Stormwater Pollution Prevention Plan
Fraser Grain Terminal

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1.0 INTRODUCTION

Hemmera was retained by Fraser Grain Terminal Ltd. (FGT) to prepare a Stormwater Pollution Prevention Plan (SPPP) for operation of the Proposed Fraser Grain Terminal Export Facility (the “Project”) for the property located on 11060 Elevator Road in Surrey, BC (the “Site”). FGT is proposing to develop a new grain handling facility on land adjacent to the Fraser Surrey Docks (FSD) facility. It is anticipated that the SPPP will be routinely updated to reflect operational management of the site.

The Site is leased from Vancouver Fraser Port Authority (VFPA) by FGT and was formerly leased by Bekaert Canada Ltd. (Bekaert). The Project will serve as a trans-shipment storage location for bulk grain products, and will include loading and unloading infrastructure, storage silos, a transfer tower and gallery, and ancillary works.

The purpose of this preliminary SPPP is to develop a pollutant control strategy to minimize the discharge of pollutants by stormwater runoff during operations by:

- Reducing the amount of stormwater discharged to the environment;
- Preventing or reducing the pollutant loading of stormwater; and,
- Treating or otherwise managing stormwater if pollutant loading cannot be prevented.

Mitigation for stormwater runoff during construction is addressed in the Project’s Construction Environmental Management Plan.

Stormwater is water that originates from precipitation events (such as rainfall) and from snow and ice melt. Stormwater either ponds on the surface and eventually evaporates, infiltrates the ground, or flows over the ground surface as runoff, which ultimately enters nearby bodies of water. Stormwater runoff flows over land or impervious surfaces such as paved roadways, parking lots and building rooftops. As it flows, it may accumulate debris, soil and sediment, and contaminants that could negatively impact water quality.

This SPPP identifies Best Management Practices (BMP) which are considered sound, are relatively low in cost, and are applicable to a broad category of industries and types of pollutants. The BMPs discussed in this plan have been developed to improve the quality of stormwater discharged from the facility and to aid in the development, implementation, and evaluation of the SPPP.

This SPPP and associated drawings follow the outline presented in the VFPA guidance document, presents the background data that has been used, and any key design assumptions that have been made.

The SPPP also details the operation and maintenance activities that will be required for stormwater management. These will include regular surface sweeping, treatment unit maintenance intervals, and ongoing operations/processes. The implementation and monitoring component will include identification of key personnel, their responsibilities and contact information. Prior to the start of operations, the SPPP will be updated with an organizational chart indicating the role of the professional(s) responsible for managing, maintaining and ensuring stormwater pollution prevention. Where more than one role is involved, a brief summary of their key duties and role in stormwater pollution prevention will be provided.

This document has been prepared to support the FGT Application for a VFPA Project and Environmental Review permit and references other attachments of the Application, including the Spill Prevention, Emergency Response and Hazardous Material Management Plan **(Attachment 6)**.

2.0 PROJECT OVERVIEW

2.1 PROJECT LOCATION

The Site is located on the south bank of the Fraser River in Surrey at 11060 Elevator Road, approximately 3.5 km south of the Pattullo Bridge (see **Figure 1**).

2.2 PROJECT BACKGROUND

The Project will serve as a trans-shipment storage location for bulk grain products, and will include loading and unloading infrastructure, storage silos, a transfer tower and gallery, and ancillary works. Inbound agri-products will be delivered to the site via railcar. The majority of product will be temporarily stored in silos until a sufficient quantity is accumulated, at which point a cargo vessel will call at the site and be loaded with the stored product for delivery overseas. Agri-products will also leave the site via rail and truck to local markets and bulk containers for overseas markets.

The Site is currently approximately 10.3 ha (25 acres) in size, of which ~40% is covered by asphalt and buildings, while the remaining ~60% is comprised of road and rail, exposed soil, open water, and vegetated areas. The topography of the site is relatively flat with a slight gradient (generally less than 1%) toward the east.

Existing stormwater infrastructure on site includes underground pipes, catch basins, manholes, culverts, and ditches (**Attachment 4E:** Drawings 32022-C-06, 32022-C-07, and 32022-C-08). A pond located on the east side of the Bekaert Production Building currently collects stormwater from the building and is connected to the City of Surrey's stormwater system through a ditch (Ditch N; **Figure 1**). The pond also receives surface runoff from the east side of the site via a drainage system. The remaining surface runoff from the site is collected by the drainage system and conveyed to the ditch at the outlet of the pond (Ditch N; **Figure 1**).

The area used for calculating stormwater drainage requirements is based on the Project design and is 6.41 ha, of which 82% will be impervious (i.e., paved) and 18% pervious (i.e., unpaved). Drainage calculations for the Project exclude the access road (already approved under permit 12-072-1), and areas where existing drainage patterns will not change due to the Project:

- rail bed and FSD areas west of the FGT facility;
- surface of the berth area; and
- around the new fixed shiploader towers.

Figure 2 below shows the area outlined in yellow that was used for calculation of stormwater drainage requirements.

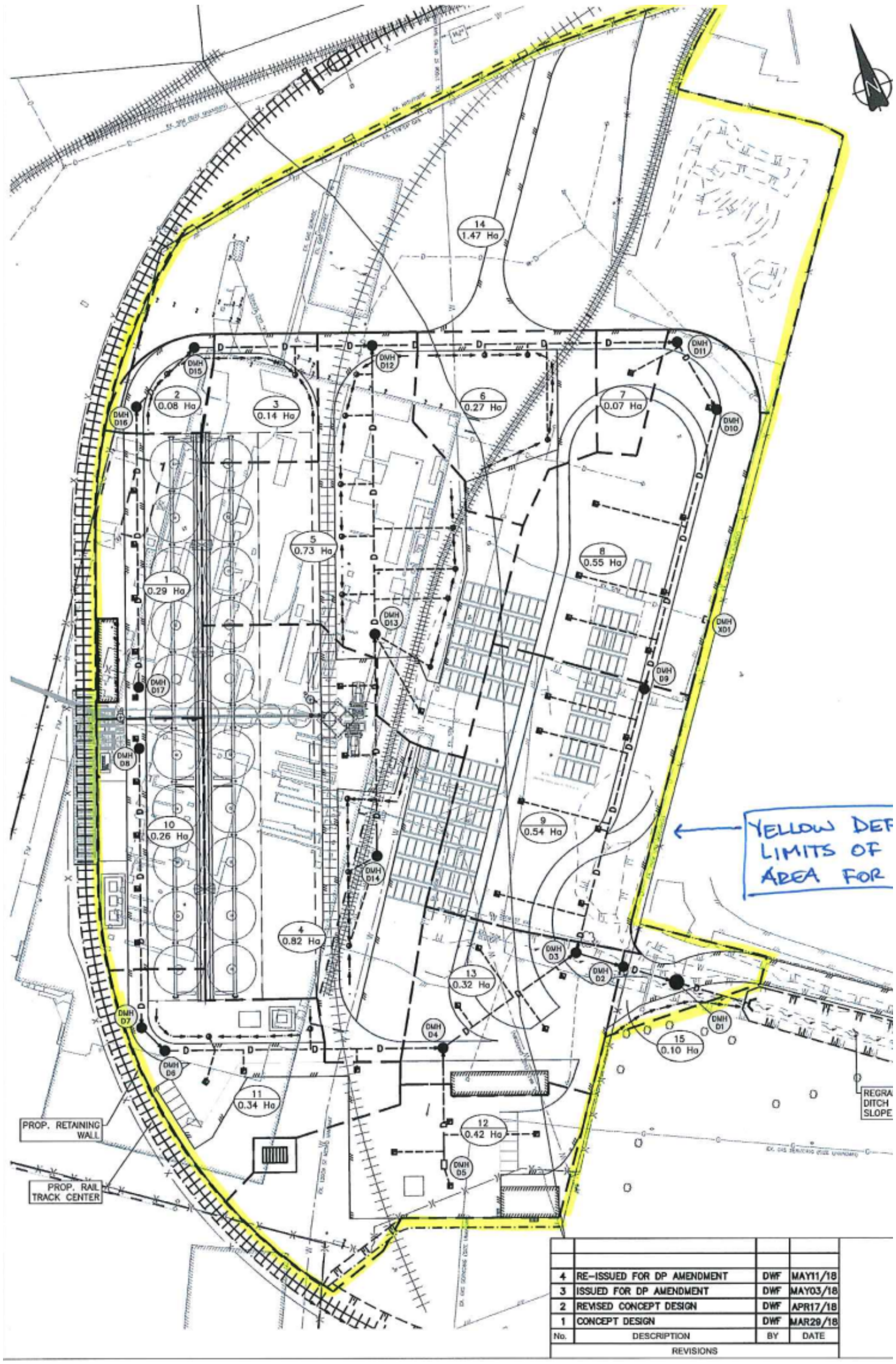

Figure 2 Sketch Showing Area for Stormwater Calculations

For construction, the existing pond will continue to function as a sedimentation pond. All surface runoff from areas disturbed during construction will be directed to the pond. The pond will also receive construction waste water (e.g., from dewatering) for containment and treatment before offsite discharge to the City of Surrey's stormwater system. The Erosion and Sediment Control Plan to be implemented during construction of the Project is illustrated in **Attachment 4E:** Drawings 32022-C-13 and 32022-C-14. Use of the existing sedimentation pond will be discontinued after construction.

The wharf is currently properly configured for stormwater management. The locations of the new shiploader towers are such that it should not be necessary to modify or relocate any of the existing services.

3.0 SITE INVENTORY

3.1 ACTIVITIES

Construction of the Project is scheduled following receipt of Project approvals and after demolition of the existing Bekaert production building and will take approximately 2 years (24 months) to complete.

The site preparation and soil improvements will be phased so early works will continue to maintain the existing sedimentation pond and stormwater discharge point to the City of Surrey's stormwater system. Installation of a new, permanent storm sewer grit interceptor will be installed once site preparation and soil improvements are complete and water will discharge via a new culvert located under the new site access road (see **Attachment 4E**). The outfall of the new culvert will discharge to the current ditch location south of Clearwood Preservers. During utility construction, surface drainage will be directed to the existing sedimentation pond and/or the new storm sewer grit interceptor before any water is discharged from the site. The existing sediment and control pond is not adequately sized and will require replacement during site construction. Timing for replacement will be dependent on construction staging and time of year to ensure there is adequate capacity for the work. The replacement pond is shown in **Attachment 4E:** Drawings 32022 C-14 and C-15. The sedimentation pond shall be maintained until the new Stormceptor is installed and operational.

Site utilities, including the stormwater collection system, will be safely located, cleared, and removed in the areas to be densified and where new utilities need to be installed. The new system and sitework will develop concurrently to ensure proper drainage controls and relatively level, gravel working surfaces throughout construction.

Permanent storm drains will be the only services required during construction. Mobile domestic washrooms with self-contained running water and sewer holding tanks will be operated and maintained during construction. Paving and road construction will be one of the last activities to take place.

During construction, a temporary fueling station with secondary containment will be established on site on an impervious working surface that drains to the existing stormwater system described above. A permanent fueling area with secondary containment will be established with a non-pervious surface draining to an oil/water separator that discharges to the permanent storm sewer system. This fueling station area is the only sub-catchment area flowing into the oil-grit separator. For both the temporary and permanent fueling stations, the secondary containment system will, at minimum, be able to hold a volume greater or equal to 110% of the largest tank or storage container and cover at least the entire surface under each tank or container.

A large part of the existing site is covered by a concrete slab that supported two large buildings that have been demolished. Floor drains in the existing slab will be decommissioned during slab removal and drainage will be replaced as shown on Drawings 32022-06 and 32022-07 in **Attachment 4E**. During construction, a system of temporary flow barriers (e.g., asphalt curbs, sandbags, and wattles) will direct stormwater to the remaining utilities.

Typical operational process activities, and their potential inputs to stormwater are listed in **Table 1** below. Grain spillage will be swept up and disposed of as solid waste.

Table 1 Operational Processes with Potential Effects on Stormwater

#	Process	Duration/Details
1	Receiving (unloading of railcars).	· 309 days/annum · 7 hours/day · Grain spillage around receiving pit.
2	Transfer to storage.	· 309 days/annum · 7 hours/day · No spillage, all equipment is enclosed.
3	Reclaim from storage.	· 317 days/annum · Variable, up to 24 hours/day · No spillage, all equipment is enclosed.
4	Container loading.	· 253 days/annum · 10 hours/day · Spillage around loading area.
5	Railcar loading.	· 253 days/annum · 10 hours/day · Potential spillage around loading area.
6	Bulk truck loading.	· 253 days/annum · 10 hours/day · Potential spillage around loading area.
7	Ship loading.	· ≈63 days/annum · 24 hours/day · Potential spillage, but generally restricted to the vessel deck.

During Project operations, activities such as equipment maintenance may adversely affect stormwater quality due to accidental spills of maintenance fluids. Spill management for equipment maintenance is addressed in **Attachment 6**. Secondary activities listed below that have the potential to expose stormwater runoff to contaminants:

- Waste disposal;
- Fueling of vehicles;
- Routine servicing of equipment; and,
- Repair and maintenance activities.

3.2 MATERIALS

3.2.1 Fuels, Oils, Lubricants

Significant materials, as they relate to stormwater, include but are not limited to storage, cleaning, or waste products. The most likely materials the Project is expected to be on Site during Project operations and that may interact with stormwater are:

- Petroleum fuels (diesel and gasoline);
- Solid waste/garbage;
- Hydraulic and lubricating oils; and,
- Coolants and antifreeze such as ethylene glycol.

Storage and handling of petroleum products, fuels, oils, and lubricants, many of which are flammable, will comply with industry best practices and regulatory requirements of the BC *Workers Compensation Act*, regulations, and guidelines, including the Occupational Health and Safety Regulation, Workplace Hazardous Materials Information System (WHMIS), and the Workers' Compensation Board of British Columbia's Prevention Manual. The storage and handling of flammable substances must comply with:

- Occupational Health and Safety Regulation Part 5 – Chemical and Biological Substances, Flammable and Combustible Substances;
- Environmental Code of Practice for Above Ground Storage Tank Systems Containing Petroleum Products (Canadian Council of Ministers of the Environment (CCME, 1994);
- Environmental Code of Good Practice for Underground Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products (CCME, 1993); and,
- National Fire Code (National Research Council).

Fuel handling and storage facilities will also comply with the provincial *Fire Services Act* and its regulations. All workers will adhere to established fire prevention and response protocols. Preparations will include spill response procedures, equipment and training, containment berms, and security. The storage facilities described will be used for both the construction and operations phases. Any spill or soil contamination occurring at storage facilities is subject to the BC *Environmental Management Act* and its regulations.

3.2.2 Agri-Products

During unloading and loading operations, agri-products and associated particulate may accumulate at transfer points at the facility (e.g., around shiploader and the rail unloading facility). Accumulated agri-product may mix with stormwater run-off and be directed towards catch basins. Spilled product can adversely affect stormwater quality by increasing total suspended solids and/or biological oxygen demand. Therefore, each catchbasin will be fitted with a trapping hood and a sump, as shown on Drawing 32022-11. Floating agri-products will be trapped in the catchbasins for later removal by maintenance programs. All stormwater from the facility will pass through the Site's main oil and grit separator unit (see **Section 5.1.6**) to capture spilled grain particulate.

3.3 HYDROLOGICAL ASSESSMENT

3.3.1 Storm Drainage Event

Environmental loads are as follows:

<u>Rainfall</u>

- 15 minutes – 10 mm;
- One day – 128 mm;
- Annual total – 1500 mm;
- Annual total Ppn. – 1575 mm.

<u>Ground Snow</u>

- Ss ground snow load 1 in 50 yr – 2.4 kPa;
- Sr associated rain load 1 in 50 yr – 0.3 kPa.

A hydrologic assessment was conducted for final Site design to estimate the runoff response, including peak flow rates and runoff volumes for various rainfall events. The design of the Site's stormwater management system will take into account the results of the hydrological assessment to ensure the stormwater infrastructure is appropriate for the Site. The basic hydrological parameters used to model hydrological properties of the permanent design are as follows:

- Total Catchment Area – 7.289 ha (72,890 m^2);
- Current design impervious –98%;
- Average slope – 1.0% to 2.0%;
- Time of concentration – Single discharge to the existing outfall is 15-30 minutes (used as input for Rational Method); and
- Precipitation event – peak runoff rate is based on the 10 year, 24-hour storm with a rainfall intensity of 95 mm (based upon City of Surrey Engineering Department Design Criteria Manual).

3.3.2 Water Quality Event

Information related to the water quality event for the site and appropriate specifications for drainage appliances is provided in **Appendix B**. The Stormceptor STC 9000 will remove 87% of the total suspended solids for the OK-110 particle size distribution, as shown in the detailed sizing report included in **Appendix B**.

For the purpose of the drainage system pipe sizing, the 0.80 runoff coefficient was used based on the various gravel and asphalt finished surfaces proposed. As a reference, the adjacent City of Surrey criteria for use of runoff coefficients is provided below. From this table, industrial sites commonly use a 0.80 as a runoff coefficient for 5 year design events. The design uses Metro Vancouver's 2012 Stormwater Source Control Guidelines that elaborate on the above DFO design criteria, which demonstrate that 90% of the net annual precipitation falls at intensities corresponding to the 6 month 24 hour rainfall event, which also corresponds to 72% of the 2 year, 24 hour storm event.

Description of Area	% Imperviousness	Runoff Coefficient (5 yr Event)	Runoff Coefficient (100 yr Event)
Commercial	90	0.80	0.95
Industrial	90	0.80	0.95
Residential			
RA, RA-G	50	0.45	0.54
RH, RH-G	55	0.50	0.60
RF, RF-SS, RM-D	65	0.60	0.72
RF-G, RM-M, RM-10, RM-15, RM-19, RM-30, RM-45, RM-70	65	0.60	0.72
RMC-150, RF-9, RF-12, RF-SD, RM-135, RMC-135	80	0.70	0.84
Parks, Playgrounds, Cemeteries; Agricultural Land	20	0.25**	0.30
Institution; School; Church	80	0.75	0.90

3.3.3 Sub-catchment Areas

The Site is divided into sub-catchments based on the following aspects:

- Ground cover;
- Topography;
- Operational areas; or
- Existing and/or proposed drainage features.

Drawing 32022-08 in **Attachment 4E** shows the sub-catchment areas.

4.0 ISSUES IDENTIFICATION AND RISK ANALYSIS

4.1 APPLICABLE STANDARDS, ACTS AND REGULATIONS

The following relevant legislation and standards are applicable, given the potential pollutant sources listed above:

- *Canada Fisheries Act* regarding the deposition of deleterious substance in waters frequented by fish.
- *Canada Shipping Act*, National Spill Response Protocol regarding the release of pollutants to the marine environment.
- *Canada Environmental Protection Act* regarding the management of harmful substances.
- *Canada Transportation of Dangerous Goods Act* – regarding the transportation of dangerous goods.
- Canadian Council of Ministers of the Environment (CCME) Guidelines relating to water quality standards.
- BC *Environmental Management Act,* regarding the unauthorized release of substances into the environment.
- BC *Environmental Management Act,* regarding the storage, handling, and disposal of hazardous materials and waste.

4.2 POTENTIAL POLLUTANT SOURCES

An assessment of the proposed Project operations was conducted to identify materials and practices that may reasonably be expected to add significant levels of pollutants to stormwater, or which may result in the discharge of pollutants during dry weather from the storm sewer draining the Site. The following provides a description of potential sources that may contribute to the presence of contaminants in stormwater runoff during operation. Pathways for sources of contaminants to reach sensitive receptors are described in **Section 4.3**.

- Fuel, oil, or coolant from service vehicles could leak from the vehicle from damage, normal wear and tear, or during maintenance;
- Fuel could be dripped or spilled from diesel or gasoline fuel tanks during the fueling of service vehicles, during the filling of the tanks, or as a result of damage to the tanks;
- Hydraulic oil or lubricating oil could be spilled during maintenance activities, or from leaks in oil-filled equipment;
- Improper storage or accidental spills of fuels, oils, paints, greases, and cleaning solvents; and
- Spilled agri-product.

Spill management is addressed in **Attachment 6.**

4.3 POTENTIAL SENSITIVE RECEPTORS

To date, there have been no stormwater issues identified in the Project's preliminary comment period by public, stakeholders, or First Nations. The Site is downslope of adjacent communities, and therefore stormwater effects are not anticipated to the public or First Nations.

Potential environmental receptors are described in the following sections. **Figure 1** shows aquatic habitat discussed below containing potential sensitive receptors that could be adversely affected by stormwater generated due to Project operations. **Table 2** summarizes watercourses potentially sensitive to stormwater. Additional detail is available in the Habitat Assessment Report (**Attachment 21**).

Table 2 Watercourses Potentially Affected by Site Stormwater Inputs

Watercourse Name	Watercourse Classification (Fraser River Estuary Management Program or City of Surrey)	Location
Fraser River shoreline	Low (FREMP)	The Fraser River shoreline borders the Site.
Unnamed Dashed Red-coded Ditch	Dashed Red, AO (CoS), Fish overwintering habitat	Parallels the south side of the Canadian National (CN) Railway tracks for roughly 100 m.
Robson Road Green-coded Ditch*	Green, C (CoS) non-fish bearing	Ditch parallels the west side of Robson Road and is connected by culverts to Ditch N and Ditch S.
Bekaert Green-coded Ditch N*	Green, C (CoS) non-fish bearing	Green-coded Ditch N is fed by surface water drainage from the site, as well as a constructed pond that collects surface water runoff and drain water from the Production Building.
Bekaert Green-coded Ditch S*	Green, C (CoS) non-fish bearing	Ditch S connects with green-coded Ditch N and Robson Road ditch via culverts at its east end
Gunderson Slough	High productivity habitat (FREMP)	Located about 120 m south of the Site.
Shadow Brook	Red, A (CoS) year-round fish habitat	Shadow Brook runs under Robson Road and Elevator Road via a series of culverts, draining into Gunderson Slough approximately 100 m downstream of Elevator Road.
Armstrong Creek/Colliers Canal	Red, A (CoS) year-round fish habitat	Parallels the Burlington Northern Railway tracks west of the South Fraser Perimeter Road.
Unnamed Yellow-coded Ditch	Yellow, B (CoS) non-fish bearing but contributes to fish habitat	Parallels the west side of the CN railway tracks, and drains to red-coded Manson Canal, approximately 1.6 km northwest of the Site.

Notes: *FSD staff have identified a culvert under Elevator Road at the west end of Ditch S, which drains these ditches into Gunderson Slough (A. Ekkert, pers.comm.)

4.4 IDENTIFIED ISSUES

There will be no large tank-type bulk fuel storage on site required for Project operations. The storage area for small amounts of fuels, coolants hydraulic oils and lubricating oils used for maintenance purposes will be in a centralized location having secondary containment. Given that the potential source for the release of these pollutants into the environment will be primarily during maintenance operations (either planned or from equipment failure), operations crews conducting the maintenance will immediately clean up and report all spills in accordance with the Project's Spill Prevention, Emergency Response and Hazardous Material Management Plan (**Attachment 6**).

4.5 IDENTIFIED POLLUTANT PATHWAYS

Pollutant pathways for the Site will be via the stormwater drainage system and overland sheet flow. During operations, most of the Site will be graded so that all rainfall and snow melt is directed to the Site's catch basins then to the Site's main oil and grit separator to discharge to Bekaert Ditch N via a culvert (**Attachment 4E:** Drawing 32022-C-07). All of the wharf deck directs water towards the Fraser River. Runoff from the track extension areas along the eastern and southern borders of the Site will be directed to the green-coded ditches (i.e., Bekaert Ditch S and Robson Road Ditch).

A second potential pollutant pathway comes from the fueling area located near the empty container yard. This station is where FGT's fork lifts and top pick units will be refueled from a diesel fuel delivery vehicle.In addition to the secondary containment that will be required for fuel storage, the fueling area will consist of a large, sloped impervious catchment area that drains to the oil-water separator. In order to capture any spilled fuel oil, the output from this basin will pass through an oil interceptor as specified in the **Attachment 4E**. The outflow from this oil interceptor will then merge with the remainder of the stormwater drainage system and will eventually pass through the Site's main oil and water separator (see **Section 5.1.6**).

5.0 STORMWATER POLLUTION PREVENTION PLAN

5.1 Management Strategy

The Project's stormwater pollution prevention strategy is to implement a set of BMPs that will target the potential pollutant sources identified in **Section 4.2** of this plan. These practices will encompass prevention, containment/reduction, and treatment during the construction and operation phases. The risk for the introduction of chemical pollutants will be low with an effective implementation of the Spill Prevention, Emergency Response and Hazardous Material Management Plan (**Attachment 6**). Refer to the Construction Environmental Management Plan (**Attachment 20**) for additional mitigation measures specific to the construction period.

5.1.1 Drawings

Stormwater drainage is shown in **Attachment 4E** (Drawing 32022-C-06, 32022-C-07 and 32022-C-08) and includes:

- The boundaries for each sub-catchment;
- Unique identifiers for each sub-catchment;
- The stormwater drainage infrastructure;
- The stormwater drainage collection points;
- The stormwater drainage release points from the Site;
- Location of treatment units;
- Downstream receiving water bodies; and
- Special features within the Site.

For the purpose of this report, these drawings have also been included as **Appendix C** of this report.

5.1.2 Good Housekeeping

Maintenance of work areas that may contribute pollutants to stormwater will be the most effective management practice for the Site. Good housekeeping practices are not only beneficial in terms of limiting exposure of materials to stormwater, but they also improve worker safety and often contribute to reducing losses of products thereby lowering operational or capital costs.

Good housekeeping will be practiced throughout the Site. All exposed areas of the Site will be maintained in a clean and orderly manner. Trash and other waste products are removed from the Site on a regular basis. Routine inspections are made to check that good housekeeping is being practiced.

Routine maintenance shall include:

- Surface sweeping in areas of agri-product accumulation following unloading of each train and loading of each ship; and
- Weekly sweeping in the truck and container loading areas, treatment unit maintenance intervals, and ongoing operations/processes.

5.1.3 Preventive Maintenance

All machinery working in the nearshore of the Fraser River must be in good working order. The Project will employ a preventive maintenance program that includes inspections, testing, maintenance, and repairs of facility equipment and systems whose failure could result in a non-stormwater discharge. During the first year of operation, catchbasins will be inspected after significant storm events and on a regular monthly basis. Maintenance frequency will be conducted in accordance with the inspection findings. After the first year, the inspection interval may be revised to suit system performance and performance criteria, with either more or less inspections and associated maintenance.

A table showing maintenance intervals by equipment type will be provided in an updated version of this document submitted prior to operations. Ongoing operations and processes will also be described.

5.1.4 Containment/Reduction

All machinery working on the Site must be free of contaminants. All hazardous material (fuels, lubricants, oils, etc.) storage areas will be equipped with secondary containment to reduce the likelihood of stormwater becoming contaminated by their contents. If the secondary containment accumulates stormwater, the water will be examined to ensure it is free of oil, foam, or discoloration prior to being drained.

In areas where solid contaminants could enter a waste water drain, the drain will be equipped with a screen to reduce the volume of solids allowed to enter the storm drain.

5.1.5 Spill Prevention and Response Procedures

Spill kits will be maintained in accessible locations on site. Spill prevention and emergency response procedures are outlined in the Spill Prevention, Emergency Response and Hazardous Material Management Plan (**Attachment 6**).

5.1.6 Treatment

During operations, stormwater effluent will pass through the Site's main oil and grit separator prior to discharge. This separator will be a Stormceptor 9000 or approved equivalent designed to remove sediment, total suspended solids, hydrocarbons and free oil from stormwater runoff. Metals may be a common component of stormwater suspended solids and would be captured by the oil and grit separator. Based on engineering calculations, this model is appropriately sized for the predicted storm events for the Site and will reduce the chance of discharging any sediment and/or oily contamination in the stormwater discharge. Storm drainage sizing calculations for the Stormceptor percent effectiveness and specifications are provided in **Appendix B** of this plan.

Specifications for the oil-grit separator are provided in **Appendix A**. As described in Section 5.1.3, the separator will be inspected regularly and cleaned, as required; the records will be passed on to the City of Surrey as required by the latter's by-laws. Material cleaned from the oil and grit separator will be disposed of at a facility permitted to take such waste.

6.0 IMPLEMENTATION AND MONITORING

6.1 IMPLEMENTATION AND MONITORING

All construction and operational staff will receive training on the contents of this plan to ensure they are able to properly assess conditions and activities that could impact stormwater quality at the facility, and who can also evaluate the effectiveness of the management practices. The training will clearly indicate that it is the responsibility of all staff to be able to recognize ineffective stormwater BMPs and to report them to their supervisor and/or site management. Monitoring frequency is described in **Section 5.1.3** above.

6.2 ADAPTIVE MANAGEMENT AND CONTINUOUS IMPROVEMENT

A key process in the effective implementation of the SPPP is the ability to change mitigation measures or actions as site conditions warrant protecting stormwater quality. This approach, generally termed as 'adaptive management', is a planned and systematic process for continuously improving environmental management practices by learning about their outcomes.

To ensure continuous improvement for the stormwater system, the contents of this plan will be reviewed as required, as Site-specific stormwater conditions warrant.

If current BMPs are not working effectively or additional mitigation efforts are needed, then the SPPP will be updated and re-issued.

6.3 REPORTING UPDATES

The SPPP will be reviewed on an annual basis to determine whether updates are required.

The SPPP will be updated in the following instances:

- Change to Port requirements for SPPPs;
- New stormwater infrastructure is constructed;
- Significant changes in the Project operations; and/or
- Changes to Site sub-catchments.

7.0 CLOSURE

This Work was performed in accordance with the Professional Services Agreement between Hemmera Envirochem Inc. (“Hemmera”) and Parrish & Heimbecker Ltd., c/o FWS Industrial Projects Canada Ltd. (“Client”), dated December 8, 2017 (“Contract”). This Report has been prepared by Hemmera, based on fieldwork and desktop work conducted by Hemmera, for sole benefit and use by the Client and Fraser Grain Terminal Ltd. In performing this Work, Hemmera has relied in good faith on information provided by others, and has assumed that the information provided by those individuals is both complete and accurate. This Work was performed to current industry standard practice for similar environmental work, within the relevant jurisdiction and same locale. The findings presented herein should be considered within the context of the scope of work and Project terms of reference; further, the findings are time sensitive and are considered valid only at the time the Report was produced. The conclusions and recommendations contained in this Report are based upon the applicable guidelines, regulations, and legislation existing at the time the Report was produced; any changes in the regulatory regime may alter the conclusions and/or recommendations. Report prepared by:

Hemmera Envirochem Inc.

Sarah Bowie, M.Sc., R.P.Bio.
Qualified Environmental Professional

Reviewed by:

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Senior Environmental Assessment Manager

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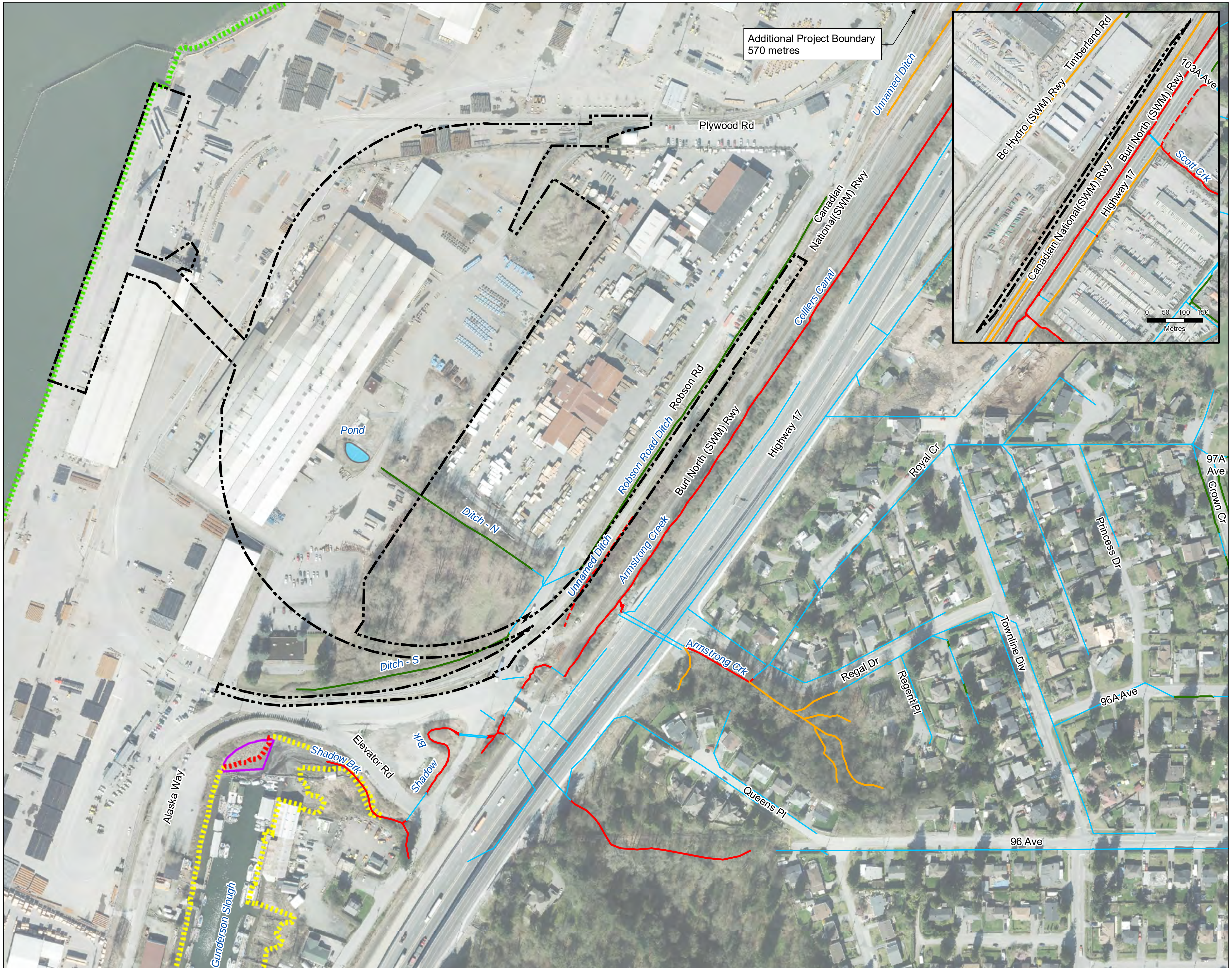
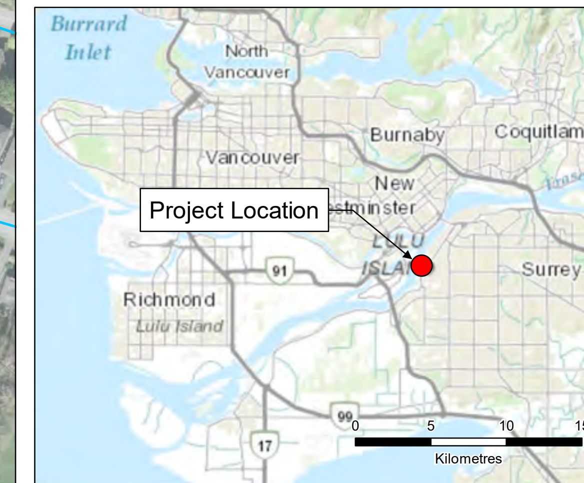
FIGURE

Stormwater Pollution Prevention Plan
Fraser Grain Terminal
11041 Elevator Road, Surrey, BC

Watercourse Classification Map





Legend

- Site Boundary

City of Surrey Watercourse Classification

- A: Watercourse inhabited by fish year round
- AO: Watercourse inhabited by fish during the overwintering period
- B: Non-fish-bearing watercourse but contributes or potentially contributes significant food/nutrient inputs to downstream fish populations
- C: Non-fish-bearing watercourse that does not contribute significant food/nutrient value to downstream fish populations

Fraser River Estuary Management Program Habitat Classification

- High productivity habitat
- Moderate productivity habitat
- Low productivity habitat

Fraser River Estuary Management Program - Habitat Compensation Sites

- Gunderson Slough Habitat Bench
- Drainage Mains

Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Open Channels: City of Surrey Mapping Online System
- Habitat Classification & Compensation Sites: Fraser River Estuary Management Program
- Aerial Image: City of Surrey, 2014

N

1:3,000

0 20 40 60 80 100

Metres

NAD 1983 UTM Zone 10N

Page Size: 11" x 17"

2191-001.01	Production Date: May 15, 2018	Figure 1

Hemmera
An Ausenco Company

FGT
FRASER GRAIN TERMINAL

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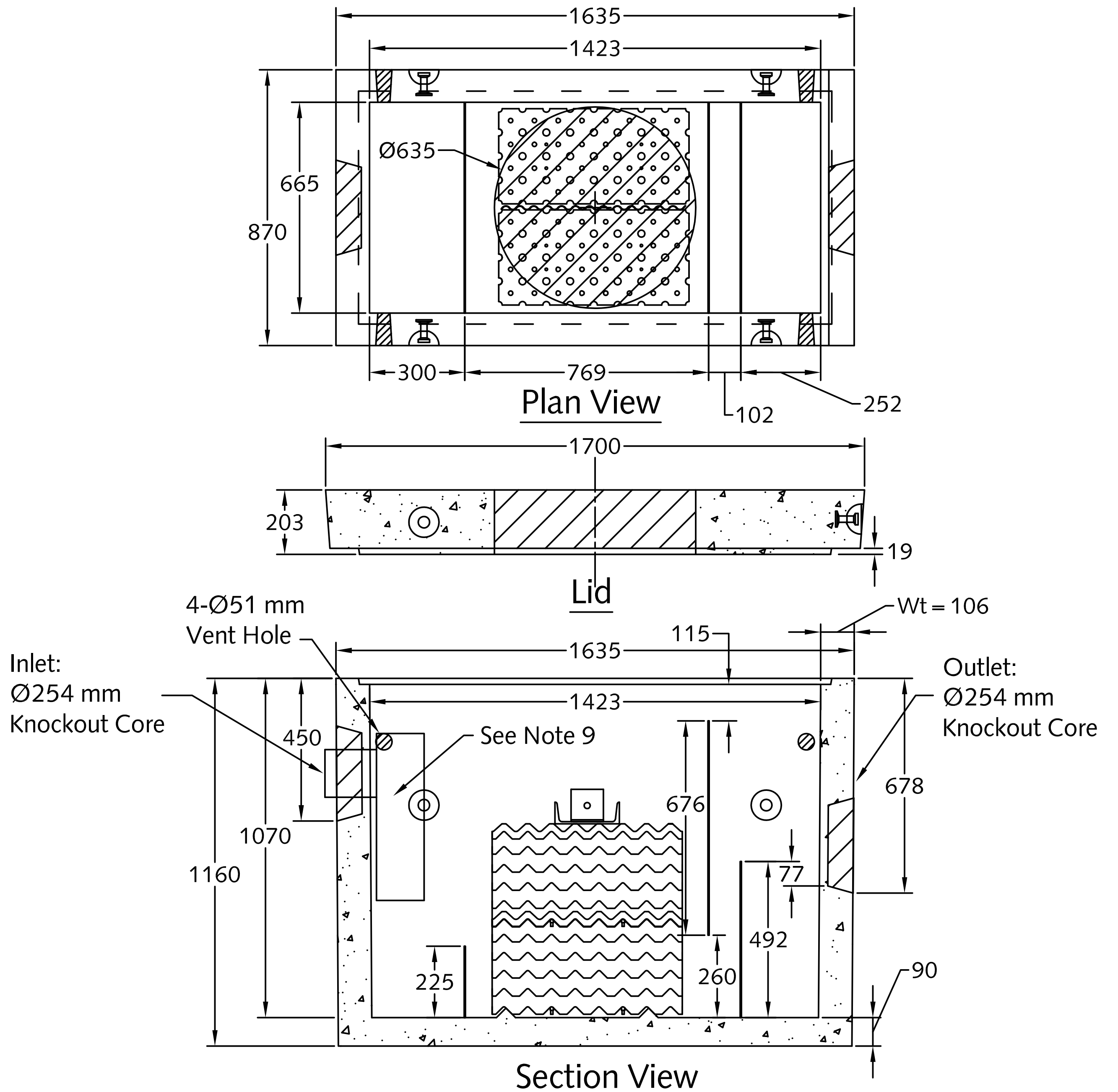
APPENDIX A

Specifications for the Oil-Grit Separator



Notes:

1. Type I-8 mm spacing, Oil interceptor manufactured for AASHTO HS20 live loading as shown.
2. Unit dimensions are 1.42 x 0.67 x 1.1 m.
3. Reinforced concrete lid manufactured for AASHTO HS20 live loading.
4. Unit c/w Ø254 mm knockout cores for inlet/outlet flow as shown.
5. Unit risers available in heights: 200, 300, 450 etc. to 1050 mm maximum.
6. Unit c/w Ø635 mm opening for access as shown.
7. Unit to have 4-Ø51 mm vent holes as shown.
8. Oil interceptor c/w 12 gauge galvanized baffles as shown.
9. PVC required by design, installed by others in field.
10. Design can be modified for specific sites, please contact LCG sales office.
11. Unit design to:
    - Temp: 0°C.
    - Oil S.G.: 0.85.
    - Influent oil = 100 mg/l.
    - Effluent oil < = 15 mg/l.
    - Max. flow rate: 5.3 l/sec.
12. Unit c/w 8 mm coalescing media as shown.
13. Unit has a maximum 595 liter [0.595 m³] capacity.
14. Unit c/w 5T lifting inserts as shown.
15. Unit c/w ladder rungs as required.
16. Approximate mass:
    - Lid: 625 kg.
    - Chamber: 1,600 kg.
17. Minimum rebar yield strength: 414 MPa.
18. Minimum concrete strength: 35 MPa.
19. All dimensions are in millimeters.

THE Langley CONCRETE GROUP

The LANGLEY CONCRETE Group of Companies

DESCRIPTION:

TYPE I Coalescing Plate Oil Interceptor
8 mm Spacing

www.langleyconcretegroup.com

DRAWN BY:	KS	ORIGIN:	CHWK
CHK BY:	JAO/JDB/SW	DWG NO:	TYPE I-COL-8
DATE:	DEC/03/2009	REV DATE:	4. NOV/01/2010
SCALE:	1:20		

LANGLEY (604) 533-1656 VICTORIA (250) 478-9581 CHILLIWACK 1-800 667-9600

APPENDIX B

Detailed Stormcepter Sizing Report

Detailed Stormceptor Sizing Report – Fraser Grain Terminal (OK-110)

Project Information & Location			
Project Name	Fraser Grain Terminal	**Project Number**	7275
City	Surrey	**State/ Province**	British Columbia
Country	Canada	**Date**	5/3/2018
Designer Information		**EOR Information (optional)**	
Name	Joel Shimozawa	**Name**	
Company	The Langley Concrete Group	**Company**	
Phone #	604-533-1656	**Phone #**	
Email	jshimozawa@langleyconcretegroup.com	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	Fraser Grain Terminal (OK-110)
Recommended Stormceptor Model	STC 9000
Target TSS Removal (%)	85.0
TSS Removal (%) Provided	87
PSD	OK-110
Rainfall Station	SURREY MUNICIPAL HALL

The recommended Stormceptor model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 300	19
STC 750	42
STC 1000	61
STC 1500	66
STC 2000	70
STC 3000	73
STC 4000	78
STC 5000	79
STC 6000	82
STC 9000	87
STC 10000	87
STC 14000	90
StormceptorMAX	Custom

Stormceptor

The Stormceptor oil and sediment separator is sized to treat stormwater runoff by removing pollutants through gravity separation and flotation. Stormceptor's patented design generates positive TSS removal for each rainfall event, including large storms. Significant levels of pollutants such as heavy metals, free oils and nutrients are prevented from entering natural water resources and the re-suspension of previously captured sediment (scour) does not occur.
Stormceptor provides a high level of TSS removal for small frequent storm events that represent the majority of annual rainfall volume and pollutant load. Positive treatment continues for large infrequent events, however, such events have little impact on the average annual TSS removal as they represent a small percentage of the total runoff volume and pollutant load.

Design Methodology

Stormceptor is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology using local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective. The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. The Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing:

- Site parameters
- Continuous historical rainfall data, including duration, distribution, peaks & inter-event dry periods
- Particle size distribution, and associated settling velocities (Stokes Law, corrected for drag)
- TSS load
- Detention time of the system

Hydrology Analysis

PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of Stormceptor are based on the average annual removal of TSS for the selected site parameters. The Stormceptor is engineered to capture sediment particles by treating the required average annual runoff volume, ensuring positive removal efficiency is maintained during each rainfall event, and preventing negative removal efficiency (scour).
Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station

State/Province	British Columbia	**Total Number of Rainfall Events**	9699
Rainfall Station Name	SURREY MUNICIPAL HALL	**Total Rainfall (mm)**	40479.2
Station ID #	1107	**Average Annual Rainfall (mm)**	1094.0
Coordinates	49°6'N, 122°50'W	**Total Evaporation (mm)**	4594.6
Elevation (ft)	249	**Total Infiltration (mm)**	8093.0
Years of Rainfall Data	37	**Total Rainfall that is Runoff (mm)**	27791.6

Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
- For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

Drainage Area	
Total Area (ha)	6.4
Imperviousness %	80.0

Up Stream Storage	
Storage (ha-m)	Discharge (cms)
0.000	0.000

Water Quality Objective	
TSS Removal (%)	85.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (L)	
Peak Conveyed Flow Rate (L/s)	
Water Quality Flow Rate (L/s)	

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cms)	0.00000

Design Details	
Stormceptor Inlet Invert Elev (m)	
Stormceptor Outlet Invert Elev (m)	
Stormceptor Rim Elev (m)	
Normal Water Level Elevation (m)	
Pipe Diameter (mm)	
Pipe Material	
Multiple Inlets (Y/N)	No
Grate Inlet (Y/N)	No

Particle Size Distribution (PSD)

Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.

OK-110		
Particle Diameter (microns)	Distribution %	Specific Gravity
1.0	0.0	2.65
53.0	3.0	2.65
75.0	15.0	2.65
88.0	25.0	2.65
106.0	41.0	2.65
125.0	15.0	2.65
150.0	1.0	2.65
212.0	0.0	2.65

Site Name	Fraser Grain Terminal (OK-110)

Site Details

Drainage Area	
Total Area (ha)	6.4
Imperviousness %	80.0

Surface Characteristics	
Width (m)	506.00
Slope %	2
Impervious Depression Storage (mm)	0.508
Pervious Depression Storage (mm)	5.08
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Maintenance Frequency	
Maintenance Frequency (months) >	12

Infiltration Parameters	
Horton's equation is used to estimate infiltration	
Max. Infiltration Rate (mm/hr)	61.98
Min. Infiltration Rate (mm/hr)	10.16
Decay Rate (1/sec)	0.00055
Regeneration Rate (1/sec)	0.01

Evaporation	
Daily Evaporation Rate (mm/day)	2.54

Dry Weather Flow	
Dry Weather Flow (lps)	0

Winter Months	
Winter Infiltration	0

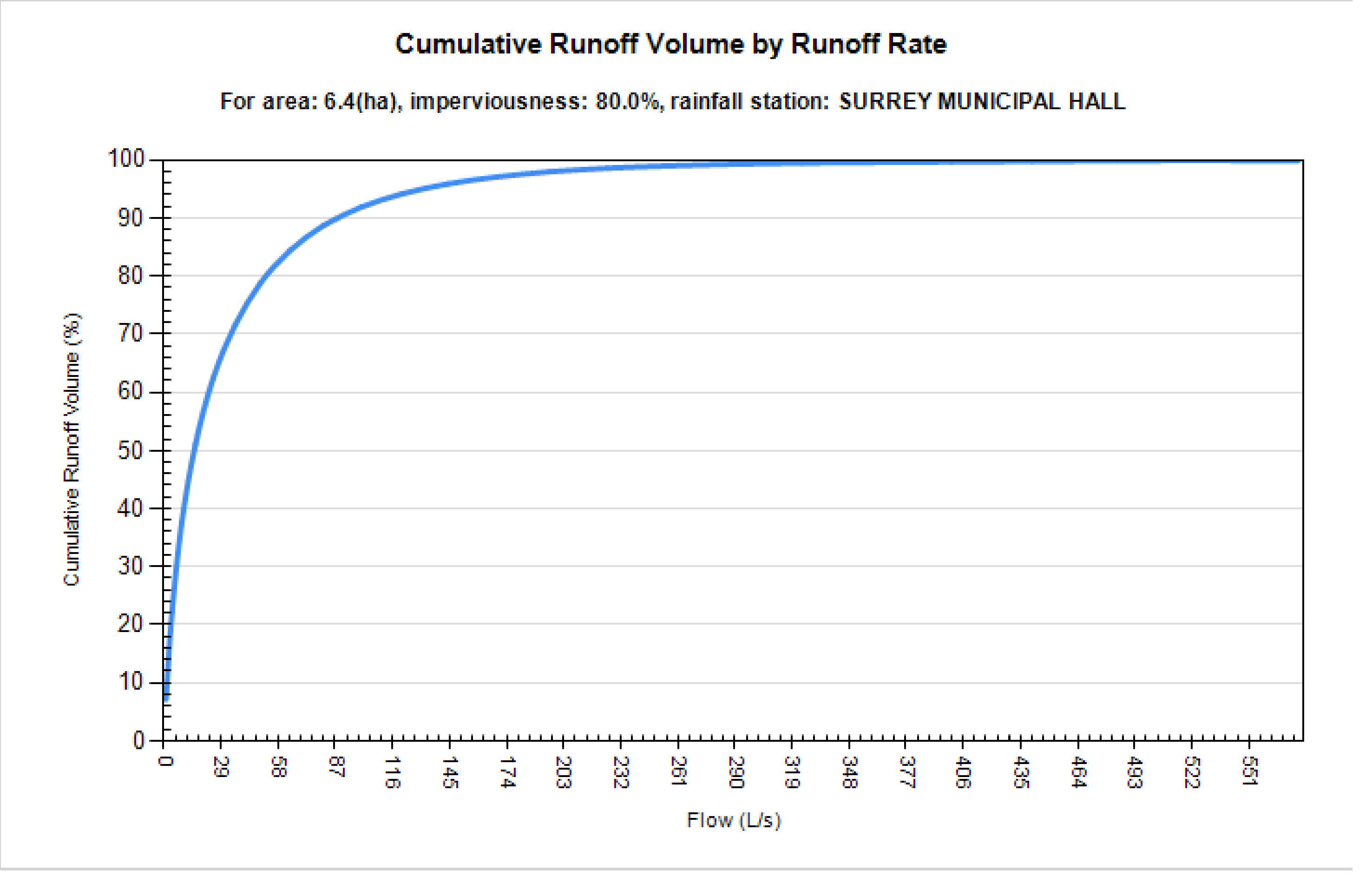
TSS Loading Parameters

TSS Loading Function	Build Up/ Wash-off

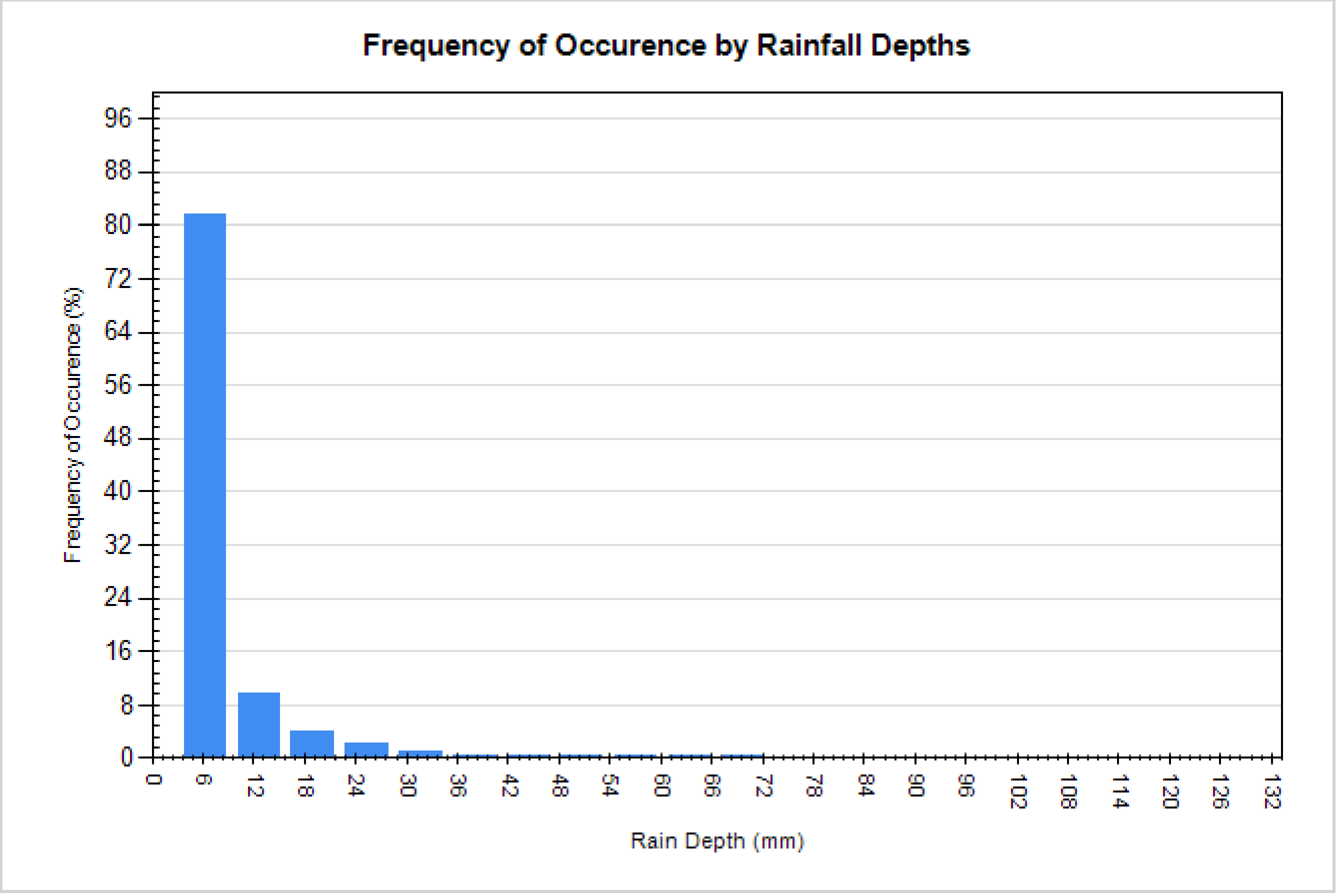
Buildup/Wash-off Parameters	
Target Event Mean Conc. (EMC) mg/L	125
Exponential Buildup Power	0.40
Exponential Washoff Exponent	0.20

TSS Availability Parameters	
Availability Constant A	0.05
Availability Factor B	0.04
Availability Exponent C	1.10
Min. Particle Size Affected by Availability (micron)	400

Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (L/s)	**Runoff Volume (m^3)**	**Volume Over (m^3)**	**Cumulative Runoff Volume (%)**
1	127831	1676136	7.1
4	398631	1405625	22.1
9	677572	1124605	37.6
16	921611	881436	51.1
25	1124124	678488	62.4
36	1289115	513705	71.5
49	1419774	383182	78.8
64	1521001	281602	84.4
81	1598279	204430	88.7
100	1655840	146598	91.9
121	1698440	104155	94.2
144	1729170	73365	95.9
169	1750875	51590	97.1
196	1766026	36436	98.0
225	1776719	25750	98.6
256	1784189	18289	99.0
289	1789381	13091	99.3
324	1792958	9514	99.5
361	1795515	6961	99.6
400	1797396	5084	99.7
441	1798805	3675	99.8
484	1799838	2640	99.9
529	1800534	1947	99.9
576	1800990	1490	99.9


Cumulative Runoff Volume by Runoff Rate
For area: 6.4(ha), imperviousness: 80.0%, rainfall station: SURREY MUNICIPAL HALL
Cumulative Runoff Volume (%)
100
90
80
70
60
50
40
30
20
10
0
0
29
58
87
116
145
174
203
232
261
290
319
348
377
406
435
464
493
522
551
Flow (L/s)

Rainfall Event Analysis				
Rainfall Depth (mm)	No. of Events	Percentage of Total Events (%)	Total Volume (mm)	Percentage of Annual Volume (%)
6.35	7917	81.6	11597	28.6
12.70	951	9.8	8680	21.4
19.05	385	4.0	6005	14.8
25.40	206	2.1	4563	11.3
31.75	83	0.9	2350	5.8
38.10	53	0.5	1843	4.6
44.45	36	0.4	1484	3.7
50.80	20	0.2	960	2.4
57.15	23	0.2	1235	3.1
63.50	12	0.1	742	1.8
69.85	5	0.1	327	0.8
76.20	3	0.0	217	0.5
82.55	0	0.0	0	0.0
88.90	2	0.0	174	0.4
95.25	1	0.0	93	0.2
101.60	1	0.0	96	0.2
107.95	0	0.0	0	0.0
114.30	1	0.0	114	0.3
120.65	0	0.0	0	0.0
127.00	0	0.0	0	0.0



For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications