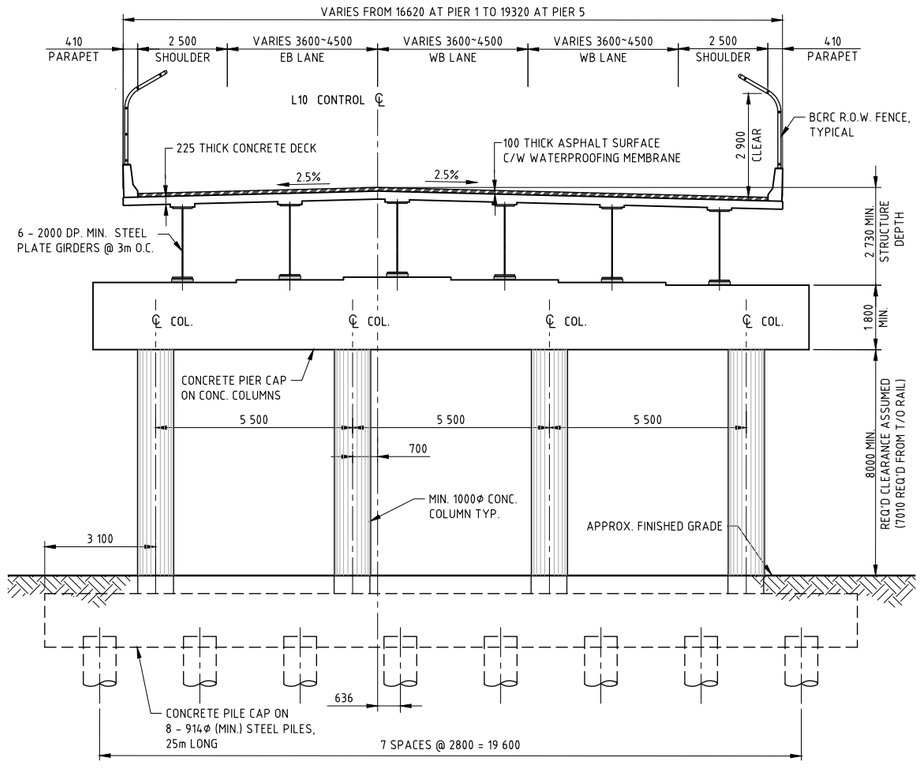
PLAN VIEW OF DREDGE BASIN AND MARINE TERMINAL AREAS

DATE: 06/06/2018

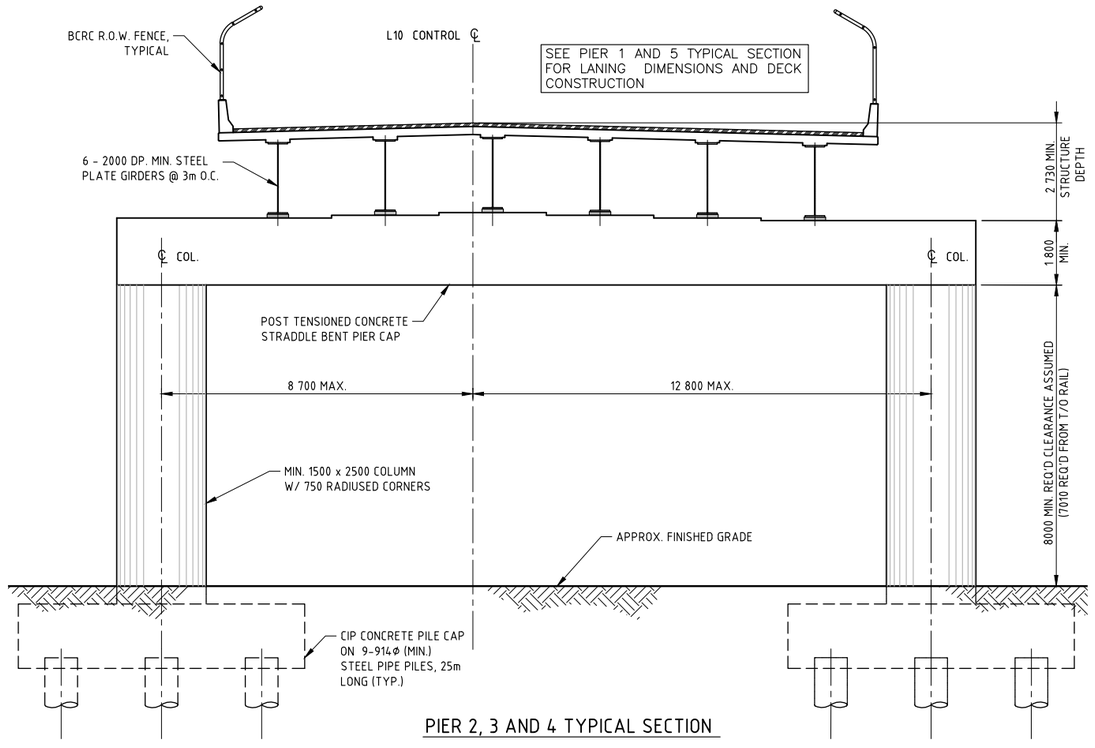
FIG No. 4-24



ELEVATION



PIER 1 AND 5 TYPICAL SECTION



PIER 2, 3 AND 4 TYPICAL SECTION

NOTES:

1. DIMENSIONS IN MILLIMETERS UNLESS STATED OTHERWISE

PRELIMINARY
DO NOT USE FOR CONSTRUCTION
Last Saved: Apr. 18/17 10:27am

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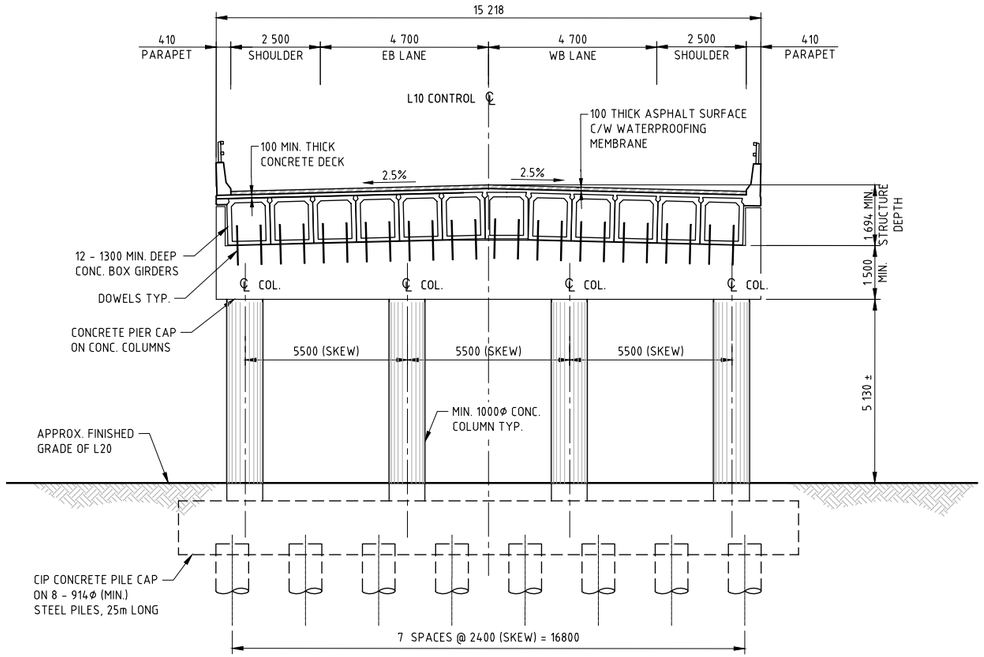
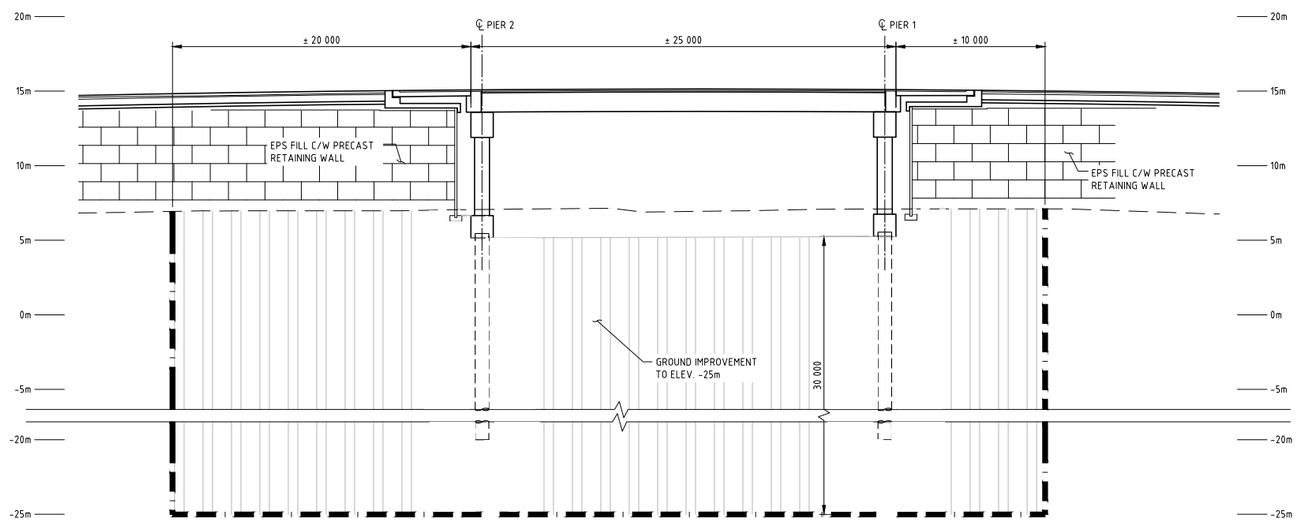
ROBERTS BANK TERMINAL 2

TERMINAL 2 OVERPASS WEST STRUCTURE CONCEPTUAL LAYOUT

DATE:	FIG No.
06/06/2018	4-32



TYPICAL SECTION



ELEVATION

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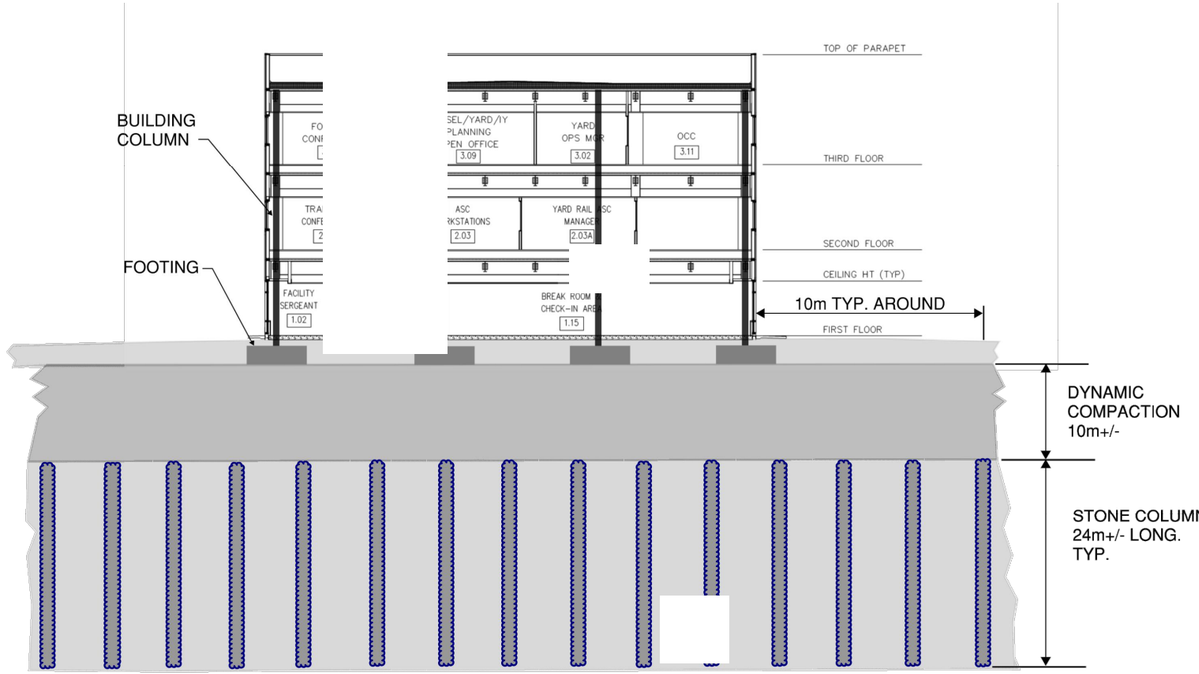
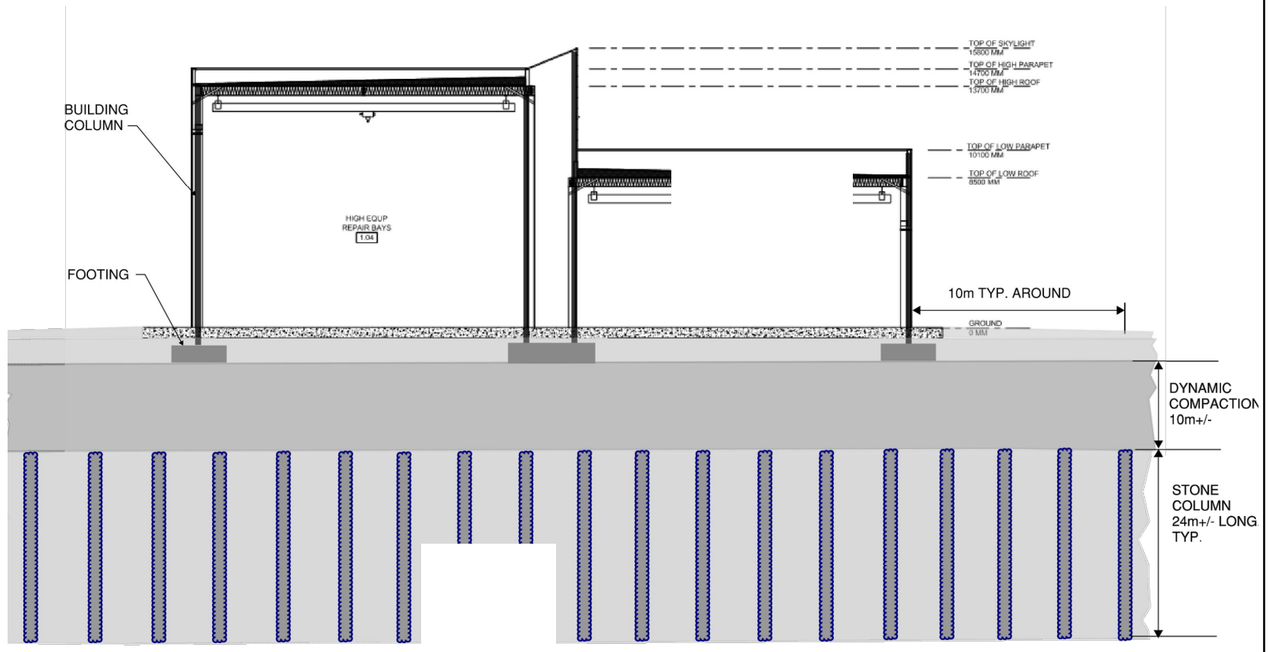
ROBERTS BANK TERMINAL 2

TERMINAL 2 OVERPASS
EAST STRUCTURE
CONCEPTUAL LAYOUT

DATE:	FIG No.
06/06/2018	4-33



TYPICAL SECTION - ADMINISTRATION BUILDING



TYPICAL SECTION - MAINTENANCE BUILDING

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ROBERTS BANK TERMINAL 2

TERMINAL BUILDINGS CONCEPTUAL X-SECTION

DATE:	FIG No.
06/06/2018	4-34

Attachment B: Updated EIS Appendices

Attachment B1	Detailed Tabulated Summary of Changes to Basis of Design (Updated Appendix 4-A)
Attachment B2	Preliminary Construction Schedule (Updated Appendix 4-E)
Attachment B3	Detailed Tabulated Summary of Changes to Basis of Schedule (Updated Appendix 4-E)
Attachment B4	Construction Equipment Peak Analysis (Updated Appendix 4-F)

Attachment B1: Detailed Tabulated Summary of Changes to Basis of Design (Updated Appendix 4-A)

Appendix 4-A Basis of Design Table of Revisions

ID	Section	Section Title	Page No.	Original Content in EIS App 4A: Basis of Design	Proposed Revision(s)	Comments/Reason(s) for Revision(s)
1	Appendix 4-A, Section 3.1	Codes, Standards, Specifications and Regulatory Requirements, General	6	The RBT2 preliminary design completed in 2012 is based on the latest relevant codes and standards as of January 2012. They are referred to in the Basis of Design as appropriate and are listed in Appendix 2. Future design and construction shall accommodate updates in codes and standards.	The RBT2 preliminary design completed in 2012 is based on the latest relevant codes and standards as of January 2012. Codes and Standards will be updated to latest versions as required over time. They are referred to in the Basis of Design as appropriate and are listed in Appendix 2. Future design and construction shall accommodate updates in codes and standards.	*Clarification.*
2	Appendix 4-A, Section 4.2.3	Wharf Structure and Mooring Dolphin	8	The berth structures and their foundations shall be designed to accommodate future vessels with draughts of up to 19 m. In the absence of specific data on these future vessels, it has been determined that the corresponding berth navigation depth will be assumed as EL -21.6 m CD. Due to the form of caisson wharf construction, this requirement establishes the initial build depth of the caisson wharf;	The berth structures and their foundations shall be designed to accommodate future vessels with draughts of up to 17.5 m. In the absence of specific data on these future vessels, it has been determined that the corresponding berth navigation depth will be assumed as EL -18.3 m CD. Due to the form of caisson wharf construction, this requirement establishes the initial build depth of the caisson wharf;	*Based on published estimates of the dimensions of a future 24,000 TEU vessels, draughts of up to 17.5m is considered more realistic for design considerations, as vessel draughts in the range of 19m is currently considered to be unlikely given the industry trend. As such, the draught (i.e. berth depth) has been reduced to reflect our expectations for future vessels.*
3	Appendix 4-A, Section 4.2.3	Wharf Structure and Mooring Dolphin, Table A - Seismic Performance Criteria (Three-berth Wharf Structure)	10	Table A Seismic Performance Criteria (Three-berth Wharf Structure)	*Revised Table A, refer to "Item No. 3 Revised Table A" tab for further details.*	*In light of VFPA adoption of the ASCE 61-14 standard, 2016 supplementary geotechnical investigation, updates to the seismic hazard model in NBCC 2015 and further analytical work conducted to-date, the seismic performance criteria for the wharf structure were revisited and revised where appropriate.Refer to "Item No.3 Revised Table A" tab for further explanation on edits made at each seismic level.*
4	Appendix 4-A, Section 4.7	RBT2 Overpass	25	Allow for a signal-controlled intersection at the top of the overpass to connect road access to RBT2, Westshore Terminals and Deltaport Terminal Gate 2.	<Deleted>	*Controlled intersection at the top of the overpass is not required to maintain planned traffic volumes.*
5	Appendix 4-A, Section 5.6	Seismic Data, Table C Site Specific Ground Motion Parameters	30	Table C Site Specific Ground Motion Parameters	*Revised Table C, refer to "Item No. 5 Revised Table C" tab for further details.*	*Changes/Updates to Table C Site Specific Ground Motion Parameters, refer to tab for detailed explanation.*
6	Appendix 4-A, Section 5.6	Seismic Data	30	Applicable short and long period amplification factors, Fa and Fv, for the site will be determined during detail design.	<Deleted>	*NBCC 2015 has adopted the 5th generation Seismic Hazard Model developed by Geological Survey of Canada, in which the short and long period amplification factors are no longer relevant or applied in design.*
7	Appendix 4-A, Section 7.0	Geotechnical Data	34	Geotechnical data for design of foundations, seismic soil-structure interaction response, land reclamation fill, and soil improvements were obtained from the site-specific geotechnical investigations and evaluations carried out over the course of trade-off studies and preliminary design of the facilities at RBT2 including: • Geotechnical Investigations for Terminal Layouts W1 and W2 - Golder Associates Ltd., August 22, 2011; • Geotechnical Evaluations for Land Reclamation and Perimeter Dikes - Golder Associates Ltd., October 5, 2011; • Terminal 2 (T2) Preliminary Geotechnical Design Input - Golder Associates Ltd., March 8, 2012; and • Pavement Design for Roberts Bank Terminal 2 (RBT2) - Golder Associates Ltd., February 10, 2012.	Geotechnical data for design of foundations, seismic soil-structure interaction response, land reclamation fill, and soil improvements were obtained from the site-specific geotechnical investigations and evaluations carried out over the course of trade-off studies and preliminary design of the facilities at RBT2 including: • Geotechnical Investigations for Terminal Layouts W1 and W2 - Golder Associates Ltd., August 22, 2011; • Geotechnical Evaluations for Land Reclamation and Perimeter Dikes - Golder Associates Ltd., October 5, 2011; • Terminal 2 (T2) Preliminary Geotechnical Design Input - Golder Associates Ltd., March 8, 2012; • Pavement Design for Roberts Bank Terminal 2 (RBT2) - Golder Associates Ltd., February 10, 2012; • Supplementary Offshore Geotechnical Investigation for RBT2 - Geotechnical Data Report - Golder Associates, January 11, 2016; and • Supplemental Geotechnical Investigation - Factual Data Report - Stantec Consulting Ltd., March 31, 2017.	*Added new geotechnical reports conducted at RBT2 in 2016 (Stantec) and in 2015 (Golder), subsequent to the EIS submission.*
8	Appendix 4-A, Section 8.1	Marine Design Criteria, Design Vessels	36	Note also that as per Section 4.2.3 the berth structure and its foundation shall be designed to accommodate future vessels with draughts of up to 19 m. However, those future vessels are not considered as “design vessels” for the purposes of navigation studies, mooring analyses, marine fenders, or berth scour protection.	Note also that as per Section 4.2.3 the berth structure and its foundation shall be designed to accommodate future vessels with draughts of up to 17.5 m. However, those future vessels are not considered as “design vessels” for the purposes of navigation studies, mooring analyses, marine fenders, or berth scour protection.	*See Item 2.*
9	Appendix 4-A, Section 8.2	Marine Design Criteria, Water Depth	37	Since the preliminary design for RBT2 was based on a future potential container ship draught of 19 m, the design water depth of the approach areas and the berth pocket is 21.7 m at LLWL (i.e., EL -21.6 m CD).	Since the preliminary design for RBT2 was based on a future potential container ship draught of 17.5 m, the design water depth of the approach areas and the berth pocket is 18.4 m at LLWL (i.e., EL -18.3 m CD).	*See Item 2.*

ID	Section	Section Title	Page No.	Original Content in EIS App 4A: Basis of Design	Proposed Revision(s)	Comments/Reason(s) for Revision(s)
10	Appendix 4-A, Section 10.3	Section 10.3 Rail Systems	45	Rail design criteria shall be developed to meet the operating conditions and the requirements of the RBT2 IY, causeway support tracks, and new track construction in the T-Yard and DPU/Bad Order Setout Yard. In general, the rail design shall follow the BC Rail Properties' (BCRP) Design Brief Document No. 290050-PM-230-S0-0001, Rev 1 regarding track structure and geometry wherever possible and practicable. Exceptions to this standard will require approval from BCRP.	Rail design criteria shall be developed to meet the operating conditions and the requirements of the RBT2 IY, causeway support tracks, and new track construction in the T-Yard and DPU/Bad Order Setout Yard. In general, the rail design shall follow the BC Rail Properties' (BCRP) Design Brief Document No. 290050-PM-230-S0-0001, Rev 4 regarding track structure and geometry wherever possible and practicable. Exceptions to this standard will require approval from BCRP.	*Updating to BC Rail Properties' Design Brief Document Rev 4.*
11	Appendix 4-A, Section 10.4.3	Section 10.4.3 Track geometry	46	Track alignment shall be accordance with AREMA guidelines. The parameters shown in Table O shall be used for design purposes	Where track alignment is not clearly defined in the BC Rail Design Brief Document No. 290050-PM-230-S0-0001, Rev 4, such design elements shall be accordance with AREMA guidelines. The parameters shown in Table O shall be used for design purposes	*Clarification.*
12	Appendix 4-A, Section 10.4.3 Table O	Table O Track geometry and Capacities	47	Notes: (1) The track centres were determined in consultation with BCR and their Design Brief 290050-PM-230-S0-0001, Rev. 1.	Notes: (1) The track centres were determined in consultation with BCR and their Design Brief 290050-PM-230-S0-0001, Rev. 4.	*Updating to BC Rail Properties' Design Brief Document Rev 4.*
13	Appendix 4-A, Section 10.8	10.8 Road Works and RBT2 Overpass	50	CY and other onsite facilities: The TAC Geometric Design Guide for Canadian Roads (1999), and the BC Ministry of Transportation Supplement to TAC Geometric Design Guide	CY and other onsite facilities: The TAC Geometric Design Guide for Canadian Roads (2017), and the BC Ministry of Transportation Supplement to TAC Geometric Design Guide	*Updates to design guide released in 2017. Does not result in design changes to the project as described in the EIS.*
14	Appendix 4-A, Section 10.8	Road Works and RBT2 Overpass	50	RBT2 Overpass: CSA-S6-06 and BC Ministry of Transportation Supplement to CHBDC S6-06;	RBT2 Overpass: CSA-S6-14 and BC Supplement to CAN/CSA-S6-14;	*Revise second bullet with newer version of the S6 bridge code. Does not result in design changes to the project as described in the EIS.*
15	Appendix 4-A, Section 10.8.1	Roadway Design Criteria	51	Table Q Roadway Design Criteria	*Revised Table Q, refer to "Item No. 15 Revised Table Q" tab for further details.*	*Changes/Updates to Table Q per Canadian Highway Bridge Design Code CAN/CSA-S6-14 and BC Supplement to CAN/CSA-S6-14. Does not result in design changes to the project as described in the EIS.*
16	Appendix 4-A, Section 13.0	References	55	Natural Resources Canada, "Determine 2010 National Building Code of Canada seismic hazard values", website: http://www.earthquakescanada.nrcan.gc.ca/hazard-alea/interpolat/index_2010-eng.php	Natural Resources Canada, "Determine 2015 National Building Code of Canada seismic hazard values", website: http://www.earthquakescanada.nrcan.gc.ca/hazard-alea/interpolat/index_2015-en.php	*Updated to reference NBCC 2015. See ID #5 and Section 2.2 for subsequent design changes.*
17	Appendix 4-A, Appendix 2	Appendix 2 - Codes and Standards, Geotechnical	62	• Geotechnical: ◦ Canadian Geotechnical Society - Canadian Foundation Engineering Manual ◦ Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS) ◦ Canadian Highway Bridge Design Code (CAN/CSA-S6)	• Geotechnical: ◦ Canadian Geotechnical Society - Canadian Foundation Engineering Manual ◦ ~~Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS)~~ ◦ Canadian Highway Bridge Design Code CAN/CSA-S6-14 and BC Supplement to CAN/CSA-S6-14	*Clarification.*
18	Appendix 4-A, Appendix 2	Appendix 2 - Codes and Standards, Marine and Structural	62	◦ Canadian Highway Bridge Design Code (CAN/CSA-S6)	◦ Canadian Highway Bridge Design Code CAN/CSA-S6-14 and BC Supplement to CAN/CSA-S6-14	*Code Update.*
19	Appendix 4-A, Appendix 2	Appendix 2 - Codes and Standards, Marine and Structural	63	• Marine and Structural: ◦ National Building Code of Canada ◦ Canadian Highway Bridge Design Code (CAN/CSA-S6)	• Marine and Structural: ◦ American Society of Civil Engineers (ASCE) standard ASCE/COPRI 61-14, Seismic Design of Piers and Wharves ◦ National Building Code of Canada ◦ Canadian Highway Bridge Design Code CAN/CSA-S6-14 and BC Supplement to CAN/CSA-S6-14	*Updated Standards. See Section 2.2 for subsequent design changes.*

Details on Revision Item No. 3 Table A

Table A Seismic Performance Criteria (Three-berth Wharf Structure)

Design Level Earthquake	Level of Service	Operation Criteria	Level of Structural Damage	Residual Horizontal Displacement at Top fo Caisson	Rotation
100 years	Serviceable	Fully operational with the possible exception of minor adjustment to crane rails and automated equipment	Minor easily repairable or no damage	Not larger than 100mm	No more than 0.5 degree
475 years	Repairable	Temporary loss of operations with 3 to 6 months to restore to full operations	Controlled repairable damage. Caisson re-float is not required.	Not larger than 750mm	No more than 2.0 degree
~~Subduction~~	~~Repairable~~	~~Temporary loss of operations with 3-6 months to restore to full operations~~	~~Significant damage is acceptable, but no collapse. Caisson re-float not required.~~	~~Not larger than 750 mm~~	~~No more than 2.0 degrees~~
1,000 years	Near Collapse	Long term or complete loss of serviceability	Extensive damage in near collapse	Not larger than 3000mm	No more than 8.0 degrees

In order to verify the set of seismic performance criteria for the caisson structures suitable for RBT2, VFPA appointed M&N/Stantec/EMI (Owner's Engineer Team) to first evaluate the site-specific performance of the caissons under the design earthquakes levels and then compare against displacement values suggested in design codes and current Basis of Design. To evaluate the caisson performance, two independent analytical approaches were taken by the OE team using geotechnical input derived from the 2016 geotechnical site investigation and testing program.

Updates/Changes to 100 years Design Level Earthquake

- Further description added to the operational criteria, as "Fully Operational" may not be entirely valid for the Ship-To-Shore (STS) crane rails; however, rail displacements following a A100 seismic event (if any) are expected to be relatively small, where only minor adjustment may be required.
- The residual horizontal displacement at top of caisson is slightly relaxed from 75mm shown in the EIS Basis of Design, to 100mm, based on further findings on the anticipated movements subjected to A100 seismic event. The expected residual horizontal displacement is considered within industry guidelines and to have minimal operational impacts.

Updates/Changes to 475 years Design Level Earthquake

- In the original Basis of Design, two "repairable" level of services were defined to capture the difference in level of structural damage anticipated between the 475 years seismic event and the subduction seismic event. Under the 475 years seismic event, controlled repairable damage would be expected with displacement of less than 300mm and requiring 1 month to restore to full operations. Under the subduction seismic event, significant damage would be expected with displacement of up to 750mm and requiring 3 to 6 months to restore to full operations.

This previous work was based on the 4th generation Seismic Hazard Model developed by Geological Survey of Canada (GSC) for the NBCC 2005, which separated crustal and subduction record; crustal earthquakes were considered in a probabilistic model but subduction earthquakes were considered deterministically. Since then, the NBCC 2015 has been released and has adopted the 5th generation Seismic Hazard Model developed by GSC, which is based on a probabilistic approach incorporating all relevant crustal, sub-crustal and subduction earthquakes.

Due to this change, the 475 years and subduction design level earthquake previously shown as separate design seismic events in the original Basis of Design can now be categorized under one A475 design level earthquake.

- Based on the OE team's analytical findings, caisson displacements up to 750mm could still be considered as "controlled repairable" damage as differential motion of the STS crane rails were found to be relatively low as they are shown to move/settle together.

Updates/Changes to 1000 years Design Level Earthquake

- According to ASCE61-14 for the highest "Design Earthquake" (DE) level, it does not explicitly recommend a design earthquake level return period. Rather, it refers to the "Design Earthquake" per ASCE 7 (2005) which is defined as an earthquake level that is generally equal to two-thirds (2/3) of the corresponding Maximum Considered Earthquake (MCE). MCE is considered to be equivalent to the earthquake with a return period of 2,475 years. The DE level considered for this project is very similar to an earthquake with a return period of approximately 1,000 years and meets the ASCE 61-14 two-thirds (2/3) MCE requirements. Therefore, the a 1000-year return period based on approximately 5% ground motion probability of exceedance in 50 years shall be used for the design of wharf structures. This is considered as "near collapse" level of service and extensive damage and complete loss of serviceability with displacement in the range of 2.7m to 3.0m.

Updates/Changes to 2475 years Design Level Earthquake

- As VFPA has adopted the ASCE 61-14 standard, the 2475 years seismic event is no longer applicable or considered for the design of wharf structures. Instead this "near collapse" level of service is considered for the 1000 years seismic event as described above.

Overall summary

Changes to the Seismic Performance Criteria for the 3-berth wharf structure described above has not resulted in any significant change in the caisson design. The major change is the caisson foundation design which has eliminated deep in-situ soil densification as detailedly described in Section 2.2 Wharf Structure and Berth Pocket in the Project Construction Update (PCU).

Details on Revision Item No. 6 Table C

Table C	Site Specific Ground Motion Parameters			
Description	**Return Period of Ground Motions**			
	1 in 100-Year	**1 in 475-Year**	**1 in 1000-Year[1]**	**1 in 2475-Year**
Probability of Exceedance per Annum	0.01	0.002	0.001	0.0004
Probability of Exceedance in 50 years	40%	10%	5%	2%
PGA	0.10g	0.23g	0.31g	0.43g
Sa (0.001s)	0.10g	0.23g	0.31g	0.43g
Sa (0.05s)	0.12g	0.27g	0.37g	0.52g
Sa (0.1s)	0.19g	0.42g	0.56g	0.79g
Sa (0.2s)	0.24g	0.52g	0.71g	0.98g
Sa (0.3s)	0.24g	0.53g	0.72g	0.88g
Sa (0.5s)	0.20g	0.46g	0.63g	0.88g
Sa (1.0s)	0.10g	0.24g	0.34g	0.49g
Sa (2.0s)	0.05g	0.14g	0.20g	0.29g
Sa (5.0s)	0.01g	0.03g	0.05g	0.09g
Sa (10.0s)	0.004g	0.01g	0.02g	0.03g

Sa - Spectral acceleration values

Updates/Changes: The spectral acceleration values shown in the original Basis of Design is based on the 4th generation Seismic Hazard Model developed by Geological Survey of Canada (GSC) for the NBCC 2005. Since then, the NBCC 2015 has been released and has adopted the 5th generation Seismic Hazard Model developed by GSC, which is based on a probabilistic approach incorporating all relevant crustal, sub-crustal and subduction earthquakes. As a result, the spectral acceleation values based on the NBCC 2015 are updated in the Basis of Design and shown above, plus including a new column for the 1 in 1000 year seismic event.

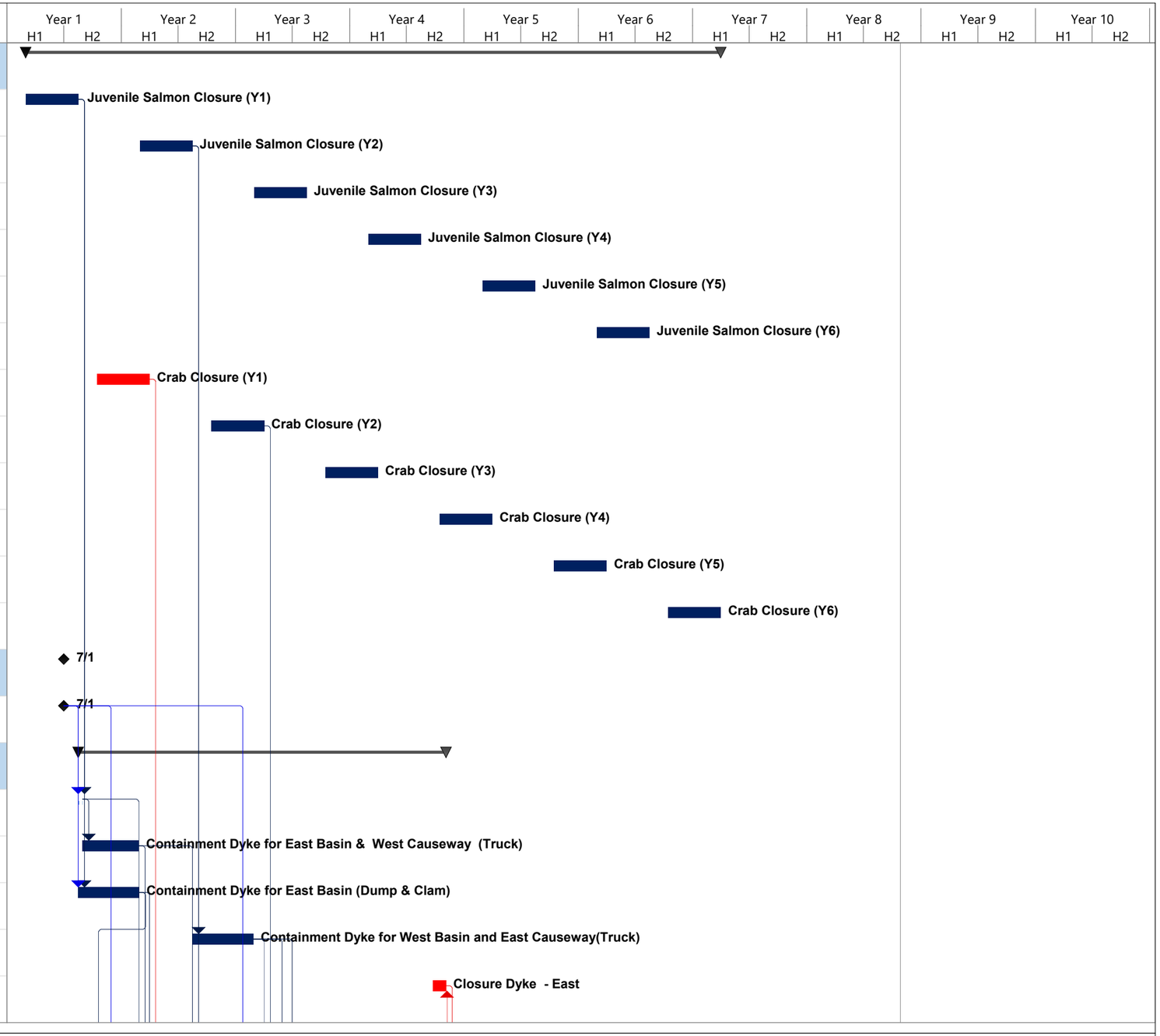
[1]1 in 975-Year Sa values are equivalent to the 1 in 1000-Year Sa values.

Details on Revision Item No. 15 Table Q

Item	Causeway	Inter-Terminal Roads and Interchanges	On-site roads	Comments / Notes
Design Classification	UAU	UAU	ULU	UAU=Urban Arterial Undivided ULU=Urban Local Undivided
Posted Speed	80 km/h	50 km/h	30	
Design Speed	80 km/h	50 km/h	30	
Basic Lanes	2	2	2	
Minimum Radius	250 m	90 m	30	The minimum Radius is for super-elevated roadway sections on level grade. Adjust as per BC Supplement to TAC.
Min. K Factor Sag	30	13	6	Based on headlight control but road shall be illuminated. (note: TAC2017 requires K = 30 & 13 for headlight control, 16 & 6 for illuminated.)
Min. K Factor Crest	36	8	2	Based on BC Supplement stopping sight distance (note: BC Supplement K = 36 & 8 for taillight / TAC2017 K = 26 & 7).
Max. Grade	0.05	0.05	6	
Min. Grade	0.005	0.005	0.5	
Max. Superelevation	0.06	0.06	4%	
Minimum S.S.D.	140 m	65 m	35	For level grade. Adjust as per TAC. (note: MoTI minimum SSD = 140 & 65m / TAC2017 = 130 & 65m)
Minimum D.S.D.	315 m	200 m	---	Avoidance Manoeuvre E.
Lane Width (multi-lane)	3.6 m	3.6 m	3.6	Existing lane width is 3.6 m. Lane widening along curves shall be provided where required to accommodate the Design Vehicle.
Lane Width (single lane)	Not applicable	4.8 m	5.2	
Shoulder Width Outside	2.5 m	2.5 m	1.5**	** In location where a disabled vehicle will cause major disruptions to terminal operations, a 2.5 m shoulder should be used.
Shoulder Width Inside	1.0 m	1.0 m	1.5**	** In location where a disabled vehicle will cause major disruptions to terminal operations, a 2.5 m shoulder should be used.
Vertical Clearance	5.2 m	5.2 m	5.2 m	5.0 m plus 200 mm for future overlays. Note, where adjacent to railways clearance must also accommodate 7.2 m from top of rail.
Design Vehicle	TAC WB-36	TAC WB-36	TAC WB-36	The WB-36 is a truck with two 16.2 m trailers capable of transporting two 53 ft. domestic containers. The wheel base of the truck is 36 m.

Attachment B2: Preliminary Construction Schedule (Updated Appendix 4-E)

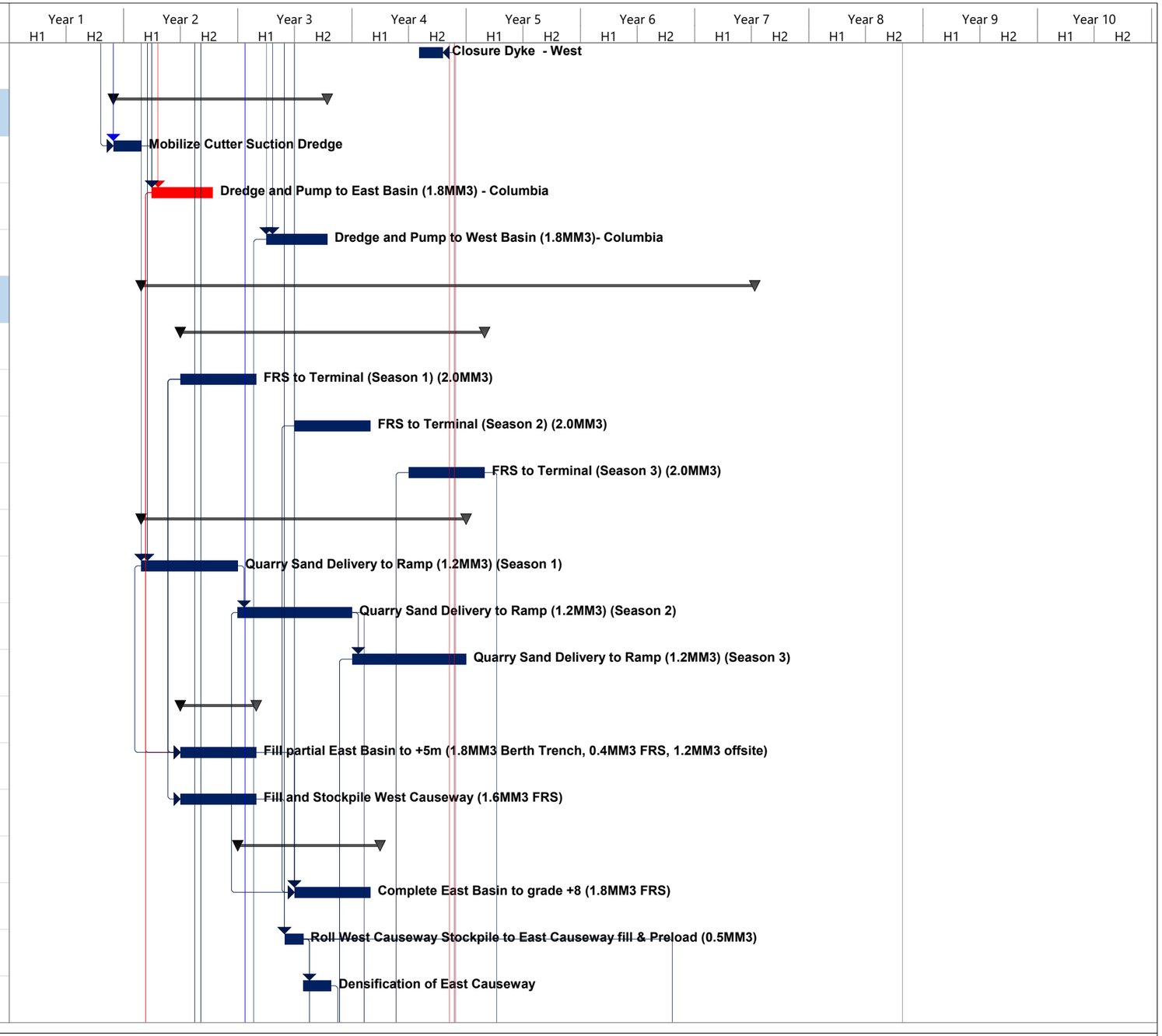
ID	Task Name	Duration	Predecessors
1	**Environmental Closures**	**2222 days**	
2	Juvenile Salmon Closure (Y1)	168 days	
3	Juvenile Salmon Closure (Y2)	168 days	
4	Juvenile Salmon Closure (Y3)	168 days	
5	Juvenile Salmon Closure (Y4)	168 days	
6	Juvenile Salmon Closure (Y5)	168 days	
7	Juvenile Salmon Closure (Y6)	168 days	
8	Crab Closure (Y1)	168 days	
9	Crab Closure (Y2)	169 days	
10	Crab Closure (Y3)	168 days	
11	Crab Closure (Y4)	168 days	
12	Crab Closure (Y5)	168 days	
13	Crab Closure (Y6)	168 days	
14	**Milestones and Target Dates**	**0 days**	
15	Start of Construction	0 days	
16	**Terminal Dyking (Incl Rip-Rap) (1.2MM3)**	**1176 days**	
17	Install Barge Ramp(s)	14 days	15,2
18	Containment Dyke for East Basin & West Causeway (Truck)	180 days	17
19	Containment Dyke for East Basin (Dump & Clam)	195 days	15,2
20	Containment Dyke for West Basin and East Causeway(Truck)	195 days	3
21	Closure Dyke - East	42 days	84FS-25 days



Project: RBT2BaseSched06-04-2018
Date: Mon 6/4/18

Task	Inactive Task	Manual Summary Rollup	External Milestone	Manual Progress
Split	Inactive Milestone	Manual Summary	Deadline	
Milestone	Inactive Summary	Start-only	Critical	
Summary	Manual Task	Finish-only	Critical Split	
Project Summary	Duration-only	External Tasks	Progress	

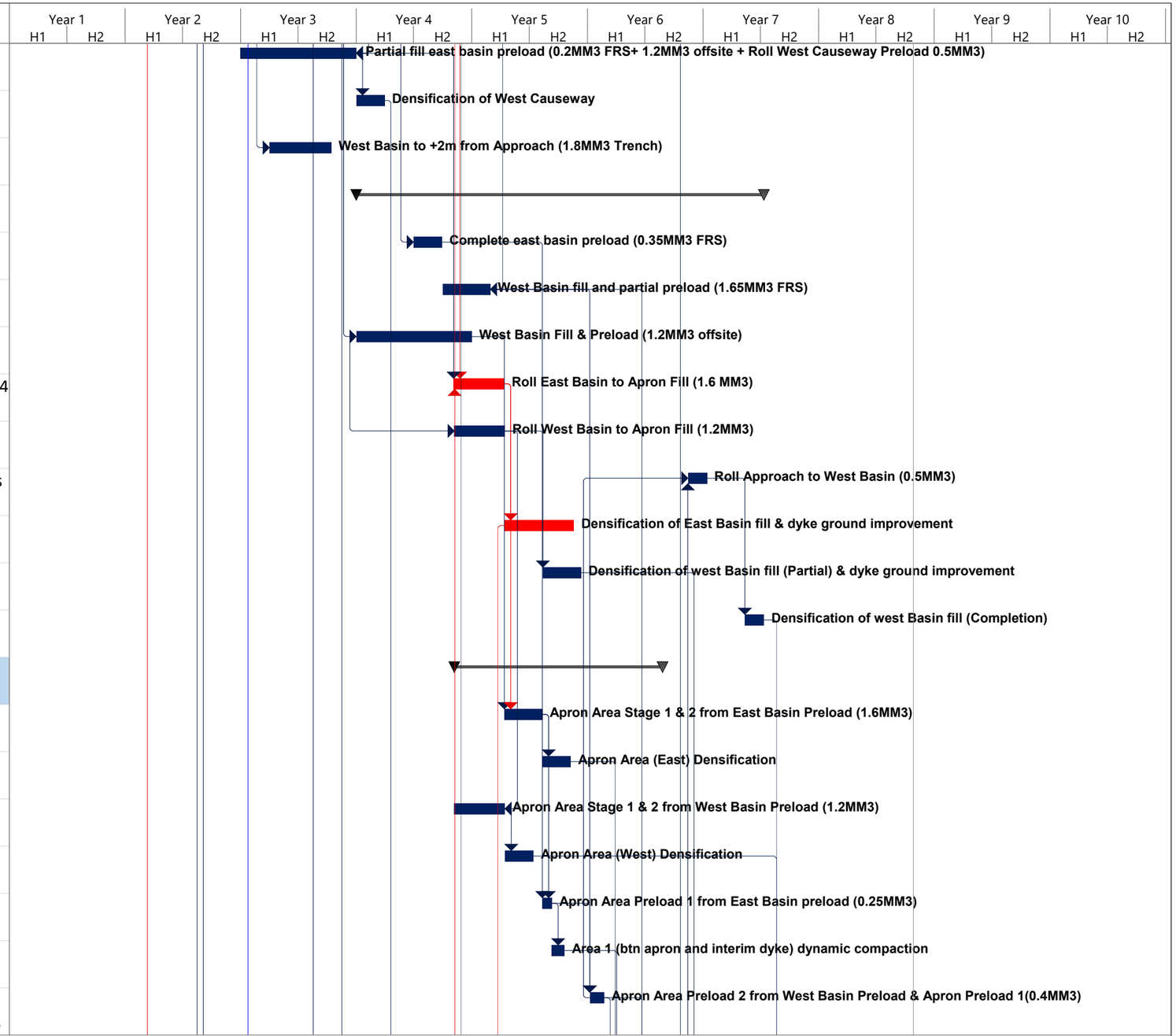
ID	Task Name	Duration	Predecessors
22	Closure Dyke - West	75 days	85FF
23	**Dredge Basin & Marine Approach Areas (3.7 MM3)**	**684 days**	
24	Mobilize Cutter Suction Dredge	90 days	15,19FS-90 days
25	Dredge and Pump to East Basin (1.8MM3) - Columbia	195 days	19,24,8
26	Dredge and Pump to West Basin (1.8MM3)- Columbia	195 days	9,20
27	**Terminal General Fill and Densification**	**1962 days**	
28	**Fraser River Sand (FRS) to Terminal by Hopper Dredge**	**973 days**	
29	FRS to Terminal (Season 1) (2.0MM3)	243 days	
30	FRS to Terminal (Season 2) (2.0MM3)	243 days	
31	FRS to Terminal (Season 3) (2.0MM3)	243 days	
32	**Import Ex. Quarry Sand to Terminal by Barge**	**1039 days**	
33	Quarry Sand Delivery to Ramp (1.2MM3) (Season 1)	309 days	18,17
34	Quarry Sand Delivery to Ramp (1.2MM3) (Season 2)	365 days	33
35	Quarry Sand Delivery to Ramp (1.2MM3) (Season 3)	365 days	34
36	**Season 1: FRS, Quarry Sand & Dredged Mat'l to East Basin & Causeway**	**243 days**	
37	Fill partial East Basin to +5m (1.8MM3 Berth Trench, 0.4MM3 FRS, 1.2MM3 offsite)	243 days	29SS,25SS,33SS
38	Fill and Stockpile West Causeway (1.6MM3 FRS)	243 days	29SS
39	**Season 2: FRS, Quarry Sand & Dredged Mat'l to East Basin, West Basin Fill & West Causeway**	**455 days**	
40	Complete East Basin to grade +8 (1.8MM3 FRS)	243 days	30SS,20,34SS,37
41	Roll West Causeway Stockpile to East Causeway fill & Preload (0.5MM3)	60 days	20,38FS+90 days
42	Densification of East Causeway	90 days	41



Project: RBT2BaseSched06-04-2018
Date: Mon 6/4/18

Task	Inactive Task	Manual Summary Rollup	External Milestone	Manual Progress	
Split	Inactive Milestone	Manual Summary	Deadline		
Milestone	Inactive Summary	Start-only	Critical		
Summary	Manual Task	Finish-only	Critical Split		
Project Summary	Duration-only	External Tasks	Progress		

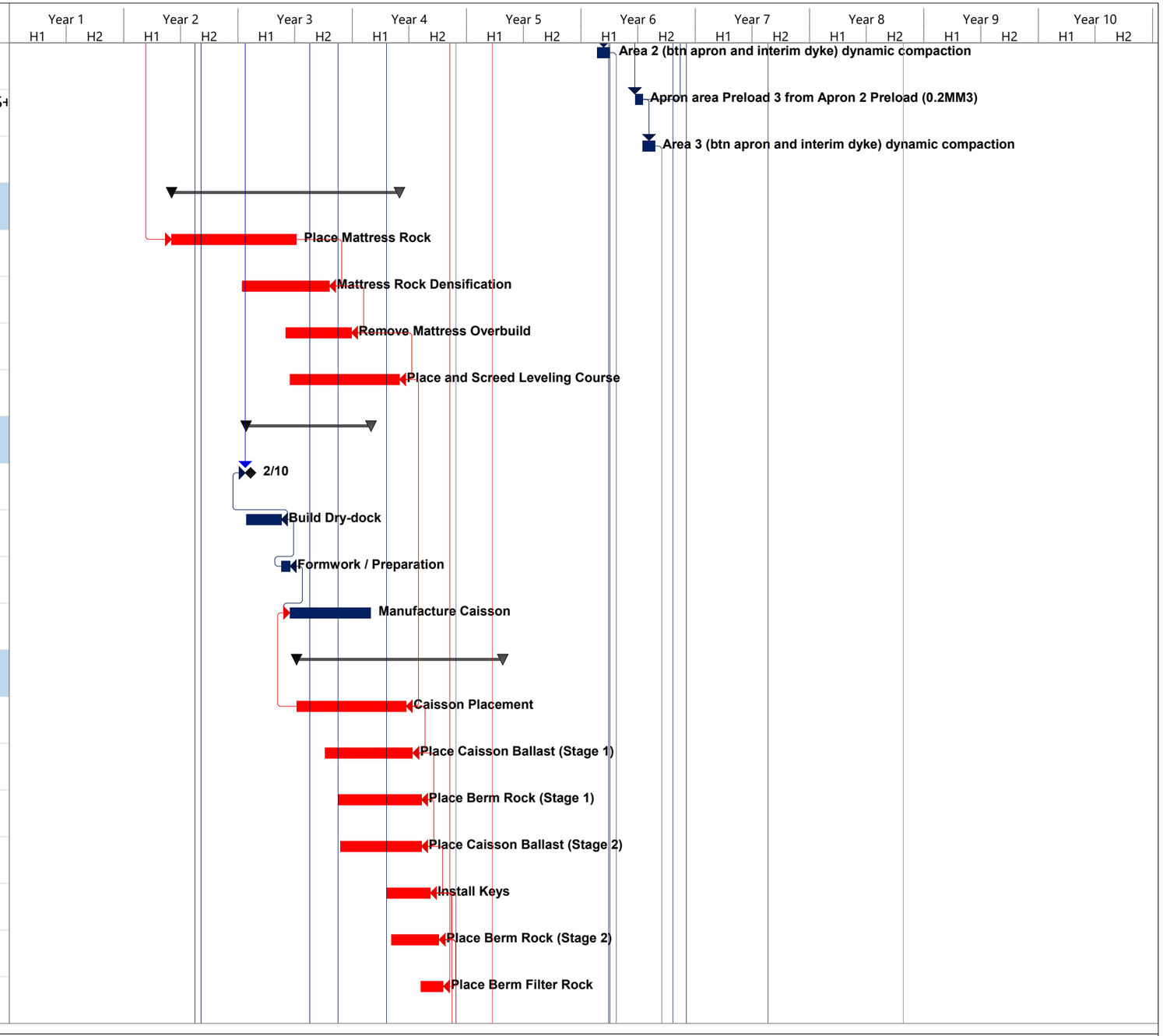
ID	Task Name	Duration	Predecessors
43	Partial fill east basin preload (0.2MM3 FRS+ 1.2MM3 offsite + Roll West Causeway Preload 0.5MM3)	365 days	34FF,41FF+90 days
44	Densification of West Causeway	90 days	43
45	West Basin to +2m from Approach (1.8MM3 Trench)	195 days	26SS
46	**Season 3: FRS & Quarry Sand to East Basin Preload, West Basin Fill**	**1288 days**	
47	Complete east basin preload (0.35MM3 FRS)	90 days	31SS
48	West Basin fill and partial preload (1.65MM3 FRS)	150 days	31FF
49	West Basin Fill & Preload (1.2MM3 offsite)	365 days	35SS
50	Roll East Basin to Apron Fill (1.6 MM3)	160 days	43FS+120 days,21,84
51	Roll West Basin to Apron Fill (1.2MM3)	160 days	49SS+310 days
52	Roll Approach to West Basin (0.5MM3)	60 days	63SS,65FS+120 days
53	Densification of East Basin fill & dyke ground improvement	220 days	50
54	Densification of west Basin fill (Partial) & dyke ground improvement	120 days	51FS+120 days
55	Densification of west Basin fill (Completion)	60 days	52FS+120 days
56	**Apron Area Fill (3MM3)**	**658 days**	
57	Apron Area Stage 1 & 2 from East Basin Preload (1.6MM3)	120 days	50,49
58	Apron Area (East) Densification	90 days	57
59	Apron Area Stage 1 & 2 from West Basin Preload (1.2MM3)	160 days	51FF
60	Apron Area (West) Densification	90 days	59
61	Apron Area Preload 1 from East Basin preload (0.25MM3)	30 days	47FS+120 days,57
62	Area 1 (btn apron and interim dyke) dynamic compaction	40 days	61
63	Apron Area Preload 2 from West Basin Preload & Apron Preload 1(0.4MM3)	45 days	48FS+120 days,61FS+120 days



Project: RBT2BaseSched06-04-2018
Date: Mon 6/4/18

Task	Inactive Task	Manual Summary Rollup	External Milestone	Manual Progress	
Split	Inactive Milestone	Manual Summary	Deadline		
Milestone	Inactive Summary	Start-only	Critical		
Summary	Manual Task	Finish-only	Critical Split		
Project Summary	Duration-only	External Tasks	Progress		

ID	Task Name	Duration	Predecessors
64	Area 2 (btn apron and interim dyke) dynamic compaction	40 days	63
65	Apron area Preload 3 from Apron 2 Preload (0.2MM3)	25 days	48FS+120 days,63FS+
66	Area 3 (btn apron and interim dyke) dynamic compaction	40 days	65
67	**Caisson Foundation / Marine Work**	**728 days**	
68	Place Mattress Rock	399 days	25SS+63 days
69	Mattress Rock Densification	280 days	68FF+105 days
70	Remove Mattress Overbuild	210 days	69FF+70 days
71	Place and Screed Leveling Course	350 days	70FF+154 days
72	**Caisson Construction**	**399 days**	
73	Order Sheet pile	0 days	15,74FS-98 days
74	Build Dry-dock	112 days	75SF
75	Formwork / Preparation	28 days	76SF
76	Manufacture Caisson	259 days	78SS-21 days
77	**Wharf Construction**	**659 days**	
78	Caisson Placement	350 days	71FF+21 days
79	Place Caisson Ballast (Stage 1)	280 days	78FF+21 days
80	Place Berm Rock (Stage 1)	268 days	79FF+28 days
81	Place Caisson Ballast (Stage 2)	260 days	80FF
82	Install Keys	140 days	81FF+28 days
83	Place Berm Rock (Stage 2)	152 days	82FF+28 days
84	Place Berm Filter Rock	72 days	83FF+14 days



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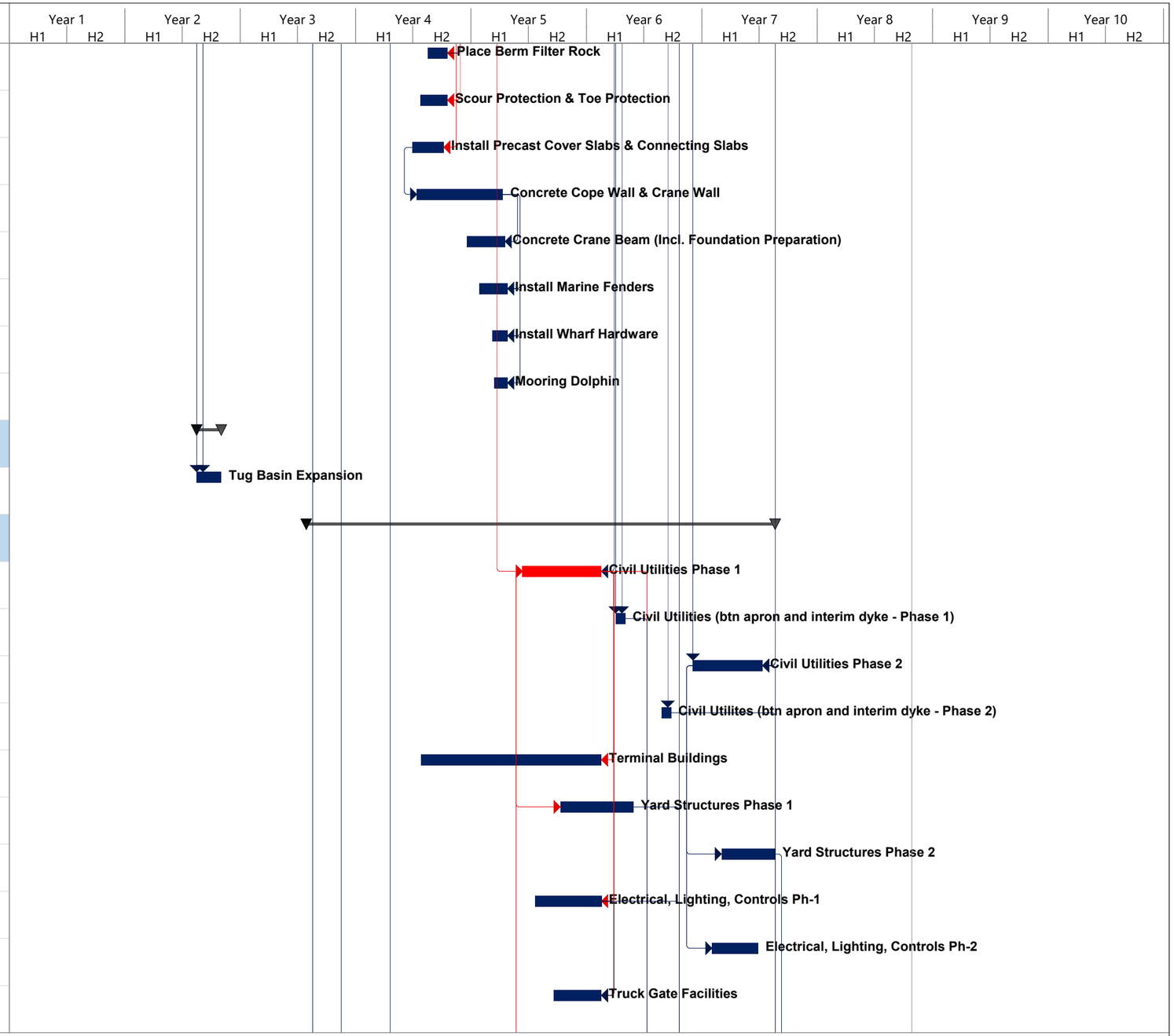
Date: Mon 6/4/18

Task	Inactive Task	Manual Summary Rollup	External Milestone	Manual Progress	
Split	Inactive Milestone	Manual Summary	Deadline		
Milestone	Inactive Summary	Start-only	Critical		
Summary	Manual Task	Finish-only	Critical Split		
Project Summary	Duration-only	External Tasks	Progress		

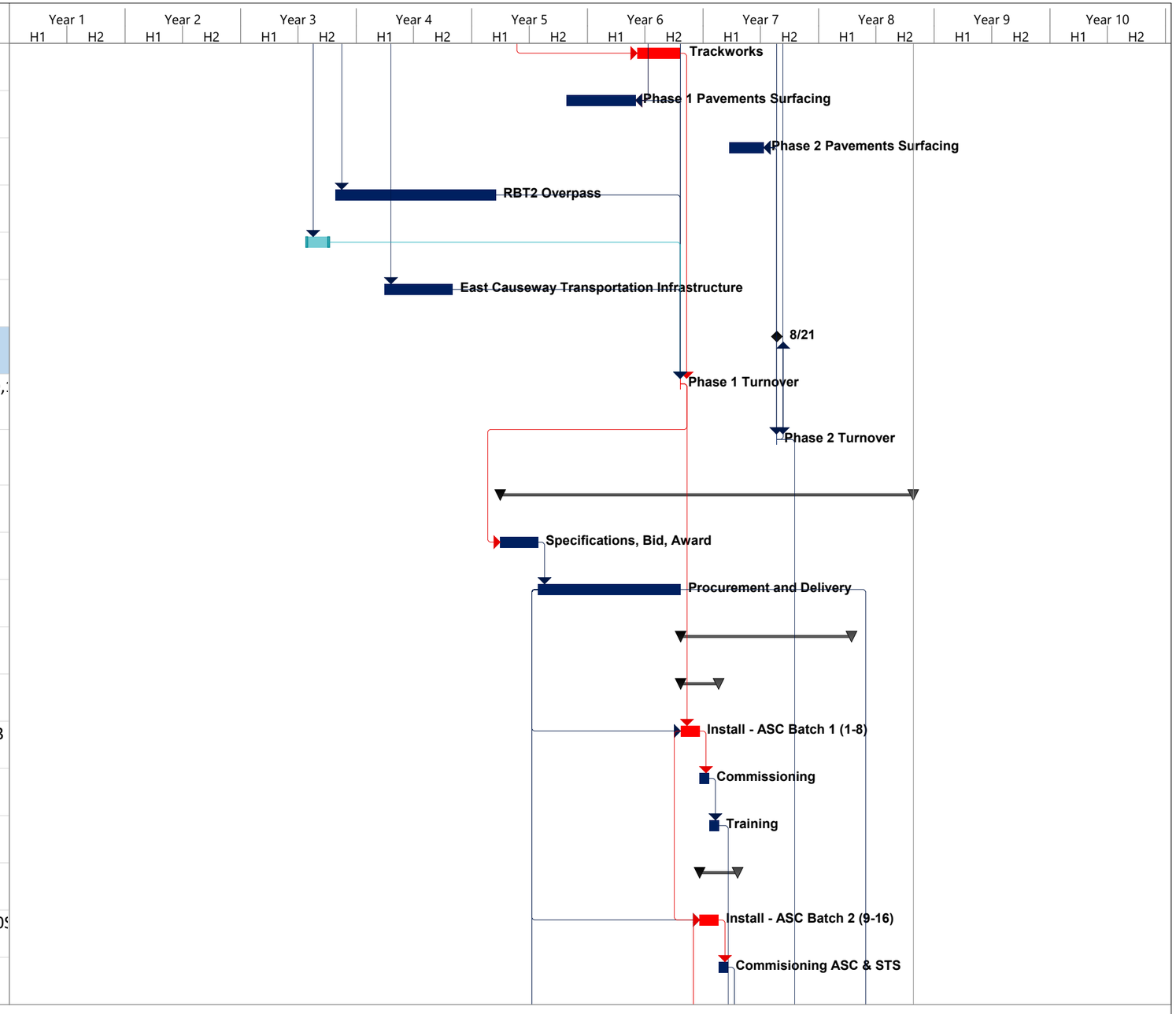
ID	Task Name	Duration	Predecessors
85	Place Berm Filter Rock	63 days	83FF+14 days
86	Scour Protection & Toe Protection	85 days	82FF+42 days
87	Install Precast Cover Slabs & Connecting Slabs	100 days	82FF+30 days
88	Concrete Cope Wall & Crane Wall	272 days	87SS+15 days
89	Concrete Crane Beam (Incl. Foundation Preparation)	120 days	88FF+7 days
90	Install Marine Fenders	90 days	88FF+15 days
91	Install Wharf Hardware	49 days	90FF
92	Mooring Dolphin	42 days	91FF
93	**Tug Basin Expansion**	**78 days**	
94	Tug Basin Expansion	78 days	18,3
95	**Other Works**	**1484 days**	
96	Civil Utilities Phase 1	250 days	58FF,53SS+60 days
97	Civil Utilities (btn apron and interim dyke - Phase 1)	30 days	64,62
98	Civil Utilities Phase 2	220 days	55FF,54,60FF
99	Civil Utilites (btn apron and interim dyke - Phase 2)	30 days	66
100	Terminal Buildings	570 days	96FF
101	Yard Structures Phase 1	231 days	96SS+120 days
102	Yard Structures Phase 2	170 days	98SS+90 days
103	Electrical, Lighting, Controls Ph-1	210 days	96FF
104	Electrical, Lighting, Controls Ph-2	146 days	98SS+60 days
105	Truck Gate Facilities	150 days	103FF,96FF



Project: RBT2BaseSched06-04-2018
Date: Mon 6/4/18

Task	Inactive Task	Manual Summary Rollup	External Milestone	Manual Progress	
Split	Inactive Milestone	Manual Summary	Deadline		
Milestone	Inactive Summary	Start-only	Critical		
Summary	Manual Task	Finish-only	Critical Split		
Project Summary	Duration-only	External Tasks	Progress		

ID	Task Name	Duration	Predecessors
106	Trackworks	136 days	96SS+360 days
107	Phase 1 Pavements Surfacing	219 days	96FF,97FF+30 days
108	Phase 2 Pavements Surfacing	110 days	98FF,99FF+30 days
109	RBT2 Overpass	507 days	42
110	Coal Track Realignment Work	69 days	41
111	East Causeway Transportation Infrastructure	215 days	44
112	End Construction	0 days	114
113	**Phase 1 Turnover**	1 day	103,106,111,41,110,1
114	**Phase 2 Turnover**	1 day	98,102,108
115	**STS, RMGs and ASCs**	**1305 days**	
116	Specifications, Bid, Award	120 days	113FS-570 days
117	Procurement and Delivery	450 days	116
118	**Phase 1 Install & Commissioning**	**540 days**	
119	**Phase 1 - Blocks 1-4**	**120 days**	
120	Install - ASC Batch 1 (1-8)	60 days	117SS+210 days,113
121	Commissioning	30 days	120
122	Training	30 days	121
123	**Phase 1 - Blocks 5-8**	**120 days**	
124	Install - ASC Batch 2 (9-16)	60 days	117SS+270 days,120
125	Commisioning ASC & STS	30 days	124



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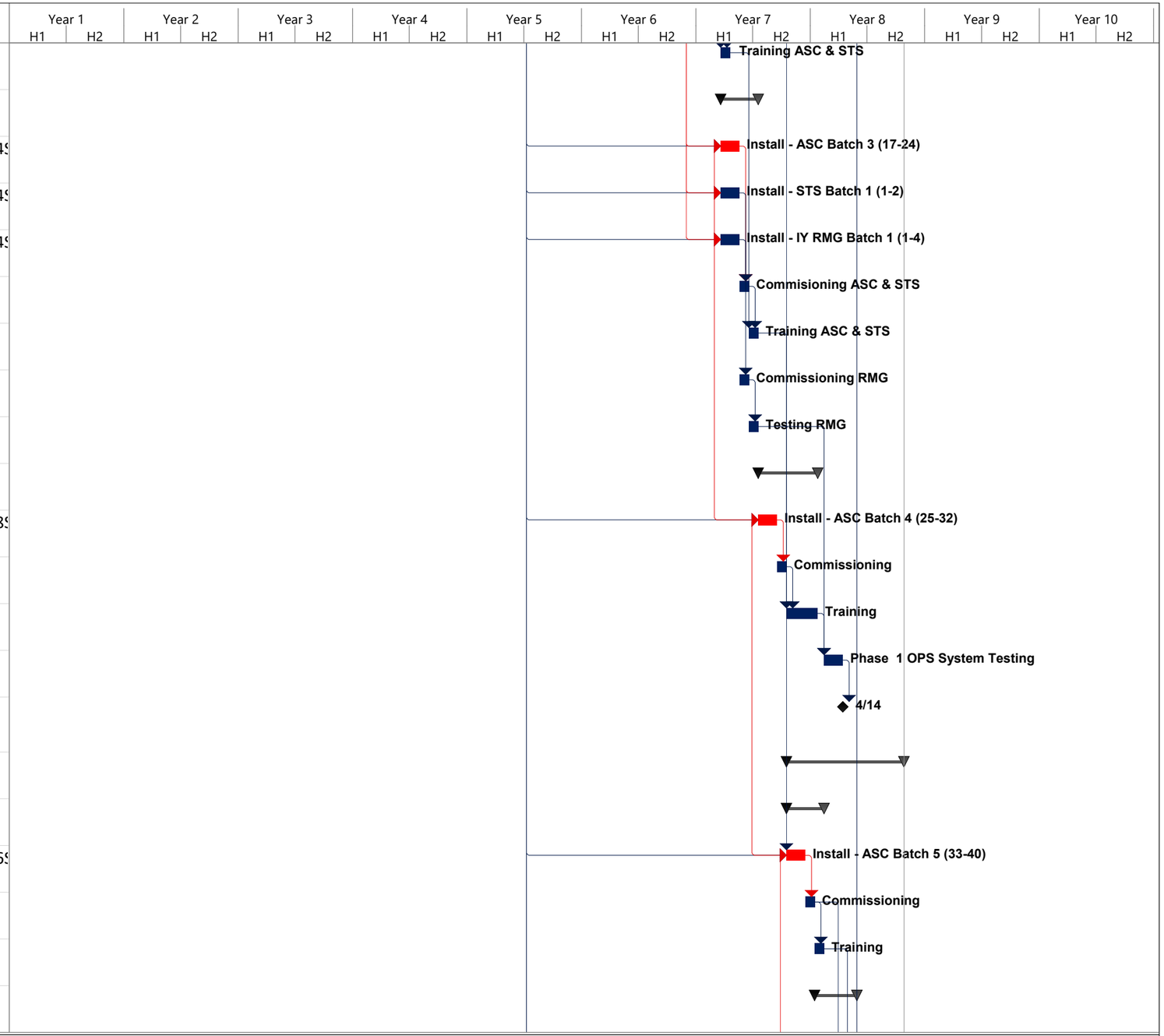
Date: Mon 6/4/18

Task	Inactive Task	Manual Summary Rollup	External Milestone	Manual Progress
Split	Inactive Milestone	Manual Summary	Deadline	
Milestone	Inactive Summary	Start-only	Critical	
Summary	Manual Task	Finish-only	Critical Split	
Project Summary	Duration-only	External Tasks	Progress	

ID	Task Name	Duration	Predecessors
126	Training ASC & STS	30 days	122,125
127	**Phase 1 - Blocks 9-12**	**120 days**	
128	Install - ASC Batch 3 (17-24)	60 days	117SS+360 days,124
129	Install - STS Batch 1 (1-2)	60 days	117SS+360 days,124
130	Install - IY RMG Batch 1 (1-4)	60 days	117SS+360 days,124
131	Commisioning ASC & STS	30 days	128,129
132	Training ASC & STS	30 days	131,126
133	Commissioning RMG	30 days	130
134	Testing RMG	30 days	133
135	**Phase 1 - Blocks 13-16**	**190 days**	
136	Install - ASC Batch 4 (25-32)	60 days	117SS+480 days,128
137	Commissioning	30 days	136
138	Training	100 days	132,137
139	Phase 1 OPS System Testing	60 days	134,138FS+20 days
140	**Phase 1 Go Live**	0 days	139
141	**Phase 2 Install & Commisioning**	**375 days**	
142	**Phase 2 - Blocks 17-20**	**120 days**	
143	Install - ASC Batch 5 (33-40)	60 days	117SS+570 days,136
144	Commissioning	30 days	143
145	Training	30 days	144
146	**Phase 2 - Blocks 21-24**	**135 days**	



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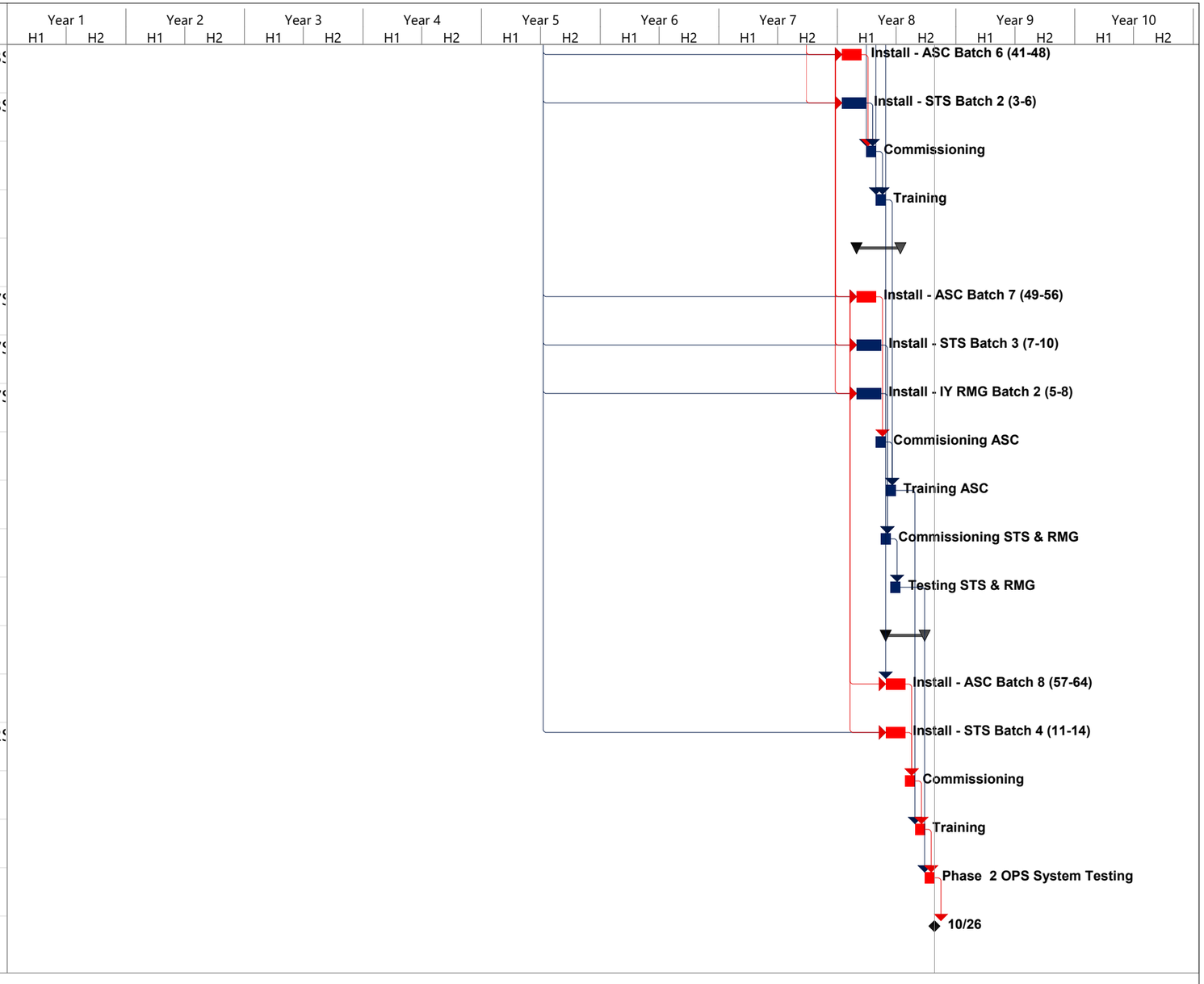
Date: Mon 6/4/18

Task	Inactive Task	Manual Summary Rollup	External Milestone	Manual Progress
Split	Inactive Milestone	Manual Summary	Deadline	
Milestone	Inactive Summary	Start-only	Critical	
Summary	Manual Task	Finish-only	Critical Split	
Project Summary	Duration-only	External Tasks	Progress	

ID	Task Name	Duration	Predecessors
147	Install - ASC Batch 6 (41-48)	60 days	117SS+660 days,143
148	Install - STS Batch 2 (3-6)	75 days	117SS+660 days,143
149	Commissioning	30 days	144,147,148
150	Training	30 days	145,149
151	**Phase 2 - Blocks 25-28**	**135 days**	
152	Install - ASC Batch 7 (49-56)	60 days	117SS+750 days,147
153	Install - STS Batch 3 (7-10)	75 days	117SS+750 days,147
154	Install - IY RMG Batch 2 (5-8)	75 days	117SS+750 days,147
155	Commisioning ASC	30 days	152
156	Training ASC	30 days	150,155
157	Commissioning STS & RMG	30 days	153,154
158	Testing STS & RMG	30 days	157
159	**Phase 2 - Blocks 29-32**	**120 days**	
160	Install - ASC Batch 8 (57-64)	60 days	117,152SS+90 days
161	Install - STS Batch 4 (11-14)	60 days	117SS+840 days,152
162	Commissioning	30 days	160,161
163	Training	30 days	156,162
164	Phase 2 OPS System Testing	30 days	158,163
165	**Phase 2 Go Live**	0 days	164



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Task	Inactive Task	Manual Summary Rollup	External Milestone	Manual Progress
Split	Inactive Milestone	Manual Summary	Deadline	
Milestone	Inactive Summary	Start-only	Critical	
Summary	Manual Task	Finish-only	Critical Split	
Project Summary	Duration-only	External Tasks	Progress	

Attachment B3: Detailed Tabulated Summary of Changes to Basis of Schedule (Updated Appendix 4-E)

Revisions Tracking Table for EIS Appendix 4E - Basis of Schedule

ID	Section	Section Title	Page No.	Original Content in EIS App 4E: Basis of Schedule	Proposed Revision(s)	Comments/Reason(s) for Revision(s)
1	-	Introduction	1	Second paragraph….The prescribed start date is July 1, 2018.	Second paragraph….The prescribed start date is July 1, Year 1.	*Revised start date based on latest project schedule.*
2	1.2	Other Constraints	2	"Coasting Trade Act 1992" is assumed to be applicable. Consequently, where suitable dredging equipment is available within Canada, dredging equipment will not be sourced from offshore.	"Coasting Trade Act 1992" is assumed to be applicable, with provisions as appropriate as per the new Canada-European Union (EU) Comprehensive Economic and Trade Agreement (CETA) which came into force on September 21, 2017. Consequently, where suitable dredging equipment is available within Canada, dredging equipment may be sourced from offshore if required.	*CETA came into affect after the EIS submission. The CETA agreement allows European dredge equipment to operate in Canadian waters, and could be used on RBT2.*
3	1.3.2	Dredging Equipment	2	Fraser River Pile & Dredge Inc. (FRPD) own and operate the only dredges on the BC coast capable of undertaking the work. Further, FRPD have the exclusive contract for the Fraser River Maintenance Dredging program. It has been established that no alternative Canadian-registered dredges are available, that are capable of dredging to EL -30 m (Chart Datum) at the production rate required for the Project (excavation by clamshell derrick is not a viable option). Consequently, the application of the "Coasting Trade Act 1992" dictates the use of FRPD equipment.	Fraser River Pile & Dredge Inc. (FRPD) own and operate the only dredges currently on the BC coast capable of undertaking the work. Further, FRPD have the exclusive contract for the Fraser River Maintenance Dredging program until the end of 2022. It has been established that no alternative Canadian-registered dredges are available, that are capable of dredging to El -26.7 m (Chart Datum) at the production rate required for the Project (excavation by clamshell derrick is not a viable option). Consequently, the application of the "Coasting Trade Act 1992" dictates the use of FRPD equipment or equipment sourced under the rules according to the CETA.	*The required dredge depth is being reduced to coincide with the reduced berth depth as per the revised Basis of Design. Reference to the CETA added.*
4	1.3.2	Dredging Equipment	2	The development of the RBT2 Schedule is based on the assumption that the Titan and the Columbia are the only FRPD dredges utilised on this Project. FRPD recently purchased an additional trailing arm suction hopper dredge (FRPD 309), but it is assumed that this dredge is intended to replace the aging Titan, and so it has been assumed (for lack of real production data) that the dredging rate and general capability of this new dredge is similar to the Titan. The FRPD 309 is now in service, and it has the ability to discharge sand directly into landside fills, which may help to reduce the overall schedule duration (due to less reliance on underwater stockpiling). However, in the absence of real production data, conservatively the schedule has maintained the previous assumption of Titan production rates and operational capability.	The development of the RBT2 Schedule is based on the assumption that the ~~Titan~~ FRPD309 and the Columbia are the only FRPD dredges to be utilised on this Project. FRPD recently purchased an additional trailing arm suction hopper dredge (FRPD 309), ~~but it is assumed that this dredge is intended~~ to replace the aging Titan. ~~and so it has been assumed (for lack of real production data) that the dredging rate and general capability of this new dredge is similar to the Titan.~~ The FRPD 309 is now in service, and it has the ability to discharge sand directly into landside fills~~, which may help to reduce the overall schedule duration (due to less reliance on underwater stockpiling). However, in the absence of real production data, conservatively the schedule has maintained the previous assumption of Titan production rates and operational capability~~. Production rates and operational capability are based on real world data generated from using the FRPD309 for the last several years.	*The Titan is no longer considered in this project since it has been replaced by the FRPD 309.*
5	1.3.3	Underwater Stockpile - Intermediate Transfer Pit (ITP)	3	It is presumed that an underwater stockpile, referred to as the Intermediate Transfer Pit, of dredged sand will be used during the dredging and reclamation works. This ITP is assumed located southeast of the approach channel to the Deltaport Terminal wharf, in the same location as the underwater stockpile used during the recent construction of the Deltaport Berth 3 Expansion (DB3). It is assumed that no restrictions will be imposed on placing Fraser River sand (FRS) into the ITP; this is based on experience during DB3 construction. DB3 crab closures were relaxed with appropriate documentation and approval. Crab surveys and salvage may be required prior to and during ITP operations. Most of the underwater stockpile will sit below El.-5.0m. It is assumed that reclaim of stockpiled FRS material sitting above El.-5.0m will not be allowed during Juvenile Salmon closures. However it is not likely to significantly impact reclaim operations.	<Deleted>	*To address concerns raised by Tsawwassen First Nation (TFN) along with other Aboriginal groups, the use of the ITP and its associated activities has been removed from the Project.*

ID	Section	Section Title	Page No.	Original Content in EIS App 4E: Basis of Schedule	Proposed Revision(s)	Comments/Reason(s) for Revision(s)
6	1.3.8	Disposal of Dredge Fines	4	Fines suspended in the water column within the contained (dyked) areas will be directed to an underwater disposal at sea (DAS) site. Seepage through the perimeter dykes is to be minimised by placing a filter layer on the inner face of the Terminal dykes. Sluice boxes would be managed to maximise the retention time of the contained water.	Fines suspended in the water column within the contained (dyked) areas will be directed to ~~an underwater disposal at sea (DAS) site~~ a decant water pipeline for underwater discharge. Seepage through the perimeter dykes is to be minimised by placing a filter layer on the inner face of the Terminal dykes. Sluice boxes would be managed to maximise the retention time of the contained water.	*This activity has been reclassified from Disposal at Sea (DaS) to decant water discharge.*
7	2.2.1(b)	Design Layout	4	East Face (Dyke TD2) This Perimeter Dyke forms the east Containment Dyke, tying into the Westshore Terminal's perimeter. Seabed contours vary up from El.-4.0m. Golder Associates (Ref 2) defines this as a Type 2 Dyke (Ref 2, Fig 9) with underlying native soil improvement. Typical section is shown on Drawing 60287583-MA-216.	East Face (Dyke TD2) This Perimeter Dyke forms the east Containment Dyke, tying into the Westshore Terminal's perimeter. Seabed contours vary up from El.-4.0m. Golder Associates (Ref 2) defines this as a Type 2 Dyke (Ref 2, Fig 9) with underlying native soil improvement. Typical section is shown on Drawing 60287583-MA-216 Rev E.	*Drawing 60287583-MA-216 updated to Rev E, to reflect the 2016 Supplemental Geotechnical Investigation which concluded the soil has a more favourable seismic response than inferred in the EIS.*
8	2.2.1 (c)	Design Layout	4	West Face (Dyke TD3) This Perimeter Dyke forms the west Containment Dyke and is categorised by Golder Associates (Ref 2, Fig 9) as Type 2 with underlying native soil improvement. Typical section is shown on Drawing 60287583-MA-216.	West Face (Dyke TD3) This Perimeter Dyke forms the west Containment Dyke and is categorised by Golder Associates (Ref 2, Fig 9) as Type 2 with underlying native soil improvement. Typical section is shown on Drawing 60287583-MA-216 Rev E.	*Drawing 60287583-MA-216 updated to Rev E, to reflect the 2016 Supplemental Geotechnical Investigation which concluded the soil has a more favourable seismic response than inferred in the EIS.*
9	2.2.1 (d)	Design Layout	4	North Face (Dyke TD4) This Perimeter Dyke forms the north Containment Dyke and is categorised by Golder Associates (Ref 2, Fig 9) as Type 2 with underlying native soil improvement. Typical section is shown on Drawing 60287583-MA-215.	North Face (Dyke TD4) This Perimeter Dyke forms the north Containment Dyke and is categorised by Golder Associates (Ref 2, Fig 9) as Type 2 with underlying native soil improvement. Typical section is shown on Drawing 60287583-MA-215 Rev E.	*Drawing 60287583-MA-215 updated to Rev E, to reflect the 2016 Supplemental Geotechnical Investigation which concluded the soil has a more favourable seismic response than inferred in the EIS.*
10	2.3.1	Dredge Basin Dredging, Extent	5	Scope of dredging is shown on Drawing 60287583-MA-501.	Scope of dredging is shown on Drawing 60287583-MA-501 Rev F.	*The change in dredging footprint is the result of a shallower berth depth and flatter dredged slope. Refer to Item No. 3 for more discussion on berth depth.*
11	2.3.2	Dredging Sequence	5	Dredging is to be undertaken in a manner that would allow subsequent wharf construction activities to commence in Season 1 (Year 2). For the purposes of schedule development, when 300 m of trench at EL -30 m. is available, placement of sacrificial stone and slope support mattress would commence. These activities would not advance closer than 200 m from the active dredge cut face. Dredging is assumed to be performed by FRPD's *"Columbia"* with an extended ladder. The maximum depth of dredging is the same as at DB3 where the *"Columbia"* completed similar dredging works successfully. Dredging to be undertaken outside Crab Closures (i.e., dredging performed only from April 1 through to October 15).	Dredging is to be undertaken in a manner that would allow subsequent wharf construction activities to commence in Season 1 (Year 2). ~~For the purposes of schedule development, when 300 m of trench at EL -30 m. is available, placement of sacrificial stone and slope support mattress would commence. These activities would not advance closer than 200 m from the active dredge cut face.~~ Dredging is assumed to be performed by FRPD's *"Columbia"* with an extended ladder. The maximum depth of dredging is similar to DB3 where the *"Columbia"* completed similar dredging works successfully. Dredging to be undertaken outside Crab Closures (i.e., dredging performed only from April 1 through to October 15).	*The need for "sacrifical stone and slope support mattress" is no longer required following the results of the 2016 Supplemental Geotechnical Investigation.*
12	2.3.3	Dredge Mobilization	6	The *Columbia* fills a dual role: dredging at the dredge basin, and reclaim from the ITP. FRPD has advised that installation of the ladder extension would require 4 weeks. In addition, the reclaim pipeline would be installed in the corridor between Westshore Terminals and Deltaport Terminal. A total of 3 months have been allocated for this pipeline set-up.	The *Columbia* ~~fills a dual role:~~ dredges the dredge basin~~, and reclaim from the ITP~~. FRPD has advised that installation of the ladder extension would require a minimum of 4 weeks. ~~In addition, the reclaim pipeline would be installed in the corridor between Westshore Terminals and Deltaport Terminal. A total of 3 months have been allocated for this pipeline set-up.~~	*The ITP and its associated activites has been removed from the project.*
13	2.4.1	General Fill/Preload	6	[Second and Third Bullet Point] - Dredge spoil retained = 85% - Dredge spoil to underwater ocean DAS site = 15% (remainder)	[Second and Third Bullet Point] - Dredge spoil retained = 97% - Dredge spoil to underwater ~~ocean~~ ~~DAS site~~ Supernatant Discharge Area = 3% (remainder)	*Based on the 2016 Geotechnical Investigation (samples collected) and 97% retention rate scenarios described in EIS Appendix 9.6-C.*

ID	Section	Section Title	Page No.	Original Content in EIS App 4E: Basis of Schedule	Proposed Revision(s)	Comments/Reason(s) for Revision(s)
14	2.4.2	Fraser River Sand (FRS)	6	Section 2.4.2 and associated tablesThis material sourced from the Fraser River Maintenance Dredging program forms the bulk of the imported sand for the reclamation. Sand would be delivered to the ITP located southeast of the Deltaport Terminal approach channel by FRPD's hopper dredge. The sand would be reclaimed by FRPD's *Columbia*, augmented by a second dredge of lesser capacity where necessary. · ITP Capacity = 2,400,000 m^3 · Maximum annual supply to ITP = 2,500,000 m^3 FRS from the Fraser River Maintenance Dredging program is the most economical source of general fill. If not augmented by another source of sand, or an increase in dredging equipment, the limit of 2,500,000 m^3/year would dictate the duration of the overall Project schedule. The *Columbia* reclaim rate from the ITP can be significantly greater than the input by the Fraser River hopper dredge. However, if reclaim from the ITP is done only by the *Columbia* between and after dredging seasons, the total volume of FRS in place will be less than that available from FRS deliveries. This can be partially offset by using the *Columbia* prior to Season 1 dredging, to pump from the ITP to a land stockpile located in the Causeway area. The time available from this pumping would be restricted by completion of suitable containment dyking. If an additional reclaim dredge unit with a minimum capacity of 3,500 m^3/day was utilised, then the Fraser River hopper dredge capacity could be fully utilised. By June 20, Year 4: <Reclaim Scenarios Table> Note for scheduling purposes, scenario (3) above has been assumed. No suitable BC-based dredge to augment the Columbia has been located. Dredging equipment capable of moving 3,500m3/day has been located in Eastern Canada, but would require mounting on a larger BC scow to survive in the local wave/wind climate. Also, since FRPD equipment is already presumed fully committed to the RBT2 Project, it may be reasonable to assume that a suitable dredge registered in another jurisdiction would be permitted under the Coastal Trade Act 1992 for a defined period. There is no advantage in early (ie. pre-award) filling of the proposed ITP, since withdrawal can only commence after completing Season 1 dredging (Terminal) or completion of containment dyking (Causeway stage 1).	This material sourced from the Fraser River Maintenance Dredging program forms the bulk of the imported sand for the reclamation. Sand would be delivered ~~to the ITP located southeast of the Deltaport Terminal approach channel by FRPD's hopper dredge~~by the FRPD 309 and discharged directly into landside fills. ~~The sand would be reclaimed by FRPD's Columbia, augmented by a second dredge of lesser capacity where necessary.~~ ~~· ITP Capacity = 2,400,000 m3~~ ~~· Maximum annual supply to ITP = 2,500,000 m3~~ ~~FRS from the Fraser River Maintenance Dredging program is the most economical source of general fill.~~ Based on equipment capacity limitions, 2,000,000 m^3/year of FRS would be availabe to the Project each year. If notaugmented by another source of general fill, or an increase in Fraser River dredging equipment, the limit of 2,000,000 m^3/year would dictate the duration of the overall Project schedule. ~~The *Columbia* reclaim rate ...~~ ~~...~~ ~~...~~ ~~...completion of containment dyking (Causeway stage 1).~~	*The ITP and its associated activities has been removed from the project. Annual production levels adjusted to reflect latest understanding of equipment capability.*
15	2.4.3	Additional Sand	7	The assumption of 1,088,000 m^3 of sand from an existing second source has been incorporated into the schedule. This material would be delivered by barge from an established quarry either to the ITP, or unloaded directly to the Terminal area. For the purpose of scheduling, placement into the ITP is assumed. The delivery rate information was provided by Lafarge Sechelt, and it is substantially lower than the delivery rate achieved for the YVR runway extension project. The consequences of including a second source of sand include: Project duration is shortened by 3 months; Superior quality sand is deposited in the upper limits of the general fill; and Schedule risk is reduced.	The assumption of 3,600,000 m3 of sand from an existing second source has been incorporated into the schedule. This material would be delivered by barge from an established quarry and unloaded directly to the Terminal area. The delivery rate information was provided by Lafarge Sechelt, and it is substantially lower than the delivery rate achieved for the YVR runway extension project. The consequences of including a second source of sand include: Project duration is shortened; Superior quality sand is deposited in the upper limits of the general fill; and Schedule risk is reduced.	*The elimination of the ITP results in a shortfall in FRS. This shortfall is made up by increasing the amount of general fill obtained from existing quarries.*

ID	Section	Section Title	Page No.	Original Content in EIS App 4E: Basis of Schedule	Proposed Revision(s)	Comments/Reason(s) for Revision(s)
16	2.4.5	Construction Sequencing	7/8	Step 1 - Dredge spoil into east basin (Columbia) Step 2 - FRS pumped (Columbia and second dredge) into east basin over dredged spoil to final sand grade. This operation may require raising the level of the sand in stages to avoid displacement of newly placed dredged spoil. Step 3 - Continue pumping FRS for preloading Step 4 - Season 2 dredged spoil into west basin (Columbia) Step 5 - Repeat Step 2 operation into west basin. The second dredge relcaims FRS in a continuing operation.	<Deleted>	*The strict construction sequence identified in the EIS is no longer required due to the proven improved quality of dredge material enabling it to now be mixed with FRS and material from existing quarries.*
17	2.5.1	Terminal Building Foundations	8	Native soil improvement is required under the Maintenance Building, Administration Building, CBSA Building, Parking Structure, and the main Substation, which are all located within the initial perimeter dyke system. This soil improvement extends to EL -42 m and is only feasible if undertaken prior to the general fill placement (i.e., prior to dyke closure). It will require the equipment to be mounted on a jack-up platform or grounded barge, due to limited water depth (although barge-mounted equipment may be feasible at mid to high tide). This activity is scheduled simultaneously with Year 1 dyke construction and must be completed, and the containment dyke closed, before the dredging operation can commence.	Native soil improvement is required under the Maintenance Building, Administration Building, CBSA Building, Parking Structure, and the main Substation. This soil improvement extends to EL -34 m and is ~~only feasible if undertaken prior to the general fill placement (i.e., prior to dyke closure)~~assumed to be performed by land based equipment in the "dry". This work may be completed either before or after preload. ~~It will require ... dredging operation can commence.~~	*Based on the results of the 2016 Supplemental Geotechnical Investigation and subsequent analysis of the building foundations, the depth of the ground improvement underneath the buildings has been reduced.*
18	3.2	Construction Sequencing	9	When dredging has advanced to expose 300m of trench at El.-30m, the caisson foundation work would commence... Starting at the east end, the wharf construction sequence would be: Place sacrificial rock and buttress mattress rock; Improvement of the native soil; Clean-up dredging (by Columbia) of fines generated by native soil improvement (to DAS site); Place mattress rock and overbuild; Densify mattress rock; Remove excess mattress rock (remaining overbuild); Place levelling course and screed; Install wharf face caissons; Place caisson ballast Stage 1; Place Stage 1 berm rock; Install keys between caissons; Complete placement of berm rock and caisson ballast; and Place berm rock filter. At this time: Prepare foundation for end caisson C30A; Improve native soil under east closure dyke (marine based equipment); When caisson C1 is in place: Prepare foundation for end caisson C1A; Improve native soil under west closure dyke (marine based equipment);	When dredging has advanced to expose 300m of trench at El. -27m, the caisson foundation work would commence... Starting at the east end, the wharf construction sequence would be: ~~Place sacrificial rock and buttress mattress rock;~~ ~~Improvement of the native soil;~~ ~~Clean-up dredging (by Columbia) of fines generated by native soil improvement (to DAS site);~~ ~~Place mattress rock and overbuild;~~ Densify mattress rock; Remove excess mattress rock (remaining overbuild); Place levelling course and screed; Install wharf face caissons; Place caisson ballast Stage 1; Place Stage 1 berm rock; Install keys between caissons; Complete placement of berm rock and caisson ballast; and Place berm rock filter. At this time: Prepare foundation for end caisson C30A; Improve native soil under east closure dyke (land based equipment); When caisson C1 is in place: Prepare foundation for end caisson C1A; Improve native soil under west closure dyke (land based equipment);	*See Comment on Item No. 3 for berth depth change. Based on the 2016 Supplemental Geotechnical Investigation, the updated EIS reference Figure 4-5 Cross Section of Caisson Wharf Structure removes the requirement of sacrificial stone and native soil densification under the caisson trench. Also, slope support (buttress rock) is not required since the dredged slopes have been revised to be flatter.*
19	4.2	Construction Sequencing	10	Stage 1 Dyking would be constructed simultaneously with the Terminal east basin Containment Dykes. This will: - Permit an early start on reclaim from the ITP prior to start of dredging for general fill and preload - [All remaining bullets remain the same] Causeway Stage 2 dyking would be constructed in the second season crab opening. FRS for general fill and preload would be relocated from the completed Causeway Stage 1 preload and stockpile. Preloading for Causeway Stage 2 would be done in a single step.	Stage 1 Dyking would be constructed simultaneously with the Terminal east basin Containment Dykes. This will: - ~~Permit an early start on reclaim from the ITP prior to start of dredging for general fill and preload.~~ - [All remaining bullets remain the same] Causeway Stage 2 dyking would be constructed in the second season crab opening. FRS for general fill and preload would be relocated from the completed Causeway Stage 1 preload and stockpile. Preloading for Causeway Stage 2 would be included in the relocated stage 1 preload and stockpile done in a single step.	*ITP has been removed from the project.*

ID	Section	Section Title	Page No.	Original Content in EIS App 4E: Basis of Schedule	Proposed Revision(s)	Comments/Reason(s) for Revision(s)
20	4.4	General Fill/Preload	11	Refer to Section 2.4.2 for reclaim of FRS from the ITP.	Refer to Section 2.4.2 for delivery of ~~FRS from the ITP~~ Fraser River Sand.	*ITP has been removed from the project.*
21	5.2	Tug Basin Expansion	11	The existing tug basin would be expanded and additional mooring facilities provided. The work consists, in part, of salvage/removal of slope protection materials, dredging by clam shell derrick, installation of slope protection and crest protection and installation of mooring piles (all involving marine equipment).	The existing tug basin would be expanded and additional mooring facilities provided. The work consists, in part, of salvage/removal of slope protection materials, dredging by clam shell derrick, pumped dredged material onshore and use as general fill, installation of slope protection and crest protection and installation of mooring piles (all involving marine equipment).	*Based on the 2016 Supplemental Geotechnical Investigation findings, the dredged material from the tug basin can be re-used as terminal fill.*
22	6.1	Production Rates, Work Days	11	Dredging, FRS reclaim from stock pile	Dredging, FRS ~~reclaim from stock pile~~ directly from FR to site.	*ITP has been removed from the project.*
23	**6.3**	**Production Rates**	**12**	**See separate revised table on App 4E 6.3 Production Rate Table Tab**		
24	7.1	Critical Path	15	The Critical Path for the RBT2 construction schedule is essentially unchanged from the "T2 Option 2 – Early Start Date" Schedule. The Critical Path for the construction of the Terminal Area and Causeway for RBT2, through to the final grading prior to granular sub-base placement, flows through the following activities: a) Mobilisation for construction of the containment dyking (including installation of barge unloading ramps with storm protection); b) Construction of the Terminal Area east basin and Causeway Stage 1 containment dyking; c) Native soil improvement for 5 Terminal Area building foundations (a gap must be kept open in the containment dykes until this operation is complete and the equipment withdrawn); d) Season 1 dredging with emphasis on providing maximum trench for wharf construction; e) Placement of FRS in the east basin; f) Installation of Terminal Area preloads 1, 2, and 3; g) Season 2 dredging; h) Continuing wharf construction; i) West Closure dyke construction; j) Apron area general fill (west end); k) Apron area preload; and l) Apron area dynamic compaction (west end).	The Critical Path for the RBT2 construction schedule ~~is essentially unchanged~~ has changed from the "T2 Option 2 – Early Start Date" Schedule to incorporate deletion of deep soil densification, no ITP and revised FRS material delivery rate. The Critical Path for the construction of the Terminal Area and Causeway for RBT2, through to the final grading prior to granular sub-base placement, flows through the following activities: a) Mobilisation for construction of the containment dyking (including installation of barge unloading ramps with storm protection); b) Construction of the Terminal Area east basin and Causeway Stage 1 containment dyking; ~~c) Native soil improvement for 5 Terminal Area building foundations (a gap must be kept open in the containment dykes until this operation is complete and the equipment withdrawn);~~ c) Season 1 dredging with emphasis on providing maximum trench for wharf construction; d) Placement of FRS in the east basin; e) Installation of Terminal Area preloads ~~1, 2, and 3~~; f) Season 2 dredging; g) Continuing wharf construction; h) ~~West~~ Closure dyke construction; i) Apron area general fill ~~(west end)~~; j) Apron area preload; and k) Apron area dynamic compaction ~~(west end)~~.	*Land based, rather than previously assumed marine based, soil improvements are required for the buildings. Refer to prior comments on removal of deep soil densification, ITP and revised Fraser River sand material delivery rate.*
25	7.2.1	Delays due to Adverse Weather	15	The most serious impacts of adverse weather would be:Damage to unloading ramps;Interruptions during the east basin containment dyke construction, including damage to dykes already constructed, but inadequately protected by rip-rap;Interruption to the native soil improvement for the Terminal building foundations;Interruption and delays in material deliveries by barge and from the ITP;Interruption to dredging, and possible disruption to dredgeate pipeline;Interruptions in wharf construction, especially native soil improvement; andDamage to stored caissons.	The most serious impacts of adverse weather would be:Damage to unloading ramps;Interruptions during the east basin containment dyke construction, including damage to dykes already constructed, but inadequately protected by rip-rap;~~Interruption to the native soil improvement for the Terminal building foundations;~~Interruption and delays in material deliveries by barge ~~and from the ITP~~;Interruption to dredging~~, and possible disruption to dredgeate pipeline~~;Interruptions in wharf construction, especially ~~native soil improvement~~ densification of mattress rock; andDamage to stored caissons.	*Based on 2016 supplemental geotechnical investigation and analysis findings, native soil improvement for the Wharf Construction Terminal Building foundations have either been eliminated or reduced. ITP has been removed from the project*

ID	Section	Section Title	Page No.	Original Content in EIS App 4E: Basis of Schedule	Proposed Revision(s)	Comments/Reason(s) for Revision(s)
26	7.2.2	Dredging and FRS ~~Reclaim~~ Delivery	16	The only equipment available for Project dredge basin dredging and reclaim of FRS from the ITP is the Columbia. If this dredge becomes unavailable for more than 3 weeks during the dredging season, the completion of the dredging as contemplated would be unlikely. If sand delivery to the ITP (by the Fraser River hopper dredge) is interrupted for 2 months during the Fraser River Maintenance Dredging program, delay in the placement of general fill and preloads will ensue.	The only equipment available for Project dredge basin dredging is the Columbia. If this dredge becomes unavailable for more than 3 weeks during the dredging season, the completion of the dredging as contemplated would be unlikely. If sand delivery to the site (by the Fraser River hopper dredge) is interrupted for 2 months during the Fraser River Maintenance Dredging program, delay in the placement of general fill and preloads will ensue.	*The Intermediate Transfer Pit (ITP) is removed from the project.*
27	7.2.3	Native Soil Improvement	16	Native soil improvement has been utilised on previous wharf projects at Roberts Bank. Native soil improvement under the perimeter dykes falls within the experience of most specialty contractors. However, native soil improvement under five Terminal buildings extends down to EL -42 m, which is probably close to the limit of current technology. This activity is on the critical path. Because of the confined site, adding additional equipment to compensate for slow progress may not be an option. Native soil improvement in the dredge basin extends the full length of the berth and extends down to EL -47 m, which is probably close to the limit of current technology. Similar work, but only down to EL -32 m, was undertaken at Deltaport Terminal Berths 1 & 2 where some difficulties were encountered requiring additional equipment to maintain scheduled progress. Specialty contractor experience in underwater improvement at these depths is very limited. Progress in underwater soil improvement is controlled by the rate of trench availability. The width of the soil improvement zone is sufficient to accommodate multiple vibro-densification units (on multiple barges) if required.	<Deleted>	*Native Soil Improvement is no longer on the critical path*
28	7.2.4	Dredging Spoil Quantity Variation	16	The percentage retained (nominal assumption is 85% retained); % retained at 0.9 bulking factor: 95% 85% 75% 65% In-place volume $m^3 \times 10^6$: 3.56 3.19 2.81 2.44	<Deleted>	*The 2016 Geotechnical Investigation (samples collected) and 97% retention rate scenarios described in EIS Appendix 9.6-C, have eliminated this uncertainty from the project, and as such this is no longer considered a critcal path issue.*
29	7.2.4	Dredging Spoil Quantity Variation	16	If 95% retention is attained (unlikely), the dredged spoil will extend into the lower level of the 6m cap of compacted sand. If retention is less than 85%, additional FRS will be required to compensate.	<Deleted>	*Based on the 2016 Geotechnical Investigation (samples collected) it is no longer an issue if dredge basin material is mixed with FRS. Thus this is no longer a Critical Path issue.*
30	12	Terminal Equipment, STS Cranes	18	STS Crane Delivery: 18-20 months (4 units at a time); and	STS Crane Delivery: 18-20 months (2-4 units at a time); and	*Updates/changes based on a greater knowledge of terminal equipment deliveries, installation, commissioning and site testing durations.*
31	12	Terminal Equipment, STS Cranes	18	STS Crane site testing: Unit #1-2 months; subsequent units 2-3 weeks/unit.	STS Crane Install, commission and site test~~ing~~: ~~Unit #1-2 months; subsequent units 2-3 weeks/unit.~~ 4-5 months per unit	*Updates/changes based on a greater knowledge of terminal equipment deliveries, installation, commissioning and site testing durations.*
32	12	Terminal Equipment, RMGs & ASCs	18	Deliveries: 12-15 months (8 units/delivery); and	Deliveries: 12-15 months (4-8 units/delivery); and	*Updates/changes based on a greater knowledge of terminal equipment deliveries, installation, commissioning and site testing durations.*
33	12	Terminal Equipment, RMGs & ASCs	18	Site Erection and testing: Unit #1-2 months; subsequent units 2-3 weeks/unit.	Install, commission and site test~~ing~~: ~~Unit #1-2 months; subsequent units 2-3 weeks/unit.~~4-5 months per unit	*Updates/changes based on a greater knowledge of terminal equipment deliveries, installation, commissioning and site testing durations.*
34	12	Terminal Equipment, Mobile Horizontal- Transfer Equipment (Shuttle Carriers assumed)	18	Site testing: 10 units per month after delivery.	Commissioning and site test~~ing~~: ~~10 units per month after delivery.~~3-6 months per unit.	*Updates/changes based on a greater knowledge of terminal equipment deliveries, installation, commissioning and site testing durations.*

ID	Section	Section Title	Page No.	Original Content in EIS App 4E: Basis of Schedule	Proposed Revision(s)	Comments/Reason(s) for Revision(s)
35	12	Terminal Equipment, Mobile Horizontal- Transfer Equipment (Shuttle Carriers assumed)	18	As part of the system/equipment start-up, there should be an allowance of 2 months of training for the remote crane operators with the terminal operating systems and consoles.	As part of the system/equipment start-up, there should be an allowance of 2 months of operations system testing training for the remote crane operators with the terminal operating systems and consoles.	*Updates/changes based on a greater knowledge of terminal equipment deliveries, installation, commissioning and site testing durations.*

Revisions to Rate Production Table in EIS Appendix 4E - Basis of Schedule, Section 6.3, page 12

#	Item	Production Rate	Unit	Notes	Comments/Reason(s) for Revision(s)
A	**Dyke Construction:**				
	Supply and place core rock and gravel				
	Place by end dumping from scow and by clam	4,250	m^3/d/barge	Up to 3 ~~2~~-5000t barges/day, includes 15% weather delay	
	Place from ramp by truck	4,250	m^3/d/barge	Up to 3 ~~2~~ ramps used, each at 1-5,000 t barge/day, includes 15% weather delay	
	Slope Protection:				
	Place from scow by clam	700	m^3/d	Up to 2 clams used	
	Place from dyke	700	m^3/d	Up to 2 backhoe/clams used	
	Raise Perimeter dyke	500	m^3/d	Done in concert with native soil improvement	
B	**Dredge Marine Approach Areas and Dredge Basin**				
	Mobilise Columbia			4 weeks to install ladder extension 6 weeks to install reclaim pipeline	
	Dredge	13,500	m^3/d	Weighted average of FRPD rates above and below EL.-15m	
C	**General Fill**				
	Dredged Spoil			Dredged volume reduced by loss (3%) and compaction (10%)	*Based on the 2016 Geotechnical Investigation (samples collected) and results from the 2017 Sediment Velocity Testing.*
	~~FRS to ITP~~	~~10,500~~	~~m^3/d~~	~~FRPD Input~~	*ITP has been removed.*
	~~ITP Capacity~~	~~2,400,000~~	~~m^3~~	~~FRPD Input~~	*ITP has been removed.*
	~~Reclaim by Columbia~~	~~15,000~~	~~m^3/d~~	~~FRPD Input~~	*This refers to taking material from ITP to reclamation area, which is no longer required as the ITP has been removed.*
	~~Reclaim by second dredge~~	~~3,500~~	~~m^3/d~~	~~Set by Project demand~~	*This refers to using a second dredge to take material from ITP to reclamation area, which is no longer required as the ITP has been removed.*
	Second sand source	~~50,000~~ 100,000	m^3/month	Lafarge Sechelt input	*Increase to 100,000m^3/month to compensate for no ITP.*
	Fraser River Sand to Basin	10,500	m^3/d		*New rate added to reflect Fraser River Sand pump volume from the FRPD 309 to terminal basin*
D	**Preload**				
	9 preloads on Terminal Area				
	2 preloads on Causeway				
	~~Reclaim by Columbia~~	~~12,000~~	~~m^3/d~~	~~Reduced FRPD rate to reflect elevation~~	*ITP has been removed.*
	~~Reclaim by second dredge~~	~~3,500~~	~~m^3/d~~	~~Set by Project demand~~	*This refers to using a second dredge to take material from ITP to reclamation area, which is no longer required as the ITP has been removed.*
	Relocate preload				
	- Max haul 1.5km	16,000	m^3/d	Utilising 20 m^3 artuculated dump trucks, 15 minutes cycle time	
	- Max haul 6.0km	8,000	m^3/d	Utilising 20 m^3 artuculated dump trucks, 25 minutes cycle time	

#	Item	Production Rate	Unit	Notes	Comments/Reason(s) for Revision(s)
E	**Native Soil Improvement**				
	Building Foundations (~~marine~~ land based)	800	m^3/d/rig	~~4 rigs used, double shift. Golder Associates rate of 100 linear m/shift with 10% weather delays.~~ Refer to Perimeter Dykes notes.	*Change in methodology based on the 2016 Supplemental Geotechnical Investigation and further analysis findings.*
	~~Caisson foundation (marine based)~~	~~730~~	~~m^3/d/rig~~	~~6 rigs used in Base, DPI rate, 1,090 m^3/d/1.5 rigs~~	*Based on the 2016 Supplemental Geotechnical Investigation, native soil densification under the caisson trench is no longer required.*
	Closure dykes (marine based)	730	m^3/d/rig	2 rigs used	
	Perimeter dykes (land based)	1,500	m^3/d/rig	3 rigs used, rate controlled by preload material	
F	**Dynamic Compaction**	**500**	**m^2/d/rig**	**6 rigs used**	
G	**Wharf Construction - marine operations**			**Rates based on previous experience which are adequate to keep abreast of dredging process**	
	~~Place buttress rock and sacrificial stone~~	~~4,000~~	~~m^3/d~~	~~Bottom dump scow, trimming by 2 clams~~	*Based on the 2016 Supplemental Geotechnical Investigation, the updated EIS reference Figure 4-5 Cross Section of Caisson Wharf Structure removes the requirement of sacrificial stone. Also, slope support (buttress rock) is not required since the dredged slopes have been revised to be flatter.*
	~~Remove sacrificial rock~~	~~2,000~~	~~m^3/d~~	~~By clam to barge, trimming by 3 clams~~	*Based on the 2016 Supplemental Geotechnical Investigation, the updated EIS reference Figure 4-5 Cross Section of Caisson Wharf Structure removes the requirement of sacrificial rock.*
	Place mattress rock ~~and overbuild~~	6,000	m^3/d	Bottom dump barge, trimming by 3 clams	*Based on the 2016 Supplemental Geotechnical Investigation, the updated EIS reference Figure 4-5 Cross Section of Caisson Wharf Structure removes the requirement of mattress rock overbuild.*
	Densify mattress rock and sand fill	1,000	m^3/d/rig	6 rigs in 2 fronts used	*Based on the 2016 Supplemental Geotechnical Investigation, the updated EIS reference Figure 4-5 Cross Section of Caisson Wharf Structure has added sand fill to be densified.*
	~~Remove mattress rock overbuild~~	~~2,000~~	~~m^3/d/rig~~	~~By clam, 2 rigs used~~	*Based on the 2016 Supplemental Geotechnical Investigation, the updated EIS reference Figure 4-5 Cross Section of Caisson Wharf Structure removes the requirement of mattress rock overbuild.*
	Place and screed levelling course	100	m^2/d		
	Construct concrete caissons	1	#/wk		
	Place Caisson Ballast	4,000	m^3/d	1-5000 t barge/day placed by 2 clams	
	Place Rock Berm	4,000	m^3/d	Bottom dump barges, trimming by 2 clams	
	Place Berm Filter	2,000	m^3/d	Bottom dump barges, trimming by clam	
	Place Scour Protection	800	m^3/d	By clam	
H	**Wharf Construction - land operations**				
	Apron area soil densification	1,500	m^3/d/rig	3 rigs used	
	Apron area general fill				
	Dynamic Compaction	500	m^2/d/rig	2 rigs used	
	Wharf infrastructure (including cope wall, rail beams, etc.)			All rates from DB3	

Attachment B4: Construction Equipment Peak Analysis (Updated Appendix 4-F)

Project Construction Update - Total Pieces of Equipment

Peak Day
Project Construction Update: Month 39 - 349 Pieces Of Equipment In Use

Concurrent Equipment Usage (#)

400
300
200
100
0
-100
-200

Month 1
Month 4
Month 7
Month 10
Month 13
Month 16
Month 19
Month 22
Month 25
Month 28
Month 31
Month 34
Month 37
Month 40
Month 43
Month 46
Month 49
Month 52
Month 55
Month 58
Month 61
Month 64
Month 67
Month 70
Month 73

Construction Months

Pieces of Equipment for Terminal Construction
(Formerly shown as *"KCB/AECOM Equipment Acitivities"* in EIS)

Pieces of Equipement for Causeway Construction
(Formerly shown as *"Delcan Equipment Acitivities"* in EIS)

Revised Total Pieces of Equipment

Difference

Peak Day
EIS: June 8 and 9, 2022 (Month 47) - 363 Pieces Of Equipment In Use
Project Construction Update: Month 39 - 349 Pieces Of Equipment In Use

Concurrent Equipment Usage (#)

400
300
200
100
0
-100
-200

Month 1
Month 4
Month 7
Month 10
Month 13
Month 16
Month 19
Month 22
Month 25
Month 28
Month 31
Month 34
Month 37
Month 40
Month 43
Month 46
Month 49
Month 52
Month 55
Month 58
Month 61
Month 64
Month 67
Month 70
Month 73

Construction Months

Attachment C: Effects Assessment Tables

Attachment C1	Overview of Updated Construction Activity Descriptions
Attachment C2	Updated Project Interaction Matrix (Updated EIS Appendix 8-B Table A)
Attachment C3	Summary of Changes to the Effects Assessments for Intermediate Components
Attachment C4	Summary of Changes to the Effects Assessments for Valued Components

Attachment C1: Overview of Updated Construction Activity Descriptions

Table C-1 Overview of Updated Construction Activity Descriptions

Project Component: Construction Activities		Project Works/Activities Assessed in the EIS	Changes Associated with Project Construction Update	Description of Works/Activities Assessed in PCU[a]
Marine Terminal	Terminal Containment Dykes Land Development	Vibro-densify native soil at terminal building foundation areas	Marine environment based vibro-densification activities originally planned in Year 1 (prior to containment dyke completion) are no longer required due to better native soil characteristics determined from the 2016 Supplemental Geotechnical Investigation Program. Vibro-replacement of native soil under terminal building foundation areas is planned in Year 4 once terminal fill is in place (activity now included below).	*Activity eliminated – vibro-densification under terminal building foundations no longer occurring at onset of construction phase*
		Transport Fraser River sand (and quarry sand if required) to ITP and store	Transport sand from the Fraser River to Roberts Bank using a dredge with pump ashore capability and pump directly into dyked containment basins. Load all sand barged from existing quarries directly to containment areas using the temporary barge ramps. This change eliminates the need for the ITP, but delays sand delivery from the Fraser River into Year 2 of the construction schedule. This change results in less dredger movements (as the new dredger has a larger hopper) to and from the Fraser River but increases the number of tug/barge movements for sand from existing quarries.	Transport Fraser River sand using a dredge with pump ashore capability and sand from existing quarries via barge to the Project site
		Install temporary pipeline between intermediate transfer pit (ITP) and marine terminal or causeway fill sites	With the elimination of ITP use, the installation of these temporary pipelines is also eliminated.	*Activity eliminated – installation of pipeline from ITP to fill sites no longer required*
		Install piles and barge ramps	With the elimination of ITP use and the loss of Fraser River sand storage in Year 1 of construction, additional quarry sand will be required. To accommodate additional tug/barge movements, a third temporary barge ramp will be built immediately adjacent to the west basin requiring the installation of up to eight temporary piles.	Install piles and three barge ramps
		Transport aggregate, rip-rap, and sand from existing quarries to barge ramps	The volume of required ballast rock for filling of shorter caissons will be less. Buttress mattress rock and sacrificial rock are no longer required. The number of tug/barge movements from existing quarries will decrease. The requirement for additional quarry sand to offset original sand quantities from the Fraser River, increases sand requirements from existing quarries from ~9% to approximately 28% of fill requirement. The number of tug/barge movements from existing quarries will increase.	Transport aggregate, rip-rap, and sand from existing quarries to barge ramps
		Construct permanent containment dykes around east and west terminal basins	No change.	Construct permanent containment dykes around east and west terminal basins
		Dredge the dredge basin, and pump dredged material to east and west terminal basins	Based on the 2016 Supplemental Geotechnical Investigation Program, the amount of material to be dredged has decreased, and the material will be pumped to fill sites within the terminal and causeway footprints.	Dredge the dredge basin, and pump dredged material to east and west terminal basins
		[Install pipelines and] pump excess water in terminal basin areas to disposal at sea (DAS) site[b]	To create the Project landmass, fill materials sourced from the Fraser River, existing quarries, the dredge basin, and the tug basin will either be pumped as a slurry with sea water or transported from the barge ramps and deposited as dry material into containment basins within the terminal Project footprint. The bulk (97%) of the fill material from the slurry will settle out; however, a supernatant containing unsettled fines in seawater will be discharged to Roberts Bank via a pipe that discharges at El.-45 m CD.	Install pipelines and pump excess water in terminal basin areas to supernatant discharge site
		Vibro-densify [vibro-replace[c]] native soil in dredged area	Marine environment based vibro-replacement activities are no longer required due to better native soil characteristics determined from the 2016 Supplemental Geotechnical Investigation Program. This activity has been deleted.	*Activity eliminated – vibro-replacement of material in dredge basin no longer required*
		Fill terminal basins to final grade with sand pumped from ITP	With the elimination of ITP use, preload west basin with Fraser River sand pumped directly from dredge vessel and sand from existing quarries. The anticipated dredge, *FRPD309,* will tie-up to an anchored buoy next to the terminal fill site for 2.0 hours, 3 to 4 times per 24-hour period, on average, while it pumps the Fraser River sand from its hopper into the fill sites. This direct loading eliminates the need for the two dredges originally proposed for reclaiming the sand from the ITP for preload purposes.	Fill terminal basins to final grade with Fraser River sand pumped directly from dredge equipment with pump ashore capability and quarry sand delivered to barge ramps for direct loading

Table C-1 Overview of Updated Construction Activity Descriptions

Project Component: Construction Activities		Project Works/Activities Assessed in the EIS	Changes Associated with Project Construction Update	Description of Works/Activities Assessed in PCU[a]
		Preload east basin with sand from ITP, then vibro-densify dyke and compact sand	With the elimination of ITP use, preload east basin with Fraser River sand pumped directly from dredge vessel and sand from existing quarries, then vibro-replace native soil under dyke and compact sand from the surface of the land mass. The anticipated dredge, *FRPD309,* will tie-up to an anchored buoy next to the terminal fill site for 2.0 hours, 3 to 4 times per 24-hour period, on average, while it pumps the Fraser River sand from its hopper into the fill sites. This direct loading eliminates the need for the two dredges originally proposed for reclaiming the sand from the ITP for preload purposes.	Preload east basin with Fraser River sand pumped directly from dredge equipment with pump ashore capability and quarry sand delivered to barge ramps for direct loading, then vibro-replace native material underneath dyke and compact sand
		Preload west basin with sand from ITP and preload material from east basin, then vibro-densify dyke and compact sand	With the elimination of ITP use, preload west basin with Fraser River sand pumped directly from dredge vessel and sand from existing quarries, then vibro-replace native soil under dyke and compact sand from the surface of the land mass. The anticipated dredge, *FRPD309,* will tie-up to an anchored buoy next to the terminal fill site for 2.0 hours, 3 to 4 times per 24-hour period, on average, while it pumps the Fraser River sand from its hopper into the fill sites. This direct loading eliminates the need for the two dredges originally proposed for reclaiming the sand from the ITP for preload purposes.	Preload west basin with Fraser River sand pumped directly from dredge equipment with pump ashore capability and quarry sand delivered to barge ramps for direct loading, then vibro-replace native material underneath dyke and compact sand
	Wharf Construction	Place sacrificial rock, slope buttress rock, then mattress rock in dredge basin	The need for sacrificial rock placement has been eliminated, as marine environment based vibro-replacement activities are no longer required due to better native soil characteristics determined from the 2016 Supplemental Geotechnical Investigation Program, and adoption of the ASCE/COPRI 61-14 standard. The draught requirements for the berth pocket has been reduced from El.-21.6 m CD to El.-18.3 m CD based on future vessel draught being reduced to 17.5 m from 19 m. As a result, the dredge basin finished elevation is revised to El.-18.3 m CD. This reduced dredge prism has allowed for flattened slopes from the preliminary design of 1.5H:1V to a new design of 2.25H:1V on the seaward side and 2.5H:1V on the shoreward side, eliminating the need for slope buttress rock. This activity has been reduced to only placing mattress rock into the dredge basin.	Place mattress rock in dredge basin
		Vibro-densify mattress rock in dredge basin	No change.	Vibro-densify mattress rock in dredge basin
		Level mattress rock layer; apply screed layer in caisson area	No change.	Level mattress rock layer; apply screed layer in caisson area.
		Transport precast concrete caisson infrastructure to Roberts Bank via marine transport	A shallower berth depth also translates to a reduced caisson height (top of the cope wall to the base of the caisson) of 27 m (compared to previous 30.3 m). No change in transportation requirements anticipated.	Transport precast concrete caisson infrastructure to Roberts Bank via marine transport
		Place caissons, ballast, berm, and berm filter rock in wharf area, and install keys to lock structure together	The volume of ballast rock for filling of smaller caissons will be less, but does not materially affect this activity.	Place caissons, ballast, berm, and berm filter rock in wharf area, and install keys to lock structure together
		Add toe and scour protection rock in berth pocket	No change.	Add toe and scour protection rock in berth pocket
		Install precast cover and connecting slabs on top of caissons; install cope and crane walls, and concrete crane beam	No change.	Install precast cover and connecting slabs on top of caissons; install cope and crane walls, and concrete crane beam
		Fill apron area with basin and causeway preload material; vibro-densify closure dykes and compact sand	Native soil underneath the closure dykes will be vibro-replaced instead of vibro-densified (both activities occur from the surface), in conjunction with compacting apron fill.	Fill apron with basin and causeway preload material; vibro-replace closure dykes and compact sand
		Install marine fenders, wharf hardware, mooring dolphin, and access bridge	No change.	Install marine fenders, wharf hardware, mooring dolphin, and access bridge

Table C-1 Overview of Updated Construction Activity Descriptions

Project Component: Construction Activities		Project Works/Activities Assessed in the EIS	Changes Associated with Project Construction Update	Description of Works/Activities Assessed in PCU[a]
	Terminal Utilities and Infrastructure	Install underground utilities in terminal buildings area, container yard (CY), intermodal yard (IY), apron area, and main wharf	No change.	Install underground utilities in terminal buildings area, container yard (CY), intermodal yard (IY), apron area, and main wharf
		Conduct ground improvements at building footprints	Vibro-replacement of native soil under terminal building foundation areas is planned in Year 4 once terminal fill is in place. Vibro-densification will occur in terminal fill under building foundation areas as required elevation is reached.	Conduct ground improvements at building footprints
		Deliver building materials to site via road transport after RBT2 overpass completion	No change.	Deliver building materials to site via road transport after RBT2 overpass completion
		Deliver rail materials to site via rail transport after causeway rail infrastructure completion	No change.	Deliver rail materials to site via rail transport after causeway rail infrastructure completion
		Construct terminal buildings; install electrical, lighting, controls, security, and communications infrastructure	No change.	Construct terminal buildings; install electrical, lighting, controls, security, and communications infrastructure
		Install fuelling facilities for mobile equipment/vehicles	No change.	Install fuelling facilities for mobile equipment/vehicles
		Install CY, IY and terminal rail infrastructure	No change.	Install CY, IY and terminal rail infrastructure
		Deliver via ocean-going vessels and install pre-assembled terminal equipment (e.g., cranes)	No change.	Deliver via ocean-going vessels and install pre-assembled terminal equipment (e.g., cranes)
		Deliver granular base materials by barge to barge ramps then to trucks or barge-mounted conveyor	No change.	Deliver granular base materials by barge to barge ramps then to trucks or barge-mounted conveyor
		Pave CY, IY, and general terminal areas	No change.	Pave CY, IY, and general terminal areas
		Install truck entry and exit gate infrastructure	No change.	Install truck entry and exit gate infrastructure
Widened Causeway	West Widening	Construct containment dyke along west portion of causeway	No change.	Construct containment dyke along west portion of causeway
		Remove rip-rap/shore protection from north side of existing causeway and use for containment dyke or place in aggregate storage site at S-bend	No change.	Remove rip-rap/shore protection from north side of existing causeway and use for containment dyke or place in aggregate storage site at S-bend
		Fill and preload contained area with sand from ITP	With the elimination of ITP use, fill and preload the widened causeway to final grade with Fraser River sand from pumped directly from dredge equipment with pump ashore capability and quarry sand delivered to barge ramps for direct loading. This direct loading eliminates the need for the 2 dredges that were proposed for reclaiming the sand from the ITP for fill and preload purposes.	Fill and preload contained areas with sand via direct pumping or loading.
		Vibro-densify dyke	No change.	Vibro-densify dyke
	East Widening	Construct containment dyke along east portion of causeway	No change.	Construct containment dyke along east portion of causeway

Table C-1 Overview of Updated Construction Activity Descriptions

Project Component: Construction Activities		Project Works/Activities Assessed in the EIS	Changes Associated with Project Construction Update	Description of Works/Activities Assessed in PCU[a]
		Remove rip-rap/shore protection from north side of existing causeway and use for containment dyke or place in aggregate storage site at S-bend	No change.	Remove rip-rap/shore protection from north side of existing causeway and use for containment dyke or place in aggregate storage site at S-bend
		Fill and preload east causeway area with west causeway preload (dry material)	No change.	Fill and preload east causeway area with west causeway preload (dry material)
	Infrastructure and Utilities	Install rail infrastructure including new leads, T-yard, locomotive, and bad-order yards, and tie-ins to existing rail network	No change.	Install rail infrastructure including new leads, T-yard, locomotive, and bad-order yards, and tie-ins to existing rail network
		Construct RBT2 overpass; install new road from RBT2 overpass to RBT2 terminal and pave	For the overpass, the preliminary design was further advanced to incorporate the latest version of the bridge code, CAN/CSA-S6-14. Land-based vibro-replacement densification of native and reclaimed soils will be carried out around the piled area and beyond the footprints of the overpass structures. The overpass will be founded on approximately 86 steel pipe piles driven from land to El.-20 m CD.	Construct RBT2 overpass including piling and vibro-replacement; install new road from RBT2 overpass to RBT2 terminal and pave
		Install VACS gates, waterline in utility corridor, overpass and rail switch lighting, and two-lane emergency gravel road	No change.	Install VACS gates, waterline in utility corridor, overpass and rail switch lighting, and two-lane emergency gravel road
Expanded Tug Basin		Dredge entire tug basin area	The tug basin will be dredged with the use of clamshells and placed on a material scow (not to a direct-dumping barge as outlined in the EIS). There is also a schedule change from Year 4 to Year 2.	Dredge entire tug basin area
		Dispose of dredge material to DAS site or re-use as general fill	Once the material scow is full, both the scow and the crane barge will get towed to the terminal area, where the dredged material will be pumped for use as general fill.	Transport material via scow barge to terminal and pump dredge material into containment basins
		Install piles, mooring floats, gangways and navigation piles, and construct crest protection dyke	No change.	Install piles, mooring floats, gangways and navigation piles, and construct crest protection dyke
Decommissioning of Temporary Construction Infrastructure		Remove ITP pipelines	Activity eliminated since there is no use of an ITP.	*Activity eliminated – ITP pipelines no longer required*
		Remove DAS discharge pipe/pump infrastructure	Change in terminology from DAS to supernatant discharge.	Remove supernatant discharge pipe/pump infrastructure
		Remove temporary piles at barge ramps, ramps, pivot ramp abutments, and navigation markers	An additional barge ramp requires removal.	Remove temporary piles at three barge ramps, ramps, pivot ramp abutments, and navigation markers

Note: a. The descriptions of works/activities assessed in the PCU include updated descriptions of works/activities resulting from the changes described in **Section 2.0**, as well as descriptions of works/activities provided in the EIS that have not changed.
b. As outlined in the *Information Request Package 3 Preamble to IR3-25 to IR3-40* (CEAR Document #984), since all fill materials can be used for construction purposes and the VFPA expects that the proposed work can be carried out in a manner that does not create marine pollution, the VFPA no longer anticipates that discharge of supernatant will require a DAS permit. Therefore, the location of supernatant discharge that was referred to as the candidate DAS area in the EIS, is referred to as the supernatant discharge area or discharge area.
c. EIS Section 4.0 stated that material would be vibro-densified, when in fact vibro-replacement was the intended activity. As indicated in EIS Section 4.4.1.9, both techniques are used to improve subsoil conditions. Vibro-replacement utilises special depth vibrators and coarse material to replace finer material (e.g., clay and sand) with the coarser material, while vibro-densification densifies *in situ* material with a depth vibrator (i.e., it is not considered a material replacement technique).

Attachment C2: Updated Project Interaction Matrix (Updated EIS Appendix 8-B Table A)

Table C-2 Updated Project Interaction Matrix

Legend: • = interaction in EIS and continues to be an interaction with the Project Construction Update (PCU); ° = interaction in EIS but no longer an interaction with PCU; * = should have been an interaction in EIS and is an interaction with PCU; ^ = Project interaction incorrectly stated in the EIS, and not an interaction with PCU.

For assessments conducted at the phase level (EIS Sections 18.0 to 28.0 and 32.2), BLACK title text indicates no changes from EIS, BLUE text indicates that there is a change to the interaction (but not necessarily assessment conclusions) with the PCU.

Construction Phase		ICs and VCs																							Other
Project Component	**Updated List of Project Works / Activities**	S. 9.2 Air Quality	S. 9.3 Noise and Vibration	S. 9.4 Light	S. 9.5 Coastal Geomorphology	S. 9.6 Surficial Geology and Marine Sediment	S. 9.7 Marine Water Quality	S. 9.8 Underwater Noise	S. 11.0 Marine Vegetation	S. 12.0 Marine Invertebrates	S. 13.0 Marine Fish	S. 14.0 Marine Mammals	S. 15.0 Coastal Birds	S. 16.0 Ongoing Productivity of CRA Fisheries	S. 18.4 Population	S. 19.0 Labour Market	S. 20.0 Economic Development	S. 21.0 Marine Commercial Use	S. 22.0 Local Government Finances	S. 23.0 Services and Infrastructure	S. 24.0 Outdoor Recreation	S. 25.0 Visual Resources	S. 26.0 Land and Water Use	S. 27.0 Human Health	S. 28.0 Archaeological and Heritage Resources	S. 32.0 Current Use of Lands and Resources for Traditional Purposes[a]
Marine Terminal	**Terminal Containment Dykes Land Development**																									
	(Activity eliminated – vibro-densification under terminal building foundations no longer occurring at onset of construction phase)	°	°	Interactions Aggregated at Phase Level		°	°	°	°	°	°	°	°	°	Interactions Aggregated at Phase Level											°
	Transport Fraser River sand using a dredge with pump ashore capability and sand from existing quarries via barge to the Project site.	•	•			°	°	•	°	°	•	•	•	•												•
	(Activity eliminated – installation of pipeline from ITP to fill sites no longer required)	°	°				°	°	°	°	°	°	°	°												°
	Install piles and three barge ramps	•	•				•	•		•	•	•	•	•												•
	Transport aggregate, rip-rap, and sand from existing quarries to barge ramps	•	•					•			•	•	•													•
	Construct permanent containment dykes around east and west terminal basins	•	•		•	•	•	•	•	•	•	•	•	•											*	•
	Dredge the dredge basin, and pump dredged material to east and west terminal basins	•	•		•	•	•	•		•	•	•	•	•												•
	Install pipelines and pump excess water in terminal basin areas to supernatant discharge site		•			•	•		•	•	•	•	•	•												•
	(Activity eliminated – vibro-replacement of material in dredge basin no longer required)	°	°			°	°	°	^	°	°	°	°	°												°
	Fill terminal basins to final grade with Fraser River sand pumped directly from dredge equipment with pump ashore capability and quarry sand delivered to barge ramps for direct loading	•	•			°	°	•	•	•	•	•	•													•

Table C-2 Updated Project Interaction Matrix

Legend: • = interaction in EIS and continues to be an interaction with the Project Construction Update (PCU); ° = interaction in EIS but no longer an interaction with PCU; * = should have been an interaction in EIS and is an interaction with PCU; ^ = Project interaction incorrectly stated in the EIS, and not an interaction with PCU.

For assessments conducted at the phase level (EIS Sections 18.0 to 28.0 and 32.2), BLACK title text indicates no changes from EIS, BLUE text indicates that there is a change to the interaction (but not necessarily assessment conclusions) with the PCU.

Construction Phase		ICs and VCs																					Other
Project Component	**Updated List of Project Works / Activities**	S. 9.2 Air Quality	S. 9.3 Noise and Vibration	S. 9.4 Light	S. 9.5 Coastal Geomorphology	S. 9.6 Surficial Geology and Marine Sediment	S. 9.7 Marine Water Quality	S. 9.8 Underwater Noise	S. 11.0 Marine Vegetation	S. 12.0 Marine Invertebrates	S. 13.0 Marine Fish	S. 14.0 Marine Mammals	S. 15.0 Coastal Birds	S. 16.0 Ongoing Productivity of CRA Fisheries	S. 18.4 Population	S. 19.0 Labour Market	S. 20.0 Economic Development	S. 21.0 Marine Commercial Use	S. 22.0 Local Government Finances	S. 23.0 Services and Infrastructure	S. 24.0 Outdoor Recreation	S. 25.0 Visual Resources	S. 26.0 Land and Water Use	S. 27.0 Human Health	S. 28.0 Archaeological and Heritage Resources	S. 32.0 Current Use of Lands and Resources for Traditional Purposes[a]
	Preload east basin with Fraser River sand pumped directly from dredge equipment with pump ashore capability and quarry sand delivered to barge ramps for direct loading, then vibro-replace native material underneath dyke and compact sand	•	•			°	°	•	^		•	•	•												•
	Preload west basin with Fraser River sand pumped directly from dredge equipment with pump ashore capability and quarry sand delivered to barge ramps for direct loading, then vibro-replace native material underneath dyke and compact sand	•	•			°	°	•	^		•	•	•												•
	Wharf Construction																								
	Place mattress rock in dredge basin	•	•	Interactions Aggregated at Phase Level		•	•	•		•	•	•	•	•	Interactions Aggregated at Phase Level										•
	Vibro-densify mattress rock in dredge basin	•	•			•	•	•		•	•	•	•	•											•
	Level mattress rock layer; apply screed layer in caisson area	•	•			•	•	•		•	•	•	*												•
	Transport precast concrete caisson infrastructure to Roberts Bank via marine transport	•	•					•			•	•	•												•
	Place caissons, ballast, berm, and berm filter rock in wharf area, and install keys to lock structure together	•	•				•	•			•	•	•												•
	Add toe and scour protection rock in berth pocket	•	•		•	•	•	•		•	•	•	•												•
	Install precast cover and connecting slabs on top of caissons; install cope and crane walls, and concrete crane beam	•	•					•				•	•												•
	Fill apron with basin and causeway preload material; vibro-replace closure dykes and compact sand	•	•			•	•	•		•	•	•	•												•

Table C-2 Updated Project Interaction Matrix

Legend: • = interaction in EIS and continues to be an interaction with the Project Construction Update (PCU); ° = interaction in EIS but no longer an interaction with PCU; * = should have been an interaction in EIS and is an interaction with PCU; ^ = Project interaction incorrectly stated in the EIS, and not an interaction with PCU.

For assessments conducted at the phase level (EIS Sections 18.0 to 28.0 and 32.2), BLACK title text indicates no changes from EIS, BLUE text indicates that there is a change to the interaction (but not necessarily assessment conclusions) with the PCU.

Construction Phase		ICs and VCs																						Other
Project Component	**Updated List of Project Works / Activities**	S. 9.2 Air Quality	S. 9.3 Noise and Vibration	S. 9.4 Light	S. 9.5 Coastal Geomorphology	S. 9.6 Surficial Geology and Marine Sediment	S. 9.7 Marine Water Quality	S. 9.8 Underwater Noise	S. 11.0 Marine Vegetation	S. 12.0 Marine Invertebrates	S. 13.0 Marine Fish	S. 14.0 Marine Mammals	S. 15.0 Coastal Birds	S. 16.0 Ongoing Productivity of CRA Fisheries	S. 18.4 Population	S. 19.0 Labour Market	S. 20.0 Economic Development	S. 21.0 Marine Commercial Use	S. 22.0 Local Government Finances	S. 23.0 Services and Infrastructure	S. 24.0 Outdoor Recreation	S. 25.0 Visual Resources	S. 26.0 Land and Water Use	S. 27.0 Human Health	S. 28.0 Archaeological and Heritage Resources	S. 32.0 Current Use of Lands and Resources for Traditional Purposes[a]
	Install marine fenders, wharf hardware, mooring dolphin, and access bridge	•	•			•	•	•		•	•	•	•	•											•
	Terminal Utilities and Infrastructure																									
	Install underground utilities in terminal buildings area, container yard (CY), intermodal yard (IY), apron area, and main wharf	•	•	Interactions Aggregated at Phase Level									•		Interactions Aggregated at Phase Level											•
	Conduct ground improvements at building footprints	•	•										•													•
	Deliver building materials to site via road transport after RBT2 overpass completion	•	•										•													•
	Deliver rail materials to site via rail transport after causeway rail infrastructure completion	•	•										•													•
	Construct terminal buildings; install electrical, lighting, controls, security, and communications infrastructure	•	•										•													•
	Install fuelling facilities for mobile equipment/vehicles	•	•										•													•
	Install CY, IY and terminal rail infrastructure	•	•										•													•
	Deliver via ocean-going vessels and install pre-assembled terminal equipment (e.g., cranes)	•	•					•			•	•	•													•
	Deliver granular base materials by barge to barge ramps then to trucks or barge-mounted conveyor	•	•					•			•	•	•													•
	Pave CY, IY, and general terminal areas	•	•										•													•
	Install truck entry and exit gate infrastructure	•	•										•													•

Table C-2 Updated Project Interaction Matrix

Legend: • = interaction in EIS and continues to be an interaction with the Project Construction Update (PCU); ° = interaction in EIS but no longer an interaction with PCU; * = should have been an interaction in EIS and is an interaction with PCU; ^ = Project interaction incorrectly stated in the EIS, and not an interaction with PCU.

For assessments conducted at the phase level (EIS Sections 18.0 to 28.0 and 32.2), BLACK title text indicates no changes from EIS, BLUE text indicates that there is a change to the interaction (but not necessarily assessment conclusions) with the PCU.

Construction Phase		ICs and VCs																						Other
Project Component	**Updated List of Project Works / Activities**	S. 9.2 Air Quality	S. 9.3 Noise and Vibration	S. 9.4 Light	S. 9.5 Coastal Geomorphology	S. 9.6 Surficial Geology and Marine Sediment	S. 9.7 Marine Water Quality	S. 9.8 Underwater Noise	S. 11.0 Marine Vegetation	S. 12.0 Marine Invertebrates	S. 13.0 Marine Fish	S. 14.0 Marine Mammals	S. 15.0 Coastal Birds	S. 16.0 Ongoing Productivity of CRA Fisheries	S. 18.4 Population	S. 19.0 Labour Market	S. 20.0 Economic Development	S. 21.0 Marine Commercial Use	S. 22.0 Local Government Finances	S. 23.0 Services and Infrastructure	S. 24.0 Outdoor Recreation	S. 25.0 Visual Resources	S. 26.0 Land and Water Use	S. 27.0 Human Health	S. 28.0 Archaeological and Heritage Resources	S. 32.0 Current Use of Lands and Resources for Traditional Purposes[a]
Widened Causeway	**West Widening**																									
	Construct containment dyke along west portion of causeway	•	•	Interactions Aggregated at Phase Level	•	•	•	•	•	•	•	•	•	•	Interactions Aggregated at Phase Level											•
	Remove rip-rap/shore protection from north side of existing causeway and use for containment dyke or place in aggregate storage site at S-bend	•	•			•	•	•	•	•	•	•	•	•												•
	Fill and preload contained areas with sand via direct pumping or loading	•	•		•	•		•	•	•	•	•	•	•												•
	Vibro-densify dyke	•	•			•	•	•			•	•	•													•
	East Widening																									
	Construct containment dyke along east portion of causeway	•	•	Interactions Aggregated at Phase Level	•	•	•	•	•	•	•	•	•	•	Interactions Aggregated at Phase Level										•	•
	Remove rip-rap/shore protection from north side of existing causeway and use for containment dyke or place in aggregate storage site at S-bend	•	•			•	•	•	•	•	•	•	•	•												•
	Fill and preload east causeway area with west causeway preload (dry material)	•	•		•	•		•	•	•	•	•	•												•	•
	Infrastructure and Utilities																									
	Install rail infrastructure including new leads, T-yard, locomotive, and bad-order yards, and tie-ins to existing rail network	•	•	Interactions Aggregated at Phase Level									•		Interactions Aggregated at Phase Level											•
	Construct RBT2 overpass including piling and vibro-replacement; install new road from RBT2 overpass to RBT2 terminal and pave	•	•										•													•
	Install VACS gates, waterline in utility corridor, overpass and rail switch lighting, and two-lane emergency gravel road	•	•										•													•

Table C-2 Updated Project Interaction Matrix

Legend: • = interaction in EIS and continues to be an interaction with the Project Construction Update (PCU); ° = interaction in EIS but no longer an interaction with PCU; * = should have been an interaction in EIS and is an interaction with PCU; ^ = Project interaction incorrectly stated in the EIS, and not an interaction with PCU.

For assessments conducted at the phase level (EIS Sections 18.0 to 28.0 and 32.2), BLACK title text indicates no changes from EIS, BLUE text indicates that there is a change to the interaction (but not necessarily assessment conclusions) with the PCU.

Construction Phase		ICs and VCs																						Other
Project Component	**Updated List of Project Works / Activities**	S. 9.2 Air Quality	S. 9.3 Noise and Vibration	S. 9.4 Light	S. 9.5 Coastal Geomorphology	S. 9.6 Surficial Geology and Marine Sediment	S. 9.7 Marine Water Quality	S. 9.8 Underwater Noise	S. 11.0 Marine Vegetation	S. 12.0 Marine Invertebrates	S. 13.0 Marine Fish	S. 14.0 Marine Mammals	S. 15.0 Coastal Birds	S. 16.0 Ongoing Productivity of CRA Fisheries	S. 18.4 Population	S. 19.0 Labour Market	S. 20.0 Economic Development	S. 21.0 Marine Commercial Use	S. 22.0 Local Government Finances	S. 23.0 Services and Infrastructure	S. 24.0 Outdoor Recreation	S. 25.0 Visual Resources	S. 26.0 Land and Water Use	S. 27.0 Human Health	S. 28.0 Archaeological and Heritage Resources	S. 32.0 Current Use of Lands and Resources for Traditional Purposes[a]
Expanded Tug Basin	Dredge entire tug basin area	•	•	Interactions Aggregated	•	•	•	•	•	•	•	•	•	•	Interactions Aggregated at Phase Level											•
	Transport material via scow barge to terminal and pump dredge material into containment basins.	•	•			°	°	•	°	°	°	•	•	°												•
	Install piles, mooring floats, gangways and navigation piles, and construct crest protection dyke	•	•		•	•	•	•	•	•	•	•	•	•												•
Decommissioning of Temporary Construction Infrastructure	*(Activity eliminated – ITP pipelines no longer required)*			Interactions Aggregated				°		°	°	°	°	°	Interactions Aggregated at Phase Level											°
	Remove supernatant discharge pipe/pump infrastructure	•	•			•	•	•		•	•	•	•	•												•
	Remove temporary piles at three barge ramps, ramps, pivot ramp abutments, and navigation markers	•	•				•	•		•	•	•	•	•												•

Note: a. And Asserted or Established Aboriginal and Treaty Rights and Related Interests.

Attachment C3: Summary of Changes to the Effects Assessments for Intermediate Components

Table C-3 Summary of Changes to the Effects Assessments for Intermediate Components Related to RBT2 Updated Construction Activities

Intermediate Component	RBT2 EIS Assessment Summary[a]		RBT2 PCU Assessment Summary		
	Construction-related Changes	Construction-related Mitigation Measures	Updated Construction-related Changes	Updated Mitigation Measures	Incremental Cumulative Change
Air Quality (EIS Section 9.2; PCU Section 3.1.1)	- Increases in particulate matter (PM) are predicted over water in the vicinity of the construction works and near the BC Ferries terminal. - No exceedances of criteria for PM, CO, NO_2, SO_2, or formaldehyde are predicted at locations on land, except potentially at the eastern end of the Roberts Bank causeway for PM_{10} concentrations. - During peak construction activity, air quality criteria may be exceeded for 1-h and 24-h average NO_2 concentrations in the immediate vicinity, and for PM, PM_{10}, and $PM_{2.5}$ concentrations over water near the Roberts Bank causeway and terminals.	**Reduction Measures:** 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.	Although decreases in emissions are anticipated with the updated construction activities, the EIS assessment conclusions remain the same.	No changes to the reduction mitigation measures described in the EIS.	EIS concluded that minor changes are expected in overall air quality levels because implementation of new vehicle emission standards will reduce emissions from all traffic. No changes as a result of PCU.
Noise and Vibration (EIS Section 9.3; PCU Section 3.1.2)	During peak periods of construction activity, perceptible increase in noise levels.	**Reduction Measures:** 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.	While the changes in construction activities result in both increased and decreased noise levels during certain periods of construction, average noise levels in upland and marine areas are expected to differ by less than ±1 dBA in upland areas, and ±0.5 dBA in marine areas, relative to those predicted in the EIS. EIS conclusions remain the same overall.	No changes to mitigation measures described in the EIS.	EIS concluded that increases in noise levels are expected in areas near Deltaport Way and the upland rail corridor within the study area. No changes as a result of PCU.
Light (EIS Section 9.4; PCU Section 3.1.3)	Minimal increases in light trespass and sky glow levels	**Reduction Measures:** Implementation of Construction Environmental Management Plan, including Light Management Plan.	Project light emissions during construction are not anticipated to change; therefore, EIS conclusions remain the same.	No changes to mitigation measures described in the EIS.	EIS concluded that incremental cumulative changes are not anticipated. No changes as a result of PCU.
Coastal Geomorphology (EIS Section 9.5; PCU Section 3.1.4)	During construction of the causeway, formation of temporary drainage channels from drainage of tidal waters through the causeway dyke prior to infilling.	**Reduction Measures:** 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).	Changes to causeway dyke construction works are not proposed; therefore, EIS assessment conclusions remain the same.	No change to reduction mitigation measures described in the EIS.	EIS concluded that incremental cumulative changes are not anticipated. No changes as a result of PCU.

Table C-3 Summary of Changes to the Effects Assessments for Intermediate Components Related to RBT2 Updated Construction Activities

Intermediate Component	RBT2 EIS Assessment Summary[a]		RBT2 PCU Assessment Summary		
	Construction-related Changes	**Construction-related Mitigation Measures**	**Updated Construction-related Changes**	**Updated Mitigation Measures**	**Incremental Cumulative Change**
	Project terminal footprint-related changes in coastal processes include the following: - 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; and - Local tidal flat area at the tug basin will be converted to subtidal waters.	**Avoidance Measures:** Optimised Project design including terminal placement in subtidal waters, terminal rounded corner.	Reduction in berth pocket and marine approach area footprint will not alter coastal processes beyond those already assessed in the EIS. Therefore, EIS assessment conclusions remain the same.	No change to avoidance mitigation measures described in the EIS.	EIS concluded that incremental cumulative changes are not anticipated. No changes as a result of PCU.
Surficial Geology and Marine Sediment (EIS Section 9.6; PCU Section 3.1.5)	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 km^2 to 170 km^2 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 km^2 for dredging at tug basin and surface disposal of material to 31 km^2 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. 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).	**Avoidance Measures:** - 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. **Reduction Measures:** - 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.	Sediment deposition and dispersion are expected to decrease as a result of less material being discharged from the containment basins to Roberts Bank. The EIS assessment conclusion remains the same (i.e., increased sediment deposition is anticipated to be minimal relative to the natural variation and dynamic environment at Roberts Bank).	No change to avoidance and reduction mitigation measures described in the EIS.	EIS concluded that incremental cumulative changes are not anticipated. No changes as a result of PCU.

Table C-3 Summary of Changes to the Effects Assessments for Intermediate Components Related to RBT2 Updated Construction Activities

Intermediate Component	RBT2 EIS Assessment Summary[a]		RBT2 PCU Assessment Summary		
	Construction-related Changes	Construction-related Mitigation Measures	Updated Construction-related Changes	Updated Mitigation Measures	Incremental Cumulative Change
Marine Water Quality (EIS Section 9.7; PCU Section 3.1.6)	All changes are related to TSS and turbidity due to sediment re-suspension 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). - Increases in TSS levels of greater than 5 mg/L (lowest federal guideline limit) above background conditions are predominantly in areas close to dredging sites, 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 km^2 to 90.5 km^2 for sediment-laden water from fill material sourced from the Fraser River and dredge basin, respectively.	**Avoidance Measures-** - Optimised Project design, including use of Fraser River dredgeate material (with low fines content) for fill material used in land development. **Reduction Measures:** - 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.	The dispersion of TSS and turbidity is expected to decrease as a result of less material being discharged from the containment basins to Roberts Bank. The EIS assessment conclusion remains the same (i.e., water quality changes are anticipated to be minimal relative to the natural variation and dynamic environment at Roberts Bank).	No change to avoidance and reduction mitigation measures described in the EIS.	EIS concluded that incremental cumulative changes are not anticipated. No changes as a result of PCU.
	Changes in salinity from altered coastal processes are anticipated to be minimal relative to the natural variation and dynamic environment at Roberts Bank. - 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.	No known measures to mitigate temporary changes in salinity.	Additional changes to coastal processes will not result from the updated construction activities; therefore, the EIS assessment conclusions remain the same.	No change to content described in the EIS.	EIS concluded that incremental cumulative changes are not anticipated. No changes as a result of PCU.
Underwater Noise (EIS Section 9.8; PCU Section 3.1.7)	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. - Underwater noise levels may at times exceed current existing levels, but they are generally comparable.	**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.	No overall change in underwater noise resulting from updated construction activities. EIS assessment conclusion remains the same (i.e., that underwater noise levels from construction-related activities are generally comparable but may at times exceed existing underwater noise levels).	No change to reduction mitigation measures described in the EIS.	EIS concluded that a minor increase in overall underwater noise levels is anticipated. No changes as a result of PCU.
Population (EIS Section 18.4; PCU Section 3.1.8)	Labour demands are expected to be met by the forecasted Metro Vancouver and Lower Mainland labour force. A small portion of permanent in-migration is expected, as well as a nominal amount of temporary in-migration to fill specialist skill positions during construction. Overall population growth trends are not anticipated to be altered by Project construction.	No mitigation proposed.	Minor employment increases with the updated construction activities will not result in changes to population growth trends; therefore, EIS assessment conclusions remain the same.	Not applicable – no mitigation proposed in the EIS.	Not applicable – a cumulative assessment on population was not conducted.

Note: a. Information presented in these columns sourced from EIS Appendix 29-B, EIS Appendix 29-D, and EIS Section 18.4.

Attachment C4: Summary of Changes to the Effects Assessments for Valued Components

Table C-4 Summary of Changes to the Effects Assessments for Valued Components Related to RBT2 Updated Construction Activities

Valued Component	RBT2 EIS Effects Assessment Summary[a]				RBT2 PCU Effects Assessment Summary				
	Construction-related Potential Effect	Mitigation Applied	Residual Effect (After Mitigation)	Significance	Updated Potential Effect Rating	Updated Mitigation Measures	Updated Residual Effect	Updated Significance	Incremental Cumulative Effects
Marine Vegetation (EIS Section 11.0; PCU Section 3.2.1)	Productivity loss for macroalgae	**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. **Offsetting Measures:** - Implementation of Offsetting Plan.	None	Not applicable	Potential loss of productivity for marine vegetation will either be eliminated, reduced, or remain the same, as described in PCU Table 3.2.1-1.	No change from EIS assessment			As per EIS, not applicable
	Changes in biofilm assemblage composition during freshet	No known measures to mitigate temporary changes in salinity.	Changes in biofilm assemblage composition during freshet	Not Significant	No change from EIS assessment, as no additional changes to coastal processes are expected from updated construction activities.	No change from EIS assessment			As per EIS, no cumulative interaction expected
Marine Invertebrates (EIS Section 12.0; PCU Section 3.2.2)	Productivity loss for bivalve shellfish, Dungeness crabs, and orange sea pens	**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.	Productivity loss for bivalve shellfish, Dungeness crabs and orange sea pens	Not Significant	Potential loss of productivity for marine invertebrates will either be eliminated, reduced, or remain the same, as described in PCU Table 3.2.2-1.	No change from EIS assessment			As per EIS, no cumulative interaction expected

Table C-4 Summary of Changes to the Effects Assessments for Valued Components Related to RBT2 Updated Construction Activities

Valued Component	RBT2 EIS Effects Assessment Summary[a]				RBT2 PCU Effects Assessment Summary				
	Construction-related Potential Effect	Mitigation Applied	Residual Effect (After Mitigation)	Significance	Updated Potential Effect Rating	Updated Mitigation Measures	Updated Residual Effect	Updated Significance	Incremental Cumulative Effects
		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. **Offsetting Measures:** - Implementation of Offsetting Plan							
Marine Fish (EIS Section 13.0; PCU Section 3.2.3)	Loss of productivity for marine fish sub-components	**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	Not Significant	Potential loss of productivity for marine fish will either be eliminated, reduced, or remain the same, as described in PCU Table 3.2.3-1.	No change from EIS assessment			As per EIS, negligible cumulative effect expected

Table C-4 Summary of Changes to the Effects Assessments for Valued Components Related to RBT2 Updated Construction Activities

Valued Component	RBT2 EIS Effects Assessment Summary[a]				RBT2 PCU Effects Assessment Summary				
	Construction-related Potential Effect	Mitigation Applied	Residual Effect (After Mitigation)	Significance	Updated Potential Effect Rating	Updated Mitigation Measures	Updated Residual Effect	Updated Significance	Incremental Cumulative Effects
Marine Mammals (EIS Section 14.0; PCU Section 3.2.4)	Change in acoustic environment resulting in behavioural effects or acoustic masking for southern resident killer whale, North Pacific humpback whale, and Steller sea lion	**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	Not Significant	Potential behavioural effects or acoustic masking from changes in the acoustic environment will either be eliminated or remain the same, as described in PCU Table 3.2.4-1.	No change from EIS assessment			As per EIS, residual cumulative effect expected to be significant (considering past, present, and future cumulative effects)
	Physical disturbance from vessel strikes for southern resident killer whale and North Pacific humpback whale	**Reduction Measures:** - Implementation of Construction Environmental Management Plan and supporting plans: Construction Compliance Monitoring Plan; Environmental Training Plan.	None	Not applicable	Potential physical disturbance effects from vessel strikes will remain the same, even though there are fewer vessel movements during the construction phase.	No change from EIS assessment			As per EIS, not applicable
Coastal Birds (EIS Section 15.0; PCU Section 3.2.5)	Productivity loss for coastal bird sub-components	**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	Productivity loss for diving birds	Not Significant	Potential loss of productivity for coastal birds will either be eliminated, reduced, increased, or remain the same, as described in PCU Table 3.2.5-1.	No change from EIS assessment			As per EIS, negligible cumulative effect expected

Table C-4 Summary of Changes to the Effects Assessments for Valued Components Related to RBT2 Updated Construction Activities

Valued Component	RBT2 EIS Effects Assessment Summary[a]				RBT2 PCU Effects Assessment Summary				
	Construction-related Potential Effect	Mitigation Applied	Residual Effect (After Mitigation)	Significance	Updated Potential Effect Rating	Updated Mitigation Measures	Updated Residual Effect	Updated Significance	Incremental Cumulative Effects
		Management Plan; Marine Species Salvage Plan (for fish). **Offsetting Measures:** - Implementation of Offsetting Plan							
Ongoing Productivity of Commercial, Recreational and Aboriginal Fisheries (EIS Section 16.0; PCU Section 3.2.6)	Negligible	No mitigation required	Not applicable	Not applicable	No change from EIS assessment				As per EIS, Not applicable
Labour Market (EIS Section 19.0; PCU Section 3.2.7)	Change in employment	No mitigation required	No adverse residual effects anticipated	Not applicable	A slight increase in employment is predicted; however, the potential effect rating will remain the same as described in the EIS assessment.	No change from EIS assessment			As per EIS, not applicable
	Change in labour income	No mitigation required	No adverse residual effects anticipated	Not applicable	A slight increase in labour income is predicted; however, the potential effect rating will remain the same as described in the EIS assessment.	No change from EIS assessment			As per EIS, not applicable
	Change in training opportunities	No mitigation required	No adverse residual effects anticipated	Not applicable	No change from EIS assessment				As per EIS, not applicable
	Change in unemployment and participation rates during construction and operation	No mitigation required	No adverse residual effects anticipated	Not applicable	No change from EIS assessment				As per EIS, not applicable
Economic Development (EIS Section 20.0; PCU Section 3.2.8)	Change in materials, goods, and services contracting revenues	No mitigation required	No adverse residual effects anticipated	Not applicable	A small increase in contracting revenues is predicted; however, the potential effect rating will remain the same as described in the EIS assessment.	No change from EIS assessment			As per EIS, not applicable
	Increase in induced output (revenue)	No mitigation required	No adverse residual effects anticipated	Not applicable	A small increase in induced output (revenue) is predicted; however, the potential effect rating will remain the same as described in the EIS assessment.	No change from EIS assessment			As per EIS, not applicable

Table C-4 Summary of Changes to the Effects Assessments for Valued Components Related to RBT2 Updated Construction Activities

Valued Component	RBT2 EIS Effects Assessment Summary[a]				RBT2 PCU Effects Assessment Summary				
	Construction-related Potential Effect	Mitigation Applied	Residual Effect (After Mitigation)	Significance	Updated Potential Effect Rating	Updated Mitigation Measures	Updated Residual Effect	Updated Significance	Incremental Cumulative Effects
Marine Commercial Use (EIS Section 21.0; PCU Section 3.2.11)	Displacement of commercial crab harvesting and reduction in harvest levels and associated revenue	**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	Not Significant	Small changes to the marine footprint of the terminal area, vessel traffic, and linked ICs and VCs are predicted; however, as described in PCU Table 3.2.11-1 the potential effect rating will remain the same as described in the EIS assessment.	No change from EIS assessment			As per EIS, non-significant residual cumulative effect expected
Local Government Finances (EIS Section 22.0; PCU Section 3.2.9)	Change in local government property tax and PILT revenue and expenditures	No mitigation required	No adverse residual effects anticipated	Not applicable	A small increase in incremental taxes and fees is predicted; however, the potential effect rating will remain the same as described in the EIS assessment.	No change from EIS assessment			As per EIS, not applicable
Services and Infrastructure (EIS Section 23.0; PCU Section 3.2.10)	Constraint on healthcare services capacity and supply	**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.	No adverse residual effects anticipated	Not applicable	A nominal increase in demand is predicted; however, the potential effect rating will remain the same as described in the EIS assessment.	No change from EIS assessment			As per EIS, not applicable
	Constraint on emergency services capacity and supply	**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. **Reduction Measures:** - Communication with emergency services on construction schedule, 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	Not applicable	A nominal increase in demand for emergency services is predicted; however, the potential effect rating will remain the same as described in the EIS assessment.	No change from EIS assessment			As per EIS, not applicable
	Constraint on municipal infrastructure	**Avoidance Measures:** - Implementation of Construction Environmental Management Plan and	No adverse residual effects anticipated	Not applicable	Project demand for municipal infrastructure would be extended with the longer construction schedule; however, the potential	No change from EIS assessment			As per EIS, not applicable

Table C-4 Summary of Changes to the Effects Assessments for Valued Components Related to RBT2 Updated Construction Activities

Valued Component	RBT2 EIS Effects Assessment Summary[a]				RBT2 PCU Effects Assessment Summary				
	Construction-related Potential Effect	Mitigation Applied	Residual Effect (After Mitigation)	Significance	Updated Potential Effect Rating	Updated Mitigation Measures	Updated Residual Effect	Updated Significance	Incremental Cumulative Effects
	capacity and supply	supporting plans: Hazardous Materials and Waste Management Plan.			effect rating will remain the same as described in the EIS assessment.				
Outdoor Recreation (EIS Section 24.0; PCU Section 3.2.12)	Displacement of recreational crab harvesting and reduction in harvest levels	**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	Not applicable	Small changes to the marine footprint of the terminal area, vessel traffic, and linked ICs and VCs are predicted; however, as described in PCU Table 3.2.12-1, the potential effect rating will remain the same as described in the EIS assessment.	No change from EIS assessment			As per EIS, not applicable
Visual Resources (EIS Section 25.0; PCU Section 3.2.13)	Change in daytime visual resources	No mitigation required specific to construction phase	Change in daytime visual resources during construction and operation	Not Significant	No change from EIS assessment				As per EIS, non-significant residual cumulative effect expected
	Change in nighttime visual resources	**Reduction Measures:** - Implementation of Construction Environmental Management Plan and supporting plan: Light Management Plan.	Change in nighttime visual resources during construction and operation	Not Significant	No change from EIS assessment				As per EIS, no cumulative effect expected
Land and Water Use (EIS Section 26.0; PCU Section 3.2.14)	Consistency with land use planning designations	**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	Not applicable	No change from EIS assessment	No change from EIS assessment			As per EIS, not applicable
	Disturbance to marine-related industrial uses	**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	No adverse residual effects anticipated	Not applicable	Change from 'moderate' in EIS to 'minor' due to reduced vessel traffic, as described in PCU Table 3.2.14-1.	No change from EIS assessment			As per EIS, not applicable

Table C-4 Summary of Changes to the Effects Assessments for Valued Components Related to RBT2 Updated Construction Activities

Valued Component	RBT2 EIS Effects Assessment Summary[a]				RBT2 PCU Effects Assessment Summary				
	Construction-related Potential Effect	Mitigation Applied	Residual Effect (After Mitigation)	Significance	Updated Potential Effect Rating	Updated Mitigation Measures	Updated Residual Effect	Updated Significance	Incremental Cumulative Effects
		supporting plans: Communications Plan; Land and Marine Traffic Management Plan.							
	Disturbance to protected area (Roberts Bank WMA)	**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	Not applicable	No change from EIS assessment				As per EIS, not applicable
	Changes in access to TFN community lease lands	**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	Change from 'minor to moderate' in EIS to 'minor' due to decreased vessel traffic, as described in PCU Table 3.2.14-1.	No change to mitigation	Change from 'measurable' to 'negligible'	Change from 'not significant' to 'not applicable'	Change from 'no cumulative interactions' to 'not applicable'
Human Health (EIS Section 27.0; PCU Section 3.2.15)	Adverse health effects related to air emissions	**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	Decreases in emissions are predicted; however, as described in PCU Table 3.2.15-1, the potential effect rating will remain the same as described in the EIS assessment.	No change from EIS assessment			As per EIS, no cumulative effect expected
	Adverse health effects related to noise	**Reduction Measures:** - Implementation of Construction Environmental Management Plan and supporting plans: Noise Management Plan, Construction Compliance Monitoring Plan, Communications Plan.	Adverse health effects related to noise during construction and operations	Not Significant	Slight increases and decreases to noise levels are predicted; however, as described in PCU Table 3.2.15-1, the potential effect rating will remain the same as described in the EIS assessment.	No change from EIS assessment			As per EIS, negligible cumulative effect expected
	Adverse health effects due to stress and annoyance	**Reduction Measures:** - Implementation of Construction Environmental Management Plan and supporting plans: Light Management Plan, Noise Management Plan, Construction Compliance Monitoring Plan, Construction Communications plan. - Mitigation measures noted above regarding visual resources.	No adverse residual effects anticipated	Not applicable	Slight changes in noise levels are predicted; however, as described in PCU Table 3.2.15-1, the potential effect rating will remain the same as described in the EIS assessment.	No change from EIS assessment			As per EIS, not applicable

Table C-4 Summary of Changes to the Effects Assessments for Valued Components Related to RBT2 Updated Construction Activities

Valued Component	RBT2 EIS Effects Assessment Summary[a]				RBT2 PCU Effects Assessment Summary				
	Construction-related Potential Effect	Mitigation Applied	Residual Effect (After Mitigation)	Significance	Updated Potential Effect Rating	Updated Mitigation Measures	Updated Residual Effect	Updated Significance	Incremental Cumulative Effects
		- Awareness and education measures regarding results of contaminant sampling of edible shellfish.							
	Adverse health outcomes due to changes in health inequity	**Reduction Measures:** - Accommodation measures related to Aboriginal employment, training, and contracting opportunities.	No adverse residual effects anticipated	Not applicable	No change from EIS assessment				As per EIS, not applicable
Archaeological and Heritage Resources (Section 28.0)	Crushing or biological degradation of potential fish trap stakes	**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 change from EIS assessment				As per EIS, no cumulative interaction expected
	Reduced access for future archaeological study or preservation of potential fish trap stakes	**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 change from EIS assessment				As per EIS, no cumulative interaction expected
	Exposure of potential fish trap stakes	**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 change from EIS assessment				As per EIS, no cumulative interaction expected
Current Use (EIS Section 32.2; PCU Section 3.3)	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 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	No adverse residual effects anticipated	Not applicable	No change from EIS assessment				As per EIS, not applicable

Table C-4 Summary of Changes to the Effects Assessments for Valued Components Related to RBT2 Updated Construction Activities

Valued Component	RBT2 EIS Effects Assessment Summary[a]				RBT2 PCU Effects Assessment Summary				
	Construction-related Potential Effect	Mitigation Applied	Residual Effect (After Mitigation)	Significance	Updated Potential Effect Rating	Updated Mitigation Measures	Updated Residual Effect	Updated Significance	Incremental Cumulative Effects
		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.							
	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	Not applicable	Decreases in crab productivity losses are predicted; however, as described in PCU Table 3.3-1, the potential effect rating will remain the same as described in the EIS assessment.	No change from EIS assessment			As per EIS, not applicable
	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	Not applicable	No change from EIS assessment				As per EIS, not applicable
	Changes in quality 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	Not applicable	Reductions in vessel traffic are predicted; however, as described in PCU Table 3.3-1, the potential effect rating will remain the same as described in the EIS assessment.	No change from EIS assessment			As per EIS, not applicable

Note: a. Information presented in these columns sourced from EIS Appendices 29-A, E, and G, and EIS Section 16.0.

Attachment D: Effects Assessment Supporting Technical Information

Attachment D1	Tabulated Summaries of Emissions Calculated for the EIS and PCU Air Quality Assessments
Attachment D2	RBT2 Project Construction Update Atmospheric Noise and Ground-borne Vibration Levels During Construction
Attachment D3	RBT2 Technical Memorandum: Underwater Noise Assessment of Trailing Hopper Suction Dredges during Sand Pumping Operations

Attachment D1: Tabulated Summaries of Emissions Calculated for the EIS and PCU Air Quality Assessments

(Analyses Completed by Arcadis Canada Inc.)

Table 1 Construction Equipment Contributing to Tailpipe Emissions and Total Horsepower (hp)

Equipment Type	Engine Specifications[a]			EIS – Peak Day[a]		PCU - Peak Day	
	Engine Rating (hp)	Tier	Load Factor	Number of Units	Total hp[b]	Number of Units	Total hp[b]
Articulated Truck (ORT)	315	3	0.21	51	3,374	67	4,432
Barge with mounted crane (Derrick)	150	0	0.43	2	129	9	581
Becker Hammer (AP-1000)	600	0	0.43	0	0	9	2,322
Boom-lift	100	1	0.21	9	189	4	84
Booster pump	2,500	0	0.43	0	0	0	0
Columbia dredge	5,000	0	0.43	0	0	0	0
Concrete delivery truck	385	1	0.59	7	1,590	6	1,363
Concrete pumper truck	197	1	0.59	13	1,511	8	930
Concrete vibrator	20	1	0.59	3	35	4	47
Crane	502	1	0.43	15	3,238	6	1,295
Crane with clam bucket	600	1	0.43	5	1,290	4	1,032
DDW (dynamic compaction by wt.)	1,000	0	0.43	0	0	0	0
Delivery barge with conveyor	670	0	0.43	0	0	9	2,594
Dozer A	250	2	0.59	8	1,180	10	1,475
Dozer B/BX	350	2	0.59	7	1,446	9	1,859
Dynamic compaction vibro roller (DDR)	100	0	0.59	3	177	0	0
Excavator A (Small)	240	4	0.59	14	1,982	5	708
Excavator B (Large)	330	4	0.59	5	974	11	2,142
Flat Deck Truck	385	1	0.59	34	7,723	8	1,817
Forklift for placing EPS Blocks	90	0	0.30	0	0	1	27
Front End Loader B (Small FEL)	148	3	0.59	4	349	16	1,397
Front End Loader C (Large FEL)	530	3	0.59	48	15,010	21	6,567
FRPD309 Dredge	7097	0	0.43	0	0	1	3,052
Generator	20	1	0.43	12	103	0	0
Grader	204	0	0.59	0	0	2	241
Loader	369	4	0.59	0	0	0	0
Paver AP1055B	174	0	0.59	0	0	2	205
Pile driver	1,000	0	0.43	1	430	0	0
Power-float (concrete)	20	1	0.59	8	94	0	0
Pump	150	2	0.43	0	0	0	0
Roller	150	1	0.59	8	708	8	708
Speed swing (for rail)	160	1	0.59	8	755	2	189
Stone Column Rig	320	0	0.59	0	0	1	189
Tamper	100	1	0.43	8	344	0	0
Tender (motorised for diving operations)	800	0	0.43	1	344	1	344
Titan hopper dredge	6,500	0	0.43	0	0	0	0
Truck	385	1	0.59	51	11,585	33	7,496
Vibro-compaction probe - marine	1,000	0	0.43	1	430	9	3,870
Vibro-compaction probe - land	500	0	0.43	5	1,075	0	0
Water Truck	250	1	0.59	8	1,180	2	295
Welder	35	2	0.21	0	0	0	0
Total				**339**	**57,245**	**268**	**47,259**

Notes: a. Information sourced from Table 3-3 in Appendix E of EIS Appendix 9.2-A where applicable.

b. Total horsepower, calculated by engine hp x load factor x number of units for each equipment type, is 17% lower for the peak day scenario in the PCU assessment compared to the EIS assessment for tailpipe emissions.

Table 2 Tailpipe Emissions – Peak Day Criteria Air Contaminants and Trace Organic Contaminants (g/s)

Air Quality Assessment	Peak Day CACs (g/s)							Peak Day TOCs (g/s)							
	CO	NO_x	SO_2	VOC	PM	PM_{10}	$PM_{2.5}$	Acrolein	Benzene	1,3-Butadiene	Acetaldehyde	Formaldehyde	Naphthalene	Benzo(a)pyrene	Diesel Particulate Matter
EIS[a]	11.6	30.5	0.024	1.7	1.6	1.6	1.5	0.016	0.020	0.0050	0.107	0.323	0.025	8.9×10^{-5}	1.5
PCU	10.5	26.3	0.018	1.8	1.5	1.5	1.4	0.017	0.022	0.0053	0.113	0.339	0.027	9.4×10^{-5}	1.4

Note: a. Source: Table 3-14 for CACs and Table 3-15 for TOCs in Appendix E of EIS Appendix 9.2-A.

Table 3 Tug Tailpipe Emissions – Peak Day Criteria Air Contaminants and Trace Organic Contaminants (g/s)

Air Quality Assessment	Peak Day CACs (g/s)							Peak Day TOCs (g/s)							
	CO	NO_x	SO_2	VOC	PM	PM_{10}	$PM_{2.5}$	Acrolein	Benzene	1,3-Butadiene	Acetaldehyde	Formaldehyde	Naphthalene	Benzo(a)pyrene	Diesel Particulate Matter
EIS[a]	0.10	0.66	0.0004	0.018	0.017	0.017	0.015	3.9×10^{-5}	2.3×10^{-4}	8.6×10^{-6}	8.3×10^{-4}	1.7×10^{-3}	1.3×10^{-5}	8.3×10^{-8}	0.015
PCU	0.24	1.60	0.0010	0.043	0.040	0.040	0.037	9.5×10^{-5}	5.5×10^{-4}	2.1×10^{-5}	2.0×10^{-3}	4.0×10^{-3}	3.2×10^{-5}	2.0×10^{-7}	0.037

Note: a. Source: Table 3-16 for CACs and Table 3-17 for TOCs in Appendix E of EIS Appendix 9.2-A.

Table 4 Rail Locomotive Emissions– Criteria Air Contaminants and Trace Organic Contaminants (g/s)

Air Quality Assessment	Peak Day CACs (g/s)							Peak Day TOCs (g/s)							
	CO	NO_x	SO_2	VOC	PM	PM_{10}	$PM_{2.5}$	Acrolein[b]	Benzene[b]	1,3-Butbadiene	Acetaldehyde	Formaldehyde	Naphthalene	Benzo(a)pyrene	Diesel Particulate Matter[b]
EIS[a]	0.09	0.40	0.0002	0.04	0.009	0.009	0.009	4.1×10^{-4}	5.2×10^{-4}	1.3×10^{-4}	2.8×10^{-3}	8.3×10^{-3}	6.5×10^{-4}	2.3×10^{-6}	0.01
PCU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: a. Source: Table 3-18 for CACs and Table 3-19 for TOCs in Appendix E, EIS Appendix 9.2-A; b. Transcription errors from the calculation spreadsheet for rail locomotive emissions to Table 3-19 for acrolein, benzene, and diesel particulate matter have been corrected and are presented as Corrected Table 3-19 below (**Table 5**). For all parameters, the emissions presented in the Table 3-19 were two orders of magnitude higher.

Table 5 Corrected Table 3-19 in Appendix E of Appendix 9.2-A – Rail Locomotive Emissions – TOCs, g/s

Construction Scenario	Acrolein	Benzene	1,3-Butadiene	Acetaldehyde	Formaldehyde	Naphthalene	Benzo(a)pyrene	Diesel Particulate Matter
Peak	4.1×10^{-4}	5.2×10^{-4}	1.3×10^{-4}	2.8×10^{-3}	8.3×10^{-3}	6.5×10^{-4}	2.3×10^{-6}	0.01

Table 6 Percent Change in Emissions from EIS Assessment to PCU Assessment, Considering Five Marine-Based Vibro-Compaction Probe Engine Specifications for PCU Assessment

Percent Change in Emissions from EIS Assessment to PCU Assessment															
Marine-based Vibro-compaction Probe	CACs							TOCs							
	CO	NO_x	SO_2	VOC	PM	PM_{10}	$PM_{2.5}$	Acrolein	Benzene	1,3-Butadiene	Acetaldehyde	Formaldehyde	Naphthalene	Benzo(a)pyrene	Diesel Particulate Matter
1,000 hp and tier 0	-9%	-12%	-20%	**4%**	-7%	-7%	-7%	**3%**	**4%**	**3%**	**4%**	**3%**	**3%**	**3%**	-7%
500 hp and tier 0	-14%	-17%	-23%	-4%	-12%	-12%	-12%	-5%	-4%	-5%	-4%	-5%	-5%	-5%	-12%
500 hp and tier 1	-17%	-18%	-23%	-9%	-16%	-16%	-16%	-10%	-9%	-10%	-9%	-9%	-10%	-10%	-16%
300 hp and tier 0	-15%	-19%	-24%	-7%	-15%	-15%	-15%	-8%	-7%	-8%	-8%	-8%	-9%	-9%	-15%
300 hp and tier 1	-18%	-20%	-24%	-10%	-17%	-17%	-17%	-11%	-10%	-11%	-10%	-11%	-11%	-11%	-17%

Note: Bolded values indicates an increase in emissions for the PCU assessment compared to EIS assessment based on most conservative engine specifications (i.e., 1,000 hp and Tier 0 for both assessments). All other engine specifications would result in a decrease in emissions (comparatively).

Attachment D2: RBT2 Project Construction Update Atmospheric Noise and Groundborne Vibration Levels During Construction

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RE: ROBERTS BANK TERMINAL 2 PROJECT CONSTRUCTION UPDATE ATMOSPHERIC NOISE AND GROUND-BORNE VIBRATION LEVELS DURING CONSTRUCTION

As requested, RWDI has reviewed the Project Construction Update (PCU) for Roberts Bank Terminal 2 and assessed how the PCU will influence the results presented in the Atmospheric Noise section of the EIS. This report discusses which aspects of the PCU will most influence changes to atmospheric noise and presents the predicted magnitude of these changes.

INFLUENCE OF PROJECT CONSTRUCTION UPDATE ON ATMOSPHERIC NOISE LEVELS

The PCU provides a description of changes to the activities and schedule for Project construction. The changes that will have the largest influence on the atmospheric noise assessment are:

- Elimination of the use of the intermediate transfer pit (decrease in dredger activity in the inter-causeway area);
- Pumping of Fraser River Sand directly into fill areas (increase in dredger activity at the berth face);
- Increase in delivery of quarry sand by tug and barge;
- Elimination of marine vibro-replacement activities related to the terminal; and
- Addition of diesel powered impact pile-driving for construction of the RBT2 overpass.

These changes will result in both increases and decreases in construction noise emissions. To assess the overall influence of these changes on monthly average noise levels during Project construction, it was necessary to estimate the types and numbers of equipment that will be used for each construction activity. This data was provided on a month-by-month basis in a March 2018 spreadsheet "Construction Equipment Peak Analysis". A similar spreadsheet, provided in 2014 for the original Project description, provided the basis for the construction noise assessment for the EIS.

CONSTRUCTION NOISE AND VIBRATION ASSESSMENT METHODOLOGY USED IN THE EIS

APPROACH TO PREDICTING CONSTRUCTION NOISE

To provide context for the discussion of changes to predicted Project construction noise levels, this section provides a brief summary of the approach used to calculate construction noise levels. This is the same approach that was used in the EIS. For a more detailed discussion of this methodology, please refer to Sections 2.3.2 and 2.3.5.2 of Appendix 9.3-A.

Upland Study Area

In predicting the construction noise levels that may be experienced by sensitive receptors in the upland study area, the procedure used in the U.S. Federal Transit Authority procedures (FTA 2006) was generally followed. The FTA procedure accounts for the following factors related to construction equipment and their planned use:

- Types and numbers of heavy construction equipment active during each phase of construction;
- The location of each phase of construction (adjacent marine environment, causeway or terminal); and
- Duration of each construction phase (months, years).

The construction equipment spreadsheet provided the above information which was then used to predict construction noise levels, in terms of L_d, L_n and L_{dn}, at sites 3, 4 and 5 in the upland local assessment area (LAA) for each month of construction. The software CadnaA was used to calculate attenuation during sound propagation due to distance and other effects. Overall noise emissions calculated for construction and equipment activities at the RBT2 marine terminal were assumed to originate from an evenly distributed area source covering the entire surface of the proposed new terminal. To estimate noise levels at each of the 3 upland sites, all causeway construction noise emissions were conservatively considered to originate from a point source location on the causeway that was closest to the site in question. At the three sites, predicted construction noise levels were then added to the noise levels predicted for expected conditions[1] The resulting "combined" levels then provide predictions of total noise levels during Project construction.

Marine Study Area

A similar process was used to predict L_d in marine areas during Project construction. To provide a conservative analysis, all construction noise was assumed to originate from the

[1] Expected conditions refers to future conditions (2025) without the Project.

RBT2 terminal rather than the causeway. The construction phase L_d were calculated at 1 km interval setback distances in all four cardinal directions from the approximate centre point of the future RBT2 marine terminal out to a distance of 10 km. The L_d are provided as ranges of values for the entire duration of construction.

APPROACH TO PREDICTING GROUND-BORNE VIBRATION

In the EIS, the influence of Project construction activities on ground-borne vibration levels was assessed by conducting a sensitivity analysis (Section 2.3.2.8 Appendix 9.3-A). The FTA procedure provided a formula for predicting ground borne vibration levels at various setback distances from a construction activity with a given peak particle velocity (PPV). It was concluded that the most vibration intensive construction activities, dynamic compaction and pile driving, would not result in perceptible ground-borne vibration levels at the locations of the nearest existing residences, or likely future residences, on Tsawwassen First Nation Land. This conclusion was based on the following assumptions:

- Minimum setback distance of 1 km from pile driving or dynamic compaction to existing or future residences on Tsawwassen First Nation Land;
- Maximum PPV of 0.03857 m/s at a setback distance of 7.62 m (value for impact pile driving, highest value of the activities listed in the FTA document)

The PCU does not change these assumptions and is, therefore, not expected to change the conclusions of the EIS regarding ground-borne vibration levels during Project construction.

UPDATED NOISE LEVEL PREDICTIONS FOR PROJECT CONSTRUCTION

MONTHLY AVERAGE NOISE LEVELS IN UPLAND STUDY AREA

Table A-1 of **Appendix A** of this report presents predicted monthly average construction L_d from August 2020 to July 2026 at sites 3 to 5. **Table A-2** presents "combined construction L_d" where predicted construction L_d and expected conditions L_d have been added together to yield total L_d during construction. **Table A-3** presents the increases represented by the combined construction L_d when compared with the L_d for expected conditions. Equivalent data to that presented in **Tables A-1** through **A-3** are presented for L_n in **Tables A-4** through **A-6**, and for L_{dn} in **Tables A-7** through **A-9**. This data is summarized in **Table 1**.

Table 1: Predicted Noise Levels and Noise-Level Increases during Project Construction

Site	L_d for Expected Conditions	Construction L_d		Combined Construction L_d		Increase, Combined vs. Expected (dBA)	
		Range	Avg.	Range	Avg.	Range	Avg.
3	51.9	23.4-50.7	41.9	51.9-54.3	52.6	0.0-2.4	0.7
4	48.4	24.8-48.9	40.5	48.4-51.7	49.5	0.0-3.3	1.1
5	52.3	26.0-42.7	36.8	52.3-52.7	52.5	0.0-0.4	0.2

Site	L_n for Expected Conditions	Construction L_n		Combined Construction L_n		Increase, Combined vs. Expected (dBA)	
		Range	Avg.	Range	Avg.	Range	Avg.
3	51.5	0.0-50.6	40.5	51.5-54.1	52.1	0.0-2.6	0.6
4	44.5	0.0-48.9	38.2	44.5-50.2	46.1	0.0-5.7	1.6
5	48.5	0.0-42.1	34.6	48.5-49.4	48.8	0.0-0.9	0.3

Site	L_{dn} for Expected Conditions	Construction L_{dn}		Combined Construction L_{dn}		Increase, Combined vs. Existing (dBA)	
		Range	Avg.	Range	Avg.	Range	Avg.
3	58.0	24.7-57.1	48.0	58.0-60.5	58.6	0.0-2.5	0.6
4	51.7	26.0-55.3	47.0	51.7-56.9	53.2	0.0-5.2	1.5
5	55.7	27.2-48.6	42.4	55.7-56.5	55.9	0.0-0.8	0.2

Construction noise is predicted to increase L_d, L_n, and L_{dn} at sites 3, 4 and 5 by 0.0 dBA to 5.7 dBA over the approximately 6-year construction phase. The highest noise levels are expected to occur from August 2022 to October 2022 during densification of the east causeway. In the EIS, dredging in the ITP in the inter-causeway area was also a primary contributor to the highest noise levels during construction but this activity is no longer planned. Over the duration of the construction phase, Project construction is not expected to increase noise levels (i.e., L_d, L_n, L_{dn}) by more than 1.6 dBA. As noted in the EIS, these relatively modest increases are primarily a result of the large setback distances of noise-sensitive upland receptors from the RBT2 terminal and causeway construction zones.

Table 2 compares the combined construction L_d, L_n, and L_{dn} of **Table 1** to those provided in **Table 9.3-18** of the EIS.

Table 2: Comparison of Combined Construction Noise Levels for the EIS and PCU

Site	L_d for Expected Conditions	Combined Construction L_d (PCU)		Combined Construction L_d (EIS)		Difference in L_d (PCU vs. EIS)	
		Range	Avg.	Range	Avg.	Range	Avg.
3	51.9	51.9-54.3	52.6	51.9-53.8	52.5	0.0-0.5	0.1
4	48.4	48.4-51.7	49.5	48.4-51.0	49.3	0.0-0.7	0.2
5	52.3	52.3-52.7	52.5	52.3-52.6	52.4	0.0-0.1	0.1
Site	L_n for Expected Conditions	Combined Construction L_n (PCU)		Combined Construction L_n (EIS)		Difference in L_n (PCU vs. EIS)	
		Range	Avg.	Range	Avg.	Range	Avg.
3	51.5	51.5-54.1	52.1	51.5-53.5	51.9	0.0-0.6	0.2
4	44.5	44.5-50.2	46.1	44.5-49.3	45.8	0.0-0.9	0.3
5	48.5	48.5-49.4	48.8	48.5-49.1	48.7	0.0-0.3	0.1
Site	L_{dn} for Expected Conditions	Combined Construction L_{dn} (PCU)		Combined Construction L_{dn} (EIS)		Difference in L_{dn} (PCU vs. EIS)	
		Range	Avg.	Range	Avg.	Range	Avg.
3	58.0	58.0-60.5	58.6	58.0-60.0	58.5	0.0-0.5	0.1
4	51.7	51.7-56.9	53.2	51.7-56.0	53.0	0.0-0.9	0.2
5	55.7	55.7-56.5	55.9	55.7-56.7	56.0	-0.2-0.0	-0.1

Table 2 shows that combined construction noise levels (L_d, L_n, and L_{dn}) at sites 3, 4, and 5 calculated for the PCU differ by less than 1.0 dBA compared to those calculated for the EIS. These differences are within the margin of error of noise measurement equipment (i.e. +/-1 dBA).

CONSTRUCTION NOISE LEVELS IN MARINE AREAS

Table A-10 in **Appendix A** provides the range of L_d that are expected to occur in marine areas during project construction. When compared to the values presented in **Table H-4** of the EIS, maximum predicted L_d have changed by less than 0.5 dBA, which is considered negligible compared to the margin of error of noise measurement equipment (i.e. +/- 1 dBA).

NOISE LEVELS DURING OVERPASS PILE DRIVING

Overpass pile-driving noise is included in the noise levels presented in the previous section. These were monthly average noise levels, however, that do not reflect the maximum noise levels (L_{max}) that will result from the pile driving. RWDI have measured noise levels from a diesel-powered impact pile driver which is expected to be similar to the equipment to be used for the Project. These measurements indicate a total sound power level (L_w) of 136.7 dBA for diesel pile driving. The measurements also captured octave-band frequency spectra and the results are presented in **Table 5** in terms of the estimated octave-band L_w and the overall A-weighted L_w.

Table 5: Sound Power Levels (L_w) for Diesel Pile Driving

Octave-Band L_w (dB)									A-Weighted L_w (dBA)
31.5	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
120.6	120.5	122.6	131.7	123.8	130.8	128.7	126.5	122.7	136.7

The octave band L_w in **Table 5** were used to create a diesel pile driving sound source in the noise model which was used for the EIS. The pile driving sound source was conservatively placed at the closest setback distance from the upland study area at which overpass pile driving will occur. At sites 3, 4 and 5, the model predicted L_{max} of 34.4 to 39.3 dBA. These noise levels are lower than the L_d for expected conditions at sites 3, 4 and 5 which range from 44.5 to 51.5 dBA. Pile driving may still be audible, however, as its impulsive nature and low-frequency content is sufficiently different from normal community noise that it may be distinguishable from other, nearer sounds.

Table A-11 in **Appendix A** presents the maximum noise levels (L_{max}) that are expected to occur at various setback distances from diesel pile driving. These construction noise levels are provided for the assessment of Project-related noise impacts on birds.

NOISE LEVELS DUE TO CONSTRUCTION ROAD TRAFFIC

In addition to considering the changes in construction activities as summarized in the Project Construction Update, which are reflected in the noise levels in Table 1, this noise and vibration assessment update has also considered the peak day construction traffic, including new traffic information provided in the response to IR1-20. During the peak period of construction, between 59 and 114 vehicles per day are projected to move in and out of the Project area for construction related activities. The single peak day construction traffic is expected to add 114 heavy vehicles to traffic volumes on the causeway, representing less than 2% of the total vehicles on the causeway in expected conditions associated with operations at the existing

Deltaport and Westshore terminals (shown in EIS Appendix 4-D). Such an increase is negligible in terms of its influence on average noise levels (i.e., L_d, L_n, L_{dn}). The noise from the additional vehicles may be perceptible during the nighttime, however, when lower traffic volumes can allow individual vehicle noise to be distinguishable.

We trust that the above information has provided you with all the information you require at this time. Please contact us should you have any questions or concerns regarding this report.

Sincerely,

Teresa Drew, B.Sc., INCE
Principal, Technical Manager

Andrew Williamson, P.Eng.
Acoustical Specialist

LIST OF APPENDICES

Appendix A: Construction Noise Assessment – Updated Tables

APPENDIX A: CONSTRUCTION NOISE ASSESSMENT - UPDATED TABLES

Table A-1: Monthly Average Construction L_d

Site	Average Construction L_d (dBA)																	
	2020						2021											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	-	26.8	44.5	44.5	44.5	44.6	44.6	44.6	44.5	27.8	27.8	28.1	29.0	44.6	44.6	44.6	44.6	44.6
4	-	28.2	42.7	42.7	42.7	42.8	42.8	42.9	42.8	29.2	29.2	29.5	30.4	43.0	43.0	43.0	42.9	42.9
5	-	29.4	35.6	35.6	35.6	36.0	36.0	36.8	36.3	30.4	30.4	30.7	31.6	37.0	37.0	37.0	36.7	36.7

Site	Average Construction L_d (dBA)																	
	2022												2023					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
3	48.8	48.8	46.7	46.7	46.7	49.4	49.4	50.7	50.6	50.6	47.5	49.0	47.6	48.1	47.0	47.3	46.7	48.3
4	47.0	47.0	44.9	45.0	45.0	47.6	47.6	48.9	48.9	48.9	45.9	47.2	45.9	46.3	45.2	45.6	45.1	46.7
5	40.4	40.4	38.5	38.7	38.7	41.0	41.1	42.3	42.2	42.2	40.8	40.5	39.3	39.7	38.6	39.5	39.2	41.0

Site	Average Construction L_d (dBA)																	
	2023						2024											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	47.8	47.5	47.9	49.6	47.0	45.0	44.5	41.0	43.8	33.9	31.9	33.4	33.5	36.3	35.4	35.1	34.9	34.0
4	46.2	45.9	46.3	48.0	45.6	43.7	43.1	40.1	42.4	35.3	33.3	34.8	34.9	37.7	36.8	36.5	36.3	35.4
5	40.7	40.6	40.8	42.7	41.1	40.1	38.9	37.8	38.0	36.5	34.5	36.0	36.1	38.9	38.0	37.7	37.5	36.6

Table A-1 Cont'd: Monthly Average Construction L_d

Site	Average Construction L_d (dBA)																	
	2025												2026					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
3	34.8	34.9	29.7	28.3	28.3	26.6	43.3	43.3	43.3	45.1	45.2	40.7	40.6	40.6	40.8	41.1	40.9	40.9
4	36.2	36.3	31.1	29.7	29.7	28.0	41.6	41.6	41.6	43.4	43.5	39.2	39.0	39.0	39.4	39.9	39.6	39.6
5	37.4	37.5	32.3	30.9	30.9	29.2	35.4	35.4	35.4	37.1	37.4	34.4	33.6	33.5	35.1	36.6	35.8	35.9

Site	Average Construction L_d (dBA)					
	2026					
	Jul	Aug	Sep	Oct	Nov	Dec
3	30.3	30.3	23.4	45.2	45.1	-
4	31.7	31.7	24.8	43.4	43.3	-
5	32.9	32.9	26.0	36.5	36.1	-

Table A-2: Monthly Average Combined Construction L_d

Site	Average Combined Construction L_d (dBA)																	
	2020						2021											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	-	51.9	52.6	52.6	52.6	52.6	52.6	52.6	52.6	51.9	51.9	51.9	51.9	52.6	52.6	52.6	52.6	52.6
4	-	48.4	49.4	49.4	49.4	49.5	49.5	49.5	49.5	48.5	48.5	48.5	48.5	49.5	49.5	49.5	49.5	49.5
5	-	52.3	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.3	52.3	52.3	52.3	52.4	52.4	52.4	52.4	52.4

Site	Average Combined Construction L_d (dBA)																	
	2022												2023					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
3	53.6	53.6	53.0	53.0	53.0	53.8	53.8	54.3	54.3	54.3	53.2	53.7	53.3	53.4	53.1	53.2	53.0	53.5
4	50.8	50.8	50.0	50.0	50.0	51.0	51.0	51.7	51.7	51.7	50.3	50.9	50.3	50.5	50.1	50.2	50.1	50.6
5	52.6	52.6	52.5	52.5	52.5	52.6	52.6	52.7	52.7	52.7	52.6	52.6	52.5	52.5	52.5	52.5	52.5	52.6

Site	Average Combined Construction L_d (dBA)																	
	2023						2024											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	53.3	53.2	53.4	53.9	53.1	52.7	52.6	52.2	52.5	52.0	51.9	52.0	52.0	52.0	52.0	52.0	52.0	52.0
4	50.5	50.3	50.5	51.2	50.2	49.7	49.5	49.0	49.4	48.6	48.5	48.6	48.6	48.8	48.7	48.7	48.7	48.6
5	52.6	52.6	52.6	52.7	52.6	52.6	52.5	52.5	52.5	52.4	52.4	52.4	52.4	52.5	52.5	52.4	52.4	52.4

Table A-2 Cont'd: Monthly Average Combined Construction L_d

Site	Average Combined Construction L_d (dBA))																	
	2025												2026					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
3	52.0	52.0	51.9	51.9	51.9	51.9	52.5	52.5	52.5	52.7	52.7	52.2	52.2	52.2	52.2	52.2	52.2	52.2
4	48.7	48.7	48.5	48.5	48.5	48.4	49.2	49.2	49.2	49.6	49.6	48.9	48.9	48.9	48.9	49.0	48.9	48.9
5	52.4	52.4	52.3	52.3	52.3	52.3	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4

Site	Average Combined Construction L_d (dBA)					
	2026					
	Jul	Aug	Sep	Oct	Nov	Dec
3	51.9	51.9	51.9	52.7	52.7	-
4	48.5	48.5	48.4	49.6	49.6	-
5	52.3	52.3	52.3	52.4	52.4	-

Table A-3: Increases in Monthly Average L_d due to Construction

Site	Average Increase in L_d (dBA)																	
	2020						2021											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	-	0.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.0	0.0	0.0	0.0	0.7	0.7	0.7	0.7	0.7
4	-	0.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	0.1	0.1	0.1	0.1	1.1	1.1	1.1	1.1	1.1
5	-	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1

Site	Average Increase in L_d (dBA)																	
	2022												2023					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
3	1.7	1.7	1.1	1.1	1.1	1.9	1.9	2.4	2.4	2.4	1.3	1.8	1.4	1.5	1.2	1.3	1.1	1.6
4	2.4	2.4	1.6	1.6	1.6	2.6	2.6	3.3	3.3	3.3	1.9	2.5	1.9	2.1	1.7	1.8	1.7	2.2
5	0.3	0.3	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.3

Site	Average Increase in L_d (dBA))																	
	2023						2024											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	1.4	1.3	1.5	2.0	1.2	0.8	0.7	0.3	0.6	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1
4	2.1	1.9	2.1	2.8	1.8	1.3	1.1	0.6	1.0	0.2	0.1	0.2	0.2	0.4	0.3	0.3	0.3	0.2
5	0.3	0.3	0.3	0.4	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1

Table A-3 (Cont'd): Increases in Monthly Average L_d due to Construction

Site	Average Increase in L_d (dBA)																	
	2025												2026					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
3	0.1	0.1	0.0	0.0	0.0	0.0	0.6	0.6	0.6	0.8	0.8	0.3	0.3	0.3	0.3	0.3	0.3	0.3
4	0.3	0.3	0.1	0.1	0.1	0.0	0.8	0.8	0.8	1.2	1.2	0.5	0.5	0.5	0.5	0.6	0.5	0.5
5	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Site	Average Increase in L_d (dBA)					
	2026					
	Jul	Aug	Sep	Oct	Nov	Dec
3	0.0	0.0	0.0	0.8	0.8	-
4	0.1	0.1	0.0	1.2	1.2	-
5	0.0	0.0	0.0	0.1	0.1	-

Table A-4: Monthly Average Construction L_n

Site	Average Construction L_n (dBA)																	
	2020						2021											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	-	24.2	42.0	42.0	42.0	42.0	42.0	42.1	42.0	27.8	27.8	28.0	28.9	42.2	42.2	42.2	42.1	42.1
4	-	25.6	40.2	40.2	40.2	40.3	40.3	40.5	40.3	29.2	29.2	29.4	30.3	40.6	40.6	40.6	40.5	40.5
5	-	26.8	33.1	33.1	33.1	33.7	33.7	35.0	34.4	30.4	30.4	30.6	31.5	35.3	35.3	35.3	34.9	34.9

Site	Average Construction L_n (dBA)																	
	2022												2023					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
3	47.9	47.9	46.7	46.7	46.7	49.4	49.4	50.6	50.6	50.6	47.1	48.1	46.4	46.7	45.9	44.8	44.2	45.8
4	46.2	46.2	44.9	45.0	45.0	47.6	47.6	48.9	48.9	48.9	45.5	46.3	44.6	45.0	44.2	43.2	42.7	44.3
5	39.6	39.6	38.4	38.6	38.6	40.9	41.0	42.1	42.1	42.1	39.9	39.7	38.2	38.5	37.6	37.7	37.4	39.0

Site	Average Construction L_n (dBA)																	
	2023						2024											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	45.3	45.0	45.4	47.1	44.6	42.7	42.1	38.8	41.4	33.1	31.0	32.3	32.4	35.0	33.6	33.1	32.6	31.5
4	43.8	43.5	43.9	45.6	43.3	41.6	40.8	38.1	40.1	34.5	32.4	33.7	33.8	36.4	35.0	34.5	34.0	32.9
5	38.8	38.7	38.9	40.8	39.5	38.7	37.2	36.3	36.3	35.7	33.6	34.9	35.0	37.6	36.2	35.7	35.2	34.1

Table A-4 Cont'd: Monthly Average Construction L_n

Site	Average Construction L_n (dBA)																	
	2025												2026					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
3	32.9	33.0	27.1	20.8	20.8	0.0	40.7	40.7	40.7	42.5	42.6	38.3	38.1	38.1	38.3	38.7	38.4	38.5
4	34.3	34.4	28.5	22.2	22.2	0.0	38.9	38.9	38.9	40.7	40.9	36.9	36.6	36.4	36.9	37.6	37.2	37.2
5	35.5	35.6	29.7	23.4	23.4	0.0	31.7	31.7	31.7	33.7	34.5	32.8	31.7	30.9	32.6	34.8	33.7	33.7

Site	Average Construction L_n (dBA)					
	2026					
	Jul	Aug	Sep	Oct	Nov	Dec
3	28.5	28.5	20.8	42.6	42.6	-
4	29.9	29.9	22.2	40.8	40.8	-
5	31.1	31.1	23.4	34.0	33.6	-

Table A-5: Monthly Average Combined Construction L_n

Site	Average Combined Construction L_n (dBA)																	
	2020						2021											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	-	51.5	52.0	52.0	52.0	52.0	52.0	52.0	52.0	51.5	51.5	51.5	51.5	52.0	52.0	52.0	52.0	52.0
4	-	44.6	45.9	45.9	45.9	45.9	45.9	46.0	45.9	44.6	44.6	44.6	44.7	46.0	46.0	46.0	46.0	46.0
5	-	48.5	48.6	48.6	48.6	48.6	48.6	48.7	48.7	48.6	48.6	48.6	48.6	48.7	48.7	48.7	48.7	48.7

Site	Average Combined Construction L_n (dBA)																	
	2022												2023					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
3	53.1	53.1	52.7	52.7	52.7	53.6	53.6	54.1	54.1	54.1	52.8	53.1	52.7	52.7	52.6	52.3	52.2	52.5
4	48.4	48.4	47.7	47.7	47.7	49.3	49.3	50.2	50.2	50.2	48.0	48.5	47.6	47.8	47.3	46.9	46.7	47.4
5	49.0	49.0	48.9	48.9	48.9	49.2	49.2	49.4	49.4	49.4	49.1	49.0	48.9	48.9	48.8	48.9	48.8	49.0

Site	Average Combined Construction L_n (dBA)																	
	2023						2024											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	52.4	52.4	52.5	52.9	52.3	52.0	52.0	51.7	51.9	51.6	51.5	51.6	51.6	51.6	51.6	51.6	51.6	51.5
4	47.2	47.0	47.2	48.1	47.0	46.3	46.0	45.4	45.8	44.9	44.8	44.8	44.9	45.1	45.0	44.9	44.9	44.8
5	48.9	48.9	48.9	49.2	49.0	48.9	48.8	48.8	48.8	48.7	48.6	48.7	48.7	48.8	48.7	48.7	48.7	48.7

Table A-5 Cont'd: Monthly Average Combined Construction L_n

Site	Average Combined Construction L_n (dBA)																	
	2025												2026					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
3	51.6	51.6	51.5	51.5	51.5	51.5	51.8	51.8	51.8	52.0	52.0	51.7	51.7	51.7	51.7	51.7	51.7	51.7
4	44.9	44.9	44.6	44.5	44.5	44.5	45.6	45.6	45.6	46.0	46.1	45.2	45.2	45.1	45.2	45.3	45.2	45.2
5	48.7	48.7	48.6	48.5	48.5	48.5	48.6	48.6	48.6	48.6	48.7	48.6	48.6	48.6	48.6	48.7	48.6	48.6

Site	Average Combined Construction L_n (dBA)					
	2026					
	Jul	Aug	Sep	Oct	Nov	Dec
3	51.5	51.5	51.5	52.0	52.0	-
4	44.6	44.6	44.5	46.1	46.0	-
5	48.6	48.6	48.5	48.7	48.6	-

Table A-6: Increases in Monthly Average L_n due to Construction

Site	Average Increase in L_n (dBA)																	
	2020						2021											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	-	0.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.5
4	-	0.1	1.4	1.4	1.4	1.4	1.4	1.5	1.4	0.1	0.1	0.1	0.2	1.5	1.5	1.5	1.5	1.5
5	-	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2

Site	Average Increase in L_n (dBA)																	
	2022												2023					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
3	1.6	1.6	1.2	1.2	1.2	2.1	2.1	2.6	2.6	2.6	1.3	1.6	1.2	1.2	1.1	0.8	0.7	1.0
4	3.9	3.9	3.2	3.2	3.2	4.8	4.8	5.7	5.7	5.7	3.5	4.0	3.1	3.3	2.8	2.4	2.2	2.9
5	0.5	0.5	0.4	0.4	0.4	0.7	0.7	0.9	0.9	0.9	0.6	0.5	0.4	0.4	0.3	0.4	0.3	0.5

Site	Average Increase in L_n (dBA)																	
	2023						2024											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
c3	0.9	0.9	1.0	1.4	0.8	0.5	0.5	0.2	0.4	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0
4	2.7	2.5	2.7	3.6	2.5	1.8	1.5	0.9	1.3	0.4	0.3	0.3	0.4	0.6	0.5	0.4	0.4	0.3
5	0.4	0.4	0.4	0.7	0.5	0.4	0.3	0.3	0.3	0.2	0.1	0.2	0.2	0.3	0.2	0.2	0.2	0.2

Table A-6 Cont'd: Increase in Monthly Average L_n due to Construction

Site	Average Increase in L_n (dBA)																	
	2025												2026					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
3	0.1	0.1	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.5	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
4	0.4	0.4	0.1	0.0	0.0	0.0	1.1	1.1	1.1	1.5	1.6	0.7	0.7	0.6	0.7	0.8	0.7	0.7
5	0.2	0.2	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.1

Site	Average Increase in L_n (dBA)					
	2026					
	Jul	Aug	Sep	Oct	Nov	Dec
3	0.0	0.0	0.0	0.5	0.5	-
4	0.1	0.1	0.0	1.6	1.5	-
5	0.1	0.1	0.0	0.2	0.1	-

Table A-7: Monthly Average Construction L_{dn}

Site	Average Construction L_{dn} (dBA)																	
	2020						2021											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	-	31.1	48.9	48.9	48.9	48.9	48.9	49.0	48.9	34.2	34.2	34.4	35.3	49.0	49.0	49.0	49.0	49.0
4	-	32.5	47.1	47.1	47.1	47.2	47.2	47.4	47.2	35.6	35.6	35.8	36.7	47.4	47.4	47.4	47.4	47.4
5	-	33.7	40.0	40.0	40.0	40.5	40.5	41.7	41.1	36.8	36.8	37.0	37.9	42.0	42.0	42.0	41.6	41.6

Site	Average Construction L_{dn} (dBA)																	
	2022												2023					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
3	54.5	54.5	53.1	53.1	53.1	55.8	55.8	57.1	57.0	57.1	53.6	54.6	53.0	53.3	52.5	51.6	51.1	52.7
4	52.7	52.7	51.3	51.4	51.4	54.0	54.0	55.3	55.3	55.3	52.0	52.9	51.3	51.6	50.7	50.0	49.5	51.1
5	46.1	46.1	44.8	45.0	45.0	47.3	47.4	48.6	48.5	48.5	46.4	46.2	44.8	45.1	44.2	44.5	44.1	45.7

Site	Average Construction L_{dn} (dBA)																	
	2023						2024											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	52.2	51.9	52.3	54.0	51.5	49.5	49.0	45.6	48.2	39.6	37.5	38.9	39.0	41.6	40.3	39.9	39.4	38.4
4	50.7	50.3	50.7	52.5	50.1	48.4	47.6	44.8	46.9	41.0	38.9	40.3	40.4	43.0	41.7	41.3	40.8	39.8
5	45.6	45.4	45.6	47.6	46.2	45.4	43.9	43.0	43.0	42.2	40.1	41.5	41.6	44.2	42.9	42.5	42.0	41.0

Table A-7 Cont'd: Monthly Average Construction L_{dn}

Site	Average Construction L_{dn} (dBA)																	
	2025												2026					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
3	39.6	39.7	34.0	29.4	29.4	24.7	47.6	47.6	47.6	49.4	49.5	45.1	45.0	44.9	45.1	45.5	45.3	45.3
4	41.0	41.1	35.4	30.8	30.8	26.0	45.8	45.8	45.8	47.7	47.8	43.7	43.5	43.3	43.7	44.4	44.0	44.1
5	42.2	42.3	36.6	32.0	32.0	27.2	38.9	38.9	38.9	40.8	41.4	39.5	38.4	37.8	39.5	41.6	40.5	40.5

Site	Average Construction L_{dn} (dBA)					
	2026					
	Jul	Aug	Sep	Oct	Nov	Dec
3	35.2	35.2	27.7	49.5	49.5	-
4	36.6	36.6	29.1	47.7	47.7	-
5	37.8	37.8	30.3	40.9	40.5	-

Table A-8: Monthly Average Combined Construction L_{dn}

Site	Average Combined Construction L_{dn} (dBA)																	
	2020						2021											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	0.0	58.0	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.0	58.0	58.0	58.0	58.5	58.5	58.5	58.5	58.5
4	0.0	51.8	53.0	53.0	53.0	53.0	53.0	53.1	53.0	51.8	51.8	51.8	51.9	53.1	53.1	53.1	53.1	53.1
5	0.0	55.7	55.8	55.8	55.8	55.8	55.8	55.9	55.8	55.8	55.8	55.8	55.8	55.9	55.9	55.9	55.9	55.9

Site	Average Combined Construction L_{dn} (dBA)																	
	2022												2023					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
3	59.6	59.6	59.2	59.2	59.2	60.0	60.0	60.5	60.5	60.5	59.3	59.6	59.2	59.3	59.0	58.9	58.8	59.1
4	55.3	55.3	54.5	54.6	54.6	56.0	56.0	56.9	56.9	56.9	54.9	55.4	54.5	54.7	54.3	54.0	53.8	54.4
5	56.2	56.2	56.0	56.1	56.1	56.3	56.3	56.5	56.5	56.5	56.2	56.2	56.0	56.1	56.0	56.0	56.0	56.1

Site	Average Combined Construction L_{dn} (dBA)																	
	2023						2024											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	59.0	58.9	59.0	59.4	58.8	58.6	58.5	58.2	58.4	58.0	58.0	58.0	58.0	58.1	58.0	58.0	58.0	58.0
4	54.2	54.1	54.3	55.1	54.0	53.4	53.2	52.5	53.0	52.1	52.0	52.0	52.0	52.3	52.1	52.1	52.1	52.0
5	56.1	56.1	56.1	56.3	56.2	56.1	56.0	55.9	55.9	55.9	55.8	55.9	55.9	56.0	55.9	55.9	55.9	55.8

Table A-8 Cont'd: Monthly Average Combined Construction L_{dn}

Site	Average Combined Construction L_{dn} (dBA)																	
	2025												2026					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
3	58.0	58.0	58.0	58.0	58.0	58.0	58.3	58.3	58.3	58.5	58.5	58.2	58.2	58.2	58.2	58.2	58.2	58.2
4	52.1	52.1	51.8	51.8	51.8	51.7	52.7	52.7	52.7	53.2	53.2	52.4	52.3	52.3	52.4	52.5	52.4	52.4
5	55.9	55.9	55.8	55.7	55.7	55.7	55.8	55.8	55.8	55.8	55.9	55.8	55.8	55.8	55.8	55.9	55.8	55.8

Site	Average Combined Construction L_{dn} (dBA)					
	2026					
	Jul	Aug	Sep	Oct	Nov	Dec
3	58.0	58.0	58.0	58.5	58.5	-
4	51.9	51.9	51.8	53.2	53.2	-
5	55.8	55.8	55.7	55.8	55.8	-

Table A-9: Increases in Monthly Average L_{dn} due to Construction

Site	Average Increases in L_{dn} (dBA)																	
	2020						2021											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	0.0	0.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.5
4	0.0	0.1	1.3	1.3	1.3	1.3	1.3	1.4	1.3	0.1	0.1	0.1	0.2	1.4	1.4	1.4	1.4	1.4
5	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2

Site	Average Increases in L_{dn} (dBA)																	
	2022												2023					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
3	1.6	1.6	1.2	1.2	1.2	2.0	2.0	2.5	2.5	2.5	1.3	1.6	1.2	1.3	1.0	0.9	0.8	1.1
4	3.6	3.6	2.8	2.9	2.9	4.3	4.3	5.2	5.2	5.2	3.2	3.7	2.8	3.0	2.6	2.3	2.1	2.7
5	0.5	0.5	0.3	0.4	0.4	0.6	0.6	0.8	0.8	0.8	0.5	0.5	0.3	0.4	0.3	0.3	0.3	0.4

Site	Average Increases in L_{dn} (dBA)																	
	2023						2024											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	1.0	0.9	1.0	1.4	0.8	0.6	0.5	0.2	0.4	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
4	2.5	2.4	2.6	3.4	2.3	1.7	1.5	0.8	1.3	0.4	0.3	0.3	0.3	0.6	0.4	0.4	0.4	0.3
5	0.4	0.4	0.4	0.6	0.5	0.4	0.3	0.2	0.2	0.2	0.1	0.2	0.2	0.3	0.2	0.2	0.2	0.1

Table A-9 Cont'd: Monthly Average Construction L_{dn}

Site	Average Increases in L_{dn} (dBA)																	
	2025												2026					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.5	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
4	0.4	0.4	0.1	0.1	0.1	0.0	1.0	1.0	1.0	1.5	1.5	0.7	0.6	0.6	0.7	0.8	0.7	0.7
5	0.2	0.2	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.1

Site	Average Increases in L_{dn} (dBA)					
	2026					
	Jul	Aug	Sep	Oct	Nov	Dec
3	0.0	0.0	0.0	0.5	0.5	-
4	0.2	0.2	0.1	1.5	1.5	-
5	0.1	0.1	0.0	0.1	0.1	-

Table A-10: Predicted L_d in Marine Areas during Project Construction (EIS vs. PCU)

Setback Distance from RBT2 (km)	Combined Construction L_d (dBA) EIS				Combined Construction L_d (dBA) PCU				Diff. in L_d (dBA) PCU vs. EIS			
	North	South	East	West	North	South	East	West	North	South	East	West
1	54.9 to 62.2	52.7 to 61.8	-*	51.0 to 63.4	54.8 to 61.9	52.6 to 61.5	-*	50.7 to 63.1	-0.1 to -0.3	-0.1 to -0.3	-*	-0.3
2	52.7 to 56.3	49.9 to 53.3	-*	47.4 to 54.8	52.7 to 56.1	49.8 to 55.0	-*	47.3 to 54.5	0.0 to -0.2	-0.1 to -0.3	-*	-0.1 to -0.3
3	50.1 to 52.4	47.2 to 51.0	63.7 to 63.8	44.8 to 49.9	50.1 to 52.3	47.2 to 50.8	63.7 to 63.8	44.7 to 49.7	0.0 to -0.1	0.0 to -0.2	0.0	-0.1 to -0.2
4	47.5 to 49.3	45.2 to 48.0	56.5 to 56.7	42.6 to 46.7	47.5 to 49.2	45.2 to 47.8	56.5 to 56.7	42.6 to 46.4	0.0 to -0.1	0.0 to -0.2	0.0	0.0 to -0.3
5	45.2 to 46.7	43.1 to 45.4	58.0 to 58.1	40.7 to 44.1	45.2 to 46.6	43.1 to 45.2	58.0 to 58.1	40.7 to 43.9	0.0 to -0.1	0.0 to -0.2	0.0	0.0 to -0.2
6	43.1 to 44.5	41.2 to 43.2	51.9 to 52.1	39.0 to 41.9	43.1 to 44.4	41.2 to 43.0	51.9 to 52.1	39.0 to 41.7	0.0 to -0.1	0.0 to -0.2	0.0	0.0 to -0.2
7	41.1 to 42.4	39.5 to 41.2	-*	37.5 to 39.0	41.1 to 42.3	39.5 to 41.1	-*	37.5 to 38.9	0.0 to -0.1	0.0 to -0.1	-*	0.0 to -0.1
8	38.9 to 40.3	38.0 to 39.6	-*	36.2 to 37.5	38.9 to 40.2	38.0 to 39.5	-*	36.2 to 37.4	0.0 to -0.1	0.0 to -0.1	-*	0.0 to -0.1
9	37.4 to 38.7	36.7 to 38.1	-*	35.0 to 36.1	37.4 to 38.6	36.7 to 38.0	-*	35.0 to 36.1	0.0 to -0.1	0.0 to -0.1	-*	0.0
10	36.0 to 37.2	35.5 to 36.8	-*	33.9 to 35.0	36.0 to 37.2	35.5 to 36.7	-*	33.9 to 34.9	0.0	0.0 to -0.1	-*	0.0 to -0.1

***Note:** Noise levels were not calculated at certain setback distances to the east as they correspond to locations over land

Table A-11: Predicted L_{max} at Various Setback Distances from Diesel Pile Driving

Construction Activity	L_{max} (dBA) at Various Setback Distances																	
	10 m	20 m	30 m	40 m	50 m	60 m	70 m	80 m	90 m	100 m	110 m	120 m	130 m	140 m	150 m	300 m	600 m	1 km	2 km
Diesel Pile Driving	108.0	102.3	98.7	96.2	94.1	92.4	91.0	89.7	88.6	87.6	86.7	85.9	85.1	84.4	83.7	76.7	69.7	64.6	56.1

Attachment D3: RBT2 Technical Memorandum: Underwater Noise Assessment of Trailing Hopper Suction Dredges during Sand Pumping Operations

ROBERTS BANK TERMINAL 2
TECHNICAL MEMORANDUM
Underwater Noise Assessment of Trailing Hopper Suction Dredges during Sand Pumping Operations

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1.0 LITERATURE REVIEW OF TRAILING SUCTION HOPPER DREDGING SOURCE LEVELS

A literature review was conducted to assess whether proposed sand pumping operations at the RBT2 dredge basin will produce higher underwater sound levels than previously modelled construction activities (cutter suction dredging, vibro-densification and vibratory piling).

The 2018 Project Construction Update (PCU) for RBT2 proposes to use a Trailing Suction Hopper Dredge (TSHD), anchored at the dredge basin, to pump sand collected from the Fraser River into the east and west containment basins. The THSD planned for this activity is the *FRPD309* (specifications provided in Table 1), which performs maintenance dredging of the Fraser River on an annual basis. To the best of our knowledge at the time of writing, no source level measurements have been obtained for the *FRPD309*. Therefore, we have based our assessment on the closest available surrogate measurements from the publicly-available literature.

Table 1 Specifications for the *FRPD309* trailing suction hopper dredge

Dredge	Length Overall (m)	Loaded draught (m)	Total installed power (kW)	Discharge pump power (kW)
FRPD309	124.1	6.49	8,814	2,647

While our literature review found a number of published source level measurements for TSHDs (Hannay et al. 2004, de Jong et al. 2010, Robinson et al. 2011, Wang et al. 2012, WODA 2013, Reine et al. 2014), very few measurements were taken of dredges while at anchor or when no propulsion mechanisms were in operation. For example, Robinson et al. (2011) and Wang et al. (2012) provide a summary of numerous dredging source levels, obtained in UK waters, including THSDs, however, none of the specific operations correspond to pumping ashore and thus, cannot be used as an accurate surrogate for the activity described in the PCU. Reine et al. (2014) measured three TSHDs during four operational modes (full dredging, transiting between sites, dredged material pump-out, and water pump-out), however, based on the levels reported in the report and discussion with the author (K. Reine, pers. comm., 11 Apr 2018), it is believed that the vessel engines were in use to maintain position during the pump-out measurements. According to our review, de Jong et al. (2010) provides the best surrogate measurements for *FRPD309* pumping ashore while anchored, based on dredge specifications and operations. That study presents measurements of six TSHDs performing several operations, including full dredging, rainbowing, direct sand dumping, pumping ashore and transiting. Rainbowing is when sediment stored in the dredge's hopper is sprayed into the water using onboard pumps. A THSD uses the same onboard machinery during pumping ashore and rainbowing, therefore, we believe rainbowing measurements are an appropriate surrogate for *FRPD309*. A comparison is made below between the rainbowing source levels reported in de Jong et al. (2010) and source levels of RBT2 construction operations previously modelled by JASCO (presented in EIS Appendix 9.8-A).

2.0 COMPARISON BETWEEN TSHD RAINBOWING AND RBT2 CONSTRUCTION OPERATIONS

The plot below compares monopole source levels for four TSHDs performing rainbowing from de Jong et al. (2010) with the cutter suction dredging, vibro-densification and vibratory piling previously modelled for RBT2 construction operations.

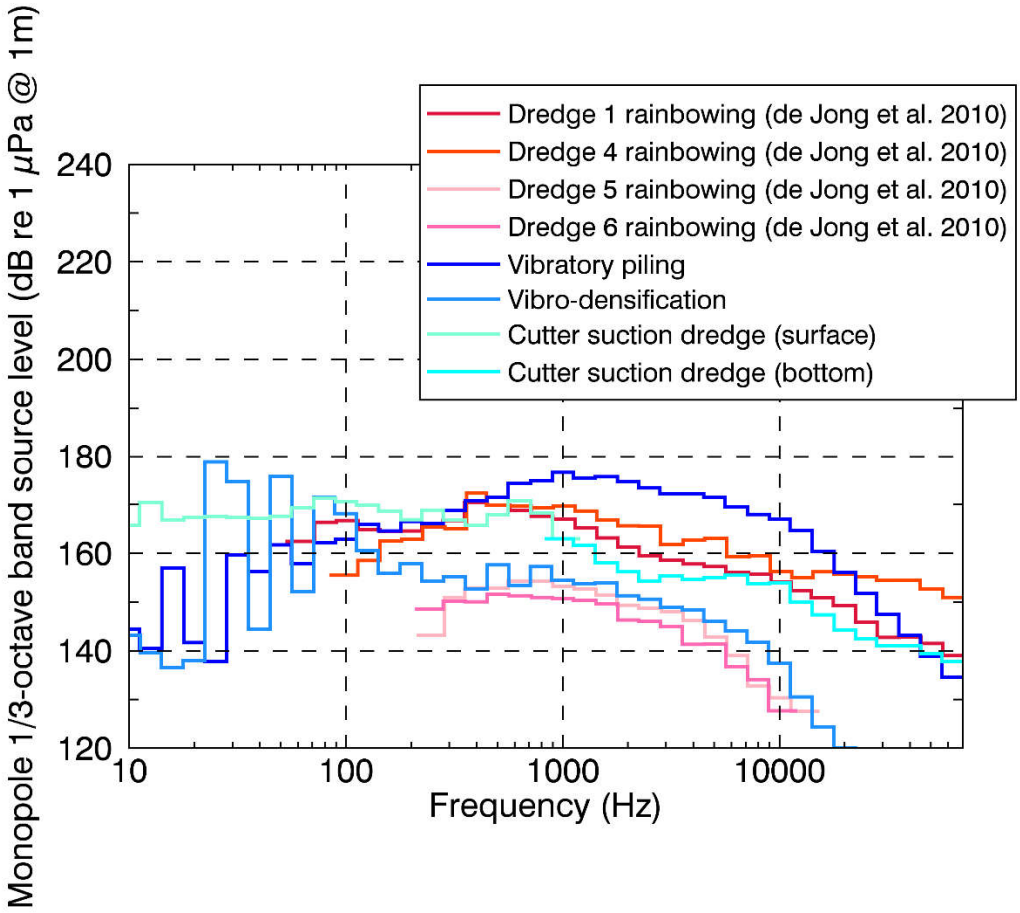

Figure 1. Monopole one-third octave band source levels for the four TSHDs performing rainbowing of sediment from de Jong et al. (2010) and previously modelled RBT2 construction activities (vibratory piling, vibro-densification and cutter suction dredge). Dipole source levels from de Jong et al. (2010) were converted to monopole source levels, according to the method described in their report, to permit comparison with monopole source levels used in modelling of RBT2 activities (EIS Appendix 9.8-A).

Communications with one of the study authors (C. de Jong, pers. comm., 4 Apr 2018) suggested that dredges 5 and 6 were most similar in size and power to the *FRPD309* dredge (these dredges had a total installed power of 6-7 MW). Furthermore, information provided in their report suggests that measurements of dredges 5 and 6 were obtained without thruster noise, whereas thruster noise (i.e., from dynamic positioning) was present in measurements of dredges 1 and 4. Note, however, that thruster activity was

identified by the authors purely on the basis of the acoustic recordings, so there remains some uncertainty as to the source of differences between their four rainbowing measurements.

Rainbowing source levels of dredges 5 and 6 are similar to those of vibro-densification (the quietest activity) over the reported frequency range. Rainbowing source levels of dredges 1 and 4 are comparable to those of the cutter suction dredge and lower than vibratory piling (the loudest activity) over most of the reported frequency range. Dredge 4 is approximately 10 dB higher than vibratory piling above 25 kHz, but it is likely that noise emissions at these frequencies are related to thruster cavitation rather than pump operation, which would not be present for an anchored THSD. Furthermore, sound levels above 25 kHz contribute very little to the broadband source pressure levels used for assessing behavioural effects on marine mammals and marine fish in the RBT2 EIS (Sections 14 and 13, respectively).

3.0 CONCLUSION

Rainbowing source levels for dredges 5 and 6, presented in de Jong et al. (2010), appear to be the best available surrogates for pumping ashore noise from *FRPD309,* based on THSD specifications and operations. Due to uncertainty regarding the specific machinery operating at the time of measurement, however, source levels for dredges 1 and 4 may also be considered as conservative surrogates for this activity. Rainbowing source levels for all four TSHDs did not exceed the loudest construction activity previously modelled at RBT2 (i.e., vibratory piling)). This suggests that noise from *FRPD309* pumping ashore would not exceed existing behavioural effects thresholds for marine mammals and fish, based on modelling of broadband SPL for previously assessed activities.

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