



PORT of  
**vancouver**

**PROJECT AND ENVIRONMENTAL REVIEW REPORT**  
**PER NO. 16-179**  
**SEDIMENT REMEDIATION AND DIKE CONSTRUCTION**

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		<b>VANCOUVER FRASER PORT AUTHORITY PROJECT AND ENVIRONMENTAL REVIEW REPORT</b>	
<b>PER No.:</b>	<b>16-179</b>		
<b>Tenant:</b>	<b>Anthem Duncan Developments LTD.</b>		
<b>Project:</b>	<b>Sediment Remediation and Dike Construction</b>		
<b>Project Location</b>	<b>41 and 175 Duncan Street in New Westminister, British Columbia</b>		
<b>VFPA SID No.:</b>	<b>NEW327</b>		
<b>Land Use Designation:</b>	<b>Industrial</b>		
<b>Applicant:</b>	<b>Anthem Duncan Developments LTD.</b>		
<b>Category of Review:</b>	<b>C</b>		
<b>Recommendation:</b>	<b>That PER No. 16-179 for Sediment Remediation and Dike Construction be approved.</b>		

## 1 INTRODUCTION

The Vancouver Fraser Port Authority (VFPA), a federal port authority, manages lands under the purview of the *Canada Marine Act*, which imparts responsibilities for environmental protection. VFPA accordingly conducts project and environmental reviews of works and activities undertaken on these lands to ensure that the works and activities will not likely cause significant adverse environmental effects. This project and environmental review report documents VFPA's project and environmental review PER No. 16-179: Sediment Remediation and Dike Construction (the Project) proposed by Anthem Duncan Developments LTD. (the Applicant).

This project and environmental review was carried out to address VFPA's responsibilities under the *Canada Marine Act*, and to meet the requirements of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012), as applicable. The proposed Project is not a CEAA 2012 "designated project" and an environmental assessment as described in CEAA 2012 is not required. However, VFPA authorization is required for the proposed Project to proceed and in such circumstances, where applicable, Section 67 of CEAA 2012 requires federal authorities to assure themselves that projects will not likely cause significant adverse environmental effects. The project and environmental review process is designed to provide that assurance. In addition, VFPA considers other interests, impacts and mitigations through the project and environmental review.

The project and environmental review considered the application along with supporting studies, assessments and consultations carried out or commissioned by the Applicant, as well as other information provided by the Applicant. In addition, this project and environmental review considered other information available to VFPA and other consultations carried out by VFPA. A full list of information sources germane to the review is provided in Appendix B.

This project and environmental review report is NOT a project authorization. This project and environmental review report summarizes the review outcome, and provides the basis for approval or denial. Should the Project be approved, the report is accompanied by a project permit (the Permit) and the conclusions described in this report require compliance with the conditions in the Permit.

## 2 PROJECT DESCRIPTION

Anthem proposes to construct a townhouse development and dike at 41 and 175 Duncan Street, which was previously the location of an industrial facility. The townhouse development is completely outside of the VFPA's jurisdiction. The dike is largely outside of VFPA's jurisdiction except for some downslope and near water activities (i.e. grading and rip rap placement) occurring within VFPA jurisdiction. The Project scope as proposed in the port authority's jurisdiction includes water lot and foreshore structure demolition and removal, remedial dredging, vegetation removal, rip rap placement, and temporary construction activities to support dike construction.

### 2.1 Proposed Works

The proposed works at the shoreline of 41 and 175 Duncan Street in New Westminster include:

#### Phase 1: Sediment Remediation and Water Lot Cleanup

- Removal of a concrete retaining wall and any remaining anthropogenic debris in the water lot;
- Shallow remedial dredging (to approximate depths of one metre below grade) of sediments in three contaminated areas along the intertidal shoreline. These are known as Risk Management Area 1 (approximately 169.4 m<sup>3</sup>), Risk Management Area 2 (approximately 2,153 m<sup>3</sup>), and Risk Management Area 3 (approximately 549.4 m<sup>3</sup>);
- Placement of sediment and debris into interim containers prior to upland disposal. Containers would be removed from the site daily by truck or barge to an approved disposal facility;
- Placement of clean Fraser River sand equal to the volume of removed sediment (approximately 3,000 m<sup>3</sup>) to backfill dredged areas to pre-dredge bathymetry; and
- Removal of riparian vegetation and one black cottonwood tree.

#### Phase 2: Dike Construction Activities

- Limited excavation, stock piling, and backfilling activities to support dike construction. All other dike construction activities are outside the port authority's jurisdiction;
- Grading and rip rap installation; and
- Removal of up to seven black cottonwood trees.

Construction would take approximately six months starting in July or August 2019. Water lot activities will be completed first during summer and early fall to accommodate tide cycles. Dike construction is anticipated to take several months. Project construction hours will adhere to VFPA's standard hours of construction from 7am – 8pm Monday to Saturday with no work on statutory holidays. The proposed works would be during the Fisheries and Ocean Canada's recommended least-risk work window for the area, which is June 16 to February 28.

### 2.2 Proposed Construction Methods

The majority of demolition and construction activities for the Project are proposed within the intertidal zone of the Lower Fraser River between the low watermark and the high watermark. The remaining works in VFPA jurisdiction occur near water, slightly upland of the high watermark.

In-water and near-water works include excavation, dredging, backfilling, and debris removal. Dredging and water lot cleanup will occur during low tide from land. Upland works include sediment and soil handling and storage, vegetation removal, and activities to support portions of the dike construction. Resuspension and dispersion of contaminated sediment during clamshell dredging will be limited by the use of an environmental clamshell bucket, sediment curtains, and working during

low tide. Once dredged, contaminated sediment will be stabilized and hardened for transport using cement. There will be no on-site dewatering. Once remedial dredging is complete, clean Fraser River sand will be used to backfill the dredged footprint to pre-dredge bathymetry.

Works would require land-based equipment with support from marine vessels and equipment. Removed materials will be transported by truck off site through Anthem's upland residential development construction site.

### **3 VANCOUVER FRASER PORT AUTHORITY INTERNAL REVIEWS**

The following VFPA departments have reviewed the application and have the following project considerations.

#### **3.1 Planning**

Planning has reviewed the application and has the following land use comments.

The proposal meets Planning's requirements, based on the primary considerations of the land use designation and current land use policies. The Project conforms to the designation of "Industrial" in Vancouver Fraser Port Authority's Land Use Plan. Public access to VFPA jurisdiction will not be encouraged or facilitated by the Project. Anthem will install a fence blocking public access to the dike and VFPA jurisdiction.

#### **3.2 Engineering**

Engineering has reviewed the application and requires the Applicant to ensure the following:

- Submit signed and sealed Issued for Construction (IFC) drawings at least 5 business days prior to the start of construction for the review and approval by the VFPA.
- Submit signed and sealed record drawings within 40 business days of completion of all physical activities.

These are reflected in conditions No. 16 and 49 in the Permit.

A geotechnical assessment by Advisian identified presence of loose saturated sands underlying the construction site, which suggested a significant potential for liquefaction to occur under seismic loading. The dike will be constructed to accommodate the anticipated settlement associated with the appropriate seismic loading and meet post-earthquake performance criteria per the applicable seismic design guidelines.

The proposal meets Engineering Department's requirements, subject to adherence to the listed project and environmental conditions in the Permit.

#### **3.3 Transportation**

Transportation has reviewed the Traffic Management Plan and have determined that it is satisfactory. While construction-related traffic is anticipated from the project, the traffic associated with sediment removal from VFPA jurisdiction is minor relative to the amount of construction traffic related to the upland residential development site outside of VFPA jurisdiction. The Applicant consulted the City of New Westminster on the potential land-based transportation impacts.

### 3.4 Marine Operations

The proposed Project intends to use and stage marine equipment in the Fraser River to conduct the remedial excavation. Marine Operations reviewed the application and requires the Applicant to:

- Submit a marine construction and staging plan, to VFPA's satisfaction, at least 20 business days prior to commencing construction.

This is reflected in condition No. 21 in the Permit.

The proposal meets Marine Operations' requirements, subject to adherence to the listed project and environmental conditions in the Permit.

## 4 STAKEHOLDER CONSULTATION

The proposed Project was assessed to have potential impacts to stakeholders and the local community and consultation activities were determined to be required. The following sections describe the stakeholder and public consultation activities undertaken by the Applicant and VFPA as part of the project and environmental review.

### 4.1 Municipal Consultation

The Project was assessed to have potential impacts to municipal interests. A referral letter was sent to the City of New Westminster on December 18, 2018, providing notification of the proposed Project.

The City of New Westminster responded with comments related to the upland residential development within the City's jurisdiction on January 23, 2019. No comments related to this Project (PER 16-179) within VFPA's jurisdiction were received.

### 4.2 Federal, Provincial, Regional Agency Consultation

VFPA did not conduct consultation activities with other regulatory agencies. The Applicant has been in consultation with several regulatory agencies including the regional diking authority and Fisheries and Oceans Canada.

### 4.3 Adjacent Tenant Consultation

The proposed Project was assessed to have potential impacts to adjacent VFPA tenant operations. A referral letter was sent to the following Harken Towing on December 18, 2018 notifying them of the proposed Project.

VFPA did not receive any tenant comments.

## 5 PUBLIC CONSULTATION

The proposed Project was assessed by VFPA to have minimal or no potential impacts to community interests upon completion of the project. Therefore public consultation was not required to be conducted by the Applicant during the permit review. A description of the Project and proposed works, and all supporting material were posted to VFPA's PER Project website page in October 2018.

The proposed Project was assessed by VFPA to have potential impacts to community interests during construction. These include potential noise and visual impacts.

As a result, the Applicant is required to send a construction notice to adjacent residents and businesses in Vancouver as shown in the map below. The notification area is within approximately four blocks (500 m) from the project site. The construction notice shall be distributed by the Applicant at least 10 business days prior to the start of the works. This is reflected in conditions No. 17 and 18 in the project permit.

*Map of notification area*



## 6 INDIGENOUS CONSULTATION

VFPA reviewed the application and determined that Indigenous consultation was required given that the Project has the potential to adversely affect asserted or established Aboriginal rights.

The following Indigenous groups were consulted:

- Cowichan Tribes
- Halalt First Nation
- Hwilitsum First Nation
- Katzie First Nation
- Kwantlen First Nation
- Kwikwetlem First Nation
- Lake Cowichan First Nation
- Lyackson First Nation
- Musqueam Indian Band
- Penelakut Tribes

- Semiahmoo First Nation
- Sto:lo Nation and Tribal Council, via People of the River Referrals Office
- Stz'uminus First Nation
- Tsawwassen First Nation
- Tsleil-Waututh Nation.

The following consultation activities were conducted:

- On September 24, 2018, VFPA sent a referral package to each of the Indigenous groups listed above. The referral package included:
  - Project Application
  - Project Description
  - Archaeological Overview Assessment
  - Archaeological Impact Assessment Methodology and Memorandum
  - Construction Environmental Management Plan
  - DFO Self-Assessment
  - Site Demolition Plan
  - Site Investigation, Risk Assessment and Remediation Plan Report
- VFPA offered participation funding to each of the Indigenous groups to facilitate their participation in the project and environmental review process. Participation funding was provided to those Indigenous groups who signed and fulfilled the obligations set forth in the participation funding agreement.
- VFPA received comments from Indigenous groups in the form of letters, emails and phone calls. VFPA responded to Indigenous groups by way of letters and email correspondences.
- No meetings were requested by Indigenous groups.

Below is a table summarizing comments received by VFPA and how they were considered as part of the project and environmental review.

Issue	Considerations	Mitigations and Permit Conditions
<p>Concern regarding impacts to fish</p> <p>Recommend project activities take place in least-risk work windows, November to April, to minimize impacts to salmon runs.</p>	<p>VFPA's assessment is that the proposed project works are unlikely to cause serious harm to sturgeon or other fish due to proposed mitigations. Mitigation measures include use of a turbidity curtain and environmental dredging bucket to restrict sediment suspension, working within the DFO timing window for least risk to fish, and using an environmental monitor to observe construction activities. Additional timing restrictions beyond DFO's least risk window are not warranted.</p>	<p>Per condition No. 30, there shall be no in-water activity during the fisheries sensitive period from March 1 to June 15, inclusive.</p> <p>Additionally, as per condition No. 19, the Permit Holder shall submit a CEMP that includes details on the installation and maintenance of erosion and sediment control measures, including turbidity curtains, and the management, stabilization and dewatering of sediment prior to transport.</p>

Issue	Considerations	Mitigations and Permit Conditions
Inquired about opportunities for offsetting measures.	The Applicant's self-screening assessment determined that serious harm to commercial, recreational or Aboriginal fishery species is unlikely. Offsetting within the context of the <i>Fisheries Act</i> is not required because of this determination. Revegetation will be required to offset the destruction of riparian vegetation.	Per condition No. 39, the Permit Holder shall submit a Riparian Vegetation Compensation Plan.
Sediment curtains should be used in order to prevent contaminated soil/broken concrete from being carried away between "out of water" work	VFPA will include the use of sediment control measures as a permit condition.	Per condition No. 19, the Permit Holder shall submit a CEMP that includes details on the installation and maintenance of erosion and sediment control measures, including turbidity curtains, and the management, stabilization and dewatering of sediment prior to transport.
Request for project monitoring reports	VFPA will require the Environmental Monitor to share reports directly with interested Indigenous groups, if requested.	VFPA will require the Environmental Monitor to share reports directly with interested Indigenous groups, if requested.
Concern regarding cumulative impacts on First Nations ability to exercise rights to fish in the Fraser River	Formally assessing cumulative effects is not a requirement for projects reviewed under Section 67 of the <i>Canadian Environmental Assessment Act, 2012</i> . However, VFPA understands that cumulative effects on the environment are important to Indigenous groups and the public. VFPA currently takes into account cumulative effects by considering existing projects in the assessment, particularly for air and noise emissions, and including biophysical studies with a focus on species at risk and declining species which have been most affected by cumulative effects from past development. As part of consultation during the Project and Environmental Review process, VFPA also welcomes input on cumulative environmental effects from proposed projects.	None required.

Issue	Considerations	Mitigations and Permit Conditions
<p>Inquired if measures would be put in place to support riparian habitat where riparian vegetation and trees are being removed</p> <p>Riparian planting requirements and slope stabilization measures must use native plant and grass species only.</p>	<p>The majority of existing riparian vegetation and trees in VFPA jurisdiction will be retained. Trees being removed from the west foreshore area are within a higher productivity area, however these are outside of VFPA jurisdiction and review.</p> <p>Replanting riparian vegetation will be a condition of approval. The Applicant will be required to submit a Riparian Vegetation Compensation Plan for on-site compensation. In the case that on-site compensation is not possible, the Applicant must facilitate off-site compensation with the local municipality or with a local non-profit organization that specializes in ecological conservation and enhancement.</p>	<p>Per condition No. 39, the Permit Holder shall submit a Riparian Vegetation Compensation Plan prior to removing any vegetation.</p> <p>Additionally, as per Condition 48, the Permit Holder shall submit proof of meaningful completion of works associated with the Riparian Vegetation Compensation Plan.</p>

Issue	Considerations	Mitigations and Permit Conditions
<p>Concern regarding impacts to archaeological and heritage resources and sites.</p> <p>Request an Archaeological Impact Assessment (AIA) be conducted prior to earthworks, and does not impact traditional or special sites</p> <p>Expressed concern with the project being in an area of high archaeological potential and inquired if additional days would be allocated for an AIA (as opposed to a one day AIA)</p> <p>Requires a field technician provide oversight during archaeological activities</p>	<p>Due to site restrictions and safety considerations, the qualified archaeologist retained by the Applicant proposed that the AIA be done concurrently with proposed project works. The AIA methodology was included in VFPA’s September 24, 2018 referral package.</p> <p>The Applicant completed an Archaeological Overview Assessment (AOA), which was attached to VFPA’s referral package, sent on September 24, 2018. The AOA recommended that an Archaeological Impact Assessment (AIA) be completed for one particular area, labelled as AOP1 on the AOA Map.</p> <p>The Applicant’s preferred methodology for conducting the AIA would be concurrent with proposed project works. An AIA methods memo was shared with Indigenous groups that outlines how the Applicant intends to conduct the AIA. This AIA methodology will be an addendum to the Construction Environmental Management Plan (CEMP) and is not meant to supersede or replicate anything already in the CEMP. The AOA also recommend that a Chance Find Procedure be in place for project works. The Applicant has submitted a Chance Find Procedure that VFPA has deemed satisfactory.</p>	<p>As per condition No. 26, if the Permit Holder encounters, expects to encounter, or should expect to encounter an actual or potential archaeological resource, the Permit Holder shall follow the Chance Find Protocol prepared by Archer and submitted to VFPA on November 22, 2018.</p> <p>Furthermore, the Permit Holder shall provide opportunities for interested Indigenous groups to monitor and be present on the Project site during ground disturbance activities, per Condition 28.</p>

Based on the record of consultation, VFPA is of the view that the duty to consult has been met.

## 7 ENVIRONMENTAL REVIEW

To fulfill its responsibilities under the *Canada Marine Act* and CEEA 2012, VFPA must make a determination on the potential environmental effects of a proposed project on VFPA managed lands and waters prior to authorizing those works to proceed. To make that determination, VFPA considers the residual adverse effects of the Project, that is, the effects after mitigation measures have been taken into account.

This section of the project and environmental review report summarizes the environmental review conducted for the Project, and provides the environmental review decision. The environmental review also considered the information provided in the previous sections of this report.

## 7.1 Scope of Environmental Review

The environmental review includes consideration of the potential environmental effects of the proposed Project, taking into account mitigation measures to avoid or reduce those effects. This review considered the Project components and physical activities described in Section 2.

The temporal scope of the review includes Project construction. The environmental review considered potential adverse environmental and social effects of the Project on 14 environmental components (e.g., species with special status, aquatic species and their habitat, recreational interests, etc.) and from accidents and malfunctions. These environmental components are aspects of the biophysical and socio-economic environment considered to have ecological, economic, social, cultural, archaeological, or historical importance.

The environmental components assessed by the VFPA are presented in Section 7.2 and include the environmental effects listed in section 5(1) and 5(2) of CEAA 2012.

Section 7.2 summarizes the results of the environmental review.

## 7.2 Environmental Effects Summary

The following table summarizes the potential environmental effects from the Project on the identified environmental components.

Environmental Component	Potential Adverse Effects?		Overview of Potential Adverse Effects, Mitigation Measures, and Residual Adverse Effects	Significant Residual Adverse Effects?	
	Yes	No		Yes	No
<b>Air quality</b> Assessed as required under subsection 5(1) and 5(2) of CEAA 2012	<input checked="" type="checkbox"/>	<input type="checkbox"/>	There is potential for adverse effects on air quality during construction activities from equipment operation. Mitigation measures to reduce the potential for adverse effects will be implemented as detailed in the CEMP. This includes an idling reduction, proper equipment maintenance, and turning off emission sources when not in use.  With mitigation in place, residual adverse effects on air quality are expected to be not significant.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>Lighting</b> Assessed as required under subsection 5(1) and 5(2) of CEAA 2012	<input type="checkbox"/>	<input checked="" type="checkbox"/>	The project is not expected to affect lighting.	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Environmental Component	Potential Adverse Effects?		Overview of Potential Adverse Effects, Mitigation Measures, and Residual Adverse Effects	Significant Residual Adverse Effects?	
	Yes	No		Yes	No
<p><b>Noise</b></p> <p>Assessed as required under subsection 5(1) and 5(2) of CEAA 2012</p>	■	<input type="checkbox"/>	<p>There is potential for adverse noise effects during construction activities.</p> <p>Mitigation measures to reduce the potential for adverse effects will be implemented as detailed in the CEMP. Construction work will be conducted only during regular hours. Construction noise is anticipated to have minimal adverse effects due to the location of the project site (adjacent to active construction site upland), works being limited to regular hours, and the mitigation measures implemented.</p> <p>With mitigation in place, residual adverse effects on noise are expected to be not significant.</p>	<input type="checkbox"/>	■
<p><b>Soils</b></p> <p>Assessed as required under subsection 5(1) and 5(2) of CEAA 2012</p>	■	<input type="checkbox"/>	<p>There is potential for excavation and storage of soil and fill to affect soil quality.</p> <p>A small portion of the Project is located upland of the high water mark. Upland activities include soil excavation, soil storage, vegetation removal, and berming in support of dike construction. Mitigation measures outlined in the CEMP will be implemented to mitigate soil admixing, contamination, and erosion.</p> <p>Proper management and transfer techniques will be used to prevent the release of contaminated sediment into upland soils during sediment handling transportation procedures. A spill prevention, containment and clean-up plan will be implemented prior to works to limit hydrocarbon contamination. Erosion and sediment control measures will be implemented to minimize loss of surface soils.</p> <p>With mitigation in place, residual adverse effects on soil quality are expected to be not significant.</p>	<input type="checkbox"/>	■

Environmental Component	Potential Adverse Effects?		Overview of Potential Adverse Effects, Mitigation Measures, and Residual Adverse Effects	Significant Residual Adverse Effects?	
	Yes	No		Yes	No
<p><b>Sediments</b></p> <p>Assessed as required under subsection 5(1) and 5(2) of CEAA 2012</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<p>There is potential for project activities to affect sediment quality.</p> <p>Dredging of the contaminated sediment within the Project area will have an overall net positive effect on sediment quality.</p> <p>During dredging activities there is potential for contaminated sediment to be resuspended in the water column and to settle elsewhere.</p> <p>Mitigation measures outlined in the CEMP will be implemented during construction to reduce resuspension of contaminated sediment during dredging activities. Mitigation measures include using an environmental clamshell bucket and using a sediment curtain, where feasible. The environmental monitor will monitor induced turbidity (resuspension) from dredging and can recommend curtailing or stopping works, and changing construction activities or methods. A spill prevention, containment and clean-up plan will be implemented prior to works.</p> <p>Sediment used to backfill the dredged areas will be environmentally clean Fraser River sand and will meet the CCME Sediment Quality Guidelines for the Protection of Aquatic Life.</p> <p>With mitigation in place, there are no residual adverse effects on sediment quality.</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<p><b>Groundwater</b></p> <p>Assessed as required under subsection 5(1) and 5(2) of CEAA 2012</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<p>The project is not anticipated to affect groundwater.</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Environmental Component	Potential Adverse Effects?		Overview of Potential Adverse Effects, Mitigation Measures, and Residual Adverse Effects	Significant Residual Adverse Effects?	
	Yes	No		Yes	No
<p><b>Surface water and water bodies</b></p> <p>Assessed as required under subsection 5(1) and 5(2) of CEAA 2012</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<p>There is potential for adverse effects on surface water and water bodies from dredging and backfill placement. Potential adverse effects are anticipated to be limited increased turbidity and total suspended solids (TSS) concentrations.</p> <p>During spring and summer background levels of TSS is naturally high due to run off from snowmelt upstream. The volume and extent of dredging and backfill placement in-water is relatively small (&lt;3,000 m<sup>3</sup>) and the increased turbidity from dredging and backfill placement compared to background will be minimal.</p> <p>To mitigate the potential sedimentation effects from increased TSS, sediment (turbidity) curtains will be used, where feasible. No dredging will occur in the fisheries sensitive period for Fraser River. Mitigation measures outlined in the CEMP will be implemented during construction to mitigate off-site transport of sediment. The environmental monitor will monitor turbidity and will recommend additional mitigation if induced turbidity is above Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines for the Protection of Aquatic Life. Additional mitigation includes curtailing or stopping works, and changing construction activities or methods.</p> <p>With mitigation in place, residual adverse effects on surface water and water bodies are expected to be not significant.</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Environmental Component	Potential Adverse Effects?		Overview of Potential Adverse Effects, Mitigation Measures, and Residual Adverse Effects	Significant Residual Adverse Effects?	
	Yes	No		Yes	No
<p><b>Species/habitat with special status</b></p> <p>Assessed as required under subsection 5(1) of CEAA 2012</p> <p>Assessed under section 79 of the <i>Species at Risk Act (SARA)</i>, as applicable</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<p>There is potential for adverse effects on species with special status during construction activities.</p> <p>Federally SARA-listed aquatic species with ranges that overlap with the Project site include green sturgeon (Special Concern) and Steller sea lion (Special Concern). Although not listed in the <i>Species at Risk Act</i>, the eulachon Fraser River population (COSEWIC-listed as Endangered) and the white sturgeon Lower Fraser River population (COSEWIC-listed as Threatened) have potential to occur within the Project site.</p> <p>Within the foreshore areas there is foraging and roosting habitat for great blue heron (Special Concern) and peregrine falcon (Special Concern).</p> <p>Mitigation measures to reduce the potential for adverse effects will be implemented as detailed in the CEMP. These include: construction works will be conducted within the fisheries least-risk window (August 16 to February 28), avoid certain physical activities during the general bird breeding season (April 1 to July 31), and have an Environmental Monitor on-site who will stop works if distressed or impacted wildlife are observed. If fin fish such as sturgeon are trapped by the sediment curtain, a fish salvage will be completed at the discretion of the environmental monitor. These mitigation measures will be described in the updated CEMP (Condition No. 19).</p> <p>SARA listed Threatened or Endangered species will not likely be affected by the Project and there is no federally designated critical habitat within the Project footprint.</p> <p>With mitigation in place, residual adverse effects on species/habitat with special status are expected to be not significant.</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Environmental Component	Potential Adverse Effects?		Overview of Potential Adverse Effects, Mitigation Measures, and Residual Adverse Effects	Significant Residual Adverse Effects?	
	Yes	No		Yes	No
<p><b>Terrestrial resources</b> (e.g., vegetation, wildlife, etc.)</p> <p>Assessed as required under subsection 5(1) and 5(2) of CEAA 2012</p>	■	<input type="checkbox"/>	<p>There is potential for adverse effects to terrestrial resources during construction activities.</p> <p>Although wildlife may be displaced during construction works (e.g., from construction noise), activities will be short-term in duration and wildlife are expected to return to the area after Project completion. The Project site is located within the Boundary Bay Roberts Bank – Sturgeon Bank (Fraser River Estuary) Important Bird Area. However, there is no unique habitat for birds within the Project site. The types of habitats in the Project area do not appear to be limited to the area.</p> <p>Riparian vegetation will be removed from up to 450 m of the shoreline for project construction. Riparian vegetation includes western red cedar, black cottonwood, hardhack, thimbleberry, snowberry, Nootka rose, salmonberry, thimbleberry, other native shrub species and the invasive Himalayan blackberry. The riparian vegetation productivity ranges from low to moderate. Approximately 92 m of the shoreline was assessed as moderately productive. One black cottonwood tree will be removed from Risk Management Area 3 to enable remedial activities and another seven black cottonwoods would be removed to enable dike construction activities.</p> <p>Mitigation measures outlined in the CEMP will be implemented during construction including marking the trees that will be removed, protecting all other trees with setbacks and barriers, and identifying areas with invasive plant species to limit their potential spread.</p> <p>A Riparian Vegetation Compensation Plan will be prepared, and implemented, to compensate for the loss of moderate or high productivity riparian vegetation (Condition 39).</p> <p>With mitigation in place, residual adverse effects on terrestrial resources are expected to be not significant.</p>	<input type="checkbox"/>	■

Environmental Component	Potential Adverse Effects?		Overview of Potential Adverse Effects, Mitigation Measures, and Residual Adverse Effects	Significant Residual Adverse Effects?	
	Yes	No		Yes	No
<p><b>Wetlands</b></p> <p>Assessed as required under subsection 5(1) and 5(2) of CEEA 2012</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<p>The project is not anticipated to affect wetlands.</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<p><b>Aquatic resources</b> (e.g., aquatic plants, fish and fish habitat, waterbirds, marine mammals, etc.)</p> <p>Assessed as required under subsection 5(1) of CEEA 2012</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<p>There is potential for adverse effects on aquatic resources during construction activities.</p> <p>Remedial dredging and water lot cleanup activities will disturb the benthic environment and can increase turbidity throughout the water column.</p> <p>The Project footprint is within the upstream limits of the salt wedge within the Fraser River. Commercial, recreational, and Aboriginal fishery species and fish species of concern that can occur in the Project footprint include but are not limited to Pacific salmon, cutthroat trout, eulachon, and white sturgeon.</p> <p>Mitigation measures outlined in the CEMP will be implemented during construction including working in the dry during low tide, having an environmental monitor on-site during all in-water works, only working during the fisheries least risk window for the area (June 16 to February 28), and using an environmental clamshell bucket.</p> <p>If fin fish are trapped by the sediment curtain, a fish salvage will be completed at the discretion of the environmental monitor. These mitigation measures will be described in the updated CEMP (Condition No. 19).</p> <p>With mitigation in place, residual adverse effects on aquatic resources are expected to be not significant.</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Environmental Component	Potential Adverse Effects?		Overview of Potential Adverse Effects, Mitigation Measures, and Residual Adverse Effects	Significant Residual Adverse Effects?	
	Yes	No		Yes	No
<p><b>Health and socio-economic conditions</b></p> <p>Assessed as required under subsection 5(1) and 5(2) of CEEA 2012</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<p>Based on the very low magnitude of residual effects on air and noise, the Project is not expected to cause adverse effects on health or socio-economic conditions of people, including Indigenous people.</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<p><b>Archaeological, physical, and cultural heritage resources</b></p> <p>Assessed as required under subsection 5(1) and 5(2) of CEEA 2012</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<p>There is potential for adverse effects on Archaeological, physical, and cultural heritage resources during construction activities.</p> <p>A site of high archaeological potential is located near Risk Management Area 3 on the eastern end of the Project footprint.</p> <p>The works will follow the recommendations made in the Archaeological Overview Assessment (AOA), Archaeological Impact Assessment (AIA), and the Chance Find Protocol. Specifically, but not limited to, conducting archeological surveys and monitoring during construction works.</p> <p>Further to these commitments, permit Condition 28 will require that interested Indigenous groups are provided opportunities to participate in archaeological monitoring and Condition 26 will require works to cease if archaeological resources are encountered.</p> <p>With mitigation measures in place, the proposed works are not anticipated to affect archaeological, physical, or cultural heritage resources.</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<p><b>Current use of lands and resources for traditional purposes by Aboriginal peoples</b></p> <p>Assessed as required under subsection 5(1) of CEEA 2012</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<p>The proposed works are not anticipated to affect current use of lands and resources for traditional purposes by Indigenous peoples.</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Environmental Component	Potential Adverse Effects?		Overview of Potential Adverse Effects, Mitigation Measures, and Residual Adverse Effects	Significant Residual Adverse Effects?	
	Yes	No		Yes	No
<p><b>Accidents and malfunctions</b></p> <p>Assessed as required by the <i>Canada Marine Act</i></p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<p>There is potential for adverse effects on surface water from accidental equipment leaks or spills of hydrocarbons or contaminated sediment.</p> <p>Mitigation measures will be in place to reduce potential for adverse, project-related effects due to accidents, by implementing the measures outlined in the CEMP.</p> <p>With mitigation measures in place, the effect of an accident or malfunction on the environment, if it were to occur, is predicted to be not significant.</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Residual adverse effects (i.e., effects that remain with mitigation in place) were identified for the following environmental components:

- Air quality;
- Lighting;
- Noise;
- Sediments;
- Surface water;
- Terrestrial resources;
- Aquatic resources;
- Archaeological, physical, and cultural heritage resources; and
- Accidents and malfunctions.

Overall, the residual adverse effects of the Project on all of the environmental components are characterized as:

- Low in magnitude due to minor and temporary impacts on surface water and aquatic resources and overall improvement to sediment quality after remedial dredging is complete;
- Local in geographic extent, because effects will be limited to the Project site and immediate vicinity;
- Short-term because the Project will duration is approximately eight months;
- Continuous (daily to weekly) in frequency during Project construction, however once construction is complete overall improvement to aquatic habitat is anticipated; and
- Reversible because residual adverse effects of the Project would cease once the Project construction is complete.

In conclusion, based on the characterization above, the mitigation measures proposed by the Applicant, and the permit conditions, the residual adverse environmental effects from the Project are predicted to be not significant.

### 7.3 Environmental Review Decision

In completing the environmental review, VFPA has reviewed and taken into account relevant information available on the proposed project, proposed mitigations provided by the Applicant, and additional technically and economically feasible mitigation measures. In accordance with section 67 of CEAA 2012, VFPA concludes that with the implementation of proposed mitigation measures and Permit conditions, the Project is not likely to cause significant adverse environmental effects.

*Original Copy Signed*

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**ANDREA MACLEOD**  
**MANAGER, ENVIRONMENTAL PROGRAMS**

July 8, 2019

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**DATE OF DECISION**

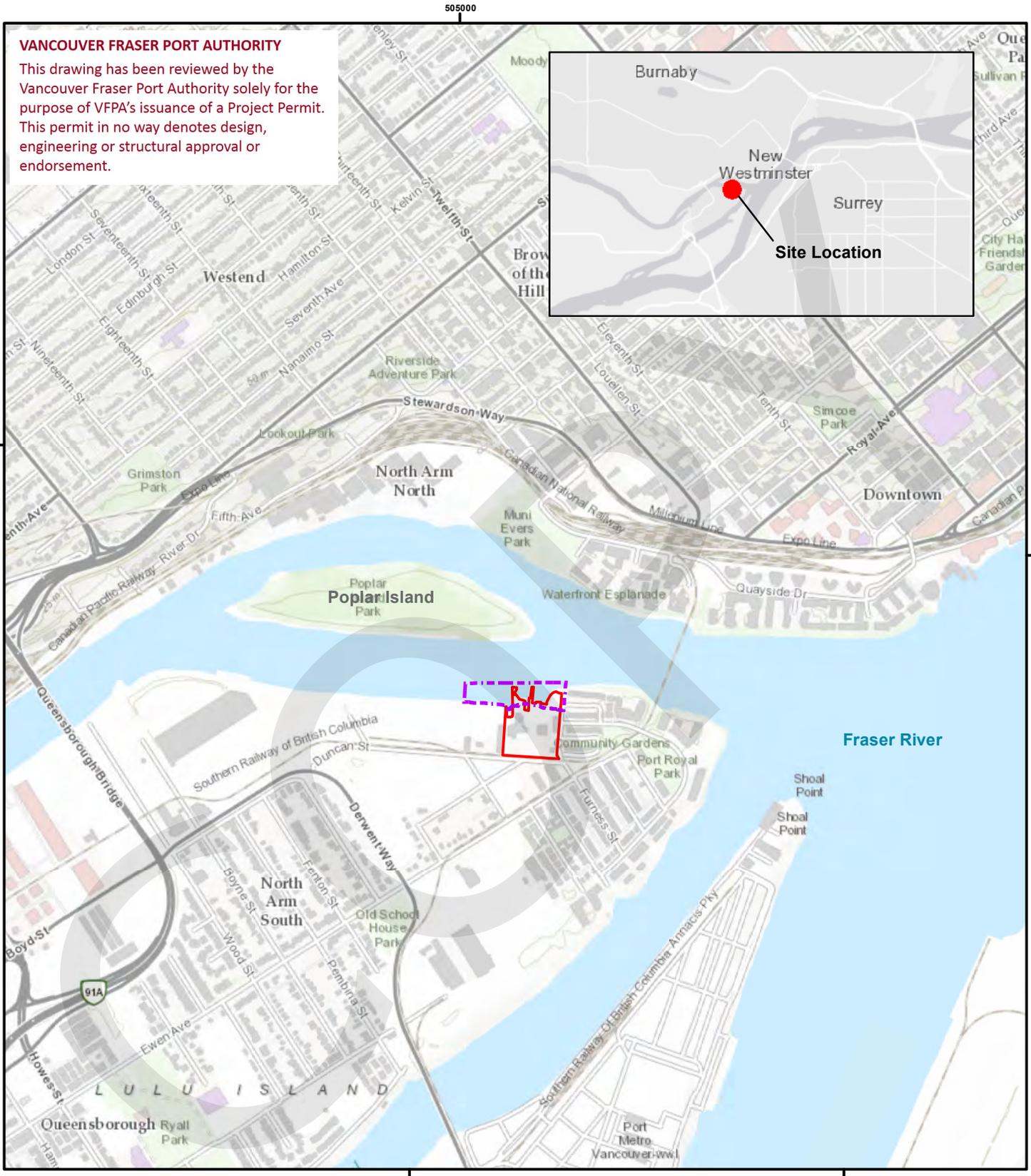
### 8 CONCLUSION

In completing the project and environmental review, VFPA concludes that with the implementation of proposed mitigation measures and conditions described in the Permit, the Project has appropriately addressed all identified concerns.

It is the recommendation of staff that this application be approved subject to conformance with the project and environmental conditions listed in project permit **PER No. 16-179**.

**APPENDIX A**  
**Location Plan and Figures**

FILE LOCATION: U:\YVR\30707101144 AP\_DuncanDike10\_Enq16\_Geomatics01\_Mxd\CEMP\Sediment Remediation and Dike Construction\Contractor\_CEMP\2018-07-24 Figure1-1\_Location.mxd



**VANCOUVER FRASER PORT AUTHORITY**  
 This drawing has been reviewed by the Vancouver Fraser Port Authority solely for the purpose of VFPA's issuance of a Project Permit. This permit in no way denotes design, engineering or structural approval or endorsement.



**Legend**

- Limit of VFPA Jurisdiction
- Site Location

0 50 100 200 300 Metres

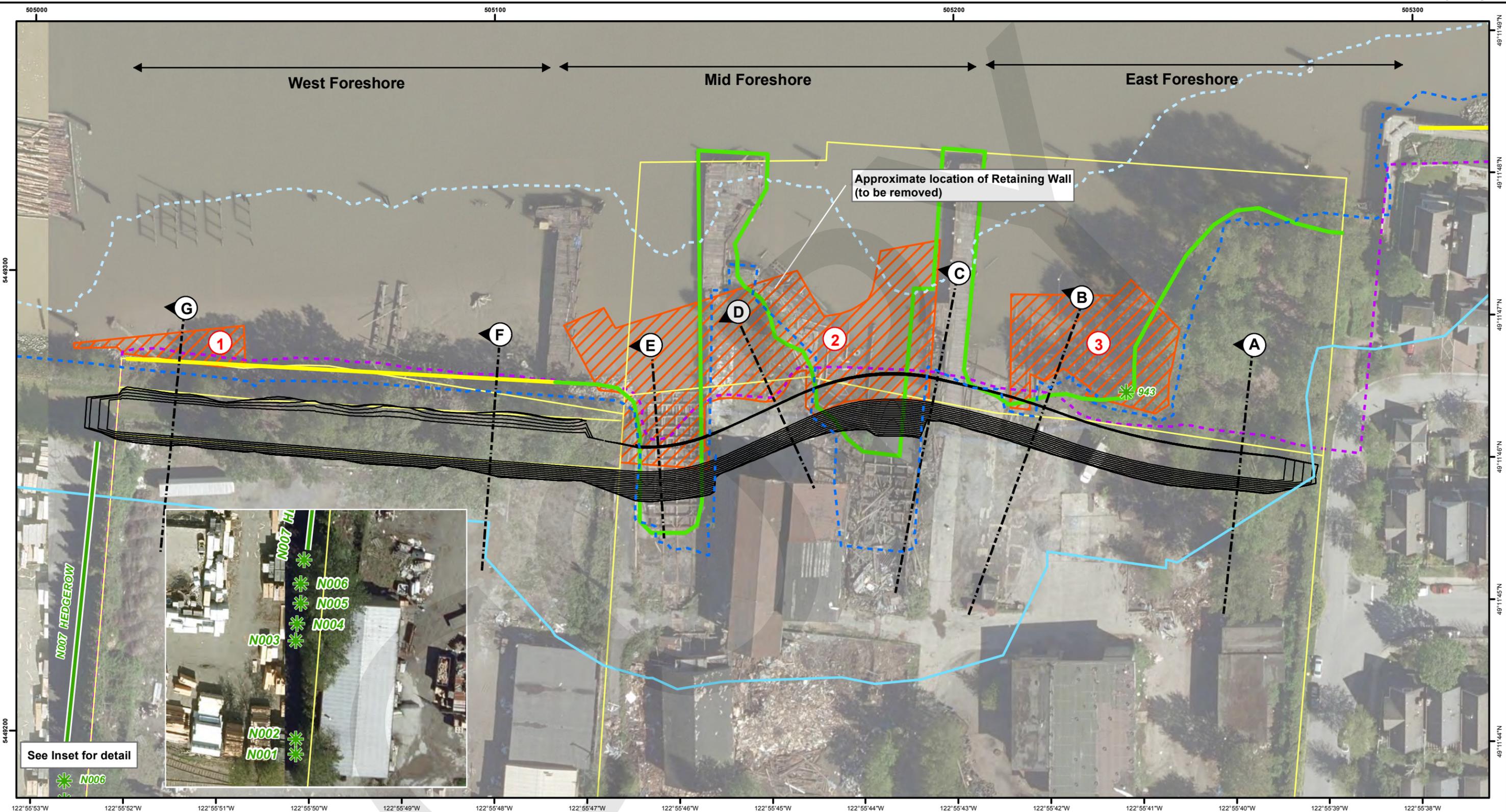
ASHEET	SCALE: SHOWN	CUSTOMER:
<b>OneWay</b> to zero harm.		
DATE:	24/07/2018	
DRAWN:	KR	
EDITED:	KR	
APPROVED:	VB	

"This drawing is prepared for the use of our customer as specified in the accompanying report. WorleyParsons Canada Ltd. assumes no liability to any other party for any representations contained in this drawing."

<p><b>Advisian</b> WorleyParsons Group</p>	
<p><b>ANTHEM PROPERTIES</b></p> <p><b>SITE LOCATION</b></p>	
WORLEYPARSONS PROJECT No: 307071-01144	FIG No: <b>1-1</b>
	REV <b>0</b>

USER NAME: kenneth.wright  
 ISSUING OFFICE: BURNABY GIS  
 PLOT DATE & TIME: 24/07/2018 12:28:37 PM  
 SAVE DATE & TIME: 24/07/2018 12:28:37 PM

FILE LOCATION: U:\VVR\30707101144 AP\_DuncanDike10\_Enq16\_Geomatics01\_Mxd\Project\_Description\2018-07-24\_Figure3-1\_Risk Management Areas Dike Footprint.mxd



- Legend**
- Tree
  - Limit of VFPA Jurisdiction
  - High High Water Level
  - Lot Boundary (Approx.)
  - Low Low Water Level
  - Risk Management
  - RAR 30m Buffer
  - Dike Layout

- Ground Truth Classification Based On Survey**
- Low Productivity
  - Moderate Productivity

**VANCOUVER FRASER PORT AUTHORITY**

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0 5 10 20  
Metres

Lot information from City of New Westminster.  
VFPA Jurisdiction supplied by Port of Vancouver.

B SHEET	SCALE: SHOWN	CUSTOMER:
<b>Oneway</b> to zero harm		
DATE:	24/07/2018	
DRAWN:	Y.M.	
EDITED:	K.R.	
APPROVED:	V.B.	

 WorleyParsons Group		
ANTHEM PROPERTIES		
<b>HABITAT CLASSIFICATIONS, RISK MANAGEMENT AREAS AND DIKE FOOTPRINT</b>		
WORLEYPARSONS PROJECT No: 307071-01144	FIG No: <b>3-1</b>	REV <b>0</b>

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

USER NAME: kenneth.w.ritchie  
ISSUING OFFICE: BURNABY GIS  
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**DESIGN CRITERIA:**

**1.0 GENERAL**

- DIKE DESIGN IS BASED ON THE FOLLOWING KEY GUIDELINES (THE GUIDELINES):
  - DIKE DESIGN AND CONSTRUCTION GUIDE, BEST MANAGEMENT PRACTICES FOR BRITISH COLUMBIA - MINISTRY OF WATER, LAND AND AIR PROTECTION, 2003
  - SEISMIC DESIGN GUIDELINES FOR DIKES, 2nd ED. - FLNRO, JUNE 2014.
- FLOOD ELEVATIONS ARE BASED ON PUBLISHED RESULTS AT 33km OF THE MIKE 11 FRASER RIVER FLOOD MODEL, DEVELOPED BY NORTHWEST HYDRAULIC CONSULTANTS (NHC, 2009; FLNRO, 2014).
- TYPICAL WATER LEVELS ARE BASED ON ELEVATIONS RECORDED AT NEW WESTMINSTER TIDE GAUGE (#7654), OPERATED BY CANADIAN HYDROGRAPHIC SERVICES.
- WATER LEVELS
  - 500 YEAR AEP, 1.0m SLR + 4.10m GD (DESIGN FLOOD)
  - 1894 FLOOD + 3.50m GD
  - 10 YEAR AEP FLOOD + 2.50m GD
  - MEAN ANNUAL HIGH + 2.23m GD
  - MEAN WALL LEVEL (MWL) + 0.54m GD
  - MEAN ANNUAL LOW - 1.47m GD
- THE DIKE IS TO BE CONSTRUCTED TO DESIGN CREST ELEVATION OF 4.8m GD TO ACCOMMODATE ANTICIPATED SETTLEMENT ASSOCIATED WITH DESIGN SEISMIC LOADING AND MEET POST-EARTHQUAKE PERFORMANCE CRITERIA PER SEISMIC DESIGN GUIDELINES.

**2.0 EROSION PROTECTION**

- ROCK RIPRAP DESIGN IS BASED ON THE APPROXIMATE SIZE OF EXISTING BANK PROTECTION, CONSTRUCTED IN 1978, WHICH IS IN REASONABLY GOOD CONDITION. ROCK SIZE IS STABLE UNDER AN ESTIMATED DESIGN FLOOD VELOCITY OF 2 m/s AND WAVE ACTION.
- TOE TREATMENT ASSUMES UP TO 2m OF SCOUR AT THE TOE OF THE DIKE. SITE OBSERVATIONS SUGGEST ONGOING SEDIMENT DEPOSITION IN THIS AREA.

**3.0 SEISMICITY**

- THE SITE IS CLASSIFIED AS SEISMIC SITE CLASS E IN ACCORDANCE WITH THE NATIONAL BUILDING CODE OF CANADA (NBCC 2015).
- SEISMIC HAZARD PARAMETERS:

EARTHQUAKE SHAKING LEVEL	RETURN PERIOD	PGA (@ GROUND SURFACE)	MAGNITUDE
EQL-1	100 YEAR	0.145	6.5
EQL-2	475 YEAR	0.239	7.0
EQL-3	2,475 YEAR	0.349	7.0

**GENERAL NOTES:**

**1.0 GENERAL**

- HYDROGRAPHIC SURVEY COMPLETED BY WESTMAR ON SEPTEMBER 6, 2007 USING A TRIMBLE PRO XRS 12/TSC1 AND A MERIDATA MD190 SOUNDER. TOPOGRAPHIC SURVEY COMPLETED BY MATSON PECK AND TOPLISS MPT ENGINEERING LTD. IN JULY-AUGUST 2007 (DRAWING No. 1552).
- ELEVATIONS AND CONTOURS ARE IN METERS, GEODETIC DATUM. HORIZONTAL COORDINATES ARE IN METERS, UTM, ZONE 10. CHART DATUM AT THE SITE IS -136m GD.
- APPROXIMATE LOCATION OF WATER LOT 177 AND THE GVRD WATER LINE RIGHT OF WAY INFORMATION WAS PROVIDED THROUGH EMAIL BY GARY TOSH OF VANCOUVER FRASER PORT AUTHORITY ON FEBRUARY 22, 2008.
- LOCATIONS AND ELEVATIONS OF EXISTING ELEMENTS AS SHOWN ON THE DRAWINGS ARE APPROXIMATE VALUES ONLY, AND ARE SUBJECT TO CONSTRUCTION VARIATIONS. THE CONTRACTOR SHALL VISIT THE SITE OF THE WORK, TAKE THEIR OWN MEASUREMENTS OF ALL EXISTING STRUCTURES, GROUND AND OTHER WORK. ALL DIMENSIONS AND DETAILS SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
- KEY PROJECT SPECIFICATIONS ARE PRESENTED BELOW FOR EASE OF REFERENCE. REFER TO ENGINEERING SPECIFICATIONS PACKAGE FOR DETAILS.

**2.0 SITE PREPARATION**

- STRIP AND REMOVE ALL EXISTING LOOSE DEBRIS, BOULDERS, ORGANIC MATERIALS, SOFT OR SATURATED SOILS AND OTHER DELETERIOUS MATERIALS WITHIN EXISTING SITE GRADE WITHIN THE WORK AREA.
- STRIP AND REMOVE ALL VEGETATION INCLUDING TREES, ROOTS, SHRUBS, GRASS AND OTHER UNSUITABLE MATERIALS FROM THE EXISTING DIKE PRIOR TO PLACING FILL.
- PROOF ROLL EXPOSED SUBGRADE WITH SEVERAL PASSES OF A HEAVY VIBRATORY ROLLER OR TRUCK (NOMINALLY 25T). REMOVE ALL SOFT OR UNSTABLE MATERIAL AS DIRECTED BY THE ENGINEER PRIOR TO PLACING FILL. REFER TO SPECIFICATIONS FOR DETAILS.
- DISPOSE OF ALL REMOVED MATERIALS OFF SITE.
- UPON COMPLETION OF THE WORK REMOVE ALL DEBRIS AND SURPLUS MATERIALS FROM THE SITE. LEAVE THE WORK AREA IN A NEAT AND CLEAN CONDITION TO THE SATISFACTION OF THE OWNER.
- THE OWNER'S ENGINEER SHALL MAKE A SUBGRADE INSPECTION PRIOR TO ANY MATERIAL PLACEMENT.

**3.0 ROCK MATERIALS USED FOR EROSION PROTECTION**

- TEST AT LEAST ONE SAMPLE OF ROCK FROM EACH QUARRY PROPOSED FOR USE AS A SOURCE OF ROCK FOR THE WORK FOR CONFORMANCE TO THE REQUIREMENTS OF THIS SECTION. EACH SAMPLE SHALL NOT WEIGH LESS THAN 100 KG AND SHALL BE ACCOMPANIED BY A STATEMENT WITH A COPY TO THE ENGINEER INDICATING THE EXACT LOCATION OF THE QUARRY.
- ALL ROCK MATERIALS SHALL BE ROUGH ANGULAR QUARRIED STONE OF A DENSE, HARD, DURABLE CHARACTER, FREE OF ORGANIC MATERIAL, INFILLED JOINTS, SEAMS OR OTHER DEFECTS, RESISTANT TO BREAKDOWN BY HANDLING, FROST ACTION OR WEATHERING, AND NOT SUBJECT TO DETERIORATION IN SEA WATER. AS A MINIMUM, ROCK SHALL MEET THE FOLLOWING:

TEST #	TEST	REQUIREMENT
1	ABSORPTION (ASTM D6437)	NOT MORE THAN 1.0%
2	MICRO-DEVAL ABRASION LOSS FACTOR (ASTM D6928)	NOT MORE THAN 20% LOSS
3	MAGNESIUM SULFATE SOUNDNESS (ASTM D5240)	NOT MORE THAN 10% LOSS (FOLLOWING 5 CYCLES)
4	SPECIFIC GRAVITY (ASTM D6437)	NO LESS THAN 2.65

- THE ROCK SHALL HAVE A UNIT MASS NOT LESS THAN 2650 kg/m<sup>3</sup>, I.E. A SPECIFIC GRAVITY NOT LESS THAN 2.65 (SSD) AND A MEDIAN DIMENSION BY WEIGHT OF 45mm.
- THE LONGEST DIMENSION OF ANY ROCK SHALL NOT EXCEED 2.5 TIMES ITS LEAST DIMENSION.
- ROCK GRADATIONS SHALL BE AS FOLLOWS:

PERCENT LESS THAN (BY WEIGHT)	MASS (Kg)	NOMINAL SIZE (mm)
100	570	600
60-100	340	500
50-75	255	460
30-50	170	400
15-35	125	360
0-20	75	300
0-5	55	270

**GRANULAR FILTER**

PERCENT LESS THAN (BY WEIGHT)	NOMINAL SIZE (mm)
100	200
70-100	90
50-80	50
20-50	15
5-30	6
0-5	1

**3.6 CLEAR CRUSHED COARSE DRAIN ROCK (MMCD SPEC)**

PERCENT LESS THAN (BY WEIGHT)	SIEVE SIZE (mm)
100	20.0
0-5	9.5

**4.0 ENGINEERED FILL (REINFORCED FILL AND RETAINED FILL)**

- ENGINEERED FILL SHALL CONSIST OF GRAVELLY SAND, FREE OF BOULDERS, CONCRETE RUBBLE, METALS, ORGANIC MATERIALS, SOLUBLE AND DELETERIOUS MATERIALS, AND BE WELL GRADED WITHIN THE FOLLOWING LIMITS:

SIEVE SIZE (mm)	MOT 2106 FILL MATERIAL CLASS - PERCENTAGE OF PASSING (%)	
	MOT CLASS A: RETAINED FILL	MOT CLASS C: REINFORCED FILL
19	100	
16		100
13.2	60-90	
9.5	40-80	30-70
4.75	20-60	25-45
0.6	0-25	5-20
0.075	0-7	0-3

REFER TO SPECIFICATIONS FOR ENGINEERED FILL PLACEMENT CRITERIA.

**5.0 DIKE ACCESS ROAD MATERIALS**

- THE DIKE ACCESS ROAD SHALL CONFORM TO:
  - MMCD 2009 VOLUME II
  - CL 2.8 - SELECT GRANULAR SUB-BASE, OR
  - CL 2.9 - CRUSHED GRANULAR SUB-BASE
- THE DIKE ACCESS ROAD BASE MATERIAL SHALL CONFORM TO:
  - MMCD 2009 VOLUME II CL 2.10 - GRANULAR BASE

**6.0 GEOGRID MATERIAL**

- GEOGRID REINFORCEMENT SHALL BE TENSAR HIGH DENSITY POLYETHYLENE PRODUCTION UXX1600 MSE (FACTORED TENSILE STRENGTH AT 5% STRAIN OF 2125KN/m WHEN THE ALLOWABLE STRENGTH REDUCTION FACTORS RECOMMENDED BY TENSAR ARE USED) OR EQUIVALENT.

**7.0 NON-WOVEN GEOTEXTILE**

- NON-WOVEN GEOTEXTILE SHALL BE NILEX 4553 OR EQUIVALENT.
- ALL NON-WOVEN GEOTEXTILES SHALL BE 8oz, UNLESS NOTED OTHERWISE.
- PLACE AND ANCHOR GEOTEXTILE MATERIALS BY UNROLLING ONTO GRADED SURFACES IN THE ORIENTATION AND LOCATIONS INDICATED ON THE CONTRACT DRAWINGS OVERLAP ADJACENT LAYERS BY 0.5m.
- PROTECT INSTALLED GEOTEXTILE MATERIAL FROM DISPLACEMENT, DAMAGE, OR DETERIORATION BEFORE, DURING, AND AFTER PLACEMENT OF MATERIAL LAYERS.

**8.0 PLACEMENT OF MATERIALS**

- PLACEMENT OF ROCK
  - PLACE THE ROCK MATERIALS IN THE LOCATIONS AND TO THE ELEVATIONS, THICKNESS AND DETAILS AS INDICATED ON THE DRAWINGS AND AS DIRECTED BY THE ENGINEER.
  - TRIM EXISTING SLOPE AS REQUIRED TO FIT THE SLOPE PROTECTION INTO THE AREAS INDICATED ON THE DRAWINGS.
  - BEGIN PLACEMENT OF THE RIPRAP AT THE TOE OF THE AREA INDICATED ON THE DRAWINGS AND CONTINUE PLACEMENT WORKING UP THE SLOPE.
  - ROCKS SHALL BE PLACED INDIVIDUALLY USING AN EXCAVATOR WITH A HYDRAULIC THUMB.
  - PLACE THE ROCK IN SUCH A WAY AS TO CREATE A FIRM BEDDING AND INTERLOCKING OF THE INDIVIDUAL PIECES OF THE ROCK TO PROVIDE A TIGHTLY PACKED STRUCTURE. PREPARE THE SURFACE SO THAT IT IS DENSELY PLACED, WELL KEYED AND GENERALLY FREE OF UNDULATIONS AND PROTRUDING ROCKS TO THE SATISFACTION OF THE ENGINEER.

**8.2 PLACEMENT OF ENGINEERED FILL**

- THE OWNER'S ENGINEER WILL VERIFY THAT THE MATERIAL MEETS THE GRADING REQUIREMENTS OF NOTE 4 PRIOR TO CONSTRUCTION.
- ENGINEERED FILL (REINFORCED FILL, RETAINED FILL) SHALL BE PLACED IN HORIZONTAL LIFTS LESS THAN 300mm THICK.
- REINFORCED AND RETAINED FILL SHALL BE COMPACTED TO MINIMUM DRY DENSITY OF 98% OF STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD) AND 95% OF SPMDD, RESPECTIVELY AT A MOISTURE CONTENT NO GREATER THAN 2 PERCENTAGE POINTS WET AND 1 PERCENTAGE POINT DRY OF OPTIMUM.
- COMPACTION WILL TAKE PLACE WITH A SELF PROPELLED PNEUMATIC TIRED ROLLER WITH A MINIMUM EFFECTIVE ROLLING WIDTH OF 1.83m. THE SUBCONTRACTOR SHALL PERFORM NUCLEAR DENSOMETER TESTING TO CONFIRM THAT THE FILL IS COMPACTED TO THE SPECIFICATION.
- IN THE REINFORCED PORTION OF THE DYKE, FILL MATERIALS SHALL BE PLACED FROM THE SLOPE FACE TOWARDS THE END OF THE GEOGRID TO ENSURE FURTHER TENSIONING.

**8.3 PLACEMENT OF GEOGRID AND CONSTRUCTION OF REINFORCED LOCKBLOCK WALL**

- THE OWNER'S ENGINEER SHALL VERIFY THAT THE MATERIAL MEETS THE SPECIFICATION OF NOTE 6.1 PRIOR TO CONSTRUCTION.
- THE CONTRACTOR SHALL FOLLOW THE INSTRUCTIONS PROVIDED IN THE SLOPE REINFORCEMENT INSTALLATION GUIDE PROVIDED BY TENSAR INTERNATIONAL CORPORATION OR APPROVED ALTERNATIVE.
- TESTING METHODS, FREQUENCY AND VERIFICATION OF MATERIAL SPECIFICATIONS SHALL BE PER ASTM STANDARDS PROVIDED IN TENSAR INTERNATIONAL CORPORATION'S GUIDELINES OR APPROVED ALTERNATIVE.
- FOR EROSION CONTROL, CONTRACTOR SHALL FOLLOW THE PROCEDURES RECOMMENDED BY TENSAR EARTH TECHNOLOGY INC. OR APPROVED ALTERNATIVE.
- GEOGRID SHALL BE PLACED AT LOCATIONS AND ELEVATIONS SHOWN ON THE DRAWINGS.
- GEOGRID SHALL BE INSTALLED PER VENDOR'S REQUIREMENTS (TENSAR INTERNATIONAL CORPORATION OR APPROVED ALTERNATIVE).
- THE TOP ROW OF GEOGRIDS SHALL BE OVERLAPPED SO THAT THE OVERLAP HAPPENS ALONG ONE LOCK AS A MINIMUM.

**9.0 TOLERANCES**

- THE MAXIMUM PERMISSIBLE VARIATIONS IN ELEVATION FROM THE PRESCRIBED LINES, MEASURED VERTICALLY, SHALL BE ±0.15m WITH THE EXCEPTION OF THE DIKE CREST, WHICH SHALL BE NO LESS THAN THE ELEVATION SHOWN.
- THE MAXIMUM PERMISSIBLE VARIATIONS IN THE FINISHED THICKNESS OF ROCK LAYERS, WHEN MEASURED NORMAL TO THE SLOPE, SHALL BE ±15% OF THE THICKNESS INDICATED.
- FINISHED SLOPE ANGLES OF ROCK LAYERS SHALL BE NO WITHIN ±2% OF THE SLOPE ANGLE SPECIFIED, AS INDICATED BY THE ANGLE OF A 2m LONG FLAT BOARD PLACED ON THE FINISHED RIPRAP GRADE.

**10.0 ABBREVIATIONS**

AEP:	ANNUAL EXCEEDANCE PROBABILITY
FLNRO:	BC MINISTRY OF FORESTS, LANDS AND NATURAL RESOURCE OPERATIONS
GD:	GEODETIC DATUM
SLR:	SEA LEVEL RISE
VFPA:	VANCOUVER FRASER PORT AUTHORITY
R/W:	RIGHT OF WAY (DIKE MAINTENANCE AND FUTURE ALTERATIONS)
NWFPMS:	NEW WESTMINSTER FLOODPLAIN MANAGEMENT STRATEGY

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**PRELIMINARY**  
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D SHEET SCALE NONE		ENGINEERING AND PERMIT STAMPS (As Required)		CUSTOMER	
WORLEYPARSONS PROJECT No 307071-01144				ANTHEM DUNCAN DEVELOPMENTS PROPOSED DIKE UPGRADE 41 AND 175 DUNCAN STREET GENERAL NOTES AND DESIGN CRITERIA	
REV DATE REVISION DESCRIPTION		DRAWN DRAFT CHK DESIGNED ENG CHK APPROVED CUSTOMER REF DRAWING No		DRG No 307071-01144-00-CI-DGA-1010 REV F	

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 USER NAME: logan.yang  
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**APPENDIX B**  
**List of Information Sources**

**VFPA has relied on the following sources of information in the project and environmental review of the Sediment Remediation and Dike Construction Project:**

- Application form and materials submitted by Applicant on March 9, 2017. The application was accepted as completed September 19, 2018.
- All Project correspondence from March 9, 2017 to May 24, 2019
- All plans labelled 16-179-A to 16-179-E;
- All Reports and Memos titled:
  - "Project Description: Anthem Sediment Remediation and Dike Construction", August 14, 2018, Advisian
  - "Construction Environmental Management Plan: Anthem Sediment Remediation and Dike Construction", August 2, 2018, Advisian
  - "Geotechnical Report: Anthem Sediment Remediation and Dike Construction", January 11, 2018, Advisian
  - "DFO Self-Screening Assessment – Sediment Remediation and Dike Construction", March 15, 2018, Advisian
  - "Tree Management Report", January 18, 2017, Arbotech Consulting
  - "Archaeological Overview Assessment", May 22, 2018, Archer
  - "Chance Find Protocol", Archer, November 22, 2018, Archer
  - "Proposed methods for Archaeological Impact Assessment for the remediation area associated with the development at 175 Duncan Street", June 9, 2018, Archer
  - "Report of Findings – Supplemental site investigation, Preliminary Risk Assessment, and Remediation Plan for 41 – 175 Duncan Street, New Westminster, BC", May 18, 2017, Keystone Environmental
  - "Traffic Management Plan", December 6, 2018, Valley Traffic Systems.
- Letter titled "Referral Response Letter – Anthem Properties Group – Sediment Remediation and Dike Construction", January 23, 2019, City of New Westminster