Stormwater Pollution Prevention Plan

Neptune Bulk Terminals

Revision No. 1

Prepared for:

Neptune Bulk Terminals
1001 Low Level Road,
North Vancouver, BC   V7L 1A7

Envirochem Project No.: 21222

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REVISION INDEX

Revision No.	Date	Description of Change	Initial
-	March 1, 2022	Original document	PD
1	June 2, 2022	Corrected the area of Catchment 4 from 19,176 m^2 to 9,176 m^2. Applied relevant updates to Section 3.2 and Figure 3 in Appendix A.	AP

Note: This document is intended to be a "living document" and subject to change based on changes which may occur at Neptune Bulk Terminals in the future.

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1.0 INTRODUCTION

1.1 Background

Neptune Bulk Terminals (NBT; the site) is a commodities export terminal located at 1001 Low Level Road in North Vancouver, fronting the Burrard Inlet. NBT handles the export of coal, potash, and phosrock with an intermodal transportation infrastructure (with access to rail, ocean, and highway), three berths, two storage warehouses, and specialized product conveyance and shiploading infrastructure. NBT has approximately 80,000 m^2 of outdoor storage area for coal and approximately 30,000 m^2 of indoor storage area for potash contained in two warehouse structures.

The site location is presented in **Figure 1** (the Site Location Plan) and **Figure 2** (the Site Layout Plan) in **Appendix A**.

NBT has commissioned this update of its previous Stormwater Pollution Prevention Plan (SPPP) after significant site changes from a recent major capital project involving the expansion of its coal export facility.

1.2 Objectives

The purpose of this SPPP is to:

- Ensure an up-to-date SPPP is maintained which meets the requirements of the Vancouver Fraser Port Authority (VFPA)
- Present the mitigation measures in place which demonstrate due diligence and decrease the likelihood of pollution to stormwater runoff at NBT.
- Be a reference for training of current and new staff in an effort to increase stormwater awareness.
- Support NBT in meeting Criterion 2.4.2 of the Spill Prevention Performance Indicator under the Green Marine certification program.

1.3 Methods

This SPPP was completed in general conformance with the following guidance:

- *Green Marine Self-Evaluation Guide for Terminals & Shipyards, Annex 2-C – Developing a Storm Water Management Plan: Guidelines (Level 4)* (Green Marine Management Corporation, 2019).
- Vancouver Fraser Port Authority (VFPA), Project and Environmental Review, *Guidelines – Developing Your Stormwater Pollution Prevention Plan,* (VFPA, 2015).

2.0 SITE INVENTORY

2.1 Physical Properties and Existing Stormwater Infrastructure

Surficial cover at NBT consists of impervious areas including asphalt, concrete, and building roofs, and pervious rail track areas. NBT uses three general stormwater systems to manage stormwater at the site: a) stormwater drainage to ocean for areas with impervious surfaces in non-industrial operation areas, b) stormwater drainage to water treatment systems for coal and dry bulk storage/handling areas with impervious surfaces, and c) stormwater infiltration to ground in areas with pervious surfaces.

<u>Stormwater drainage to ocean in non-industrial operation areas</u>

- Impervious surfaces in non-industrial operation areas include:
  - Main office building, maintenance shop, security gate, and parking lot located in the western portion of the site.
    - Stormwater runoff from these areas is collected in a series of gravity stormwater catch basins, and transferred to an oil interceptor which then discharges directly into the Burrard Inlet.
  - Access roads located in the northern portion of the site and between the potash storage sheds, and roof areas of the storage sheds.
    - Stormwater runoff from these areas is collected by a series of gravity stormwater catch basins, and discharges into a municipal 54-inch storm main that services the District of North Vancouver.
    - One oil interceptor from the locomotive fueling area (adjacent to the north access road) is connected to the municipal 54-inch storm main.

<u>Stormwater drainage to water treatment systems in industrial operation areas</u>

- Impervious surfaces in industrial operation areas include the rail dumper, storage, conveyors, and shiploading areas for coal and potash (dry bulk).
- Coal water treatment system (CWTS) discharges into the Burrard Inlet via a discharge point in Berth 3.
  - There are two oil/water separators and three oil interceptors in the industrial operation areas that discharge into the CWTS.
- Potash water treatment system (DBWTS) discharges into municipal sanitary sewer.
  - There is one oil/water separator and one oil interceptor in the industrial operation areas that discharge into the DBWTS.

<u>Stormwater infiltration to ground</u>

- Onsite pervious areas include all rail tracks with surficial ballast materials and gravel underneath. Excess water along the rail tracks that does not infiltrate is collected in surrounding catch basins/collection sumps connected to water treatment systems.

2.2 Activities

2.2.1 Construction, Demolition/Decommissioning

For major projects, construction and demolition/decommissioning activities will be identified on a project specific basis. A project specific Construction Environmental Management Plan (CEMP), which will include aspects of stormwater management, will be required prior to the commencement of major projects as part of the planning and permitting requirements.

2.2.2 Operational Primary Activities

Primary activities identified at NBT include:

- Product handling.
  - Potash and coal railcars are mechanically unloaded in dumper buildings and transported to associated storage areas.
  - Potash and coal are conveyed through associated conveyor networks to shiploaders and loaded onto vessels.
- Product storage – products are stored either outdoors or in two warehouse buildings with concrete floors.
  - Potash is stored in two indoor warehouses (Potash Shed 1 & 2).
  - Coal is stored outdoors in the central area of the site.

2.2.3 Operational Secondary Activities

Secondary activities identified at NBT include:

- Site maintenance such as equipment, infrastructure, and vehicle repairs/maintenance, cleaning/maintenance of stormwater catch basins, and cleaning/maintenance of oil/water separators.
- Waste handling, including municipal solid waste, recyclable materials, waste used oils, and used oil filters.
- Mobile equipment fueling (i.e., diesel, gasoline) at designated fueling locations and a fueling truck.
  - The designated fueling location for gasoline is located at the gasoline aboveground storage tank (AST) located in the northwestern portion of the site.
  - The designated fueling location for diesel is located at the diesel AST located adjacent to the heavy duty maintenance shop near the DBWTS.
  - Fueling of immobile equipment is conducted using a fueling truck (diesel).

2.3 Materials

The following materials are stored in significant quantities at NBT.

2.3.1 Aboveground Storage Tanks

There are two ASTs stored outdoors at NBT:

- Diesel is stored in one 13,600 L AST, which is vacuum-monitored and double-walled. Diesel is used for fueling onsite mobile equipment.
- Gasoline is stored in one 4,500 L AST, which is double-walled with asphalt berm secondary containment. Gasoline is used for fueling onsite crew transportation vehicles.

2.3.2 Fueling Truck

- One onsite flat deck truck with a mounted diesel tidy tank is used to refuel mobile equipment at NBT.

2.3.3 Waste Oil and Oily Filters

- The onsite 1,000 L waste oil AST is located in a concrete storage room adjacent to the heavy duty maintenance shop near the DBWTS. This storage room is constructed with concrete trench drains.
- Used oil filters are stored in 170 L metal drums located outside of the heavy duty maintenance shop.

2.3.4 Miscellaneous Chemicals

The following miscellaneous chemicals are stored in small quantities and indoors throughout the site:

- Oils/Lubricants/Greases
- Paints
- Coolants
- Anti-Freeze
- Acetylene
- Coagulant
- Flocculants

3.0 HYDROLOGIC ASSESSMENT

3.1 Methodology

A hydrologic assessment estimates runoff response, including peak flow rates, runoff volumes, and runoff direction for each sub-watershed over the property for various rainfall events. Based on review of available site drawings and a site reconnaissance, the site has been divided into six catchment areas. Several of these catchment areas have been further divided into sub-catchments based on unique characteristics or drainage features. The colour-coded catchment areas are shown in **Figure 3** in **Appendix A** and described in detail in **Section 3.2**. Catchment areas were estimated using available aerial photos of the site and past treatment plans (Urban Systems, 2019; Urban Systems, 2020) and should be considered as estimates only.

Two rainfall events are identified for the site as outlined in the Vancouver Fraser Port Authority *Project and Environmental Review, Guidelines – Developing Your Stormwater Pollution Prevention Plan* (VFPA, 2015). These are the Water Quality Event and the Storm Drainage Event, discussed in greater detail below.

For the purpose of this SPPP, the hydrologic assessment has been completed in accordance with the BC Ministry of Transportation and Infrastructure *Supplement to TAC Geometric Design Guide 3rd Edition – Chapter 1000 Hydraulics* (BC MoTI, 2019). Although various resources are available providing guidance on conducting hydrologic assessments, the BC MoTI guide was selected as it is:

- An up-to-date (i.e., 2019) province-wide manual; and
- Approved by the BC Government as a guide to the acceptable procedures and methods used in the development of hydrotechnical design plans for the design, construction, and maintenance of British Columbia highways. Similar paved/impervious surfaces are typically found on large commercial/industrial sites.

3.1.1 Water Quality Event

A water quality event is a time period over which water with anomalous characteristics is detected. Substances accumulated on site during dry periods can be picked up by the next rainfall and quickly moved to the drainage system. These discharges can be detrimental to the environment, as peak contaminant concentrations are typically present in 'first flush' discharges. An example of the 'first flush' effect is shown in **Figure A** below, where contaminant concentrations peak relatively early in the storm duration.

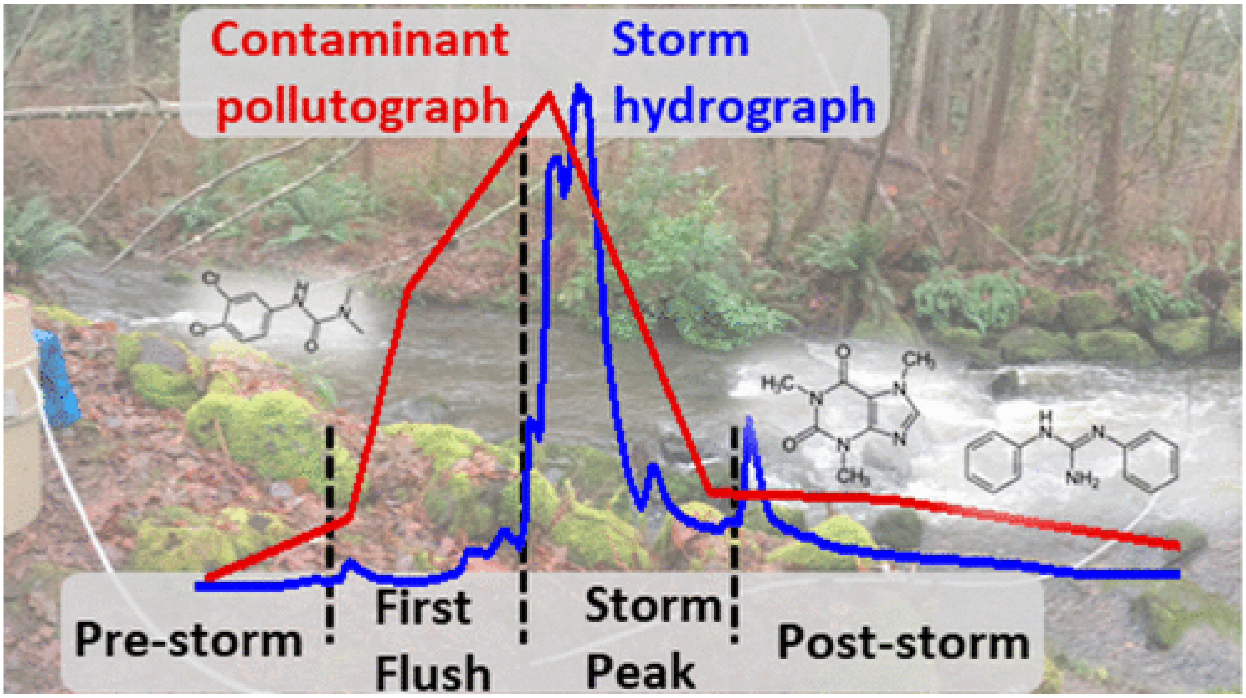

Figure A: First Flush Effect (https://en.x-mol.com/paper/article/1252053396455579648)

This hydrologic assessment utilizes the VFPA recommendation for a water quality event of 50% of the 2-hour duration, 2-year return period event, with a peak rainfall intensity corresponding to a 15-minute time of concentration.

A water quality event can also be considered in the context of a rainfall forecast. The total 24-hour precipitation for a 2-year return period at the site is approximately 64.8 mm (such that 50% of this total precipitation is 32.4 mm). As such, a water quality event could be defined as all measurable flows up to a rainfall forecast of 32.4 mm over a 24-hour period. Such a water quality event may trigger certain water quality sampling requirements due to the mobilization of potential pollutants.

3.1.2 Storm Drainage Event

A storm drainage event is a time period used to evaluate stormwater flow and infrastructure requirements to prevent flooding and ensure safe drainage at a site. This is the design event typically used for sizing drainage infrastructure within the site (e.g., catch basins, storm drains, storage units, etc.), and should be selected to ensure efficient and safe drainage within the site to prevent property damage and protect the safety of personnel.

This hydrologic assessment utilizes the VFPA recommendation for a storm drainage event of a 100-year return period rainfall (with the time of concentration calculated for each catchment).

3.1.3 Time of Concentration

t_c Calculation:

The time of concentration is defined as the time required for the surface runoff from the most remote part of the drainage basin to reach the point of concentration being considered. The time of concentration can be estimated for overland flow on bare earth and mowed grassed roadside channels using the Kirpich formula as presented below (BC MoTI, 2019). Once calculated, the time of concentration is used to obtain the rainfall intensity from the applicable Intensity-Duration-Frequency (IDF) curve.

$$t_c = \frac{0.00032L^{0.77}}{S^{0.385}}$$

Where:
t_c = time of concentration (hours)
L = the total stream length from the most remote part of the basin as extended from the stream source to the divide (m)
S = the average slope of the total stream length (m/m)

In addition, an adjustment factor is applied depending on the surface condition:

- For overland flow, grassed surfaces, multiply t_c by 2.
- For overland flow, concrete or asphalt surfaces, multiply t_c by 0.4

Selected/Calculated t_c Values:

For the Water Quality Event, the time of concentration was assumed to be 15 minutes in accordance with the VFPA recommended water quality event (regardless of the actual calculated time of concentration for each catchment).

For the Storm Drainage Event, the minimum time of concentration was assumed to be 5 minutes for urban areas (BC MoTI, 2019), such that:

- When the calculated t_c was less than 5 minutes for a catchment, a t_c of 5 minutes was used for the IDF curve.
- When the calculated t_c was greater than 5 minutes for a catchment, the calculated t_c was used for the IDF curve.

None of the calculated t_c values for the Storm Drainage Event exceeded the 5-minute minimum. Hence, the time of concentration used for each of the catchments was 5 minutes.

3.1.4 Rainfall Intensity

Once the time of concentration is determined for a catchment, the applicable rainfall intensity is obtained from the IDF curve for the given return period. 2009 IDF curves were obtained for Zone 5 (i.e., the zone the site is located in) from the *Regional IDF Curves, Metro Vancouver Climate Stations: Phase 1* (Zone 5 from BGC Engineering, 2009) with combined data from 18 Metro Vancouver Climate Stations. The 2009 IDF curves are presented in **Appendix B**. Rainfall intensities were interpreted from the IDF curves where required.

As the Water Quality Event is a fixed event (i.e., 50% of 2-year return period for a 15-minute time of concentration), the rainfall intensity for the Water Quality Event was consistent across all catchments at 11.4 mm/hr.

As the t_c for the Storm Drainage Event (100-year return period) was consistent for all catchments (i.e., t_c = 5 min), the rainfall intensity for the Storm Drainage Event was consistent across all catchments at 89.7 mm/hr.

3.1.5 Flow Calculations

The Rational method, presented below, may be suitable to calculate design flows for urban watersheds up to 1 km^2 and for rural watersheds up to 10 km^2 (BC MoTI, 2019):

$$Q_p = \frac{CiA}{360}$$

Where:
Q_p = peak flow (m^3/s)
C = runoff coefficient
i = rainfall intensity (mm/hr)
A = drainage area (hectares)

3.1.6 Assumptions

Several assumptions were made during this hydrological assessment, as noted below:

- An average slope of 0.05 was assumed for the potash shed roofs and portion of the overpass ramp (with discharge to municipal 54" storm outfall), and coal storage areas (TP2, TP3 West, TP11, and TP12), while an average slope of 0.01 was assumed for other areas of the site. A sensitivity analysis was then completed for parameters in the t_c calculation. Specifically, the average slope (S) and the total stream length (L) were varied by factors of 2 and 0.5.
- The runoff coefficient (C) in the Rational method varies by catchment based on slope and surface cover. Additional modification factors include +0.1 to account for rain induced snowpack melt, and +0.1 to account for a return period of >25 years (BC MoTI, 2019). Runoff coefficients were cross-checked with those in previous treatment plans for Neptune Terminals (Urban Systems, 2019; Urban Systems, 2020) for consistency.
- For the purposes of flow calculations, it is assumed that all required maintenance of the stormwater drainage infrastructure is completed and that snow and ice blockages do not occur.

3.2 Catchments and Flows

Catchment 1

Catchment Area:

- Northwest side of Potash Shed 1 roof to CWTS discharge point. See **Figure 3** in **Appendix A** for the location of this catchment.

Assumed Flows:

- Runoff in this area is collected in catch basins and collection sumps located along the base of the building, then discharged via the CWTS discharge point.

Table 1: Estimated Peak Discharge and Volume – Catchment 1

Sub-Catchment	Event Type	t_c (mins)	c	i (mm/hr)	Area (m^2)	Peak Discharge (L/s)	Volume (m^3)
Northwest Roof Area of Potash Shed 1 to CWTS Discharge Point	Water Quality Event	15	0.9	11.4	10,846	30	30 m^3 over the 15-minute event
	Storm Drainage Event	5	1	89.7		270	80 m^3 over the 5-minute event

Catchment 2

Catchment Area:

- Non-industrial activity areas that drain into Burrard Inlet through a municipal 54" storm outfall. This catchment has been divided into three sub-catchments including the roofs of the potash sheds and access road, portions of the overpass ramp, and the northern access road. See **Figure 3** in **Appendix A** for the locations of these sub-catchments.

Assumed Flows:

- Runoff enters the stormwater infrastructure through a series of stormwater catch basins within each sub-catchment, and discharges into Burrard Inlet at a storm outfall located in Berth 3. Roof runoff is collected by stormwater catch basins located at the base of the buildings.

Table 2: Estimated Peak Discharge and Volume – Catchment 2

Sub-Catchment	Event Type	t_c (mins)	c	i (mm/hr)	Area (m^2)	Peak Discharge (L/s)	Volume (m^3)
Potash Sheds Roofs and Access Road	Water Quality Event	15	0.9	11.4	41,316	120	110 m^3 over the 15-minute event
	Storm Drainage Event	5	1	89.7		1,030	310 m^3 over the 5-minute event
Overpass Ramp	Water Quality Event	15	0.9	11.4	2,143	6	5 m^3 over the 15-minute event
	Storm Drainage Event	5	1	89.7		50	20 m^3 over the 5-minute event
Northern Access Road	Water Quality Event	15	0.9	11.4	6,377	20	20 m^3 over the 15-minute event
	Storm Drainage Event	5	1	89.7		160	50 m^3 over the 5-minute event
Catchment Area Total							
Municipal 54" Storm Outfall	Water Quality Event				49,836	146	135 m^3 over the 15-minute event
	Storm Drainage Event					1,240	380 m^3 over the 5-minute event

Catchment 3

Catchment Area:

- Various rail areas circling the terminal. See **Figure 3** in **Appendix A** for the location of this catchment.

Assumed Flows:

- Stormwater from the rail areas infiltrates into the gravel rail beds.

Estimated Peak Discharge and Volume:

- No stormwater discharge or runoff from this area (i.e., assumed 100% infiltration).

Catchment 4

Catchment Area:

- Impervious parking area located on the western portion of NBT that drains into Burrard Inlet through a storm outfall. See **Figure 3** in **Appendix A** for the location of this catchment.

Assumed Flows:

- Stormwater runoff enters a network of stormwater catch basins in this catchment area, and discharge to the west into Burrard Inlet.

Table 3: Estimated Peak Discharge and Volume – Catchment 4

<table>
<tr><th>Sub-Catchment</th><th>Event Type</th><th>t_c (mins)</th><th>c</th><th>i (mm/hr)</th><th>Area (m^2)</th><th>Peak Discharge (L/s)</th><th>Volume (m^3)</th></tr>
<tr><td rowspan="2">Storm Outfall</td><td>Water Quality Event</td><td>15</td><td>0.9</td><td>11.4</td><td rowspan="2">9,176</td><td>30</td><td>30 m^3 over the 15-minute event</td></tr>
<tr><td>Storm Drainage Event</td><td>5</td><td>1</td><td>89.7</td><td>230</td><td>70 m^3 over the 5-minute event</td></tr>
</table>

Catchment 5

Catchment Area:

- Terminal areas associated with coal handling and storage operations which direct runoff to the CWTS. This includes coal stockpile areas as well as primarily impervious areas associated with coal operations (i.e., coal dumpers, Berth 1, heavy duty maintenance shop, overpass, etc.).
- This catchment area has been divided into nine sub-catchments:
  - Coal Dock Pond
  - TP1
  - TP2
  - TP3 West
  - TP3 East
  - TP5
  - TP10
  - TP11
  - TP12

See **Figure 3** in **Appendix A** for the locations of these sub-catchments.

Assumed Flows:

- Runoff from these sub-catchments is collected in various catch basins, collection sumps, and treatment ponds prior to being routed to the CWTS.
- Flows (and associated peak discharge and volume estimates) are highly uncertain for the coal stockpile areas (catchment areas for TP2, TP3 West, TP11, and TP12). Runoff from the coal stockpiles may infiltrate into the base of the storage area, pool at local low points and infiltrate/evaporate over time, and/or flow towards drainage infrastructure which leads to the CWTS.
    - Infiltration/flow through stockpiled and/or compacted coal is a complex function dependent upon parameters[1] such as (but not limited to) slope, degree of compaction, initial moisture content, saturated moisture content, and hydraulic conductivity. For example, greater infiltration capacity would be expected after an extended period of dry weather in comparison to after multiple days of intense rainfall.
- Additional flows of up to approximately 50 L/s may be associated with the automatic spray pole system for the coal stockpile areas. Since the spray pole system is used as a dust control measure during dry weather conditions, it is assumed to not be applicable during rainfall events.
- Treated water from CWTS discharges into the Burrard Inlet through a discharge point in Berth 3.

Table 4: Estimated Peak Discharge and Volume – Catchment 5

Sub-Catchment	Event Type	t_c (mins)	c	i (mm/hr)	Area (m^2)	Peak Discharge (L/s)	Volume (m^3)
Coal Dock Pond	Water Quality Event	15	0.9	11.4	11,550	30	30 m^3 over the 15-minute event
	Storm Drainage Event	5	1	89.7		290	90 m^3 over the 5-minute event
TP1	Water Quality Event	15	0.9	11.4	14,514	40	40 m^3 over the 15-minute event
	Storm Drainage Event	5	1	89.7		360	110 m^3 over the 5-minute event
TP2	Water Quality Event	15	0.65	11.4	27,937	60	50 m^3 over the 15-minute event
	Storm Drainage Event	5	0.75	89.7		520	160 m^3 over the 5-minute event
TP3 West	Water Quality Event	15	0.65	11.4	28,537	60	50 m^3 over the 15-minute event
	Storm Drainage Event	5	0.75	89.7		530	160 m^3 over the 5-minute event
TP3 East	Water Quality Event	15	0.9	11.4	10,016	30	30 m^3 over the 15-minute event
	Storm Drainage Event	5	1	89.7		250	80 m^3 over the 5-minute event

[1] Note that parameters associated with the coal storage area also vary temporally due to active export operations, which further complicates attempts at accurately modelling runoff. A detailed hydrologic assessment/modelling of the coal piles is outside the scope of this SPPP.

Sub-Catchment	Event Type	t_c (mins)	c	i (mm/hr)	Area (m^2)	Peak Discharge (L/s)	Volume (m^3)
TP5	Water Quality Event	15	0.85	11.4	2,640	7	6 m^3 over the 15-minute event
	Storm Drainage Event	5	0.95	89.7		60	20 m^3 over the 5-minute event
TP10	Water Quality Event	15	1	11.4	1,694	5	5 m^3 over the 15-minute event
	Storm Drainage Event	5		89.7		40	10 m^3 over the 5-minute event
TP11	Water Quality Event	15	0.65	11.4	25,764	50	50 m^3 over the 15-minute event
	Storm Drainage Event	5	0.75	89.7		480	140 m^3 over the 5-minute event
TP12	Water Quality Event	15	0.65	11.4	14,334	30	30 m^3 over the 15-minute event
	Storm Drainage Event	5	0.75	89.7		270	80 m^3 over the 5-minute event
Catchment Area Total							
Coal Water Treatment System	Water Quality Event				136,986	312	291 m^3 over the 15-minute event
	Storm Drainage Event					2,800	850 m^3 over the 5-minute event

Catchment 6

Catchment Area:

- Terminal areas associated with potash handling and storage operations which direct runoff to the DBWTS. This includes primarily impervious areas associated with potash vessel loading operations (Berth 2 and Berth 3) as well as the inner circle area.
- This catchment has been divided into nine sub-catchments:
  - West Dock (Pond 1)
  - East Dock (Pond 2)
  - Berth 3 Collection Sumps
  - Pond 3
  - Pond 4
  - TP6
  - TP7
  - TP8
  - Phosrock Pond

See **Figure 3** in **Appendix A** for the locations of these sub-catchments.

Assumed Flows:

- Runoffs within the dry bulk operations are collected in four collection sumps, two located in Berth 2 and two in Berth 3. Runoff within the inner circle is collected in trench drains with grated covers and collection sumps. All runoff is directed to the DBWTS, and treated water is discharged into the municipal sanitary sewer.

Table 5: Estimated Peak Discharge and Volume – Catchment 6

Sub-Catchment	Event Type	t_c (mins)	c	i (mm/hr)	Area (m^2)	Peak Discharge (L/s)	Volume (m^3)
West Dock (Pond 1)	Water Quality Event	15	0.9	11.4	4,097	10	10 m^3 over the 15-minute event
	Storm Drainage Event	5	1	89.7		100	30 m^3 over the 5-minute event
East Dock (Pond 2)	Water Quality Event	15	0.9	11.4	3,614	10	10 m^3 over the 15-minute event
	Storm Drainage Event	5	1	89.7		90	30 m^3 over the 5-minute event
Berth 3 Sump	Water Quality Event	15	0.9	11.4	10,662	30	30 m^3 over the 15-minute event
	Storm Drainage Event	5	1	89.7		270	80 m^3 over the 5-minute event
Pond 3	Water Quality Event	15	0.9	11.4	6,725	20	20 m^3 over the 15-minute event
	Storm Drainage Event	5	1	89.7		170	50 m^3 over the 5-minute event
Pond 4	Water Quality Event	15	0.9	11.4	2,553	7	6 m^3 over the 15-minute event
	Storm Drainage Event	5	1	89.7		60	20 m^3 over the 5-minute event
TP6	Water Quality Event	15	0.9	11.4	866	2	2 m^3 over the 15-minute event
	Storm Drainage Event	5	1	89.7		20	10 m^3 over the 5-minute event
TP7	Water Quality Event	15	0.9	11.4	6,410	20	20 m^3 over the 15-minute event
	Storm Drainage Event	5	1	89.7		160	50 m^3 over the 5-minute event
TP8	Water Quality Event	15	0.9	11.4	1,323	4	4 m^3 over the 15-minute event
	Storm Drainage Event	5	1	89.7		30	10 m^3 over the 5-minute event
Phosrock Pond	Water Quality Event	15	0.9	11.4	1,062	3	3 m^3 over the 15-minute event
	Storm Drainage Event	5	1	89.7		30	10 m^3 over the 5-minute event
Catchment Area Total							
Dry Bulk Water Treatment System	Water Quality Event				37,312	106	105 m^3 over the 15-minute event
	Storm Drainage Event					930	290 m^3 over the 5-minute event

3.3 Climate Change Considerations

Climate change impacts are affecting communities across the province with more frequent and intense weather extremes and climate-related events causing damage to infrastructure, property, and ecosystems (BC MoTI, 2019). The design life of infrastructure is typically measured in decades, hence designing new infrastructure and/or adapting existing infrastructure for future climate conditions is a prudent risk-management strategy. It is also often a requirement of certain organizations. For example, the BC Ministry of Transportation and Infrastructure requires all new projects and rehabilitation/maintenance projects to evaluate the risk and include the impacts of future climate change (BC MoTI, 2019). According to the *Green Marine Self-Evaluation Guide, Environmental Program, Terminals & Shipyards, Annex 2-C – Developing a Storm Water Management Plan: Guidelines* (Green Marine Management Corporation, 2019) stormwater management plans should ideally account for climate change considerations. Potential impacts of climate change which will directly impact stormwater infrastructure include (i) seasonal alterations in precipitation where storm events may become more frequent and intense, and (ii) sea level rise. These two factors are discussed in greater detail below.

Precipitation Changes due to Climate Change

The historical rainfall data used in calculations in **Section 3.2**, based on the published IDF curves (Zone 5 from BGC Engineering, 2009; see **Appendix B**), may no longer be directly applicable without inclusion of a “climate change correction factor” or equivalent. The *Study of the Impacts of Climate Change on Precipitation and Stormwater Management* (GHD, 2018) estimates changes to the IDF curves in 2050 and 2100 under both moderate[2] and high[3] climate change scenarios. The anticipated increase in future precipitation intensity to 2050 and 2100 was averaged across storm durations (5 mins, 10 mins, 15 mins, 30 mins, 1 hour, 2 hours, 6 hours, 12 hours, and 24 hours) for various return periods (2, 5, 10, 25, 50, 100, and 200 years). The results for Zone 5 are presented in **Figure B** below.

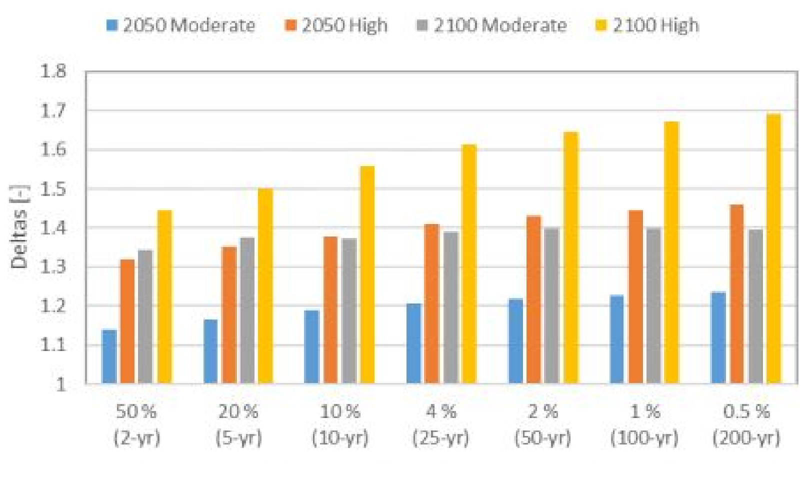

Figure B: Changes in IDF Curves for Zone 5, Averaged Over all Durations for Each Annual Exceedance Probability (Obtained from GHD, 2018)

[2] Represents a mid-range but still conservative prediction of the future rainfall estimated as the median of the general climate models using the RCP8.5 scenario (GHD, 2018)

[3] Represents an extreme prediction of the future rainfall estimated as the 95th percentile estimate of the general climate models using the RCP8.5 scenario (GHD, 2018)

Overall, the 2018 GHD report suggests that the future climate rainfall intensities are expected to increase by 21% in 2050 and 41% in 2100 for the moderate change scenario, and by 44% in 2050 and 75% in 2100 for the high change scenario. A technical brief summarizing this study is included in **Appendix C** (Metro Vancouver and GHD, 2018). The study also advocates for a risk-based approach when selecting IDF curves for adaptation planning; projects or infrastructure of high risk and/or long design life should utilize IDF curves based on more extreme climate models. Furthermore, estimations of future precipitation are subject to many assumptions and uncertainties such as climate and economic modelling, population growth, and technological advances.

Sea Level Rise due to Climate Change

Climate change also influences rising sea levels, which may exacerbate the strain placed on existing drainage infrastructure beyond the impacts anticipated solely due to increased precipitation. According to the *Sea Level Rise Adaptation Primer a Toolkit to Build Adaptive Capacity on Canada's South Coasts* (BC Ministry of Environment, 2013), the Government of BC recommends a sea level rise planning level of 1.0 meter to the year 2100. Based on the reconnaissance of NBT, a sea level rise of 1.0 meter may impact all stormwater outfalls. Submerged outfalls limit the effectiveness of stormwater infrastructure to adequately convey flow, potentially resulting in flooding during rainfall events.

4.0 ISSUES IDENTIFICATION & RISK ANALYSIS

4.1 Applicable Standards, Acts, and Regulations

A list of compliance obligations at NBT is provided in its Environmental Management System (EMS) Manual. This list outlines regulations of significance and is intended to highlight those most relevant to the activities conducted by NBT. Regulations listed below are relevant to this SPPP.

4.1.1 Fisheries Act

The federal *Fisheries Act* is the main federal statute which provides protection to fish, fish habitat, and water quality. It requires that activities taking place near waterbodies that support commercial, recreational, and First Nations fisheries must avoid causing harm to fish and fish habitat unless authorized by the Department of Fisheries and Oceans (DFO). DFO and Environment Canada administer the Act (*Fisheries Act*, 1985). NBT is aware not to deposit substances that can affect fish and fish habitat at the Terminal area.

4.1.2 Migratory Birds Convention Act

The *Migratory Birds Convention Act* is the main federal statute which aims to protect and conserve migratory birds, their eggs, and their nests. (*Migratory Birds Convention Act*, 1994). Similar to the *Fisheries Act*, NBT is aware not to deposit substances that can affect migratory birds that frequent the Terminal area. This Act is administered by Environment Canada.

4.1.3 BC Hazardous Waste Regulation

The BC *Hazardous Waste Regulation*, under the BC Environmental Management Act, defines hazardous waste and regulates how hazardous wastes are stored, packaged, labeled, treated, and transported in British Columbia. In part, hazardous waste in BC is defined as those materials listed in Schedule 1 and 3 of the Federal *Transportation of Dangerous Goods* Regulations which are no longer used for their original purpose.

4.1.4 BC Contaminated Sites Regulation

The BC *Contaminated Sites Regulation*, under the BC *Environmental Management Act*, defines the identification, investigation, and remediation of contaminated sites. This regulation is administered by the Ministry of Environment and Climate Change Strategy (Queen's Printer, 2021b).

4.1.5 CCME Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products

The CCME *Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products* "comprises a model set of technical requirements designed to protect the environment by preventing product releases from aboveground and underground storage systems." These technical requirements include, but are not limited to, "monitoring and leak detection, operation and maintenance, and withdrawal from service of storage tank systems." This code of practice "only comes into effect if adopted, in whole or in part, by an authority having jurisdiction." (CCME, 2003).

4.1.6 Federal Fire Code

The *Federal Fire Code* provides the requirements for the use, storage, and installation and operation of flammable materials handling in Canada, including the storage and dispensing of diesel fuel, from the viewpoint of fire prevention and fire safety (National Research Council of Canada, 2015).

4.1.7 Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations

Under the *Canadian Environmental Protection Act*, the S*torage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* applies to "any storage tank system located in Canada in which petroleum products or allied petroleum products are stored and…. that is located on federal land."

From Section 2(2) of the regulation (*Canadian Environmental Protection Act*, 1999):

> "These Regulations do not apply to: […] (c) storage tank systems that have aboveground tanks in which the aggregate capacity of the tanks is 2500 L or less and the systems are connected to a heating appliance or emergency generator."

NBT has one 1360 L diesel AST and one 450 L gasoline AST for which this regulation applies.

4.2 Potential Pollutant Sources

4.2.1 From Construction, Demolition/Decommissioning Activities

For major projects, potential pollutant sources associated with construction and demolition/decommissioning activities will be identified on a project specific basis. A project specific CEMP will include aspects of stormwater management, and will be required prior to the commencement of major projects as part of the planning and permitting requirements.

4.2.2 From Operational Primary Activities

Potential pollutant sources from NBT's operational primary activities are limited to the handling and storage of bulk products. Potential pollutant sources and activities include:

- Insufficient maintenance or failure of components within the shiploading systems resulting in the release of products and hydraulic/motor oils, with potential to release into the marine environment.
- Insufficient or lack of wetting of coal storage pile and during dumping operations resulting in the airborne release of coal dust, with potential to enter offsite stormwater infrastructure.
- Insufficient or lack of washing of onsite vehicles prior to leaving site, resulting in products carried offsite, with potential to enter stormwater catch basins.
- Insufficient or lack of treatment of coal-contaminated liquid at the CWTS resulting in the release of coal into the Burrard Inlet.

4.2.3 From Operational Secondary Activities

Operational secondary activities at NBT that take place outdoors and have the potential to impact stormwater runoff are summarized below:

4.2.3.1 Fuel Storage and Handling

One onsite designated fueling area for gasoline is located within the CWTS catchment area, and another located within the DBWTS catchment area. Both areas have a low probability of environmental release. Potential pollutant sources and activities include:

- Improper handling of fueling equipment (e.g., nozzle, hose, containers) during fueling activities outside of designated fueling areas resulting in the release of diesel/gasoline onto surrounding surfaces, with potential to enter nearby stormwater catch basins or infiltrate unpaved surfaces.

4.2.3.2 Waste Oil and Used Oil Filters Storage and Handling

Waste oil and used oil filter storage area is located within the DBWTS catchment area, and has a low probability of environmental release. Potential pollutant sources and activities include:

- Improper handling or failure of equipment (vacuum truck) during cleaning of concrete spill containment.
- Improper closure of the used oil filters storage containers (170 L drums), resulting in the release of oily fluids during precipitation.

4.2.3.3 Mobile Equipment Environmental Incidents and Spill Response

Potential pollutant sources and activities include:

- Failure of mobile equipment components (hoses, valves, etc.), resulting in the release of hydraulic oils, motor oils, or lubricants onto nearby pervious or impervious surfaces, with potential to enter nearby stormwater catch basins and/or infiltrate unpaved surfaces.
- Improper or lack of containment, and/or insufficient clean-up of spilled fluids during mobile equipment environmental incidents, resulting in the release of hydraulic oils, motor oils, or lubricants onto surrounding surfaces, with potential to enter nearby stormwater catch basins and/or infiltrate unpaved surfaces.

4.2.3.4 Maintenance of Oil/Water Separators

Potential pollutant sources and activities include:

- Insufficient maintenance of the onsite oil/water separators and oil interceptors, resulting in the build-up of sludge and release of oily fluids/residue into the Burrard Inlet.
    - This applies to the oil interceptor in the parking lot (catchment area 4) located in the western portion of the site. All other onsite oil/water separators and oil interceptors discharge into the CWTS or DBWTS catchment area.

4.2.4 Accumulated Dust on Paved Areas

Potential pollutant sources and activities include:

- Insufficient street sweeping and cleaning, resulting in accumulation of dust on paved surfaces from the deposition of airborne particulate and vehicle wear. Accumulated solids will enter nearby stormwater catch basins during the "first flush" event described in **Section 3.1.1**.

4.2.5 Roof Runoff

Roofing materials for buildings at NBT include corrugated steel and tar/gravel. Potential pollutant sources include:

- Degradation of roofing materials over time creates the potential for contaminant loading of stormwater runoff (e.g., zinc in galvanic coatings, hydrocarbons). Similar to accumulated dust on paved areas described above, potential rooftop contaminants captured in rooftop runoff will enter stormwater catch basins (via underground piping) during the "first flush" event described in **Section 3.1.1**.

4.3 Potential Sensitive Receptors

NBT is aware that effectively managing stormwater quality is important to the physical receiving environment, the local community, interest groups, First Nations, port officials, and other regulators. NBT understands that the receiving environment (i.e., Burrard Inlet) is frequented by transiting fish such as Salmon (Coho, Chum, Chinook, Pink), Steelhead, Trout, and Stickleback.

Fisheries and Oceans Canada's (DFO's) *Aquatic Species at Risk Map* (**Attachment E**) was queried for critical habitat and species at risk within a 1 km radius of the terminal. The following information was obtained:

- No critical habitat for species at risk was identified within a 1 km radius of NBT.
- Species at risk that may occur or have the potential to occur at and about the terminal include:
  - Steller sea lion (Special concern);
  - Humpback whale (Special concern);
  - Harbour porpoise (Special concern);
  - Grey Whale (Special Concern);
  - Leatherback sea turtle (Endangered);
  - Northern abalone (Endangered);
  - Yelloweye rockfish (Special concern);
  - Tope (Special Concern);
  - Green sturgeon (Special concern);
  - Bluntnose Sixgill Shark (Special Concern);
  - Basking Shark (Endangered);

- Longspine thornyhead (Special concern);
- Killer whale (Threatened); and,
- Rougheye rockfish types I and II (Special concern)

4.4 Identified Issues

As identified in **Section 4.2**, potential stormwater pollutant sources at NBT are associated with both primary and secondary operational activities. **Table 6** below describes the identified issues and associated risk at NBT.

Table 6: Risk Analysis of Potential Pollutant Sources

Activities	Potential Pollutant Sources	Affected (Sub)Catchment Areas	Anticipated Pollutants	Controls	Probability of Occurrence (Release into Environment)	Severity of Pollution
Onsite Product Shiploading	Insufficient maintenance or failure of components within the shiploading systems	• Coal Dock Pond	• Coal (bulk or dust) • Potash (bulk or dust) • Hydraulic oil • Motor oil	• Shiploading Standard Operating Procedures (SOPs) • Timely maintenance and inspection of shiploading and dust control equipment • NBT Environmental Policy and Training	Low	Medium
Onsite Coal Handling and Storage	Insufficient or lack of wetting of the coal storage pile and during dumping operation	• All Catchment Areas	• Coal dust	• Automatic spray pole system for coal storage area • Dumper and conveyor water application system • Frequent cleaning of roadways with onsite sweeper and water truck • Air quality monitoring stations	Medium	Low

Activities	Potential Pollutant Sources	Affected (Sub)Catchment Areas	Anticipated Pollutants	Controls	Probability of Occurrence (Release into Environment)	Severity of Pollution
Onsite/Offsite Transportation	Lack of or insufficient washing of onsite vehicles	• All Catchment Areas	• Coal/Potash dust • Suspended solids	• Wheel wash stations • Frequent cleaning of roadways with onsite sweeper and water truck • NBT Environmental Policy and Training	Low	Low
Coal water treatment	Lack of or insufficient treatment of coal-contaminated liquid at the coal water treatment system	• All Catchment Areas for the CWTS	• Coal • Suspended solids • Hydrocarbons	• Effluent Sampling Program • Wastewater Treatment Procedures • Spill Response Procedures • Emergency Response Plan	Low	Medium
Fuel Storage and Handling	Improper handling of fueling equipment (nozzle, hose, containers) during fueling activities	• TP1 and Pond 3 (designated fueling areas) • All Catchment Areas for the CWTS, DBWTS, and the Municipal 54” Storm Outfall	• Diesel • Gasoline	• Fuel Dispensing Procedures • Stormwater Shut Off Valve Procedures • Spill Response Training/Procedures • Spill Kits Readily Available • Maintenance Operating Procedure • Emergency Response Plan	Low to Medium	Low to Medium

<table>
<tr><th>Activities</th><th>Potential Pollutant Sources</th><th>Affected (Sub)Catchment Areas</th><th>Anticipated Pollutants</th><th>Controls</th><th>Probability of Occurrence (Release into Environment)</th><th>Severity of Pollution</th></tr>
<tr><td rowspan="2">Waste Oil and Used Oil Filters Storage and Handling</td><td>Improper handling or failure of equipment during cleaning of spill containment</td><td>• Pond 3</td><td>• Waste oil
• Oily residue</td><td>• Hazardous Waste Disposal Procedure
• Oil/Water Separator and Coal Water Treatment System</td><td>Low</td><td>Low</td></tr>
<tr><td>Improper closure of the oily filters storage containers (170 L drums)</td><td>• Pond 3</td><td>• Waste oil
• Oily residue</td><td>• Hazardous Waste Disposal Procedure
• Oil/Water Separator and Coal Water Treatment System</td><td>Low</td><td>Low</td></tr>
<tr><td rowspan="2">Mobile Equipment Environmental Incidents and Spill Response</td><td>Failure of mobile equipment components (hoses, valves, etc.)</td><td rowspan="2">• All Catchment Areas</td><td rowspan="2">• Diesel
• Gasoline
• Hydraulic oil
• Motor oil
• Lubricants
• Anti-Freeze</td><td rowspan="2">• Spill Response Training/Procedures
• Spill Kit Deployment Training
• Spill Kits Readily Available
• Emergency Response Plan</td><td>Low to Medium</td><td>Low to Medium</td></tr>
<tr><td>Improper or lack of containment, and/or insufficient clean-up of spilled fluids during mobile equipment environmental incidents</td><td>Low to Medium</td><td>Low to Medium</td></tr>
</table>

Activities	Potential Pollutant Sources	Affected (Sub)Catchment Areas	Anticipated Pollutants	Controls	Probability of Occurrence (Release into Environment)	Severity of Pollution
Maintenance of Oil/Water Separators and Oil Interceptors	Insufficient or lack of maintenance of onsite oil/water separators	• Storm Outfall • All Catchment Areas in CWTS and DBWTS	• Diesel • Gasoline • Hydraulic oil • Motor oil • Lubricants • Anti-Freeze • Suspended solids	• Oil/Water Separator and Oil Interceptor Maintenance Records • Monthly Inspections • Bi-Annual Environmental Audits	Low	Low to Medium
Street Sweeping	Insufficient or lack of street sweeping and cleaning	• All Catchment Areas	• Coal/Potash • Suspended solids	• Frequent cleaning of roadways with onsite sweeper and water truck • NBT Environmental Policy and Training	Low	Low
Rooftop Drainage	Runoff	• Municipal 54" Storm Outfall (Potash Shed Roofs and Access Road) • Northwest roof of Potash Shed 1	• Metals from galvanic coatings (e.g., zinc) • Petroleum hydrocarbon particulate	• Stormwater Shut-off Valve Procedures • Periodic inspections • Preventative maintenance • Repair/replacement as needed (long term)	Low	Low

Based on current onsite stormwater infrastructure and pollution prevention measures implemented by NBT, the overall risk of any potential pollutants releasing into the environment is inferred to be **Low**, as presented on the risk matrix (**Figure C**) below.

Figure C: Neptune Bulk Terminals Stormwater Pollution Risk Matrix

Risk Matrix		Severity of Pollution				
		Low	Low to Medium	Medium	Medium to High	High
Probability of Pollution Occurring	Low					
	Low to Medium		Site Risk			
	Medium					
	Medium to High					
	High					

- Inferred risk status of the existing stormwater infrastructure at NBT.

This inferred risk status is evaluated based on the probability of pollution occurrence, and the severity of pollution in the environment, if occurred. The probability of pollution occurrence is a function of existing pollution pathways, and pollution prevention systems in place such as engineered controls, training, and approved SOPs and prevention plans. The severity of pollution is dependent on the type of pollutant as well as the potential quantity of its release. For instance, gasoline and diesel fuels are considered to be non-persistent in the marine environment and rapidly dissipate through evaporation, whereas waste oil and motor oils have long lasting impact.

Notwithstanding the overall low risk for stormwater pollution, there exists the potential for higher risk events to occur. For example, significant spills from uncontrolled overflow of fuel tanks or severe damage to storage tanks. However, these examples of elevated level risk events have a low probability of occurrence. On this basis the overall risk rating remains **Low**.

4.5 Identified Pollutant Pathways

Pollutant pathways to Burrard Inlet from activities at NBT are through the following:

- Existing engineered stormwater collection infrastructure including oil/water separators and oil interceptors strategically located throughout the site and the stormwater shutoff valves located between the potash sheds immediately upstream of the municipal 54-inch stormwater line.
- Existing engineered coal water treatment system discharge point.
- Infiltration through rail ballasts on rail tracks located throughout NBT.

5.0 STORMWATER POLLUTION PREVENTION PLAN

5.1 Management Strategy

NBT has existing management plans and strategies in place within its EMS Manual, to address stormwater pollution prevention. In addition to the EMS is a combination of maintenance, operations, engineering controls, and employee training aimed to prevent environmental pollution. The key components of these plans, as related to this SPPP, and additional stormwater pollution management practices/strategies are described in the following subsections.

5.1.1 Preventative Maintenance

NBT has a comprehensive preventative maintenance program consisting of the following:

5.1.1.1 Maintenance

- All NBT inventory, maintenance activity and assets are managed through an Enterprise Resource Planning system, which includes preventative maintenance records for environmental system assets.
- Under the instructions of Superintendents and Senior Reliability Engineer, a Maintenance Planner schedules and see to completion of preventative maintenance and inspections on assets/equipment including the following:
    - Dry bulk transfer systems, including scrubbers and shiploading cascade chutes
    - Dry bulk effluent treatment system, including foreshore and treatment ponds operations
    - Coal storage and transfer systems, including pole-mounted spray system, dumper scrubber, and shiploading trimmers
    - Coal water treatment systems
    - Spill response equipment
    - Air quality monitoring equipment
    - Oil/Water separators
    - Stormwater shutoff valves
    - HVAC equipment
    - Used oil and materials confinement vessels
    - Rail track oiling system
    - Other critical pieces of equipment
- Mobile equipment maintenance and inspection will be carried out in a dedicated maintenance shop, located over 30 m from the ocean.
- NBT will arrange frequent street-sweeping and water spraying to keep the site clean and minimize dust and debris.
- Hazardous materials located at NBT will be managed in accordance with applicable regulations.

- Spill kits will be maintained and inspected. Any usage will be reported to Managers/ Superintendents, and supplies will be replenished after use.
- Spill trays will be used under stationary devices and equipment to contain potential leaks.
- Periodic roof inspections to monitor conditions and check for indications of degradation.

5.1.1.2 Containment

- Storage of all bulk fuel and hazardous materials will be in accordance to modern codes for storage tanks (double-walled and with spill containment).

5.1.1.3 Training

- Fuel Dispensing Procedures
- Stormwater Shut off Valves Procedures
- Hazardous Waste Management Procedures
- Spill Response Procedures
- Shiploading Standard Operating Procedures
- Spray System Procedures
- Emergency Preparedness and Response Plan
- Effluent Sampling Program
- Emergency Procedure Manual
- Operating Manuals
- Environmental Management System Manual

5.1.2 Coal Effluent Sampling Program

Coal effluent sampling at NBT is required by a BC Ministry of Environment and Climate Change Strategy (BC ENV) effluent permit (PE-06898), and is performed by a third-party contractor on a scheduled basis at pre-defined locations to assess discharge quality. Refer to the NBT Effluent Sampling Program for additional information.

5.1.3 Management Review

NBT holds relevant management review activities that are scheduled daily, monthly, and annually to ensure timely performance assessment and subsequent implementation of improvements. Monitoring and measuring of compliance of the EMS is a daily function that is reported monthly to senior management in the Environmental Due Diligence Report, which highlights activities of continuous improvement, permit compliance and any areas of concern. EMS performance is reviewed semi-annually by senior management and reported to the Board of Directors.

5.1.4 First Flush Event

As introduced in **Section 3.1.1**, first flush events occur when pollution residues accumulate on the ground surface, typically over an extended period of dry weather. During the next rain event, elevated levels of suspended solids and peak concentrations of potential pollutants enter the stormwater infrastructure.

5.1.5 High Risk Areas

Areas with higher potential of pollution release with nearby pathways to the environment are identified as high-risk areas. Given that stormwater runoff in all areas where industrial activities take place is collected and transferred to onsite water treatment systems, no high-risk areas are identified at NBT.

5.1.6 Employee and Contractor Awareness

Through EMS awareness for employees or project indoctrination for contractors, personnel on site are made aware of NBT's stormwater protection requirements, infrastructure, prohibited discharges, controls, and discharge points.

6.0 IMPLEMENTATION & MONITORING

6.1 Responsible Persons

Effective stormwater management is a shared responsibility at NBT. **Table 7** below summarizes the key roles and responsibilities for the program.

Table 7: Responsible Persons for Stormwater Management

Title	Roles and Responsibilities
President	• Oversight of the program. • Ensure appropriate levels of training for personnel involved in management of environmental aspect.
Vice-President, Operations	• Development and maintaining operations manuals and procedures for pollution control works. • Ensure operating procedures comply with all applicable environmental regulations.
VP, Major Projects, and Environment	• Develop long term environmental strategies. • Responsible for all aspects of the EMS. • Capital planning.
Director, Engineering and Environment	• Maintaining operations in accordance with the EMS. • Implement environmental controls and checking compliance with all environmental permits, rules, and regulations. • Management of and reporting on all environmental aspects.
Maintenance Manager	• Development and update of maintenance manuals. • Development and update of maintenance procedures for pollution control works. • Responsible for all aspects of the EMS. • Responsible for the periodic inspection of pollution prevention equipment (oil/water separators and oil interceptors).
Procurement Manager	• Obtaining and maintaining inventory of spill containment materials and equipment, and water treatment chemicals and test kits.
Operations Manager	• Oversee site operations, and ensure compliance with the EMS. • Oversee emergency response. • Review and approve training material.
Safety Manager	• Program training and implementation.

6.2 Site Audits

NBT retains third-party contractors to conduct environmental evaluations of their operations which include ensuring stormwater management practices are being implemented. These evaluations include:

- Semi-annual compliance and EMS audits.
- Bi-annual green marine verification.
- Quadrennial compliance and EMS audits.

6.3 Adaptive Management and Continuous Improvement

This SPPP will be reviewed annually by responsible personnel, or when a significant site operation change that may require modifications to the existing stormwater infrastructure is expected. The SPPP will be included in the scope of the NBT's internal audits. Site audits and inspections will be reviewed to determine if current practices are effective in stormwater protection.

All reviews will be documented with clear action items identified, assigned responsible persons, and timelines for completion.

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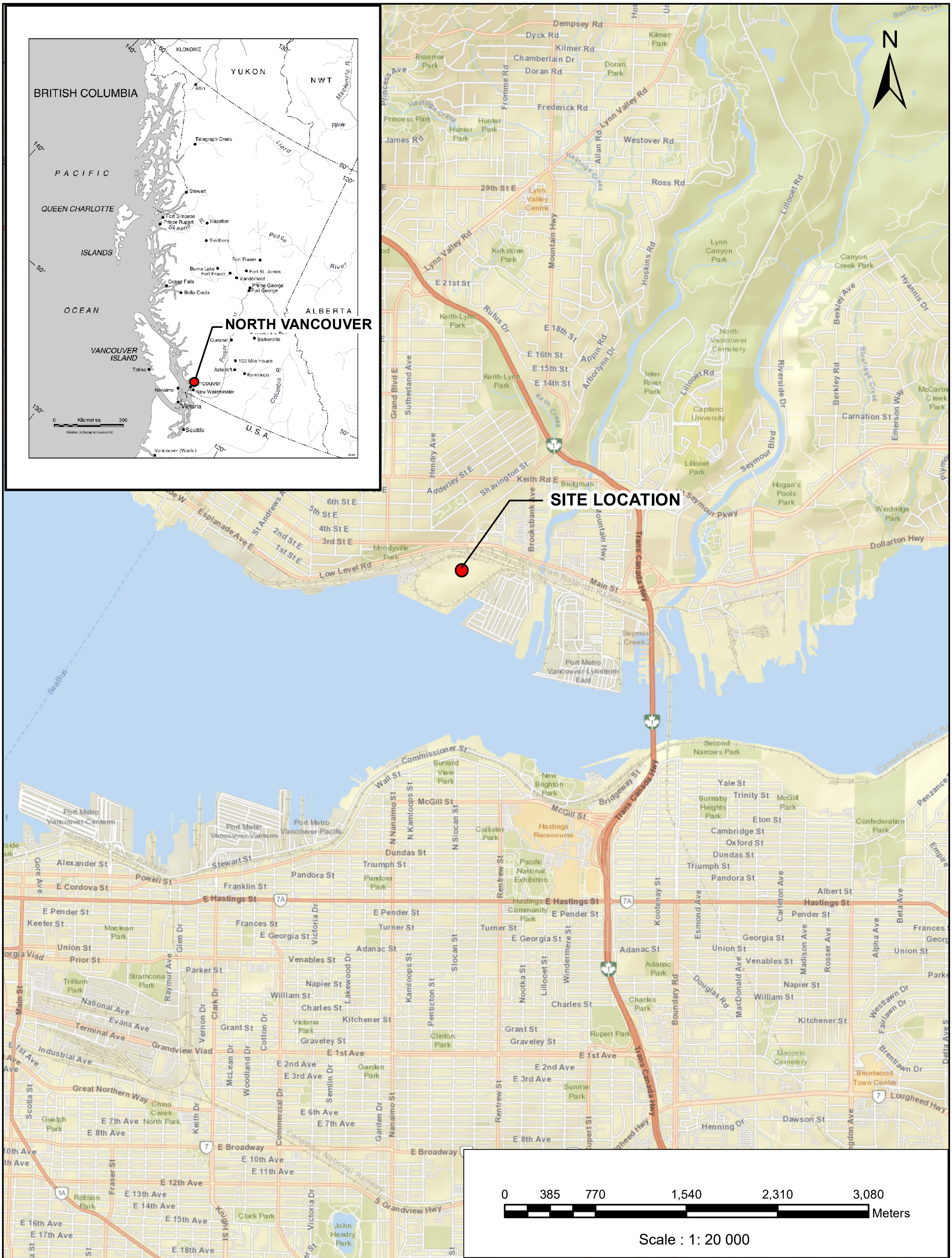
APPENDIX A

FIGURES



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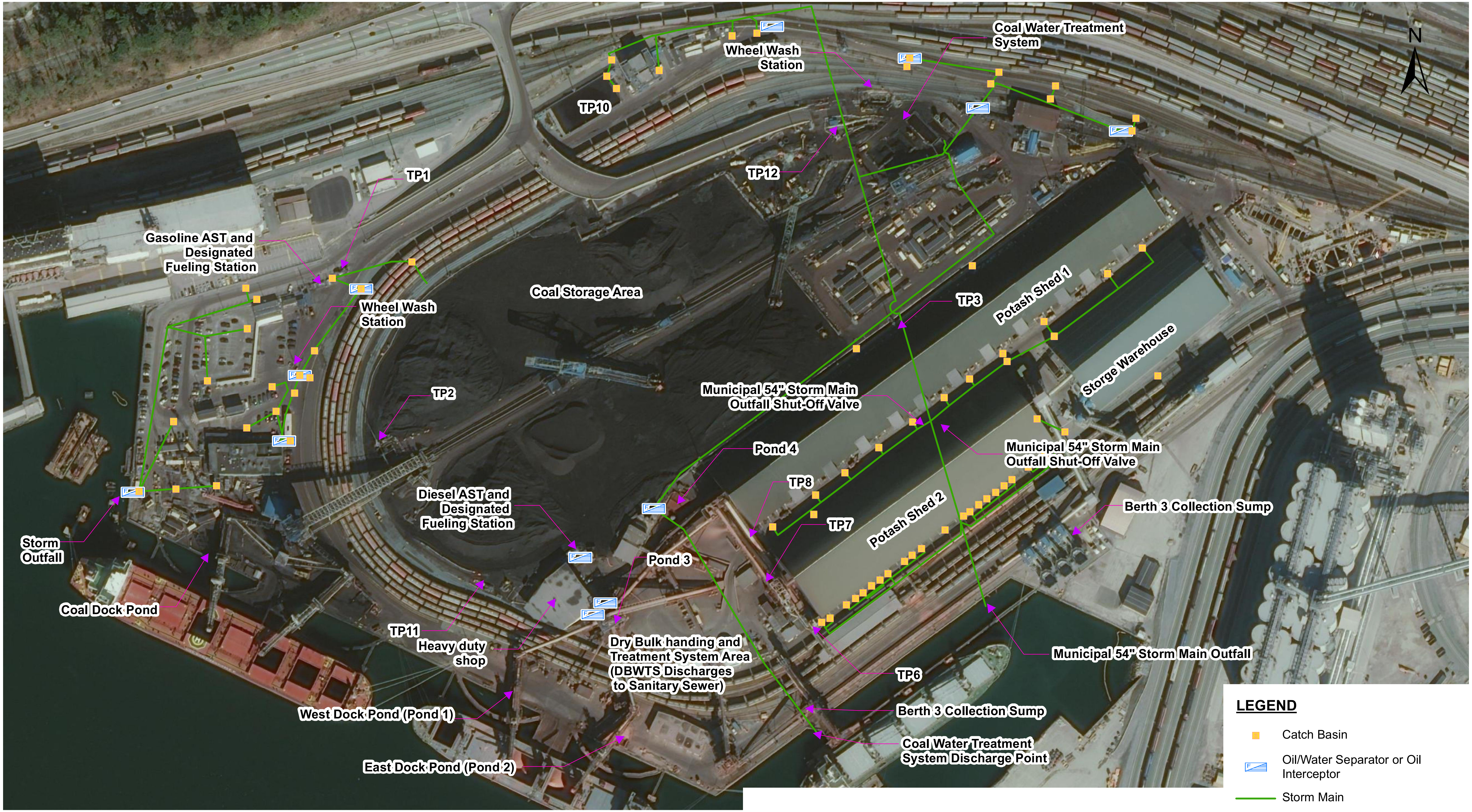
Title: Site Location Plan	Figure No: 1 / Rev. No: 00
Client: Neptune Bulk Terminals (Canada) Ltd.	Date: March 2021
Project: Stormwater Pollution Prevention Plan	Project No: 21222
Site Location: 1001 Low Level Road, North Vancouver, BC	Drawn: HL / Checked: BT

Fig1-Site Location Map_21222



envirochem 206-267 Esplanade W, North Vancouver, BC V7M1A5 T: 604-986-0233 E: response@envirochem.com	NOTE: - Aerial image is downloaded from Google EarthPro.(2019) - Original drawing is ANSI full bleed B (11.00 x17.00 Inches) and in color	Scale: 0 20 40 80 120 160 M Scale: 1:2,500	Title: Site Layout Plan	Figure No: 2	Rev. No: 00
			Client: Neptune Bulk Terminals (Canada) Ltd.	Date: March 2022	
			Project: Stormwater Pollution Prevention Plan	Project: 21222	
			Site Location: 1001 Low Level Road, North Vancouver, BC	Drawn: HL	Checked: BT

Fig2- Site Layout Plan-21222

envirochem

206-267 Esplanade W,
North Vancouver, BC V7M1A5
T: 604-986-0233
E: response@envirochem.com

NOTE:
- Aerial image is downloaded from Google EarthPro.(2019)
- Original drawing is ANSI full bleed B (11.00 x17.00 Inches) and in color

Scale:

0 20 40 80 120 160 M

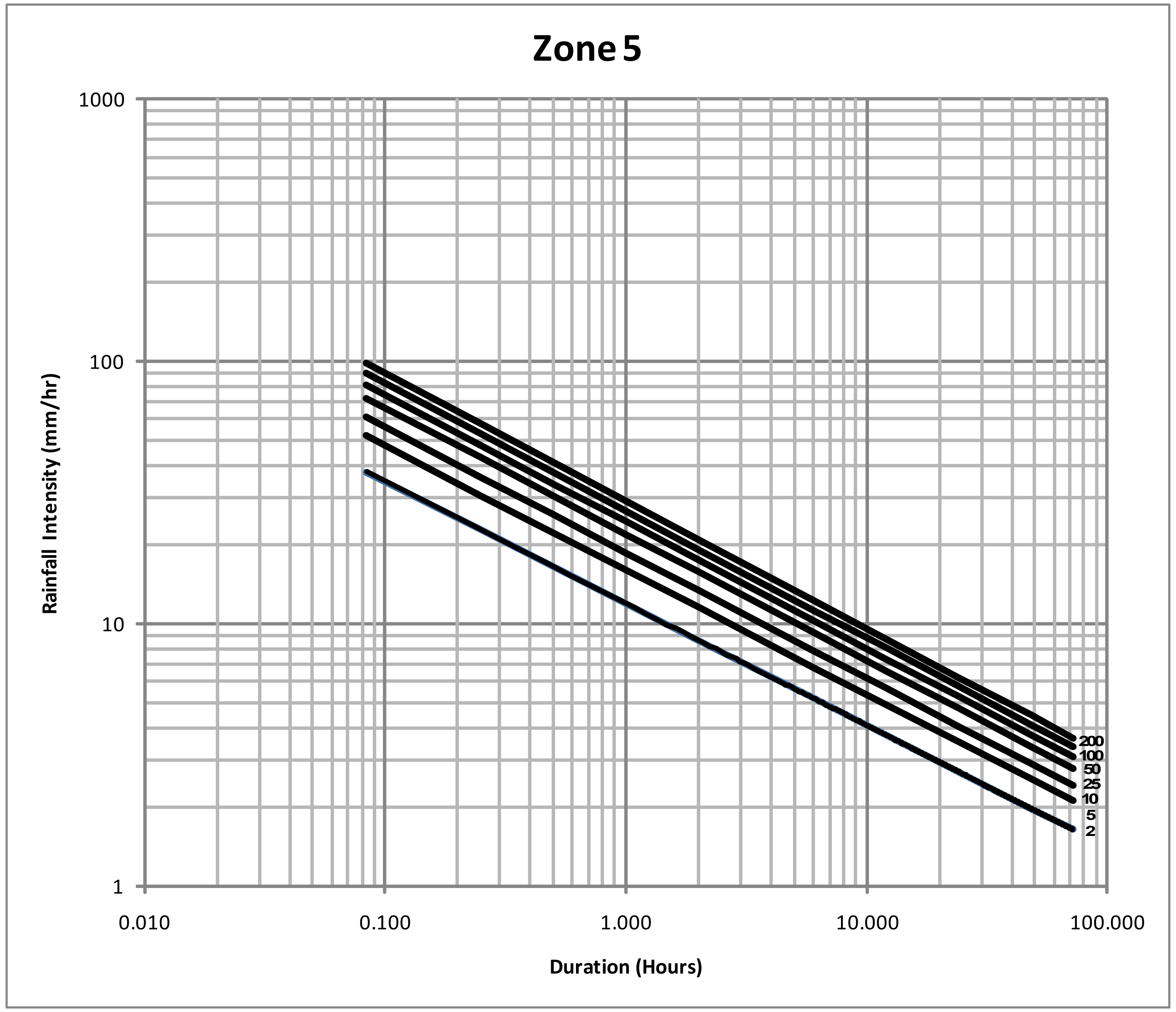
Scale: 1:2,500

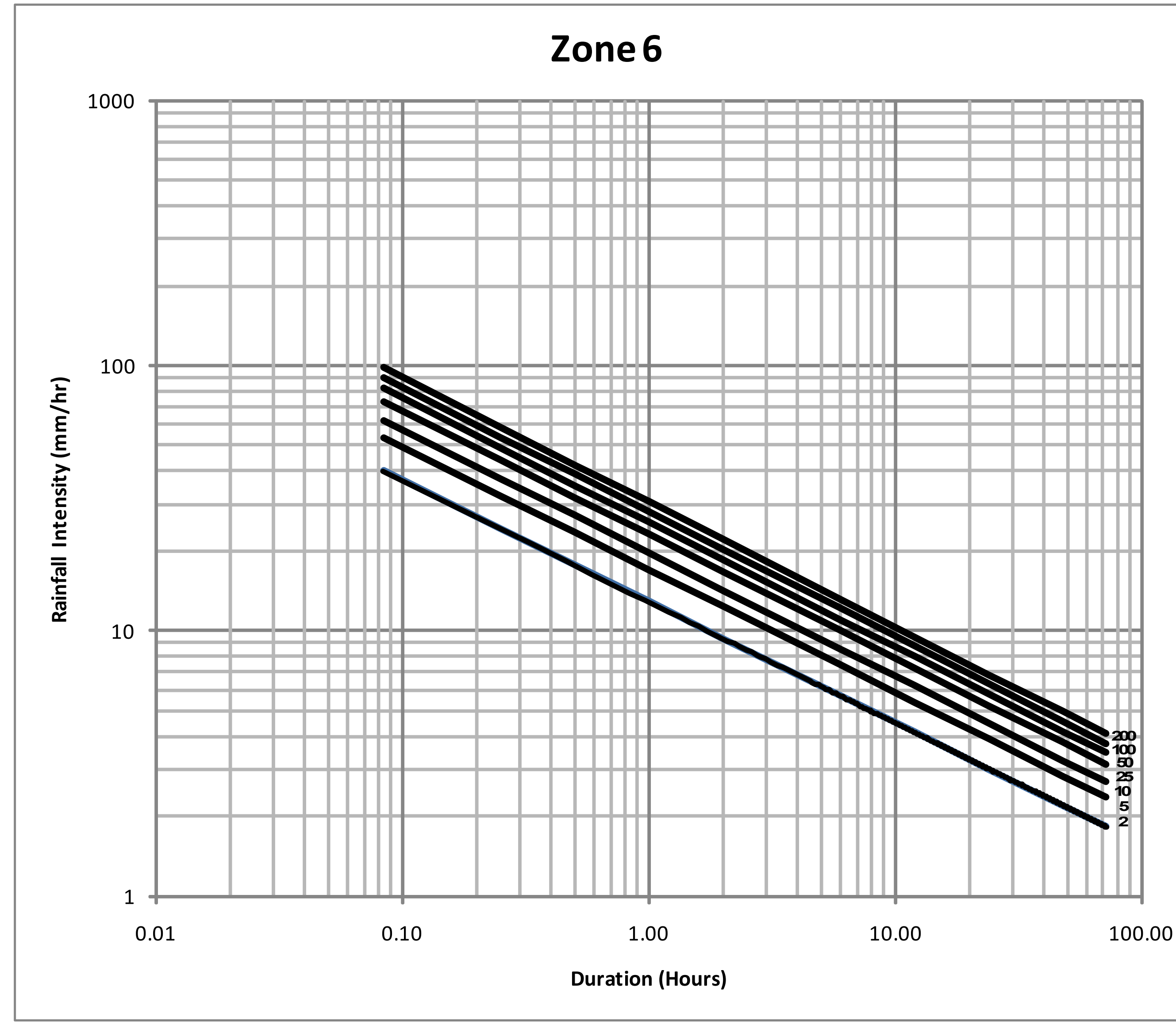
Title: Catchment Area	Figure No: 3 / Rev. No: 00
Client: Neptune Bulk Terminals (Canada) Ltd.	Date: June 2022
Project: Stormwater Pollution Prevention Plan	Project: 21222
Site Location: 1001 Low Level Road, North Vancouver, BC	Drawn: HL / Checked: BT

Fig3- Catchment Area Plan-21222

APPENDIX B

VANCOUVER INTENSITY-DURATION-FREQUENCY (IDF) CURVE





Duration	2 year	5 year	10 year	25 year	50 year	100 year	200 year
5 min	37.8	51.8	61.0	72.6	81.2	89.7	98.2
15 min	22.7	30.8	36.1	42.8	47.7	52.7	57.6
30 min	16.5	22.2	25.9	30.6	34.2	37.6	41.1
1 h	11.9	16.0	18.6	22.0	24.4	26.9	29.3
2 h	8.6	11.5	13.4	15.7	17.5	19.2	20.9
6 h	5.2	6.8	7.9	9.3	10.3	11.3	12.3
12 h	3.8	4.9	5.7	6.6	7.4	8.1	8.8
24 h	2.7	3.5	4.1	4.8	5.3	5.8	6.3
48 h	2.0	2.5	2.9	3.4	3.8	4.1	4.5
72 h	1.6	2.1	2.4	2.8	3.1	3.4	3.7

Duration	2 year	5 year	10 year	25 year	50 year	100 year	200 year
5 min	40.0	53.4	62.3	73.5	81.8	90.0	98.2
15 min	24.2	32.2	37.4	44.0	48.9	53.8	58.6
30 min	17.7	23.4	27.1	31.9	35.4	38.9	42.3
1 h	12.9	17.0	19.7	23.1	25.6	28.1	30.6
2 h	9.4	12.3	14.2	16.7	18.5	20.3	22.1
6 h	5.7	7.4	8.6	10.0	11.1	12.1	13.2
12 h	4.1	5.4	6.2	7.2	8.0	8.8	9.5
24 h	3.0	3.9	4.5	5.2	5.8	6.3	6.9
48 h	2.2	2.8	3.3	3.8	4.2	4.6	5.0
72 h	1.8	2.4	2.7	3.1	3.5	3.8	4.1

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:
DATE: DEC 2009
DRAWN: KH
DESIGNED: KH
CHECKED: KH
APPROVED: MJ

PROFESSIONAL SEAL:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT: Metro Vancouver

PROJECT: Metro Vancouver Regional IDF Curves

TITLE: Rainfall Zone IDF Curves

PROJECT No.: 0431-007
DWG No.: 5
REV.:

X:\Projects\0431 GVRD\007\Designwork\20091222_report_drawings_final\Dwg5_IDFGraphs_Zone5&6.mxd

APPENDIX C

METRO VANCOUVER & GHD CLIMATE CHANGE STUDY

metrovancouver
SERVICES AND SOLUTIONS FOR A LIVABLE REGION

GHD

Study of the

Impacts of Climate Change on Precipitation and Stormwater Management

Background

Climate change adaptation is one of the most important issues facing local governments today. Increasing frequency and intensity of extreme rainfall events will have a significant impact on existing sewerage and stormwater collection infrastructure. Municipalities must adapt to changing rainfall regimes to ensure that adequate levels of service for infrastructure are maintained in the future.

Engineers, planners, and policy makers use Intensity-Duration-Frequency (IDF) curves in municipal planning and infrastructure design. IDF curves characterize the relationship between the intensity of rainfall occurring over a specified period and its frequency of occurrence. They are based on historical observations of rainfall. Developing future climate IDF curves is essential for planning for climate change.

Currently, there is no standard or accepted methodology to derive IDF curves for future climate conditions. The Greater Vancouver Sewerage and Drainage District (GVS&DD) initiated this project to advance the knowledge and capabilities of GVS&DD and its member municipalities to adapt to the effects of climate change within the region's sewerage and drainage infrastructure.

This project adressed the following objectives:

- ☑ Update the existing IDF curves to present day
- ☑ Quantify uncertainty of climate change impacts on rainfall and develop future climate IDF curves
- ☑ Determine the potential effects of climate change on sewerage and stormwater infrastructure
- ☑ Develop good practice recommendations for incorporating climate change in infrastructure planning and design

Summary

1. Existing Climate IDF Curves

The existing IDF curves for the Metro Vancouver region were updated. Rainfall data from 74 stations across the region were used to perform a regional rainfall frequency analysis (RRFA).

IDF curves were developed for six homogeneous rainfall zones as shown in **FIGURE 1.** A sample updated IDF curve is depicted in **FIGURE 2**.

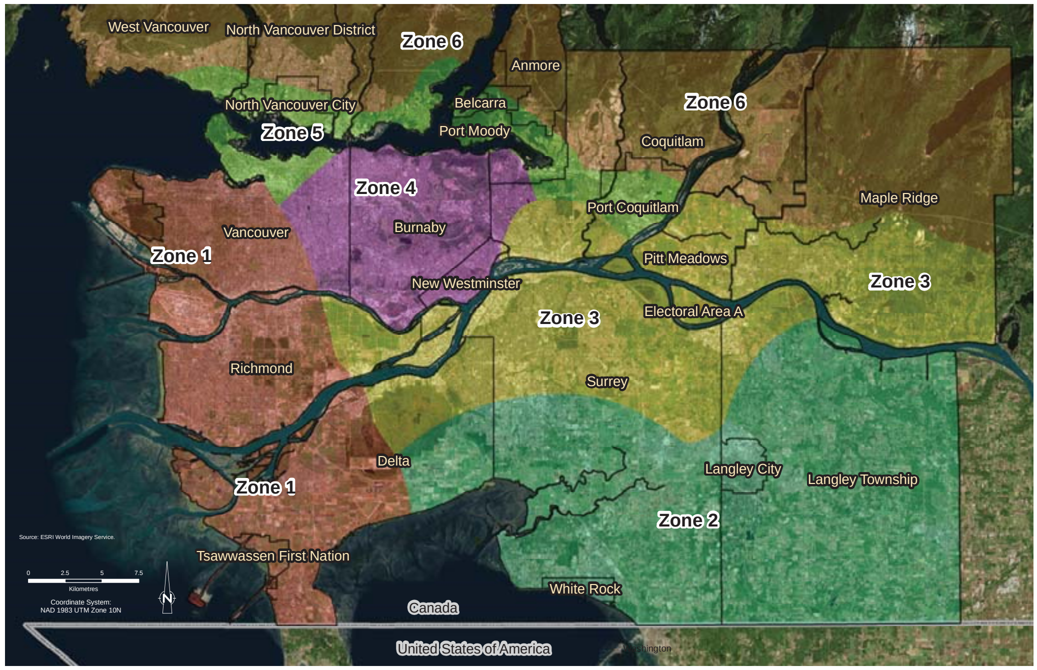


FIGURE 1 – Rainfall Zones

2. Future Climate IDF Curves

Future climate IDF curves were developed from an ensemble of 12 Global Circulation Models (GCM). A new methodology was developed to address challenges in developing future climate rainfall events from GCM data. Projections of future precipitation are subject to many uncertainties in climate modelling, prediction of the future economy, population and technology, and other factors. A sensitivity analysis compared the relative importance of various sources of uncertainty by evaluating over 108,000 combinations of factors and their effects on IDF curves.

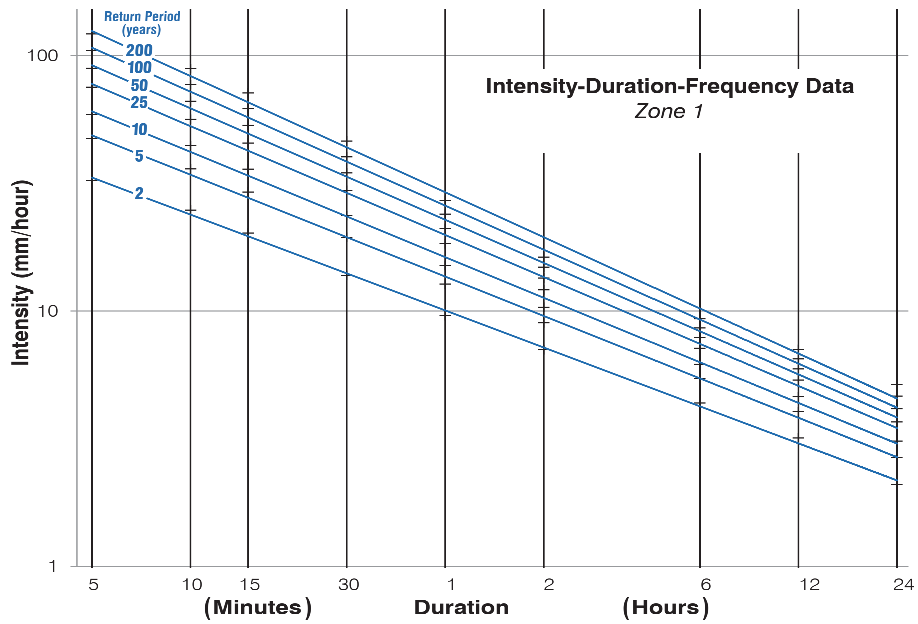


FIGURE 2 – Sample IDF Curve

The results of the sensitivity analysis were used to define IDF curves for a moderate and a high climate change scenario. Both scenarios were based on the Representative Concentration Pathway (RCP) 8.5 "business-as-usual" greenhouse gas (GHG) emissions. The moderate change IDF curve represents the median or likely increase in rainfall. The high change IDF represents an extreme or worst-case increase. Moderate and high change future IDF curves were developed for two time horizons, 2050 and 2100, as shown in **FIGURE 3.**

FIGURE 3 – Future Climate IDF Curves

All of the future IDF curves predict substantial increases in rainfall. The average increase for each future climate IDF curve is shown in **FIGURE 4.** The increase for the high climate change scenario for 2050 is similar to the increase for the moderate climate change scenario for 2100. This indicates that a certain level of increase is expected to occur, but it is not certain when the increase will occur (i.e. it may occur by 2050 in the worst-case scenario, or it may be delayed to 2100 in the moderate scenario).

3. Potential Impacts on Infrastructure

The potential impacts of climate change on infrastructure were analyzed. Three case studies were examined: stormwater drainage networks, sewage collection systems, and combined sewer systems. Significant impacts were identified, and applying adaptation measures will require significant expense.

Increases in future rainfall due to climate change in combination with sea level rise could cause flooding in stormwater drainage networks. Adaptation measures are key to ensuring the levels of service of stormwater drainage infrastructure are maintained.

Stormwater Adaptation Measures

- Best management practices
- Green Infrastructure/Low Impact Development
- Peak flow diversion/storage
- Stormwater management ponds
- Pipe upsizing
- Rehabilitation of infrastructure part-way through design life

Climate change is expected to impact sewage collection systems through increasing rainfall derived inflow and infiltration (RDII). Population growth is also a significant factor for sewage collection systems. Adaptation measures are focused on reducing the impact of increased RDII.

Sewage Collection Adaptation Measures

- RDII reduction
- Peak flow storage
- Private-side measures (e.g. backflow preventors)
- Pipe upsizing
- Increases in the capacities of pump stations and wastewater treatment plants

More combined sewer overflows can be expected with increasing stormwater volume and RDII due to climate change. Population growth also affects the capacity of combined sewers. Along with the adaptation measures already described, accelerated sewer separation should also be considered

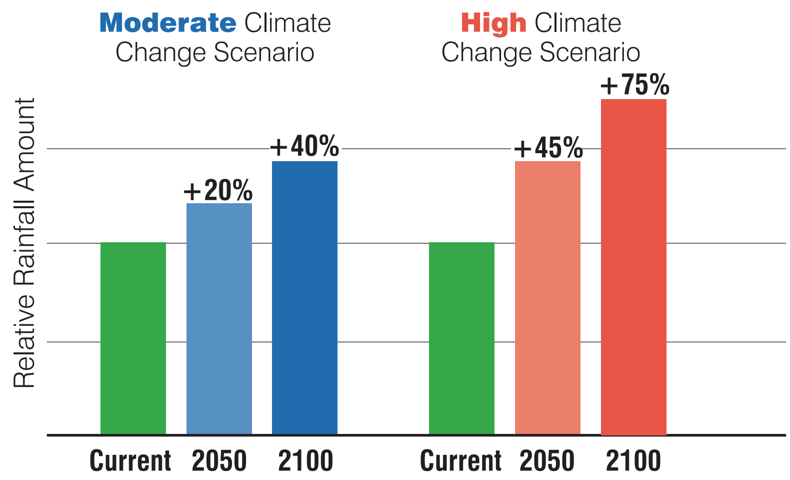


FIGURE 4 – Average Rainfall Increase

4. Good Practice Recommendations

The future climate is uncertain, and climate change adaptation must balance the uncertainty with risk and the infrastructure planning horizon. Selecting the preferred IDF curve for planning and design is a key factor to ensure that the right adaptation measures are selected, at the right time, for the right reasons, and for the right costs.

The selection of the preferred IDF curve for adaptation planning is based on the level of risk, as shown in **FIGURE 5**. Using the current climate IDF curves for design is suitable for temporary infrastructure (e.g. less than five-year design life). Using the moderate change future climate IDF curves is suitable for infrastructure with low to medium risk due to failure. Using the high change future climate IDF curves is suitable for infrastructure where the risk due to failure is high or catastrophic. The selection of 2050 or 2100 depends on the planning horizon of the infrastructure.

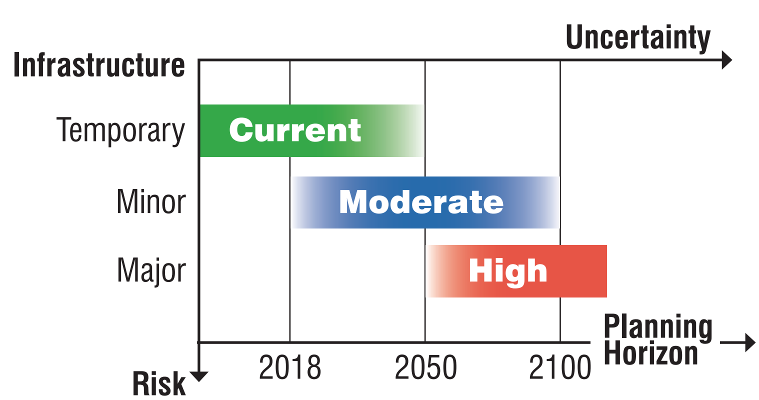


FIGURE 5 – Climate Change Adaptation

Conclusions and Next Steps

Stormwater and sewerage infrastructure in the Metro Vancouver region is vulnerable due to increasing rainfall. The future climate IDF curves developed in this project can be used to plan for and adapt to climate change to ensure that adequate levels of service are maintained.

Next steps to further the development of climate change adaptation planning are included in **FIGURE 6.** The steps have been divided into four categories: Planning and Research, Design and Delivery, Support Services, and Performance Management. These four categories will work together to ensure that climate change adaptation planning is coherent and consistent across the Metro Vancouver region, and that a regional climate change 'culture' is developed.

Planning and Research	Design and Delivery	Support Services	Performance Management
Develop a formal climate change policy Determine level of service targets Perform vulnerability and risk assessments Conduct cost-benefit analyses and select adaptation responses Develop a ten-year capital program	Propose draft version of design updates to incorporate climate change adaptation Integrate climate change adaptation into other capital delivery stages Implement final design updates	Create a climate change Data Management Strategy Create a Knowledge Management Plan Formalize climate change roles within job descriptions and adopt succession planning	Create a formal audit process to benchmark climate change adaptation progress

FIGURE 6 – Climate Change Adaptation Planning

metrovancouver
SERVICES AND SOLUTIONS FOR A LIVABLE REGION

Metro Vancouver is a federation of 21 municipalities, one Electoral Area and one Treaty First Nation that collaboratively plans for and delivers regional-scale services. Its core services are drinking water, wastewater treatment and solid waste management.

Metro Vancouver and the Greater Vancouver Sewerage and Drainage District (GVS&DD) own, maintain and operate regional trunk sewers and major wastewater treatment plants. Municipal members of the GVS&DD own and maintain collector sewers and manage stormwater systems.

www.metrovancouver.org

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APPENDIX D

DFO AQUATIC SPECIES AT RISK MAP

DFO Aquatic Species at Risk Map
Stormwater Pollution Prevention Plan
Neptune Bulk Terminals
1001 Low Level Road, North Vancouver, BC