APPENDIX L

Stormwater Management Plan (R1)

FIBRECO

Fibreco Export Terminal Enhancement
Permit Application Document

APPENDIX L

Stormwater Management Plan - Executive Summary

Fibreco is committed to ensuring the highest level of environmental protection is maintained. In order to keep our waterways clean, Fibreco will not allow any harmful water to escape from the site. The existing Stormwater Management Plan effectively removes solids, oil and grease and any other run off that may occur within the site boundaries.

The proposed land use changes do not alter the ground grades nor the impervious area. Thus, runoff quantities and patterns as well as catchment areas are expected to remain un-changed. Design flows were computed using the Rational Method to evaluate the pipe capacity of DNV storm mains. The results show that in the receiving DNV storm sewer from the sites northeast catchment has ample capacity for the flow it receives up to the 100-year storm event. The 250 mm DNV storm main that receives flow from the site's northwest catchment is near capacity for the regions 10-year flood event. Overland flow is expected during larger storms. The additional flow would enter the 1050 mm trunk storm main through catch basins on McKeen Avenue and Pemberton Avenue.

The proposed site redevelopment which includes the removal of the woodchip pile and containment and coverage of the materials on the site is expected to lead to an improvement in the stormwater quality with respect to total suspended solid (TSS).

Best Management Practices (BMP) by several local agencies were reviewed and recommendations on stormwater management measures, maintenance and inspection, and water monitoring were made to improve stormwater management in the future.

The complete report details these findings, provides relevant drawings, and includes project-specific design information. Please refer to the complete report to fully understand the recommendations and appropriate context.

STORMWATER MANAGEMENT PLAN FOR 1209 MCKEEN AVENUE EXPANDED TO ADDRESS VFPA COMMENTS

FINAL REPORT

Prepared for:

Fibreco Export Inc.
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DISCLAIMER

This report has been prepared by Northwest Hydraulic Consultants Ltd. for the benefit of Fibreco Export Inc. for specific application to the Stormwater Management Plan for 1209 McKeen Avenue, North Vancouver, British Columbia. The information and data contained herein represent Northwest Hydraulic Consultants Ltd. best professional judgment in light of the knowledge and information available to Northwest Hydraulic Consultants Ltd. at the time of preparation, and was prepared in accordance with generally accepted engineering practices.

Except as required by law, this report and the information and data contained herein are to be treated as confidential and may be used and relied upon only by Fibreco Export Inc., its officers and employees. Northwest Hydraulic Consultants Ltd. denies any liability whatsoever to other parties who may obtain access to this report for any injury, loss or damage suffered by such parties arising from their use of, or reliance upon, this report or any of its contents.

EXECUTIVE SUMMARY

Fibreco Export Incorporated (Fibreco) operates a wood fibre export terminal on the north shore of Burrard Inlet at 1209 McKeen Avenue, within the District of North Vancouver (DNV). Operations at the terminal consist of handling and storage of woodchips and wood pellets delivered to and from the site by rail, truck, barge, and deep sea vessels. Fibreco is planning changes in property use from handling wood pellets and woodchips to wood pellets and bulk food grains. These changes include installation of storage silos on the northeastern and southern portions of the property where the wood stockpiles used to be.

The proposed land use changes do not alter the ground grades nor the impervious area. Thus, runoff quantities and patterns as well as catchment areas are expected to remain unchanged. Design flows were computed using the Rational Method to evaluate the pipe capacity of DNV storm mains. The results show that the receiving DNV storm sewer from the sites northeast catchment has ample capacity for the flow it receives up to the 100 year storm event. The 250 mm DNV storm main that receives flow from the site's northwest catchment is near capacity for the regions 10 year flood event. Overland flow is expected during larger storms. The additional flow would enter the 1050 mm trunk storm main through catch basins on McKeen Avenue and Pemberton Avenue.

The proposed site redevelopment, which includes the removal of the woodchip pile and containment and coverage of the materials on the site, is expected to lead to an improvement in the stormwater quality with respect to total suspended solid (TSS).

Best Management Practices (BMP) by several local agencies were reviewed and recommendations on stormwater management measures, maintenance and inspection, and water monitoring were made to improve stormwater management in the future. The initial report prepared primarily to address District of North Vancouver requirements (August 2016) was updated in response to comments from the Vancouver Fraser Port Authority (VFPA) October 2016.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

Fibreco Export Incorporated (Fibreco) operates a wood fibre export terminal on the north shore of Burrard Inlet at 1209 McKeen Avenue, within the District of North Vancouver (DNV). Operations at the terminal consist of handling and storage of woodchips and wood pellets delivered to and from the site by rail, truck, barge, and deep sea vessels. Handling of the wood products can result in the generation of dust and wood fibre. Fibreco has implemented equipment and processes to intercept and retain wood fibre from site's stormwater over the years (NHC 2013).

Fibreco is currently planning changes in property use from handling wood pellets and woodchips to wood pellets and bulk food grains. These changes include the installation of storage silos on the northeastern and southern portions of the property where the wood stockpiles used to be. This document presents the stormwater management plan on the Fibreco site based on the proposed changes. The initial report prepared primarily to address District of North Vancouver requirements (August 2016) was updated in response to comments from the Vancouver Fraser Port Authority (VFPA) October 2016.

2 STORMWATER DRAINAGE PLAN

The project site is located on the north shore of Burrard Inlet about 2.2 km east of the Lions Gate Bridge. The site is relatively flat with slight grades generally towards the edges of the property and existing drainage structures. The site is mostly covered with impermeable surfaces such as concrete work areas, rail yards, offices, out-buildings, wood pellet storage silos, a covered wood fibre storage and bulk wood fibre piles. Currently the bulk wood fibre piles cover roughly 3 ha of the site. The following sections describes the site condition, drainage network, and stormwater qualities in details.

2.1 Description of Existing Drainage Network

The project site comprises four sub-drainage systems that are separated by site grade, structures above grade or an underground drainage pipe network. The areas and characteristics of the sub catchments are summarized in **Table 1**.

Table 1. Sub catchments on the property of 1209 McKeen Avenue

Sub Catchment	Area (ha)	Site Slope	Impervious Ratio
Northeast	3.2	0.0078	90%
Northwest	1.6	0.0037	90%
Central East	1.7	0.0194	90%
Southern	2.4	0.0054	90%

Drawing 1 and **2** in **Appendix A** provide an aerial photograph overlaid with a schematic of stormwater management components and existing key infrastructure.

2.1.1 Northeastern Drainage

The northeastern region of the site consists of an automated car wash, maintenance shop, woodchip stock pile and storage silos. The storm runoff from the northeastern catchment enters the DNV's storm trunk at three locations. The automated car wash yard is located at the northeast corner of the property. Surface runoff from the car wash area is collected by the catchment basins along McKeen Avenue and enters 900 mm storm trunk on Pemberton Avenue. Another onsite drainage system collects runoff near the maintenance shop that is slightly south of the car wash area. The runoff goes through a 200 mm local storm pipe and an interceptor at MH4-1 (5' long, 3' wide and 5' deep) before connecting to the 1050 mm DNV storm trunk. The surface runoff further south of the maintenance shop is collected through a series of catch basins in-between the woodchip stockpile and the wood pellet silos before going through a multi-cell separator near the storage building, and a storm interceptor at MH3-1 (5' long, 30" wide and 42" deep) near the north silo.

The stockpile wood chips is exposed to precipitation and wind. The runoff from nearby areas would likely contain high levels of total suspended solids (TSS), and the leachate of timber products would likely raise the level of biochemical oxygen demand (BODs) in runoffs. In addition, the parking lot near the office building, the car wash, and the maintenance shop where heavy machinery and petroleum fueled vehicles operate and store, are often sources of stormwater pollutants such as solvents, paint solids, polychlorinated biphenyls (PCBs), Polycyclic aromatic hydrocarbons (PAHs) and other hydrocarbons. Traces of heavy metals, such as lead, cadmium, zinc and copper, may also enter the stormwater drainage network through surface runoff. The stormwater collected from this sub-basin is treated by the multi-cell separator and the storm interceptor to reduce the levels of TSS and oil and grease (hydrocarbons) before discharging to DNV's storm trunk.

2.1.2 Northwestern Drainage

The northwestern region of the site consists of rail yard for wood fibre transport and paved work area used to store and handle wood fibre. Handling of the wood fibre consists of loading and transporting it using conveyors and front end loaders. The runoff goes into catch basins and is then carried by a local 150 mm main through an interceptor at MH1-4 (8' long, 3' wide and 5' deep) before discharging to the 250 mm DNV storm main along McKeen Avenue. The main pollutant of concern from this sub-basin is heavy metals, that are washed off the rail tracks during storm events. Traces of oil and grease may also enter the stormwater system.

2.1.3 Central Eastern Drainage

The central eastern region of the site houses covered bulk storage of wood pellet and multiple conveyors. The runoff from the central eastern catchment drains directly to a 280 m long open channel in the form of overland flow. There is a 270 m long straw bale barrier and silt fence installed along the right bank of the channel. .

Bulk wood chips are stored under the cover of a shed. This significantly limits the potential interaction of runoff with the wood chips and hence reduces the presence of sediment and wood dust in stormwater runoff. The belt conveyor of the wood pellets is not covered, and therefore exposed to precipitation and wind. As a result, wood dust and sediment may be washed off and carried by stormwater. The straw bale barrier was placed to prevent wood waste from entering the open channel with stormwater. Stormwater runoff from this sub-basin could also contain small amount of heavy metals, oil, and grease sourced from the belt conveyor.

2.1.4 Southern Drainage

The southern region of the site is houses an uncovered woodchip pile and a single conveyor transport between the site and marine vessels. The south end of the site drains south towards Burrard Inlet either as surface flow or through a filtration pond located at the southwest corner of the site (CB-21). The main contaminant of concern for this sub-basin is TSS in stormwater. Traces of metal and oil grease may be washed off conveyor by rain water, however, the presence of heavy metals and oil and grease is deemed to be low given only one conveyor is located within this sub-basin.

Table 2. Summary of common activities, pollutant sources, and associated pollutants of the sub-basins of the existing condition

Sub-Catchment	Receiving Water	Site Activities	Potential Pollutant Sources	Pollutants of Concern	Pollution Consequences[1]	Pollution Possibility[1]	Pollution Risk Rank[1]	Existing BMP
Northeast	DNV Storm System	Car washing	Wash water	Paint Solids, heavy metals, suspended solids, debris	3	4	12	Preventative measures include good house keeping practices, minimizing exposure, and local erosion and sediment control. Parts are washed by contained parts washer, and the solvent for washing is recycled. Runoff goes through a multi-cell separator and/or storm interceptors before discharge to DNV's storm system.
		Wood fibre and pellet stockpile and silo storage , handling, and transfer	Spills, overfills, exposed fine wood fibres and pellets to wind and precipitation	Wood dust and fibres could cause high level of TSS and leachate usually contain high biochemical oxygen demand (BODs)	2	4	8	
		Engine and heavy machinery maintenance and fueling station	Parts cleaning, waste disposal of greasy parts, used lubricants, coolants, and batteries. Fueling spills, leaks, and hosing area	Paint solids, heavy metals, solvents, oil, debris	3	2	6	
		Vehicle parking	Combustion of fuel, leaking, and spill of fuel	Fuel, oil and grease	3	2	6	
Northwest	DNV Storm System	Railway maintenance and fueling station	Spills and leaks of oil, lubricants, and heavy metals through leaching process of the railway tracks	Oil and grease, sediments, heavy metals	3	2	6	Preventative measures include good house keeping practices, minimizing exposure, and local erosion and sediment control. Runoff goes through storm interceptors before discharge to DNV's storm system.
		Wood fibre loading and handling	Spills and exposure to wind and precipitation during loading	Wood dust and fibres could cause high level of TSS and leachate usually contain high biochemical oxygen demand (BODs)	3	2	6	

Sub-Catchment	Receiving Water	Site Activities	Potential Pollutant Sources	Pollutants of Concern	Pollution Consequences[1]	Pollution Possibility[1]	Pollution Risk Rank[1]	Existing BMP
Central East	Open Channel to Burrard Inlet	Wood fibre storage (storage shed), loading, and handling	Although storage shed covers the wood pellets, spilling can occur during handling and loading; where enclosure is not complete, wood fibres would be exposed to wind and precipitation	Wood dust and fibres could cause high level of TSS and leachate usually contain high biochemical oxygen demand (BODs)	2	2	4	Preventative measures include good house keeping practices, minimizing exposure, and local erosion and sediment control. Runoff goes through a 280 m long straw bale barrier where wood debris and fibres were intercepted before discharge to the open channel.
		Conveyor and the pavement are exposed to precipitation	Heavy metals and oil and grease (from lubricant) can be washed off by rain water from the conveyor and pavement surface	Oil and grease, heavy metals	2	1	2	
Southern	Burrard Inlet	Wood fibre and wood chips stockpile storage, handling and loading (both deep and shallow water ships)	Stockpiled wood chips and fibres are exposed to wind and precipitation. Wood chips and pellets are handled and loaded to deep and shallow water ships through covered conveyor, yet spills can occur where the conveyor closure is not complete.	Wood dust and fibres could cause high level of TSS and leachate usually contain high biochemical oxygen demand (BODs)	2	3	6	Preventative measures include good house keeping practices, minimizing exposure, and local erosion and sediment control. Runoff filtration pond (CB2-1) is installed on the southwest corner of the sub-basin.
		Conveyor and the pavement are exposed to precipitation	Heavy metals and oil and grease (from lubricant) can be washed off by rain water from the conveyor and pavement surface	Oil and grease, heavy metals	2	1	2	Containment booms are placed within the receiving water to prevent wood fibre/debris dispersion.

1. The pollution probability is ranked from 1 (least likelihood of release) to 5 (most likely to release); the pollution consequences is ranked from 1 (least significance of the consequences) to 5 (most significant consequences to receiving water); the pollution risk is the product of the probability and consequences (PMV, 2015).

2.2 Design Discharge and Capacity Analysis of Existing Drainage Network

The project site is an industrial land and has an impervious area ratio of 90%. Based on the small area and the simple characteristics of the site, the Rational Method was used to estimate the design flow during storms. The general form of the rational formula is:

Q = RAIN Where R is the runoff coefficient

A is the drainage area in hectares

I is the rainfall intensity in mm/h, and

N is the time unit conversion 1/3600 (hr/sec).

The runoff coefficient is determined by the land use, average site slope, soil adjustment factor (SAF) and impervious area ratio. A runoff coefficient of 0.8 was selected for floods up to 10-year return period, and 0.85 for floods of return period up to 100 years (DNV, 2006). The DNV Municipal Hall's hydrometric station (DN25) is located within 4 km distance from the project location and has published intensity, duration and frequency (IDF) Curves based on data collected between 1964 and 2014. DN25's IDFs were used for rational flood estimates. Design flows are summarized in **Table 3**.

Table 3. Design precipitation intensity and flow approximation

Catchment	Area (ha)	Runoff Coefficient, R		Intensity, I (mm/hr)		Discharge, Q (cms)	
		10 Yr	100 Yr	10 Yr	100 Yr	10 Yr	100 Yr
Northeast	3.2	0.8	0.85	8.74	13.40	0.063	0.103
Northwest	1.6	0.8	0.85	8.74	13.40	0.031	0.051
Central East	1.7	0.8	0.85	8.74	13.40	0.032	0.053
Southern	2.4	0.8	0.85	8.74	13.40	0.047	0.077

Calculations (**Table 4**) were also conducted to evaluate how the receiving pipe capacity accommodates the stormwater runoff from the northeast and northwest catchment areas where the runoff enters DNV's storm system.

Table 4. Evaluation of receiving pipe capacity

Catchment	Pipe Specifications			Discharge (cms)			% of Pipe Capacity	
	Diameter (mm)	Slope (%)	Cross-sectional Area (m^2)	Full Capacity[1]	10-yr	100-yr	10-yr	100-yr
Northeast	1050	0.364	0.866	1.429	0.063	0.103	4.4 %	7.2 %
Northwest	250	0.441	0.049	0.034	0.033	0.051	98.5%	NA

1. The pipe's full capacity is calculated assuming the pipe is full under gravity flow condition

In the northeast catchment, the drainage from the region occupies only a small percentage (<8%) of the 1050 mm DNV storm trunk. Upstream of the project site, the 1050 mm DNV storm trunk drains a

catchment area that is approximately 19 ha (blue shading in **Figure 1**). The upper catchment consists roughly 32% low density residential area, 36% mixed use commercial lots, and 32% roads and pavements. The composite runoff coefficient, R, for the upper catchment is 0.7 for events of 5 years to 10 years return period, and 0.75 for events over 100 years return period. The estimated runoff from the upper watershed during the 10-year event is 0.41 m^3/s, and the runoff during the 100-year event is estimated to be 0.66 m^3/s. Therefore, during the 100-year storm event, the total estimated discharge including from the Fibreco's site to the 1050 mm storm trunk is 0.77 m^3/s, under 60% of the capacity of the 1050 mm storm trunk.

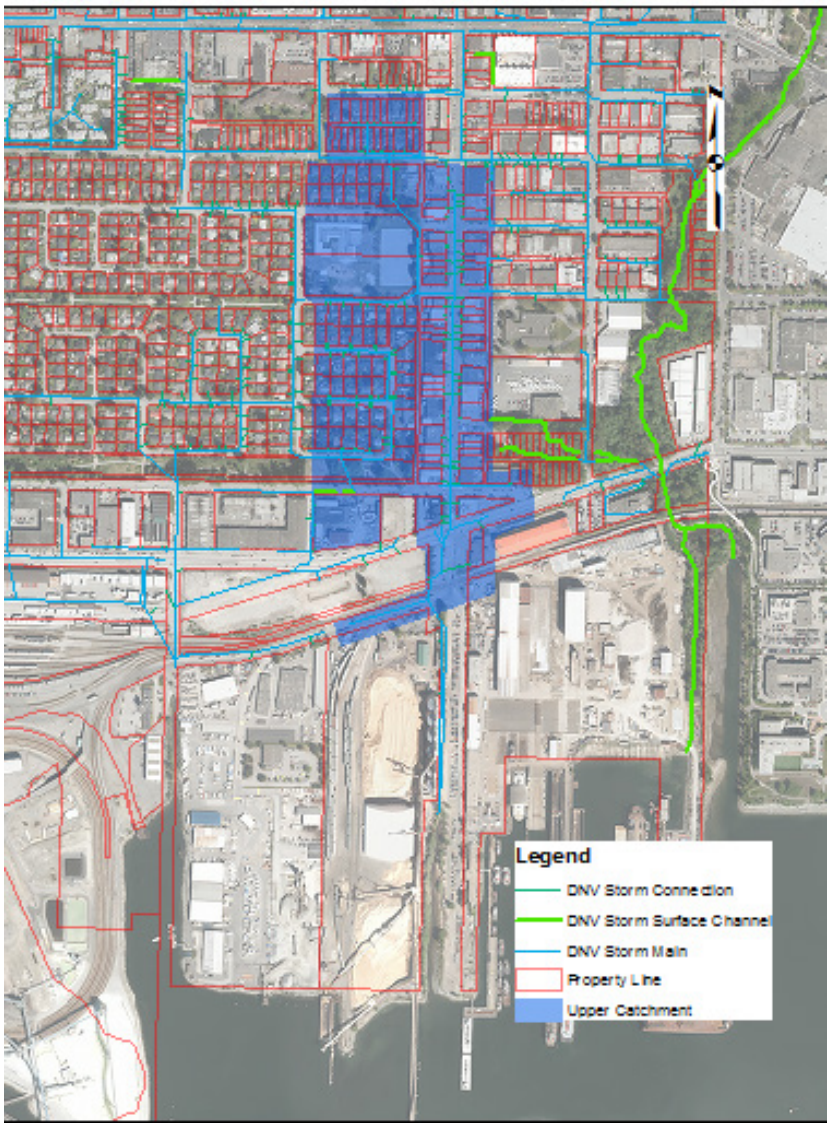

Figure 1. Catchment of DNV 1050 mm Trunk Storm Main Upstream of the Fibreco Site

The northwest catchment is connected to DNV's 250 mm storm main. The 250 mm storm main is considered a minor drainage system, and it is designed to drain runoff from a 10 -year storm event (DNV,

2006). Surface runoff from the northwest catchment occupies nearly the full capacity of the storm main. During greater storm events, overland flow would occur when the storm main reaches its capacity. The additional overland flow is expected to enter the 1050 mm storm trunk further downstream through street catch basins on McKeen Avenue and Pemberton Avenue.

2.3 Proposed Changes in Relation to the Drainage Network

The proposed site changes are limited to the northeast and southern catchments only. The proposed changes are related to the use of the site and not direct modification of the drainage network. The typical operational functions and infrastructures on the northwest and central east catchments are to remain unchanged.

In the northeast catchment, the general runoff direction is not expected to change. Removal of the woodchip stockpile and its replacement with silos and closed conveyors will not change the site's impervious area. Therefore, the runoff quantity will remain the same. The transition to covered systems and contained storage is expected to significantly reduce the organic dust fibre and sediments found in stormwater.

Similar to the northeastern drainage catchment, the general runoff flow direction in the southern drainage catchment is not expected to change with the proposed land use change. The removal of the woodchip stockpile and its replacement with silos and closed conveyors will not change the site's impervious area and the runoff quantity will remain the same. The transition to covered systems and contained storage is expected to improve the runoff water quality.

The contaminant source and path under the existing and proposed conditions for the northeastern and southern regions are outlined in **Table 5**.

Table 5. Summary of Common Activities, Pollutant Sources, and Associated Pollutants for the Sub-Basins of the Proposed Development

Sub-Catchment	Receiving Water	Site Activities	Potential Pollutant Sources	Pollutants of Concern	Pollution Consequences[1]	Pollution Possibility[1]	Pollution Risk Rank[1]	Existing BMP
Northeast	DNV Storm System	Car washing	Wash water	Paint Solids, heavy metals, suspended solids, debris	3	4	12	Preventative measures include good house keeping practices, minimizing exposure, and local erosion and sediment control.
		Silo storage of wood pellets and bulk grain, handling, and transfer	Dust and sediment can be transferred to storm runoff where the enclosures of silos and conveyors are not complete	TSS and BODs	2	1	2	
		Engine and heavy machinery maintenance and fueling station	Parts cleaning, waste disposal of greasy parts, used lubricants, coolants, and batteries. Fueling spills, leaks, and hosing area	Paint solids, heavy metals, solvents, oil, debris	3	2	6	Parts are washed by contained parts washer, and the solvent for washing is recycled.
		Vehicle parking	Combustion of fuel, leaking, and spill of fuel	Fuel, oil and grease	3	2	6	Runoff goes through a multi-cell separator and/or storm interceptors before discharge to DNV's storm system.
Northwest	DNV Storm System	Railway maintenance and fueling station	Spills and leaks of oil, lubricants, and heavy metals through leaching process of the railway tracks	Oil and grease, sediments, heavy metals	3	2	6	Preventative measures include good house keeping practices, minimizing exposure, and local erosion and sediment control.
		Wood fibre loading and handling	Spills and exposure to wind and precipitation during loading	Wood dust and fibres could cause high level of TSS and leachate usually contain high biochemical oxygen demand (BODs)	3	2	6	Runoff goes through storm interceptors before discharge to DNV's storm system.

Sub-Catchment	Receiving Water	Site Activities	Potential Pollutant Sources	Pollutants of Concern	Pollution Consequences[1]	Pollution Possibility[1]	Pollution Risk Rank[1]	Existing BMP
Central East	Open Channel to Burrard Inlet	Wood fibre storage (storage shed), loading, and handling	Although storage shed covers the wood pellets, spilling can occur during handling and loading; where enclosure is not complete, wood fibres would be exposed to wind and precipitation	Wood dust and fibres could cause high level of TSS and leachate usually contain high biochemical oxygen demand (BODs)	2	2	4	Preventative measures include good house keeping practices, minimizing exposure, and local erosion and sediment control.
		Conveyor and the pavement are exposed to precipitation	Heavy metals and oil and grease (from lubricant) can be washed off by rain water from the conveyor and pavement surface	Oil and grease, heavy metals	2	1	2	Runoff goes through a 280 m long straw bale barrier where wood debris and fibres were intercepted before discharge to the open channel.
Southern	Burrard Inlet	Silo storage of bulk grain, handling and transfer to enclosed conveyor	Dust and sediment can be transferred to strom runoff where the enclosures of silos and conveyors are not complete	TSS	2	1	2	Preventative measures include good house keeping practices, minimizing exposure, and local erosion and sediment control.
		Enclosed conveyor and the pavement are exposed to precipitation	Heavy metals and oil and grease (from lubricant) can be washed off by rain water from the conveyor and pavement surface	Oil and grease, heavy metals	2	1	2	Runoff filtration pond (CB2-1) is installed on the southwest corner of the sub-basin.

1. The pollution probability is ranked from 1 (least likelihood of release) to 5 (most likely to release); the pollution consequences is ranked from 1 (least significance of the consequences) to 5 (most significant consequences to receiving water); the pollution risk is the product of the probability and consequences (PMV, 2015).

3 MEASURES TO PROTECT STORMWATER QUALITY

Best management practices (BMPs) have been identified by provincial, regional, and local governmental agencies; including DNV, Metro Vancouver (MV), and Vancouver Fraser Port Authority (VFPA). Many of these BMPs were previously documented and implemented (NHC, 2013). Following is an outline of BMP's implemented on the site and additional measures to potentially further enable achieving stormwater management objectives.

3.1 Best Management Practices Guidelines

A variety of plans written in the Greater Vancouver region suggest operational and structural measures to improve stormwater quality. DNV provides a Design Criteria Manual from 2006 with Section C of the manual focused on Drainage. Metro Vancouver (MV) provides Stormwater Source Control Design Guidelines, published May 2012 to outline best stormwater management practices. VFPA offers best practices in their Guidelines – Developing Your Stormwater Pollution Prevention Plan from July 2015.

The major stormwater pollutants of concern from the project site are associated with bulk food grain and wood pellets handling, storage, and loading, as well as vehicle/equipment maintenance and washing, truck traffic, fuel and lubricants storage. On the project site, there could be solids and organics suspended and transported by runoff, released as dust from material handling, or spilled from conveyors. Also, there is a possibility of metals or oils released from car washing, and the exposed railway tracks and conveyors to precipitation as described for both the current condition and the proposed development in **Table 2** and **Table 5**.

Based on the site drainage characteristics, nature of the terminal activities, and the onsite facilities, a suite of prevention and treatment BMPs is implemented and recommended for the site. The prevention BMPs are aimed to minimizing the exposure of potential pollutant sources, promote good housekeeping practices, mitigate erosion, and control sediment transportation at the source. Where these prevention BMPs are not sufficient, engineered structures, known as the treatment BMPs, such as the multi-cell separator and storm interceptors are installed to treat storm runoffs.

The proposed future use of the site would eliminate exposed stockpile storage of wood fibres and wood chips. The bulk food grain and wood pellets are to be stored in silos and the existing wood chip shelter and transported via enclosed conveyors. This would eliminate the contact and interaction of product and runoff, significantly lowering the potential for TSS in stormwater runoff. The site surface will remain paved where the silos will be installed, and the fuel stations in the maintenance shop and at the railcar dumper will remain the same. The main pollutant of concern for the new development would be fine dust and sediments, oil and grease, and heavy metals. The following sections describes the BMPs implemented and recommended for the new development.

3.2 Implemented BMPs

3.2.1 Water Quality Targets

The current water quality target is based on the *Greater Vancouver Sewage and Drainage District Sewer Use Bylaw* and the *BC Approved Water Quality Guidelines*, and are presented in **Table 6**. According to the *BC Approved Water Quality Guidelines*, many of the maximum allowable contaminant concentrations are determined by their effect on the receiving waterbody. For example, the maximum allowable TSS discharged to the receiving water must not causing more than 10% change of the background water TSS. As a result, the following results are recommended as the treatment target.

Table 6. Adopted Stormwater Contaminant Treatment Target

Pollutant of Concern	Currently In Use	Recommended
Dissolved Cadmium (mg/L)	NA	0.2
Total Copper (mg/L)	NA	2
Total Lead (mg/L)	NA	1
Total Zinc (mg/L)	NA	3
Total Hydrocarbons (mg/L)	15	15
BOD (mg/L)	500	500
COD (mg/L)	NA	600
TSS (mg/L)	600	600
pH	5-7	7.0-8.7

3.2.2 Prevention BMPs

Prevention BMPs that are recommended for the site are summarized in **Table 7**.

Table 7. Prevention BMPs for Pollutants of Concern

Pollutants of Concern	BMPs
Oil and grease	▪ Engine part wash should be done in a container where possible to prevent and contain spills and drips. ▪ Conduct work indoors in the maintenance shop, and conduct the cleaning operations in the area with a concrete floor with no floor drainage other than to the installed multi-cell separator and storm interceptors. ▪ If operations are uncovered, perform them on a concrete surface that is impervious and where water can be contained. ▪ Store equipment and wash materials indoors and regularly maintain and organize inventory of materials and parts.

Pollutants of Concern	BMPs
	▪ Label and track the recycling of waste material (e.g., used oil, spent solvents, batteries, greasy rags, oil filters, degreasers and etc.). ▪ Conduct fueling operations on an impervious surface under a roof or canopy where possible. ▪ Use fueling hoses with check valves to prevent hose drainage after filling. Keep spill cleanup material readily accessible. ▪ Collect stormwater runoffs near fueling areas and provide treatment (stormwater interceptors are placed downstream of both fueling stations on site) ▪ If spill occur, stop the source immediately, contain the liquid until clean up is complete, cover the spill with absorbent material, keep area well ventilated, dispose of cleanup materials as per recommended hazardous material disposal guidelines/recommendations. ▪ Inspect the maintenance area regularly to ensure the BMPs are implemented. ▪ Train employees on waster control and disposal procedures.
Heavy Metals	▪ Regular maintenance and repair of machinery and repaint metal machinery, conveyor, and storage shed as needed to prevent corrosion and pollutants entering the stormwater. ▪ Regular heat inspection of rollers/bearings of the conveyors to allow replacement of the parts prior failure. ▪ Store equipment indoors where possible. ▪ Safe store, label, and inventory organize hazardous and corrosive materials. ▪ Regular cleaning of the surfaces where equipment, metal facilities, and machineries are exposed to precipitation, especially to prevent high concentration of heavy metals entering the storm water by the first wash during a storm event after a long dry period of time. ▪ Monitoring the discharge water quality quarterly.

Pollutants of Concern	BMPs
Total Suspended Solids	▪ Store all the bulk grains and wood pellets in silo. ▪ Transfer and loading are through enclosed conveyors only. ▪ Regular inspections of the enclosures of the silos and conveyors. ▪ Improve enclosure or place under trays immediately once spill or leak is observed. ▪ Develop protocols to handle spills in the water during loading, place emergency booms to contain the spill. ▪ Train employees on safe handling bulk material and spill control procedures.

3.2.3 Monitoring Program

There is an existing monitoring program which tests the runoff in the interceptor from the northeast catchment area for pH, BOD, COD, TSS, and oil and grease. Scheduling of the water quality sampling is done within their overall computerized maintenance management system (CMMS). The Fibreco maintenance manager receives notification to ensure samples are taken quarterly. Water samples are sent to SGS Canada Inc. for testing. Results from seven tests conducted between November 2014 and June 2016 showed acceptable stormwater quality.

3.2.4 Straw Bale Barrier and Silt Fence

A 270 m long straw bale barrier is placed along the east boundary of the property along the open channel. In addition, a silt fence installed parallel to the straw bale barrier serves as a secondary filtration for any storm runoff bypasses the straw bale. Straw bale barriers are effective in filtering fine wood fibres and dusts that are the main contaminant of concern under the current site use.

The uncovered stockpile wood chips will be removed and replaced with bulk grains in silo storage. The enclosed storage and conveyance system would have minimal contribution to the level of TSS in stormwater runoff. The straw bale barrier and silt fence are planned to remain, but may not be needed following the proposed changes to use of the site.

3.2.5 Multi-Cell Stormwater Separator and Storm Interceptors

There is a potential for oil, hydrocarbon, or petrochemical contamination in the northeast and the northwest sub-basins due to the fueling station in the maintenance shop, fueling in the railway yard, the car wash, vehicle parking, and machinery storage. There will be no new direct sources of these contaminants under the proposed development conditions; the present sources and paths of contamination remain unchanged. As a result, the multi-cell separator and the storm interceptors located at the end of the local drainage network from these catchment areas are recommended to remain in operation.

3.2.6 Fire Pump House Flushing Discharges

Fire pump houses and fire lines on site are inspected every four years. During the inspection, if sediments are observed in the fire lines or hoses, a flush will be carried out to clean the system and ensure the system is effective during fire emergencies. Discharge locations from such a flushing are shown in **Figure 2.**

At both locations water is discharged to the riprap armoured bank and is not expected to cause erosion or increase in sediment concentration in the receiving water. Portable water flushing through the fire distinguish system is considered safe to discharge by both Metro Vancouver and US Environmental Protection Agency (MV, 2007; USEPA, 2015).

On May 2nd 2015, a routine fire line inspection was conducted. Portable water was used to flush the fire pump houses and fire lines. Discharge from the flushing was detected by VFPA. The flushing procedure was then discussed between Fibreco and VFPA.

Figure 2. Discharge Points During Flushing of the Fire Pump Houses and Fire Lines

4 SUMMARY AND RECOMMENDATIONS

As the impermeable surface on the site will remain unchanged, the total stormwater quantity is expected to remain unchanged. Site redevelopment and the removal of the woodchip pile and containment and coverage of the materials on the site is expected to lead to an improvement in the stormwater quality with respect to TSS. The continued carwash, fueling, and conveyor use will continue

to be the primary potential sources of contamination with hydrocarbons in the runoff. The existing stormwater infrastructure and monitoring program will continue to mitigate the potential impacts from these sources. In addition monitoring of stormwater should be expanded to monitor and sample when possible the runoff from the central eastern and southern catchments. Additional measures, such as incorporating an oil water separator at the car wash discharge, can be applied if monitoring indicates water quality targets are frequently not achieved.

4.1 Stormwater Management Measures

The equipment that have been installed to maintain water quality should be kept to continue to serve their intended purposes of collecting, conveying and improving water quality.

- The filters on the catch basins should remain to provide initial water filtration
- Interceptors should be maintained to remove suspended sediments and other contaminants before drainage systems convey the water to DNV storm sewers
- The multi-cell separator should remain to remove coarse wood fibres and settle finer materials
- The interceptors should be maintained and its capacity verified to ensure oil from the carwash in the northeast catchment is removed before entering the DNV storm system
- The straw bale filtration barrier adjacent to the open channel on the northeast of the site should remain to filter water entering the channel.
- The containment booms in the Burrard Inlet should remain to offer some solid containment or removal from runoff entering this waterbody
- The paved areas should remain paved and cleaned regularly to prevent surge in contaminant concentration due to the first wash during the first storm after a prolonged dry period of time.
- If spill occur, stop the source immediately, contain the liquid until clean up is complete, cover the spill with absorbent material, keep area well ventilated, dispose of cleanup materials as per recommended hazardous material disposal guidelines/recommendations.
- Train employees and encourage good housekeeping practices, develop and implement protocols to handle leaks and spills of fuel and other solid/liquid contaminants.

4.2 Maintenance and Inspections

Maintenance and facility inspection is critical to ensure that the stormwater systems continue to function to their planned capacity. Without maintenance, systems can become blocked, flow reduced

and local flooding occur. The following is a list of recommended site practices and maintenance which promotes effective use of on-site stormwater management infrastructure.

- Ensure conveyors and material storage are covered
- Supress dust on the site
- Detect, report and clean-up spills immediately
- Inspect and clean catch basins
- Check for blockages in catch basin filters
- Clean debris from the multi-cell separator
- Monitor condition and degradation of straw bale barrier
- Inspect and clean oil-water separator
- Monitor and clean filtration / settlement ponds as required
- Monitor condition and possible degradation of floating containment booms
- Ensure stormwater pumps are working with potential for full capacity

4.3 Water Monitoring

Quarterly sampling of stormwater to ensure its quality and the effectiveness of site stormwater infrastructure and practices is important to ensure appropriate stormwater management. The monitoring program should record the test results of the contaminants of concerns (**Table 6**), the date, time, location weather and operational notes.

With the changes to the site, this monitoring program should be used to identify if there are any improvement and adverse changes in stormwater quality. In addition to the northeast sub-basin, water sampling is recommended for the central east and southern sub-basins starting at the commissioning stage of the new development and continue to the operational stage to determine the effectiveness of the preventive BMPs in the two sub-basins. Additional treatment BMPs can be installed if sample tests raise concerns of the stormwater quality. Otherwise the frequency and necessity of water quality sampling for each sub-basin can be adjusted if the tested water quality is consistent and acceptable during operational stage upon reviewing the water sampling results.

5 CLOSURE

We hope this report meets your needs. Please contact Jasmine Kang or Dale Muir by email (JKang@nhcweb.com or dmuir@nhcweb.com) or phone (604.980.6011) with any questions, concerns or for further discussion.

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APPENDIX A - SITE DRAWINGS

LEGEND

- NORTHEAST WATERSHED
- NORTHWEST WATERSHED
- CENTRAL EAST WATERSHED
- SOUTHERN WATERSHED
- FLOW ARROW
- 4.00 CONTOUR ELEVATION (GEODETIC)
- PROPOSED INFRASTRUCTURE

DNV MH
900mm @0.20%
DNV MH
900mm @0.20%
DNV MH
900mm @0.22%
DNV OUTFALL
INTERCEPTOR
MH4-1
MH4-2
300mm
200mm
CB4-3
CB4-4
MAINTENANCE SHOP
CB5-1
CAR WASH
INTERCEPTOR
MH3-1
150mm
CB3-2
STORAGE BUILDING
FILTRATION POND
WOOD PELLET SILOS
250mm
250mm
200mm
200mm
CB3-3
CB3-4
CB3-5
CB3-6
COVERED CONVEYOUR
WOOD CHIP CONTAINMENT WALL
WOOD CHIP CONTAINMENT WALL
MULTI-CELL SEPARATOR
SCREEN SEPARATOR
COVERED CONVEYOUR
COVERED STORAGE
AREA = 3.2 ha
SLOPE = 0.0078%
DNV SM 250mm @ 0.43%
CONNECTION TO DNV STORM SEWER
McKEEN AVENUE
OFFICE
CB1-3
CB1-2
65mm
CB1-5
MH1-6
150mm
MH1-4
INTERCEPTOR
MH1-1
150mm
CB1-7
150mm
CB1-8
150mm
AREA = 1.6 ha
SLOPE = 0.0037%

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REVISIONS		
A	11 AUG 2016	ISSUED FOR REVIEW

DRAWING INFORMATION	
DATE	30 Aug 2016
DESIGNED BY	D. Muir
DRAWN BY	K. Hooper
CHECKED BY	D. Muir
SHEET SIZE	D (22" x 34")

DISTRICT OF NORTH VANCOUVER
FIBRECO STORMWATER MANAGEMENT PLAN

NORTHEAST AND NORTHWEST WATERSHEDS

PROJECT NUMBER	3002083
DRAWING NUMBER	3002083-001

Drawing 1

REVISION A

LEGEND

- NORTHEAST WATERSHED
- NORTHWEST WATERSHED
- CENTRAL EAST WATERSHED
- SOUTHERN WATERSHED
- FLOW ARROW
- 4.00 CONTOUR ELEVATION (GEODETIC)
- OPEN CHANNEL

DNV OUTFALL

@0.22%

OPEN CHANNEL

STRAW BALE FILTRATION BARRIER

COVERED CONVEYOUR

COVERED CONVEYOUR

WOOD CHIP CONTAINMENT WALL

WOOD CHIP CONTAINMENT WALL

COVERED STORAGE

COVERED CONVEYOUR

COVERED CONVEYOUR

WOOD CHIP CONTAINMENT WALL

BURRARD INLET

AREA = 1.7 ha
SLOPE = 0.0194%

AREA = 2.4 ha
SLOPE = 0.0054%

150mm

150mm

CB1-9

CB1-10

CB1-11

CB2-1

5.00

4.50

4.50

4.57

4.25

4.50

2.50

4.00

4.00

0.00

3.80

3.20

4.00

4.80

1.40

2.80

0.20

0.00

4.80

4.80

4.80

4.80

4.80

4.80

4.80

4.80

4.20

4.00

4.00

4.80

4.80

4.80

3.80

1.80

0.60

0.40

3.60

0.60

0.50

0.50

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DISTRICT OF NORTH VANCOUVER
FIBRECO STORMWATER MANAGEMENT PLAN

CENTRAL AND SOUTHERN WATERSHEDS

PROJECT NUMBER	3002083
DRAWING NUMBER	3002083-002

Drawing 2

REVISION A

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