Stormwater Management Design Criteria

Sterling Shipyard Remediation and Infill

Prepared for:

Vancouver Fraser Port Authority

October 29, 2021

Internal Ref: 677011-0000-41EC-0001

Revision Index

Revision	Prepared	Reviewed	Approved	Date	Remarks
PA	CL			2021-07-19	In Progress for 90% Design Submission
PB	CL	TL	TL	2021-10-26	90% Design Submission
PC	CL	TL	TL	2021-10-29	90% Design Submission

Signature Page

Prepared By:

Chris Liu, M. ASc., P.Eng
Municipal Engineer
Water Infrastructure Western Canada
Engineering, Design & Project Management

Review By:

Tori Liu, M.Sc., P. Eng.
Director, Water Infrastructure Western Canada
Water Infrastructure Western Canada
Engineering, Design and Project Management

Notice to Reader

This report has been prepared and the work referred to in this report has been undertaken by SNC-Lavalin Inc. (SNC-Lavalin) for the exclusive use of the Vancouver Fraser Port Authority (Port Authority), who has been party to the development of the scope of work and understands its limitations. The methodology, findings, conclusions, and recommendations in this report are based solely upon the scope of work and subject to the time and budgetary considerations described in the proposal and/or contract pursuant to which this report was issued. Any use, reliance on, or decision made by a third party based on this report is the sole responsibility of such third party. SNC-Lavalin accepts no liability or responsibility for any damages that may be suffered or incurred by any third party as a result of the use of, reliance on, or any decision made based on this report.

The findings, conclusions, and recommendations in this report (i) have been developed in a manner consistent with the level of skill normally exercised by professionals currently practicing under similar conditions in the area, and (ii) reflect SNC-Lavalin's best judgment based on information available at the time of preparation of this report. No other warranties, either expressed or implied, are made as to the professional services provided under the terms of our original contract and included in this report. The findings and conclusions contained in this report are valid only as of the date of this report and may be based, in part, upon information provided by others. If any of the information is inaccurate, new information is discovered, site conditions change, or applicable standards are amended, modifications to this report may be necessary.

This report must be read as a whole, as sections taken out of context may be misleading. If discrepancies occur between the preliminary (draft) and final versions of this report, it is the final version that takes precedence. Nothing in this report is intended to constitute or provide a legal opinion.

The contents of this report are confidential and proprietary. Other than by the port authority, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of the Port Authority and SNC-Lavalin.

Table of Contents

Figures

Tables

1 Introduction and Background

The Vancouver Fraser Port Authority is remediating the former Sterling Shipyard Site (the Site) at 2089 to 2095 Commissioner Street, which includes an upland area, and undeveloped intertidal and subtidal areas. The Site is located between the Lafarge Ready Mix concrete plant to the East, and the Former Marco Marine Container Inc. ("Marco") facility to the West, which is currently used for surface parking by various nearby companies.

In this project, the proposed site elevation will be temporarily raised to a rough grade elevation of 6.0 m CD. A future project by others will develop a final grade design of approximately 7.0 m CD.

As part of this Sterling Shipyard Remediation and Infill Project, stormwater management design and analyses were conducted to ensure that with the rough grade design, the Site would be properly drained, and the stormwater from the Site would not flood the surrounding areas. The analysis was completed on the understanding that the rough grade design is temporary, and a final grade design will be completed by others. This Stormwater Management Design Criteria demonstrates the standards, parameters and methods used for the stormwater management design and analyses, as well as the results and recommendations.

2 Design Standards and References

The stormwater management design for this project conforms to the following standard:

- Port of Vancouver Project and Environmental Review Guidelines – Developing Your Stormwater Pollution Prevention Plan (2015).
- The City of Vancouver Engineering Design Manual (2018).
- USDA National Engineering Handbook (2009).

3 Design Storm

The design storm event for this project is 1:100 year storm event. Since the stormwater management design is temporary for the project area before its future development, Climate Change is not considered in the stormwater management analyses. According to the City of Vancouver Engineering Design Manual (2018), the 2014 IDF data was used to calculate the 1:100 year, 24 hour rainfall intensity and depth, and the SCS type 1A rainfall distribution was applied to generate the design storm in the PCSWMM hydraulic model. Table 3-1 summarizes the 1:100 year, 24 hour rainfall intensity and depth.

Table 3-1 City of Vancouver 1:100 year, 24 hour Rainfall Intensity and Depth

Rainfall Return Period (year)	Duration (hour)	Rainfall Intensity (mm/hour)	Rainfall Depth (mm)
100	24	5.61	134.62

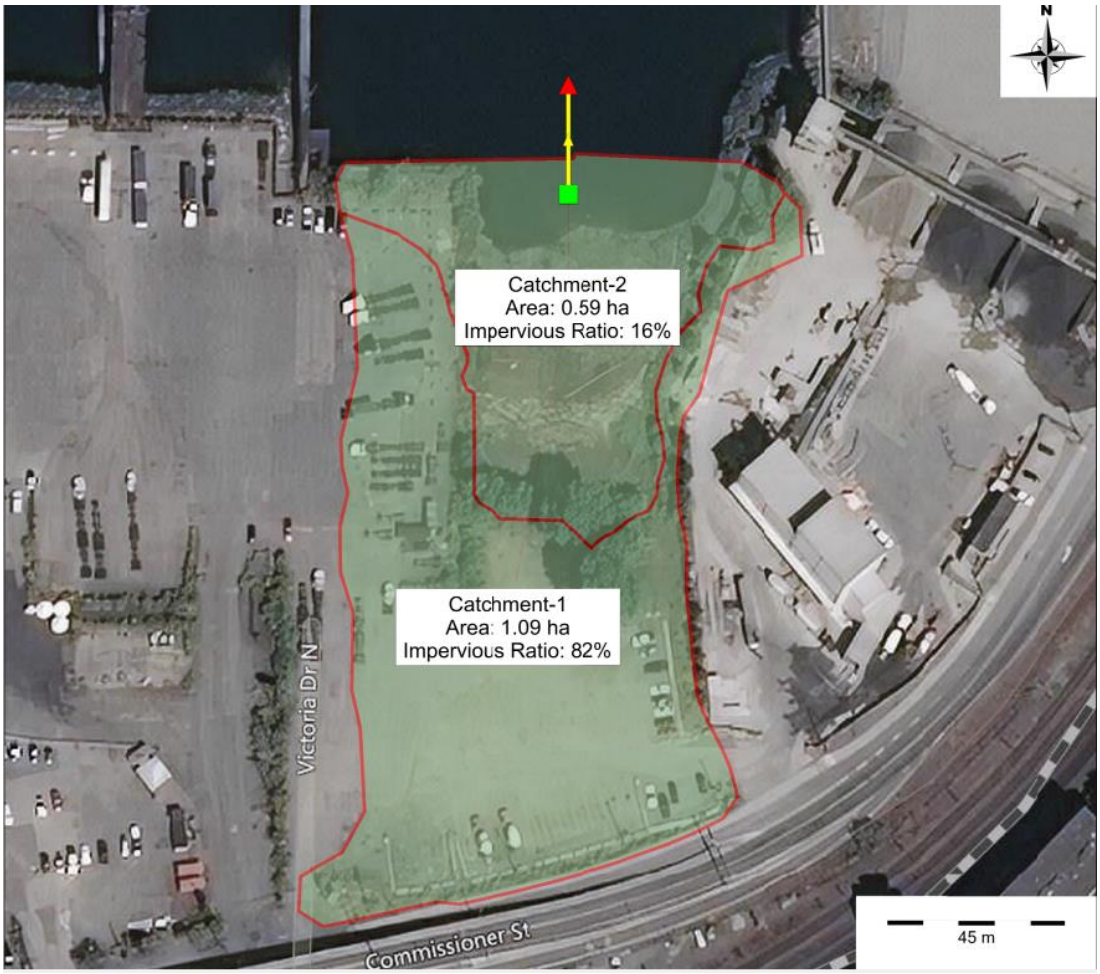
4 Storm Catchment

The storm catchments were delineated based on the proposed contours of the intertidal area and the berm, and the existing survey contours for the surrounding area draining to the intertidal area. Figure 4-1 shows the catchments for this project, and Table 4-1 summarizes the catchment properties. Cathchment-1 is the surrounding area draining to the intertidal area, and most of this catchment is paved with asphalt. Catchment-2 is the intertidal area that is going to be remediated and backfilled with the compacted sand and gravel.

Table 4-1 Catchment Property Summary

Catchment No.	Area	Impervious Area	Pervious Area	Impervious Ratio
	(ha)	(ha)	(ha)	(%)
Catchment-1	1.09	0.90	0.20	82
Catchment-2	0.59	0.09	0.50	16
Total	1.69	0.99	0.70	59

Figure 4-1 Sterling Shipyard Catchments



5 Soil Infiltration Parameters

Based on the borehole logs in the current and previous Geotechnical reports, the native soil underneath the project area is sandy soil. According to USDA National Engineering Handbook, Part 630 Hydrology, Chapter 7 Hydrologic Soil Group, the native soil is classified as Group B soil with the maximum infiltration rate of 7.62 mm/hour and minimum infiltration rate of 3.81 mm/hour. The native soil within the intertidal area will be removed, and the intertidal area will be backfilled with the compacted sand and gravel. Therefore, the soil infiltration rates used for this area will be the maximum and minimum infiltration rates of the backfilling material. Table 5-1 shows the infiltration parameters of the backfilling material provided by the Geotechnical group, and the Lower K and Upper K was converted to the infiltration rates to be used in the PCSWMM model. The soil infiltration for each catchment was modeled using the Horton's equation. Table 5-2 summarizes the parameter used for the catchments.

Table 5-1 Backfilling Material Infiltration Parameters from Geotechnical Engineer

Materials	Saturated Kx* (m/s)		Ky*/Kx Ratio	Volumetric Water Content
	Lower K Values	Upper K Values		
Compacted Sand and Gravel (Fill)	1e-04	1e-03	1	0.1

Table 5-2 Horton's Infiltration Parameters

Location	Maximum Infiltration Rate (mm/hour)	Minimum Infiltration Rate (mm/hour)	Decay Constant (1/hour)
Surrounding Area (Catchment-1)	7.62	3.81	4
Intertidal Area (Catchment-2)	3.60E+03	3.60E+02	4

6 PCSWMM Modeling Results

The PCSWMM hydrologic and hydraulic model was built to analyze the peak flow rate and total flow volume and hence to determine if the entire site can be drained through infiltration or if an outfall is required.

the peak flow rate from the project site is 0.023 m^3/s and the total flow volume is 332 m^3.

7 Conclusions and Recommendations

The rough grade design will infill the intertidal area to the elevation of 6.0 m CD, which will be lower than the Lafarge site at the east and most of the Macro site at the west. However, the northeast corner of the Macro site is slightly lower than 6.0 m CD. In order to contain the stormwater within the intertidal area, a 0.5 m berm will be built along the west boundary of the intertidal area to prevent the stormwater from flooding the Macro site. According to the survey, the Macro site is generally sloping towards north, so the stormwater from the site is draining into the sea and will not be ponding on site after the berm is built.

The total surface area of the infill is 5,000 m^2. With a berm built along the west boundary of the intertidal area, the 1:100 year stormwater flow volume will be stored and infiltrated in the intertidal area. The maximum water depth will be less than 0.1 m and will not flood the surrounding area.

In case of emergency such as the failure of infiltration due to high ground water season, a 250 mm diameter overflow pipe is designed, and its outlet invert is set at 6.2 m CD to drain the intertidal area and avoid the stormwater flooding the surround area. Since the Design Water Level (DWL) is 6.2 m CD for the year 2021, the check valve will not be needed at the pipe outlet.

The stormwater management measures described in this design criteria are temporary for the rough grade design before the final grade design by others is completed. In the future project, the final stormwater management design and analyses shall be carried out for the final site design. The stormwater designer/engineer shall validate the location, size, material and inverts of the outfall, and determine whether the outfall needs to be removed and replaced with a new one.