SNC·LAVALIN

ENVIRONMENTAL IMPACT ASSESSMENT
for the Terminal Infrastructure Reinvestment Project

Westshore Terminals

Westshore Terminals Limited Partnership

Submitted to:

PORT METRO VANCOUVER

Prepared by:

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EXECUTIVE SUMMARY

Westshore Terminals is an existing coal export terminal located at Roberts Bank, Delta, British Columbia. The terminal has been in operation since 1970, and has been the busiest single coal export terminal in North America. In 2012, Westshore shipped 26.1 million tonnes of coal and anticipates shipping over 30 million tonnes in 2013.

Westshore Terminals Limited Partnership (Westshore) is proposing a $230 million reinvestment into the coal terminal to replace 30 to 40 year old terminal equipment with modern efficient and reliable equipment in order to sustain existing coal throughput projections and current rated capacity of 33 million tonnes per year. The equipment upgrades will ensure Westshore continues to operate with the latest technology and environmental management systems, and will result in an overall reduction in our operating emissions. Due to the increased reliability and minor capacity increases in the new equipment Westshore has estimated that the project could increase the terminal throughput capacity from 33 mtpa to 36 mtpa provided that the markets are available and the remainder of the coal chain can accommodate up to the 3 mtpa capacity increase.

The Terminal Infrastructure Reinvestment Project (the project) is anticipated to start in early 2014 with a completion date in 2017. The major components of the upgrade and replacement project include:

- Relocation and construction of a new consolidated office and shops building (2014-2015);
- Removal of the office, shops, warehouse complex (2015);Expansion of Row D coal stockpile on the former footprint of office, shops and warehouse complex by approximately 500x 285 feet (limiting height of 85 feet) (135,000 tonnes) (2015);
- Replacement of Shiploader on Berth One (2015);
- Replacement of three stacker-reclaimers circa 1972, 1981 and 1983(2015, 2016, 2017); and
- Conveyor upgrades (2016, 2017).

Benefits of the upgrades and replacements include improved reliability, decreased noise levels and reduced potential for dusting.

The increase in stockyard capacity through the expansion of Row D does not (i.e., the relocation of the office), in and of itself, increase terminal throughput capacity, as it is limited by dumper, stacker-reclaimer and shiploader availability. This move increases storage capacity by up to 135,000 tonnes of coal. The proposed upgrades are expected to increase ship loading efficiency and reduce waiting times currently experienced by the bulk carrier vessels that serve the terminal.

In July 2013, Westshore submitted a Project Application to Port Metro Vancouver (PMV) seeking approval of the proposed project (such portions as require permit approval). To support the application, Westshore has undertaken studies to evaluate future capacity of the terminal (WorleyParsons), air quality (SNC-Lavalin 2013), wastewater treatment upgrades (Associated Engineering 2013) and environmental conditions (Limited Phase 1 ESA; WorleyParsons 2013) of the project area.

In October 2013, Westshore commissioned SNC-Lavalin Environment & Water (SNC-Lavalin) to complete an Environmental Impact Assessment (EIA) document and Human Health Impact Assessment in response to a request by PMV to facilitate their environmental review.

This EIA assembles and integrates the project studies and information that have been carried out to date, including updates to an environmental assessment completed by Hemmera (2006) which provides the basis of this report. This EIA includes a separate section for the Human Health Impact Assessment, which summarizes and assesses the potential effects of coal dust and diesel emissions on human health in the Tsawwassen area.

The scope of the EIA is limited to the upgrades and components listed above. The scope does not include physical works and activities undertaken during or preceding the loading of coal onto railcars, the transport of coal from the mine site to Westshore, or during and after the coal is loaded to the bulk carrier vessels. Neither the mining of the coal, nor the use of coal, are within the scope of the EIA.

Construction

All of the proposed works will be undertaken within the existing footprint of the coal handling facility and will not require any land clearing. In-water works will be limited to the relocation of an existing wastewater outfall as required by the BC Ministry of Environment. The new equipment, stacker – reclaimers (S/R) and shiploader, will operate on the existing rail systems and will not require foundation preparation or result in excavated material requiring off-site disposal. Replacement of S/R’s 41 and 42 will coincide with the replacement of the two associated yard conveyors. The replacements are expected to be fabricated offsite and brought to the terminal in relatively large pieces by barge.

Reconstruction of the existing office and shop complex at the northwest corner of the site will require that ground works be carried out to provide services (e.g., water, electrical, communications, sewer and drainage) to the building as well as to compact the ground under the building to meet the requirements of the National Building Code prior to forming the building foundation.

The existing conveyors will be demolished down to grade, and foundations that interfere with the new equipment will be removed completely. New concrete foundations will be installed at the head and tail of the conveyors with sleepers installed under the remainder of the conveyor length. Excavations will be required for the foundations, which will not be deeper than eight feet in order to allow them to be constructed without dewatering.

The project will not require in-water work and all the work will take place within the existing lease lot, except for a minor reconfiguration of the northern lease boundary (for minor modifications to a new entrance location).

Operation

The project will not result in any changes to principal operations at the Terminal and will mainly serve to replace existing terminal infrastructure approaching the end of its useful life in order to allow the terminal to maintain existing operations. To address environmental and human health effects of current operations, Westshore currently has in place the following:

Dust Management Plan – to reduce and eliminate dust from coal handling operations.

Continual Management Presence – 24/7 management presence to oversee terminal operation.

Air Emissions Monitoring – Dust monitoring and recorded usage of water spray systems, a requirement of the existing air emissions permit issued by Metro Vancouver.

Water Management Strategy – water recycling and distribution and effluent treatment, potable water and fire main management. No changes will be required to the effluent discharge systems.

Emergency Contingency Plan – inclusive of emergency response, accident spill and and malfunction, and worker health and safety plans.

Sustainability Initiatives – the Terminal is a part of BC Hydro's PowerSmart Program and has undertaken several initiatives to improve efficiencies in operation such as light replacement, installation of high efficiency motors, reduced water consumption, reduction in Criteria Air Contaminant (CAC)and Greenhouse Gas emissions, design standards and clean standards in construction.

Environmental Considerations

Terminal upgrades and replacement are expected to create efficiencies in operation, as well as improvements in emissions and dust control. The results of the air assessment conclude that terminal upgrades are positive for air quality, even with the assumption of 36 mt maximum throughput in 2018. SNC-Lavalin (2013) notes that the total CAC emissions, in addition to nitrous oxides (NO_x), sulphur oxides (SO_x), particulate matter (PM), PM_{10}, $PM_{2.5}$ and Diesel Particulate Matter (DPM) will decrease from current levels at the 2018 projected throughput.

Lighting and noise effects from the upgrades and replacements will have negligible change to the current operation, if anything it is expected to decrease due to the use of focused light-emitting diode (LED) lighting and lower allowable noise levels for equipment. Traffic is projected to increase, but with the efficiencies created from the project, in addition to improvements from DeltaportTerminal Road and Rail Improvement Project (DTRRIP) and other PMV projects, ongoing and planned, impacts from traffic are considered to be low. Negligible effects to marine mammals have been cited given low speeds of berthing ships. No changes to water run-off or increases of water discharge beyond existing permitted levels are expected.

As follow-up to the Phase I Environmental Site Assessment (ESA) completed by WorleyParsons (2013), Westshore has indicated they will initiate a Phase II ESA with the project schedule and address any potential issues that may arise.

With the application of the control and mitigation measures described in section 4 and Table 8-1, the continuance of existing environmental management plans and monitoring, there is expected to be low to negligible effects on the environment from project upgrades and replacements, as well as continued operations.

Socio-economic Considerations

A considerable amount of work will be generated during the construction and installation phases of the project that are expected to create employment opportunities in the local economy for skilled trades personnel. The project itself is expected to employ an average of 30 persons per day, mostly skilled trades personnel, over the four year period expected to complete work. In addition, there is the potential for additional work associated with local supply and fabrication of equipment and structures (Westshore, 2013a).

Consultation

Westshore has publicly announced its intention of replacing existing equipment in order to maintain existing terminal capacity and estimated that the project may incrementally increase the terminal throughput. To date Westshore has made a number of government, First Nations, and public consultation efforts with others planned over the next few months.

Human Health Considerations

Measured concentrations of criteria air contaminants associated with fugitive dust and diesel/combustion emissions at the nearest receptor (BC Ferries Terminal) and/or in the nearest community of Tsawwassen, are below the health-based Ambient Air Quality Objectives (AAQO) from Metro Vancouver, the BC Ministry of Environment, the Canadian Council of Ministers of the

Environment (CCME) and the World Health Organization, and in most cases below the most stringent of the available AAQOs. The measured concentrations are considered to be a conservative representation of concentrations associated with Westshore Terminals based on the contribution from background sources. Additionally, concentrations of the CACs associated with the Terminal will decrease with distance from the facility, with the proposed equipment upgrades resulting in a decrease in future CAC emissions associated with the facility. On this basis, and based on predicted coal dust levels the ongoing operations are anticipated to run at levels more than ten-times lower (better/safer) than the Worksafe BC occupational exposure limits, and the maximum predicted DPM concentration five times lower than the United States Environmental Protection Agency 'safe' level for diesel exhaust emissions. No unacceptable health risks are predicted to be associated with exposures to fugitive dust, coal dust and combustion emissions from the Terminal.

Conclusions

Based on the results of this EIA, SNC-Lavalin has concluded that the project is not likely to cause negative adverse environmental, socio-economic, or health effects, taking into account the implementation of appropriate effect management measures, as identified in this document.

The environmental review, as governed by Port Metro Vancouver, is intended to foster sustainable development by ensuring that projects are constructed and operated in a manner that minimizes adverse environmental, socio-economic, and health effects. After consideration of the potential project effects, and taking into account engineering design, identified control and mitigation measures, best practices and current standards, the Terminal Infrastructure Reinvestment project upgrades and replacements can be implemented with negligible effect.

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ATTACHMENTS

ACRONYMS & ABBREVIATIONS

AAQO	*Ambient Air Quality Objectives*
AQG	*WHO Air Quality Guidelines*
BC	*British Columbia*
BMPs	*Best Management Practice(s)*
CAC	*Criteria Air Contaminant*
CDC	*BC Conservation Data Centre*
CHE	*Cargo handling equipment*
CoD	*Corporation of Delta*
CoS	*Corporation of Surrey*
CH_4	*Methane*
CO	*Carbon monoxide*
CO_2e	*Equivalent Carbon dioxide*
CO_2	*Carbon Dioxide*
cph	*Cars Per Hour*
CWS	*Canada Wide Standards*
DFO	*Fisheries and Oceans Canada*
DP3	*Deltaport Third Berth*
DPM	*Diesel Particulate Matter*
DTRRIP	*Deltaport Terminal Road and Rail Improvement Project*
DWT	*Deadweight Tonnage*
ECA	*Emission Control Area*
EC	*Environment Canada*
EIA	*Environmental Impact Assessment*
EVCC	*Elk Valley Coal Corporation*
EMP(s)	*Environmental Management Plan(s)*
ESA	*Environmental Site Assessment*
ft	*Feet*
FLNRO	*BC Ministry of Forests Lands and Natural Resources Operations*
USgals	*US Gallons*
GHG	*Greenhouse Gas*
GVWD	*Greater Vancouver Water District*
GVRD	*Greater Vancouver Regional District*
HSE	*Health, Safety and Environment Plan*
IARC	*International Agency for Research on Cancer*
IGPM	*Imperial Gallons Per Minute*
IMO	*International Maritime Organization*
LED	*Light Emitting Diode*

LSA	*Local Study Area*
MoE	*BC Ministry of Environment*
Mtpa	*Million Tonnes Per Year (Anno)*
MV	*Metro Vancouver*
MWh	*Megawatt Hours*
NH_3	*Ammonia*
N_xO	*Nitrous oxide*
NAAQO	National Ambient Air Quality Objectives
NOAEL	*No observed adverse effect level*
NO_2	*Nitrogen dioxide*
OCC	*Operations Control Centre*
the project	*Terminal Infrastructure Reinvestment Project*
PM	*Particulate Matter*
PMV	*Port Metro Vancouver*
psi	*Pounds Per Square Inch*
RfC	*Reference Concentration*
RSA	*Regional Study Area*
SARA	*Species at Risk Act*
SENES	*SENES Consultants Ltd.*
SOP	*Standard Operating Procedure*
SOx	*Sulphur oxide*
SO_2	*Sulphur dioxide*
S/R	*Stacker-reclaimer*
SECA	*Sulphur Emission Control Area*
SNC-Lavalin	*SNC-Lavalin Environment & Water*
TFN	*Tsawwassen First Nation*
TSI	*Terminal Systems Incorporated*
tph	*Tonnes Per Hour*
WDMP	*Westshore Dust Management Plan*
Westshore	*Westshore Terminals Limited Partnership*
WWMP	*Westshore Water Management Plan*
WHO	*World Health Organization*
WorleyParsons	*WorleyParsons Canada Limited*
VFPA	*Vancouver Fraser Port Authority*
VOC	*Volatile Organic Compounds*
US EPA	*United States Environmental Protection Agency*

1.0 INTRODUCTION

Westshore Terminals Limited Partnership (Westshore) is an existing coal export terminal located at Roberts Bank, Delta, British Columbia (BC). The terminal has been in operation since 1970, and has been the busiest single coal export terminal in North America. Westshore Terminals has two deep-sea berths at the terminal and shipped 26.1 million tonnes of coal in 2012 and is anticipated to ship 30 million tonnes in 2013. Westshore employs 300 full and part time employees and operates 24/7 365 days per year.

Westshore submitted a Project Application to Port Metro Vancouver (PMV) in July 2013, to replace existing coal handling equipment and infrastructure, in combination with moving the existing office and shops complex. The proposed replacement affects Westshore's current stacker-reclaimers and Berth No. 1 shiploader that handle coal at their Roberts Bank terminal (refer to Figure 1-1).

The proposed upgrades, referred to as the Terminal Infrastructure Reinvestment Project (the project), are expected to increase ship loading efficiency and reduce waiting times currently experienced by the bulk carrier vessels that serve the terminal.

Westshore currently has four stacker-reclaimers, one of which was added in 2010. In addition to the stacker-reclaimers, Westshore operates diesel and gasoline powered off-road and on-road equipment to support their terminal operations and receives up to seven loaded coal trains each day for processing.

Subsequent to submission of the Project Application, Port Metro Vancouver has requested that Westshore submit an Environmental Impact Assessment (EIA) document, including a Human Health Impact Assessment that would assist them in evaluating the potential environmental implications of the proposed upgrades and replacements, prior to approving the project. This document responds to PMV's request.

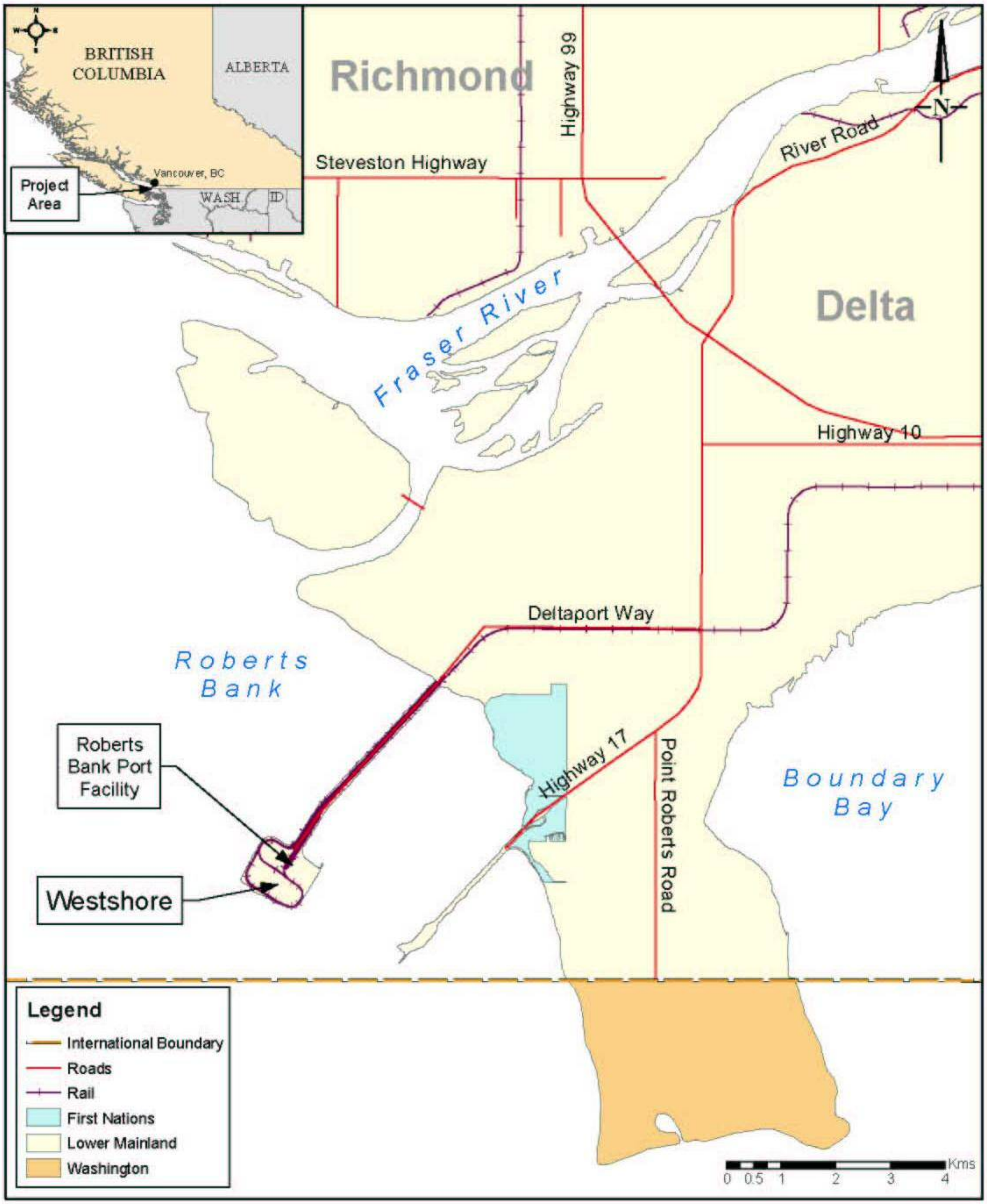

Figure 1-1 Location Map

1.1 Project Identification

The project proponent is Westshore Terminals Limited Partnership. Westshore is responsible for all aspects of the project including design, staging, scheduling, and operations. Project enquiries should be directed to:

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1.2 Background

Westshore's operation is located on federal land at Roberts Bank, Delta, BC and is under the jurisdiction of the Vancouver Fraser Port Authority (VFPA), doing business as Port Metro Vancouver. By agreement, for air quality management issues, Westshore reports to Metro Vancouver and is the permit holder of Air Quality Management Permit GVA-0153 issued by Metro Vancouver. The permit regulates the amount of air borne contaminants that can be discharged from the existing site and requires updating to reflect the new equipment and dust suppression facilities added in 2012 and 2013, which will form the basis of the systems used to suppress dust in the future.

The initial coal terminal operation commenced operation in 1970 on a 50 acre land parcel created at Roberts Bank for the purpose of supporting the development of coal mines in southeast BC. For purposes of identification and reference, the original development is referred to as Phase 1. Since 1970, over 720 million tonnes of coal has been exported to the world market at annual throughput rates of over 20 million tonnes per year for the past fifteen years. Westshore has an approximate workforce of 300 full time equivalent employees.

The Terminal underwent a significant expansion in 1983, at which time Westshore increased its lease area to 130 acres, created by dredging, and invested $130 million in new equipment and infrastructure, including a tandem railcar dumper and new deep-sea berthing facility. This development increased the

Terminal's throughput capacity to 22 million tonnes per year (mtpa). This development is identified as Phase 2 Stage 1 and it established the groundwork for further developments in the future.

In 1991, Westshore added additional equipment and reconfigured the terminal including the installation of a new single rotary car dumper and transfer conveyors at a cost of $31 million (Phase 2 Stage 2). Subsequent to 1991, a number of other improvements have taken place, including converting one of the tandem dumper barrels to handle US-sized cars which increased productivity and raised the terminal's nominal capacity to 26 mtpa (Phase 2 Stage 3). The maximum annual shipment exported from the Terminal in 1997 was 23.5 million tonnes of coal. Between 1997 and 2005, annual shipments averaged around 21 million tones.

From 2008 to 2012, a further $110 million was spent to add an additional stacker-reclaimer and conveyor line as well as to replace the single rotary dumper with a tandem unit raising the throughput capacity of the terminal to 33 mtpa (Phase 2 Stage 4). The present arrangement comprises two inbound rail systems via two rotary dumpers, two outbound systems via two deepwater ship berths and four yard handling systems, each comprised of a rail mounted stacker-reclaimer and supporting conveyor line. The operation consists of unloading coal from railcars, storing the coal in stockpiles and then loading the coal on to ocean-going vessels.

Over the years, Westshore has developed a comprehensive approach to limit the amount of dust generated during the handling of coal through the operation. The procedures and practices used are consistent and comparable to those used in large coal terminals around the world.

Westshore's dust suppression capabilities have been the source of continuous improvement since inception. In the initial operations, limited water spraying capabilities were in place, which were greatly expanded during the expansion of 1980, when a dedicated ring main and reservoirs were installed as well as a combination of low mast rain gun sprays together with high mast spray poles.

Additional low mast and high mast sprays were added in 1993, with the relocation of the dumping facilities and the expansion on to the west side of the terminal. The extension of Conveyor 9A took place at the same time, allowing stacker-reclaimer (S/R) 42 to traverse the length of the coal storage area.

In 2013 Westshore undertook an upgrade of the dust suppression systems that included the replacement of the existing 77 ground level rain guns with 94 new rain guns. Twelve new tower sprays were also added at the east (5) and west (7) ends of the site to improve Westshore dust suppression capability doing wind events.

1.3 Purpose and Need for the Project

Westshore's coal terminal at Roberts Bank is the leading coal handling and shipment facility on the west coast of the Americas. Westshore operates on a throughput basis and receives handling charges from its customers based on volumes of coal exported through the Terminal. Coal is delivered to the Terminal by Canadian Pacific Railway (CP Rail), Canadian National Railway (CN Rail) and Burlington Northern Santa Fe (BNSF) Railway. Coal is unloaded and either directly transferred onto a ship or stockpiled on-site for future ship loading.

Westshore does not take ownership of the coal at any point during storage and handling. In April 2005, CP Rail announced they were investing $160 million to reduce bottlenecks in its western rail corridor in order to increase capacity. Similarly, the Elk Valley Coal Corporation (EVCC), a jointly owned partnership between Fording Trust and Teck-Cominco accounting for 95% of Westshore's 2005 revenues, announced significant expenditures at its mines to increase output. These announcements indicated that Westshore could reasonably expect to handle increased volumes of coal in the future. Based on this information, Westshore conducted an assessment of the Terminal's throughput capacity in 2005 resulting in nearly five years of major capital equipment upgrades increasing the terminal capacity from 23.5 mtpa in 2009 to 33 mtpa in 2012.

Through that process, it was identified that in order to sustain these levels of throughput, the Terminal needs to undertake the next phase of reinvestment associated with replacing existing old equipment approaching its end of economic life with modern, more efficient and reliable equipment. At present, Westshore's site has limited new equipment, including stacker-reclaimer 44, dumpers D31 and D32, and some critical chute-work; however, in order to continue operating at current levels, additional investment will be required to replace existing equipment. The alternative would be to spend $50-75 million to attempt to maintain old equipment running for the next 5-10 years, which in any event would ultimately require replacement.

The proposed project has been given the identifier of Phase 2 Stage 5 (P2S5) in keeping with the long-range development plan for the terminal that was originally conceived in the late 1970s.

1.4 Project Overview and Scope

The proposed project is an upgrade to the existing coal handling equipment at the terminal, and consists of replacing 30-40 year old equipment with new equipment, and replacing the existing 40 year old office and shop buildings by reconstructing a consolidated office and shop complex at the northwest corner of the lease boundary (See Attachments – Engineering Drawings). The project will not require in-water work and all the work will take place within the existing lease lot, except for a potential minor reconfiguration of the northern lease boundary.

The following equipment and infrastructure will be upgraded and/or replaced:

- Office, shops and warehouse complex (2014-2015);
- Shiploader No. 1 (2015);
- Stacker-reclaimers 41, 42 and 43 (2015, 2016, 2017); and
- Conveyors 9A and 3A (2016, 2017).

With the replacement and relocation of the office, shop and warehouse complex to the northwest corner or the lease land, Westshore is able to expand storage capacity on the former footprint by approximately 500x 285 feet (limiting height of 85 feet), approximately 135,000 tonnes of storage.

The 130 acre Terminal is part of the existing PMV facilities at Roberts Bank that also include Deltaport, a 65-hectare (160 acre) container terminal operated by Terminal Systems Inc. (TSI). The terminals are connected to the mainland by a 4.1 km long causeway, which supports road and rail infrastructure.

Pending the necessary approvals from PMV, construction of the project is proposed to begin in January 2014 with active on-site construction starting in Spring 2014 and an estimated project completion in 2017.

A detailed project description is provided in section 2.

1.5 Purpose of the Environmental Impact Assessment

The purpose of this EIA is to provide information in support of Westshore's project permit application to PMV for reinvesting in terminal facilities for the long-term.

This EIA document presents an evaluation of potential impacts associated with the proposed works, with a particular focus on environmental and social components identified by PMV, including air quality, human health, and noise.

EIA sections on environmental and social components such as traffic, lighting, wastewater management, marine mammals and socio-economy, have largely been reproduced from the previously conducted environmental assessment for Westshore (i.e., Hemmera, 2006). Where available and appropriate, existing information has been complemented and/or updated with current information.

Air quality and human health have been identified for additional assessment as requested by PMV. This EIA undertakes an assessment of potential human health impacts, and summarizes an air quality study completed under a separate scope of work by SNC-Lavalin (2013) entitled, "*Westshore Terminals Air Quality Study 2012 – 2018*" (Appendix 1).

2.0 PROJECT DESCRIPTION

The Terminal Infrastructure Reinvestment Project (the project) is proposing to replace three older stacker-reclaimers, of the four in use, as well as a 30 year old shiploader. The project also includes the demolition of the outdated administration, operations and maintenance offices, shops and warehouses; and construction of one consolidated complex. These changes are expected to take four to five years to complete in stages.

The following section provides a detailed description of the proposed project infrastructure, including project schedule and activities associated with the construction and operation phases. Existing project components are discussed in detail in section 2.1 below. Preliminary engineering drawings of the project layout, including existing infrastructure, are provided in Attachments (Engineering Drawings). Detailed design drawings have been previously provided to PMV in the project Application dated July 26, 2013. The detailed design drawings are as follows:

- A1 – Site Layout
- A2 – Office and Shop Complex
- A3 – Site Services
- A4 – Existing Equipment
- A5 - Conveyors

2.1 Existing Infrastructure

2.1.1 Coal Handling/Transfer System

Existing infrastructure and facilities at the Terminal have been identified as follows (updated from Hemmera, 2006, as appropriate):

- Two rail loops for freight trains to deliver coal to the Terminal.
- One tandem rotary dumper (Dumper No. 31) with a capacity to unload 60 railcars per hour. Both barrels of the tandem dumper were previously replaced: one of the two barrels (the east barrel) was replaced in 1998 and the other (the west barrel) was replaced in 2008 with new ones that can handle newer aluminum railcars.

- One tandem rotary dumper (Dumper No. 32) with a capacity to unload 60 railcars per hour. Both barrels of the tandem dumper were replaced in 2012 and can now only handle the newer aluminum railcars.
- Berth One: Accommodates a rail-mounted shiploader that has a loading capacity of 7,000 tonnes per hour (tph) and can handle ships up to 260,000 deadweight tonnage (dwt).
- Berth 2: Accommodates new twin quadrant shiploaders with a combined capacity of 7,000 tph, and can handle ships up to 180,000 dwt.
- Seven kilometres (km) of high-speed conveyors that move incoming coal between the dumpers and the loading berths.
- Four stacker-reclaimers (three first generation stacker-reclaimers and one second generation stacker-reclaimer). The first generation S/R's 41, 42, and 43 (built in 1972, 1981 and 1983, respectively) have a reclaim capacity of 6,500 tph (1) and 4,500 tph (2); the second generation S/R 44 (built in 2010) has a reclaim capacity of 7000 tph. The four stacker-reclaimers are rail mounted and can operate at locations anywhere along the conveyor system.

2.1.2 Dust Control Equipment

Westshore Terminals dust suppression capabilities have been the source of continuous improvement since inception. In the initial operations limited water spraying capabilities were in place which were greatly expanded in the expansion of 1980 when a dedicated ring main and reservoirs were installed and a combination of low mast rain gun sprays together with high mast spray poles.

Additional low mast and high mast sprays were added in 1993 with the relocation of the dumping facilities and the build out on to the west side of the terminal with the extension of Conveyor 9A allowing S/R 42 to traverse the length of the coal storage area.

The first generation of a tower spray was erected with a height of 85 ft and cross arms 24 ft in length which provided a misting spray to the central pile area difficult to reach by the perimeter sprays.

During the period 2008-2011, Westshore added to these resources by the erection of four more towers in key locations within the coal stockpile area to bring the total to five by 2011. These second generation tower sprays were 124 ft tall with cross arms of 100 ft.

In 2012, Westshore determined that the condition of aging infrastructure comprising valves, pipes and control systems, required replacement and upgrading. Some parts to the system had become obsolete and difficult to maintain. The investigation also led to the conclusion that the remote control system associated with the water sprays required upgrading.

In late 2012, capital funds were secured for the wholesale replacement of the existing system with the objective of having the replacement system on-line for the summer of 2013. Contracts were placed on a fast track basis and details were completed for a new and expanded system. The details included replacing all the underground valves and piping and eliminating the underground electrical wiring between each pole in favour of constructing a consolidated valve house to service each quadrant of the site area. As well, 12 additional tower sprays were constructed, including water supply mains and piping, to bring the overall number of tower sprays up to total of 17. The new generation of tower spray has a height of 130 ft with a cross arm 130 ft long. These have been located at the east (5) and west (7) ends of the stockyard across the line of the prevailing wind direction.

Currently, the Terminal's network of tower sprays, ground level rain guns, and other dust suppression equipment providing dust control include (updated from Hemmera, 2006, as appropriate):

- 13 high mast sprays (installed in 1993) predominantly along the south side of the site that develops a fine mist under any wind conditions. The original (first generation) tower spray was erected with a height of 85 ft and cross arms 24 ft in length;
- 94 low level rain guns (installed in 2013) that rapidly apply water to coal stockpiles.
- 17 water tower sprays, four of which were erected during the period 2008 to 2011 (second generation) and 12 were installed in 2012/2013 (third generation); these are centrally located in key locations within the coal stockpile area. Second generation tower sprays are 124 ft tall with cross arms of 100 ft; and the third generation tower sprays are 130 ft high with a cross arm of 130 ft length.
- Three water trucks that operate around the site to dampen the roadways and spray the coal piles.
- Equipment to spray the roadways and stockpiles with a binding agent (magnesium chloride) on a periodic basis.

The layout and location of the new rain-guns and tower sprays are shown in Attachments – Engineering Drawing SK010.

An on-site weather station continuously monitors changes in weather patterns and the spray systems are controlled manually to cater to changes in wind conditions. Air quality in and around the facility is monitored through off-site sampling stations, including one at the ferry terminal that operates on a continuous real-time basis. This station is monitored by an independent professional, who provides sampling and testing services.

The terminal has a closed loop water recycling system that collects site run-off in a network of ditches. Water from the collection ditches is directed to Westshore’s new $4.5 million water treatment system for removal of solids before being directed to reservoirs for storage prior to re-use on-site for dust control.

2.1.3 Water Management

Westshore obtains water from Greater Vancouver Water District by arrangement with the Corporation of Delta. Under the terms of this agreement, water is provided at a rate of 1500 Imperial Gallons Per Minute (IGPM) at a residual pressure of 50 psi.

The water supply system provides potable water to the administration building and occupied areas of the site for personal use. Other uses include adding make-up water to the recycled water in the reservoirs to be sprayed for dust control purposes by rain guns and high masts and also providing water directly to the second and third generation tower sprays. In addition, the water supply system also charges the fire mains around the site and supply to the vehicle wash facility.

The water is provided by the Corporation of Delta. Westshore’s objective is to use the water in an efficient and sustainable manner and collect the run-off, where possible, to recycle the water to reduce overall consumption. Westshore’s water management strategy is based on maximizing the use of recycled water consistent with the functional requirements of the dust suppression task.

No changes will be required to the Delta water main feeding the site either for supply volumes or metering. On-site, the reconstruction of the shops and office facilities in a different location of the site will require revisions to Westshore’s internal water main distribution system. These details will be addressed in the development of the site infrastructure utility modifications.

2.1.3.1 Surface Run-off

In order to re-use water on the site, a comprehensive containment and collection system exists to capture surface run-off water and route it by ditches, pumps and pipes to the holding reservoirs. There are three reservoirs on-site that have a combined holding capacity of 1.4 million US gallons (gals). The reservoirs are connected via a ring main system such that water can be transferred to, or drawn from any of the reservoirs depending on which pumps are activated.

Run-off water also comprises of rain water that falls on the site. Rain water is collected in the same ditches and ponds as the run-off water which comes from spraying the coal piles. Water in these catchment ditches is routed to the on-site screening facility to reduce the amount of solids that are contained within the effluent prior to re-use.

During winter months when increased rainfall is experienced, the amount of run-off water exceeds the capacity to store and re-use it requiring that excess water be discharged from the site. Westshore has an Effluent Discharge Permit PE-6819 issued by BC Ministry of the Environment which permits the discharge of effluent provided that it has been cleaned to prescribed standards. No changes will be required to the existing permit or effluent discharge systems on account of the project upgrades and replacements.

2.1.3.2 Wastewater Treatment

Westshore's existing wastewater treatment facilities operate under permit from BC Ministry of Environment (Permit PE-6819; Appendix 5). The facilities comprise an aerobic processing tank unit located near the existing administration building, shops and offices which handles the major source domestic effluent and a septic tank system located near the Operations Control Centre (OCC), which handles the small amount of domestic waste generated at that facility. The combined treated flow is then discharged into the local marine environment.

The main wastewater treatment plant and infrastructure, including the process tank, in ground wet well transfer tank, pumps and piping will be demolished along with the all of the shops and offices as part of the relocation and rebuilding of the new facilities.

The wastewater plant will be replaced with a new facility (details in Appendix 6) meeting current discharge standards and located at the east end of the site.

2.1.4 Other Facilities

A cluster of small buildings along the northern boundary of the site currently serves as the central office and services facility. This facility provides the necessary services for employees, including washrooms, as well as shop and warehouse facilities to support terminal operations.

The existing fuelling station comprises two storage tanks, one for diesel (28,000 litres) and one for gasoline (10,000 litres). The steel tanks are double walled and vacuum sealed with a leak detection alarm. The dispensing system is from standard electrically operated pumps.

The existing administration complex including offices, warehouse, workshops and dry facilities are provided with propane fuel heating and cooling, either by forced air systems or in the case of the workshop space, radiant heat. The propane is provided from a 12,000 US gal storage tank located in the vicinity of the offices. The existing storage tank is the subject of an Emergency Response Plan and subject to reporting under the Environmental Emergency Regulations (E2) administered by Environment Canada.

Existing lighting at the stacker-reclaimers consists of area lighting and local task lighting. The operation of the stacker-reclaimers typically takes place on the inside of the coal storage area where the coal is stockpiled or reclaimed on either side of the stacker-reclaimer rail track. Normally, the stacker-reclaimers are out of view to observers outside of the coal terminal because they are obscured by the stockpiles of coal. The area proposed for the new office/shop complex is presently used for parts storage and illuminated by pole mounted flood lights. The new office and shop complex is further away from residential areas than the present facilities.

2.2 Proposed Equipment Replacement and Upgrades

The project will be located on the existing Westshore marine terminal facility at Roberts Bank in Delta, BC. The project involves the replacement of older equipment with similar modern and more efficient equipment, expansion of the existing Row D stockpile (northern stockpile row) by approximately 500 feet, and relocation of the office and shops complex. The project includes the construction (including demolition) and installation of the following terminal equipment and infrastructure:

- Relocation of office, shops and warehouse complex;
- Changes to the internal water main distribution system;
- Modification and rerouting of the internal water recirculation system;
- Replacement of existing wastewater treatment plant;
- Replacement of a water reservoir;
- Modification of the existing site access road;
- Replacement of fuelling facilities and propane tank;
- Reconfiguration of lighting;
- Replacement of Stacker-Reclaimer 43;
- Replacement of Stacker-Reclaimer 42 and associated conveyor 9A;

- Replacement of Stacker-Reclaimer 41 and associated conveyor 3A; and
- Replacement of Shiploader No. 1.

2.2.1 Office and Shop Complex Relocation

The existing office and shop complex, originally constructed in the 1970’s, will be relocated from the centre of the northern border of the site to the northwest corner of the site (refer to Attachments - Engineering Drawings SK001 and SK002). The new building will be a consolidated and modernized office and shop complex. The access gate to the Westshore site will also be relocated to the northwest corner, making the access road along the northern site boundary unnecessary.

The new two-storey complex will incorporate the best of building design and environmental standards including:

- Modern insulated wall design to reduce heat loss and minimize energy consumption;
- Heat pump regenerative heating systems allowing heat to be transferred from areas of excess heat to areas requiring heat;
- Modern energy efficient boiler systems for heating and hot water:
- LED lighting systems; and
- Replacement of the existing wastewater treatment plant with a new system that meets current discharge regulations and reduces impact on the marine environment.

The area vacated by the existing office and shop complex will be used to store an additional 135,000 tonnes of coal. Coal stored within reach of the stacker-reclaimers can be handled almost entirely by these electrically-powered machines minimizing the use of diesel-powered mobile equipment.

The area along the northern site boundary will be reconfigured to make use of the land area that is currently unoccupied or occupied by the access road (A1 – Site Layout). Westshore plans to incorporate approximately 500 ft of the existing terminal access road into the relocated equipment and parts lay-down area (bone-yard).

Reconstruction of the office/shop complex requires revisions to Westshore’s internal water main distribution system, which will need to be rerouted to the location of the new office/shop complex.

Modification and rerouting will also be required for some of the internal water recirculation system. One of the three on-site water reservoirs (reservoir #3, with a capacity of 660,000 US gallons) that stores surface run-off water will be taken out of service as part of the project to make way for coal pile storage. This reservoir is proposed to be reconstructed at a location along the northern lease boundary.

Relocation of the office/shop complex will require that the present wastewater treatment plant be replaced with a new plant proposed to be located along the terminals east boundary behind Berth No. 2. Detailed information on the wastewater treatment plant upgrade can be found in Appendix 6.

Further, replacement of the present fuelling facilities for on-site equipment, as well as the existing propane tank, will be required. The new fuelling facility is proposed to be located at the west end of the coal storage yard between the conveyor lines. The relocated propane tank will be positioned adjacent to the existing new warehouse.

In the area of the new office/shop complex, new area lighting will be provided for the outside circulation area and parking areas. Where used, mast mounted LED (light emitting diode) area lights will be cowled to minimize the limited amount of light spillage beyond the target area.

In a separate initiative, Westshore is spending $2.1 million to change the existing mercury and sodium vapour outdoor lighting and some indoor lights to efficient LED in conjunction with BC Hydro's Power Smart program. During this program, some 1,900 outside lights will be changed to LED in a phased program which offers to use 75% less energy (747 MWh (megawatt hours) per year) and last much longer than the incandescent lights that they are replacing. The other advantages of LED lighting are quick start up and no mercury presence as a final disposal hazard. All lights will be applied with sensitivity to unwanted light spillage by aiming and cowling.

2.2.2 Major Equipment Replacement

Four major pieces of equipment will be replaced during the project, including three stacker-reclaimers (S/R's) and the existing shiploader No. 1 on Berth One (refer to A1 – Site Layout and A4 – Existing Equipment).

2.2.2.1 Stacker-Reclaimer Replacement

The existing S/R's were originally installed in the early 1970's and 1980's and had a reclaim capacity between 4500 tph and 6500 tph (Hemmera, 2006). The maintenance and repair of these 30 to 40 year old stacker-reclaimers is becoming more challenging as parts are becoming more difficult to source and their overall reliability is being reduced. The typical lifespan of an S/R is 25 years or longer with proper maintenance and care. The new S/R's will have reclaim capacities of up to 7100 tph to match the newest S/R installed in 2010.

The new stacker-reclaimers will have a reach 10 metres further than the existing machines, thereby minimizing the use of bulldozers on site. The increased reach will give them access to 20% more material than the existing S/R's thereby allowing them to reach material that would otherwise have to be bulldozed back into the reach of the old S/R's. The increased reach of the new S/R's, in combination with the storage of coal on the existing office land area, is estimated to reduce bulldozing activities by 45%.

The new S/R's will incorporate energy efficient electrical drives, LED lighting systems, modern technologically advanced transfer points to minimize potential for dust, and dust suppression equipment both in the transfers, as well as at the end of the boom where material is either stacked or reclaimed. In addition, the new S/R's will operate at a noise level threshold of 85 decibels (dB) at one metre, which is an improvement over aging machines that have noise levels in excess of 95 dB.

The work associated with the replacement of S/R 43 is scheduled to take place in 2015, while the replacement of S/R 42 and 41 will take place in 2016 and 2017, respectively.

2.2.2.2 Shiploader Replacement

The new shiploader will be installed on Berth One, located on the southeast side of the site. The current shiploader, built in 1983, was not designed to handle modern vessels which, due to increasing size, are often difficult to load. The new shiploader will incorporate spill tray collection systems to minimize the amount of coal spilled during loading, energy efficient drives, LED lighting systems, modern technologically advanced chutework to minimize dust generation at transfers, and dust suppression equipment both in the transfers, as well as at the end of the boom where material is loaded to the ship. Berth One can accommodate a rail-mounted shiploader with a loading capacity of 7000 tph, and can handle ships up to 250,000 dwt (Hemmera, 2006).

The work associated with the replacement of the shiploader is scheduled to take place in 2015.

2.2.3 Conveyor 3A and 9A Upgrades

The stacker-reclaimers replacing S/R 41 and S/R 42 will have higher peak reclaim capacities than the two existing yard conveyors. Westshore will be replacing the two existing 72 inch 6300 tph yard conveyors with 84 inch 7100 tph to allow the higher peak reclaim rate to be handled with minimal spillage (refer to A1 – Site Layout and A5 – Conveyors). Due to the use of modern conveyor and drive components it is anticipated that overall noise levels will be reduced as a result of the replacement of the conveyors. Switching from steel idler rollers to composite versions, as components fail and equipment is upgraded, will further reduce operational noise.

The work associated with the replacement of the two conveyors will coincide with the replacement of the S/R 42 and 41, and will take place in 2016 (S/R 42 and Conveyor 9A) and 2017 (S/R 41 and Conveyor 3A).

2.3 Proposed Project Schedule

Provided that all required permits from the PMV are in place, Westshore proposes to initiate the project in early 2014, with an anticipated completion by the end of 2017. Westshore expects to complete the upgrades without any material disruption of its throughput capacity during implementation. A proposed project implementation schedule was provided in Appendix B of the Project Application dated July 26, 2013.

2.4 Construction Details

2.4.1 Office and Shop Complex Relocation

Reconstruction of the existing office and shop complex at the northwest corner of the site will require that ground works be carried out to provide services (e.g., water, electrical, communications, sewer and drainage) to the building as well as to compact the ground under the building to meet the requirements of the National Building Code prior to forming the building foundation.

Paving will be provided around the new shops and offices, vehicle parking areas, vehicle wash bay and employee car wash facility. The run-off collected from these areas will be routed through an oil water separator to prevent oily water from entering the recycled water system.

Details of the revisions to Westshore’s internal water main distribution system will be addressed in the development of the site infrastructure utility modifications. A preliminary site location for fresh water storage has been identified in Attachments - Drawing SK002 (reservoir #5).

Although the exact location and details of the future replacement reservoir have not been completed, it is proposed to construct an above-ground reservoir to contain an equal volume of water as was in reservoir #3. Space exists for such a storage tank or impoundment structure along Westshore’s northern lease boundary and a preliminary site location has been identified for planning purposes (refer to reservoir #4 in Drawing SK002).

The main wastewater treatment plant and infrastructure, including the process tank, in ground wet well transfer tank, pumps and piping will be demolished along with the shops and offices as part of the relocation and reconstruction of the new office/shop facilities. Associated Engineering Inc. (2013)

prepared a report dated October 18, 2013 that provides a general concept for the wastewater treatment plant upgrade. The report can be found in Appendix 6. Associated Engineering designed the new treatment facilities with the following parameters:

- Sized to handle the projected employee loading, including showers;
- An allowance to be made to provide a contingency above the projected requirements;
- System to be robust;
- Consider maintenance aspects and ease of changing components and cleaning;
- Provide back-up system if plant is out of operation;
- Provide alarms and annunciation of malfunctions; and
- Develop emergency response plan in the event of system failure.

The existing fuel dispensing station and propane service tank will be removed from site and demolished in accordance with Environment Canada's decommissioning protocols (per Westshore in Appendix 2), and new facilities will be constructed at the east end of the stockyard close to the new office/shop complex consistent with safety considerations. The existing fuelling facilities are considered to be adequately sized for the service duty and no changes are proposed for the installation. The surface area around the tanks will be made of concrete and drainage will be provided to collect drips and spillage to the proposed oil-water separator located either adjacent to Transfer 3 or at the water treatment services (details to be developed during detailed engineering). Westshore is proposing to relocate the existing propane storage tank to fuel space heating in the offices and radiant heat in the shops. The new heating system in the office complex will use a high efficiency central boiler system feeding distributed water to air heat pump systems. The heat pumps will have heat recovery capability allowing heat to be moved from areas of the building requiring cooling to areas that require heating. Design parameters and concept layouts for the new fuelling and propane facilities will be developed as part of the infrastructure included with the office and shop complex designs.

Engineering works are in progress to develop detailed drawings for the office and site services. Drawings showing the current progress are included in A2 – Office and Shop Complex and A3 – Site Services.

The existing lighting facilities in the area of the new office/shop complex will be demolished and the present illumination in that area will be removed as the area becomes part of the coal storage yard. New lighting will be installed in the office complex area including mast and building mounted area lights.

2.4.2 Major Equipment Replacement

All of the proposed works will be undertaken within the existing footprint of the coal handling facility and will not require any land clearing. In-water works will be limited to the relocation of an existing wastewater outfall in accordance with the requirements of revised permit PE-06819 issued by the BC Ministry of Environment (Appendix 5) The new equipment, S/R's and shiploader, will operate on the existing rail systems and will not require foundation preparation, or result in excavated material requiring off-site disposal.

2.4.2.1 Stacker - Reclaimers

Replacement of the three existing stacker-reclaimers (S/R 41, S/R 42 and S/R 43) (refer to A1 – Site Layout and A4 – Existing Equipment) will not require any ground works or modification of the existing S/R foundations (i.e., berms and rail) beyond normal maintenance activities. Replacement of S/R's 41 and 42 will coincide with the replacement of the two associated yard conveyors (refer to section 2.3.3).

The three S/R's are expected to be fabricated offsite and brought to the terminal in relatively large pieces by barge. There are two options for lifting the fabrications ashore from the barge:

S/R Option 1: on the northeast corner of the site behind Berth 2 (as was previously done for S/R 44); ***or***

S/R Option 2: on the south side of the site behind Berth One.

Once on shore, the fabrications will be transported using heavy lift transporters to the erection site.

When the three existing S/R's are demolished, Westshore's expectation is that they will be cut into pieces that can be transported off-site by truck. Tenders have not been received associated with this work and, therefore, there is a potential that the above assumed transportation and installation methodology may change.

2.4.2.2 Shiploader

The shiploader to be installed on Berth One will not require any modification to the existing berth structure with the possible exception of temporary extension of the existing rails to allow the equipment to be moved on and off the berth (refer to A1 – Site Layout and A4 – Existing Equipment). Westshore expects that the new shiploader will be brought to site complete and will be either rolled or lifted off a transport vessel directly onto the existing berth structure. In-water works will be limited to the relocation of an existing wastewater outfall in accordance with the requirements of revised permit PE-

06819 issued by the BC Ministry of Environment. Once installed, the new shiploader will operate on the same rails as the existing shiploader.

There are currently two options for the demolition of the existing shiploader:

Shiploader Option 1: involves rolling or lifting the existing shiploader off the berth onto a transport vessel; ***or***

Shiploader Option 2: involves disassembling the shiploader at the east end of the berth and moving the scrap material out using a combination of barges and trucks.

2.4.2.3 Conveyor 3A and 9A Upgrades

The existing conveyors will be demolished down to grade, and foundations that interfere with the new equipment will be removed completely. New concrete foundations will be installed at the head and tail of the conveyors with sleepers installed under the remainder of the conveyor length. Excavations will be required for the foundations, which will not be deeper than 8 feet in order to allow them to be constructed without dewatering.

The new conveyors will be similar in profile and design to the existing conveyors they are replacing. Preliminary design calculations indicate that the existing installed power will be sufficient and that an increase in power will not be required, as per the Permit Application dated July 26, 2013 (Westshore, 2013a).

2.5 Operational Details

The project will not result in any changes to principal operations at the Terminal and will mainly serve to maintain existing loading/unloading capacity of the facility. Relocation of the office/shop complex and addition of the new stacker-reclaimers and associated conveyor systems is expected to allow for a smoother transition between the incoming and outgoing coal streams, thereby reducing queuing time for ships at the loading berths. Due to the increased reliability and minor capacity increase in the new equipment, Westshore is predicting that the project may increase the terminal throughout capacity from 33 mtpa to 36 mtpa provided that the markets are available and the remainder of the coal chain can accommodate the 3 mtpa capacity increase.

2.5.1 Coal Handling/Transfer System

The terminal operation of unloading trains and loading ships will continue on a 24/7 basis throughout the year. In 2012, the shift supervisors schedule was revised such that there is always now a management presence on-site to oversee the terminal operation.

2.5.2 Dust Control Equipment

The new stacker-reclaimers will be equipped with dedicated dust-control systems to minimize dust generation during stacking and reclaim operations. The larger site-wide water-spray control network will continue to provide dust suppression following the upgrades.

The maintenance and repair schedule for the facility will be updated to incorporate the equipment changes.

The functional responsibility for the performance of the dust suppression activities lies with the Operation group, under direction of the Operations Manager, and is delegated to the work force through superintendents and foremen. Daily shift meetings are conducted in which the environmental priorities are established and tasks assigned.

The operation of the spray systems is determined by the supervisor based on information available from a suite of inputs including the subscription-paid Environment Canada Weather Alert system, which provides e-mail notification of wind warnings, and the subscription-paid UBC Weather Alert systems, which provides on-line graphical projection of forecast wind speed and direction over the next 24 hours. Westshore also has its own site weather station and on-board anemometers on all the major equipment providing wind speed, wind direction, precipitation, temperature and humidity.

The availability of quality weather forecast information enables the shift supervisor to make an informed decision on the use of dust suppression systems based on forecasted and real time wind speeds, direction and precipitation. The general descriptor of the weather condition requires the input of a low, medium or high level of operation of dust suppression systems. The spray systems are operated on an individual basis or group basis and later will be automated with routines that initiate spray cycles appropriate to the requirements.

Westshore's water management strategy is based on maximizing the use of recycled water consistent with the functional requirements of the dust suppression task. No changes will be required to the Delta water main feeding into the site either for supply volumes or metering, and the closed loop water recycling system will continue to operate in its present manner.

2.5.3 Other Facilities

The new office/shop complex will accommodate similar numbers of staff and visitors to those present today, and therefore, the total complement of personnel is not projected to change following the project. Westshore currently employs a total of 300 (approximate) full and part time personnel.

As part of the project, level control devices will be installed at each reservoir (existing and new) such that automated filling of the reservoirs can occur when required during operations and sufficient water will always be on hand to provide dust control without manual intervention.

Run-off water includes rain water that falls on the site. Rain water is collected in the same ditches and ponds as the run-off water that comes from spraying the coal piles. Water in these catchment ditches is routed to the screening facility to reduce the amount of solids that are suspended in the water before it is directed to one of the reservoirs for storage prior to being replaced through the dust suppression system. During winter months when increased rainfall is experienced the amount of run-off water exceeds the capacity to store it and re-use it requiring that excess water must be discharged from the site. The existing Effluent Discharge Permit PE-6819 currently covers this excess. As previously mentioned, no changes will be required to the effluent discharge systems as part of the project upgrades and replacements.

The new wastewater treatment plant and infrastructure design (Appendix 6) will incorporate all existing effluent from the existing office and shop complex as well as the effluent presently treated in the septic tank at the OCC. The new design will be coordinated with the BC Ministry of the Environment, and a new permit will be obtained to cover operations of the new facilities.

The new fuel dispensing facilities (diesel, gasoline and propane services) will comply with applicable Environment Canada regulations and Fire codes. Westshore's Emergency Response Plan will be revised to address all facets of risk associated with this facility. An abbreviated copy of the existing Emergency Contingency Plan is found in Appendix 3.

2.5.4 Project Decommissioning

Improvements are considered permanent structures and decommissioning of the project is not anticipated. In the case that the project is to be decommissioned, the proponent shall engage appropriate regulatory agencies to plan decommissioning activities and meet the criteria laid out in the lease agreement with PMV.

Decommissioning of the project is not discussed further in the EIA.

2.6 Current and projected Future Coal Throughput

Westshore has recently completed a five year continuous series of major capital equipment upgrades increasing the terminal capacity from 23.5 mtpa in 2009 to 33 mtpa in 2012. Westshore had an annual throughput of 26.1 mtpa in 2012, which is reduced from the projected throughput of 28.2 mtpa due to a ship damaging one of the two loading berths in December of that year. For 2013, Westshore anticipates loading 30 million tonnes of coal.

Completion of the project forecasts a potential increase in capacity of up to 3 mtpa for a total of 36 mtpa, without change to the existing size of the terminal. This assumes that there will be a market to sell more coal and the entire coal change can similarly incrementally improve overall. Since its opening in 1970, Westshore has facilitated the export of 720 million tonnes of coal to the world market at annual throughput rates over 20 mtpa for the past fifteen years.

WorleyParsons Canada Limited (WorleyParsons) conducted static simulations of the terminal operations to predict the effects of the new equipment on the future capacity of the terminal to receive and ship coal, following the completion of the proposed Terminal Infrastructure Reinvestment project (Westshore 2013a). The simulations were based on (and extrapolated from) the terminal operations in 2012.

The simulations addressed changes to equipment and operations at the terminal for eight case studies:

Case 1: Base case simulation using 2012 data (prior to P2S4 Dumper 32 Upgrade project);

Case 2: Existing Terminal Configuration (P2S4 Dumper Upgrade project complete, Terminal capacity 33 mtpa)

Case 3: Case 2 plus replace S/R 41 with 7100 tph peak reclaim rate machine (exist. 4500 tph) including Conveyor 3A upgrade;

Case 4: Case 3 plus replace S/R 42 with 7100 tph peak reclaim rate machine (exist. 4500 tph) including Conveyor 3A upgrade;

Case 5: Case 4 plus reduction in Berth One hatch change time (associated with new shiploader);

Case 6: Case 5 plus replace S/R 43 with 7100 tph peak reclaim rate machine (exist. 7100 tph);

Case 7: Case 6 plus increase dumper gross dumping rates from 21 to 23.6 cph; and

Case 8: Case 7 plus double sourcing Berth One 30% of the time.

The most representative simulation runs were determined to be Case 7 and Case 8, which predict a theoretical terminal capacity increase of between two and three million tonnes per year from the existing terminal capacity (Case 2 at 33 mtpa). However, the simulations carried out do not include the full coal supply chain and as such only predict the capability of the terminal to handle additional coal throughput. The utilization of this additional throughput capacity will be conditional upon the additional volume to be shipped being available and improvements being affected in the entire coal supply chain to provide the capability of handling the additional coal volume.

Assuming that an additional 3 mtpa of coal is shipped through Westshore Terminal, there will be an increase in the number of trains arriving at the terminal each day from 6.24 to 6.81, approximately one train every two days, and an increase of 30 ships per year arriving at the terminal, or approximately one ship every 12 days. If current trends for larger ships and longer train sets continue, these incremental increases will be even less.

Westshore has developed a forecast for Low Case and High Case tonnage scenarios for 2013 onwards, based on input from all of its coal suppliers, including Teck Coal Ltd., Grand Cache Coal Company, Peace River Coal Inc., Coal Valley Resources, Cloud Peak Energy and Signal Peak. This is displayed in Table 2-1, along with the actual throughputs experienced over the past twelve years.

Table 2-1 Historic and Projected Annual Throughput (Million Tonnes/Year)

YEAR / CASE	ACTUAL											FORECAST					
Year	2001	2001	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Long-term
Low Case													28	31	31	31	31	31
High Case	23.3	19.4	19.3	21.2	21.9	18.9	21.2	21.1	20.1	24.7	27.3	26.1	31	33	33	34	35	36

2.6.1 Changes in Stockpiles

Relocation of the existing office and shop complex to the northwest of the site will allow the expansion of the exiting Row D stockpile (northern stockpile row) by approximately 500 feet (ft) (based on a pile footprint of 500 ft length by 285 ft width by 85 ft height). The additional stockyard area will provide the ability to increase the existing stockyard capacity, currently a maximum of approximately 2 million tonnes (mt), by a further 135,000 tonnes. Although the terminal is capable of storing up to 2 mt of coal on-site, the stockyard typically operates with approximately 1.3 mt of coal being stocked on-site and a smaller overall stockpile allows for more efficient overall operations.

Increasing stockyard capacity will not result in a direct correlation to terminal capacity increase, as overall throughput capacity of the stockyard will still be limited by dumper, stacker-reclaimer and shiploader availability.

2.7 Current and Projected Marine Activity

This section is based on Hemmera (2006) and has been updated as appropriate.

Marine activity levels change from year to year at the Terminal, depending on the size of vessels and total volume of export. In 2005, a total of 241 ships visited the Terminal, 106 of which were large capacity ships loaded at Berth One. In 2012, Westshore shipped 26.1 million tonnes of coal in 270 ships.

The nature of the international coal exporting business is such that buyers, representing steel mills, usually contract for specified tonnage over a period of time. After that, the buyer will charter ships on an as-needed basis to transport the coal between the Terminal and the offshore destination. Unlike the container business, bulk ships do not run on a regular schedule between ports and their arrival and cargo requirements are unknown until declared. In addition, some buyers purchase coal on the ‘spot’ market and may contract for a shipment at any time. These facets inevitably lead to bunching of ships and the necessity to queue if the berths are already occupied at the time of arrival. If the berths are already occupied, ships destined for the Terminal will transit to English Bay, and wait at anchor until an appropriate berth is available to receive them (Figure 2-1).

As mentioned in section 2.6, an increase in throughput of up to 3 mtpa may lead to an increase in ship traffic at the terminal, as up to approximately 30 additional ships will be arriving at (and departing from) the terminal. This is estimated to result in one additional ship every 12 days, or 2.5 ships per month. If ship sizes arriving at Westshore continue to increase in size (i.e., more overall Cape size vessels), this incremental increase in ships will be less.

The primary effect of the project will be a reduction in the average vessel loading time thereby reducing overall ship related emissions per tonne of coal transferred. Replacement of the shiploader at Berth One and the old S/R’s, and upgrade of the conveyors will allow for a higher peak reclaim rate (with minimal spillage), allowing for more efficient loading. This will increase the opportunity for a ship to come to berth and reduce the incidence of ships going to anchor in English Bay. It will also shorten the length of time that the ships that do go to anchor have to wait, before coming to berth. Due to current high berth utilisation rates it is not anticipated that the total number of hours that ships reside at the berths will increase.

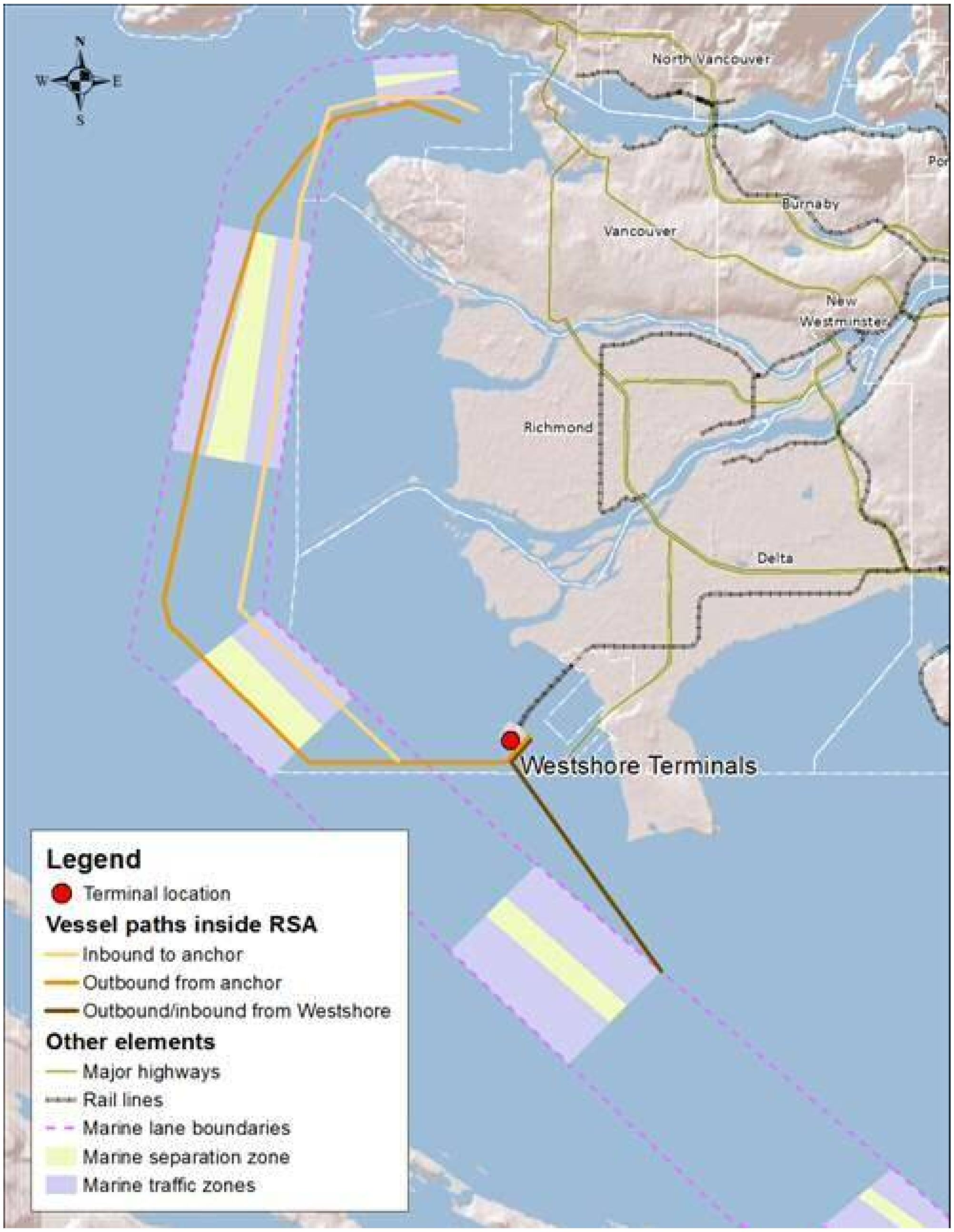

Figure 2-1 English Bay In- and Outbound Marine Traffic

3.0 PROJECT SETTING

The proposed project is located on Roberts Bank in Delta, approximately 35 km south of Vancouver, BC (Figure 1-1). Roberts Bank is located within the Corporation of Delta (CoD) on the south side of the Fraser River estuary. The CoD had a population of approximately 97,200 residents based on 2006 Census numbers.

Roberts Bank is situated within the traditional territory of the Tsawwassen First Nation (TFN). Tsawwassen First Nation signed the Tsawwassen First Nation Final Agreement (the Treaty) in April 2009, which involves a land claim and self-government agreement. The Treaty clarifies legal rights to lands, resources, and self-government for TFN. The community is located on a 273 hectare parcel of land situated between the BC Ferries terminal and the port facility and includes homes, small businesses, the TFN administration office, longhouse, and a youth centre.

The CoD hosts two key transportation facilities for the movement of goods and people: the port facility at Roberts Bank, operated by the PMV; and the Tsawwassen Ferry Terminal, operated by the BC Ferries Corporation. The marine transportation facilities are connected to road and rail infrastructure, which continue the movement of goods and people across the region. The port facility at Roberts Bank is located at the end of an approximately 4.1 km long causeway and consists of the Westshore Terminal and Deltaport, a three-berth container terminal operated by TSI.

The marine environment around Roberts Bank supports several species of fish, eelgrass beds, and contains mudflats that sustain bird communities on the Pacific Flyway. Socially and economically, the Roberts Bank area maintains agriculture and fishing, is home to First Nations, and has provided direct and indirect employment to local and regional residents since the late 1950s, due to local transportation developments.

Westshore has implemented a continuous improvement program to address the environmental aspects of the operation with a series of capital and maintenance projects. Historically, the prime focus of terminal upgrades has been to increase terminal throughput capacity but recent projects, the 2013 dust suppression system upgrade, changed this focus to dust control and control of off-site discharges. These projects amount to significant capital investment over the years. To address environmental and human health effects of current operations, Westshore currently has in place the following:

Dust Management Plan – comprehensive dust management systems including, but not limited to stockyard dust suppression systems including ground level water guns, mid and high level tower sprays, perimeter road maintenance and the use of widely used dust suppressant/binding agents on stockyard roads to reduce dust from coal handling operations.

Continual Management Presence – 24/7 management presence to oversee terminal operation.

Air Emissions Monitoring – Dust monitoring and recorded usage of water spray systems, a requirement of the existing air emissions permit issued by Metro Vancouver.

Water Management Strategy – water recycling and distribution and effluent treatment, potable water and fire main management. No changes will be required to the existing permit or effluent discharge systems.

Emergency Contingency Plan – inclusive of emergency response, accident spill and malfunction, and worker health and safety plans.

Sustainability Initiatives – the Terminal is a part of BC Hydro's PowerSmart Program and has undertaken several initiatives to improve efficiencies in operation such as light replacement, installation of high efficiency motors, reduced water consumption, reduction in Criteria Air Contaminant and Greenhouse Gas emissions, design standards and clean standards in construction.

In addition, Westshore has initiated recycling programs to ensure the collection and return of recyclable products, including the following, to recycling centres:

- Waste oil and grease
- Used oil filters
- Used paper and packaging materials
- Batteries
- Used light bulbs
- Antifreeze
- Electronic components (e-waste)
- Filter rolls
- Steel and other metals
- Paint

Westshore has also employed innovative measures to limit the waste products generated by drum-sized unit handling, by switching to bulk storage and dispensing bulk fluids in a refillable format.

As demonstrated by the above initiatives, Westshore is committed to complying with the federal Canada-Wide Standard (CWS) that requires active strategies for the continuous improvement of environmental performance. Every year, Westshore identifies capital and maintenance projects that serve to enhance environmental aspects of its operation.

4.0 ENVIRONMENTAL CONSIDERATIONS

Environmental and socio-economic values for the project are described in this section. The information provided is a summary of environmental assessment work previously completed for Westshore such as Hemmera (2006), WorleyParsons (2013) and SNC-Lavalin (2013), as well as existing information from the Deltaport Terminal Road and Rail Improvement project (PMV, 2012) and Deltaport Third Berth (PMV, 2006).

4.1 Environmental and Social Components

The following environmental and social components will form the focus of the assessment for the project:

- Effects on Air Quality;
- Traffic effects;
- Noise effects;
- Lighting effects;
- Storm and Wastewater Management;
- Phase 1 Environmental Site Assessment;
- Marine Mammals; and
- Socio-economic considerations (section 5)

The Human Health Effects Assessment is discussed in detail in section 6.

4.2 Air Quality

As noted in Appendix 1, SNC-Lavalin completed an emissions assessment for Westshore operations both within a Local Study Area (LSA) and a Regional Study Area (RSA). The LSA entails the terminal grounds itself, including the two berths where loading of vessels occurs. The RSA includes the additional activities that extend off of the terminal grounds – ship movements to and from the terminal (including anchoring that may occur at English Bay), as well as train movements to and from the terminal. The RSA is shown in Figure 2-1, which includes the location of Westshore itself as well and the nearby BC Ferries Terminal. The focus of the air summaries provided here is the LSA. The reader is directed to the full air quality study for details associated with the RSA.

4.2.1 Emission Sources

Emission sources at the terminal include marine vessels, rail locomotives, off-road machinery, on-road vehicles and administration (buildings). The off-road machinery (bulldozers, cranes etc) are referred to collectively as cargo handling equipment (CHE). These are emission sources that relate to combustion of fuels (exhaust) and therefore release a number of gaseous contaminants as well as particulate matter (PM). The evaluation of the exhaust emissions is limited to the 'criteria air contaminants' (CACs) which include:

- Nitrogen oxides (NO_x),
- Sulphur oxides (SO_x),
- Carbon monoxide (CO),
- Volatile organic compounds (VOCs),
- Particulate matter (PM, as total PM, PM_{10} and $PM_{2.5}$) and
- Ammonia (NH_3)

In addition, the greenhouse gases carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) are estimated and expressed as equivalent carbon dioxide (CO_2e). Diesel particulate matter (DPM) is also estimated by accounting for the sources that consume diesel rather than gasoline or other fuels.

Coal handling and storage also causes the release of 'fugitive' dust. Since fugitive dust (PM) is different in nature than exhaust PM it is accounted for separately. Estimates of fugitive dust relate to activities directly rather than equipment/vehicles. All of the key emission sources at Westshore in 2012 are identified in Table 4-1 below, separated to exhaust and fugitive sources.

Table 4-1 Emission Sources and Activity Levels at Westshore, 2012

SOURCES	Value	Units	Comments
Exhaust			
Marine	262	Vessel calls/yr	Bulk carrier characteristics available in air study report
Rail	1,841	trains/yr	Locomotives characterized from Railway Association of Canada reports
CHE	31	pieces CHE	Equipment types range from bulldozers to forklifts to electric stacker/reclaimers
	630,485	Litres diesel	Small amounts of gasoline and propane also used
On-road Vehicle			

SOURCES	Value	Units	Comments
Admin	234,724	L propane	Propane use for space heating purposes.
	4,630	kWh electricity	Estimate from the total electricity consumption at the terminal
Fugitives			
Railcar Unloading	28.2	Million tonnes	Coal throughput value for the year
Stockpile Wind Erosion	1.1	Million tonnes	Average stockpile 'size' during the year
Transfer Points	28.2	Million tonnes	Coal throughput for the year
Ship Loading	28.2	Million tonnes	Coal throughput for the year, loaded to ships
Stacker-reclaimer	28.2	Million tonnes	Coal throughput for the year
Bulldozing	4.5	h/day	Based on average usage to shape the coal storage pile

Exhaust emission estimates relate to the specific engines and fuels used by the various equipment pieces whereas fugitive dust estimates relate to activity estimates that support previous measurement studies that have yielded average emission rates that can be used. In most cases the fugitive dust estimates relate to the amount of coal that is handled. Bulldozer dust estimates relate to the amount of time the bulldozers push/move coal on the terminal to shape the storage piles such that the coal is within the reach of the stacker/reclaimers.

Emission estimates are provided in Table 4-2. These estimates are referred to as the 2012 baseline and are slightly different (higher) than what actually occurred during the year, due to an accident at one of the marine berths. A ship collision occurred late in the year which reduced the ship loading capacity at the terminal for approximately one month. For this reason, the actual throughput (26.1 million tonnes) was scaled to 28.2 million tonnes which is the estimated throughput that would have occurred without the accident. The activities shown in Table 4-1 relate to 28.2 million tonnes, as do the emission estimates in Table 4-2.

Table 4-2 2012 Baseline Emission Estimates for Westshore

Source	Annual Emissions, tonnes/yr									
	NO_x	SO_x	CO	VOC	PM	PM_{10}	$PM_{2.5}$	DPM	NH_3	CO_2e
Exhaust										
Marine	139.11	160.55	18.25	5.18	17.85	17.14	15.77	15.77	0.04	11,695
Rail	37.61	0.16	5.39	1.82	0.94	0.94	0.91	0.91	0.23	2,297
CHE	19.10	0.02	13.30	1.50	1.20	1.20	1.16	1.09	0.03	2,586
On-road Vehicles	1.31	0.02	8.17	0.32	0.08	0.08	0.04	0.00	0.07	1,071
Admin	0.36	0	0.20	0.03	0.02	0.02	0.02	0.00	0.03	367
TOTAL	**197.49**	**160.74**	**45.32**	**8.84**	**20.09**	**19.37**	**17.90**	**17.84**	**0.40**	**18,017**

Source	Annual Emissions, tonnes/yr									
	NO_x	SO_x	CO	VOC	PM	PM_{10}	$PM_{2.5}$	DPM	NH_3	CO_2e
Fugitives										
Railcar Unloading	—	—	—	—	1.82	0.85	0.13	—	—	—
Stockpile Wind Erosion	—	—	—	—	33.60	15.80	2.42	—	—	—
Transfer Points	—	—	—	—	76.24	35.83	5.49	—	—	—
Ship Loading	—	—	—	—	1.82	0.85	0.13	—	—	—
Stacker/reclaimer	—	—	—	—	6.05	2.85	0.44	—	—	—
Bulldozing	—	—	—	—	55.94	26.29	4.03	—	—	—
TOTAL	**—**	**—**	**—**	**—**	**175.46**	**82.47**	**12.63**	**—**	**—**	**—**

The estimates in Table 4-2 show that fugitive dust PM is much greater in magnitude than exhaust PM for TSP but similar for fine particulate ($PM_{2.5}$). DPM estimates are nearly equivalent to $PM_{2.5}$ estimates since most of the exhaust sources at the terminal consume diesel.

4.2.2 Future Activity Projections

The future activity levels were estimated from the maximum theoretical throughput of the terminal in 2018, when the equipment upgrades will be completed. This maximum throughput is 36 mt. The activities for each of the emission sources were estimated by accounting for the potential increase in throughput in a number of different ways. In general, the activities that drive the specific emission calculations were adjusted; for example engine hours (marine vessels) or fuel consumption (CHE). These adjustments are identified for each of the sources below:

- Marine sources – hours of engine use scaled linearly
- Rail – hours of engine use scaled linearly
- CHE – total fuels consumption scaled linearly
- On-road Vehicles – total fuels consumption scaled linearly
- Admin – total fuels/energy consumption held constant
- Railcar unloading – throughput increase
- Stockpile wind erosion – size held constant*
- Transfer points – throughput increase

- Ship loading – throughput increase
- Stacker/reclaimer – throughput increase
- Bulldozing – hours of activity decrease

* The proposed 135,000 tonne increase in stockyard capacity will offset coal currently stored in the yard in locations where bulldozers must be used to both stock and reclaim the material. Overall average stockpile size of 1.1 million tonnes is not anticipated to increase.

Importantly, the equipment upgrades (new stacker/reclaimers) increase the capability to access coal from the storage piles and reduce the need for bulldozing to move and shape the piles. While this is not expected to have an impact on the size of the coal piles it will reduce the amount of time the bulldozers are needed (from 4.5 hours/day to 2.3 hours/day). This is explained in greater detail in Appendix 1.

Office and shop complex energy consumption is held constant for the future since administration activities do not increase with greater throughput. However, the equipment upgrades will result in lower energy consumption for buildings and therefore the future administrative activity estimates are conservative.

4.2.3 Effects of the Upgraded Equipment

The projected activity estimates were used to re-calculate the terminal emissions, accounting for equipment rollover (newer ships, vehicles etc) and government fuel quality regulations that will be in effect. Notably, Canada has implemented an Emission Control Area (ECA) for the west coast (with the United States) that will restrict the sulphur level of marine fuels that can be used. This regulation was enacted in 2013 and will be in effect in future years. This regulation in particular has a dramatic influence on marine vessel emissions of SO_x and PM. The projected 2018 emissions are provided in Table 4-3, accounting for the effects of the upgraded equipment.

Table 4-3 2018 Emission Estimates for Westshore

Source	Annual Emissions, tonnes/yr									
	NOx	Sox	CO	VOC	PM	PM10	PM2.5	DPM	NH3	CO2e
Exhaust										
Marine	109.18	8.07	21.18	5.97	4.49	4.32	3.98	3.98	0.04	13,578
Rail	44.38	0.20	6.88	2.12	1.09	1.09	1.06	1.06	0.29	2,929
CHE	24.35	0.02	16.96	1.91	1.53	1.53	1.48	1.48	0.04	3,296
On-road	0.61	0.01	4.46	0.18	0.08	0.08	0.03	0.01	0.03	652
Admin	0.36	0.00	0.20	0.03	0.02	0.02	0.02	0	0.03	367
TOTAL	**178.87**	**8.31**	**49.68**	**10.20**	**7.22**	**7.04**	**6.57**	**6.53**	**0.43**	**20,822**

Source	Annual Emissions, tonnes/yr									
	NOx	Sox	CO	VOC	PM	PM10	PM2.5	DPM	NH3	CO2e
Fugitives										
Railcar Unloading	—	—	—	—	2.32	1.09	0.17	—	—	—
Stockpile Wind Erosion	—	—	—	—	33.60	15.79	2.42	—	—	—
Transfer Points	—	—	—	—	97.20	45.68	7.00	—	—	—
Ship Loading	—	—	—	—	2.32	1.09	0.17	—	—	—
Stacker-reclaimer	—	—	—	—	7.72	3.63	0.56	—	—	—
Bulldozing	—	—	—	—	31.01	14.57	2.23	—	—	—
TOTAL	**—**	**—**	**—**	**—**	**174.16**	**81.85**	**12.54**	**—**	**—**	**—**

The emissions effect of the terminal upgrades is shown in Table 4-4. A significant decrease is expected for most of the CACs, and an increase for GHGs.

Table 4-4 Emissions Effect of Project Upgrades

Emissions Inventory	NO_x	SO_x	CO	VOC	PM	PM_{10}	$PM_{2.5}$	DPM	NH_3	CO_2e
Local Study Area										
2012 Baseline	197.49	160.74	45.32	8.84	195.55	101.84	30.53	17.84	0.40	18,018
2018 Future with Project	178.87	8.31	49.68	10.20	181.38	88.89	19.11	6.52	0.43	20,822
% Change with Project	-9.4%	-94.8%	9.6%	15.4%	-7.2%	-12.7%	-37.4%	-63.5%	7.0%	15.6%

4.2.4 Air Quality Conclusion

The overall impact of the terminal upgrades is positive for air quality. Even if assuming the maximum theoretical throughput occurs in 2018, the total CAC emissions will decrease. Emissions of NO_x, SO_x, PM, PM_{10}, $PM_{2.5}$ and DPM are expected to significantly decrease. When considering fugitive coal dust alone, the future emissions are expected to decrease by a small amount.

Potential effects and mitigation for air quality are summarized in Table 8-1.

4.3 Traffic

Traffic at the Westshore Terminal consists of road traffic, rail traffic and marine traffic. Existing and expected future traffic patterns and the potential effects of the project on traffic are described in this section.

4.3.1 Road

An increase in the total number of personal transportation vehicles entering and exiting the Terminal is expected during construction. An increase in truck traffic to and from the Terminal is also anticipated during construction (e.g., for the transportation of demolished shiploader parts and delivery of equipment or services).

During operations, road traffic associated with the Terminal is limited to the routine travel of personnel to and from the facility. Due to the proposed relocation of the entrance portal to the northwest of the property, operational road traffic along the northern boundary will be eliminated.

During construction and installation, the project is expected to employ an average of 30 persons per day over the four year period. The proposed upgrades and projected increases in annual throughput at the facility are anticipated to lead to a temporary increase of an average of 30 persons per day during construction and installation therefore, no impacts on road traffic flows/patterns in the area during operations are expected and no mitigation is proposed.

4.3.2 Rail

Coal is delivered to the Terminal by CP Rail, CN Rail and BNSF. Over the past years, capacity of individual trains in terms of cargo weight has continued to increase steadily as the rail companies convert steel cars to lighter shorter aluminum cars with increased payload capacity. Due to the increased payload capacity and the shorter car length each train is effectively able to transport a greater amount of coal without increasing the train length.

In 1997, an average of six trains per day delivered 23.9 million tonnes of coal with an average load of 10,978 tonnes per train. The average number of trains in 2005, with a throughput of 21.9 mtpa, was 4.9 (Hemmera, 2006). At a throughput of 24.7 mtpa in 2010, 5.0 trains per day were required on average (PMV, 2012). The current number of trains arriving at the Terminal is 6.24 per day.

Assuming an increase in shipping capacity from 33 mtpa to 36 mtpa (i.e., an additional 3 mtpa) of coal through Westshore Terminal, there will be an increase in the number of trains arriving at the terminal each day from 6.24 to 6.81, approximately one train every two days. This is based on the current train length remaining the same. In recent years, train lengths have been increasing. Table 4-5 shows container capacity and one-way rail traffic volumes to the Terminal.

Table 4-5 Summary of Westshore Terminal's Capacity and One-Way Rail Traffic Volumes

Year	Capacity (million tonnes)	Total Average One-Way Coal Trains (trains/day)
1997 (actual)*	23.9	6
2005 (actual)*	21.9	4.9
2010 (actual)*	24.7	5
2012 (actual)	33	6.24
2017 (projected)	36	6.81

Source: *PMV, 2012

4.3.3 Marine

Westshore operates on a throughput basis and receives handling charges from its customers based on volumes of coal exported through the Terminal. The coal is delivered by rail and is then unloaded and either directly transferred onto a ship or stockpiled on-site for future ship loading.

Westshore completed nearly five years of major capital equipment upgrades increasing the terminal capacity from 23.5 mtpa in 2009 to 33 mtpa in 2012, reacting to an increase in demand for coal. The proposed replacement of old equipment with modern efficient equipment is needed to sustain these higher levels of throughput.

Based on trends in the cargo ship industry, the average cargo capacity of vessels increased from 93,168 tonnes in 2001 to 99,100 tonnes in 2011, a six percent (6%) increase over 10 years. The total ship activity for Westshore was 246 in 2010, 270 in 2012. Table 4-6 provides bulk carrier activity for 2012 (SNC-Lavalin, 2013).

Table 4-6 Westshore Bulk Carrier Activity Summary for 2012

	Ship Calls	Dead Weight Tonnage (dwt)	Berth Stays (days)	Ships to Anchor	Anchor Stays (days)
# in 2012	262			270	
Minimum		38,393	0.44		0.06
Maximum		207,964	7.28		61.42
Average		123,116	2.44		6.28

During construction, an increase in marine traffic (e.g., transport vessels and barges) is anticipated for the transport of demolished shiploader parts and new fabrications to and from the Terminal but this increase will be minimal, infrequent and temporary.

During operation, assuming an increase of an additional 3 mtpa of coal through Westshore Terminal, there will be a potential increase of up to 30 ships per year arriving at the terminal, approximately one ship every 12 days (or 2.5 ships per month). However, if ship size continues to increase as it has done in recent years, this incremental increase will be less.

Hemmera (2006) noted with the upgraded equipment, the percentage of ships queuing to be loaded would drop from a forecast value of 70% to 61% for 23 mtpa throughput and from 78% to 67% for 25.4 mtpa throughput, based on 2011 projected marine activity levels at the Terminal. A net positive impact on the flow of marine traffic through English Bay based on reduced anchor times and percentage of ships at anchor was expected.

4.3.4 Conclusion

Westshore's reinvestment in modern stacker-reclaimers will allow the terminal to function more efficiently, producing productivity gains in ship loading and train unloading. The benefit of these efficiencies will be to turn around ships and trains more quickly. The ships and trains that arrive at Westshore in 2018 are expected to be newer (and lower emitting) on average, due to fleet turnover in North America (rail) and internationally (ships) (SNC-Lavalin, 2013). Emissions of the priority air contaminants including NO_x, $PM_{2.5}$ and diesel particulate matter (DPM) generated by ships and trains are also expected to be reduced, as the time of the ships/trains at the terminal or in queue will shorten, leading to a proportional reduction in overall emissions. These reductions will be additional to the improvements expected from emerging engine technology and fuel improvements from national and international regulations and will also include greenhouse gas (GHG) savings (Westshore, 2013a).

Potential effects and mitigation for traffic are summarized in Table 8-1.

4.4 Noise

4.4.1 Existing Noise Environment

Westshore Terminals is now in its forty-third year of operation, receiving and unloading trains, handling coal through the facility and loading ocean-going vessels. Since commencement in 1970 the throughput tonnage has risen from a start-up operation based on 2 mtpa throughput to today's rated capacity of 33 mtpa. Westshore introduced round-the-clock 24 hr operations in 1984 at which time throughput capacity stepped up to 18 mtpa. The suite of mechanical handling equipment installed on site has increased as the tonnage has increased, as have the number of trains and ships handled.

According to Westshore records going back twenty years, no specific complaints have ever been received regarding noise from Westshore's operations. During that time frame, Westshore has received only three generalized complaints regarding noise from Roberts Bank and upon investigation, none have been associated with any activity at Westshore.

All conveyors at Westshore are driven by electric motor drives, which are used for continuous duty and are not subject to variations in pitch or tone. As an innovation for reasons of serviceability and weight, Westshore is moving to replace steel idler rollers with composite idler rolls. These new idler rolls are lighter than their steel predecessors and quieter to the point that it is sometimes difficult to discern whether the conveyor is actually running.

As part of the environmental impact study for the DTTRRIP, Port Metro Vancouver commissioned a study into the ambient noise levels prevailing in the community of Tsawwassen which have a direct exposure to noise coming from the marine terminal area. (See Section 6.1 of DTRRIP: http://www.portmetrovancouver.com/docs/default-source/projects-ccip/the-environmental-assessment-report.pdf?sfvrsn=0).

This study included a review of previous data collected at the same monitoring stations over a period of years and found that there was consistency to the values obtained and that existing day and night noise levels were below any relevant standards requiring mitigation.

4.4.2 Effect of the Project on Noise Levels

Westshore commissioned a noise study of its operations in 1995 (Pacific, 1995). This study included all of the major infrastructure and equipment at the terminal at the time. Noise measurements were made near the various pieces of equipment to identify the maximum sound intensities workers could be exposed to.

These measurements identified the sources and locations with the highest sound levels, as identified below:

- Conveyor belt ends, belt transfers and bad rollers
- Sampling plants
- Surge bins
- Railcar dumpers
- Shiploaders, particularly Shiploader 1
- Some locations on the stacker/reclaimers
- Bulldozer cabs

Noise levels were determined to be as high as 94 dBA (conveyors with bad rollers), 97 dBA (transfer station, near one motor), 99 dBA (inside railcar dumper structure) and 106 dBA (stacker/reclaimer). These noise levels were measured at varying time periods and represent values at source (e.g., up to 10 feet away).

Since 1995, new and/or replaced equipment has been introduced, including:

- Replacement shiploaders (#3 and #4)
- Stacker/reclaimer No. 44 (to replace one of the older units)
- Composite idler on Conveyors 1B and 5A
- An additional bulldozer (CAT D10)
- A replacement water truck (CAT 725)
- All barrels and drives for the railcar dumpers

For the last several years, Westshore has made its equipment purchases with the requirement that noise levels at 1m from source cannot be greater than 85 dBA. This was in effect for the previous purchase of stacker/reclaimer No. 44. With the equipment upgrades associated with the project, the same noise requirements have been expressed to the suppliers. As such, the noise environment at Westshore has improved since 1995 and this trend is expected to continue with the successful completion of the project.

Potential effects of noise, control measures and mitigation are summarized in Table 8-1.

4.5 Storm and Wastewater

4.5.1 Existing Stormwater Management

Westshore obtains water from the Greater Vancouver Water District by arrangement with the Corporation of Delta. Under the terms of this agreement, water is provided at a rate of 1500 IGPM at a residual pressure of 50psi.

The water supply system provides potable water to the administration building and occupied areas of the site for personal use. Other uses include adding make-up water to the recycled water in the reservoirs to be sprayed for dust control purposes by rain guns and high masts and also providing water directly to the tower sprays. In addition, the water supply system also charges the fire mains around the site and supply to the vehicle wash facility.

The water is provided by the Corporation of Delta. Westshore's objective is to use the water in an efficient and sustainable manner and collect the run-off where possible to recycle the water to reduce overall consumption.

The existing stormwater management system consists of a network of drainage ditches, swales and culverts, four sludge pits, four transfer sumps, three water treatment plants, three stormwater storage reservoirs, a secondary sedimentation pond, and an ocean outfall (WorleyParsons, 2013).

Surface run-off water from the Terminal (including water from coal spraying operations and rain water) is captured and routed via a comprehensive containment and collection system, consisting of ditches, pumps and pipes, to the three on-site reservoirs. Prior to entering the reservoirs, the water is pumped through the on-site screening facility to reduce the amount of solids that are contained within the effluent. The reservoirs are connected and operated by a pump system that can transfer or draw water from any of the reservoirs.

Water from the reservoirs is fed into the recycled water main system, and is used to operate the dust suppression equipment on-site (WorleyParsons, 2013). The three reservoirs on site have a combined holding capacity of 1.4mil USgals.

Reservoir 3 (near the office building in the north central portion of the Site) is filled using potable water received from the Corporation of Delta. Water in Reservoir 3 is used for dust suppression during dry periods when water levels in Reservoirs 1 and 2 are low. Excess water is pumped to the water treatment plant (on the south of the Site) before being discharged into the ocean (WorleyParsons, 2013). The sludge pits and water treatment plants contain the coal that is collected in surface water drainage. The sludge pits consist of a series of weirs that allow the coal to dewater in the pits. The accumulated coal in the pits is removed by front end loader and re-deposited onto the coal storage piles (WorleyParsons, 2013). Water from both the sludge and transfer sumps is fed through one of the two screening plants on-site to remove any remaining coal solids.

Run-off water also comprises rain water that falls on the site. Rain water is collected in the same ditches and ponds as the run-off water which comes from spraying the coal piles. Water in these catchment ditches is routed to sludge pits and the screening facility to reduce the amount of solids that are contained within the effluent.

During winter months when increased rainfall is experienced the amount of run-off water exceeds the capacity to store and utilise it and excess water must be discharged from the site. Westshore has an Effluent Discharge Permit PE-6819 issued by BC Ministry of the Environment which permits the discharge of effluent provided that it has been treated to prescribed standards. No changes will be required to the existing permit or effluent discharge systems on account of the project.

4.5.2 Existing Wastewater Management

Westshore's existing wastewater treatment facilities operate under Permit PE-6819 from BC Ministry of Environment issued in 1983 (Appendix 5). This permit allows effluent from the system to be discharged into the marine environment at a maximum rate of 32 m^3 per day, at a BOD (biological oxygen demand) level of 130 mg/l or less and total suspended solids (TSS) level of 130 mg/l or less. In addition to the septic discharge, this permit allows the discharge of treated surface run-off at a maximum rate of 10,000 m^3 per day, provided TSS levels are below 50 mg/l, and oil and grease levels are below 10 mg/l. The permit requires the completion of quarterly 96 hr LC50 bioassay tests to ensure that the effluent is not exhibiting any toxicity.

Excess water at the terminal (e.g., overflow during a storm event) is collected through the ditch collection system, pumped to the water treatment plant (located near the dumper building at the south side of the site) and subsequently discharged into the ocean through an outfall. The waste is transferred via a sanitary line that runs along the east side of the Site and discharges alongside the trestle leading to Berth No. 1 (WorleyParsons, 2013). The facilities comprise an aerobic processing tank unit, which handles the major source domestic effluent, and a septic tank system, which handles the small amount of domestic waste produced at the OCC building. The combined treated flow is then discharged into the local marine environment.

Regular testing of the outfall discharge water via an automatic sampling system is conducted by Westshore as per their permit requirements (WorleyParsons, 2013). From the sampling, total dissolved solids, hydrocarbons and volume of water discharged are reported. The main wastewater treatment plant and infrastructure, including the process tank, in ground wet well transfer tank, pumps and piping will be demolished along with all of the shops and offices as part of the relocation and rebuilding of the new facilities.

Chemicals are not added to the water sprayed for dust suppression or the water used in the car wash near the Site entrance (potable water is used for the car wash) (WorleyParsons, 2013).

4.5.3 Proposed Upgrades

Reservoir 3 has a capacity of 660,000 USgals and will be taken out of service during the course of the Terminal Infrastructure Reinvestment Project and the existing Row D stockpiles will be extended. At present the exact location and details of the future replacement reservoir have not been completed. In order to provide an equivalent volume of water, it is proposed to construct an above-ground reservoir along Westshore’s northern lease boundary and a preliminary site location has been identified for planning purposes.

The reservoirs are connected via a ring main system such that water can be transferred to, or drawn from any of the reservoirs depending on which pumps are activated.

As part of the new project, level control devices will be installed at each reservoir such that automated filling of the reservoirs can occur when required and sufficient water will always be on hand to provide dust control without manual intervention.

Paving will be provided around the new shops and offices, vehicle parking areas, vehicle wash bay and employee car wash facility. The run-off collected from these areas will be routed through an oil water separator to prevent oily water from entering the recycled water system.

The replacement of the existing wastewater treatment plant has been designed by Associated Engineering Inc.. Appendix 6 provides detailed information on the proposed upgrade. The following parameters have been included in the new plan:

- Sized to handle the projected employee loading, including showers
- An allowance to be made to provide a contingency above the projected requirements
- System to be robust
- Consider maintenance aspects and ease of changing components and cleaning
- Provide back-up system if plant is out of operation

- Provide alarms and annunciation of malfunctions
- Develop emergency response plan in the event of system failure

The new system design will incorporate all the effluent present treated in the septic tank at the OCC.

The new design will be coordinated with BC Ministry of the Environment and either the existing permit will be amended or a new permit will be issued to cover the new facilities. It is expected that the amended permit will require the relocation of the existing wastewater discharge line from its existing location, in approximately 10 ft. of water at LLWL, to a new location further out on the Berth One trestle where is can be located in deeper water. The existing discharge line runs along Westshore's trestle structure before dropping in a vertical pipe at the discharge point. The relocated system will be installed in a similar manner further out along the trestle and will require minimal in water work to secure the new vertical discharge line to the existing trestle structure.

4.5.4 Potential Effects and Mitigation

On-site construction associated with the project will consist of demolition, assembly and installation of prefabricated equipment, with minimal excavation/foundation work required. The existing wastewater treatment plant and infrastructure will be demolished and reconstructed at the east end of the site as part of the office/shop relocation. All of the proposed construction areas are located above the intertidal zone.

As mentioned, the new wastewater treatment plant system will incorporate all the effluent present treated in the septic tank at the OCC. The design will be coordinated with BC Ministry of the Environment. Potential effects and mitigation for storm and wastewater management are summarized in Table 8-1.

4.5.5 Conclusion

Considering the above-noted factors, the proposed project activities are not expected to have an effect on current water quality as the project deals mainly with upgrades and replacement. Westshore's water management strategy is based on maximizing the use of recycled water consistent with the functional requirements of the dust suppression task. The project is aimed at enhancing operational efficiency of the Terminal, without any change in the nature of operations. As such, the quality of site run-off is expected to remain at present levels, and will continue to be captured by the existing on-site drainage network and treatment/recycling systems.

The replacement of Westshore's existing effluent treatment facility will improve the quality of the effluent and meet current regulations. In addition, Westshore has a well established water management plan that is in compliance with the current effluent discharge permit authorized by the BC Ministry of Environment (MoE). No changes will be required to the surface water run-off discharge system (ocean discharge) and project activities will be adapted to current protocols.

The proposed replacements and upgrades are not expected to change the quality or quantity of surface run-off discharged from the Terminal and effluent discharge quantity will remain similar while the quality of the discharge is improved. The quality of the waters of the receiving environment are expected to be unaffected by the project.

4.6 Phase I Environmental Site Assessment

During 2012, in anticipation of a project to demolish the existing office and shop facilities and associated infrastructure, WorleyParsons was retained to conduct a Phase I Environmental Site Assessment (ESA).

The objective of the Phase I ESA was to list potential areas of concern and provide an estimate for the cost for further investigation and possible remedial requirements during demolition and construction activities.

The following text originates from WorleyParsons (2013):

WorleyParsons (2013) reported a total of nine (9) Areas of Potential Environmental Concern (APECs) that may be relevant during the demolition/construction activities associated with project. Seven (7) APECS were located in the office/maintenance area, one (1) APEC was identified as the boneyard area and one (1) APEC was identified as site-wide (entire Site). A description of the APECs, location and rationale for identification as APECs is provided below.

- APEC 1 was located underneath the southwest corner of the heavy vehicle maintenance building in the office/warehouse area. Historical environmental reports identified hydrocarbon contaminated soil from a former small waste oil underground storage tank (UST), was removed from the accessible areas around the UST but an amount, inferred to be minor, which extended under the building was left in place.
- APEC 2 was to confirm that an unknown UST identified on as-built drawings marked as located between the main office and the trailer located to the southwest in the office/warehouse area had been removed and determine the extent of any remedial action.

- APEC 3 was to confirm that an unknown UST identified on as-built drawings marked as located at the southeast corner of the main office building where the building meets the employee facilities building had been removed and determine the extent of any remedial action.
- APEC 4 was located outside of the northwest corner of the lunch room of the office/warehouse area. An abandoned underground septic tank is located in this area.
- APEC 5 was located south of the welding shop in the area where former gas and diesel USTs and associated underground piping is located. Historical environmental reports describe this area as excavated and backfilled when the USTs were removed.
- APEC 6 included the current gasoline and diesel aboveground storage tanks (ASTs) in the office/warehouse area. Refuelling of the tanks and fuelling of vehicles may have resulted in leaks in this area although there have been no reported leaks/spills and the area appears to be well maintained.
- APEC 7 included the sludge pit/oil water separator in the office/warehouse area. The sludge pit is designed to collect the surface water drainage in this area and may collect oils/fuel as run-off.
- APEC 8 included the boneyard area because of activities conducted in this area including spray painting of machine parts, storage of creosoted rail ties and chemical storage in the boneyard area. The area appears to be well maintained but there may be spills or leaks from past activities.
- APEC 9 included the entire Site and has been divided into two areas: 9A - the fill material the Site is constructed from, and 9B - surface soils across the site which may be impacted through site operations.
    - 9A: The Site was constructed of dredgate and fill material, which has been identified as an APEC.
    - 9B: Included additional infrastructure on the Site that may have contributed to potential contamination of surface soils included substations, stacker/reclaimers, rail lines, sludge pits, transfer towers, and coal storage.

4.6.1 Potential Effects and Proposed Follow-up

WorleyParsons (2013) summarize that there is the potential for Health, Safety and Environment (HSE) issues associated with workers coming into contact with contaminated soil, groundwater and/or soil vapour during demolition or construction of the project. The potential for spreading or mobilization of contamination exists during demolition/construction if unknown contaminated soils, tanks or drains/pipes are encountered, which would result in higher remedial costs (WorleyParsons 2013).

Recommendations for demolition and construction activities include, among others, soil disposal at a landfill facility capable of handling contaminated soils. In addition, the WorleyParsons Phase I ESA study recommends that a Phase II ESA be conducted in specific areas to identify to what extent, if any, those areas present environmental concerns by testing subsurface conditions. As Westshore has been in continuous possession of the site since its inception, it is not expected that any exotic materials will be found, only those typical of an industrial operation with on-site vehicle maintenance.

Westshore will initiate a Phase II ESA consistent with the project schedule and address any issues arising.

4.7 Marine Mammals

Twenty-three species of marine mammals live in B.C. waters, 16 species inhabit the southern Strait of Georgia/Georgia Basin area and nine are considered common to the area (Triton, 2004). Marine mammal diversity in this region is relatively high, with five of the seven representative marine mammal sub-order/families present on a seasonal or annual basis. This includes seven odontocete (toothed whale) and four mysticete (baleen whale) cetaceans; two species of otariids (eared seals) and phocids (true seal); and two mustelid (otter) species. Humpback whales and sea otters are believed to be highly sporadic. Harbour seals are distributed evenly throughout the area and porpoises were noted to be the next most abundant species. Steller's sea lions and sea otters both have growing populations and the proximate area does not appear to be an important habitat for them (Hemmera, 2006). Table 4-7, adapted from DTRRIP (2012), summarizes the species found in the Roberts Bank area, including conservation status.

Two forms, or ecotypes, of killer whales (*Orcinus orca*) have been encountered within the project area; the Transient and Southern resident killer whale (SRKW). SRKWs are known to use both the proximate and local area for foraging. Killer whales were encountered twice out of nine surveys conducted in 2007 – 2009 during the Deltaport Third Berth (DP3) Marine Mammal Monitoring Program (MMMP) (Stantec, 2010 as cited in PMV, 2012). The purpose of the MMMP was to monitor marine mammal presence during construction within the DP3 project area and to avoid, reduce or mitigate any potential environmental effects and how they may apply to killer whales in particular.

SRKWs are a provincially red-listed species and are classified as "Endangered" under Schedule 1 of the *Species at Risk Act* (SARA), resulting in increased and stringent regulation. They are known for their cultural (First Nations and public) and economic (tourism) value, and have been well studied in the Southern Strait of Georgia (PMV, 2012). SRKWs are presently considered to be at risk due to their low population size which according to DFO (2008) totaled 88 as a result of low reproductive rates, and anthropogenic threats which include environmental contaminants, physical and acoustic disturbances and low availability and quality of prey.

Westshore is situated in designated critical habitat (as identified in the revised federal Recovery Strategy) of the SRKW community due to the project area being located within foraging range during the salmon migration period (DFO, 2011).

Table 4-7 Marine Mammal Species Found in the Strait of Georgia and Roberts Bank Area and their Conservation Status

Common Name	Scientific Name	COSEWIC Status	SARA Status	BC Listing*
Southern resident killer whale	*Orcinus orca*	Endangered	Schedule 1	Red
Transient killer whale	*Orcinus orca*	Threatened	Schedule 1	Red
Grey Whale	*Eschrichtius robustus*	Special Concern	Schedule 1	Blue
Humpback whale	*Megaptera novaeangliae*	Special Concern	Schedule 1	Blue
Steller's sea lion	*Eumetopias jubatus*	Special Concern	Schedule 1	Blue
Harbour porpoise	*Phocoena phocoena*	Special Concern	Schedule 1	Blue
Dall's porpoise	*Phocoenoides dalli*	Not at Risk	Not Listed	Yellow
Pacific white-sided dolphin	*Lagenorhynchus obliquedens*	Not at Risk	Not Listed	Yellow
Harbour seal	*Phoca vitulina*	Not at Risk	Not Listed	Yellow
California sea lion	*Zalophus califonianus*	Not at Risk	Not Listed	Yellow
Minke whale	*Balaenoptera acutorostrata*	Not at Risk	Not Listed	Yellow

Note: Red: Extirpated, Endangered or Threatened; Blue: Special Concern; Yellow: Not at Risk (BC Conservation Data Centre 2010). Adapted from PMV (2012)

4.7.1 Potential Effects

The proposed construction is limited to the on-site assembly of pre-fabricated equipment, involving minimal excavation, and the areas of active construction are located above the intertidal zone. As such, no increase in noise levels or potential release of environmental contaminants – factors that could potentially impact marine mammals – is expected during construction.

Studies suggest that lethal vessel strikes to whales are infrequent at speeds of less than 14 knots and are rare at speeds of less than ten knots (PMV, 2012). Considering the low speeds of typical coal bearing ships in the area, any risk of marine mammal collisions associated with the project is considered to be negligible (Hemmera, 2006).

Any potential operational effects of the project would relate to increased risk of collision of marine mammals with vessels. At a projected additional 2 - 3 mtpa of coal shipped through Westshore terminals by 2017/2018, the total number of ships accessing the Terminal is expected to increase by approximately one ship every 12 days; however, the impact of this projected increase in number of ship visits is offset by a reduction in the need for queuing resulting from improved efficiencies at the Terminal. In many cases, a reduced need for queuing and lower queuing periods will eliminate the transit of ships to and from the anchorage in English Bay, which will reduce effective marine traffic in this portion the Georgia Strait (Hemmera, 2006).

4.8 Sustainability and Other Environmental Considerations

Westshore Terminals is committed to continuous improvement in its activities and uses the replacement and renewal process to seek opportunities to implement efficiencies to its operations.

- Westshore supports the PMV’s initiatives to influence ship owners to reduce emissions while in port, and support initiatives at an international level to declare the West Coast of North America as a Sulphur Emission Control Area (SECA) by the International Maritime Organization (IMO).
- Westshore continues to seek ways to reduce ships emissions by minimizing the queuing time required while ships are at anchor prior to coming to berth for loading.
- Westshore continues to seek ways to reduce the emissions from its on-site vehicle fleet and equipment, including but not limited to, the possible use of ultra low sulphur diesel, bio-diesel and propane fuels. Westshore commits to adopt such schemes that provide an emission reduction without negatively impacting the terminal’s operations or production efficiency.

- Westshore works with the railways to ensure that locomotives used in coal haul service are compliant to the latest emission standards and that idling of locomotives, while at the Terminal, is minimized (Hemmera, 2006).
- Westshore has already initiated action to join BC Hydro's PowerSmart Program and has implemented a site-wide program of converting older style incandescent light fixtures with more efficient LED lighting. This project will see over 1900 fixtures replaced during the program with an annual savings of 747 MWh.
- Westshore purchases and installs high efficiency motors as equipment is upgraded or replacement is required. Where practical large motor drive systems implement variable frequency drives to be able to moderate the power used in proportion to the demand.
- Westshore's newly installed rain-bird and tower spray system improves dust control capabilities and reduces the possibility of fugitive dust leaving the site. The system also makes better use of the spray water used for dust control and more water is now collected and passed through the new water treatment plant for recycling.
- Westshore's reinvestment in modern stacker-reclaimers will allow the terminal to function more efficiently producing productivity gains in ship loading and train unloading. The benefit of these efficiencies will be to turn around ships and trains more quickly. As a result, emissions of the priority air contaminants including NO_x, $PM_{2.5}$ and DPM generated by ships and trains will be reduced as their time at the terminal or in queue will shorten, leading to a proportional reduction in overall emissions. These reductions will be additional to the improvements expected from emerging engine technology and fuel improvements from national and international regulations and will also include GHG savings. The new electric powered stacker-reclaimers will also do some of the work currently done by the diesel powered bulldozers which will reduce overall emissions further. In Appendix 1 SNC-Lavalin confirms these reductions and contains a detailed analysis of the favourable changes in air quality expected with completion of the project.
- As well as the direct project benefits, Westshore has registered with Metro Vancouver Non-Road Diesel Engine Emission program which promotes cleaner air by the planned retirement of older equipment replacing it with the latest Tier compliant engines.
- The new shop and office facilities will be custom designed to take into account all of Westshore Terminals' operating requirements for a facility that will be in constant use on a 24/7 basis. The development of specifications will consider conservation opportunities; this will include

plumbing, lighting and HVAC systems and the complementary use of natural heating/cooling available via heat pump applications and the use of appropriate glazing systems to insulate and limit heat gain.

- Westshore will include provisions in its contract specification guidelines that require best practices for the use of diesel equipment by construction contractors working on-site.

4.9 Summary and Conclusion

The project will not affect any land areas beyond the existing lease boundary with the exception of a minor reconfiguration of the lease along the northern boundary between Westshore and TSI. The results of the air assessment conclude that terminal upgrades are positive for air quality, even with the assumption of 36 mt maximum throughput in 2018. SNC-Lavalin (2013) notes that the total CAC emissions, in addition to NO_x, SO_x, PM, PM_{10}, $PM_{2.5}$ and DPM will decrease at the 2018 projected throughput.

In water works will be limited to the relocation of an existing wastewater outfall. No additional load on the effluent discharge facility is expected, and operations will continue as permitted.

The Phase I ESA work identified nine APECs associated with the demolition and construction activities of the project. The risks identified with these APECs have been outlined, and mitigation measures to address contaminated soils have been described (WorleyParsons 2013).

Terminal upgrades and replacement are expected to create efficiencies in operation, as well as improvements in emissions and dust control. Lighting and noise effects from the upgrades and replacements will have negligible change to the current operation. Traffic is projected to increase, but with the efficiencies created from the project, in addition to improvements from DTRRIP and other PMV projects, ongoing and planned, impacts from traffic are considered to be low. Negligible effects to marine mammals have been cited given low speeds of berthing ships. No changes to water run-off or increases of water discharge are expected.

With the application of the mitigation measures described in preceding sections and in Table 8-1 continuance of existing environmental management plans (Appendix 2) and monitoring, there is expected to be low to negligible effects on the environment.

5.0 SOCIO-ECONOMIC CONSIDERATIONS

5.1 Employment

Westshore currently employs approximately 300 full-time or part-time employees. The equipment that is proposed to be installed as part of the project will replace existing equipment with similar manning requirements, therefore, it is not anticipated that the additional terminal throughput capacity will result in an increase in the size of the existing workforce or the annual hours worked.

However, a considerable amount of work will be generated during the construction and installation phases of the project that are expected to create employment opportunities in the local economy for skilled trades personnel.

During construction and installation, the project is expected to employ an average of 30 persons per day, mostly skilled trades personnel, over the four year period expected to complete work. In addition, there is the potential for additional work associated with local supply and fabrication of equipment and structures (Westshore, 2013a).

5.2 Public Consultation

Westshore publicly announced in February 2013, and thereafter monthly since then in a variety of public materials, its intention of replacing existing equipment in order to maintain and potentially incrementally increase the terminal throughput and has made numerous government, First Nations, and public consultation efforts to date with others planned over the next few months. A listing of these efforts was provided previously to PMV in Appendix C of the Project Application dated July 26, 2013.

5.3 First Nations Consultation

Over the terminal's history, Westshore has maintained a good relationship with local native bands, predominantly the Tsawwassen First Nation (TFN), keeping the band council aware of the projects being carried out at the terminal. This relationship and process has been extended to include the current proposed project. A meeting was held on July 29, 2013 with the TFN Band council to review the entire project. It is worth noting that Westshore has historically worked with the TFN with no contentious issues arising from previous projects. The most recent opportunity was the provision of water transportation assistance by TFN during the rebuild of the damage to the trestle at Berth One earlier this year (Westshore, 2013a).

6.0 HUMAN HEALTH CONSIDERATIONS

A human health effects assessment was undertaken to assess the potential health effects associated with the project, and in particular to determine if the project would result in a deterioration in air quality from coal dust and emissions from diesel-reliant equipment.

To address the potential for impact to human health, this section will discuss the following:

- The study area
- The existing condition, represented by baseline ambient air quality data for the area
- Effects of particulate matter (PM)
- Effects of criteria air contaminants (CAC) from combustion emissions
- Discussion and Conclusions

In summary, based on the information presented in the following sections, it is concluded that the Project will result in improved emission standards by implementing new more efficient equipment .

6.1 Study Area

An air quality analysis was done for Westshore operations in 2012 with its current terminal configuration and in 2018 when the equipment replacements will be completed (see Appendix 1). The regional study area is defined in Figure 2-1.

6.2 Existing Conditions

Baseline ambient air quality in the area surrounding Westshore was determined from station data at the BC Ferries Terminal and in the community of Tsawwassen (a Metro Vancouver [MV] station). Data is presented for the MV Tsawwassen Station for 2011 - 2012 and for the BC Ferry Terminal for 2010-2012, by averaging period of interest. The Tsawwassen Ferry Terminal station collects data for total suspended particulate (TSP) only, whereas the MV station collects data for the primary CACs of interest. Each station has a relatively short history compared with other air quality stations in the Lower Fraser Valley. The BC Ferries Terminal station is operated and quality-assured by Levelton Consultants Ltd. on behalf of Westshore. Figure 6-1 below presents the locations of the BC Ferries Terminal and MW Tsawwassen stations.

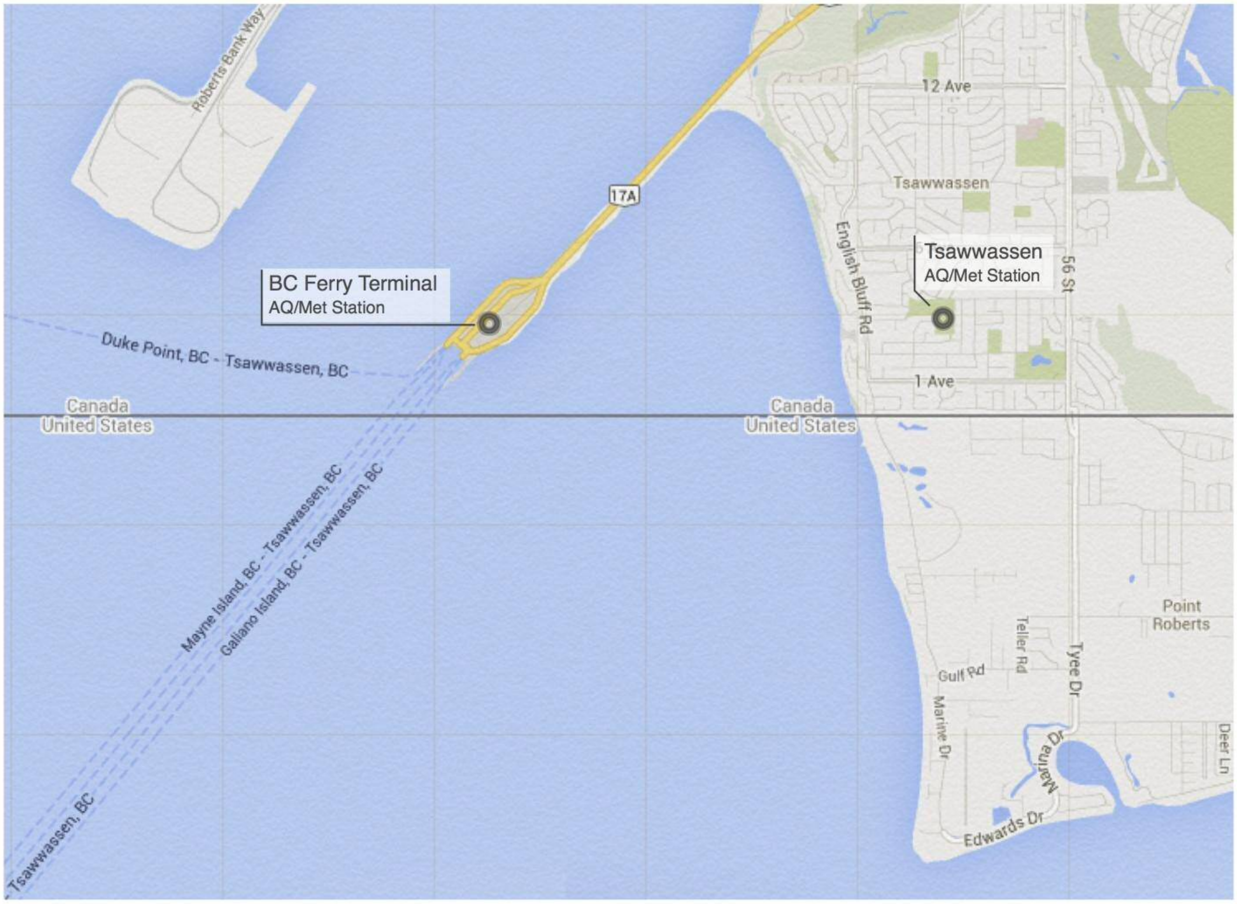

Figure 6-1 Locations of the BC Ferries Terminal and Metro Vancouver Tsawwassen air quality stations

A summary of the ambient air data for the CAC is presented in Table 6-1. Where applicable, the measured concentration data are accompanied by the most stringent of the applicable MV or BC Ministry of Environment (MoE) objectives or standards (in brackets). Percentile values are also shown for the 1-hour concentrations, to identify the typical patterns between the relatively high maximum concentrations compared with the average values. Data capture in all cases was 'good' (98% capture over the year or better), with the exception of TSP data at Tsawwassen in 2011 (93% data capture). Exceedences of the ambient criteria are indicated with use of red highlighting.

Table 6-1 Concentration Statistics of Criteria Air Contaminants at the Tsawwassen BC Ferry Terminal (2010–2012) and the MV Tsawwassen Station (2011–2012)[a]

Parameter	Concentration, µg/m^3					
	MV Tsawwassen AQ Station					Tsawwassen Ferry Station
	NO	NO_2	CO	SO_2	$PM_{2.5}$	TSP
1-Hour Maximum (2010)	—		—	—	—	733.1
1-Hour Maximum (2011)	103.5	118.4 (200)	710.3 (14,300)	39.3 (450)	31.2	503.5
1-Hour Maximum (2012)	98.8	77.5 (200)	664.5 (14,300)	39.3 (450)	45.5	365.8
1-Hour 99th Percentile (2012)	33.5	48.5	343.7	8.1	13.1	31.0
1-Hour 98th Percentile (2012)	21.7	43.5	309.3	6.3	11.2	17.6
1-Hour 95th Percentile (2012)	10.1	35.2	263.5	3.7	8.9	11.0
1-Hour 90th Percentile (2012)	4.9	27.7	229.1	2.6	7.0	8.1
1-Hour 75th Percentile (2012)	1.7	16.2	194.8	1.3	4.8	5.6
Annual Mean (2010)	—	—	—	—	—	11.0 (60)[b]
Annual Mean (2011)	3.2	13.2 (40)	185.3	1.6 (25)	3.5 (6)	7.4 (60)[b]
Annual Mean (2012)	2.4	12.2 (40)	175.3	1.1 (25)	3.4 (6)	5.9 (60)[b]
8-Hour Maximum (2011)	—	—	544.2 (5,500)	—	—	—
8-Hour Maximum (2012)	—	—	379.5 (5,500)	—	—	—
24-Hour Maximum (2010)	—	—	—	—	—	25.9 (120)
24-Hour Maximum (2011)	52.9	47.8 (200)	500.1	9.1 (150)	11.9[d]	88.7 (120)
24-Hour Maximum (2012)	38.2	42.4 (200)	342.2	6.8 (150)	14.1[d]	**141.8** (120)[e]

[a]Arithmetic means used throughout unless indicated otherwise.
[b]Arithmetic mean. [c]Canada-wide Standard for 8-hour ozone based on 4th highest annual value.
[d]Rolling average applied here.
[e]Exceeds the B.C. Level A Objective for 24-h TSP (120 µg/m^3) and the National Maximum Acceptable Objective for 24-h TSP (120 µg/m^3).

As noted in Table 6-1, $PM_{2.5}$ concentrations in the nearby community of Tsawwassen are available, but not at the BC Ferries Terminal, which can be considered the nearest location where members of the general public would frequent; the BC Ferries Terminal will herein referred to as the nearest receptor. The TSP data was allocated to the respirable (PM_{10}) and inhalable ($PM_{2.5}$) portions using the following ratios:

- PM_{10} – 0.47 of TSP
- $PM_{2.5}$ – 0.072 of TSP

These ratios were applied in the air quality study (Appendix 1) and were obtained from US Environmental Protection Agency (EPA) size criteria for batch/drop operations (e.g., representative of coal handing)[1]. The BC Ferries TSP data are re-expressed in Table 6-2 showing the estimated PM_{10} and $PM_{2.5}$ concentrations. The 99th percentile concentrations are added to provide some insight to the expected distribution of ambient concentrations experienced at this location. Exceedence level values are shown in red bold.

Table 6-2 TSP Concentration Data and Estimated PM_{10} and $PM_{2.5}$ Concentrations at BC Ferries Terminal, 2010 - 2012

		TSP (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
2010	1-hour maximum	45.0	21.2	3.2
	1-hour 99th percentile	15.3	7.2	1.1
	24-hour maximum	25.9	12.2	1.9
	24-hour 99th percentile	13.0	6.1	0.9
	annual average	3.7	1.8	0.3
2011	1-hour maximum	909.7	427.6	65.5
	1-hour 99th percentile	37.1	17.4	2.7
	24-hour maximum	88.7	41.7	6.4
	24-hour 99th percentile	29.5	13.9	2.1
	annual average	6.6	3.1	0.5
2012	1-hour maximum	307.2	144.4	22.1
	1-hour 99th percentile	94.7	44.5	6.8
	24-hour maximum	**141.8**	**66.6**	10.2
	24-hour 99th percentile	64.0	30.1	4.6
	annual average	13.7	6.4	1.0

[1] US EPA AP 42 Chapter 13.2.4

The data presented in Tables 6-1 and 6-2 have been considered in the following sections in the evaluation of potential health effects associated with fugitive dust and coal dust, as well as with CAC from combustion sources.

6.3 Health Effects from Particulate Matter

6.3.1 Potential Effects

Particulate matter ($PM_{2.5}$ and PM_{10}) are measures of particles with a diameter of 2.5 µm or less and 10 µm or less, respectively, that can enter the respiratory tract and are considered to be associated with health effects. PM_{10} is referred to as inhalable particulate, while particles smaller than 2.5 µm ($PM_{2.5}$) are referred to as fine, respirable particulate (WHO, 2006). PM_{10} is primarily produced by mechanical processes such as construction activities and wind (road dust, sand), whereas $PM_{2.5}$ is primarily produced by combustion sources (WHO, 2006).

As presented above, $PM_{2.5}$ and PM_{10} were estimated based on TSP concentrations measured at the Tsawwassen BC Ferries Terminal, the nearest receptor. As these estimates are based on measured ambient air concentrations, they include contribution from both fugitive dust and combustion sources from the Westshore facility, as well as from dust and combustion sources in the general area. The data from the BC Ferries Terminal is a conservative representation of dust and combustion emissions from the Westshore facility, but outside of the fenceline of the facility (i.e., at the nearest receptor); concentrations of Westshore related emissions will decrease with distance from the facility, and the data from the Ferry Terminal includes significant contribution from emissions from the ferries/associated equipment. Additionally, as described in section 5, the overall impact of the terminal upgrades is positive for air quality, with a predicted decrease in CAC emissions, including for TSP, PM_{10}, $PM_{2.5}$ and diesel particulate matter (DPM) (discussed below).

A summary of the predicted 24-hour maximum and annual average concentrations for TSP, $PM_{2.5}$ and PM_{10} compared to the AAQO is presented in Table 6-3. In addition, in order to provide a more comprehensive assessment of potential adverse health effects, predicted concentrations were also compared to the BC Ambient Air Quality Objectives (AQO) (BC MoE, 2013), the Canadian Council for Ministers of the Environment (CCME) Canada Wide Standards (CWS) for Particulate Matter (CCME, 2000) and the World Health Organization (WHO) Air Quality Guidelines (AQG) (WHO, 2006) where available. The resulting assessment therefore provides a local, provincial, national and international context to the predicted PM values.

Table 6-3 TSP, $PM_{2.5}$ and PM_{10} Concentrations at Tsawwassen BC Ferries Terminal, 2010-2012

Pollutant	Averaging Time	Maximum Concentration (µg/m^3)			Air Quality Objectives (µg/m^3)				
		2010	2011	2012	Metro Vancouver [a]	CCME [b]	British Columbia [c]	WHO [d]	Most Stringent Objective
TSP	24-hour	25.9	88.7	**141.8**	-	120 (A), 200 (T)	120 (MDL) 200 (Level B)	-	120
	24-hour 99th percentile	13.0	29.5	64.0	-	120 (A), 200 (T)	120 (MDL) 200 (Level B)	-	120
	Annual	3.7	6.6	13.7	-	60 (D) 70 (A)	60 (Level A) 70 (Level B)	-	60
$PM_{2.5}$	24-hour	1.9	6.4	10.2	25	30	25	25	25
	24-hour 99th percentile	0.9	2.1	4.6	25	30	25	25	25
	Annual	0.3	0.5	1.0	8 6 (Planning Goal)	-	8 6 (Planning Goal)	10	8
PM_{10}	24-hour	12.2	41.7	**66.6**	50	-	50	50	50
	24-hour 99th percentile	6.1	13.9	30.1	50	-	50	50	50
	Annual	1.8	3.1	6.4	20	-	-	20	20

Notes:

a. Metro Vancouver Ambient Air Quality Objectives (2011)

b. CCME Canada Wide Standards (2000) or CCME National Ambient Air Quality Objectives (1999)

c. B.C. Ambient Air Quality Objectives (2013)

d. WHO Air Quality Guidelines (2006) or WHO Air Quality Guidelines for Europe (2000)

(A): CCME Acceptable Air Quality Objective

(D): CCME: Desirable Air Quality Objective

(T): CCME: Tolerable Air Quality Objective

MDL: National Maximum Desirable Level

As presented in Table 6-3, the predicted 24-hour and annual concentrations of $PM_{2.5}$ and PM_{10} at the BC Ferries terminal, were less than the AAQO, as well the BC AQO, the CCME CWS and the WHO AQGs, with the exception of the maximum 24-hour TSP, as well as the PM_{10} based on the maximum 24-hour TSP concentration measured at the BC Ferries Terminal in 2012. The CCME has developed up to three objective values using the categories "maximum desirable", "maximum acceptable", and "maximum tolerable". The "maximum desirable" objective is the most stringent standard. British Columbia has established a similar set of objective values, designated as levels A, B and C, with level A being the most stringent. The maximum 24-hour TSP concentration of 141.8 µg/m^3 exceeds the "maximum desirable" objective of 120 µg/m^3; however, the value is below the BC Level B AQO of 200 µg/m^3, which is also equivalent to the CCME tolerable level. In addition, the 2012 24-hour 99th percentile TSP concentration of 64 µg/m^3 is well below the "maximum desirable" level, indicating that 99% of the 24-hour average TSP measurements at the BC Ferries Terminal in 2012 were less than 64 µg/m^3 and below all AAQO. As further described below, the AAQO are health-based, and are protective of chronic (i.e. long-term) exposures in the general public.

As described above, the predicted maximum 2012 24-hour average PM_{10} concentration is based on the maximum TSP concentration and assuming that 47% of the total concentration is equivalent to PM_{10} and is associated with the Westshore facility. This approach has likely overestimated PM_{10} concentrations associated with coal dust from the facility, and additionally, the 2012 24-hour 99th percentile PM_{10} concentration of 30.1 µg/m^3 is well below the most stringent AAQO of 50 µg/m^3, indicating that 99% of the predicted 24-hour average PM_{10} concentrations at the BC Ferries Terminal in 2012 were less than 30.1 µg/m^3 and below all AAQO. The maximum annual PM_{10} concentration of 6.4 µg/m^3 is also well below the annual AAQO of 20 µg/m^3.

The AAQO (annual average) for $PM_{2.5}$ is based on the BC AQO for this parameter. The BC AAQO for $PM_{2.5}$ was revised to 8 µg/m^3 (annual average) in 2009 following a thorough review of the scientific literature by SENES Consultants Limited (SENES), on behalf of the BC Lung Association (SENES, 2005). Additionally, the AAQO references a planning goal (i.e., future desirable level) of 6 µg/m^3. A review of guidelines from other jurisdictions for $PM_{2.5}$ (annual averages) was conducted by SENES (2005); the AAQO for $PM_{2.5}$ is among the lowest of the available guidelines across Canada and world-wide.

The AAQO, as well as the guidelines/objectives from the other jurisdictions/agencies, have been derived to be protective of potential adverse health effects associated with exposures to TSP and PM. A summary of the critical effects (i.e., the first adverse effect observed following exposure to a chemical/substance) for which the guidelines are derived and intended to be protective of is presented below, with a more detailed discussion of potential short and long term health effects associated with exposures to TSP and PM, at ambient air levels which exceed quality guidelines, included in Appendix 4.

Critical Effects for Total Suspended Particulate and Particulate Matter

The available data on particulate matter and associated health impacts was compiled and reviewed by SENES (2005), on behalf of the BC Lung Association (report is the basis of the BC AQO), and was largely based on the review of health aspects of air pollution in Europe completed by the WHO in 2004 and formed the basis of the WHO (2006) update of their Air Quality Guidelines for $PM_{2.5}$ and PM_{10}. WHO (2006) summarized that long-term exposure to elevated particulate matter concentrations had the potential to lead to a marked reduction in life expectancy, primarily due to increased cardio-pulmonary and lung cancer mortality. While mortality was the basis on which WHO considered that ambient air quality objectives should be set, increases in lower respiratory symptoms and reduced lung function in children, and chronic obstructive pulmonary disease and reduced lung function in adults, were likely long-term health outcomes associated with exposures to elevated $PM_{2.5}$ concentrations at or near background levels (SENES, 2005; WHO, 2006). WHO noted that epidemiological studies on large populations have not identified a threshold concentration for non mortality endpoints below which ambient PM has no effect on health (SENES, 2005; WHO, 2006; CCME, 2004). It is important to be aware that a range of thresholds may exist within the population, depending on the type of health effect and the susceptibility of subgroups; noting, however, that no threshold for effects at the population level, other than mortality (as noted above), and for the most sensitive subgroups, has been identified (SENES, 2005). Both WHO (2006) and SENES (2005) have indicated that as threshold levels for effects other than mortality have not been identified, the air quality guidelines have been derived on the basis of mortality and reflect concentrations below which increased mortality outcomes due to exposure to PM air pollution are not expected based on the current body of scientific evidence.

6.3.1.1 Coal Dust

Although no ambient guidelines/objectives are available for coal dust specifically, Worksafe BC's occupational exposure limits (Time Weighted Average) range from 400 or 900 µg/m^3 (depending on the type of coal) (available at http://www2.worksafebc.com/PDFs/regulation/exposure_limits.pdf). The 2012 24-hour 99th percentile PM_{10} concentration of 30.1 µg/m^3 has been used as a conservative estimate of the maximum coal dust concentration at the BC Ferries Terminal (the nearest receptor). If it is assumed that this entire concentration is associated with coal dust, the predicted concentration would be approximately 13 to 30 times lower than the Worksafe BC limits for coal dust. Occupational exposure limits are set on the basis of exposure for 8 hrs /day, 5 days/week and over an entire working lifetime which are not expected to result in adverse health effects. Although occupational exposure limits are not explicitly derived to be protective of sensitive subpopulations (i.e., subpopulations such as children or the elderly that may be more sensitive to effects), the limits for coal dust are based on the available epidemiological data (i.e., results of occupational exposure studies). In the derivation of toxicity reference values (TRVs), or threshold levels (i.e., levels below which adverse effects would not be expected), health agencies typically apply a ten-fold uncertainty factor to account for intraspecies variability; this factor is applied to account for potential sensitive subpopulations, such as children and/or the elderly. Estimated coal dust levels associated with the Project are more than ten-times lower than the occupational exposure limits, and thus would remain below the limits even if a ten-fold uncertainty factor for intraspecies variability was applied. On this basis, no unacceptable health risks are predicted to be associated with coal dust from the Westshore facility.

In response to public enquiries Westshore has had testing carried out to assess the presence of coal at fourteen residences in Delta/Tsawwassen and three residences in Ladner. The results of the program indicated that coal dust was not present at ten of the fourteen locations tested in Delta and all three of the locations tested in Ladner, was present at concentrations < 10% at two locations on English Bluff Road, to the immediate southeast of the Westshore facility, and was present at concentrations > 10% at two additional locations on English Bluff Road.

Potential Carcinogenicity of Coal Dust

The International Agency for Research on Cancer (IARC) (1997) indicates that there have been no epidemiological studies on cancer risks in relation to coal dust, with the exception of limited occupational exposure studies evaluating high level exposures to coal miners to coal mine dust. The findings of the occupational studies have been inconsistent, and IARC (1997) indicates that there is no consistent evidence supporting an exposure-response relationship. IARC (1997) has indicated there is inadequate evidence in humans for the carcinogenicity of coal dust.

Carcinogenicity of coal dust has been tested in animal studies using rodents exposed via inhalation or injection (IARC, 1997). In these studies, the incidence of tumours did not increase compared to control animals (IARC, 1997).

6.3.1.2 Diesel Particulate Matter

Although DPM data at the nearest receptor/outside of the Westshore facility fenceline is not available and cannot be predicted from the TSP concentrations measured at the BC Ferries Terminal, it has conservatively been assumed that the entire predicted $PM_{2.5}$ concentration is equivalent to DPM. As presented in Table 6-3, the maximum predicted annual $PM_{2.5}$ concentration is 1.0 µg/m^3 (based on the 2012 dataset).

No AAQO for DPM are available from Canadian agencies (including Metro Vancouver, the BC MoE and the CCME), however, several agencies are in the process of developing such objectives. In the absence of published objectives, reference has been made to the US Environmental Protection Agency's (US EPA) Reference Concentration (RfC) for Diesel Exhaust Emissions (or DPM). A RfC is a 'safe' level in air below which no adverse effects are expected to occur. The US EPA's RfC for DPM is 5 $\mu g/m^3$ (available at http://www.epa.gov/iris/subst/0642.htm) and is based on a critical effect of pulmonary inflammation and histopathology observed in a chronic rat inhalation study. A human equivalent concentration (HEC) was calculated based on the no observed adverse effect level (NOAEL) from the rat study (HEC = 144 $\mu g/m^3$), and an uncertainty factor of 30 was applied (3 for interspecies (i.e. between rats and humans) variability and 10 for intraspecies variability, or inter-individual human variation in sensitivity). The resulting RfC is considered protective of chronic exposures in the general population, including for sensitive subpopulations.

To assess the potential for DPM associated with the Westshore facility to adversely impact human health, the maximum predicted annual $PM_{2.5}$ concentration of 1.0 $\mu g/m^3$, which has conservatively been assumed to be entirely related to DPM from the Westshore facility, has been directly compared to the RfC of 5 $\mu g/m^3$. The predicted annual concentration is considered to be the most appropriate comparison as it is representative of a long-term (vs. a short-term) exposure, and the RfC has been derived to be protective of long-term (i.e. chronic) exposures. Given that the maximum assumed DPM concentration is 5 times lower than the RfC, no unacceptable health risks are predicted to be associated with DPM from the Westshore facility.

6.3.2 Conclusion

Measured TSP and resulting predicted PM_{10} and $PM_{2.5}$ concentrations at the BC Ferries Terminal, the nearest receptor to the Westshore Facility, are generally less than the AAQOs, as well as the available BC AQO, CCME CWS and the WHO AQG. Although the maximum 24-hour TSP concentration of 141.8 $\mu g/m^3$ exceeded the "maximum desirable" objective of 120 $\mu g/m^3$; the value is below the BC Level B AQO of 200 $\mu g/m^3$, which is also equivalent to the CCME tolerable level. The BC Level B AQO/CCME tolerable level represents a concentration that is still protective of human health. In addition, the 2012 24-hour 99^{th} percentile TSP concentration of 64 $\mu g/m^3$ is well below the "maximum desirable" level, with all TSP concentrations measured in 2010 and 2011 below the AAQO, including the "maximum desirable" level. The maximum annual TSP concentration is also well below all AQO. Given the infrequent measurement of TSP in excess of the "maximum desirable" level, and as the maximum is less than the "tolerable" level, TSP is considered to meet the AAQO. Additionally, the TSP concentrations measured at the BC Ferries Terminal are a conservative representation of concentrations beyond the Westshore facility fenceline, and concentrations associated with the Westshore facility will decrease with distance from the facility.

Similar to TSP, although the maximum predicted 24-hour PM_{10} concentration exceeded the AAQO, the maximum the 2012 24-hour 99^{th} percentile PM_{10} concentration of 30.1 µg/m^3 is well below the AAQO of 50 µg/m^3, with all predicted PM_{10}concentrations based on the 2010 and 2011 TSP data below the AAQO. The maximum annual PM_{10} concentration is also well below all AQO. Given the infrequent measurement of PM_{10} in excess of the AAQO, it is considered to meet the AAQO. As with TSP, the predicted PM_{10} concentrations (based on the TSP data from the BC Ferries Terminal) are a conservative representation of concentrations beyond the Westshore facility fenceline, and concentrations associated with the Westshore facility will decrease with distance from the facility.

Based on the data presented, the predicted TSP, PM_{10} and $PM_{2.5}$ concentrations are considered to meet the AAQO. In addition, the $PM_{2.5}$ concentrations were estimated to be below the Metro Vancouver planning objective of 6 µg/m^3. The objectives have been derived based on the best available scientific evidence and, if achieved, are considered protective of health effects in the general public, including for sensitive sub-populations.

As described above, even if it is conservatively assumed that the entire maximum $PM_{2.5}$ concentration predicted based on the BC Ferries Terminal TSP data is associated with DPM, the predicted concentration is five times lower than the ‘safe’ concentration derived by the US EPA (i.e., five times lower than the US EPA RfC). Additionally, even if it is conservatively assumed that the entire maximum PM_{10} concentration is associated with coal dust, the predicted concentration is below the Worksafe BC occupational exposure limits divided by a factor of ten to account for intraspecies variability (i.e., to ensure protection of sensitive subpopulations).

Based on the above, it is concluded that no unacceptable health risks are anticipated from exposures to TSP, PM and DPM resulting from fugitive dust and diesel/combustion emissions associated with the Westshore facility. Additionally, no significant adverse health effects are predicted to be associated with coal dust from the Westshore facility.

The Dust Management Plan (Appendix 2) currently in place ensures mitigation measures are effective and air quality objectives are met.

6.4 Health Effects of Other Criteria Air Contaminants (CO, NO_2, SO_2)

In addition to particulate matter, there are additional criteria air contaminants (CAC) associated with combustion/diesel emissions associated with the Project (i.e., from equipment and locomotives). The SNC-Lavalin Air Emissions Report (Appendix 1) included these combustion sources, and assessed measured associated PM, carbon monoxide (CO), nitrogen dioxide (NO_2) and sulphur dioxide (SO_2) concentrations; PM is discussed in Section 6.3, with the additional CAC discussed below. The results of the assessment, including a comparison to the AAQO and air quality objectives from other agencies, as well as a discussion of the potential health effects of the associated air contaminants, are discussed below.

6.4.1 Potential Effects

Emissions from diesel engines include PM, CO, NO_2 and SO_2. Carbon monoxide is primarily produced by incomplete combustion of hydrocarbons and is emitted in engine exhaust, while nitrogen dioxide and sulphur dioxide are released as emissions from the combustion of fossil fuels.

Baseline ambient air quality in the area surrounding Westshore was determined from station data at the BC Ferries Terminal and in the community of Tsawwassen (a Metro Vancouver station). Data is presented for the Tsawwassen Station for 2011 - 2012 and 2010 - 2012 for the Ferry Terminal, by averaging period of interest. Whereas the Tsawwassen Ferry Terminal station collects data for total suspended particulate (TSP), the MV station collects data for the primary CACs of interest. It is noted that although the BC Ferries Terminal is considered to be the nearest receptor (i.e., the location closest to the Site where people would be present on a regular basis), as depicted on Figure 6-1, the MV Tsawwassen station is 3.5 km from the Westshore facility, and is in the nearest community (i.e., Tsawwassen). As with the BC Ferry Terminal data, the data from the MV station is conservative in that it includes contribution from other sources within the community. The concentrations associated with the Westshore facility will decrease with distance from the facility.

A summary of the results for CO, NO_2 and SO_2, compared to the AAQO, is presented in Table 6-4. The BC AQO (BC MoE, 2013), the CCME National Ambient Air Quality Objectives (NAAQO) (CCME, 1999) and the WHO AQG (WHO, 2006) are also provided for comparison purposes. As described above, the CCME has developed up to three objective values using the categories "maximum desirable", "maximum acceptable", and "maximum tolerable". The "maximum desirable" objective is the most stringent standard. British Columbia has established a similar set of objective values, designated as levels A, B and C, with level A being the most stringent. Level A is typically applied to new and proposed discharges to the environment, and is usually the same as the federal "maximum desirable" objective. Metro Vancouver's regional ambient air quality objectives are health-based objectives.

It is noted that the WHO (2006) AQG for SO_2 (24-hour average) is approximately an order of magnitude, or more, lower than the guidelines recommended by the other jurisdictions/agencies, including Metro Vancouver. The WHO (2006) have established a 10-minute average guideline of 500 µg/m^3 to be protective of short-term exposures, as well as the 24-hour average guideline of 20 µg/m^3 to be protective of longer term exposures; no annual average guideline is available. As indicated in Table 6-4, maximum measured SO_2 concentrations are well below all guidelines/objectives, including the most stringent WHO 24-hour average AQG of 20 µg/m^3.

Table 6-4 CO, NO_2 and SO_2 Concentrations at Metro-Vancouver Tsawwassen Monitoring Station, 2011-2012

CAC	Averaging Time	Maximum Measured Concentration (µg/m^3)		Air Quality Objectives (µg/m^3)								
		2011	2012 Maximum Receptor	Metro Vancouver[a]	CCME[b]			British Columbia[c]			WHO	Most Stringent Objective
					Maximum Desirable	Maximum Acceptable	Maximum Tolerable	Level A	Level B	Level C		
CO	1-hour	710.3	664.5	30,000	15,000	35,000	-	14,300	28,000	35,000	30,000[d]	14,300
	8-hour	554.2	379.5	10,000	6,000	15,000	20,000	5,500	11,000	14,300	10,000[d]	5,500
NO_2	1-hour	118.4	77.5	200	-	400	1,000	-	400 (MAL)	1000 (MTL)	200[e]	200
	Annual	13.2	12.2	40	60	100	-	600 (MDL)	100 (MAL)	-	40[e]	40
SO_2	1-hour	39.3	29.3	450	450	900	-	450	900	900	-	450
	24-hour	9.1	6.8	125	150	300	800	160	260	360	20	20
	Annual	1.6	1.1	30	30	60	-	25	50	80	-	25

Notes:

a. Metro Vancouver Ambient Air Quality Objectives (2011)

b. CCME National Ambient Air Quality Objectives (1999)

c. B.C. Ambient Air Quality Objectives (2013)

d. WHO Air Quality Guidelines for Europe (2000)

e. WHO Air Quality Guidelines (2006)

As presented in Table 6-4, the 2011 and 2012 measured concentrations of CO, NO_2 and SO_2, including background concentrations (i.e., contributions from other sources within the community), were less than the AAQO, as well as guidelines/objectives from other provincial, national and international jurisdictions and health agencies. Maximum concentrations are below the federal and provincial guidelines/objectives, including the CCME “Maximum Desirable” levels and the BC Level A.

The AAQO, as well as the BC, CCME and WHO objectives/guidelines, have been derived to be protective of potential adverse health effects associated with exposures to CO, NO_2 and SO_2, including for sensitive sub-populations (e.g. children, elderly, pregnant women). A summary of the critical effects for which the guidelines are derived and intended to be protective of is presented below, with a more detailed discussion of potential short and long term health effects associated with exposures to these parameters at ambient air levels which exceed quality guidelines included in Appendix 4.

Critical Effects for CO

Following exposure, carbon monoxide can readily diffuse across membranes (e.g., alveolar, capillary, and placental) (WHO, 2000). Absorbed CO binds with haemoglobin in the blood to form carboxyhaemoglobin (COHb) (WHO, 2000). Carbon monoxide has a significantly higher affinity for haemoglobin (200 to 250 times higher) compared to oxygen, which means that exposure to even relatively small amounts of CO results in reduced oxygen-carrying capacity of the blood (WHO, 2000).

Environmental exposure and endogenous production of CO results in COHb concentrations of approximately 0.5% to 1.5%, while pregnant women can experience COHb levels of up to 2.5%, due to increased endogenous CO production (WHO, 2000). Guidelines for a one hour average exposure of 30 mg/m^3 and an eight hour average exposure of 10 mg/m^3 were selected by WHO (2000) to ensure a COHb level of 2.5% is not exceeded in sensitive populations (i.e., non-smoking groups with coronary artery disease or foetuses of non-smoking women). The guidelines are therefore health-based and protective of sensitive sub-populations.

Critical Effects for NO_2

The available studies indicate that there is no clearly defined dose-response relationship for health effects caused by NO_2 exposure (WHO, 2000). To derive a AQG for NO_2, WHO applied a 0.5 uncertainty factor to the lowest observed effect level (375 µg/m^3 to 565 µg/m^3) for small changes in lung function and changes in airway responsiveness following NO_2 exposure, to derive a one hour average objective of 200 µg/m^3 (WHO, 2000).

Chronic exposure can result in long-term health effects and therefore, an annual average guideline of 40 µg/m^3 has been proposed (WHO, 2000). This value is based on the potential for direct toxic effects of chronic NO_2 exposure at low concentrations (WHO, 2000). In addition, during epidemiological studies NO_2 is often used as a marker for other combustion-generated pollutants and it is difficult to attribute health effects solely to NO_2 exposure when there are other correlated co-pollutants present; therefore, WHO (2006) indicated that retaining a conservative annual NO_2 guideline is considered prudent and health-protective.

Critical Effects for SO_2

The available studies indicate that there is no clearly defined dose-response relationship for health effects caused by SO_2 exposure and a clearly defined exposure threshold is not evident (WHO, 2000). Although individuals with asthma are more sensitive, there is a large range of sensitivity to SO_2 exposure throughout the general population (WHO, 2000). To be protective of the most sensitive sub-populations, guidelines for SO_2 were developed considering the minimum concentrations associated with adverse effects in asthmatics (WHO, 2000). WHO (2006) reports that there is uncertainty in the causality between SO_2 and adverse effects, which may be attributed to other factors such as ultrafine particles or another correlated pollutant. WHO (2006) recommends a more stringent 24-hour guideline (20 µg/m^3) compared to previous WHO values in order to provide greater protection as precautionary approach. As noted above, the maximum measured SO_2 concentrations associated with the Project are well below the WHO (2006) 24-hour AQG of 20 µg/m^3.

6.4.1.1 Discussion

The Air Emission Report (Appendix 1) concluded that CO, NO_2, and SO_2 emissions from diesel engines will be localized around the facility and predicted to have low impact on air quality in the area.

As summarized in Table 6-4, the maximum measured CO, NO_2, and SO_2 concentrations in the nearest community to the Westshore facility are less than the AAQOs, as well as the BC AQO, the CCME NAAQO and the WHO AQG. As documented above, the guidelines have been derived based on the best available scientific evidence, and are considered protective of health effects in the general public, including for sensitive sub-populations.

As presented in Appendix 2, Westshore has developed sustainability initiatives to improve its activities and use replacement and renewal processes to seek opportunities to implement efficiencies to its operations; the plan promotes the replacement of select diesel equipment with more efficient electric-powered stacker-reclaimers, which will also help to reduce queue times and subsequent train and ship emissions from loading and unloading activities. Further details are provided in Appendix 2 of this EIA.

Based on the above, no significant adverse health effects are anticipated from exposures to CO, NO_2 and SO_2 from diesel/combustion emissions generated by equipment and locomotives as part of the Project. Diesel/combustion emissions associated with the Project are anticipated to have a negligible impact on ambient air quality in the area, as is evidenced by measured concentrations in the nearest community of Tsawwassen being less than the most stringent AAQO. Additionally, as presented in section 5.0, the proposed equipment replacements will result in a significant decrease in NO_2 and SO_2 emissions.

6.4.2 Conclusion

As summarized above, measured concentrations of air contaminants associated with fugitive dust and diesel/combustion emissions at the nearest receptor (BC Ferries Terminal) and/or in the nearest community of Tsawwassen, are below the health-based AAQOs from Metro Vancouver, the BC Ministry of Environment, the CCME and the WHO, and in most cases below the most stringent of the available AAQOs. The measured concentrations are considered to be a conservative representation of concentrations associated with the Westshore facility based on the contribution from background sources, including significant emissions from the ferries/other equipment at the BC Ferries Terminal. Additionally, concentrations of the CACs associated with the Westshore facility will decrease with distance from the facility. As described in section 5.0, even assuming the maximum theoretical throughput occurs in 2018, the total CAC emissions will decrease, with a predicted significant reduction in emissions of NO_x, SO_x, PM, PM_{10}, $PM_{2.5}$ and DPM.

Based on the above, fugitive dust and diesel/combustion emissions associated with the Project are predicted to have negligible impact on ambient air quality in the area of the Project, with the proposed equipment upgrades resulting in a decrease in future CAC emissions associated with the facility. In addition, no unacceptable health risks are predicted to be associated with exposures to fugitive dust, coal dust and combustion emissions from the Westshore facility based on the following:

- Measured air concentrations of the CAC, including PM_{10}, $PM_{2.5}$, CO, NO_2 and SO_2, are below the AAQOs that have been derived to be protective of human health, including for sensitive subpopulations;
- Predicted coal dust levels are more than ten-times lower than the Worksafe BC occupational exposure limits, and thus would remain below the limits even if a ten-fold uncertainty factor for intraspecies variability was applied to ensure the protection of sensitive subpopulations; and,
- The predicted maximum DPM concentration is five times lower than the US EPA ‘safe’ level for diesel exhaust emissions.

7.0 EFFECTS OF ACCIDENTS AND MALFUNCTIONS

Given the location and nature of the project, accidents or equipment malfunction during construction or operation could have an impact on the environment as well as the health and safety of the personnel. The existing health and safety protocol and monitoring systems will be updated to accommodate the additional equipment and ensure that effective emergency response plans and procedures are in place. While the existing Emergency Response Plan will not change in structure, it will be revised to reflect the changed location of the shops and office complex (Hemmera, 2006).

Contractual agreements with the construction contractor(s) will ensure that an appropriate site-specific Construction Environmental Management Plan (EMP) and adequate emergency response protocols are in place prior to start of construction. The construction EMP should include a Risk Mitigation Plan and Health Safety and Environment (HSE) plan to address potential contamination during demolition activity (WorleyParsons 2013). The construction EMP and emergency response protocols will be reviewed by Westshore to ensure that all standard regulatory requirements and best management practices, as well as any specific requirements recommended by the PMV, have been incorporated.

Westshore also has an Emergency Contingency Plan in place (see Appendix 3), in addition to a Contractor Safety System, which all contractors are required to comply with . Westshore's Contractor Safety System includes an awareness of emergency response procedures.

8.0 CONCLUSION

Based on the results of this EIA, SNC-Lavalin has concluded that the project is not likely to cause negative adverse environmental, socio-economic, or health effects, taking into account the implementation of appropriate effect management measures, as identified in the above sections.

The environmental review, as governed by PMV, is intended to foster sustainable development by ensuring that projects are constructed and operated in a manner that minimizes adverse environmental, socio-economic, and health effects. After consideration of the potential project effects, and taking into account engineering design, identified control and mitigation measures, best practices and current standards, the project upgrades and replacements can be implemented with negligible effect.

The following table (Table 8-1) summarizes the project effects and mitigation measures proposed by Westshore.

Table 8-1 Summary of Potential Project Effects, Control and Mitigation Measures

Project Phase / Component	Potential Effect(s)	Control and Mitigation Measures
Terminal Lease Area Construction		
Demolition • Demolition of existing office and shop complexes and removal from site • Reservoir #3 to be replaced • Wastewater treatment plant to be replaced **Construction** • Minor reconfiguration of the lease along northern boundary between Westshore and TSI properties • Incorporate ~500ft of the existing terminal access road into the relocated equipment and parts lay-down area • Relocation of the existing offices and shops to north west corner of the site • Increase of road, rail and barge traffic accessing the terminal for all project components **Excavation** • Ground works carried out to provide utility services and on-site water distribution to the newly relocated offices and shops • Reservoir 3 will be abandoned and replaced with an equal reservoir source • Modification and re-routing of the effluent water treatment system is required for some of the internal recirculation systems	• Discharge of treated effluent water • Uncovering contaminated soil • Exposing underground hazardous materials (e.g., storage tanks, fuel lines, septic tanks, sanitary lines, and asbestos cement pipes) • Topsoil erosion • Sedimentation of nearby watercourses • Stormwater management; escape of run-off water • Air quality; increase in dust and carbon emissions from construction activities • Hazardous product spills • Contaminants exposed as a result of the demolition of existing office and shop complexes	• Classify contaminated soil requiring removal (e.g., for foundations) prior to disposal. • Account for potential contaminants that workers may come into contact with during installation of foundations and other below ground work in the Health Safety and Environment (HSE) plan for construction activities. • Include a methodology for management of unanticipated soil/groundwater contamination or underground tanks or pipes which may still contain liquid or solid contaminants. • Preparation of a construction EMP which will include a Risk Mitigation Plan and HSE Plan to address potential contamination issues associated with demolition activity. • Apply best management practices for erosion and sediment control prior to and during construction (i.e., silt and/or wind fencing, catch basin stormwater inlet protection) • Locate soil and preload stockpiles away from water • Minimize the amount of exposed soil on-site by covering disturbed areas/slopes with mulch, erosion blankets, or tackifiers • Control mud and dirt track-out from construction sites and clean up arterial roads where construction results in the accumulations of mud and/or dust • The Westshore Water Management Plan (WWMP) includes descriptions of the water supply system, on site drainage, collection, and recycling systems (see Appendix 3). • Conduct soil testing in areas where ground disturbance and soil removal is expected to occur (Phase II ESA will be completed by WorleyParsons)

Project Phase / Component	Potential Effect(s)	Control and Mitigation Measures
		• Grade work sites to ensure positive drainage (i.e., minimize the collection of water on-site) • Run-off will be collected from construction areas and routed through oil interceptor drains to prevent oily water from entering the main collection system • Minimize the handling of soils and aggregates (i.e., by avoiding double handling of spoil, and covering truckloads of fine-grained materials during hauling) • Include provisions in the Westshore contract specification guidelines that require best practices for the use of diesel equipment by construction contractors working on-site. • On-going air quality monitoring program. • A Phase II ESA will be conducted. Completion of the Phase II ESA will meet the PMV review requirements • Known and unknown aboveground and underground storage tanks that are encountered will require decommissioning and removal as per federal regulations (Canada Gazette, 2008) as noted by WorleyParsons (2013). • Follow the Section 11.0 Hazardous Product Spill Procedures found in the Emergency Contingency Plan (Appendix 3) • Take account of potential contaminants that workers may come into contact with during demolition in a Health, Safety and Environment plan. • Development of a construction environmental management (to include HSE) plan with contractors which will be completed and implemented prior to the start of construction.
Major Equipment Replacement		

Project Phase / Component	Potential Effect(s)	Control and Mitigation Measures
Demolition • Demolition of existing S/R's and shiploader • Existing shiploader will be transported off-site either by transport vessel or by a combination of barges and trucks **Construction** • Four major pieces of equipment will be replaced (3 Stacker-Reclaimers (S/R) and 1 shiploader on Berth One); in water works will be limited to the relocation of an existing wastewater outfallTemporary extension of existing rails to allow equipment to be moved on and off the berth • New S/R's will be delivered by barge and lifted ashore either behind Berth 2 (NE corner) or behind Berth One (SE corner), and then transported using heavy lift transporters	• Air quality; increase in dust and carbon emissions from construction activities • Increased level of noise • Increased traffic (road and/or marine)	• Development of a construction environmental management (to include HSE) plan with contractors which will be completed and implemented prior to the start of construction. • Minimize the generation of dust (i.e., Minimize the time that unpaved surfaces are exposed, install temporary cover) • Use environmentally acceptable dust suppressants or water to control dust during demolition of buildings on access roads, lay-down areas, work areas, and disposal areas • Construction to take place within Corporation of Delta bylaws. • Maintain construction equipment in good working condition • Operate equipment at or within load tolerances and ratings • Relocate and/or re-orient stationary equipment (i.e., Generators and compressors) so that natural noise screening/dampening features prevent noise from travelling directly from the source(s) to adjacent noise sensitive areas
Conveyor Upgrades		
Demolition • The existing conveyors will be demolished down to grade, with foundations removed that interfere with new equipment • Subsurface foundations will be removed from grade level down to 3 ft below grade, deeper structures will be filled with sand and left in place **Construction** • Replacement of two existing yard conveyors to allow the higher	• Concrete leachate; elevated pH levels in water • Air quality; increase in dust and carbon emissions from construction activities	• Refer to the WWMP for descriptions of the water supply system and on site drainage, collection, and recycling systems (Appendix 2). • Use a carbon dioxide tank with regulator, hose, and diffuser to neutralize pH levels should a spill occur • Control and contain concrete wash water for treatment prior to discharge or remove concrete wash water for off-site treatment or disposal at an approved facility • On-going air quality monitoring program as noted in SNC-Lavalin

Project Phase / Component	Potential Effect(s)	Control and Mitigation Measures
peak reclaim rate to be handled with minimal spillage (2016/2017). **Concrete works** • New concrete foundations will be installed at the head and tail of the conveyors under the remainder for the conveyor length (excavations not to exceed 8 ft; no dewatering)		(2013).
Terminal Operations		
• Predicted terminal capacity increase of between 2 and 3 mtpa from the existing terminal capacity • Assuming that an additional 3 mtpa of coal is shipped through Westshore terminals there will be an increase in the number of trains at the terminal each day from 6.24 to 6.81 (approximately one train every two days) and an increase of 30 ships per year arriving at the terminal (~1 ship every 12 days)	• Increase in truck, rail and barge traffic • Possible increase in number of trains by ~1 train per day • Possible increase in number of ships by ~1 ship per 12 days • Air Quality; potential increase in fugitive coal dust	• Westshore dust management plan (WDMP) includes details of the steps taken to reduce and eliminate dust arising from coal handling operations (Appendix 2). • Emission monitoring plan is included in the WDMP • Reinvestment in modern machinery in order to reduce ship and train turn-around time resulting in a reduction of priority air contaminants and reduction in overall emissions • Improvements from emerging engine technology and fuel improvements from national and international regulations
Changes in Stockpiles		
• Expansion of the existing Row D stockpile by ~500 ft • The additional stockyard area will provide the ability to increase the existing stockyard capacity, currently a maximum of ~2 Million tons, by 135,000 tons or 7%. • Stockyard storage equates to 2.8 mtpa of additional throughput all else being equal	• Air Quality - Additional 135,000 tons of stockyard storage will mean 2.8 mtpa of additional throughput resulting in a risk of potential increase in fugitive coal dust	• See Appendix 2, WDMP • Emission monitoring plan is included in the WDMP • Use of Westshore's rain-bird and tower spray system to improve dust control capabilities and reduce the possibility of fugitive dust leaving the site
Manpower Review		
• Workforce increase during construction anticipated (30 persons	• Air quality; increase in construction and personal vehicles	• Use water spray trucks to remove loose sediment from

Project Phase / Component	Potential Effect(s)	Control and Mitigation Measures
per day over 4 years plus local supply/fabrication)	• Solid and liquid waste management	impervious or paved surfaces • Remove food and/or domestic waste from the construction site on a daily basis or store within animal resistant waste receptacles separate from construction waste • Equip all temporary toilets with approved septic tanks with closed holding tanks that are emptied only into approved wastewater tanker trucks
Lighting		
• Construction and Operation	• No additional burden anticipated to the off-site lighting profile of the site from the relocation of shop and office complex and replacement of major machinery	• Westshore is spending $2.1 million to change all the existing mercury and sodium vapour outdoor lighting and some indoor lights to the environmentally friendlier LED (light emitting diodes) in conjunction with BC Hydro's Power Smart program. • During this program, some 1,900 outside lights will be changed to LED in a phased program which offers to use 75% less energy and last much longer than the incandescent lights that they are replacing. The other advantages of LED lighting are quick start up and no mercury presence as a final disposal hazard. • All lights will be applied with sensitivity to unwanted light spillage by aiming and cowling.
Noise		
• Construction and Operation	• Improved sound profile due to on-going improvements and increase in modern equipment.	• None proposed. None required – three noise complaints logged over 20 years. Also, See Appendix 2 for details on noise effects.
Relocation of Fuelling Facilities		
• Replacement of the present fueling facilities for on-site equipment are required due to relocation of offices and shop complex	• High risk of improper fuelling procedures resulting in spills or refueling located in proximity to an environmentally sensitive area (e.g., eelgrass beds)	• Designs/concepts will be developed as part of the infrastructure included with the office and shop complex designs • Refuelling station must not be placed within 30 metres of the

Project Phase / Component	Potential Effect(s)	Control and Mitigation Measures
		shoreline, or at a prescribed distance as agreed to with DFO or PMV. • The fuel facilities will comply with applicable Environment Canada regulations and fire codes.
Emergency Response		
• Construction and Operation	• On-site health and safety emergencies and incidents, hazardous spills, fires etc.	• Refer to Westshore Management and Emergency Contingency Plan, Appendix 2 and 3

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APPENDIX 1

Air Emissions Report (SNC-Lavalin 2013)

WESTSHORE TERMINALS AIR QUALITY STUDY 2012 - 2018

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TABLE OF ABBREVIATIONS

AWMA	Air and Waste Management
CAC	Criteria Air Contaminants
CHE	Cargo Handling Equipment
CH_4	Methane
CN	Canadian National (Rail)
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CPR	Canadian Pacific Rail
CWS	Canada Wide Standards
DPM	Diesel particulate matter
ECA	Emissions Control Area
EF	Emission factor
EI	Emissions Inventory
EPA	Environmental Protection Agency (US)
GHG	Greenhouse Gas
GWP	Global Warming Potential
HFO	Heavy fuel oil
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
kWh	Kilowatt-hour
LEI	(Port Metro Vancouver) Landside Emissions Inventory
LF	Load factor
LSA	Local Study Area
MAMUs	Mobile air monitoring units
MEIT	Marine Emissions Inventory Tool
MDO	Marine distillate oil
MOVES	(US EPA) Motor Vehicle Emission Simulator
MV	Metro Vancouver

TABLE OF ABBREVIATIONS (Cont'd)

mtpa	Metric tonnes per annum
NAAQOs	National Ambient Air Quality Objectives
NH_3	Ammonia
NIR	(Environment Canada) National Inventory Report
NO_x	Nitrogen oxides
N_2O	Nitrous oxide
NRES	Norfolk Southern Rail Emission Study
OGVs	Ocean going vessels
PM	Particulate matter
PMV	Port Metro Vancouver
RAC	Railway Association of Canada
RH	Relative humidity
RSA	Regional Study Area
SAR	(IPCC) Second Assessment Report
SNC-Lavalin	The Environment & Water business unit of SNC-Lavalin Inc. (SNC-Lavalin)
SO_x	Sulphur oxides
TRS	Total reduced sulphur
TSP	Total suspended particulate
VFPA	Vancouver Fraser Port Authority
VOC	Volatile Organic Compounds
WD	Wind direction
Westshore	Westshore Terminals LP
WS	Wind speed

EXECUTIVE SUMMARY

An air quality assessment was completed for Westshore Terminals (Westshore) in advance of a proposed replacement of the three older stacker-reclaimers, of the four in use, as well as a 30 year old shiploader to enhance operational efficiencies. The project also includes replacing the outdated administration, operations and maintenance offices, shops and warehouses with one consolidated complex. These changes are expected to take four to five years to complete in stages.

Westshore currently has the capacity to handle 33 million tonnes per annum (mtpa). Completion of the project forecasts an increase in capacity to 36 mtpa, without change to the existing size of the terminal. Since its opening in 1970, Westshore has facilitated the export of 720 million tonnes of coal to the world market at annual throughput rates over 20 mtpa for the past fifteen years. In 2012, Westshore had an annual throughput of 26.5 mtpa. The expected 2012 throughput of 28.2 mtpa was reduced due to a ship accidentally knocking out one of Westshore's two loading berths in December of that year. This air quality assessment includes a 2012 baseline emissions inventory that relates to 28.2 mtpa, a *Future with Project* scenario that relates to the new facilities and maximum throughput capacity (36 mtpa) and a *Future without Project* scenario that relates to the existing facilities and maximum throughput capacity (33 mtpa).

The estimated emission inventories include both exhaust emissions and fugitive coal dust emissions for each year at the terminal itself (the Local Study Area) and within a broader region where the rail and ship traffic constitute a significant portion of the total traffic (the Regional Study Area). Consistent with Port Metro Vancouver requirements, the inventories include the Westshore emission sources as well as the transportation sources that bring the coal to and from the terminal (trains and ships). The transportation sources dominate the emissions footprint at both the local and regional scales. Figure ES-1 shows the extent of the Regional Study Area.

The emission estimates include the following air contaminants:

- Criteria Air Contaminants (CACs)

  Nitrogen oxides (NO_x), sulphur oxides (SO_x), carbon monoxide (CO), volatile organic compounds (VOCs), particulate matter (PM, as total PM, PM_{10} and $PM_{2.5}$) and ammonia (NH_3)

- Greenhouse Gases (GHGs)

  Carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O)

  Equivalent carbon dioxide (CO_2e)

- Diesel Particulate Matter (DPM)

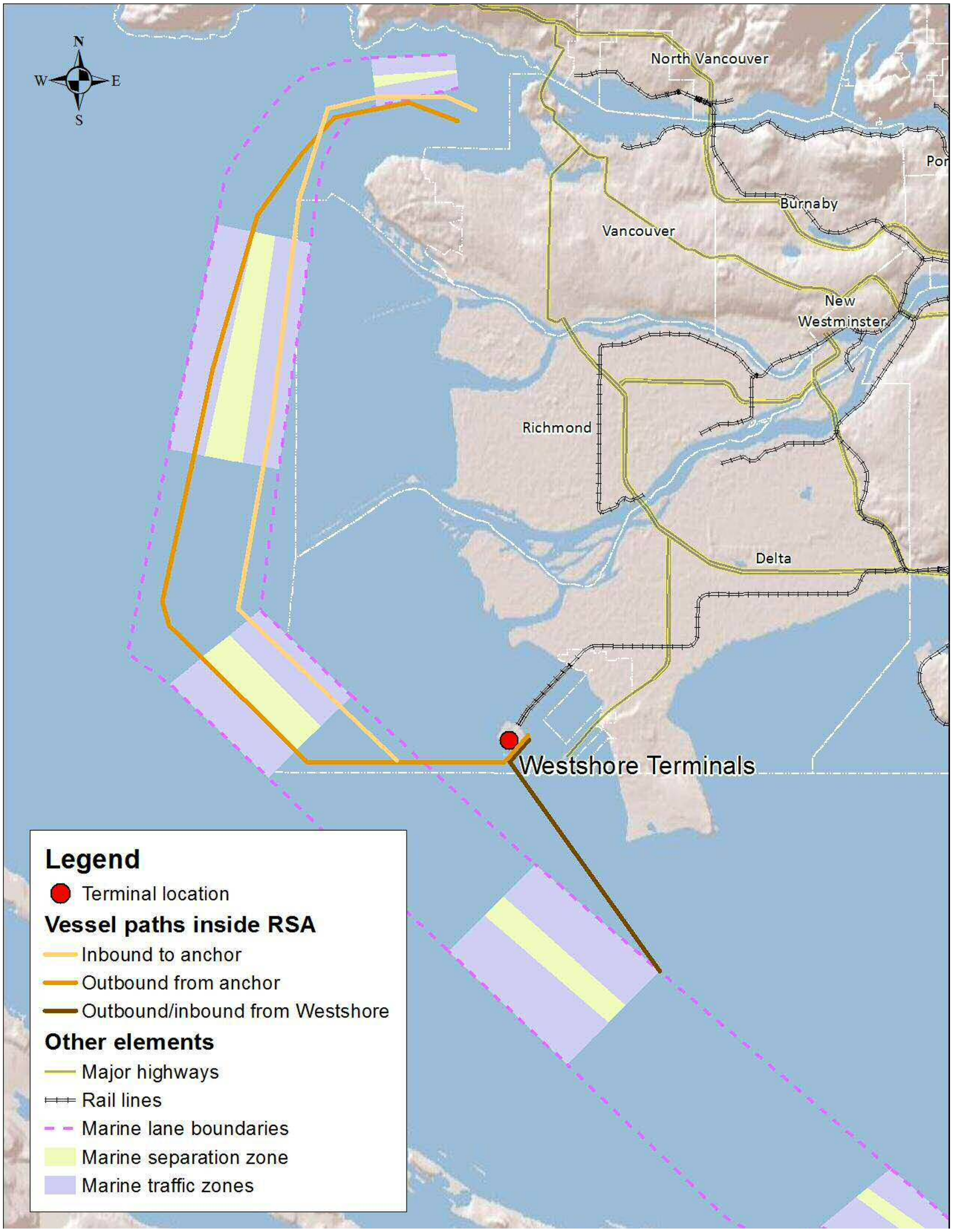
The baseline and future emission inventories are shown in Table ES-1.

Table ES-1: Summary of Baseline (2012) and Future (2018) Emissions Estimates for Westshore Operations (tonnes)

Emissions Inventory	NO_x	SO_x	CO	VOC	PM	PM_{10}	$PM_{2.5}$	DPM	NH_3	CO_2e
Local Study Area										
2012 Baseline	197.49	160.74	45.32	8.84	198.52	103.24	30.75	17.84	0.40	18,018
2018 Future with Project	178.87	8.31	49.68	10.20	184.35	90.29	19.32	6.52	0.43	20,822
2018 Future without Project	171.97	8.12	46.69	9.52	223.66	108.60	21.88	6.23	0.39	20,074
% Change with Project	-9.4%	-94.8%	9.6%	15.4%	-7.1%	-12.5%	-37.2%	-63.5%	7.0%	15.6%
% Change without Project	-12.9%	-94.9%	3.0%	7.6%	12.7%	5.2%	-28.8%	-65.1%	-1.1%	11.4%
Regional Study Area										
2012 Baseline	755.58	634.41	110.61	29.92	307.74	182.53	84.94	68.33	1.16	53,800
2018 Future with Project	672.54	34.64	138.43	37.46	268.45	138.44	39.69	22.14	1.45	67,887
2018 Future without Project	624.52	32.41	128.69	34.78	300.81	152.80	40.61	20.55	1.33	63,362
% Change with Project	-11.0%	-94.5%	25.1%	25.2%	-12.8%	-24.2%	-53.3%	-67.6%	25.0%	26.2%
% Change without Project	-17.3%	-94.9%	16.3%	16.2%	-2.3%	-16.3%	-52.2%	-69.9%	15.1%	17.8%

Definitions:
2012 Baseline – 2012 operations, scaled to 28.2 mtpa
2018 Future with Project – 2018 projected operations assuming new terminal capacity of 36 mtpa
2018 Future without Project – 2018 projected operations assuming existing terminal capacity of 33 mtpa

Figure ES-1: Regional Study Area for Westshore Terminals



The air quality assessment also included a review of available ambient monitoring data in the area. This included a Metro Vancouver ambient station in Tsawwassen (for CACs) as well as a PM station at the neighbouring BC Ferries terminal. The ambient data are compliant with all of the relevant regional, provincial and federal standards and objectives, with the exception of PM at the BC Ferries terminal. Two exceedences of the federal Maximum Acceptable 24-hour Total Suspended Particulate objective were recorded during 2010 – 2012; as such, particulate emissions in the general area of Westshore were considered an existing sensitivity for the project analysis. Although no exceedences were determined for the other CACs, NO_x and SO_x are considered high priority air contaminants in the local airshed due to their role in the development of ground-level ozone as well as secondary PM. Respirable particulate ($PM_{2.5}$) and DPM are also high priority pollutants. GHGs, as represented by CO_2e, were additionally considered key contaminants for the analysis for their role in the atmospheric greenhouse effect.

The emission estimates show that NO_x, SO_x PM and $PM_{2.5}$ decrease from the 2012 Baseline with both 2018 scenarios in the Local Study Area and Regional Study Area, with the exception of PM and PM_{10} in the Local Study Area for the *Future without Project* scenario. In any case, based on previous study work, much of the PM recorded against the LSA in the form of fugitive dust will be deposited within the site boundary. DPM emissions are estimated to dramatically decline at both the local and regional scales by 2018 with both scenarios. In contrast, GHG emissions are projected to increase at the local and regional scales for both scenarios. For the *Future with Project* scenario, CO_2e emissions increase by 15.6% and 26.2% in the Local Study Area and Regional Study Area respectively. For the *Future without Project* scenario, the estimated increases are 11.4% and 17.8% respectively. The projected reduction in bull-dozing hours (a "Future with Project" element) significantly contributes to the overall reduction of emissions in all categories. The relative changes to the estimated emissions from 2012 to 2018 are displayed graphically in Figure ES-2.

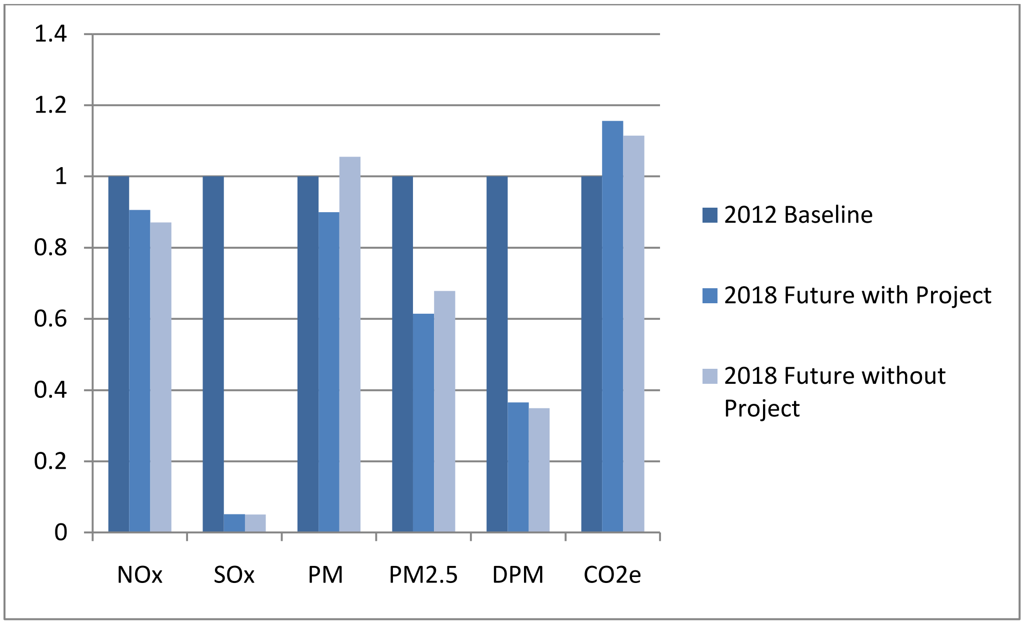


Figure ES-2: Estimated Scenario Emissions in the Local Study Area (as fraction of baseline)

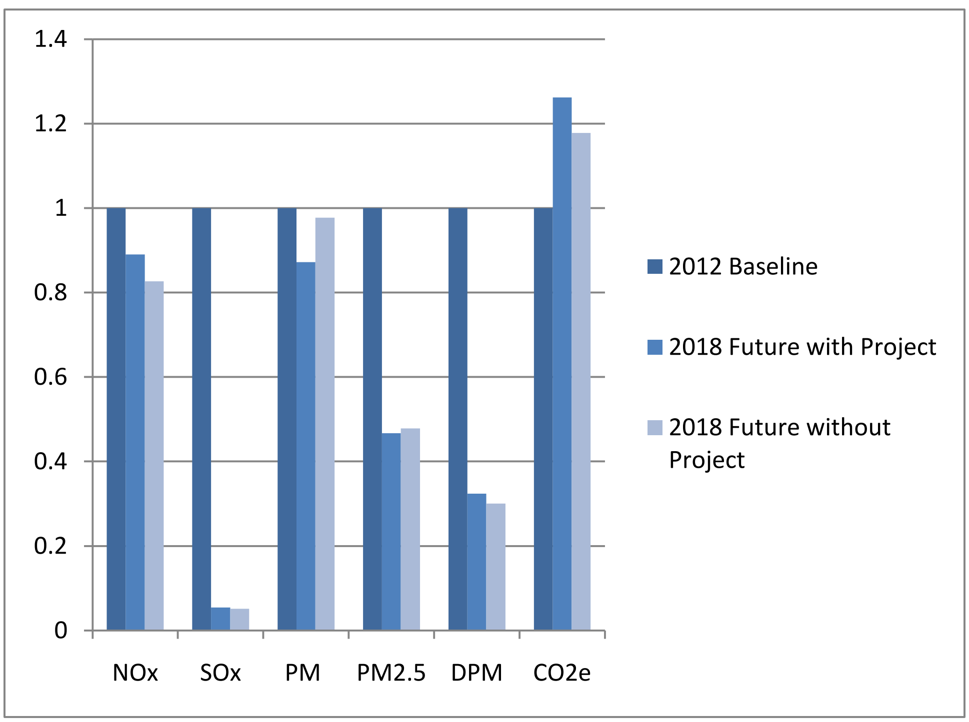


Figure ES-3: Estimated Scenario Emissions in the Regional Study Area (as fraction of baseline)

With the exception of GHGs, reductions in the annual air emissions associated with Westshore operations are expected by 2018 for the key air contaminants of concern. These reductions are expected even if an increase in coal throughput occurs by this year. The reductions are expected to be realized through improvements to emissions performance of the ships and locomotives that serve the terminal, as well as improvements to the coal handling efficiency on the terminal itself (for the *Future with Project* scenario only). Westshore has limited ability to influence the total GHG emissions associated with its broader operational footprint that includes the rail and ship movements through the port; however, Westshore participates in larger air quality programs such as the port's Air Action Strategy that targets older, higher emitting cargo equipment (amongst other source groups).

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APPENDICES

1.0 INTRODUCTION

Westshore Terminals LP (Westshore) has applied to the Vancouver Fraser Port Authority (VFPA) to replace some of its coal handling equipment. The proposed replacement affects Westshore's current stacker-reclaimers that handle coal at their Roberts Bank terminal. Westshore has two deep-sea berths at the terminal and shipped approximately 26.5 million tonnes of coal in 2012. The replacements are expected to increase ship loading efficiency and reduce waiting times currently experienced by the bulk carrier vessels that serve the terminal.

Westshore currently has four stacker-reclaimers, one of which was added in 2010. In addition to the stacker-reclaimers, Westshore operates diesel and gasoline powered off-road and onroad equipment to support their terminal operations and receives up to six loaded coal trains each day for processing. To support the review process, Westshore has developed an emissions inventory for existing operations and a forecast inventory for future operations that incorporate the new equipment and infrastructure. An aerial overview of Westshore Terminals is shown in Figure 1-1.

Figure 1-1: Westshore Terminals

1.1 Background: Westshore Terminals

The following brief provides historical context and Westshore's rationale for the proposed project for the replacement of coal handling equipment. Westshore Terminals owns and operates the bulk coal exporting facilities at Roberts Bank, Delta, BC on land leased from Port Metro Vancouver (federal land). Since its opening in 1970, over 720 million tonnes of coal have been exported to the world market at annual throughput rates over 20 million tonnes per year for the past fifteen years.

The initial coal terminal operation commenced in 1970 on a 20 hectare land parcel created at Roberts Bank for the purpose of supporting the development of coal mines in southeast BC. The land was expanded in the early 1980s, at which time Westshore doubled its lease area and invested $130 million in new equipment and infrastructure, including a tandem railcar dumper and new deep-sea berthing facility. This development increased the terminal's throughput capacity to 22 million tonnes per year.

In 1991, Westshore added additional equipment and reconfigured the terminal including the installation of a new single rotary car dumper and transfer conveyors at a cost of $31 million. Subsequent to 1991, a number of other improvements took place, including converting one of the tandem dumper barrels to handle US-sized cars which increased productivity and raised the terminal's nominal capacity to 26 million tonnes per year.

In the period 2008-2012 a further $110 million has been spent to add an additional stacker-reclaimer and conveyor line as well as to replace the single rotary dumper with a tandem unit raising the throughput capacity of the terminal to 33 million tonnes per year. The present arrangement comprises two inbound rail systems via two rotary dumpers, two outbound systems via two deepwater ship berths and four yard handling systems, each comprised of a rail mounted stacker-reclaimer and supporting conveyor line.

The mine shippers are predominantly located in southeastern British Columbia. In 2003 several mining companies amalgamated their operations to become the Elk Valley Coal Corporation, which is now operated as Teck Coal. This company is responsible for 58% of the product that is shipped through Westshore (2012); whereas, other coal arrives from mines in Alberta and the USA. 60% of all the coal shipped through Westshore is used for steel-making and is destined for the blast furnaces of Asia, South America and Europe, while 40% is used to fire the boilers that make steam for turbines that generate electricity around the world. Since 2006 producers of energy coal in the USA have seen domestic use decline as an abundance of cheap natural gas has come on to the market. This, coupled with the cleaner burning characteristics of gas and the new regulations requiring power plants to cut emissions, have lead the power plants to convert to gas and coal producers to seek off-shore markets.

1.1.1 Proposal for the Replacement of Aging Equipment

Based on the continued steady demand for both steelmaking and energy coal by off-shore markets, and Westshore's long term land lease and customer contracts, a study was conducted to determine what additional resources and facilities would be necessary for Westshore to carry out its business of providing a reliable and economic outlet to bring coal to the world market over the long term. Based on this study, it was determined that the age of some of the existing equipment and infrastructure will place a maintenance burden on the company that will negatively affect customer shipping objectives. In addition, the current location of the shops and offices, constructed over forty years ago based on the original site configuration, is seen as an inefficient use of the site that can be optimized to improve stockyard function.

It has therefore been concluded that the soundest approach to service long term contracts is to replace the suite of aging equipment with the latest generation of equipment which incorporates the technological advances in control, operation and efficiency, and relocate the maintenance shops and administrative office complex with a single integrated operation control centre, including maintenance and employee facilities, that will allow the current stockyard layout to be optimized.

The proposed capital program will see the replacement of the three oldest stacker-reclaimers (all between 30 and 40 years old) and the 30 year old shiploader with new equipment. By acquiring three new stacker-reclaimers of the same model, Westshore will be able to significantly enhance its operational efficiencies in several respects, including standardization of spare parts, repairs and maintenance, and by reducing overall maintenance downtime time and costs involved in maintaining older equipment. The project will also involve replacing the outdated and inefficient administration, operations and maintenance offices, shops and warehouses with one consolidated complex, together with storage optimization. The project is expected to take 4 to 5 years to complete in stages.

No additional equipment is being added to the site, nor is the site footprint being increased. Any additional throughput capacity will only result from the improved productivity of the new equipment, operating efficiencies, and reduced maintenance downtime, and will only be realized if other participants in the coal chain can also improve efficiencies. Currently, it is estimated that 2 to 3 million tonnes per year may be possible, but in any event not before 2018.

The expenditures also include approximately $14 million for new, state of the art dust suppression systems and related environmental control equipment which were completed this year.

In order to maintain throughput levels for the long term, additional reinvestment in the terminal's operations is required – including specifically, the replacement of the three older stacker reclaimers and shiploader. The alternative would be to spend significantly more money on annual maintenance capital to sustain throughput levels (estimated to be $50 to $60 million over the next 5 to 10 years); but by doing so, Westshore would continue to have old equipment that would inevitably need to be replaced and will be less reliable than the proposed equipment. The new stacker-reclaimers and shiploader will have an anticipated useful life of 30 to 40 years. Westshore has been in business for over 42 years and is of the opinion that replacing the older equipment with new is in the best interest of operating the terminal, its customers and neighbors for the decades to come.

1.1.2 Environmental Management

Westshore has responded to community concerns associated with coal dust through several recent changes to their environmental management program. As detailed in Appendix B, changes to Westshore's program include the following:

- New dust suppression equipment, including 17 'Big Bertha' 130 foot high tower sprays to provide site-wide coverage in high winds;
- A new water processing plant to allow efficient recycling of water used for dust control;
- Construction and use of two mobile air monitoring units (MAMUs) to allow collection of ambient air quality data in the community; and
- Construction and use of a remote surveillance station at the 80th Street overpass in Delta to monitor coal train dusting.

Westshore has an Air Discharge Permit with Metro Vancouver. A requirement of the permit is to collect off-site ambient particulate matter data to evaluate air quality. Evaluation of the data collected to date is presented in Chapter 3 of this report. No data is yet available for the MAMU units, although other ambient sampling data, in particular from a monitoring station located at the nearby BC Ferries Tsawwassen Terminal was assessed.

Although it is difficult to quantify or predict the effects of the new program elements, improvements to ambient coal dust concentrations are expected at and near Westshore in future years.

1.2 Scope of Work

The scope of work for this air quality assessment includes development of a 2012 air emissions inventory (EI) baseline for the current operations at Westshore Terminals, of Criteria Air Contaminants (CACs), Greenhouse Gases (GHGs) and fugitive dust, based on best practice methods. Diesel Particulate Matter (DPM) is also accounted for, by attributing the exhaust-based fine particulate emissions ($PM_{2.5}$) to the various fuel sources. Forecast EIs to 2018 are included, incorporating the new equipment purchases and infrastructure changes (as indicated) as well as the higher potential coal throughput. These forecasts are labeled “Future with Project”, which includes the proposed equipment replacement and an assumed maximum terminal throughput of 36 mtpa (made possible with the new equipment) and “Future without Project”, which maintains the current coal handling equipment and maximum terminal capacity of 33 mtpa. Characterization of the existing air quality in and near the Westshore Terminals is also addressed, based on historical monitoring data and other available information.

CACs and GHGs include the following specific compounds:

- Criteria Air Contaminants (CACs)

  Nitrogen oxides (NO_x), sulphur oxides (SO_x), carbon monoxide (CO), volatile organic compounds (VOCs), particulate matter (PM, as total PM, PM_{10} and $PM_{2.5}$) and ammonia (NH_3)

- Greenhouse Gases (GHGs)

  Carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O)

  Equivalent carbon dioxide (CO_2e)

CO_2e amounts are consistent with the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report (SAR) Global Warming Potential (GWP) values of 1, 21 and 310 for CO_2, CH_4, and N_2O, respectively[1].

[1] IPCC SAR available at http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#.UX7WVEpHCQs

2.0 AIR QUALITY ASSESSMENT AREA

In accordance with a draft Environmental Air Quality Assessment Guidance document (PMV Guidance) as well as discussions with PMV staff, both a local study area (LSA) and a regional study area (RSA) are defined and used throughout this report. The LSA constitutes the terminal itself, including its two deep water berths. The RSA constitutes the terminal as well as additional areas on both the land side and water side where the marine and rail traffic to/from Westshore makes up a significant portion of the total traffic on the routes used. Figure 2-1 provides an illustration of the RSA.

Figure 2-1 shows the shipping lanes used by the ocean going vessels (OGVs) travelling through the Strait of Georgia that make a stop at the port. The bulk carriers that arrive at Westshore either travel approximately 5 km from the shipping lane into the terminal (a minority of the vessels) or go to anchor in English Bay (approximately 30 km from the terminal) to await an open berth.

Three rail operators bring coal to the terminal, with CN and CPR arriving from the east and BNSF arriving from the south. All three operators use the same track from near Mud Bay, which constitutes the eastern edge of the RSA, to the terminal. This track length is approximately 25 km.

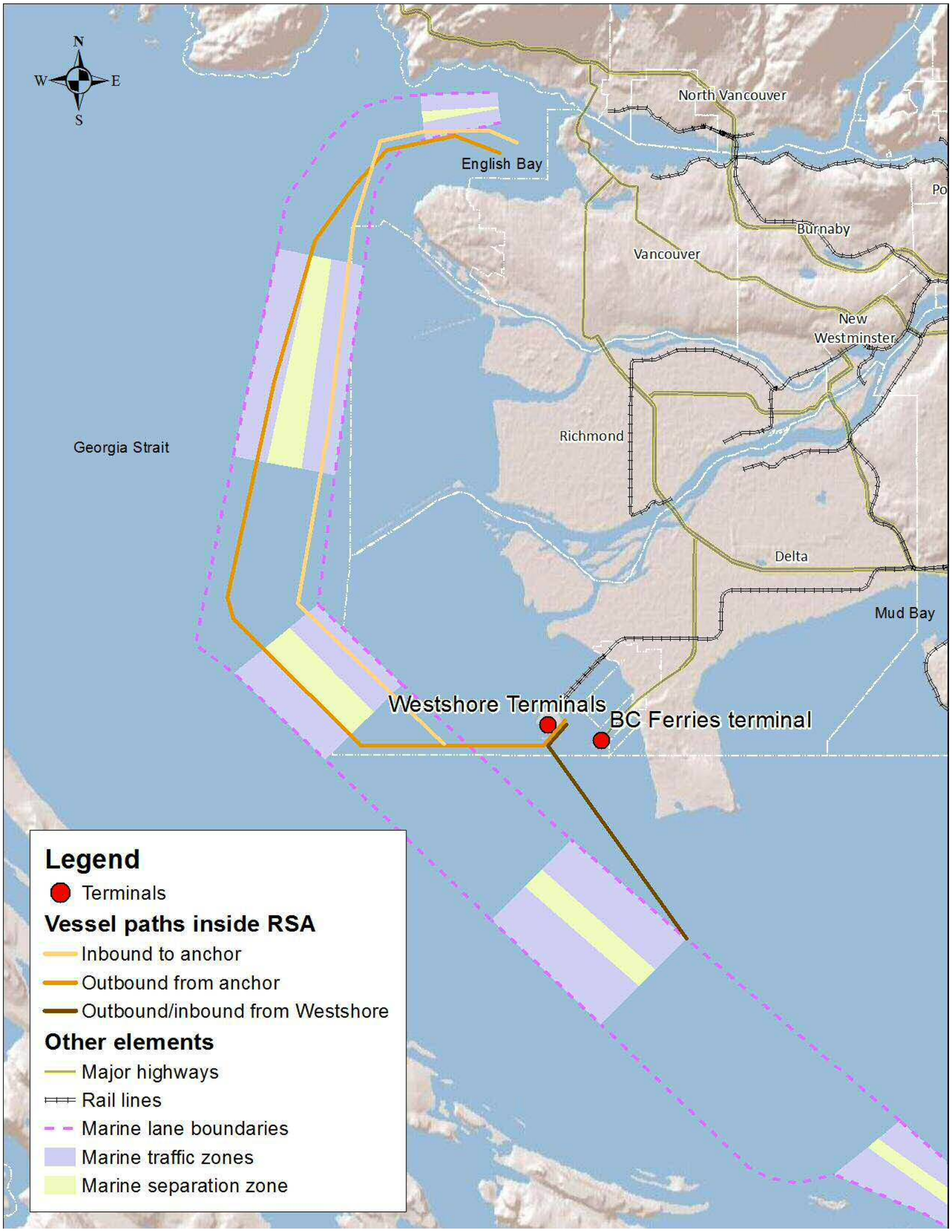


Figure 2-1: Westshore Terminals Air Quality Assessment – Regional Study Area (RSA)

3.0 AMBIENT CONDITIONS AND AIR QUALITY OBJECTIVES

3.1 Meteorological Conditions

Table 3–1 provides location information and wind speed summary statistics for the Tsawwassen ferry terminal monitoring station (2 km east of the facility) and the Metro Vancouver (MV) Tsawwassen monitoring station (6 km east of Westshore). Figure 3-1 provides wind rose diagrams representative of station data for 2012, showing frequency distributions for both annual wind speed (WS) and wind direction (WD). Figure 3-1 provides a map of where the stations are located relative to Westshore Terminal. Each station also collects ambient air quality data, which is discussed in the following two sections.

Table 3-1: Identification of Monitoring Stations and Wind Speed Statistics

Parameter	Tsawwassen Ferry Terminal Met Station	Tsawwassen MV Met Station
Station Information		
Location (Latitude, Longitude)	49°0’26.79’’N, 123°7’57.32’’W	49°0’35.64’’N, 123°4’55.22’’W
Location (UTM NAD83, Zone 10)	490.467 km E, 5428.230 km N	494.004 km E, 5428.560 km N
Elevation (m ASL)	15.0	52.0
Station Owner	Westshore Terminals	Metro Vancouver
Meteorological Data		
Data Period	November 1, 2009 – present	May 6, 2010 – present
Parameters Measured	WS, WD, Wind Gust, temperature (max, min, average), relative humidity, precipitation	WS, WD, temperature, relative humidity
Average Data Capture for 2010	99.92% (WS), 99.92% (WD)	—
Average Data Capture for 2011	99.93% (WS), 99.93% (WD)	80.0% (WS), 75.7% (WD), 80.0% (temperature), 80.0% (relative humidity)

Table 3-1 (Cont'd): Identification of Monitoring Stations and Wind Speed Statistics

Parameter	Tsawwassen Ferry Terminal Met Station	Tsawwassen MV Met Station
Average Data Capture for 2012	99.95% (WS), 99.95% (WD)	99.5% (WS), 99.5% (WD), 99.5% (temperature), 99.5% (relative humidity)
Calms Hours in 2012 (WS<0.5 m/s)	1049 (11.95%)	583 (6.6%)
Annual Mean WS (m/s)	2.8	7.6

Given the higher elevation of the Tsawwassen station, the mean wind speed is considerably higher than that recorded at the Ferry Terminal station. The distributions of winds by direction are similar for the two, although the frequency of northeast and southwest flow is greater for the Ferry Terminal. Figure 3-1 identifies the location of the two stations relative to Westshore. The locations of dustfall canisters are also shown.

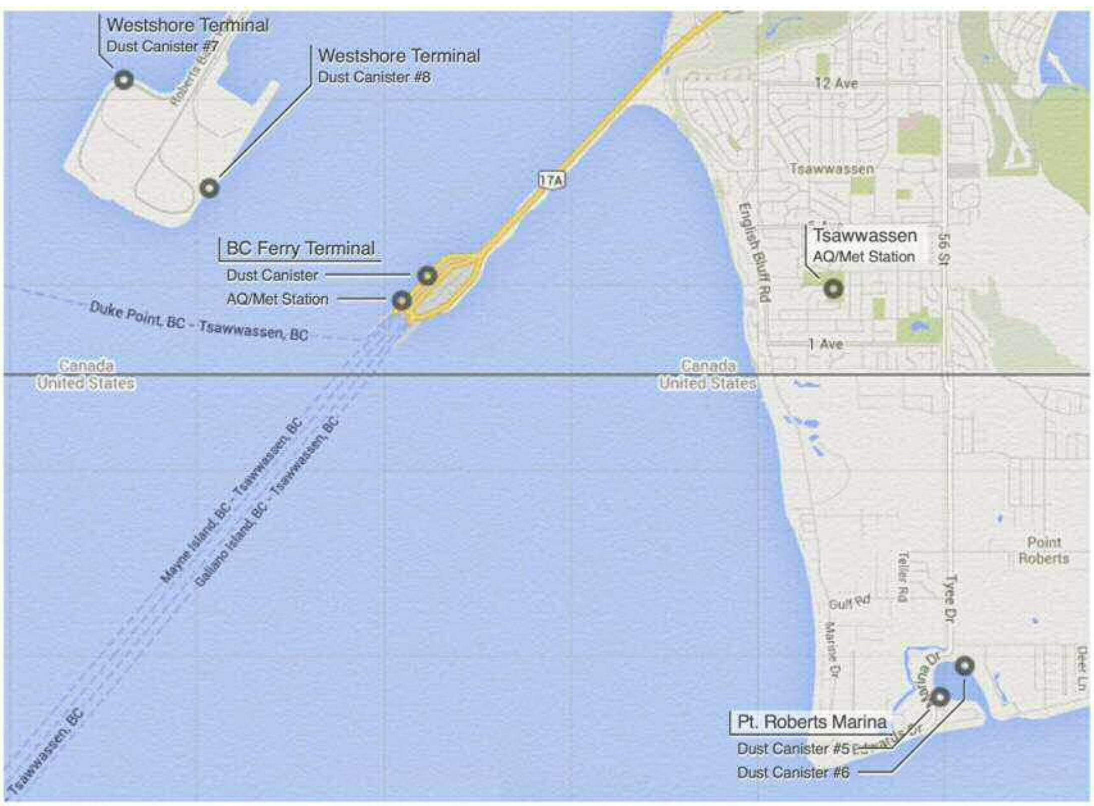
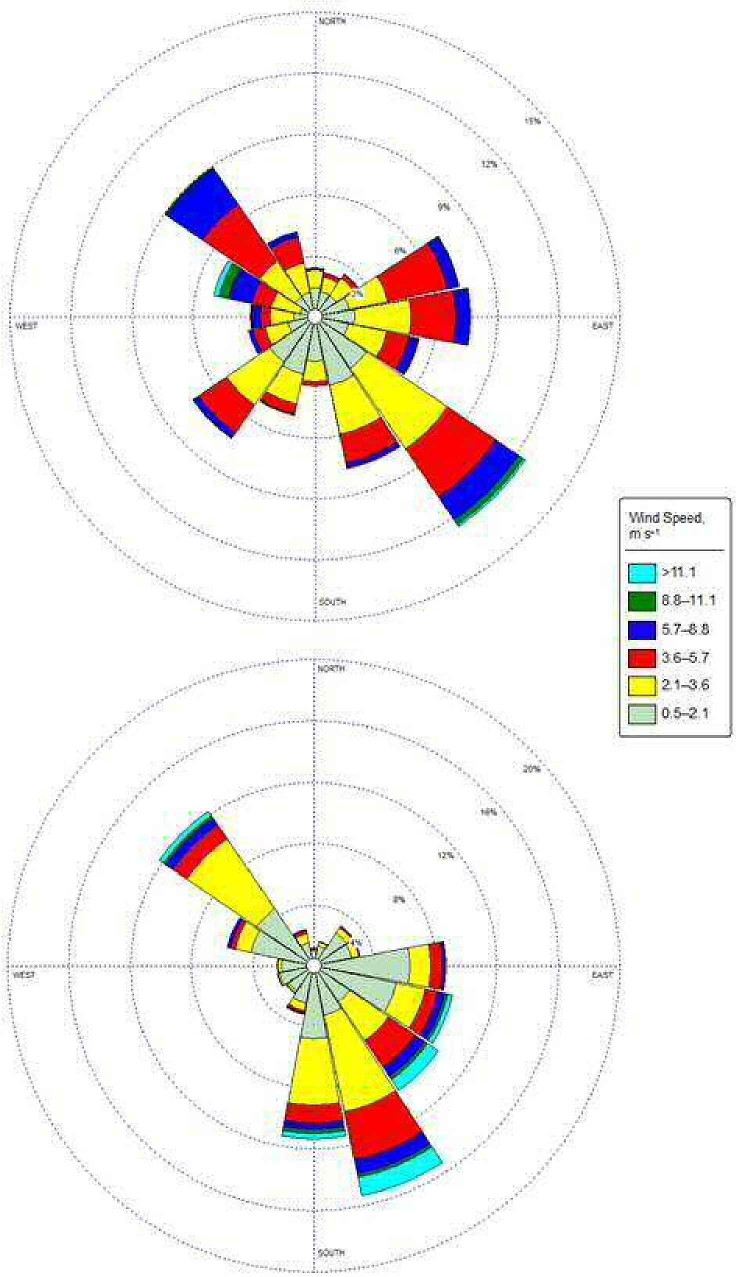


Figure 3-1: Location of meteorological and AQ stations in the vicinity of Westshore Terminals



*Wind direction as shown is from which the wind is coming

Figure 3-2: 2012 Windrose Diagrams for the Tsawwassen Ferry Terminal Monitoring Station (top) and the nearby MV Station in Tsawwassen (bottom)*

Additional meteorological data from the two stations is presented in Table 3-2. Relative humidity (RH) is presented as monthly averages for the day as well as monthly average values at 6 am and 3 pm. Precipitation data is presented as monthly totals by year, with an average for the three years of available data.

Table 3-2: Station Data for Temperature, Humidity and Precipitation

Parameter	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
MV Tsawwassen Met Station (2010 – 2012)												
Mean RH at 0600LST, %	80.3	84.3	81.8	82.8	79.8	81.8	84.7	84.9	84.1	86.1	83.2	85.3
Mean RH at 1500LST, %	75.6	73.9	68.7	64.0	60.4	61.9	59.8	59.9	61.7	73.5	76.7	80.9
Daily Mean Temp, °C	5.1	5.1	6.4	8.4	11.5	13.9	16.3	17.4	15.4	10.1	6.6	4.6
Ferry Terminal Met Station												
Total Precip. 2010, mm	96.6	55.7	64.2	25.7	36.3	27.7	0.3	34.5	116.3	37.1	69.1	103.6
Total Precip. 2011, mm	107.4	36.3	81.7	49.3	56.0	9.1	28.1	12.4	37.0	35.3	74.8	35.3
Total Precip. 2012, mm	47.2	47.4	47.4	53.9	20.5	47.4	60.0	43.9	0.9	120.1	83.2	119.0
Avg. Monthly Precip.	83.7	46.5	64.4	43.0	37.6	28.1	29.5	30.3	51.4	64.2	75.7	86.0

3.2 Regional Air Quality Objectives

Standards, Objectives and Guidelines are expressed by different levels of Canadian government to ensure the protection of human health and the environment. The Metro Vancouver ambient air quality objectives are shown in Table 3-3, noting the applicable averaging periods for each objective. Table 3-4 identifies the national criteria: Canada Wide Standards (CWS) as well as the National Ambient Air Quality Objectives (NAAQOs). The Provincial criteria are also included. The most stringent objectives or standards are considered applicable for a particular air contaminant and averaging period.

Table 3-3: Metro Vancouver Ambient Air Quality Objectives

Pollutant	Averaging Period	MV Objective (µg/m^3)
Carbon monoxide	1 hour	30,000
	8 hour	10,000
Nitrogen dioxide	1 hour	200
	Annual	40
Sulphur dioxide	1 hour	450
	24 hour	125
	Annual	30
Ozone	8 hour	156
PM_{10}	24 hour	50
	Annual	20
$PM_{2.5}$	24 hour	25

Table 3-4: National and Provincial Air Quality Criteria (all values in µg/m³)

Pollutant and Averaging Period	BC objective [a]			National objective [b]			CWS
	Level A	Level B	Level C	Maximum Desirable	Maximum Acceptable	Maximum Tolerable	
CO							
1hr max	14,300	28,000	35,000	15,000	35,000	-	-
8hr max	5,500	11,000	14,300	6,000	15,000	20,000	-
NO_2							
1hr max	-	-	-	-	400	1,000	-
24hr max	-	-	-	-	200	300	-
Annual mean	-	-	-	60	100	-	-
PM_{10}							
24hr max	-	50	-	-	-	-	-
$PM_{2.5}$							
24hr mean	25[d]			-	-	-	30[c]
Annual mean	8			-	-	-	-
Annual mean	6[e]			-	-	-	-

Table 3-4 (Cont'd): National and Provincial Air Quality Criteria (all values in µg/m³)

Pollutant and Averaging Period	BC objective [a]			National objective [b]			CWS
	Level A	Level B	Level C	Maximum Desirable	Maximum Acceptable	Maximum Tolerable	
Ozone							
1hr max	100	160	300	-	-	-	-
8hr mean							127[f]
24hr max	30	50	-	-	-	-	-
Annual mean	-	30	-	-	-	-	-
SO_2							
1hr max	450	900	-	450	900	900-1300	-
3hr max	-	-	-	-	375	665	-
24hr max	150	300	800	160	260	360	-
Annual mean	30	60	-	25	50	80	-
TSP							
24hr mean	150	200	260	-	120	400	-
Annual mean (geom.)	60	70	75	60	70	-	-

(a) Concentrations at 20°C, 760 mm Hg, dry basis
(b) Concentrations at 25°C, 101 kPa, dry basis
(c) 98th percentile of 24 hour means averaged over three years
(d) 98th percentile of 24 hour means
(e) Planning goal
(f) 4th highest value over the year, averaged over 3 years

Additional national and provincial ambient standards or objectives exist for specific compounds that may be released to the air (e.g., non criteria contaminants). For example, the provincial objectives include levels for formaldehyde and total reduced sulphur (TRS). However, the Westshore operations release insignificant quantities of these contaminants, and therefore, compliance to the additional standards/objectives are not considered in this study.

3.3 Air Quality Baseline

Table 3-5 provides a summary of the ambient air quality data collected at the MV Tsawwassen AQ Station (2011 and 2012 data) and at the Tsawwassen Ferry Terminal during 2010–2012, by averaging period of interest. These two stations are co-located with the met stations identified in Chapter 3.1. Whereas, the Tsawwassen Ferry Terminal station collects data for total suspended particulate (TSP), the MV station collects data for the primary CACs of interest. Each station has a relatively short history compared with other air quality stations in the Lower Fraser Valley. The Tsawwassen Ferry station is operated and quality-assured by a contractor on behalf of Westshore.

Where applicable, the measured concentration data are accompanied by the applicable objective or standard (in brackets). Percentile values are also shown for the 1-hour concentrations, to identify the typical patterns between the relatively high concentrations with the average values. Data capture in all cases was 'good' (98% capture over the year or better), with the exception of TSP data at Tsawwassen in 2011 (93% data capture). Exceedences of the criteria are indicated with use of red highlighting.

Table 3-5: Concentrations Statistics of Criteria Air Contaminants at the Tsawwassen Ferry Terminal (2010–2012) and the MV Tsawwassen Station (2011–2012)[a]

Parameter	Concentration, µg/m³						
	MV Tsawwassen AQ Station						Tsawwassen Ferry Station
	NO	NO_2	O_3	CO	SO_2	$PM_{2.5}$	TSP
1-Hour Maximum (2010)	—	—	—	—	—	—	733.1
1-Hour Maximum (2011)	103.5	118.4 (200)	**102.3** (100)	710.3 (14,300)	39.3 (450)	31.2	503.5
1-Hour Maximum (2012)	98.8	77.5 (200)	**132.9** (100)	664.5 (14,300)	39.3 (450)	45.5	365.8
1-Hour 99th Percentile (2012)	33.5	48.5	91.1	343.7	8.1	13.1	31.0
1-Hour 98th Percentile (2012)	21.7	43.5	86.8	309.3	6.3	11.2	17.6

Table 3-5 (Cont'd): Concentrations Statistics of Criteria Air Contaminants at the Tsawwassen Ferry Terminal (2010–2012) and the MV Tsawwassen Station (2011–2012)[a]

Parameter	Concentration, µg/m³						
	Tsawwassen MV AQ Station						Tsawwassen Ferry Station
	NO	NO_2	O_3	CO	SO_2	$PM_{2.5}$	TSP
1-Hour 95th Percentile (2012)	10.1	35.2	81.1	263.5	3.7	8.9	11.0
1-Hour 90th Percentile (2012)	4.9	27.7	75.2	229.1	2.6	7.0	8.1
1-Hour 75th Percentile (2012)	1.7	16.2	64.2	194.8	1.3	4.8	5.6
Annual Mean (2010)	—	—	—	—	—	—	11.0 (60)[b]
Annual Mean (2011)	3.2	13.2 (40)	**44.7** (30)	185.3	1.6 (25)	3.5 (6)	7.4 (60)[b]
Annual Mean (2012)	2.4	12.2 (40)	**47.2** (30)	175.3	1.1 (25)	3.4 (6)	5.9 (60)[b]
8-Hour Maximum (2011)	—	—	54.3 (127)[c]	544.2 (5,500)	—	—	—
8-Hour Maximum (2012)	—	—	61.3 (127)[c]	379.5 (5,500)	—	—	—
24-Hour Maximum (2010)	—	—	—	—	—	—	25.9 (120)
24-Hour Maximum (2011)	52.9	47.8 (200)	**88.1** (30)	500.1	9.1 (150)	11.9[d]	88.7 (120)
24-Hour Maximum (2012)	38.2	42.4 (200)	**83.9** (30)	342.2	6.8 (150)	14.1[d]	**141.8** (120)[e]

[a]Arithmetic means used throughout unless indicated otherwise. [b]Arithmetic mean. [c]Canada-wide Standard for 8-hour ozone based on 4th highest annual value. [d]Rolling average applied here. [e]Exceeds the B.C. Level A Objective for 24-h TSP (150 µg/m³) and the National Maximum Acceptable Objective for 24-h TSP (120 µg/m³).

Exceedences are noted in Table 3-4 for ground-level ozone (for 1-hour maximum, 24-hour maximum and annual averages). These all relate to the provincial ozone objectives (Level A and B), which are frequently exceeded in many parts of Canada. The CWS and Metro Vancouver values for ozone are considered up to date (an 8-hour average standard) and the ambient levels in Tsawwassen were well below these values in 2011 and 2012. Ground-level ozone is a regional, secondary pollutant that is influenced by long range transport from other areas and chemical mixing/reaction of primary pollutants in the atmosphere (NO_x and VOC) with solar radiation.

The maximum 24-hour TSP values at the Ferry Terminal exceeded the national objective of 120 µg/m³ on two occasions (both in 2012). It should be noted that these exceedences relate to the lower planning-oriented objective for TSP and not the higher thresholds that may imply regulatory action (the BC Level C objective of 260 µg/m³ and the federal Maximum Tolerable objective of 400 µg/m³). The exceedences were investigated further in terms of causal factors.

A simple wind analysis was conducted for these two exceedence days to evaluate which sources may have contributed to the relatively high concentrations. Westshore is positioned in the west northwest (WNW) quadrant with respect to the Ferry Terminal; therefore, winds originating from the W to NW have the potential to carry coal dust as well as other particulate originating from Roberts Bank towards the Ferry Terminal (fugitive coal dust is assumed to be the largest source of particulate from Westshore – as supported by the analysis presented in Chapter 4). The ferry berths are to the south of the monitoring station and therefore winds from the south may carry ship engine exhaust and/or vehicle emissions and road dust during loading/unloading. A summary of the winds for the two TSP exceedence days is as follows:

- 120 µg/m³ on October 10, 2012: Winds were light and variable in direction during the day, from the NE, E and SE sectors. Mean wind speed of 1.24 m/s (standard deviation of 0.44 m/s).
- 142 µg/m³ on October 11, 2012: Winds were light and primarily from the S and E sectors. Mean wind speed of 1.46 m/s (standard deviation of 0.43 m/s).

The wind summaries indicate that the Westshore sources were not upwind of the Ferry Terminal during the exceedences. However, on both days, winds were light and dispersion conditions may have been relatively poor. Wind erosion from the stockpile (which is caused by high wind speeds) was not likely significant on either day.

A 'pollution rose' was constructed for the Ferry Terminal location (Figure 3-3) to provide a view of the dust concentrations allocated to the different wind sectors over an extended period (2010 – 2012). The diagram simply links the hourly dust concentrations with the hourly average wind direction at the same location. By viewing the highest concentration levels (shown through use of colour-coded concentration bins) the diagram provides an indication of which source locations are associated with the high dust measurements.

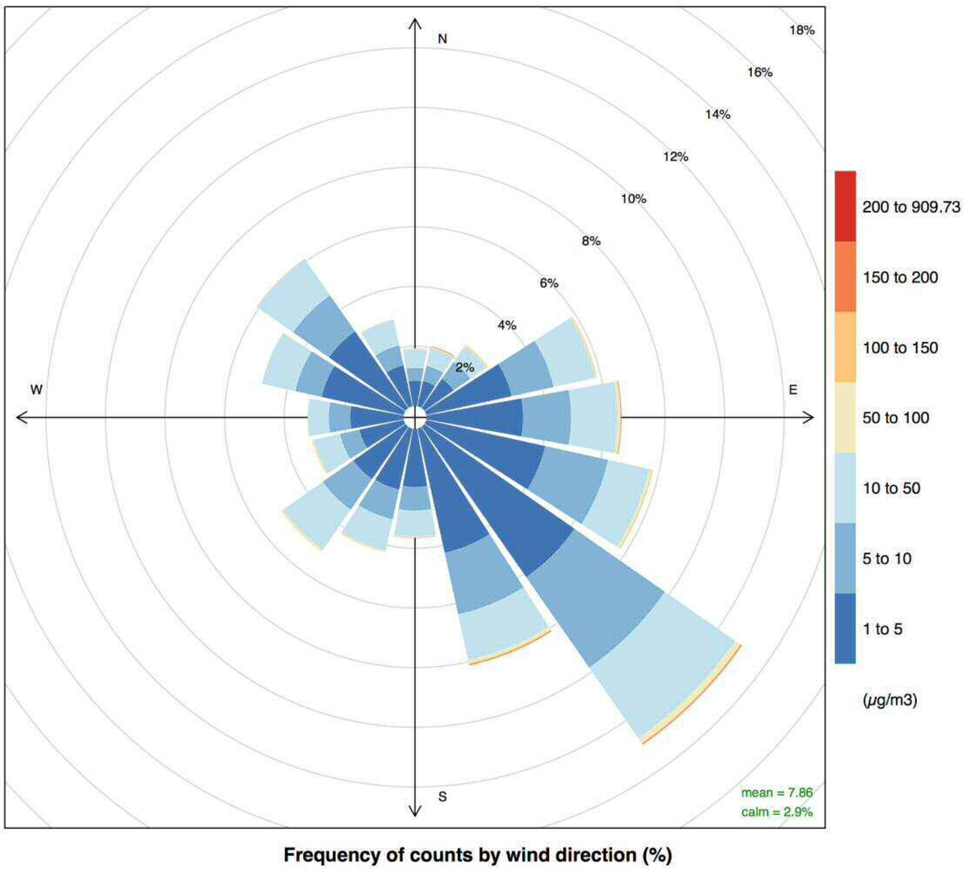


Figure 3-3: Pollution Rose for 1-hour PM (dust) Measurements at BC Ferry Terminal, 2010 - 2012

Figure 3-3 shows that the highest 1-hour dust measurements occur when the ambient winds are from the SE and E sectors. Some of the moderately high counts (hourly concentrations 10 - 50) occur when the winds blow from Westshore (NW).

An additional pollution rose was developed only for periods when the wind speed at the Ferry Terminal was 6 m/s or higher. This diagram shows that the highest dust measurements (1-hour concentrations of 100 or more) are not associated with high wind speeds. Moderately high dust measurements (10 – 50) during higher wind speeds are more likely to be associated with the NW wind flow and Westshore, but are also associated with SE flow.

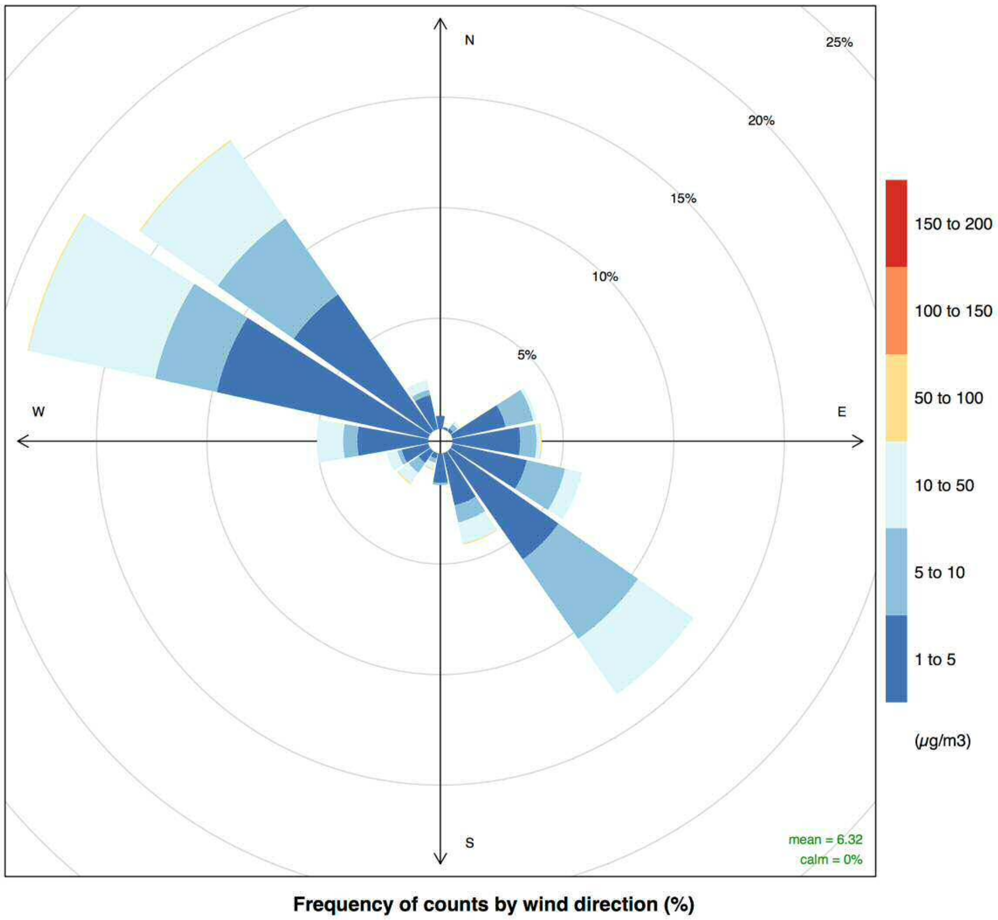


Figure 3-4: Pollution Rose for 1-hour PM (dust) Measurements at BC Ferry Terminal, 2010 – 2012, with Wind Speeds of 6 m/s or Higher

The analysis of the 2010-2012 PM concentration data at the Ferry Terminal can be summarized as follows:

- The relative significance of the Westshore fugitive coal dust emissions to the Ferry Terminal appears to be the highest during days with moderate to high wind speeds from the NW, but these conditions were not associated with the relatively high concentrations (including the two exceedences noted in Table 3-5) during 2010 – 2012.
- At times, in particular when winds are from the SE and E sectors, non-Westshore sources may have a significant influence on PM measurements at the Ferry Terminal (the magnitude of other potential sources was not investigated).

The two exceedences found in 2012 were associated with calm conditions and variable wind direction, making it difficult to attribute the measured concentrations to potential sources. Other studies have assessed PM measurements at the BC Ferries station. In particular, the environmental assessment study completed for the Deltaport Third Berth Expansion Project, which neighbours Westshore, determined there were four exceedences of the federal 24-hour Maximum Acceptable concentration (120 µg/m³) over the 15 year period assessed[2].

3.4 Dust Deposition

Deposition of dust is also measured at and near Westshore, both at the Tsawwassen Ferry Terminal and at two locations on Roberts Bank, as indicated in Figure 3-1. The Westshore locations are identified in greater detail in Figure 3-4. Since 2008, dustfall monitoring has been conducted at the Westshore locations as well as the Tsawwassen Ferry Terminal and the marina at Point Roberts, approximately 2 km and 7.5 km from Westshore, respectively. The results of the dustfall monitoring are provided in Table 3-5.

Figure 3-5: Location of Dustfall Canisters at Roberts Bank

[2] RWDI, 2005. Environmental Assessment Application for the Deltaport Third Berth Project. Supplemental Document #4: Amendments for Application Chapter 13 – Air Quality Assessment. Available from http://www.portmetrovancouver.com

Table 3-6: Dustfall Data, 2008 - 2012 (Total Particulate, in mg/dm^2/day, 30 day average)

Year	Measure	Westshore #7	Westshore #8	BC Ferry	Pt. Roberts A	Pt. Roberts B
2008	Maximum	3.50	3.43	4.50	0.90	1.00
	Average	1.67	2.24	1.01	0.22	0.24
2009	Maximum	1.41	8.34	2.40	0.20	0.30
	Average	0.84	3.30	0.89	0.14	0.19
2010	Maximum	1.60	4.88	1.60	0.50	0.60
	Average	0.83	2.77	0.80	0.17	0.16
2011	Maximum	8.40	9.80	3.40	0.30	0.30
	Average	2.03	4.08	1.07	0.18	0.15
2012	Maximum	3.31	5.65	4.30	0.90	0.50
	Average	1.46	3.00	0.73	0.23	0.17

Provincial dust deposition objectives include a 'Lower' objective of 1.75 mg/dm^2-day, and an 'Upper' objective of 2.90 mg/dm^2-day, averaged over 30 days. These objectives are applicable to off-site areas. Both of these criteria were exceeded on Roberts Bank during 2008 - 2012. Off-site levels were lower, although five exceedences of the Lower objective were experienced at the BC Ferry Terminal (including three of the Upper objective) during the previous five years. At the Point Roberts Marina (Pt. Roberts A and Pt. Roberts B in Table 3-5) no exceedences of the dustfall criteria occurred.

A recent summary of short-term dustfall measurements was prepared by the Corporation of Delta as a Council Report[3]. This summary provides an accounting of dustfall measurements collected during the period June 28, 2013 to July 29, 2013, for five different locations in Tsawwassen (four locations) and Delta (one location). This period of time was described in the report as a 'very dry period' which in general would tend to increase both the liberation and atmospheric transport of fugitive coal dust. The Delta location, labelled 'North 40, near rail' was approximately 15m from the rail tracks used by the coal

[3] Corporation of Delta, October 8, 2013. Coal Dustfall Monitoring. Prepared by the Office of Climate Action and Environment

trains that visit Westshore. The dust samples collected were analysed for total dustfall as well as coal fraction (percent coal by particle type).

The results of these measurements show very low total dustfall (< 0.25 mg/dm^2-day) and coal fraction (5%) at the four Tsawwassen sites and higher dustfall (5.17 mg/dm^2-day) and coal fraction (65%) at the North 40 site near the rail tracks. Metro Vancouver collected ambient PM_{10} and $PM_{2.5}$ during this same period at Pebble Hill near the Tsawwassen dustfall sites. This (filter-based) sampling shows similar low fractions of coal dust (approximately 5%) and low average ambient concentrations (5 $\mu g/m^3$ and 10 $\mu g/m^3$ for $PM_{2.5}$ and PM_{10} respectively).

It should be noted that dustfall measurements can be problematic, due to contamination of the sample with non-dustfall materials (such as bird feces). While efforts are made to visually identify contaminated samples before they are sent to the lab for analysis, there is no fail-proof method to ensure that all contaminated samples are removed from the analysis.

4.0 AIR EMISSIONS – OPERATIONAL PHASE

4.1 Emission Sources and Activity

To provide a complete accounting of emissions, both direct and indirect emissions were included for all sources. In particular, this means that the indirect emissions associated with electricity production were evaluated, even though these emissions are not released at or near Westshore. Employee commuting emissions are also considered indirect (or 'scope 3' in terms of GHG reporting standards[4]) since they are not commonly associated with industrial activities. However, the indirect emissions are relatively insignificant when compared to the emissions of the large sources (ships, locomotives, cargo equipment).

4.1.1 Marine Activity

Marine sources are dominated by the bulk carriers that are loaded at Westshore. Tugs are also used to assist the cargo ships to and from berth. A detailed account of the bulk carrier activity in 2012 was obtained from Westshore, as summarized in Table 4-1. The data show that most of the vessels to Westshore anchor for a period of time while awaiting a berth. Complete details are provided in Appendix A.

Table 4-1: Westshore Bulk Carrier Activity Summary for 2012

	Ship Calls	DWT	Berth Stays (days)	Ships to Anchor	Anchor Stays (days)
# in 2012	262			237	
Minimum		38,393	0.44		0.06
Maximum		207,964	7.28		61.42
Average		123,116	2.44		6.28

Table 4-1 summarizes the activity information necessary to estimate the marine emissions. Each ship has propulsion and auxiliary engines as well as one or more boilers. The propulsion engines are assumed to be used for all transit activities (but not berthing and anchoring) whereas the auxiliary engines and boilers are assumed to be used at all times.

[4] For example, see the World Resources Institute, World Business Council for Sustainable Development Greenhouse Gas Protocol, www.ghgprotocol.org

There are no available operations data for the tugs that assist the Westshore bulk carrier vessels. The tugs used are stationed at Roberts Bank and assist vessels at Deltaport Container Terminal as well as Westshore. A total estimated time for the tug assist is 30 minutes per vessel, for each arrival and each departure of the bulk carriers. Two tugs are assumed to assist in each case. This time includes travel from the nearby tug basin to the Westshore berths; as such, the activity (engine hours) is split evenly for the LSA (at dock) and the RSA (travel). The two specific tugs that tend to perform this duty were identified as relatively new craft (2009 and 2011 build years) with propulsion engines of 4,538 kW and 4,700 kW, respectively.

4.1.2 Marine Vessel Emission Rates

The equations used to calculate the marine emissions are shown below:

Engines: $E = P \times LF \times T \times EF_{energy}$ (1)

Boilers: $E = F \times T \times EF_{fuel}$ (2)

Where E = Emissions

F = Fuel consumption in tonnes/hour

P = Power Rating of Engine (Maximum Continuous Rating)

LF = Load Factor (fraction of rated power for an engine)

T = Time in mode

EF_{energy} = Emission Factors in g/kWh

EF_{fuel} = Emission Factors in kg/tonne

These equations are consistent with Canada's Marine Emissions Inventory Tool (MEIT) Version 4.0[5]. Additional parameters from MEIT are also leveraged for the marine emissions estimates.

The total emissions for a marine vessel are the sum of emissions from engines (mains and auxiliaries) and boilers in each activity mode (transit, anchor, and berth). Emission factors for engines (EF_{energy}) relate to engine type (2-stroke, 4-stroke) engine build year and fuel consumed on a vessel by vessel basis. These characteristics are identified through vessel lookup tables (IHS Fairplay Seaweb data)[6]. Boiler emission factors (EF_{fuel}) are more generic, but relate to the expected fuels consumed.

5 SNC-Lavalin Environment, 2012. 2010 National Marine Emissions Inventory for Canada. Prepared for Environment Canada

6 http://www.ihs.com/products/maritime-information/ships/sea-web.aspx

Not all of the parameters necessary for equations (1) and (2) can be identified from vessel lookup tables. Previous vessel surveys have been collected by the BC Chamber of Shipping for vessel visits to PMV, including many bulk carriers that visited Westshore. The results of these surveys have been incorporated to the MEIT model and have been used in previous marine emission inventories. These surveys characterize the bulk carrier auxiliary engine and boiler use as follows:

Auxiliary Engines:

- Installed auxiliary capacity (kW) = 0.0852 * ME + 1016.3 kW (where ME is main engine capacity).
- Average auxiliary load factor (LF) = 0.30, 0.29, 0.28 for underway, berth and anchor, respectively.

Boilers:

- Average boiler fuel consumption = 0.080 tonnes/hour, all activity modes.

In some cases the bulk carrier auxiliary engines can be identified from the lookup tables. In these cases the specific data are used rather than the profile data shown above.

Propulsion engine loads are also required for equation (1) and these can be estimated from the expected vessel speed. Travel to and from anchorage is expected to occur under normal cruise speeds (12 knots – 14 knots) and this relates to an average propulsion engine load of 0.80. Approach and departure from Westshore relates to transient use of the engines that cannot be easily characterized. For simplicity, cruise speed and 0.80 engine load was assumed for these movements as well. While departure is typically associated with high engine load and quick progression to normal cruise speeds, arrival is associated with lower engine load and use of the ship's momentum. The assumption of normal cruise conditions is considered reasonable for emission estimates over longer periods.

Manoeuvring to berth requires some use of the ship propulsion engines as well as the tug assist. A load factor of 0.1 on the bulk carrier main engines is applied for all manoeuvring operations. 30 minutes of engine use is applied for each vessel visit (arrival and departure combined). This activity is considered within the LSA since it is at the berth. All tug operations are considered to occur with an average propulsion engine load of 0.50. No auxiliary engine use for the tugs is assumed, consistent with MEIT characterization.

Emission factors from MEIT version 4.0 were used to complete the calculations, with the exception of fuel consumption and CO_2 factors, which were sourced from a recent IMO emissions study[7]. These factors are identified in Tables 4-2 – 4-5. Both SO_x and PM emissions were determined from the sulphur content of fuel and equations (3) and (4) shown below. These equations are also consistent with Canada's MEIT.

SO_x:

Engines: EF (g/kWh) = 4.2(S) (3)

Boilers: EF (kg/tonne) = 20.0(S) (4)

PM:

Engines: (g/kWh) = 0.4653(S) + 0.25 (5)

Boilers: (kg/tonne) = 1.17(S) + 0.41 (6)

where S = sulphur content of fuel in %.

Ratios of 0.96 and 0.92 are applied for PM_{10} to total PM and $PM_{2.5}$ to PM_{10}, respectively. The sulphur content of fuel applied to the bulk carriers in 2012 is 2.38 for main engines and 1.90 for auxiliaries and boilers, consistent with MEIT.

All CO_2 emissions were determined from estimates of fuel consumption and the CO_2 fuel based emission factors for heavy fuel oil (HFO) and marine distillate oil (MDO) that also originate from the IMO (2009):

- 3,130 kg/tonne fuel (HFO)
- 3,190 kg/tonne fuel (MDO)

Table 4-2: Marine Activity Based Emission Factors (g/kWh) by Engine Classification (from MEIT V4.0)

Engine	NOx (HFO/MDO)	CO	HC	NH3	CH4	N2O
Main 2-stroke	18.1/17.0	1.4	0.6	0.02	0.06	0.017
Main 4-stroke	14.0/13.2	1.1	0.5	0.02	0.04	0.017
Auxiliary 4-stroke	14.7/13.9	1.1	0.4	0.001	0.04	0.017

*Note: HFO – heavy fuel oil, MDO – marine distillate oil
NO_x values are shown for higher sulphur fuel (HFO) and lower sulphur fuel (MDO)

[7] IMO 2009. Second IMO GHG Study 2009. Contributing authors: Buhaug, Ø., Corbett, J.J., Endresen, Ø., Eyring, V., Faber, J., Hanayama, S., Lee, D.S., Lee, D., Lindstad, H.,Markowska, A.Z., Mjelde, A., Nelissen, D., Nilsen, J., Pålsson, C., Winebrake, J.J., Wu, W., Yoshida, K

Table 4-3: Marine Specific Fuel Oil Consumption (SFOC) in g/kWh by Engine Classification (kW) and Age (from IMO 2009)

Engine	Age of Build	SFOC (>15,000 kW)	SFOC (5,000-15,000 kW)	SFOC (<5,000 kW)
Main 2-stroke	1970-1983	205	205	205
	1984-2000	185	185	185
	2001-2007	175	175	175
	2008+	175	175	175
Main 4-stroke	1970-1983	215	225	225
	1984-2000	195	205	205
	2001-2007	185	195	195
	2008+	185	195	195
Auxiliary 4-stroke	1970-1983	220	220	220
	1984-2000	220	220	220
	2001-2007	220	220	220
	2008+	220	220	220

Table 4-4: Boiler Emission Factors (kg/tonne fuel)

Fuel	NOx	CO	HC	NH3	CH4	N2O
HFO,MDO	12.3	4.6	0.38	0.006	0.29	0.081

Table 4-5: Low Load (Engine Load 0.1) Factors for Specific Air Contaminants

	NOx	CO	HC	PM	CH4	N2O	Fuel
Ratio	1.22	2.00	2.83	1.38	1.22	1.22	1.22

The low load factors shown in Table 2-5 account for the higher emission rates from propulsion engines when used for manoeuvring or slow transit near berth.

All emission calculations are subject to the international IMO emission regulations summarized in Table 4-6. The Tier 1 and 2 regulations apply to all vessels. Additional NO_x and fuel regulations apply to Emission Control Areas (ECAs). Canada, with the US, has successfully applied to the IMO for an ECA within the west coast of North America[8] and the Canadian government is expected to implement the standards through domestic regulation during 2013[9].

8 See http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=694C8126-1

9 Personal communication with Ernst Radloff, Senior Development Officer with Transport Canada, Transportation Development Centre, April 23, 2013.

Table 4-6: IMO NO_x and SO_x/Fuel Regulations

Standard	Engine RPM 'n'	NOx Emission Limit (g/kWh)	Fuel Standard (max. sulphur content)	Year	Relevance
Tier 1	n < 130	17.0	n/a	2000	Applies to all vessels constructed during or after this year.
	n = 130-2000	$45*n^{-0.2}$			
	n > 2000	9.8			
SO_x /FUEL	n/a	n/a	1.00%	2010	Only applies to ECA areas.
Tier 2	n < 130	14.4	n/a	2011	Applies to all vessels constructed during or after this year.
	n = 130-2000	$44*n^{-0.23}$			
	n > 2000	7.7			
SO_x /FUEL	n/a	n/a	0.10%	2015	Only applies to ECA areas.
Tier 3	n < 130	3.4	n/a	2021	Applies to all vessels constructed during or after this year. Only applies to vessels operating in ECA areas.
	n = 130-2000	$9*n^{-0.2}$			
	n > 2000	1.96			
SO_x /FUEL	n/a	n/a	0.50%	2020	Applies to all areas, pending a 2018 fuel availability review.

Future emission rates were developed according to the emissions data tables above (i.e., the IMO regulations) and an assumption of vessel rollover. Since the bulk carriers are sourced from the international fleet, newer vessels will be used by 2018 compared to 2012. To simulate this, the relative age distribution of the ships that visited Westshore in 2012 was kept for 2018. Most notably, the existence of an ECA for 2018 will result in dramatically lower SO_x and PM emission rates for the ships.

4.1.3 Rail Activity

In 2012, a total of 1,841 trains brought 26,457,213 tonnes of coal to Westshore. Over half of the trains were operated by CPR, with the remaining trains operated by BNSF and CN. Each train to Westshore undergoes a similar activity cycle:

- Arrival to the terminal, queuing outside the terminal gate (average queue time 0.5 days);
- Engage with the Rail Car Positioner, which slowly moves the train through the compound to dump each car (average dump time 0.3 days); and
- Queuing/positioning before leaving terminal (average queue time 0.1 days).

4.1.4 Rail Emission Rates

The locomotives used to push/pull the trains are under load coming to and from the terminal and are inactive (shut down) whenever motionless for longer than 10 minutes. During dumping, the locomotives idle the entire time to keep systems active. The equation used to estimate the locomotive emissions is shown below:

$$E = EF_{duty\text{-}cycle} \times T \qquad (7)$$

Where: E = Emissions

$EF_{duty\text{-}cycle}$ = Emission Factors in g/hr, based on a defined engine duty cycle

T = Time

The number of locomotives used to push/pull the trains varies from a low of 2 to a high of 4 or more. This depends somewhat on the age and power rating of the locomotives used. On average, CPR and CN use 2.5 – 2.7 locomotives per train, whereas BNSF uses 4. The dominant line haul locomotive in the national fleets for CPR and CN is the GE AC4400 which is a relatively high-powered locomotive. The reason for a greater number of locomotives used for the BNSF trains is likely use of lower-powered models. However, data to support this assumption could not be obtained and the GE AC4400 was used as being a conservative estimate. As further described in the following paragraphs, 3 locomotives were assumed for each train arrival and departure, for all three of the operating rail lines.

The Railway Association of Canada (RAC) publishes emission estimates, including representative emission factors, for the total locomotive activities each year across Canada. The fuel-based emission factors from the most recent RAC publication (for the 2010 calendar year) are shown in Table 4-7 for NO_x, SO_x, CO, VOCs and PM[10]. The emission rates for CO_2, CH_4, N_2O were taken for Canada's GHG National Inventory Report (NIR)[11]

Table 4-7: Fuel-based Emission Factors for line haul locomotives in Canada

Locomotive Model	Rail Emission Factor (g/litre)								
	NO_x	SO_x*	CO	VOCs	PM	NH_3	CO_2	CH_4	N_2O
Line haul	49.23	0.21	7.06	2.38	1.23	0.30	2,663	0.15	1.10

*Assumes sulphur in diesel level of 127 ppm[12]

[10] Railway Association of Canada, 2012. Locomotive Emissions Monitoring Program 2010. ISBN # 978-0-9809464-3-7

[11] Canada's National Inventory Report, Greenhouse Gas Sources and Sinks in Canada 1990 – 2011. Report available at http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/7383.php

[12] See http://www.ec.gc.ca/energie-energy/default.asp?lang=En&n=7A8F92ED-1

To use the fuel-based emission factors in an activity-based inventory requires an estimate of the fuel consumption in each mode of activity (transit and idling). The specific fuel consumption rates for the GE 4400 locomotive model are provided in Table 4-8 for each throttle notch setting (including DB or dynamic braking). These rates were obtained from the US EPA Locomotive Emissions Standards report[13].

Table 4-8: Fuel Consumption Rates (litres/hour) for Line Haul Locomotives (based on GE AC4400)

Notch	Idle	N1	N2	N3	N4	N5	N6	N7	N8	DB
Line	13.5	42.0	98.0	204.6	298.6	414.7	527.2	646.6	796.4	22.3

Additional characteristics of the trains assumed for a previous assessment completed for Westshore were used to estimate emissions:

- Notches 4 and 5 are used for all train movements to and from Westshore.
- Trains travel an average of 10 mph along Deltaport Way and 35 mph on track further east.

The trains that leave Westshore are empty, which implies the locomotives would not have to work as hard (or fewer locomotives would be active). For this reason the rail emissions may be over-estimated to some degree.

Future emission rates were determined by evaluating locomotive emission standards promulgated in the US.[14] These same standards are considered applicable in Canada, as outlined in Table 4-9.

[13] US EPA, 1998. Locomotive Emissions Standards, Regulatory Support Document

[14] US EPA, 2008. Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression-Ignition Engines less than 30 litres per cylinder.

Table 4-9: US EPA Locomotive Emissions Data, by Emissions Tier

	Implementation Dates	Implementation Dates	Emissions (g/hp-hr)			
			NOx	CO	VOCs	PM
Line Haul	**Baseline 'In-Use' Locomotives (1998)**	**Pre-1998**	**13**	**1.28**	**0.48**	**0.32**
	Tier 0	1998	8.60	1.28	0.48	0.32
	Tier 1	2002	6.70	1.28	0.47	0.32
	Tier 2	2005	5.50	1.28	0.26	0.18
	Tier 3	2012	4.95	1.28	0.13	0.09
	Tier 4	2015, 2017 (NO_x)	1.00	1.28	0.04	0.03
Switch	**Baseline 'In-Use' Locomotives (1998)**	**Pre-1998**	**17.40**	**1.83**	**1.01**	**0.44**
	Tier 0	1998	14.00	1.83	1.01	0.44
	Tier 1	2002	11.00	1.83	1.01	0.43
	Tier 2	2005	8.10	1.83	0.51	0.19
	Tier 3	2012	5.00	1.83	0.26	0.09
	Tier 4	2015	1.00	1.83	0.08	0.02

The line haul rates in Table 4-9 were used for the 2018 inventories in the following way:

- All new engines were considered to be compliant with the Tier 3 rates.
- New locomotives are introduced to the existing fleet that serves Westshore at a rate of 2%/year.

The tier 3 rates are energy-based whereas the RAC rates used for the inventory are fuel-based. To account for this difference, the ratio of tier 3 rates to baseline rates in Table 4-9 was used to determine the fuel-based rates for the new locomotives. For example, the PM rate for a new locomotive in 2018 would be 0.09/0.32 * 1.23 g/litre = 0.35 g/litre. This approach assumes that the new locomotives would replace the oldest (and highest emitting) locomotives.

It should be noted that the locomotive replacement is conservative and should rail activity significantly grow in the country over the next few years there would be more newer locomotives (potentially including Tier 4 locomotives) introduced by CN and CPR and the fleet-average emission rates by 2018 could decrease further than simulated. The emission rates for air contaminants (and fuel consumption) not represented in Table 4-9 were held constant out to 2018.

4.1.5 Onroad Vehicle Activity and Emissions

During 2012, Westshore had 48 licensed (‘onroad’) vehicles. 47 of these used gasoline and 1 used diesel. A total estimated annual consumption of 210,964 and 6,369 litres was determined by Westshore for gasoline and diesel, respectively. The vast majority of gasoline used at the terminal is consumed by the onroad trucks (estimated as 97% of the total); whereas, very little of the total diesel is consumed by the one truck (estimated as 1% of the terminal total). It is anticipated that with the consolidation of the shops, offices and warehouse facilities, employee on-site transit will be reduced compared to present levels although no estimate of this improvement has been made. Cargo Handling Equipment (CHE), described in the next section, consumes most of the diesel at the terminal. For this reason there is greater uncertainty associated with the diesel consumption value for onroad vehicles. A complete listing of the Westshore onroad vehicle fleet by type and age is provided in Appendix A.

Onroad vehicle CAC emissions are calculated with use of emission rates from the US EPA Motor Vehicle Emission Simulator (MOVES) model Version 2010b. This allows determination of specific rates associated with the type and age of each vehicle in grams of pollutant per km of travel. These emission rates are then converted to fuel based rates (g/litre) by accounting for the fuel consumption rates for each vehicle model. MOVES develops emission rates for an identified driving cycle and average speed. An average vehicle speed of 35 km/h was used for all activities.

GHG emissions are calculated separately with use of the fuel-based GHG rates for gasoline and diesel from the NIR, as presented in Table 4-10. Rates for other fuels are also indicated, which are relevant to the CHE and Administration source groups.

Table 4-10: GHG Emission Factors for Diesel and Gasoline from NIR (g/L)

Fuel Type	Source Group	Equipment Type	CO_2	CH_4	N_2O
Diesel	Admin	All	2,663	0.150	1.100
	CHE	All	2,663	0.150	1.100
	Onroad	Passenger car, <2004	2,663	0.150	1.100
		Passenger car, 2004-2006	2,663	0.100	0.160
		Passenger car, >2006	2,663	0.068	0.210
		Passenger truck, <2004	2,663	0.120	0.082
		Passenger truck, 2004-2006	2,663	0.068	0.160
		Passenger truck, >2006	2,663	0.068	0.160
		Commercial trucks and buses, <2004	2,663	0.051	0.220
		Commercial trucks and buses, 2004-2006	2,663	0.150	0.075
		Commercial trucks and buses, >2006	2,663	0.140	0.082
	Rail	All	2,663	0.150	0.075

Table 4-10 (Cont'd): GHG Emission Factors for Diesel and Gasoline from NIR (g/L)

Fuel Type	Source Group	Equipment Type	CO_2	CH_4	N_2O
Gasoline	Admin	All	2,663	0.068	0.160
	CHE	All	2,663	0.150	1.100
	Onroad	Passenger car, <1996	2,289	0.320	0.660
		Passenger car, >1996	2,289	0.120	0.160
		Passenger truck <1996	2,289	0.210	0.660
		Passenger truck, >1996	2,289	0.130	0.250
		Commercial trucks and buses	2,289	0.490	0.084
Natural gas	Admin	All	1.92	0.000037	0.000035
	CHE	All	1.89	0.009000	0.000060
	Onroad	All	1.89	0.009000	0.000060
Propane	Admin	All	1,510	0.024	0.108
	CHE	All	1,510	0.640	0.028
	Onroad	All	1,510	0.640	0.028

The 2012 emission rates were held constant for the future. Although some of the onroad vehicle fleet will be replaced by 2018, there are no plans that can be applied to the inventory at this time. For this reason, the 2018 emission estimates for the source group will be over-estimated by some degree.

4.1.6 Cargo Handling Equipment (CHE) Activity and Emissions

Westshore had 31 individual CHE pieces in 2012, which consumed a total estimate of 630,485 litres, 6,246 litres and 1,000 litres of diesel, gasoline and propane respectively, in addition to almost 46 million kWh of electricity. A complete listing of the CHE used in 2012 is provided in Appendix A.

CHE CAC emissions from fossil fuel combustion were calculated with emission rates from the US EPA NONROAD 2008 model. This model has been extensively used for port CHE equipment emission estimates, including PMV's 2010 Landside Emissions Inventory (LEI)[15]. Equation (8) shows the equation used to calculate emissions for each CHE piece.

$$E = P \times LF \times T \times EF_{duty\text{-}cycle} \times LM \qquad (8)$$

[15] SNC-Lavalin Environment, 2012. Port Metro Vancouver Landside Emissions Inventory for 2010. See http://www.portmetrovancouver.com/en/environment/initiatives/Air.aspx

Where E = Emissions

P = Power rating of engine

LF = Load Factor (fraction of rated power)

T = Time (elapsed) of engine use

$EF_{duty\text{-}cycle}$ = Emission Factors from NONROAD, based on a defined usage cycle

LM = Load Modification (actual fuel consumed / predicted fuel consumed)

Annual hours of engine use (T) were estimated by Westshore for each CHE piece.

Port CHE must be 'mapped' to the equipment types handled in NONROAD. The mapping used for this assessment is consistent with that used in the LEI. A table of the equipment mapping used is provided in Appendix A. The equipment mapping also implies a representative load factor for each CHE piece. To ensure the estimated engine use does not imply a greater fuel consumption than that recorded over the year, the correction factor LM in equation (8) is used.

GHGs were estimated by use of the NIR emission rates shown in Table 4-10. The (indirect) emissions associated with electricity use were calculated based on the most recent factors available from BC Hydro (as published in the NIR):

- CO_2 – 29 g/kWh;
- CH_4 – 0.006 g/kWh; and
- N_2O – 0.0007 g/kWh.

These emissions are included in the LSA emission estimates. However, in reality they are not released at the terminal but instead at the point of generation (BC Hydro generation facilities).

4.1.7 Administration Activity and Emissions

Administration emissions result from use of propane and electricity for space heating and lighting. In 2012, Westshore consumed an estimated 234,724 litres of propane and 463,000 kWh of electricity. While the vast majority of propane at the terminal is consumed for space heating, most of the electricity consumed relates to CHE. The administration electricity consumption was estimated at 1% of the total electricity consumption for the terminal in 2012, consistent with the assumption applied in the 2010 PMV LEI.

CAC emissions associated with propane consumption in boilers were obtained from the US EPA AP-42 compilation of emission factors[16], as shown in Table 4-11. GHG emissions were determined with the NIR rates shown in Table 4-10. The same emission intensity factors for electricity use used for CHE were used for Administration.

Table 4-11: Administration (Boiler) Emission Rates

Source	Emission Factor (g/litre)								
	NO_x	SO_x*	CO	VOCs	PM	NH_3	CO_2	CH_4	N_2O
LPG Boiler	1.515	0.002	0.874	0.117	0.082	0.131	1,510	0.023	0.105

No changes were assumed for the Administration emission rates for 2018. It is expected that the new administration building will be more energy efficient than the existing separate shops and office buildings. Thus, electricity and propane consumption are not expected to exceed present usage.

4.1.8 Employee Commuting Activity and Emissions

Although minor in significance, employee commuting emissions were also calculated over the RSA. These emissions were determined with MOVES and assumption of an 80 km/h drive cycle. Emission rates were developed for an average light duty vehicle fleet distribution (the US average distribution in the MOVES model) for both 2012 and 2018, as shown in Table 4-12. In this case the MOVES GHG rates were used directly since fuel consumption data are not available.

Table 4-12: MOVES Emission Rates for Light Duty Vehicles (Commuting)

Year	Emission Factor (g/km)									
	NO_x	SO_x*	CO	VOCs	PM_{10}	$PM_{2.5}$	NH_3	CO_2	CH_4	N_2O
2012	0.322	0.003	1.802	0.071	0.006	0.005	0.020	215.591	0.003	0.002
2018	0.172	0.003	1.307	0.039	0.005	0.004	0.014	197.197	0.002	0.001

The MOVES data show that a significant improvement is expected for vehicles within the next five years (the same relative fleet distribution by year was applied, due to the expectation that employees' vehicles would be newer by this time). This improvement also includes changes to average vehicle fuel efficiency (and hence lower CO_2 emission rates).

As noted in Table 4-13, a total estimate of 2.5 million km is made to represent all of the employee commuting travel during 2012. This estimate assumes an average commuting distance of 25 km in the RSA, consistent with the distance of travel for rail. For 2018 operations and a throughput of 36 million tonnes, it was assumed that the total employee commuting distance would increase by 20%. This assumption assumes that the commuting activity scales linearly with ½ of the increase in throughput.

[16] See http://www.epa.gov/ttnchie1/ap42/

Table 4-13: Estimate of Employee Commuting Distances within the RSA for 2012

Position	Number of Employees	Shifts/year	Total Shifts	Total Travel (km)
Clerical	15	234	3,505	175,246
Supervisory	36	218	7,786	389,320
Trades	144	218	31,397	1,569,837
Management	29	260	7,489	374,457

4.1.9 Fugitive Dust

Fugitive coal dust is caused by wind erosion of the coal storage piles and by handling activities such as the dumping of rail cars.

Methodologies used to estimate fugitive dust emissions require identification of the size distribution of coal dust (total PM, fraction of total within the PM_{10} size range and fraction within the $PM_{2.5}$ size range). For all fugitive dust estimates, PM was defined to be total particulate less than or equal to 30 µm in aerodynamic diameter. PM_{10} was estimated at 0.47 of PM and $PM_{2.5}$ as 0.072 of PM for all sources, based on US EPA size criteria for batch/drop operations[17].

Westshore applies water to the active handling areas to limit dust. For this reason, the moisture content of the coal is often higher on site than when it leaves the mines. An 8% moisture level was applied to all of the emission estimation equations, although at times the actual coal moisture levels can be as high as 9.5%.

The methodology used to assess fugitive emissions from coal handling at the terminal is consistent with the US EPA AP 42 approach, which requires an estimate of the coal storage piles (sizes, exposure) as well as material handling rates. The methods scale linearly with coal throughput and therefore can be scaled to determine future dust emissions in addition to the baseline.

4.1.9.1 Railcar Unloading

Equation (9) was used to estimate emissions from railcar unloading.[18]

$$E = 0.0016\, k\, (U/2.2)^{1.3} / (M/2)^{1.4} \qquad (9)$$

Where:

E = emission factor in kg/tonne of coal handled

k = particle size multiplier (for PM size fraction)

U = mean wind speed (m/s)

17 US EPA AP 42 Chapter 13.2.4

18 US EPA AP 42 Chapter 13.2.4

M = material moisture content (%)

This equation is applied to the annual tonnage from rail, accounting for moisture content of the coal (8%) and the mean 10m wind speed for the area (2.63 m/s). The equation represents exposed dumping whereas the railcar unloading occurs in a semi-enclosed building (open at both ends); as such, a 70% reduction ('control efficiency') was applied to the emission estimates based on a recommended value from the Air and Waste Management (AWMA) air pollution engineering manual[19]. By use of equation (9), railcar unloading, with control efficiency, yields 1.70 tonnes of PM for 2012.

4.1.9.2 Stockpile Wind Erosion

Equation (10) was used to estimate emissions from stockpile erosion[20]:

$$E = k \Sigma P \qquad (10)$$

Where:

E = emission factor in g/m^2

k = particle size multiplier (for PM size fraction)

P = erosion potential corresponding to the observed wind gust speed (in g/m^2)

To determine the erosion potential, Equation (11) was used for a dry, exposed surface of coal:

$$P = 58 (u^* - u_t^*)^2 + 25 (u^* - u_t^*) \qquad (11)$$

Where:

P = erosion potential for a dry, exposed surface (g/m^2)

u^* = friction velocity (m/s)

u_t^* = threshold friction velocity (m/s)

Importantly, Equation (11) becomes non zero if $u^* > u_t^*$, otherwise no emissions are predicted. A threshold friction velocity value of 1.12 m/s was used, representing an empirical value representative of an uncrusted coal pile. The equation relies on a separate estimate to determine the effective area of a storage pile exposed to the wind, and an hourly estimate of friction velocity. In order to use this methodology, an assumption that the erosion potential is completely restored each hour is applied.

Westshore records show that the stockpile varies over the year from 0.8 to 1.3 million tonnes with an average of 1.1 million tonnes. The maximum theoretical capacity is 2.4 million tonnes although not practically achievable due to pile separation requirements for differing coal products. For the calculations, a consistent stockpile of 1.1 million tonnes was used.

[19] AWMA, 2000. Air Pollution Engineering Manual, Second Edition

[20] US EPA AP 42 Chapter 13.2.5

Friction velocity depends on hourly gust wind speeds, which were determined from wind data collected at the Tsawwassen Ferry Terminal station identified in Chapter 3. The hourly gust wind speeds were corrected from the anemometer height of 15 m to a reference height of 10 m using Equation (12):

$$u^{+}_{10} = u^{+} [\ln(10/0.005)/\ln(z/0.005)] \qquad (12)$$

Where:

u^{+} = wind gust speed (m/s)

u^{+}_{10} = wind gust speed corrected for a 10 m anemometer height (m/s)

z = actual anemometer height (m)

This approach assumes a typical roughness height (z_0) of 0.5 cm.

For a representative conical pile shape (37-degree side slope), the ratios of surface wind speed (u_s) to approach wind speed (u_r) have been derived from wind tunnel studies.[21] The pile with subareas of distinct u_s/u_r ratios is depicted in Figure 4-1.

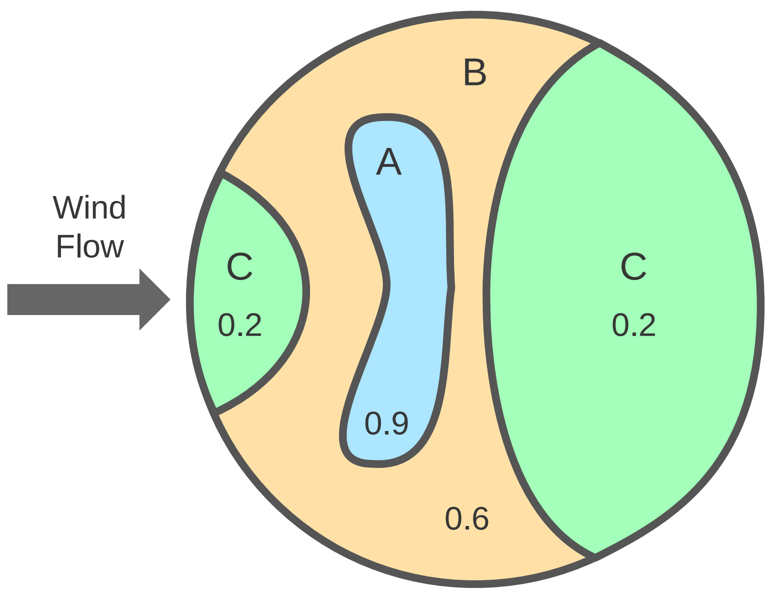


Figure 4-1: Subareas of u_s/u_r Ratios used for Analyses of Equivalent Friction Velocities

[21] Countess Environmental, September 2001. Recommendations for Estimating Emissions of Fugitive Windblown and Mechanically Resuspended Road Dust Applicable for Regional Scale Modeling, final report prepared for the Western Governors' Association.

Table 4-14 provides a summary of the u_s/u_r ratios for each of the subareas, the amount of surface area attributed to those ratios, and the threshold gust speed at 10m height that results in a nonzero emission potential.

Table 4-14: Subarea Distribution for Regimes of u_s/u_r

Pile Subarea	Value of u_s/u_r	Percentage of Pile Surface Area	Minimum Wind Gust Speed to Attain P > 0, m/s
A	0.9	12%	13.2
B	0.6	48%	19.7
C	0.2	40%	59.0

The procedure determining erosion potentials is to treat every subarea of every pile as a distinct source. Thus, for every hour of wind data, the necessary steps are to:

(1) Convert corrected wind gust speeds (u_{10}) to equivalent friction velocities taking into account the non-uniform wind exposure of elevated surfaces (piles), using Equations (13) and (14):

$u^+_s = (u_s/u_r) * u^+_{10}$ (13)

$u^* = 0.10 * u^+_s$ (14)

Where:

u^+_s = surface wind speed

(u_s/u_r) = ratio of surface wind speed to approach wind speed

u^* = equivalent friction velocity

(2) Calculate the erosion potential (P) every hour for every subarea using Equation (11).

(3) Calculate each corresponding emission factor (E) for the hour for each subarea using Equation (10).

(4) Multiply the resulting emission factor for each subarea type (A, B, or C as indicated in Table 4-1) by the size of the subarea type in each coal pile; then add the emission contributions of all subareas from each coal pile.

This procedure thus generates three distinct values for u^+_s and u^*, where each u^* value at three different subarea types are compared to the threshold friction velocity (u_t^*). If a subarea's u^* value exceeds that of u_t^* for the hour, then a nonzero emission potential is calculated. The subareas with higher u_s/u_r ratios always generate the highest emission potentials whereas the subarea with the u_s/u_r ratio of 0.2 (representing 40% of the surface area of a coal pile) rarely generates any erosion potential (since a 10 m wind gust of at least 59 m/s is required).

To use this procedure, an estimate of the total number of coal piles and their respective sizes were required. GIS imagery was used to determine the distribution of coal piles and to estimate the sizes of each pile. A total of 29 distinct pile sites were identified and the dimensions of a moderately sized conical pile of coal (with an average ground surface area of 7,700 m^2 and an average height of 23 m) were centered at each site. Given a bulk density of coal of 800 kg/m^3, these piles represent a combined mass of 1.1 million tonnes of coal and a total exposed surface area of nearly 200,000 m^2.

Through the use of the procedure outlined above and the application of 50% control efficiency[22] (accounting for the upgraded automated coal dust suppression system the facility has in place), the total controlled PM emissions estimate for 2012 is 33.6 tonnes.

It is noted that a large sensitivity to this analysis is the selection of the threshold friction velocity (chosen here as 1.12, representing an uncrusted coal pile from the AP-42 value). The value of this parameter may not be fully representative of the coal material at Westshore. Assuming an error of ±5% for the threshold friction velocity, a range of 24.5 – 45.9 tonnes of PM results.

Based on previous study work, much of the fugitive dust will be deposited within the site boundary[23].

4.1.9.3 Transfer Points

The emission rate noted below was used to estimate emissions from the coal transfer points (conveyors)[24].

E = 0.0015 kg/tonne

32% of the coal delivered to Westshore goes straight to the ships, with 5 or 6 transfer points depending on berth. The remaining 68% of coal goes to the stockpile to be reclaimed at a later time. This coal passes through 6 or 7 transfer points before loading to ships, depending on berth. As an average, 6 transfer points were assumed for 100% of the coal delivered to Westshore.

A 70% control efficiency was applied to this process, since all conveyor transfer points at Westshore are enclosed. Given the large volume of coal moved through the transfer points, this activity generates the greatest amount of estimated dust. A total of 71.4 tonnes of PM is calculated for 2012.

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22 A range of 50% – 80% control efficiency was noted with use of water sprays on coal storage piles in a study completed by Katestone Environmental Pty Ltd. *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining* (June 2011).

23 SENES Consultants Ltd., 2006. Air Emission Inventories for Westshore Terminal 2005 – 2011

24 US EPA AP 42 Chapter 11.19.2-1

4.1.9.4 Shiploading

Shiploading is a continuous drop operation and therefore Equation (9) was used to represent this process. As with the railcar unloading, a 70% control efficiency was applied due to use of a chute to convey the coal into the ship hold. A total of 1.70 tonnes of PM is calculated for 2012.

4.1.9.5 Stacker-reclaimer

Equation (9) was also applied to the stacker-reclaimers for the drops associated with moving coal to and from the storage piles. As previously noted, 68% of the coal delivered to Westshore passes through the storage piles. Since this operation occurs in the open, a lower control efficiency was applied (50%). This efficiency relates to use of the water sprays on the stacker-reclaimers. For 2012, an estimated 5.7 tonnes of PM was released due to this activity.

4.1.9.6 Bulldozing

Fugitive dust due to bulldozing activities relates to the amount of time the machines are used to shape the storage piles. An average of 4.5 hours per day of bulldozing activity, for each of the three bulldozers used at Westshore, was applied based on average activity rates at the terminal over the past several years. Equation 11, shown below, was used for the estimates[25].

$$E \text{ (lb/hour)} = 35.6(s)^{1.2}/(M)^{1.3} \qquad (11)$$

A 50% control efficiency was applied to the bulldozing activities, due to use of the water sprays. Bulldozing generates a significant amount of estimated dust and use of equation (11) produces an annual PM total of 52.4 tonnes in 2012, much of which remains on site. Qualitatively, according to Westshore staff, bulldozing is the activity which is most frequently identified as the source of visible dust.

The amount of bulldozing activity is expected to significantly decline with use of the new stacker-reclaimers. The new equipment will have a longer boom (70 m, compared to the existing boom length of 60 m), which reduces the need for bulldozing to move the coal in reach of the stacker-reclaimers. Analysis completed by Westshore indicates that bulldozing activity will fall to 48% (or less) of the existing activity levels once the new stacker-reclaimers are in place. This significant reduction in bull-dozing hours will result in a proportional reduction in dust associated with this activity. This analysis is provided in Appendix C.

[25] US EPA AP 42 Chapter 11.9.2

4.1.9.7 Other Fugitive Sources of Emissions (GHGs)

GHG emissions (methane) have been attributed to post-mining operations of coal (e.g., storage piles, transportation). However, as noted in the BC Reporting Regulation Methodology Manual[26], the favoured approach for these emissions is to attribute them entirely to the facility that combusts the coal. While some of these emissions would be released during storage at Westshore, they were not accounted for in the inventories.

4.2 Emission Scenarios

2012 was an atypical year for Westshore, notably due to an accident that occurred at one of its berths. Two events in particular are identified:

- A vessel damaged the trestle when leaving Westshore on December 7, leaving the terminal with only one operational berth for the remainder of the year.
- Both rail dumpers and Berth 1 were taken out of service from March 23 to April 6 for service on transfer chutes.

For this reason, a revised 2012 inventory was developed to act as a baseline to predict emissions out to the future when increased coal throughput may be experienced. The average monthly throughput loaded to ship, not including the atypical months of March, April and December was 2,353,000 tonnes. The baseline uses marine activity data for the first 11 months of the year (e.g., not including December when ship activities would be significantly different), scaled up to the projected annual throughput that would have occurred without the disruptions. The projected annual throughput of 28.237 mtpa results from the average monthly throughput applied to all 12 months of the year. The actual amount of coal shipped during the year was 26.173 mtpa on the water side and 26.457 mtpa on the rail side. The land-based emissions for the baseline were achieved by scaling the rail throughput to 28.237 mtpa. Additional details on emissions scaling are provided in the scenario documentation below.

Appendix B provides a month to month data list of ship calls to Westshore and the associated tonnes of coal handled. Also included is the number of ships that went to anchor each month.

Emission scenarios are presented for 2012, 2012 Baseline, Future with Project and Future without Project. The future year chosen is 2018, since it is expected that the equipment and facility changes will be fully implemented by that time.

[26] BC Ministry of Environment, 2009. British Columbia Reporting Regulation Methodology Manual. Available from www.env.gov.bc.ca

4.2.1 2012 Operations

Emission estimates for 2012 operations are provided in 4-16 for the LSA and 4-17 for the RSA. For the source groups that use electricity (CHE and Admin), direct emissions due to combustion and indirect emissions due to electricity use are shown separately. All emission sources comply with regulatory standards and permits.

Table 4-15: 2012 Operations Emissions Estimates in the LSA (tonnes)

Source Group	Sub-group	NO_x	SO_x	CO	VOC	PM	PM_{10}	$PM_{2.5}$	NH_3	CO_2e
Marine	Berth	117.01	148.12	15.91	4.20	16.21	15.56	14.32	0.02	10,472
	Anchor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
	Transit	6.49	3.01	0.60	0.32	0.46	0.45	0.41	0.00	203
	Tug	6.90	0.13	0.66	0.36	0.16	0.16	0.14	0.01	337
Rail	Idle	35.24	0.15	5.05	1.70	0.88	0.88	0.85	0.21	2,152
	Transit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
CHE	Direct	17.89	0.02	12.47	1.40	1.12	1.12	1.09	0.03	1,905
	Indirect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	518
Onroad Vehicle	Facility	0.45	0.01	3.28	0.13	0.06	0.06	0.02	0.02	479
	Commuter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Admin	Direct	0.36	0.00	0.20	0.03	0.02	0.02	0.02	0.03	362
	Indirect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
Total Exhaust		**184.33**	**151.43**	**38.18**	**8.14**	**18.92**	**18.24**	**16.85**	**0.33**	**16,434**
Fugitive	Materials Handling	-	-	-	-	166.52	78.27	11.99	-	-
Total Fugitive		-	-	-	-	**166.52**	**78.27**	**11.99**	-	-

Table 4-16: 2012 Operations Emissions Estimates in the RSA (tonnes)

Source Group	Sub-group	NO_x	SO_x	CO	VOC	PM	PM_{10}	$PM_{2.5}$	NH_3	CO_2e
Marine	Berth	117.01	148.12	15.91	4.20	16.21	15.56	14.32	0.02	10,472
	Anchor	236.78	301.05	32.30	8.43	32.75	31.44	28.92	0.03	21,273
	Transit	215.30	143.09	18.97	7.98	19.01	18.25	16.79	0.26	7,881
	Tug	13.81	0.25	1.32	0.72	0.33	0.31	0.29	0.02	675
Rail	Idle	35.24	0.15	5.05	1.70	0.88	0.88	0.85	0.21	2,152
	Transit	66.91	0.29	9.60	3.23	1.67	1.67	1.62	0.41	4,087
CHE	Direct	17.89	0.02	12.47	1.40	1.12	1.12	1.09	0.03	1,905
	Indirect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	518
Onroad Vehicle	Facility	0.45	0.01	3.28	0.13	0.06	0.06	0.02	0.02	479
	Commuter	0.81	0.01	4.52	0.18	0.01	0.01	0.01	0.05	542
Admin	Direct	0.36	0.00	0.20	0.03	0.02	0.02	0.02	0.03	362
	Indirect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
Total Exhaust		**704.56**	**592.98**	**103.62**	**28.00**	**72.06**	**69.33**	**63.94**	**1.09**	**50,353**
Fugitive	Materials Handling	-	-	-	-	166.52	78.27	11.99	-	-
Total Fugitive		-	-	-	-	**166.52**	**78.27**	**11.99**	-	-

4.2.2 2012 Baseline

The baseline emissions estimates in the LSA and RSA are provided in Tables 4-18 and 4-19. These baselines were developed by linearly scaling the marine activity and emissions for the 11 ‘good’ months of the year (24.910 million tonnes) by the annual throughput that would have occurred with normal operations (28.237 mtpa). This assumes that the ships that came during the 11 months, as well as their activity patterns (time at berth, trips to anchor and back) would be reasonable for December if the accident had not occurred.

Under normal operations, the amount of coal brought by rail to Westshore is nearly equal to the amount of coal shipped. Since detailed scheduling information on the coal trains is not available, the 2012 rail activity and emissions were simply scaled up from the actual rail throughput (26.457 mtpa) to 28.237 mtpa. This scaling was also performed on the other landside sources, with the exception of Administration sources. For fugitive dust, the stockpile wind erosion estimates were not scaled, since the stockpile would not differ in size (all coal handling activities were scaled however).

Table 4-17: 2012 Baseline Estimates in the LSA (tonnes)

Source Group	Sub-group	NO_x	SO_x	CO	VOC	PM	PM_{10}	$PM_{2.5}$	NH_3	CO_2e
Marine	Berth	124.60	157.16	16.88	4.44	17.17	16.49	15.17	0.02	11,110
	Anchor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
	Transit	7.02	3.25	0.65	0.35	0.50	0.48	0.44	0.00	219
	Tug	7.49	0.14	0.71	0.39	0.18	0.17	0.16	0.01	366
Rail	Idle	37.61	0.16	5.39	1.82	0.94	0.94	0.91	0.23	2,297
	Transit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
CHE	Direct	19.10	0.02	13.30	1.50	1.20	1.20	1.16	0.03	2,033
	Indirect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	553
Onroad Vehicle	Facility	0.48	0.01	3.50	0.14	0.06	0.06	0.02	0.02	511
	Commuter	0.83	0.01	4.67	0.18	0.02	0.02	0.01	0.05	560
Admin	Direct	0.36	0.00	0.20	0.03	0.02	0.02	0.02	0.03	362
	Indirect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
Total Exhaust		**197.49**	**160.74**	**45.32**	**8.84**	**20.09**	**19.37**	**17.90**	**0.40**	**18,018**
Fugitive	Materials Handling	-	-	-	-	175.46	82.47	12.63	-	-
Total Fugitive		-	-	-	-	**175.46**	**82.47**	**12.63**	-	-

Table 4-18: 2012 Baseline Estimates in the RSA (tonnes)

Source Group	Sub-group	NO_x	SO_x	CO	VOC	PM	PM_{10}	$PM_{2.5}$	NH_3	CO_2e
Marine	Berth	124.60	157.16	16.88	4.44	17.17	16.49	15.17	0.02	11,110
	Anchor	254.02	322.73	34.61	9.01	35.03	33.63	30.94	0.04	22,801
	Transit	232.17	153.75	20.38	8.57	20.43	19.61	18.04	0.28	8,472
	Tug	15.00	0.27	1.43	0.78	0.36	0.34	0.31	0.03	733
Rail	Idle	37.61	0.16	5.39	1.82	0.94	0.94	0.91	0.23	2,297
	Transit	71.41	0.30	10.24	3.45	1.78	1.78	1.73	0.44	4,362
CHE	Direct	19.10	0.02	13.30	1.50	1.20	1.20	1.16	0.03	2,033
	Indirect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	553
Onroad Vehicle	Facility	0.48	0.01	3.50	0.14	0.06	0.06	0.02	0.02	511
	Commuter	0.83	0.01	4.67	0.18	0.02	0.02	0.01	0.05	560
Admin	Direct	0.36	0.00	0.20	0.03	0.02	0.02	0.02	0.03	362
	Indirect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
Total Exhaust		**755.58**	**634.41**	**110.61**	**29.92**	**77.01**	**74.09**	**68.33**	**1.16**	**53,800**
Fugitive	Materials Handling	-	-	-	-	175.46	82.47	12.63	-	-
Total Fugitive		-	-	-	-	**175.46**	**82.47**	**12.63**	-	-

4.2.3 Future with Project

2018 emissions estimates were developed for the LSA and RSA by scaling all landside and waterside activities linearly with the maximum coal throughput that may be experienced by this time: 36 mtpa. Revised emission rates were applied to the increased activities as noted in Chapter 4.1, where possible. Notably, the ships and trains that arrive to Westshore in 2018 are expected to be newer (and lower emitting) on average, due to fleet turnover in North America (rail) and internationally (ships). Employee vehicles are also expected to be newer and cleaner. No assumption of equipment rollover was made for CHE or facility vehicles, although some changeover will occur by 2018. Additionally, no improvement was assumed for fugitive dust on an emissions per tonne handled basis, with the exception of bulldozing. As described in Appendix C, the new stacker-reclaimers will reduce the need for bulldozing activities (shaping of the stockpiles) by almost 50%. Administration activities were not scaled as they are not expected to increase with throughput.

The forecasts account for a minor increase in loading efficiency due to the new infrastructure and stacker/reclaimers. The changes at the terminal forecast an increase coal handling ability from 33 mtpa to 36 mtpa. This was simulated in the forecast inventories by a reduction in ship berthing times by a factor of 33/36 to those experienced in 2012. No changes to the ship queuing activity rates (e.g., # of ships to anchor and average time at anchor) were assumed, although some improvement may occur for those activities as well.

No changes were assumed for the bulk carrier size distribution for vessels to Westshore, although these ships are generally increasing in size/capacity; as such, the 2018 estimates have a degree of conservatism. The 2018 emissions estimates for the LSA and RSA are shown in Tables 4-20 and 4-21, respectively.

Table 4-19: 2018 Future with Project Estimates assuming 36 mtpa in the LSA (tonnes)

Source Group	Sub-group	NO_x	SO_x	CO	VOC	PM	PM_{10}	$PM_{2.5}$	NH_3	CO_2e
Marine	Berth	95.77	7.90	19.71	5.19	4.22	4.05	3.73	0.02	12,975
	Anchor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
	Transit	5.79	0.17	0.84	0.44	0.13	0.13	0.12	0.01	280
	Tug	7.62	0.00	0.63	0.34	0.14	0.14	0.13	0.01	323
Rail	Idle	44.38	0.20	6.88	2.12	1.09	1.09	1.06	0.29	2,929
	Transit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
CHE	Direct	24.35	0.02	16.96	1.91	1.53	1.53	1.48	0.04	2,592
	Indirect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	704
Onroad Vehicle	Facility	0.61	0.01	4.46	0.18	0.08	0.08	0.03	0.03	652
	Commuter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Admin	Direct	0.36	0.00	0.20	0.03	0.02	0.02	0.02	0.03	362
	Indirect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
Total Exhaust		**178.87**	**8.31**	**49.68**	**10.20**	**7.22**	**7.04**	**6.57**	**0.43**	**20,822**
Fugitive	Materials Handling	-	-	-	-	174.16	81.85	12.54	-	-
Total Fugitive		-	-	-	-	**174.16**	**81.85**	**12.54**	-	-

Table 4-20: 2018 Future with Project Estimates assuming 36 mtpa in the RSA (tonnes)

Source Group	Sub-group	NO_x	SO_x	CO	VOC	PM	PM_{10}	$PM_{2.5}$	NH_3	CO_2e
Marine	Berth	95.77	7.90	19.71	5.19	4.22	4.05	3.73	0.02	12,975
	Anchor	217.80	18.13	45.23	11.89	9.68	9.29	8.55	0.05	29,772
	Transit	189.22	7.97	26.23	11.04	5.52	5.30	4.87	0.36	10,814
	Tug	15.26	0.01	1.82	0.99	0.42	0.40	0.37	0.03	934
Rail	Idle	44.38	0.20	6.88	2.12	1.09	1.09	1.06	0.29	2,929
	Transit	84.28	0.39	13.06	4.02	2.08	2.08	2.02	0.55	5,561
CHE	Direct	24.35	0.02	16.96	1.91	1.53	1.53	1.48	0.04	2,592
	Indirect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	704
Onroad Vehicle	Facility	0.61	0.01	4.46	0.18	0.08	0.08	0.03	0.03	652
	Commuter	0.51	0.01	3.87	0.12	0.01	0.01	0.01	0.04	585
Admin	Direct	0.36	0.00	0.20	0.03	0.02	0.02	0.02	0.03	362
	Indirect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
Total Exhaust		**672.54**	**34.64**	**138.43**	**37.46**	**24.64**	**23.85**	**22.14**	**1.45**	**67,887**
Fugitive	Materials Handling	-	-	-	-	174.16	81.85	12.54	-	-
Total Fugitive		**-**	-	-	-	**174.16**	**81.85**	**12.54**	-	-

4.2.4 Future without Project

2018 emissions estimates were developed for the LSA and RSA without the benefit of the planned upgrades. The current capacity of the terminal for handling coal is 33 mtpa, which was assumed for the Future without Project forecast. Similar to the Future with Project scenario, revised emission rates were applied to the increased activities as noted in Chapter 4.1 where possible (ships, trains). No assumption of equipment rollover was made for CHE or facility vehicles and administration activities were held constant, consistent with the Future with Project scenario. No changes were made to the 2012 bulldozing activity patterns, implying that bulldozing activity increases with the increase in throughput (as detailed in Appendix C). The emissions scenarios are displayed in Tables 4-22 and 4-23 for the LSA and RSA, respectively.

Table 4-21: 2018 Future without Project Estimates assuming 33 mtpa in the LSA (tonnes)

Source Group	Sub-group	NO_x	SO_x	CO	VOC	PM	PM_{10}	$PM_{2.5}$	NH_3	CO_2e
Marine	Berth	95.77	7.90	19.71	5.19	4.22	4.05	3.73	0.02	12,975
	Anchor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
	Transit	5.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
	Tug	6.98	0.00	0.83	0.45	0.19	0.18	0.17	0.02	427
Rail	Idle	40.69	0.19	6.30	1.94	1.00	1.00	0.97	0.27	2,685
	Transit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
CHE	Direct	22.32	0.02	15.55	1.75	1.40	1.40	1.36	0.03	2,376
	Indirect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	646
Onroad Vehicle	Facility	0.56	0.01	4.09	0.16	0.07	0.07	0.03	0.02	598
	Commuter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Admin	Direct	0.36	0.00	0.20	0.03	0.02	0.02	0.02	0.03	362
	Indirect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
Total Exhaust		**171.97**	**8.12**	**46.69**	**9.52**	**6.91**	**6.73**	**6.27**	**0.39**	**20,074**
Fugitive	Materials Handling	-	-	-	-	213.78	100.48	15.39	-	-
Total Fugitive		-	-	-	-	**213.78**	**100.48**	**15.39**	-	-

Table 4-22: 2018 Future without Project Estimates assuming 33 mtpa in the RSA (tonnes)

Source Group	Sub-group	NO_x	SO_x	CO	VOC	PM	PM_{10}	$PM_{2.5}$	NH_3	CO_2e
Marine	Berth	95.77	7.90	19.71	5.19	4.22	4.05	3.73	0.02	12,975
	Anchor	199.65	16.62	41.46	10.90	8.87	8.52	7.83	0.04	27,291
	Transit	173.45	7.30	24.05	10.12	5.06	4.85	4.47	0.33	9,913
	Tug	13.99	0.01	1.67	0.91	0.38	0.37	0.34	0.03	856
Rail	Idle	40.69	0.19	6.30	1.94	1.00	1.00	0.97	0.27	2,685
	Transit	77.26	0.36	11.97	3.68	1.91	1.91	1.85	0.51	5,098
CHE	Direct	22.32	0.02	15.55	1.75	1.40	1.40	1.36	0.03	2,376
	Indirect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	646
Onroad Vehicle	Facility	0.56	0.01	4.09	0.16	0.07	0.07	0.03	0.02	598
	Commuter	0.48	0.01	3.69	0.11	0.01	0.01	0.01	0.04	557
Admin	Direct	0.36	0.00	0.20	0.03	0.02	0.02	0.02	0.03	362
	Indirect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
Total Exhaust		**624.52**	**32.41**	**128.69**	**34.78**	**22.94**	**22.20**	**20.60**	**1.33**	**63,362**
Fugitive	Materials Handling	-	-	-	-	213.78	100.48	15.39	-	-
Total Fugitive		-	-	-	-	**213.78**	**100.48**	**15.39**		-

4.3 Fuels and Energy Analysis

The 2012 baseline is re-assessed in this section to distinguish Westshore's emissions footprint by the various energy sources used to process and move coal through the terminal. The emissions are limited to combustion sources only (fugitive dust is not included). Tables 4-24 and 4-25 provide the 2012 baseline inventory by fuel source for the LSA and RSA, respectively.

Table 4-23: 2012 Baseline Emissions Inventory in the LSA by Fuel Source

Fuel Source	NO_x	SO_x	CO	VOC	PM	PM_{10}	$PM_{2.5}$	NH_3	CO_2e
Diesel	56.71	0.18	18.70	3.32	2.14	2.14	2.07	0.26	4,330
Marine Fuels	139.11	160.55	18.25	5.18	17.85	17.14	15.77	0.04	11,695
Gasoline	1.37	0.02	11.71	0.51	0.07	0.07	0.04	0.07	1,069
Propane	0.39	0.00	0.34	0.04	0.02	0.02	0.02	0.03	364
Electricity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	558
Total	**197.49**	**160.74**	**45.32**	**8.84**	**20.09**	**19.37**	**17.90**	**0.40**	**18,018**

Table 4-24: 2012 Baseline Emissions Inventory in the RSA by Fuel Source

Fuel Source	NO_x	SO_x	CO	VOC	PM	PM_{10}	$PM_{2.5}$	NH_3	CO_2e
Diesel	128.05	0.48	25.27	6.57	3.93	3.93	3.81	0.69	8,694
Marine Fuels	625.79	633.91	73.30	22.80	72.99	70.07	64.46	0.36	43,116
Gasoline	1.37	0.02	11.71	0.51	0.07	0.07	0.04	0.07	1,069
Propane	0.39	0.00	0.34	0.04	0.02	0.02	0.02	0.03	364
Electricity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	558
Total	**755.58**	**634.41**	**110.61**	**29.92**	**77.01**	**74.09**	**68.33**	**1.16**	**53,800**

Most of the baseline emissions derive from marine fuels (heavy fuel oil as well as marine distillate), with diesel consumed by the landside sources (trains, CHE) also significant. Emissions associated with electricity and propane use are very low. Propane consumption of the new facilities is not expected to increase over that presently used by the existing shops and offices.

5.0 RESULTS AND ASSESSMENT CRITERIA

An air quality assessment was completed for Westshore Terminals in advance of a proposed replacement of Westshore's current electric powered stacker-reclaimers that handle coal on site. The assessment includes development of an emissions inventory of both exhaust emissions as well as fugitive dust emissions for the most current operations year (2012) and the future year of 2018 when the replacements would be fully implemented. The changes to the terminal, which include a new shiploader as well as moving the location of the current administration buildings, are expected to increase handling efficiencies and the maximum coal throughput the terminal is able to process and load to ships from 33 mtpa to 36 mtpa. Westshore processed approximately 26.5 mtpa in 2012; however, the terminal's second berth was knocked out of commission during December of that year, limiting the amount of coal processed from approximately 28.2 mtpa that would have otherwise occurred.

Three emission estimates were developed to evaluate the air quality implications of the project; the baseline emissions inventory in 2012 (2012 Baseline) relating to 28.2 mtpa, and two future scenarios with higher throughput: 2018 Future with Project (36 mtpa) and 2018 Future without Project (33 mtpa). Following the PMV Guidance, the assessment criteria for the project is considered to be:

- CAC emissions, including DPM for the baseline and 2018 operations under maximum capacity.
- GHG emissions, as indicated by CO_2e, including the indirect emissions associated with electricity use.

A review of available ambient monitoring data in the general area was also completed as part of the study. This review found that the current air quality levels experienced near Westshore are compliant with all relevant objectives and standards, with the exception of total suspended particulate matter (TSP). Two exceedences of the federal Maximum Acceptable 24-hour TSP objective occurred during 2010 - 2012 at the BC Ferries Tsawwassen terminal. For this reason, PM emissions were considered an existing sensitivity for the project analysis (in addition to other air contaminants).

During 2013 Westshore installed a new and upgraded site dust suppression system including the complete replacement and renewal of the rain-gun and underground distribution system. The project also included the addition of 12 new tower sprays to augment the existing 5 and a recycled water screen plant. Westshore is committed to a program of continuous improvement and as such, Westshore's ability to limit fugitive dust emissions in future years is expected to improve.

While not formally required, the indirect GHG emissions associated with electricity use at the terminal were included with the assessment. However, due to availability of low carbon electricity in the province of British Columbia, the indirect CO_2e emissions from electricity use is relatively low compared to the combustion sources accounted for in the inventory. These emissions account for approximately 3% and

1% of the total estimated CO_2e emissions within the Local Study Area (LSA) and the Regional Study Area (RSA), respectively.

Table 5-1 provides a summary of the emission estimates, including the difference in emissions from the 2012 baseline and the 2018 scenarios. The comparison is made for both the LSA and the RSA. The RSA differs from the LSA by including the ship, rail and vehicle movements over a broader area where the Westshore-based traffic makes up a significant amount of the total traffic.

The emission estimates show that the key CACs of interest (NO_x, SO_x, PM, PM_{10}, $PM_{2.5}$) decrease with both 2018 scenarios in the LSA and RSA, exception PM and PM_{10}. Total PM and PM_{10} are estimated to increase by 2018 (for the LSA only) with the Future Without Project scenario. DPM emissions are expected to dramatically decline in the LSA and RSA by 2018 with both scenarios.

GHG emissions, as indicated by the CO_2e amounts, are projected to increase in the LSA and RSA for both scenarios. For the Future with Project scenario, CO_2e emissions increase by 15.6% and 26.2% in the LSA and RSA respectively. For the Future without Project scenario, the estimated increases are 11.4% and 17.8%, respectively.

Table 5-1: Summary of Baseline (2012) and Future (2018) Scenario Emissions (tonnes)

Emissions Inventory	NO_x	SO_x	CO	VOC	PM	PM_{10}	$PM_{2.5}$	DPM	NH_3	CO_2e
Local Study Area										
2012 Baseline	197.49	160.74	45.32	8.84	195.55	101.84	30.53	17.84	0.40	18,018
2018 Future with Project	178.87	8.31	49.68	10.20	181.38	88.89	19.11	6.52	0.43	20,822
2018 Future without Project	171.97	8.12	46.69	9.52	220.69	107.21	21.67	6.23	0.39	20,074
% Change with Project	-9.4%	-94.8%	9.6%	15.4%	-7.2%	-12.7%	-37.4%	-63.5%	7.0%	15.6%
% Change without Project	-12.9%	-94.9%	3.0%	7.6%	12.9%	5.3%	-29.0%	-65.1%	-1.1%	11.4%

Table 5-1 (Cont'd): Summary of Baseline (2012) and Future (2018) Scenario Emissions (tonnes)

Emissions Inventory	NO_x	SO_x	CO	VOC	PM	PM_{10}	$PM_{2.5}$	DPM	NH_3	CO_2e
Regional Study Area										
2012 Baseline	755.58	634.41	110.61	29.92	252.47	156.56	80.96	68.33	1.16	53,800
2018 Future with Project	672.54	34.64	138.43	37.46	198.80	105.70	34.67	22.14	1.45	67,887
2018 Future without Project	624.52	32.41	128.69	34.78	236.72	122.68	36.00	20.55	1.33	63,362
% Change with Project	-11.0%	-94.5%	25.1%	25.2%	-21.3%	-32.5%	-57.2%	-67.6%	25.0%	26.2%
% Change without Project	-17.3%	-94.9%	16.3%	16.2%	-6.2%	-21.6%	-55.5%	-69.9%	15.1%	17.8%

Estimated changes to emissions from 2012 to 2018 are displayed graphically in Figure 5-1 and Figure 5-2.

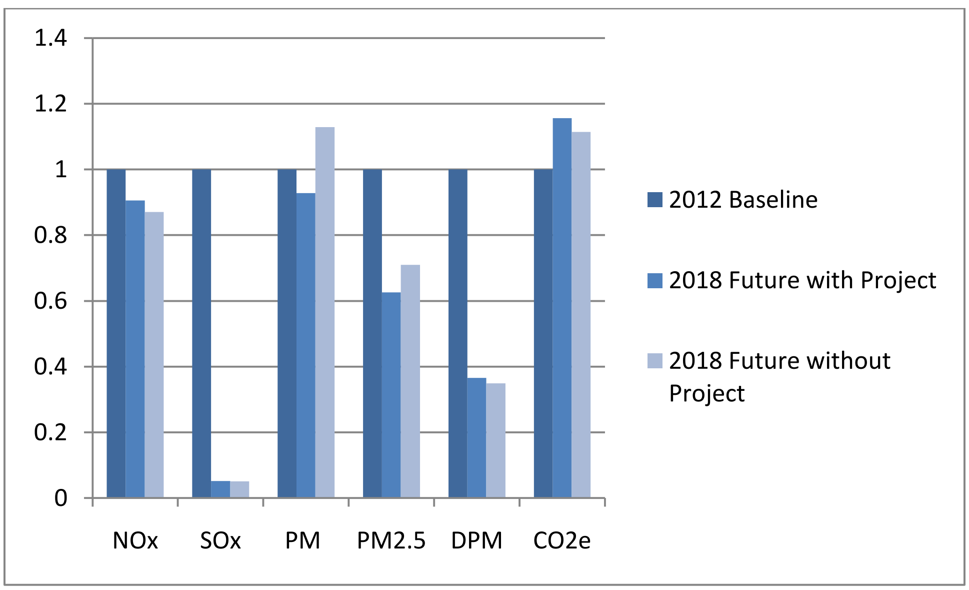


Figure 5-1: Estimated Scenario Emissions in the LSA (as fraction of baseline)

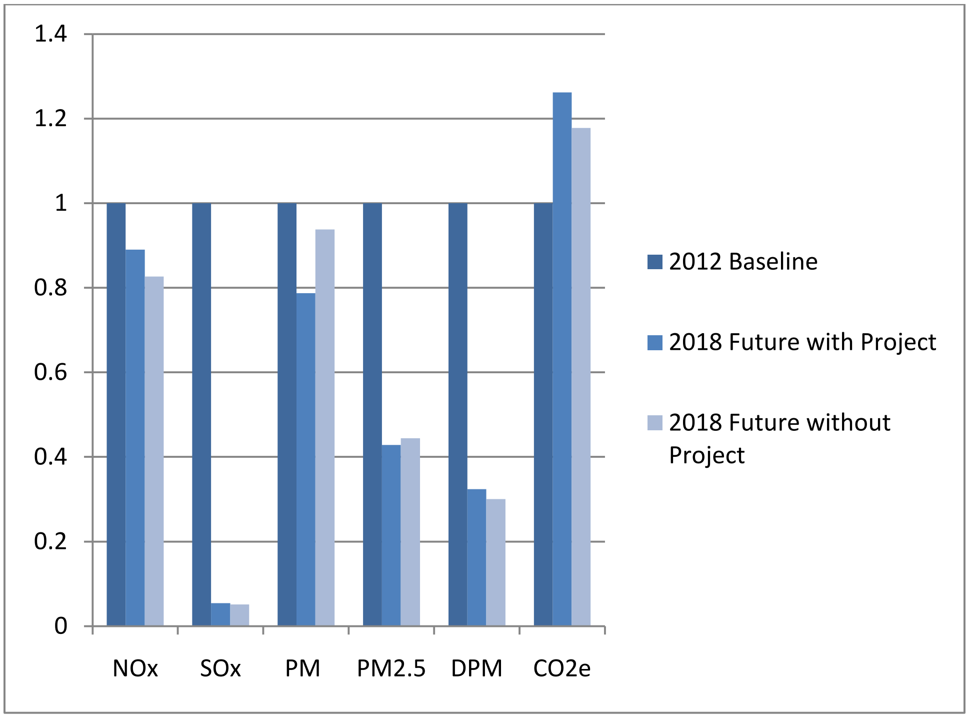


Figure 5-2: Estimated Scenario Emissions in the RSA (as fraction of baseline)

With the exception of GHGs, reductions in the annual air emissions associated with Westshore operations are expected by 2018 for the key air contaminants of concern. These reductions are expected even if an increase in coal throughput occurs by this year. The reductions are expected to be realized through improvements to emissions performance of the ships and locomotives that serve the terminal, as well as improvements to the coal handling efficiency on the terminal itself (for the Future with Project scenario only). Westshore has limited ability to influence the total GHG emissions associated with the rail and ship movements through the port. However, Westshore participates in larger scale emission reduction programs, such as PMV's Air Action Strategy that work towards minimizing all air contaminants associated with marine and port activities.

APPENDIX A

Supplementary Tables

Table A-1: Ship Call Data to Westshore in 2012

Ship Name	Arrival Date	Vessel DWT	Anchor Hours	Berth Hours
CAPE ACACIA**	1/1/2012	206237	73.93	71.17
AUDAX	1/2/2012	75220	115.63	71.52
GOLDEN HOPE	1/4/2012	176890	98.75	30.42
SEA GLORIA*	1/5/2012	157600	147.48	117.75
CAPE KEYSTONE	1/6/2012	179200	14.40	74.77
CAPE SUN*	1/9/2012	176000	772.50	174.75
GOLDEN EMPRESS	1/10/2012	79471	73.00	43.17
CSK BRILLIANCE*	1/12/2012	179942	335.30	100.00
NAVIOS GEMINI S	1/16/2012	68636	17.67	48.58
OCEAN GARNET	1/17/2012	92500	27.48	46.17
ROSEMARY	1/18/2012	179742	16.10	41.92
HANJIN PORT HEDLAND	1/19/2012	179283	27.52	112.58
JEWEL OF DUBAI	1/20/2012	55885	610.70	41.73
GLOBAL FALCON	1/22/2012	51725	71.20	28.80
AMORITA	1/23/2012	46667	31.43	46.75
CHRISTIANNA	1/23/2012	82176	38.20	63.47
JIN STAR	1/25/2012	79387	13.57	49.97
ROSEMARY	1/26/2012	179742	210.90	45.70
ARKADIA	1/28/2012	56100	0.00	68.08
LEON V	1/28/2012	146019	60.58	43.25
STX BONA	1/30/2012	175401	12.63	76.62
CORVIGLIA	1/31/2012	73035	605.07	36.67
FAR EASTERN JUPITER	2/1/2012	82655	49.60	47.85
FRONTIER JACARANDA	2/2/2012	182757	76.83	102.08
NEW HERALD	2/3/2012	72875	40.33	44.50
STAR OF EMIRATES	2/5/2012	83610	73.20	36.67
LEON V	2/7/2012	146019	60.58	35.83
C. ATLAS	2/7/2012	179185	14.80	87.92
MARGRETH PISSAREK	2/8/2012	81439	482.00	59.83
NORTH FRIENDSHIP	2/11/2012	74732	391.82	35.00

Table A-1 (Cont'd): Ship Call Data to Westshore in 2012

Ship Name	Arrival Date	Vessel DWT	Anchor Hours	Berth Hours
TANAGER BULKER	2/11/2012	57991	74.30	13.97
KEY HUNTER	2/11/2012	82099	6.17	54.17
MEDI SALERNO	2/12/2012	81702	8.67	46.50
NEW HORIZON	2/14/2012	38468	178.10	20.50
55000EPIC	2/14/2012	182060	46.50	72.22
SINCERE SALUTE	2/15/2012	85778	64.50	46.83
K. FAITH	2/17/2012	75845	56.80	45.50
GRANDE SOLARIS	2/17/2012	172694	83.80	61.83
MIZUNAGI MARU	2/19/2012	82619	114.08	35.58
CAPE SASANQUA	2/20/2012	207860	0.00	90.18
ALONA	2/20/2012	177944	130.82	87.08
OCEAN PROMETHEUS	2/24/2012	203200	153.58	95.75
KATE	2/24/2012	176405	159.50	138.80
AOM MILENA	2/28/2012	76606	597.40	65.58
CAPE VIOLET	5/1/2012	180274	257.50	91.00
WESER	5/2/2012	75321	1,474.00	36.67
POS COURAGE	5/3/2012	76801	129.90	57.42
ROSEMARY	5/4/2012	179742	194.30	73.27
PREMA ONE	5/6/2012	71741	883.38	32.62
CORONA GARLAND	5/7/2012	88222	280.08	50.72
CRECIENTE	5/8/2012	152065	181.58	35.67
LINDA HOPE	5/9/2012	181458	339.87	76.50
THRASHER	5/9/2012	53360	854.40	25.67
NAVIOS HYPERION	5/10/2012	75707	187.92	41.17
CORONA FRONTIER	5/12/2012	88291	35.80	33.17
ANANGEL MERCHANT	5/12/2012	179719	623.23	75.55
PINCHAT	5/14/2012	81290	557.20	39.95
HANJIN PORT HEDLAND	5/15/2012	179283	327.80	20.17

Table A-1 (Cont'd): Ship Call Data to Westshore in 2012

Ship Name	Arrival Date	Vessel DWT	Anchor Hours	Berth Hours
BULK PROSPERITY	5/16/2012	172589	629.92	61.33
HANJIN PORT KEMBLA	5/16/2012	126267	235.70	75.92
MONA PEGASUS	5/18/2012	172571	128.50	65.42
OCEAN ETERNITY	5/19/2012	50630	576.00	25.75
MATSUURA	5/20/2012	86062	221.42	62.17
SEMIRIO	5/21/2012	174261	56.93	81.08
JEWEL OF DUBAI	5/23/2012	55885	178.30	29.17
STX BONA	5/24/2012	175401	498.67	82.50
CARAVOS GLORY	5/24/2012	82000	370.47	62.33
HANJIN PITTSBURG	5/27/2012	38393	314.70	34.17
AIGAION	5/28/2012	170081	90.42	68.58
MARIETTA	5/29/2012	73880	79.52	37.67
OCEAN PARADISE	5/30/2012	58701	82.60	28.00
GOODWILL	5/31/2012	149401	0.00	57.08
IKAN BAWAL*	5/31/2012	83454	234.30	70.17
OTOTACHIBANA	6/3/2012	207964	2.33	83.58
GENCO PICARDY	6/3/2012	55257	32.90	29.83
ALPHA ACTION	6/5/2012	150790	73.58	45.67
STX FREESIA	6/6/2012	180736	290.92	88.67
BULK HONG KONG	6/7/2012	180230	138.87	48.67
FELICIA *	6/9/2012	72456	2.08	32.42
DONG-A OKNOS	6/10/2012	179329	360.90	42.77
BELLE ROSE	6/10/2012	50472	36.75	27.92
SALAMANCA	6/11/2012	46743	32.70	25.75
BULK HONG KONG	6/12/2012	180230	69.28	28.88
BARGE PCC PROVIDER	6/12/2012	7200	0.00	6.50
SHIN-EI	6/13/2012	207933	110.17	61.50
BRILLIANT RIVER	6/16/2012	154249	0.00	52.50

Table A-1 (Cont'd): Ship Call Data to Westshore in 2012

Ship Name	Arrival Date	Vessel DWT	Anchor Hours	Berth Hours
ENERGY ANGEL	6/16/2012	77697	0.00	39.42
SHIN-EI	6/18/2012	207933	227.42	21.58
CORAL RING	6/18/2012	75395	52.08	40.42
OCEAN PROMETHEUS	6/19/2012	203200	16.17	82.92
CSK BRILLIANCE*	6/20/2012	179942	35.00	54.37
SHOHO	6/22/2012	87996	34.92	42.33
DONG-A OKNOS	6/22/2012	179329	247.20	39.58
CSK BRILLIANCE*	6/24/2012	179942	37.60	53.62
OCEAN ALLIANCE	6/24/2012	52388	80.85	25.33
PACIFIC TIARA	6/25/2012	180310	524.42	126.75
AVRA	6/26/2012	75121	103.42	30.42
AMAZING SALUTE	6/28/2012	107288	536.33	61.50
CHINA PROGRESS	6/30/2012	174322	76.30	61.83
ROSEMARY	6/30/2012	179742	80.67	77.33
SHIGA	7/3/2012	176990	441.25	77.92
IRON LINDREW	7/4/2012	82191	148.92	40.17
KT BIRDIE	7/6/2012	74886	133.50	34.13
HANJIN PORT HEDLAND	7/6/2012	179283	259.00	68.58
PIET	7/7/2012	93200	93.90	50.67
HANJIN SHIKOKU	7/9/2012	181502	437.27	72.25
STX CHAMPION	7/9/2012	175293	23.67	87.75
NAVIOS FELICITY	7/12/2012	73867	52.47	28.33
KEY FRONTIER	7/13/2012	81500	168.10	38.67
STX BONA	7/13/2012	175401	290.00	77.67
NEW HORIZON	7/15/2012	38468	15.50	25.17
GLOBAL ISLAND	7/16/2012	53556	38.80	26.42
STX CHAMPION	7/17/2012	175293	202.55	14.50
CHINA STEEL ENTREPRENEUR	7/17/2012	203512	249.90	61.50

Table A-1 (Cont'd): Ship Call Data to Westshore in 2012

Ship Name	Arrival Date	Vessel DWT	Anchor Hours	Berth Hours
GLOBAL WIND	7/18/2012	53026	0.00	33.25
TIAN LI HAI	7/20/2012	148726	45.17	32.17
CHINA ACT	7/20/2012	151688	159.90	51.08
GLOBAL WIND	7/21/2012	53026	28.67	10.50
CHANCHAL PREM	7/21/2012	93258	21.30	46.17
OTOTACHIBANA	7/22/2012	207964	116.50	93.02
TIAN LI HAI	7/23/2012	148726	53.75	35.50
CORONA KINGDOM	7/25/2012	88233	37.17	45.25
CERBA	7/26/2012	80370	60.75	37.67
COPOSA	7/27/2012	46493	90.17	23.25
ANTONELLA LEMBO	7/28/2012	93257	14.58	34.92
GLOBAL LEGACY	7/28/2012	52223	32.30	30.75
CIC PRIDE	7/29/2012	171381	41.80	88.33
NEW PRIDE	8/1/2012	58761	0.00	43.60
HANJIN CAPETOWN	8/2/2012	151525	57.60	82.08
WESTERN OSLO	8/3/2012	56548	31.80	53.37
SPRING AEOLIAN	8/5/2012	83478	25.00	40.75
DELTA PRIDE	8/6/2012	38486	9.92	22.58
MATSUURA	8/6/2012	86062	37.33	49.83
ALPHA PROGRESS	8/8/2012	82000	105.17	35.42
CSE HARMONY EXPRESS	8/9/2012	76634	0.00	42.67
CAPE PROGRESS	8/10/2012	185920	0.00	99.45
PRABHU SHAKTI	8/11/2012	83690	0.00	47.18
UNITED GALAXY	8/13/2012	82100	26.08	46.67
OCEAN PROMETHEUS	8/14/2012	203200	82.92	72.58
C. S. PEGASUS	8/15/2012	77663	23.17	45.92
JIAN HUA	8/17/2012	73747	58.28	37.42
ZHONG TENG HAI	8/17/2012	178242	69.23	126.58

Table A-1 (Cont'd): Ship Call Data to Westshore in 2012

Ship Name	Arrival Date	Vessel DWT	Anchor Hours	Berth Hours
MILAGRO	8/19/2012	75205	52.00	41.83
SHORYU	8/20/2012	92418	40.33	42.00
NEW VISION	8/22/2012	48221	45.50	27.58
NSS ADVANCE	8/23/2012	173246	48.00	69.58
SHIRANE	8/23/2012	77672	7.67	41.33
ASHIYA STAR *	8/25/2012	52223	0.00	28.42
MINERAL MANILA	8/26/2012	179842	46.13	20.00
MINERAL MANILA	8/27/2012	179842	89.30	60.00
SOUTHERN WISDOM	8/30/2012	177325	13.08	63.33
KEY CALLA	8/30/2012	83353	0.00	38.05
HONG HING	9/1/2012	76549	1.42	35.75
NSS ADVANCE	9/2/2012	173246	174.15	10.65
KURENAI	9/3/2012	86041	37.42	33.50
NEW JOY	9/4/2012	149297	9.10	67.42
STX FREESIA	9/4/2012	180736	0.00	105.50
GLORIOSA LILY	9/7/2012	119488	8.67	65.92
CHINA STEEL EXCELLENCE	9/9/2012	175775	24.08	136.50
HANJIN PITTSBURG	9/10/2012	38393	4.75	33.58
GLOBAL GARNET	9/11/2012	52223	112.30	28.25
ANTONELLA LEMBO	9/13/2012	93257	153.13	44.33
OTOTACHIBANA	9/14/2012	207964	14.17	75.58
ANANGEL GLORY	9/15/2012	180575	0.00	86.08
ANTONELLA LEMBO	9/18/2012	93257	67.78	14.08
RED LILY	9/18/2012	76606	263.03	69.02
BOTAFOGO	9/19/2012	76623	0.00	36.25
E.R. BRANDENBURG	9/20/2012	179436	11.62	76.08
HANJIN CAPE LAMBERT	9/21/2012	179147	0.00	109.00
NORTH FORTUNE III	9/25/2012	91439	74.67	38.50

Table A-1 (Cont'd): Ship Call Data to Westshore in 2012

Ship Name	Arrival Date	Vessel DWT	Anchor Hours	Berth Hours
VENUS HALO	9/26/2012	55848	0.00	18.08
AUSTRALIA MARU	9/27/2012	180200	24.13	93.17
OCEAN COMPASS	9/27/2012	180200	44.28	79.50
SHIOSAI	9/30/2012	176827	96.58	101.00
NORTH FORTUNE III	10/1/2012	91439	79.67	45.33
BULK PROSPERITY	10/3/2012	172589	118.58	87.17
OCEAN PROMETHEUS	10/5/2012	203200	132.17	81.25
VENUS HALO	10/6/2012	55848	226.33	29.58
CSK BRILLIANCE*	10/8/2012	179942	185.80	57.38
HYUNDAI VISION	10/8/2012	179135	68.40	97.20
COLLONGES	10/10/2012	149391	258.90	69.67
LAKE DAHLIA	10/12/2012	78802	78.47	43.70
CAPE NORTHVILLE	10/13/2012	169126	0.00	84.58
NIKOMARIN	10/14/2012	82623	90.08	34.08
CSK BRILLIANCE*	10/16/2012	179942	129.00	30.50
ELEGANT STAR	10/17/2012	177216	224.13	94.17
HANJIN PORT HEDLAND	10/17/2012	179283	40.00	69.92
LEO FELICITY	10/20/2012	178564	68.17	89.33
CAPE SAKURA	10/21/2012	181529	17.20	93.75
CORONA LIONS	10/24/2012	86141	63.75	49.08
MARTINE	10/26/2012	86800	0.00	72.67
JU HUA HAI	10/29/2012	115076	0.00	56.17
ZAMPA BLUE	10/30/2012	178459	0.00	96.08

Table A-2: Cargo Handling Equipment at Westshore in 2012

Equipment Type	Engine Model Year	Number of Similar Units	Fuel Type	Engine Power or Boiler Rating	Power Units (kW, hp, BTU/hr)	US EPA Emissions Tier	Annual Hours of Use (for one unit)	Comments
Crawler Tractor/Dozers	1995	1	1 - Diesel	520	hp	Pre-Tier	1,822	WTL# 307
Crawler Tractor/Dozers	1996	1	1 - Diesel	520	hp	Pre-Tier	2,394	#308
Crawler Tractor/Dozers	2005	1	1 - Diesel	646	hp	Tier 3	2,353	# 309
Cranes (not RTG)	1985	3	3 - Electricity	1540	hp		6,400	S/R 41, 42, 43 Heavy duty electric-powered cranes - estimated hours based on electricity usage.
Cranes (not RTG)	2010	1	3 - Electricity	1540	hp		6,400	S/R 44 Heavy duty electric-powered cranes - estimated hours based on electricity usage
Excavators (normal/adapted for logs)	1983	1	1 - Diesel	150	hp	Pre-Tier	200	#507 130G CAT GRADER
Welders	1993	1	1 - Diesel	30	hp	Pre-Tier	400	#729 HOBART - MA5040DD WELDER
Tractors/Loaders/Backhoes	1995	1	1 - Diesel	270	hp	Pre-Tier	400	#509 VOLVO LOADER L180 SERIES 1700
Gas Compressors	1999	1	1 - Diesel	55	hp	Tier 1	400	#739 COMPRESSOR LEROI
Welders	2000	1	1 - Diesel	35	hp	Tier 1	400	#742 MILLER BIG BLUE 5040DD
Welders	2000	1	1 - Diesel	35	hp	Tier 1	400	#743 MILLER BIG BLUE 5040DD
Yard trucks (Hostler, Goats, Terminal Tractors)	2004	1	1 - Diesel	250	hp	Tier 2	200	# 211 FREIGHTLINER M2 Chassis Mercedes 250 HP Diesel Eng.
Aerial Lifts	2005	1	1 - Diesel	140	hp	Tier 2	200	# 508 JLG G12-55A (telehandler)
Cranes (not RTG)	2005	1	1 - Diesel	210	hp	Tier 2	200	#605 RT 875E Grove 75-ton Rough Terrain Crane Engine Size Cummins QSB 5.9 L 6 cyl diesel
Yard trucks (Hostler, Goats, Terminal Tractors)	2006	1	1 - Diesel	430	hp	Tier 2	200	#217 2006 Peterbilt Model 357 truck Complete with RAFNA R-850 Rail Gear
Cranes - Other	2006	1	1 - Diesel	410	hp	Tier 2	200	#217A National 13110A 30 Ton Hyd Mounted Crane/Mounted on a 2006 Peterbuilt Model 357
Pressure Washers	2006	1	1 - Diesel	19	hp	Tier 2	200	#748 Hotsy Model HSS-603289E 3200 PSI (variable) 6.3 GPM (variable)
Generator Sets	2007	1	1 - Diesel	475	hp	Tier 3	100	#723 CATERPILLAR C15ATAAC
Signal Boards/Light Plants	2007	1	1 - Diesel	14	hp	Tier 2	200	#749 AMIDA AL 400 Engine: Kubota Diesel 13.6 HP
Pumps - Water	2007	1	1 - Diesel	80	hp	Tier 2	200	#750 Pump Diesel Powered c/w Trailer (sn.H2700005) 80 HP Duetz engine
Other Forklifts	2008	1	1 - Diesel	88	hp	Tier 2	200	#501 TMC Series FD40T9
Generator Sets	1993	1	2 - Gasoline	5	hp		200	#730 HONDA 2500X GEN SET
Generator Sets	1990	1	1 - Diesel	800	hp	Tier 1	50	#721 CATERPILLAR C18ATTAAC
Skid Steer Loaders (small loaders)	2006	1	2 - Gasoline	36	hp		200	#506 CLARK BOBCAT
Welders	2000	1	2 - Gasoline	30	hp		400	#522 MILLER BIG 40 WELDER
Other Forklifts	2000	1	4 - Propane	58	hp		200	#504 FORKLIFT DAEWOO MODEL G30P
Pumps - Water	1995	1	1 - Diesel	100	hp	Pre-Tier	400	#234A Fuel type estimated by SLE; JOHN DEERE
Pumps - Water	2006	2	1 - Diesel	100	hp	Tier 2	800	#219A Fuel type estimated by SLE; JOHN DEERE

Table A-3: Cargo Handling Equipment Categories for NONROAD Emissions Modelling

General Equipment Type	Specific Equipment Type	SCC Code	NONROAD Equipment Type
Aux/Misc	Air Compressors	006015	Air Compressors
	AC\Refrigeration	003060	Refrigeration
	Aerial Lifts	003010	Aerial Lifts
	Crushers/grinders	002054	Crushing/Proc. Equipment
	Gas Compressors	006020	Gas Compressors
	Generator Sets	006005	Generator Set
	Conveyors (listed as "Pumps – Transfer" in database)	003050	Other Material Handling Equipment
	Pumps - Water	006010	Pumps
	Pressure Washers	006030	Pressure Washers
	Roller/compactors	002015	Rollers
	Signal Boards/Light Plants	002027	Signal Boards
	Sweepers/Scrubbers	003030	Sweepers/Scrubbers
	Welders	006025	Welders
Loader	Crawler Tractor/Dozers	002069	Crawlers Tractors/Dozers
	Excavators (normal/adapted for logs)	002036	Excavators
	Feller/Bunchers	007015	Fellers/Bunchers/Skidders
	Other Forklifts	003020	Forklifts
	Rubber-Tire Loaders	002060	Rubber Tire Loaders
	Skid Steer Loaders (small loaders)	002072	Skid Steer Loaders
	Tractors/Loaders/Backhoes	002066	Tractors/Loaders/Backhoes
Stack/Crane	Cranes - Other	002045	Cranes
	Cranes - STS	002045	Cranes
	Chassis Stackers	003040	Other General Industrial Equipment
	Reach Stackers	003040	Other General Industrial Equipment
	Cranes - Rubber-tired gantries	003050	Other Material Handling Equipment
	Top or Side Picks Chassis or Reach Stackers	003040	Other General Industrial Equipment
Truck Offroad	Off-Hwy Truck (Not registered for onroad use)	002051	Off-Highway Trucks
	Yard trucks (Hostler, Goats, Terminal Tractors)	003070	Terminal Tractors

Table A-4: Onroad Vehicle Fleet at Westshore in 2012

Vehicle Type	General Fleet Age	Number of Units	Fuel Type
Heavy Commercial Truck	2005 - 2009	5	1 - Gasoline
Pickup Truck	2000 - 2004	5	1 - Gasoline
Pickup Truck	2005 - 2009	19	1 - Gasoline
Pickup Truck	2010 and newer	13	1 - Gasoline
Pickup Truck	1995 - 1999	2	1 - Gasoline
Van	2005 - 2009	1	1 - Gasoline
Car	2005 - 2009	1	1 - Gasoline
Heavy Commercial Truck	1995 - 1999	1	1 - Gasoline
Heavy Commercial Truck	1989 and older	1	1 - Gasoline
Medium Commercial Truck	2010 and newer	1	1 - Gasoline
Heavy Commercial Truck	1995 - 1999	1	1 - Gasoline
Heavy Commercial Truck	2005 - 2009	2	2 - Diesel
Heavy Commercial Truck	2005 - 2009	1	1 - Gasoline

Table A-5: Monthly Ship Loading Summary at Westshore in 2012

2012	Ships Sailed	%	Tonnes Loaded	Hours Along Side
January	23	7.8%	2,048,535	1,436.40
February	22	9.1%	2,404,511	1,356.68
March	20	7.6%	1,983,422	1,220.80
April	20	6.7%	1,748,882	1,207.83
May	28	10.5%	2,738,194	1,439.10
June	29	9.3%	2,434,723	1,326.38
July	28	10.7%	2,807,572	1,365.82
August	25	8.1%	2,107,610	1,271.15
September	23	8.5%	2,228,492	1,302.58
October	19	8.8%	2,289,437	1,317.20
November	22	8.1%	2,118,546	1,258.87
December	11	4.8%	1,262,768	940.97
YTD	**270**	**100.0%**	**26,172,692**	**15,443.78**

APPENDIX 2

Management Plans

Appendix E – Environmental Assessment

This appendix contains an evaluation of how aspects of the Infrastructure Reinvestment Project relate to environmental issues.

The following topics are addressed in this Appendix E:

5.1 Dust Management Plan

Contents

5.1.1 Background

Westshore Terminals is the operator of the coal exporting terminal located at Roberts Bank, Delta, BC. The operation consists of unloading coal from railcars, storing in stockpiles and then loading the coal on to ocean–going vessels. Since the commencement of operations in 1970, the terminal has undergone several expansions and now has the capacity to ship approximately 33million tonnes per year. It has approximately 300 full time equivalent employees.

Westshore Terminals operation is located on federal land and is under the jurisdiction of the Vancouver Port Authority, also known as Port MetroVancouver. By agreement, for air quality management issues Westshore reports to MetroVancouver and is the permit holder of Air Quality Management Permit GVA-0153 issued by MetroVancouver. This permit regulates the amount of air borne contaminants that can be discharged from the site and requires to be updated to reflect the new equipment and dust suppression facilities added in 2012 and 2013 which will form the basis of the system used to suppress dust in the future.

Over the years Westshore has developed a comprehensive approach to limiting the amount of dust generated during the handling of coal through the operation. The procedures and practices used are consistent and comparable to those used in large coal terminals around the world.

Westshore Terminals dust suppression capabilities have been the source of continuous improvement since inception. In the initial operations limited water spraying capability was in place which were greatly expanded in the expansion of 1980 when a dedicated ring main and reservoirs were installed and a combination of low mast rain gun sprays together with high mast spray poles.

Additional low mast and high mast sprays were added in 1993 with the relocation of the dumping facilities and the build out on to the west side of the terminal with the extension of Conveyor 9A allowing S/R 42 to traverse the length of the coal storage area.

1993 Low Mast Rain-Guns

1993 High Mast Sprays

The first generation of a tower spray was erected with a height of 85ft and cross arms 24 ft in length which provided a misting spray to the central pile area difficult to reach by the perimeter sprays.

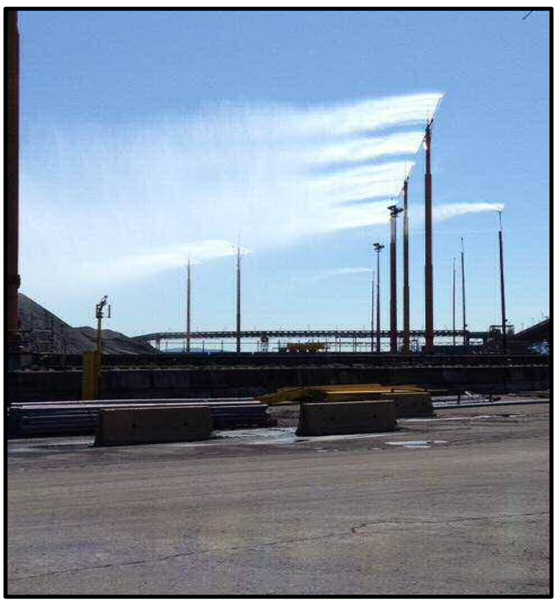
During the period 2008-2011, Westshore added to these resources by the erection of four more towers in key locations within the coal stockpile area to bring the total to five by 2011. These second generation tower sprays were 124ft tall with cross arms of 100ft.

2008 Tower Spray

In 2012 Westshore determined that the condition of aging infrastructure comprising valves, pipes and control systems, required replacement and upgrading. Some parts to the system had become obsolete and more difficult to replace. The investigation also lead to the conclusion that the remote control system associated with the water sprays also required to be upgraded.

In late 2012 capital funds were secured for the wholesale replacement of the existing system with the objective of having the replacement system on-line for the spring summer season of 2013. Contracts were placed on a fast track basis and details were completed for a new and expanded system. The details include replacing all the underground valves and piping and eliminating the underground electrical wiring between each pole in favour of constructing a consolidated valve house to service each quadrant of the site area. As well, 12 additional tower sprays were constructed, including water supply mains and piping, to bring the overall number of tower sprays up to total of 17. The new generation of tower spray has a height of 130ft with a cross arm 130ft long. These have been located at the edge of the coal storage area across the line of the prevailing wind direction

The layout and location of the new rain-guns and tower sprays are shown on the Dust Suppression Site Plan, Omni Dwg 2096-SK010, copy attached as Appendix 5.1.1-A



2013 New Tower Sprays

5.1.2 Potential Sources of Dust

Fine particles of dust can become air-borne when they are disturbed from their state of rest. The disturbance takes place as coal is handled through the operation from the time it is discharged from railcars at the dumper, being conveyed to storage, exposure to wind in storage and subsequently while being reclaimed from storage for ship loading. The key areas which are continuously addressed during the normal course of operations at the terminal are:

.1 Wind erosion

.2 Mechanical disturbance by the action of moving

5.1.3 Methods Used for the Prevention of Dusting

Westshore employs a multi- layered approach to prevent dust emissions depending on the source. These methods include:

- Water spraying to maintain an elevated surface moisture
- Containment by enclosure
- Sealing exposed surfaces with a binding agent
- Stockpile profiling and compaction
- Dust removal from paved areas
- Spillage clean up
- Magnesium Chloride sprayed on conveyor roads

These strategies employ various company resources and assets which are deployed when required. The determination of how to respond to any potential dusting risks rests with the Operations Department which is proactive in its approach and required to anticipate what issues may arise.

The decision making is enhanced by weather forecasting inputs from Environment Canada and UBC and from the internal systems control interface on-site with real-time feedback from a weather station which provides wind speed, wind direction, precipitation, temperature and humidity.

5.1.4 Dust Control Application Systems

.1 Dust Control in Transit

The first application of a dust control agent takes place at the mine-load out station with the rail-cars being profiled during load-out to present a smooth tight surface which is then sprayed with a binding agent to seal the surface during transit. Since 2003, the rail cars transiting from the mines from south-east British Columbia have been receiving a second spraying of topping agent at a location near Kamloops .This automated facility coats the tops of the cars as they pass through the spray arches.

Westshore Terminals' role commences once the coal has been delivered to the terminal via a unit train delivery system operated by a railway operator, CPR, CN or BN bringing the coal from the coal mine source.

.2 Dust Control during Terminal Operations

.1 Railcar Unloading.

Once the unit train arrives on site, Westshore Terminals arranges for the trains to be directed to the appropriate dumper station for unloading. The railcars of the unit train are connected by rotary couplings such that the railcar can be inverted at the dump station to allow the coal to flow into the hopper below and the railcars need not be uncoupled during this operation.

A T-bar water spray is located at the entry to the dumper to spray water on to the cars to wet-down the load prior to dumping.

The cars are automatically indexed forward to the dump spot position ready for unloading. The dump station is enclosed in a sheet steel building that provides containment during the unloading operation.

As the coal is tipped into the hopper below, water sprays blanket the receiving hopper with mist that suppresses the movement of particles as the coal is tipped into the pit. The coal is drawn down by vibrating feeders and delivered on to a conveyor belt for transport into the site. The delivery of coal on to the conveyor belt takes place in an enclosed skirt and water spray nozzles inject a fine mist into the skirt to suppress dust from rising while in transit on the conveyor belt.

Once the rotary dump activity is completed, the cars are returned to the upright position and automatically moved forward a precise length in order for the next cars to be moved into the dumping position. At the exit end of the dump station there is an overhead spray bar that automatically sprays water to rinse off the sills of the rail car to remove any residue that has accumulated during the dumping process.

.2 Moving Coal by Belt Conveyor

The coal is moved through the site on a series of belt conveyors which are connected by transfer points through which the coal passes and can be directed to the appropriate stockpile area. The design of the conveyors and transfers within the transport system has been done specifically to minimize dust emission levels. . Specifically, the chutes are designed to enclose the passage of coal with a minimum amount of turbulence in the system so that streamlined flow is achieved.

The chute-work in the transfer towers has recently been upgraded to reflect the best of modern design which allows the coal stream to smoothly transition from one direction to another while maintaining its flow path. These chutes reduce the amount of dust which becomes entrained at each of the transfer points and cause the coal to be delivered centrally on to the next conveyor eliminating spillage that may be caused if the conveyor belt were to be push off centre.

Each of the chutes has been equipped with a water spray system that can be used as a wash-down system to maintain the integrity of the chute performance and thus prevent the possibility of the chute plugging and causing secondary problems associated with spillage.

.3 Stockpiling and Reclaiming

Coal is placed into the stockpile by stacking machines which later reclaim the coal by the operation of a bucket wheel that continuously rotates and elevates coal on to the take-away conveyor belt. The operation of the stacker-reclaimers has been enhanced by the incorporation of automated stacking and reclaiming functions. This allows each of the four stacker -reclaimers to operate smoothly and place coal on to the stockpiles with a minimum fall distance which limits the opportunity for coal to escape. The piles are constructed with an even, uniform profile which limits the creation of dust by removing discontinuities that cause wind shear to pick up dust particles. The stacker-reclaimers were also upgraded with controlled flow chutes that have been provided at the transfer points to smooth the flow of coal through the machine to reduce dust and eliminate spillage.

.4 Shiploading

Coal is delivered to the shiploader by belt conveyor. The shiploaders travel on crane rails and comprise an out-reach boom that is positioned over the ship to deliver coal into the ship’s hold. The coal is directed by means of a vertical telescopic spout with a rotating directional spoon at the end designed to deliver a discrete coal stream to its location with the hold. This function is important for the trimming of the ship during loading and also provides dust containment while the coal is being placed.

.5 On-site Coal Storage

The nature of Westshore's business is to stockpile and store coal in quantities ready for loading on to ocean-going vessels. These vessels vary in size from 50,000 – 250,000 tonnes, and as Westshore serves a variety of mine sources, it is necessary to build stockpiles by the addition of trainload quantities over a period of days or weeks. A typical train delivers in the range of 12-16,000 tonnes. By experience, Westshore has found that the average operating volume of stockpile is around 1.3mt and it varies according to coal market conditions between about 600,000 tonnes to 1.8 mt . The maximum theoretical storage capacity is calculated to be 2.2mt although this is not a normal operating condition and could only be realized in practice if a force majeure event were to prevent vessels loading at the terminal while still allowing train deliveries to continue.

The stacking equipment can stockpile the coal 85ft high in regular piles. The piles need to be separated from each other as they are of different types and from different mine customers. Typically the stockpile layout utilizes about 24 piles ranging anywhere from about 50,000 to 200,000 tonnes. By the nature of the business, the piles are constantly being drawn down and restocked.

Westshore employs a multi-level strategy for preventing fugitive dust from leaving the stockpile area. The methods used rely primarily on the well established principal that surface moisture on the coal piles will prevent particles from becoming air-borne.

.1 Operational Procedures for Stockpiling

In order to minimize dust generation from the stockpiles during stacking and storage the following steps are taken as part of the regular operations during the stacking of the pile and over the life of the pile:

a. Moisture content of coal prone to dusting is maximised as it is transported to the stockpile using the water addition systems.
b. Stockpiles are kept as low and stacked in a manner to produce as smooth a surface as possible.
c. Stockpiles are stacked in benches to limit size segregation and maintain as consistent a particle size distribution as possible on the pile surface.
d. Stockpiles are stacked along the direction of the prevailing wind in order to minimize the wind velocity across the exposed surfaces

e. During dry periods the moisture content of the pile is monitored and kept as high as practical through the repeated use of the rain-guns and high masts.

.2 Applications

The application of surface moisture is done on a regular basis by the use of low mast rain-guns. These rain-guns have been designed for the specific purpose of distributing a large quantity of water over a defined area with generally equal amounts of water falling in the designated area. Based on Westshore experience together with the manufacturers input, the most suitable nozzle size and spacing was selected. These nozzles can throw water to a height of 95 ft and a distance of 195 ft so they are capable of spraying over the top of the stockpiles which have a maximum height of 85 ft.

Water for these rain guns is drawn from the on-site reservoirs which collect site run-off water via a system of ditches and pump-outs, which is then screened and stored ready for re-use. Automatic cycling of the system allows every one of the 94 rain-gun to be used in turn to spray water for sixty seconds. The cycle can be reinitiated at a frequency based on the requirements of the day.

A secondary application is provided by high level tower sprays which are configured to allow a fine mist to be ejected which the wind than carries with it on to the stockpiles. In this way the surface of the piles can be maintained in a moist state.

Both the rain guns and tower sprays are automated to be able to be operated on pre-selected criteria which includes weather mode which is linked to the site weather station. The run-time of each apparatus is recorded by the terminal's data collection system and can be used to assess the performance and effectiveness of the system.

A third level of spraying can be performed on an as required basis by the use of any one of Westshore's four water truck units. One recent addition to this fleet is the purpose built Caterpillar 725 which hold 6500 gallons of water and has a six-wheel off-road chassis that allows it to travel over rough terrain anywhere on the site. The

other three water trucks are conventional water tracks each with a capacity 3000 gallons with a dedicated John Deere diesel pump mounted on the rear.

For equipment safety reasons, the large coal handling equipment of the stacker-reclaimers, dumper and shiploaders are shut-down at wind speeds over 40 mph, so no coal handling operations take place while the wind speed is at such elevated levels.

.3 Housekeeping

Westshore maintains a fleet of four water trucks which are also used to perform the duty of keeping the paved roads washed down to prevent dust arising due to the passage of vehicle traffic. Westshore has three tandem axle trucks each with a tank capacity of 3000 gallons and the newest addition is CAT 725 all-terrain 6 wheeler with a water tank capacity of 6500 gallons.

6500 gallon Water Truck

In addition, Westshore Terminals retains a contract sweeper truck service on an as-needed basis to vacuum-sweep areas if water wash-down methods cannot be used.

The internal service roads which are used to access the stacker-reclaimers are conditioned by grading and compacting and then spraying the surface with magnesium chloride which acts as a binding agent to keep the road surface tightly bound and minimize the amount of dust generated by service vehicles moving through the yard.

a) Scrapers and Skirts

As part of the on-going preventative maintenance program all conveyors are routinely inspected on a regular basis to assess the condition of the scrapers. Scapers are used to remove residue from the conveyor belt and are situated near the head pulley of a conveyor as the coal is discharged on to the next system. Many conveyors have been fitted with secondary scrapers to back-up the work of the first. Typically tension in the scraper mounting mechanism allows the scraper to self adjust to compensate for wear. When required, scraper blades are replaced.

b) Conveyor Belt Misalignment

From time to time, a conveyor belt may move out alignment known as ‘side travel’. If the side travel becomes excessive, minor temporary spillage of coal product could occur on site. All the conveyors are fitted with automatic side-travel correction devices which lead the belt back on to its designed track. In the event that the side travel overcomes these tracking devices, there are side travel sensor switches which detect excessive movement which automatically shut the conveyor down requiring further investigation by the maintenance department.

c) Spillage Protection

Each conveyor has plugged chute detectors, spill detectors and rip detectors any of which will shut-down the conveyor if they are tripped. The plugged chute detectors are of a tilt switch design which trip as soon as coal in the chute backs-up to the point that the switch is displaced from a vertical position. The spill detectors are a balance device deployed at the head-end of a conveyor and provide a back-up to the tilt switches. All conveyors are electrically interlocked together which ensures that if any one conveyor is stopped then all following conveyors in the sequence also stop in order to prevent over-load and spillage. Belt-rip detectors provide an early warning for objects penetrating the belt which may cause damage to the belt and spillage to occur.

5.1.5 Supervision and Operation

The terminal operation of unloading trains and loading ships continues on a 24/7 basis through-out the year. In 2012 the shift supervisors schedule was revised such that there is always now a management presence on-site to oversee the terminal operation.

The functional responsibility for the performance of the dust suppression activities lies with the Operation group under the direction of the Manager, Operations and delegated to the work force through superintendents and foremen. Daily shift meetings are conducted in which the environmental priorities are established and tasks assigned.

The operation of the spray systems are determined by the supervisor based on information available from a suite of inputs including the subscription-paid Environment Canada Weather Alert system which provides e-mail notification of wind warnings and the subscription-paid UBC Weather Alert system which provides on-line graphical projection of forecast wind speed and direction over the next twenty four hours. Westshore also has its own site weather station and on-board anemometers on all the major equipment.

The availability of quality weather forecast information enables the shift supervisor to make an informed decision about the level of preparation to be done for dealing with the expected conditions. The general descriptor of the weather condition requires a low, medium of high level of preparation. The spray systems have automated routines that initiate spray cycles appropriate to the requirements and also may be operated on an individually controlled basis should that be required.

5.1.6 Monitoring

Monitoring is a requirement of the air emissions permit issued by GVA. The permit calls for recording the on-site usage of the water spray systems used for dust control purposes and the daily weather conditions; it also requires that dust monitoring be conducted by the deployment of two dustfall canisters located close to the operating site.

In addition to the requirements of the permit, Westshore has installed dust collection canisters at the BC Ferries Tsawwassen Ferry Terminal and two canisters at the Marina in Pt. Roberts, Washington, USA. The results over a period of time for all these canisters are incorporated into Air Quality Study by SNC-Lavalin – Appendix F (to come).

Previous studies by MetroVancouver (formerly as GVRD) have determined that the air quality in Tsawwassen is on a par or better that that generally experienced in the Lower Mainland (ref: Tsawwassen Particulate – Air Quality Study 2002 by Air Quality Monitoring and Assessment Division, GVRD). A monitor station at English Bluff School continues to register low dust levels and may be viewed on-line at http/www.bcairquality.ca/readings.

Over the years Westshore has responded to the limited complaints of coal dusting at private residences in the Tsawwassen and Ladner area. As a matter of policy, Westshore investigates all such complaints and arranges to take samples for analysis at a specialist materials laboratory. Of seventeen samplings in the Tsawwassen /Ladner area taken over the twelve year period from 2001-2013, thirteen had no indications of the presence of any coal dust. See Appendix 5.1.6 -A Summary of Results of Dust Analysis in South Delta 2001-2013. In the case of the other four, minor readings were noted.

In order to expand Westshore's air monitoring activities Westshore has commissioned Levelton to construct two Mobile Air Monitoring Units (MAMU) with the intention of placing them in the community to collect data about the degree of particulate matter that has been anecdotally reported.

Mobile Air Monitoring Unit (MAMU)

5.2 Water Management Plan

.1 Fire Main and Potable Water

Westshore obtains water from GVWD by arrangement with the Corporation of Delta. Under the terms of this agreement, water is provided at a rate of 1500 IGPM at a residual pressure of 50psi.

The water supply system provides potable water to the administration building and occupied areas of the site for personal use. Other uses include adding make-up water to the recycled water in the reservoirs to be sprayed for dust control purposes by rain guns and high masts and also providing water directly to the tower sprays. In addition, the charging of the fire mains around the site and supply to the vehicle wash facility.

The water provided by the Corporation of Delta is provided at a marginal rate, higher than other users in the water district. Westshore's objective is to use the water in an efficient and sustainable manner and collect the run-off where possible to recycle the water to reduce overall consumption.

Westshore's water management strategy is based on maximizing the use of recycled water consistent with the functional requirements of the dust suppression task.

No changes will be required to the Delta water main feeding into the site either for supply volumes or metering. On-site, the reconstruction of the shops and office facilities in a different location of the site will require revisions to Westshore's internal water main distribution system. These details will be addressed in the development of the site infrastructure utility modifications.

.2 Surface Run-off Water

In order to reuse water on the site a comprehensive containment and collection system exists to capture surface run-off water and route it by ditches, pumps and pipes to the holding reservoirs.

Westshore is working on methods to clean the water routed to the reservoirs to improve the quality of the residual water and make more recycled water available for other on site uses. Recently a new sieve bend water treatment plant has been commissioned by which water routed to the reservoirs is cleaned by removing the larger particles by the action of passing across a fine wedge wire screen.

There are three reservoirs on site that have a combined holding capacity of 1.4mil USgals. Reservoir 3 has a capacity of 660,000 USgals and will be taken out of service during the course of the Upgrade Project to make way for coal pile storage. At present the exact location and details of the future replacement reservoir have not been completed. In order to provide an equivalent volume of water, it is proposed to construct an above-ground reservoir to contain an equal volume of water. Space exists for a such a storage tank or impoundment structure along Westshore's northern lease boundary and a preliminary site location has been identified for planning purposes.

The reservoirs are connected via a ring main system such that water can be transferred to, or drawn from any of the reservoirs depending on which pumps are activated.

As part of the new project, level control devices will be installed at each reservoir such that automated filling of the reservoirs can occur when required and sufficient water will always be on hand to provide dust control without manual intervention.

Run-off water also comprises rain water that falls on the site from time to time. Rain water is collected in the same ditches and ponds as the run-off water which comes from spraying the coal piles. Water in these catchment ditches is routed to the screening facility to reduce the amount of solids that are contained within the effluent.

During winter months when increased rainfall is experienced the amount of run-off water exceeds the capacity to store it and excess water must be discharged from the site. Westshore has an Effluent Discharge permit PE-6819 issued by BC Ministry of the Environment which permits the discharge of effluent provided that it has been cleaned to prescribed standards. No changes will be required to the effluent discharge systems on account of the project to reconstruct the shops and offices.

.3 Oil Interceptors

Paving will be provided around the new shops and offices and vehicle parking areas and vehicle wash bay and employee car wash facility. The run-off collected from these areas will be routed through oil interceptor drains to prevent oily water from entering the main collection system.

5.3 Replacement of the Sewage Treatment Plant

Westshore's existing sewage treatment facilities operate under permit from BC Ministry of Environment. The facilities comprise an aerobic processing tank unit located near the existing administration building, shops and offices which handles the major source domestic effluent and a septic tank system located near the Operations Control Centre (OCC) which handles the small amount of domestic waste from that facility. The combined treated flow is then discharged into the local marine environment.

The main sewage treatment plant and infrastructure, including the process tank, in ground wet well transfer tank, pumps and piping will be demolished along with the all of the shops and offices as part of the relocation and rebuilding of the new facilities.

An engineering company has been retained to develop a design for the new treatment facilities with the following parameters:

- Sized to handle the projected employee loading, including showers
- An allowance to be made to provide a contingency above the projected requirements
- Consider separate treatment for gray water and black water
- System to be robust
- Consider maintenance aspects and ease of changing components and cleaning
- Provide back-up system if plant is out of operation
- Provide alarms and annunciation of mal-functions
- Develop emergency response plan in the event of system failure

The new system design will incorporate all the effluent present treated in the septic tank at the OCC.

The new design will be coordinated with BC Ministry of the Environment and a new permit will be applied to cover the new facilities.

5.4 Lighting

The replacement of the Stacker reclaimer machines will see the existing machines replaced by similar style machines. The new machines will have a similar complement of lights as the existing machines that includes area lighting and local task lighting.

For the most part, the operation of the stacker-reclaimers takes place on the inside area of the coal storage area while the coal is stockpiled or reclaimed either side of the stacker-reclaimer rail track. Normally the stacker-reclaimers are out of view to observers outside of the coal terminal because they are obscured by the stock piles of coal.

In the area of the new shops and office new area lighting will be provided for the outside circulation area and parking areas. The area is presently used for parts storage and is illuminated by pole mounted flood lights. Where used, mast mounted area lights will be cowled to minimize the limited amount of light spillage beyond the target area. The new facilities are further away from residential area than the present facilities. The existing facilities will be demolished and all the present illumination in that area will be removed as the area becomes part of the coal storage yard.

Lighting during the project construction phase or from the completed facilities is anticipated to have minimal effects on local residents and no residual effects are anticipated.

In the interim, in a separate initiative Westshore is spending $2.1 million to change all the existing mercury and sodium vapour outdoor lighting and some indoor lights to the environmentally friendlier LED (light emitting diodes) in conjunction with BC Hydro's Power Smart program. During this program, some 1,900 outside lights will be changed to LED in a phased program which offers to use 75% less energy and last much longer than the incandescent lights that they are replacing. The other advantages of LED lighting are quick start up and no mercury presence as a final disposal hazard. All lights will be applied with sensitivity to unwanted light spillage by aiming and cowling.

5.5 Fuel Dispensing Facilities

.1 Diesel and Gasoline Storage

As part of the project to construct the new shops and offices in the north-west corner of the site, the existing fuel dispensing station will be demolished in accordance with Environment Canada's decommissioning protocols and new facilities will be constructed in an appropriate location close to the new office/shop complex consistent with safety considerations.

The existing fueling station comprises two storage tanks, one for diesel (28,000 litres)and one for gasoline (10,000 litres). The steel tanks are double walled and vacuum sealed with a leak detection alarm. The dispensing system is from standard electrically operated pumps.

The existing facilities have proved to be adequately sized for the service duty and no changes are contemplated for the installation which will be a newer version of the tanks to be removed. The surface area around the tanks will be of concrete and drainage will be provided with an oil interceptor to collect drips or leakage from the area.

The fuel facilities will comply with applicable Environment Canada regulations and Fire codes. Westshore's Emergency Response Plan will be revised to address all facets of risk associated with this facility.

.2 Propane Service

The existing administration complex including offices, warehouse, workshops and dry facilities are provided with propane fuel heating and cooling, either by forced air systems or in the case of the workshop space, radiant heat. The propane is provided from a 12,000 US gal storage tank located in the vicinity of the offices. The existing storage tank is the subject of an Emergency Response Plan and subject to reporting under the Environmental Emergency Regulations (E2) administered by Environment Canada.

As part of the reconstruction of the shops and offices in the north-west corner of the site, the existing propane tank will be removed from service and the foundations will be demolished. At this time, the design of HVAC systems for the new building and shop complex has not been finalized , however it is likely that space heating for the offices will embrace the use of heat exchangers while the shops will use radiant heat from a propane source. It is therefore possible that the new propane storage tank will be smaller than the existing one. Whatever system is provided it will be designed according to the appropriate codes and standards governing its installation and use.

5.6 Emergency Response Plan

Westshore Terminals has an established Emergency Contingency Plan. No significant changes are required to this plan although sections of the plan will be required to be adjusted as a result of the new location of the shops and offices and entrance gate facilities.

Westshore has a full time First-Aid Attendant on-site and the new facilities will include a dedicated first-aid room and office as well as a vehicle garage for a dedicated emergency response vehicle.

Supplementary Emergency Response is provided by the Delta Fire and Emergency Services operating out of Delta Fire Hall No. 1. No change is foreseen in the frequency or type of responses required than was provided in the past.

Ambulance services are provided by the BC Ambulance Services which are regionally dispatched from a central command location. The Ladner ambulance station has four ambulances and additional back-up can be provided from other localities if required, including the possible deployment of an air ambulance dispatched from Vancouver International Airport. No change is foreseen in the frequency or type of responses required than was provided in the past.

With the construction of the new buildings and new entrance gate arrangements, members of the off-site response services will be updated with the appropriate documentation and invited to participate in familiarization trips around the new facilities for orientation.

5.7 Demolition of Existing Facilities

The existing office and shops will be demolished and removed from site. Sub-surface foundations will be removed from grade level down to three feet below grade, deeper structures such as the dumper pit will be filled with sand and left in place. The location will be identified on record drawings.

During 2012, in anticipation of a project to demolish the existing office and shop facilities and associated infrastructure, WorleyParsons was retained to conduct a Phase I Environmental Site Assessment (ESA).

The objective of the Phase I ESA was to list potential areas of concern and provide an estimate for the cost for further investigation and possible remedial requirements during demolition and construction activities.

The WorleyParsons Phase I ESA study recommends that a Phase II Environmental Site Assessment be conducted in specific areas to identify to what extent , if any, those areas present environmental concerns by testing subsurface conditions. As Westshore has been in continuous possession of the site since its inception, it is not expected that any exotic materials will be found, only those typical of an industrial operation with on-site vehicle maintenance.

Westshore will initiate a Phase II Environmental Site Assessment consistent with the project schedule and address any issues arising.

5.8 Sustainability

Westshore Terminals is committed to continuous improvement in its activities and uses the replacement and renewal process to seek opportunities to implement efficiencies to its operations.

.1 Energy Saving

Westshore has already initiated action to join BC Hydro's PowerSmart Program and has implemented a site-wide program of replacing older style incandescent light fixtures with the more efficient LED lighting. This project will see over 1900 fixtures replaced during the program with a annual savings of thousands of kilo-watt hours.

Elsewhere on the site, Westshore has purchased and installed high efficiency motors and with large motor drive systems has implemented variable frequency drives to be able to moderate the power used in proportion to the demand.

.2 Reduced Water Consumption

Westshore's newly installed rain-bird and tower spray system was initiated to improve dust control capabilities and reduce the possibility of fugitive dust leaving the site. The system also makes better use of the spray water used for dust control and more water is now collected and passed through the new water treatment plant for recycling.

.3 Criteria Air Contaminant and GHG Emissions Reduction

Westshore's reinvestment in modern stacker-reclaimers will allow the terminal to function more efficiently producing productivity gains in shiploading and train unloading. The benefit of these efficiencies will be to turn around ships and trains more quickly. As a result, emissions of the priority air contaminants including NO_x, $PM_{2.5}$ and diesel particulate matter (DPM) generated by ships and trains will be reduced as their time at the terminal or in queue will shorten, leading to a proportional reduction in overall emissions. These reductions will be additional to the improvements expected from emerging engine technology and fuel improvements from national and international regulations and will also include greenhouse gas (GHG) savings. The new electric powered stacker-reclaimers will also do some of the work currently done by the diesel powered bulldozers which will reduce overall emissions further. In Appendix 4.15 Air Quality Study SNC-Lavalin confirms these reductions and contains a detailed analysis of the favourable changes in air quality expected with completion of the project.

As well as the direct project benefits, Westshore has registered with MetroVancouver Non-Road Diesel Engine Emission program which promotes cleaner air by the planned retirement of older equipment replacing it with the latest Tier compliant engines.

.4 Design Standards

The new shop and office facilities will be custom designed to take into account all of Westshore Terminals' operating requirements for a facility that will be in constant use on a 24/7 basis. The development of specifications will consider conservation opportunities; this will include plumbing, lighting and HVAC systems and the complementary use of natural heating/cooling available via heat pump applications and the use of appropriate glazing systems to insulate and limit heat gain.

.5 Clean Construction Standards

Westshore will include provisions in its contract specification guidelines that require best practices for the use of diesel equipment by construction contractors working on-site.

APPENDIX 3

Westshore Contingency Emergency Response Plan

WESTSHORE TERMINALS LTD. PARTNERSHIP EMERGENCY CONTINGENCY PLAN

TABLE OF CONTENTS

To All Holders of this Manual

Westshore Terminals Ltd. Partnership has undertaken to document and regularly publish those authorized Policies and Procedures that shall apply during an emergency situation which involves a co-ordinate response by internal and external participating agencies.

All persons, upon receipt of an approved copy of the EMERGENCY CONTINGENCY PLAN Manual, will be responsible for ensuring that any error or omissions are brought to the attention of the Terminal Health & Safety Coordinator as follows:

Health & Safety Coordinator
HUMAN RESOURCES DEPARTMENT
#1 - Roberts Bank
Delta,B.C.
V4M 4G5

Telephone: 604-946-3436

The holder of this manual is reminded that all material contained herein is STRICTLY CONFIDENTIAL, must not be photocopied, and all outdated pages must be destroyed.

DISTRIBUTION OF EMERGENCY CONTINGENCY PLANS

PLAN #	RECIPIENT	STORAGE LOCATION
01	ADMINISTRATION	HEALTH/SAFETY
02	ADMINISTRATION	PRESIDENT
03	ADMINISTRATION	RECEPTION
04	MAINTENANCE OFFICE	SAFETY BOOKSHELF
05	OPERATIONS DEPT.	FOREMAN'S OFFICE
06	OPERATIONS DEPT.	SUPERINTENDENT
07	WTL FIRST AID	FIRST AID STATION
08	SECURITY	GUARD STATION
09	ENGINEERING	MANAGER
10	EMERGENCY SUPPLY CABINET	CONFERENCE TRLR.

POLICY STATEMENT

The goals of the Westshore Terminals Emergency Contingency Plan are to ensure that no employee, contractors, guests or community members are injured during and emergency situation, to prevent environmental damage, and to minimize damage to terminal property.

This plan has been put together through the cooperative efforts of all terminal employees and is in continuing review by the terminal's Management/Union Site Safety Committee. At the foundation of the Emergency Contingency Plan, is the fact that no person is expected to endanger their safety during an emergency. The plan includes response procedures for many types of potentially hazardous incidents. If a situation arises that a person feels may be unsafe, is beyond their training, or requires modifications in standard operating procedures, that person should immediately report back to their Supervisor for further instructions.

In all hazardous or potentially hazardous situations it is important that all persons work as a team and follow established safety procedures. This will aid in minimizing the effects of the emergency and promote a rapid return to normal operations.

LEVELS OF EMERGENCY

Emergency incidents are categorized according to their severity and potential impact, so that the response is equated with the actual conditions. There are three types of emergency incidents:

Emergency Incident

An emergency incident may be regarded as a minor localized incident that occurs in a specific area of the terminal or affects a small portion of the property, and can be quickly resolved with existing company resources or limited outside help. This level of emergency incident has little or no impact on the daily operations except in the affected area. Normally, this type of emergency incident would not require activation of the ECP.

Examples: Industrial accident/injury, localized hazardous spill, localized fire and plumbing or power failure.

Major Emergency Incident

A major emergency incident is an event that disrupts a sizeable portion(s) of the terminal property and/or affects a substantial subset of the daily operations. This type of emergency incident may require assistance from external agencies. These events may escalate quickly, and have serious consequences on business functions and/or life-safety. The Incident Commander will receive information of the scope of the incident and determine if activation of the ECP and the Emergency Operations Centre (EOC) is required. Other management personal may be alerted, as appropriate.

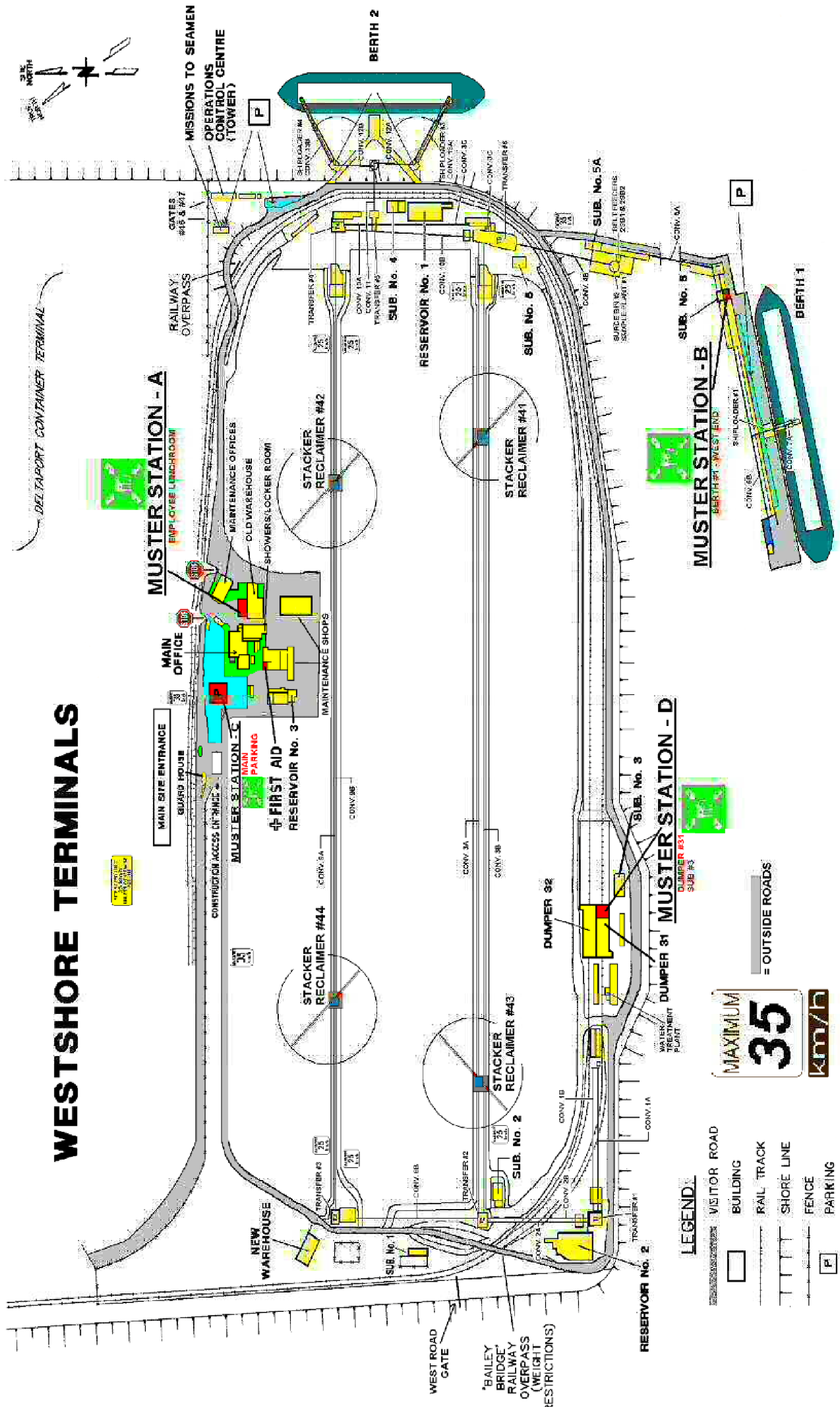
Examples: Large fire, major structural damage, severe flooding, major chemical spill, extensive power outage, man in the water or an external emergency incident that may impact WTL personnel or operations.

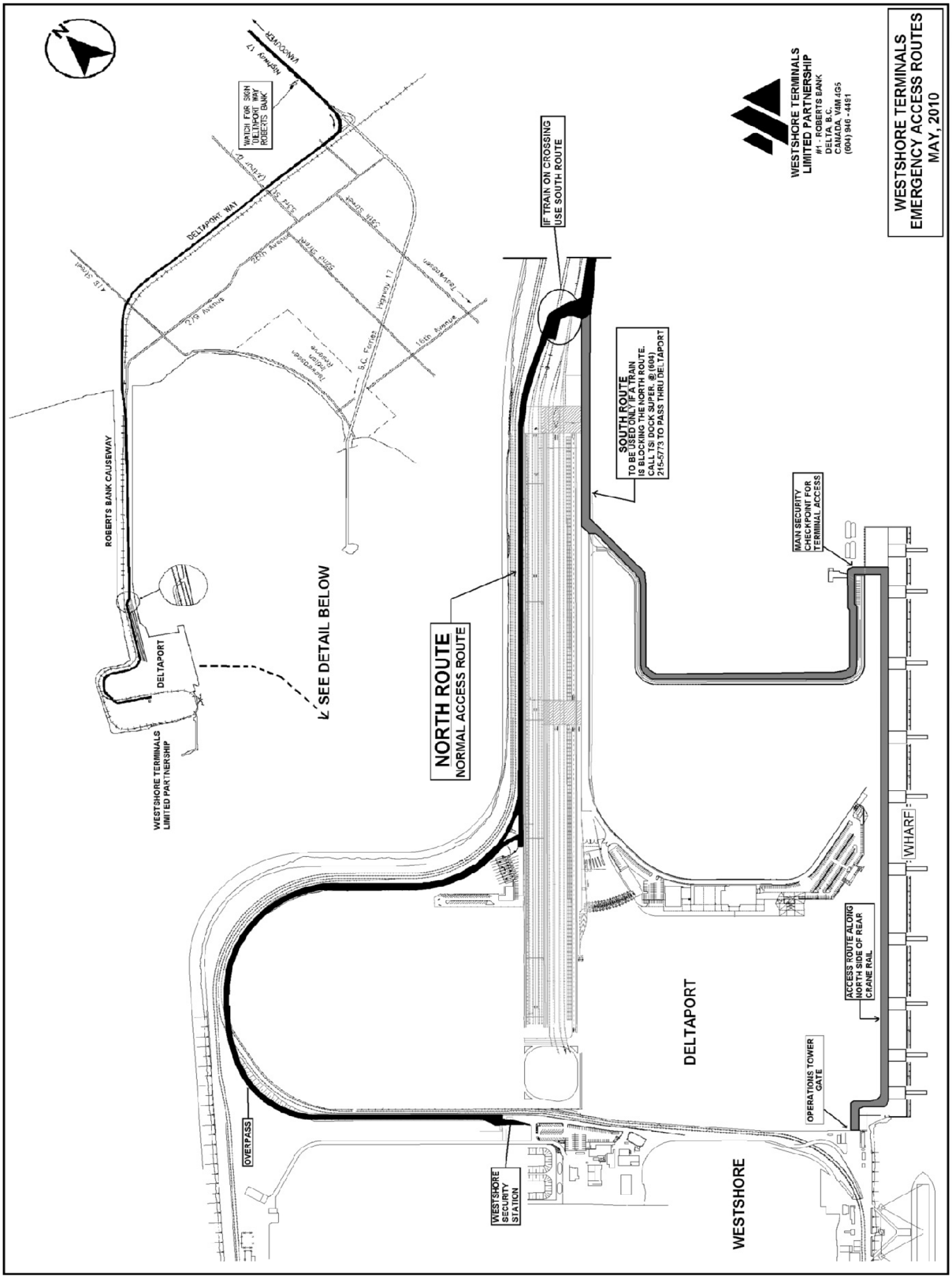
Disaster Emergency Incident

A disaster emergency incident is an event that affects the entire Roberts Bank area and surrounding community. Normal business operations are suspended. The effects of the emergency are wide-ranging and complex. A timely resolution of the disaster conditions will require a company-wide co-operation and extensive co-ordination with external jurisdictions.

In the event of a Level Three incident, governmental emergency operation centres may be activated. The Incident Commander shall co-ordinate the emergency response activities with the outside responders. In the event of activation of these centres, the Vice President & General Manager shall act to advise all employees on company matters.

Examples: Hurricane or earthquake with major damage, widespread chemical or biological agent contamination.


WESTSHORE TERMINALS
DELTAPORT CONTAINER TERMINAL
MUSTER STATION - A
EMPLOYEE LUNCHROOM
MUSTER STATION - B
BERTH #1 - WEST END
MUSTER STATION - C
MAIN PARKING
MUSTER STATION - D
DUMPER #31
SUB #3
MISSIONS TO SEAMEN
OPERATIONS CONTROL CENTRE (TOWER)
GATES #16 & #17
RAILWAY OVERPASS
BERTH 2
BERTH 1
SUB. No. 4
SUB. No. 5A
SUB. No. 5
SUB. No. 6
RESERVOIR No. 1
STACKER RECLAIMER #42
STACKER RECLAIMER #41
MAINTENANCE OFFICES
OLD WAREHOUSE
SHOWERS/LOCKER ROOM
MAIN OFFICE
MAINTENANCE SHOPS
MAIN SITE ENTRANCE
GUARD HOUSE
CONSTRUCTION ACCESS ENTRANCE
FIRST AID
RESERVOIR No. 3
STACKER RECLAIMER #44
STACKER RECLAIMER #43
DUMPER 32
DUMPER 31
SUB. No. 3
WATER TREATMENT PLANT
= OUTSIDE ROADS
MAXIMUM 35 km/h
NEW WAREHOUSE
SUB. No. 1
SUB. No. 2
RESERVOIR No. 2
WEST ROAD GATE
"BAILEY BRIDGE" RAILWAY OVERPASS (WEIGHT RESTRICTIONS)
LEGEND:
VISITOR ROAD
BUILDING
RAIL TRACK
SHORE LINE
FENCE
PARKING


WESTSHORE TERMINALS
EMERGENCY ACCESS ROUTES
MAY, 2010
WESTSHORE TERMINALS
LIMITED PARTNERSHIP
#1 - ROBERTS BANK
DELTA B.C.
CANADA, V4M 4G5
(604) 946 - 4491
VANCOUVER
Highway 17
WATCH FOR SIGN 'DELTAPORT WAY ROBERTS BANK'
DELTAPORT WAY
IF TRAIN ON CROSSING USE SOUTH ROUTE
SOUTH ROUTE
TO BE USED ONLY IF A TRAIN IS BLOCKING THE NORTH ROUTE. CALL TSI DOCK SUPER. @ (604) 215-5773 TO PASS THRU DELTAPORT
MAIN SECURITY CHECKPOINT FOR TERMINAL ACCESS
ROBERTS BANK CAUSEWAY
DELTAPORT
WESTSHORE TERMINALS LIMITED PARTNERSHIP
SEE DETAIL BELOW
NORTH ROUTE
NORMAL ACCESS ROUTE
WHARF
ACCESS ROUTE ALONG NORTH SIDE OF REAR CRANE RAIL
DELTAPORT
OPERATIONS TOWER GATE
WESTSHORE
WESTSHORE SECURITY STATION
OVERPASS

OBJECTIVE

The objective of the emergency contingency plan is to ensure efficient and timely response during emergencies. However, planning alone will not guarantee preparedness. Training is a vital element of the Emergency Contingency Plan. The objective of this procedure is to layout an effective training program while maintaining the business function of the terminal.

EXERCISES/TRAINING

Training/exercises shall be carried out in several forms:

1. Orientation Seminars

Orientation seminars are used to introduce or refresh employees to plans and procedures. They will involve discussions and presentations or reviews of past cases for lessons learned. Venue: Crew Safety Meetings, Orientation training sessions.

2. Tabletop Exercises

Tabletop exercises are used to provide a convenient method of introducing supervisory personnel to scenario-related problem situations for discussions and problem solving. Such exercises are a good way to see if policies and procedures exist to handle certain issues. Venue: Scheduled meetings.

3. Functional Exercises

Functional Exercises are utilized to simulate actual emergencies. They will involve supervisory and line employees and are designed not only to exercise procedures but also to test the readiness of personnel, communications, and facilities. Such exercises will be conducted at the incident command level with field exercises.

TRAINING PROGRAM

EMPLOYEE ORIENTATION	A general training program including an overview of: ● Site Safety Committee - Preparation of Plan ● WTL Emergency Contingency Plan ● Why Plan? ● Policy Statement ● Definition of Emergency ● Distribution of Emergency Binders ● Hazard Analysis/manual Layout ● Duties and Responsibilities ● Specific Plans	**Who Should Attend:** All WTL Employees
Presented by: H. & S. Coordinator or Site Safety Committee Members or Department Superintendents	**How often:** Annually and every new hire	

TABLETOP EXERCISE	• A non time-sensitive, facilitated, discussion based training session. It usually includes an initial scenario and allows participants to verbally review plan policies and procedures.	**Who Should Attend:** Department Supervisory Department Foremen Other required Employees
Presented by: H. & S. Coordinator, Site Safety Committee Members, Department Managers	**How often:** Annually	

FUNCTIONAL EXERCISE	• An activation practice of emergency contingency procedures utilizing simulated response to an emergency scenario.	**Who Should Attend:** Department Supervisory Department Foremen Other required Employees
Presented by: H. & S. Coordinator, Site Safety Committee Members, Department Managers	**How often:** Annually	

PROCEDURE FOR ON-SITE HAZARDOUS PRODUCT SPILL

When a spill occurs involving a petroleum based product or hazardous material, to minimize risk to persons and property, the following procedures shall apply;

IMMEDIATELY CONTACT THE OPERATIONS CONTROL TOWER AND PROVIDE INFORMATION ON:

- WHAT HAPPENED?
- WHERE DID IT HAPPEN?
- WHEN DID IT HAPPEN?
- WHAT IS THE EXTENT OF THE SPILL?
- WHAT HELP IS NEEDED?
- PRODUCT IDENTIFICATION
- WHAT IS YOUR NAME ?
- ARE THERE ANY OTHER HAZARDS ?

Response Duties

Upon receipt of an emergency hazardous product spill, the Incident Commander shall;

- **Safety of people. Control access to the area - KEEP ALL PERSONS (except those necessary to cope with the condition) AT A SAFE DISTANCE, UPWIND AND OUT OF THE SPILL AREA.**

- If required, make a radio announcement that an emergency spill incident is underway and that all employees should remain at their workstations, clear all radio channels and wait for further instructions.

- Assign one Operations Foreman to the role as **On-Scene Coordinator** and to immediately have him attend the incident scene to access the extent and nature of the spill. The On-scene coordinator is to immediately report all findings to the Incident Commander..

- Assign one Operations Foreman to the role as **Communications Coordinator** and to immediately have him attend the Operations Tower.

- If required, contact the Fire Department @ 911 provide the following information;
  - WHAT HAPPENED?
  - WHERE DID IT HAPPEN?
  - WHEN DID IT HAPPEN?
  - WHAT IS THE VOLUME AND EXTENT OF THE SPILL?
  - WHAT HELP IS NEEDED?
  - PRODUCT IDENTIFICATION
  - SUGGESTED APPROACH OR ROUTE TO THE SCENE
  - ACTION TAKEN, IF ANY

- Advise WTL First Aid Attendant to attend the incident scene or stand-by for further instructions.

- ► Contact B.C. Rail and advise terminal has an emergency incident and inquire as to status of causeway junction crossing. Advise B.C. Rail to stand-by for further information/instructions.

- ► If the identity of the material is known and it is safe to do so, obtain the proper safety equipment, stop the emission at its source to prevent further release.

- ► If the identity of the material is not known, it is to be treated as an hazardous material until properly identified. Retrieve the appropriate Material Safety Data Sheet for the proper spill response measures and personal protection requirements. MSDS's are available at the Operations Tower, Maintenance Office, Warehouse, First Aid Station, Main Office.

- ► Assign one WTLP employee in a vehicle to meet emergency response agencies at the Causeway Junction and escort them to WTLP.

- ► If required, contact TSI and advise of the hazardous material spill. (Periodically update TSI and advise at conclusion of incident).
  Dock/Rail Superintendent - 604-267-5473
  Safety - 604-215-5771 - Cell - 604-317-2504
  Operations Manager - Doug Garland - (Cell) 604-536-2818

- ► Assess incident situation from information obtained from On-Scene Coordinator and any personal visual observations. Based on the results of the incident assessment, the Incident Commander will define and coordinate cleanup procedures, personnel and equipment that are to be used to control or correct the incident.

- ► If required, coordinate emergency terminal evacuation procedures.

- ► Coordinate normal production activities.

- ► Photograph and record all incident activities.

Communications Coordinator

- ► Contact the Provincial Emergency Program (PEP) at 1-800-663-3456 for
  - Oil Spills in excess of 100 litres
  - All spills in excess of 200 Kg.

  provide the following information;

- ► WHAT HAPPENED?
- ► WHERE DID IT HAPPEN?
- ► WHEN DID IT HAPPEN?
- ► WHAT IS THE VOLUME AND EXTENT OF THE SPILL?
- ► WHAT HELP IS NEEDED?
- ► PRODUCT IDENTIFICATION
- ► SUGGESTED APPROACH OR ROUTE TO THE SCENE
- ► ACTION TAKEN, IF ANY

► Notify David Crook - Manager. Environmental 946-3442 (Office)
448-0422 (Home)
and relay the following information;

- ► Product Identification
- ► Approximate volume of spill and time occurred.
- ► Action taken, if any
- ► Other personnel at the scene.

CLEAN-UP

► As requested by the Incident Commander, the Communications Coordinator will call in one of the following companies to assist with control and removal of the spilled material;

Contractors - Clean Up

Burrard Clean Operations Ltd. (Oil Spill)	604-294-6001
Spray Away Marine Services (Oil Spill)	604-433-8020
Hazco Environmental Services	604-214-7000
Ceda-Reactor Ltd.	604-540-4100

WTLP SPILL RESPONSE EQUIPMENT

TYPE	SIZE	QUANTITY AVAILABLE	STORAGE	STOCK NUMBER
Personal Protection Equipment	Raingear, Goggles, faceshield, glasses, gloves, boots, etc..	Stock quantities	Warehouse	#
Shovels	48" - round head 48" - square head	Stock quantities	Warehouse	W22858010, W22858020
Brooms	corn	Stock quantities	Warehouse	W22441015
Green Garbage Bags	24 X 22 35 X 50	Stock quantities	Warehouse	W22440510, W22440520
Floor Dry Absorbent	Clay type material	Stock quantities	Warehouse	W22023000
Boom, Oil Absorbent	4' X 20'	2 PER BAG X 2	New Warehouse	W22301010
Pad, Oil Absorbent	17" X 19"	100 PER BAG X 3	New Warehouse	W22301050
Sock, Oil Absorbent	8" X 10'	4 PER BAG X 2	New Warehouse	W22301090
Cardboard	36" X 6'	Stock quantities	Cat Shop	#

I F YOU DISCOVER AN OIL SPILL FROM SHIP

1) **REMAIN CALM.**

2) **IMMEDIATELY CONTACT THE OPERATIONS CONTROL TOWER AND PROVIDE INFORMATION ON**:

- ► WHAT HAPPENED?
- ► WHERE DID IT HAPPEN?
- ► WHEN DID IT HAPPEN?
- ► WHAT IS THE EXTENT OF THE INCIDENT?
- ► WHAT HELP IS NEEDED?
- ► WHAT IS YOUR NAME?

Response Duties

Upon receipt of an emergency incident alarm, the Incident Commander shall;

- ► Immediately contact the vessel and determine if the vessel has been notified and if the crew has responded.

- ► Make a radio announcement that an emergency oil spill incident is underway and that all employees should remain at their workstations, clear all radio channels and wait for further instructions.

- ► Assign one Operations Foreman to the role as **On-Scene Coordinator** and to immediately have him attend the incident scene to access the extent and nature of the spill. The On-scene coordinator is to immediately report all findings to the Incident Commander.

- ► Assign one Operations Foreman to the role as **Communications Coordinator** and to immediately have him attend the Operations Tower.
  - ► Contact:
    VMCTS - 1 - 800 - 889 - 8852
    Harbour Master @ 671-7267 (Business Hours)
    Duty Harbour Master @ 805 - 3317 (After Hours)
    David Crook - WTLP Enviro. Manager. 946-3442 (Office)
    448-0422 (Home)
    Operations Department Duty Superintendent

Note: The Harbour Master or the ship will arrange for a clean-up contractor.

If Required;

- ► Advise WTLP First Aid Attendant to attend the incident scene or stand-by for further instructions.

- ► Contact B.C. Rail and advise terminal has an emergency incident and inquire as to status of causeway junction crossing. Advise B.C. Rail to stand-by for further information/instructions.

- Assign 1 employee in a vehicle to meet emergency response agencies at:
  1) Main Gate Security Station (North Terminal Emergency Access) or
  2) Causeway Junction - (South Terminal Emergency Access - T.S.I.)

- Assess incident situation from information obtained from On-Scene Coordinator, the Incident Commander will define and coordinate procedures, personnel and equipment that are to be used to control or correct the incident.

- Coordinate normal production activities.

- Photograph and record all incident activities.

- Determine if incident will generate media interest – report to Superintendent.

WTL SPILL RESPONSE EQUIPMENT

TYPE	SIZE	QUANTITY AVAILABLE	STORAGE	STOCK NUMBER
Personal Protection Equipment	Raingear, Goggles, faceshield, glasses, gloves, boots, etc..	Stock quantities	Warehouse	#
Shovels	48" - round head 48" - square head	Stock quantities	Warehouse	W22858010, W22858020
Brooms	corn	Stock quantities	Warehouse	W22441015
Green Garbage Bags	24 X 22 35 X 50	Stock quantities	Warehouse	W22440510, W22440520
Floor Dry Absorbent	Clay type material	Stock quantities	Warehouse	W22023000
Boom, Oil Absorbent	4' X 20'	2 PER BAG X 2	New Warehouse	W22301010
Pad, Oil Absorbent	17" X 19"	100 PER BAG X 3	New Warehouse	W22301050
Sock, Oil Absorbent	8" X 10'	4 PER BAG X 2	New Warehouse	W22301090
Cardboard	36" X 6'	Stock quantities	Cat Shop	#

Oil Or Hazardous Product Spill
CHECK LIST

Incident Commander

On-Scene Coordinator:____________________________________

First Aid Personal: ____

- [ ] Obtain an initial injury/damage assessment
- [ ] Initiate advisory to all personnel
- [ ] Define the Primary Mission
- [ ] Review the Action Plan
- [ ] Determine if head count is required
- [ ] Notify appropriate WTL staff and other authorities
- [ ] Designate a Spokesperson

Oil Or Hazardous Product Spill

CHECK LIST

On-Scene Coordinator

- Obtain an initial injury/damage assessment ☐
- Determine nature and identity of material ☐
- Obtain MSDS from Safety Library ☐
- Provide first aid and decontamination (if required) ☐
- Call 911, advise Fire Department of chemical spill ☐
- Check protective clothing recommendations ☐
- Relocate personnel away from hazardous areas ☐
- Isolate and secure hazardous areas ☐
- Determine best route for emergency vehicles ☐
- Designate damage assessment team ☐
- Retrieve site services plans ☐
- Locate electrical disconnect points ☐
- Locate nearest hydrant and water supply valves ☐
- Determine staging area for emergency vehicles ☐

Oil Or Hazardous Product Spill

CHECK LIST

First Aid Personnel - Oil Or Hazardous Product Spill

- Conduct initial injury assessment ☐
- Consider rapid transport decision ☐
- Review MSDS data ☐
- Record details of patients and injuries ☐
- Advise IC and Recorder of injury status ☐
- Advise IC if additional help is required ☐
- Assist ambulance crews, as required ☐
- Notify Delta Hospital of incoming patient ☐
- Send the MSDS to the hospital with the patient ☐

APPENDIX 4

Potential Short and Long Term Health Effects of Fugitive Dust and Diesel Emissions

A. POTENTIAL SHORT AND LONG TERM HEALTH EFFECTS OF FUGITIVE DUST AND DIESEL EMISSIONS

The following sections provide information on the potential short and long term health effects of PM, CO, NO_2 and SO_2. This information is provided for informational purposes only. As presented in Section 6.0, based on predicted air concentrations of PM, CO, NO_2 and SO_2 less than or equal to the ambient air quality objectives/guidelines, including the most stringent provincial and federal guidelines, it has been concluded that fugitive dust and diesel emissions associated with the Project are anticipated to have negligible impact on ambient area quality in the area. The ambient air quality objectives/guidelines have been derived to be protective of health effects, including for sensitive sub-populations, and therefore exposure to air concentrations less than the objectives/guidelines would not be expected to result in unacceptable health risks.

A.1 Particulate Matter

WHO (2006) summarized that long-term exposure to particulate matter concentrations had the potential to lead to a marked reduction in life expectancy, primarily due to increased cardio-pulmonary and lung cancer mortality. In addition, increases in lower respiratory symptoms and reduced lung function in children, and chronic obstructive pulmonary disease and reduced lung function in adults, were likely long-term health outcomes associated with exposures to elevated $PM_{2.5}$ concentrations (SENES, 2005; WHO, 2006). Susceptibility to PM pollution appears to vary with health and age; however, there is evidence to suggest that elderly subjects, and subjects with pre-existing heart and lung disease, are more susceptible to the effects of PM on mortality and morbidity (e.g. hospitalization and emergency room visits) (WHO, 2006). Additionally, more symptoms, larger lung function changes and increased use of medication are reported for asthmatics exposed to elevated ambient PM (WHO, 2006).

Table A-1 below summarizes both the short and long-term health effects associated with exposure to PM.

Table A-1. Summary of Health Effects Associated with Exposure to Particulate Matter (SENES, 2005)

Effects Related to Short-term Exposure	Effects Related to Long-term Exposure
Lung inflammatory reactions	Increase in lower respiratory symptoms
Respiratory symptoms	Reduction in lung function in children
Adverse effects on the cardiovascular system	Increase in chronic obstructive pulmonary disease
Increase in medication usage	Reduction in lung function in adults
Increase in hospital admissions	Reduction in life expectancy (due to cardiopulmonary mortality and lung cancer)

WHO (2006) summarized that long-term exposure to particulate matter concentrations had the potential to lead to a marked reduction in life expectancy, primarily due to increased cardio-pulmonary and lung cancer mortality. Epidemiological studies on large populations have not identified a threshold concentration below which ambient PM has no effect on health (SENES, 2005; WHO, 2006; CCME, 2004). It is noted that although a range of thresholds may exist within the population, depending on the type of health effect and the susceptibility of subgroups, no threshold for adverse effects at the population level and for the most sensitive subgroups has been identified (SENES, 2005). Both WHO (2006) and SENES (2005) indicate that as threshold levels have not been identified, the air quality guidelines reflect concentrations below which increased mortality outcomes due to exposure to PM air pollution are not expected, including for sensitive sub-populations.

A.1.1 Potential Carcinogenicity of Coal Dust

Concerns regarding the potential carcinogenicity of coal dust have also been raised. The International Agency on Cancer Research (IARC) (1997) indicates that there have been no epidemiological studies on cancer risks in relation to coal dust, with the exception of limited occupational exposure studies evaluating high level exposures to coal miners to coal mine dust. The findings of the occupational studies have been inconsistent, and IARC (1997) indicates that there is no consistent evidence supporting an exposure-response relationship. IARC (1997) has indicated there is inadequate evidence in humans for the carcinogenicity of coal dust.

Carcinogenicity of coal dust has been tested in animal studies using rodents exposed via inhalation or injection (IARC, 1997). In these studies, the incidence of tumours did not increase compared to control animals (IARC, 1997).

A.2 CARBON MONOXIDE

When inhaled, carbon monoxide can readily diffuse across membranes (e.g., alveolar, capillary, and placental) (WHO, 2000). Haemoglobin is a vital protein found in red blood cells that is used to transport oxygen throughout an organism. Absorbed CO binds with haemoglobin in the blood to form carboxyhaemoglobin (COHb) (WHO, 2000). Carbon monoxide has a significantly higher affinity for haemoglobin (200 to 250 times higher) compared to oxygen, which means that exposure to even relatively small amounts of CO results in reduced oxygen-carrying capacity of the blood (WHO, 2000).

At low concentrations, acute CO exposure can cause severe hypoxia, resulting in both reversible neurological deficits and delayed, irreversible neurological damage (WHO, 2000). Such neurobehavioural effects can include impaired coordination and reduced athletic and cognitive performance. The health effects of CO exposure are most notable in tissues with high oxygen requirements such as the brain, heart, skeletal muscles, and the developing foetus (WHO, 2000). Subjects with coronary disease have demonstrated a decrease in the time to onset of angina, following exposure to CO (WHO, 2000). Exposure to CO can also result in ventricular arrhythmias, cardiovascular mortality and the early course of myocardial infarction (heart attack) (WHO, 2000). In addition, CO exposure has been responsible for acute accidental and suicidal deaths (WHO, 2000).

Table A-2 below summarizes both the short and long-term health effects associated with exposure to CO.

Table A-2. Summary of Health Effects Associated with Exposure to Carbon Monoxide (from WHO, 2000)

Effects Related to Short-term Exposure	Effects Related to Long-term Exposure

Reversible, short-lasting neurological deficits	Reduction in athletic performance
Irreversible, delayed neurological damage	Increase in hospital admissions for cardiac diseases
Aggravates cardiac symptoms	Reduction in life expectancy (cardiovascular mortality and myocardial infarction)
Asphyxiation	
Acute accidental and suicidal death	

Environmental exposure and endogenous production of CO results in COHb concentrations of approximately 0.5% to 1.5%, while pregnant women can experience COHb levels of up to 2.5%, due to increased endogenous CO production (WHO, 2000). Guidelines for an one hour average exposure of 30 mg/m^3 and an eight hour average exposure of 10 mg/m^3 were selected by WHO (2000) to ensure a COHb level of 2.5% is not exceeded in sensitive populations (i.e., non-smoking groups with coronary artery disease or foetuses of non-smoking women).

A.3 NITROGEN DIOXIDE

Inhalation exposure to NO_2 usually results in mild irritation to the upper respiratory tract; however, when NO_2 enters into solution in the moist alveolar spaces of the lungs, more serious pulmonary damage can occur (CDC, 1979).

Exposure to NO_2 can result in mucosal irritation (eyes, nose and throat), chemical pneumonitis, acute pulmonary edema or death, depending on the duration of exposure and concentration of NO_2 (CDC, 1979). Short-term health effects following exposure to NO_2 can result in decreased pulmonary function and increases bronchial reactivity, both of which are generally more evident in asthmatics (WHO, 2000). WHO (2006) summarized that long-term exposure to NO_2 concentrations had the potential to lead to both reversible (biochemical) and irreversible (cellular structure) effects, primarily in the lungs but also in the spleen, liver, and blood. In addition, increased susceptibility to bacterial and viral lung infections were likely long-term health outcomes associated with exposures to elevated NO_2 concentrations (WHO, 2006). Repeated lung infections in children can cause future lung damage and children are at risk of increased respiratory illness with exposure to NO_2 (WHO, 2000).

Table A-3 below summarizes both the short and long-term health effects associated with exposure to NO_2.

Table A-3. Summary of Health Effects Associated with Exposure to Nitrogen Dioxide (from WHO, 2006 and 2000)

Effects Related to Short-term Exposure	Effects Related to Long-term Exposure
Reduction in pulmonary function	Reduction in lung function in children
Reduction in forced expiratory volume in asthmatics	Increase in bronchitic symptoms of asthmatic children
Increase in bronchial reactivity	Reversible and irreversible lung effects
Irritation to the eyes, nose and throat	Increase in susceptibility to bacterial and viral lung infections

The available studies indicate that there is no clearly defined dose-response relationship for health effects caused by NO_2 exposure (WHO, 2000). A 0.5 uncertainty factor was applied to the lowest observed effect level (375 $\mu g/m^3$ to 565 $\mu g/m^3$) based on small changes in lung function and changes in airway responsiveness following NO_2 exposure, resulting in a one hour average objective of 200 µg/m^3 (WHO, 2000). Chronic exposure can result in long-term health effects and therefore, an annual average guideline of 40 µg/m^3 has been proposed (WHO, 2000). This value is based on the potential for direct toxic effects of chronic NO_2 exposure at low concentrations (WHO, 2000). In addition, during epidemiological studies NO_2 is often used as a marker for other combustion-generated pollutants and it is difficult to attribute health effects solely to NO_2 exposure when there are other correlated co-pollutants present; therefore, retaining a conservative annual NO_2 guideline is considered prudent and health-protective (WHO, 2006).

A.4 SULPHUR DIOXIDE

Inhalation exposure to SO_2 usually results rapid onset of irritation to mucous membranes due to the formation sulphurous acid upon contact with moist mucous (CDC, 1974).

Exposure to SO_2 can result in the onset of adverse health effects within minutes of the commencement of inhalation exposure. Symptoms of exposure include reductions in forced expiratory volume, increases in airway resistance and wheezing or shortness of breath (WHO, 2000). The onset of effects occurs rapidly and extending the duration of exposure does not increase the effects. Exercise has been shown to increase the penetrative depth of SO_2 into the respiratory tract (WHO, 2000). Long-term effects have shown increased mortality as a result of cardiovascular and respiratory effects, and increased hospital admissions for respiratory causes and pulmonary disease (WHO, 2000).Table A-4 below summarizes both the short and long-term health effects associated with exposure to SO_2.

Table A-4. Summary of Health Effects Associated with Exposure to SO_2 (from WHO, 2006 and 2000)

Effects Related to Short-term Exposure	Effects Related to Long-term Exposure
Reductions in forced expiratory volume	Increase in mortality from cardiovascular and respiratory effects
Increase in airway resistance	Increase in hospital admissions
Irritation to mucous membranes	
wheezing	
Shortness of breath	

The available studies indicate that there is no clearly defined dose-response relationship for health effects caused by SO_2 exposure and a clearly defined exposure threshold is not evident (WHO, 2000). Although individuals with asthma are more sensitive, there is a large range of sensitivity to SO_2 exposure throughout the general population (WHO, 2000). To be protective of the most sensitive population, guidelines for SO_2 were developed considering the minimum concentrations associated with adverse effects in asthmatics (WHO, 2000). WHO (2006) reports that there is uncertainty in the causality between SO_2 and adverse effects, which may be attributed to other factors such as ultrafine particles or another correlated pollutant. WHO (2006) recommends a more stringent 24-hour guideline (20 µg/m^3) compared to previous WHO values in order to provide greater protection as precautionary approach.

A.5 REFERENCES

CCME, 2004. Human Health Effects of Find Particulate Matter: Update in Support of the Canada-Wide Standards for Particulate Matter and Ozone. Prepared for the Canadian Council for Ministers of the Environment. Revised in July 2004.

CDC, 1974. Criteria for a recommended standard: Occupational exposure to sulfur dioxide. U.S. Department of Health, Education, and Welfare. National Institute for Occupational Safety and Health Publication No. 74-111.

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IARC, 1997. World Health Organization International Agency for Research on Cancer, IARC Mongraphs on the Evaluation of Carcinogenic Risks to Humans. Volume 68, Summary of Data Reported and Evaluation; Coal Dust. Available on-line at http://monographs.iarc.fr/ENG/Monographs/vol68/volume68.pdf .

SENES, 2005. Development of Options for a New Provincial $PM_{2.5}$ Air Quality Objective, Summary Report. SENES Consultants Ltd. Prepared for British Columbia Lung Association. December 2005.

WHO, 2000. Air Quality Guidelines for Europe, Second Edition. WHO Regional Publications, European Series, No. 91, Copenhagen.

WHO, 2006. WHO air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. Global update 2005. Summary of risk assessment. WHO Press, World Health Organization, Geneva.

APPENDIX 5

BC Ministry of Environment Effluent Discharge Permit PE-6819

MINISTRY OF ENVIRONMENT, LANDS AND P^'RKS
Environmental Protection

PERMIT

Under the Provisions of the Waste Management Act

WESTSHORE TERMINALS LTD.

1900 - 1188 West Georgia Street

Vancouver, British Columbia

V6E 4B9

is hereby authorized to discharge effluent

from a coal loading terminal

located at Roberts Bank, Delta, British Columbia

to the Strait of Georgia.

This permit has been issued under the terms and

conditions prescribed in the attached appendices:

01, 02, A-1, B-1, C-1 and C-2.

R. H. Robb
Assistant Regional Waste Manager

Permit No. **PE-6819**

Date Issued June 28, 1983

Date Amended December 19, 1984

November 24, 1989

DEC 2 3 1992

MINISTRY OF ENVIRONMENT, LANDS AND PARKS
Environmental Protection

APPENDIX 01

to Permit No. PE-6819

(A) The discharge of effluent to which this appendix is applicable is from a package sewage treatment plant and from a septic tank serving a coal loading terminal located at Roberts Bank Port near Delta, British Columbia, identified as "01" as shown on the attached Appendix A-1.

(B) The maximum rate at which effluent may be discharged is 32 cubic metres per day.

(C) The characteristics of the effluent at the sampling stand pipe located near the north end of the coal sampler's trailer shall be:

5-day biochemical oxygen demand (BOD_5),	130 mg/L or less;
Total suspended solids (nonfilterable residue),	130 mg/L or less.

(D) The works authorized are a sewage treatment plant, a septic tank, any other treatment works necessary to meet the effluent characteristics specified in Clause (C) above, a submerged outfall and related appurtenances approximately located as shown on the attached Appendix A-1.

(E) The location of the facilities from which the effluent originates and to which this appendix is appurtenant is Crown Lease--240.449 acre portion of Lot 1, Parcel A, Group 2, New Westminster District, Plan 61571, Except Crown Federal Roll Number D-410-033-00-0, Drawing Ax-21037.

(F) The location of the point of discharge and to which this appendix is appurtenant is Roberts Bank of the Strait of Georgia near or within Crown Lease--240.449 acre portion of Lot 1, Parcel A, Group 2, New Westminster District, Plan 61571, Except Crown Federal Roll Number D-410-033-00-0, Drawing Ax-21037.

(G) The works authorized must be complete and in operation on and from the date of this appendix.

Date Issued June 28, 1983

Date Amended December 19, 1984

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Assistant Regional Waste Manager

2090 W-817

MINISTRY OF ENVIRONMENT, LANDS AND PARKS
Environmental Protection

APPENDIX 02

to Permit No. PE-6819

(A) The discharge of effluent to which this appendix is applicable is primarily from a water treatment plant providing water for use in the coal pile dust suppression system of a coal loading terminal, identified as "02" as shown on the attached Appendix A-1.

(B) The maximum rate at which effluent may be discharged is 10 000 cubic metres per day.

(C) The characteristics of the effluent at the effluent sampling site located at the upstream end of the outfall shall be:

Total suspended solids (nonfilterable residue),	50 mg/L or less;
Oil and grease,	10 mg/L or less;
Toxicity,	96h LC50 ≥ 100%.*

*96 hour LC50 ≥ 100% means that, in a static bioassay on salmonid species, at least 50% of the test fish must survive over 96 hours in undiluted effluent.

(D) The works authorized are a sedimentation basin, a flocculation facility, any other treatment works necessary to meet the effluent characteristics specified in Clause (C) above, an outfall and related appurtenances approximately located as shown on the attached Appendix A-1.

(E) The location of the facilities from which the effluent originates and to which this appendix is appurtenant is Crown Lease--240.449 acre portion of Lot 1, Parcel A, Group 2, New Westminster District, Plan 61571, Except Crown Federal Roll Number D-410-033-00-0, Drawing Ax-21037.

(F) The location of the point of discharge and to which this appendix is appurtenant is Roberts Bank of the Strait of Georgia near or within Crown Lease--240.449 acre portion of Lot 1, Parcel A, Group 2, New Westminster District, Plan 61571, Except Crown Federal Roll Number D-410-033-00-0, Drawing Ax-21037.

(G) The works authorized must be complete and in operation on and from the date of this appendix.

Date Issued June 28, 1983

Date Amended December 19, 1984

November 24, 1989

DEC 2 3 1992

Assistant Regional Waste Manager

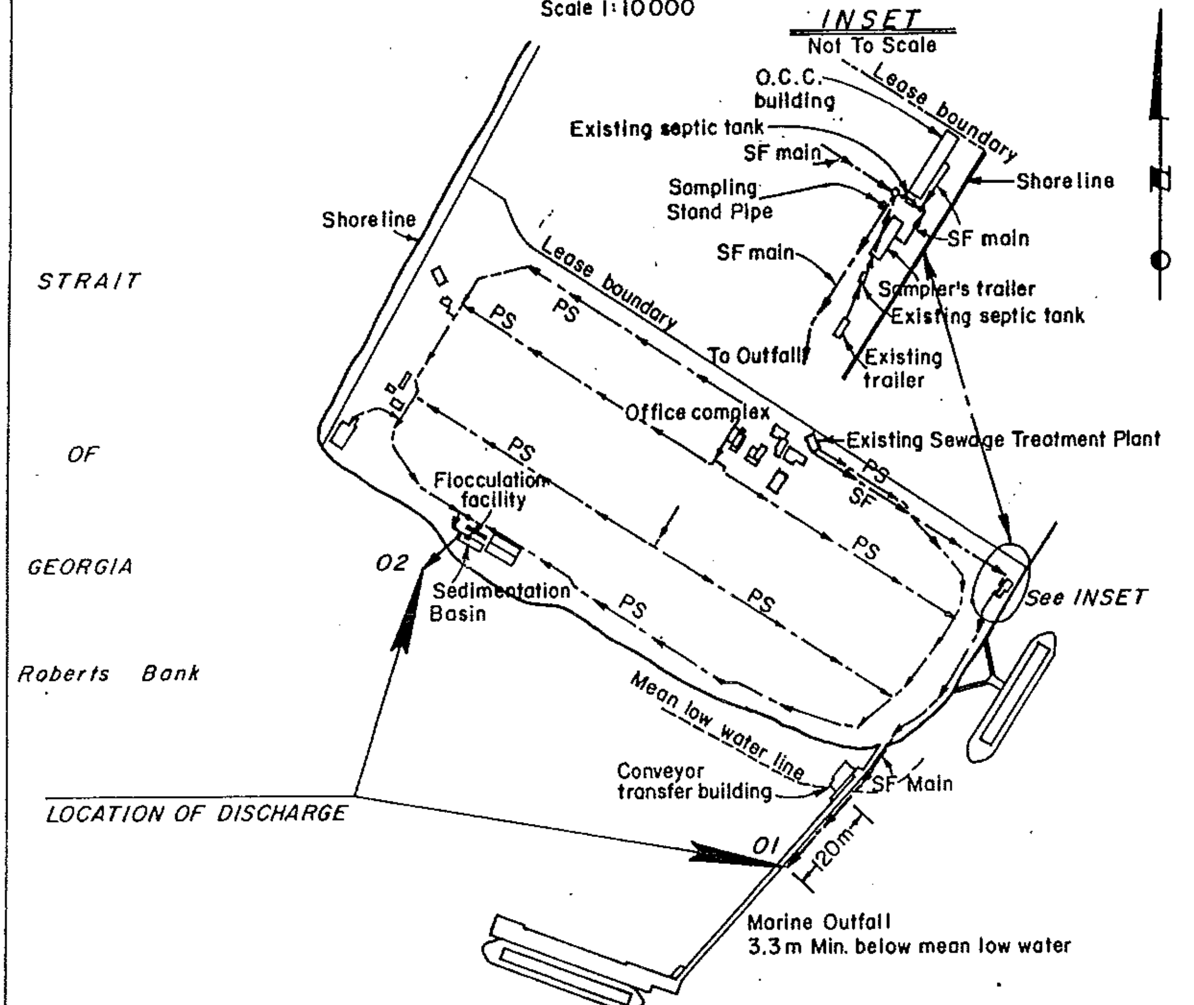
Province of
British Columbia

MINISTRY OF
ENVIRONMENT,
LANDS AND PARKS

BC Environment

Environmental Protection

SITE PLAN
Scale 1:10000



LEGEND

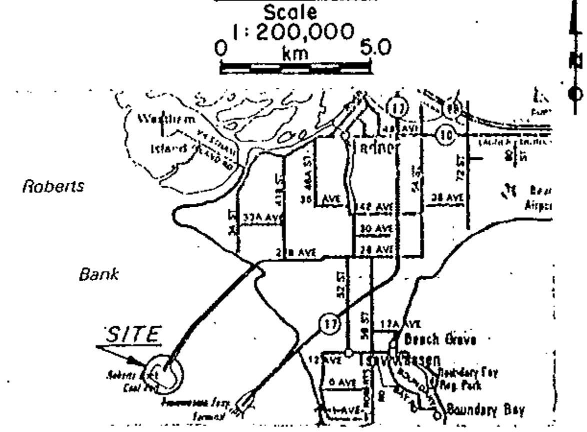
PS : Pile Spray Main (Recycled water)

SF : Sanitary Forcemain (Sanitary Sewage)

LEGAL DESCRIPTION OF SITE

Crown Lease — 240.449 acre portion of Lot 1, Parcel A, Group 2, New Westminster District, Plan 61571, Except Crown Federal Roll Number D-410-033-00-0, Drawing Ax-21037.

LOCATION MAP
Scale 1:200,000



WESTSHORE TERMINALS LTD.
(Name of applicant(s))

(Date) (Signature of applicant(s) or agent)

(FOR OFFICE USE ONLY)

June 28, 1983
Date Issued

DEC 2 3 1992
Date Amended

Assistant Regional Waste Manager

Appendix A-1 to Permit No. PE-6819

Approval No.

ENV 1987

MINISTRY OF ENVIRONMENT, LANDS AND PARKS
Environmental Protection

APPENDIX B-1

to Permit No. PE-6819

A. SLUDGE AND SCUM REMOVAL

Sludge and scum shall be removed from the septic tank, sewage treatment plant and the sedimentation basin at least once every three months, or at other frequencies as the Regional Waste Manager may allow, for disposal at a suitable site. The disposal arrangements are subject to the approval of the Regional Waste Manager.

B. BYPASSES

The discharge of effluent which has bypassed the designated treatment works is prohibited unless the approval of the Director or the Regional Waste Manager is obtained and confirmed in writing.

C. PROCESS MODIFICATIONS

The Permittee shall notify the Regional Waste Manager prior to implementing changes to any process that may affect the quality and/or quantity of the discharge.

D. MAINTENANCE OF WORKS

The Permittee shall inspect the pollution control works regularly and maintain them in good working order. Notify the Regional Waste Manager of any malfunction of these works.

E. EMERGENCY PROCEDURES

1. In the event of an emergency which prevents the Permittee from complying with a requirement of the Permit that would otherwise be applicable, that requirement will be suspended for such time as the emergency exists or until otherwise directed by the Regional Waste Manager provided that:

   i The Permittee can demonstrate the exercise of due diligence in relation to the process, operation or event which has caused the emergency and that the emergency has occurred notwithstanding this exercise of due diligence;

   ii The Regional Waste Manager has been immediately notified of the emergency; and

   iii The Permittee is proceeding with due diligence to correct the emergency condition.

2. Notwithstanding, i, ii, and iii above, the Regional Waste Manager may require the Permittee to reduce or suspend operation to protect the environment while correcting the situation.

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MINISTRY OF ENVIRONMENT, LANDS AND PARKS
Environmental Protection

APPENDIX C-1
to Permit No. PE-6819

MONITORING

The following monitoring program shall be undertaken by the Permittee. The Regional Waste Manager may modify the monitoring program based on the results submitted as well as any other data obtained by Environmental Protection.

1. SAMPLING SITES

Sampling sites shall be located as follows:

Site No.	Location
01	At the sampling stand pipe located near the north end of the coal sampler's trailer.
02	Effluent sampling site located at the upstream end of the outfall.

2. GRAB SAMPLING

The Permittee shall install suitable sampling facilities, obtain grab samples and analyze the samples as follows:

Parameter	Site No. 01	Site No. 02
BOD_5, mg/L	Monthly	-
Total suspended solids, mg/L	Monthly	Weekly
Oil and grease, mg/L	-	Monthly
Toxicity, 96h LC50	-	Quarterly

Samples shall be taken on days when discharge occurs into the Strait of Georgia.

Proper care should be taken in sampling, storing and transporting the samples to adequately control temperature and avoid contamination, breakage, etc.

Sampling and flow measurement shall be carried out in accordance with the procedures described in "Field Criteria for Sampling Effluents and Receiving Waters", April 1989, 17 pp., or by suitable alternative procedures as authorized by the Regional Waste Manager.

Copies of the above manual are available from the Environmental Protection Division, Ministry of Environment, Lands and Parks, 777 Broughton Street, Victoria, British Columbia, V8V 1X5, at a cost of $20.00, and are available for inspection at all Environmental Protection Offices.

Date Issued June 28, 1983

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November 24, 1989

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Assistant Regional Waste Manager

MINISTRY OF ENVIRONMENT, LANDS AND PARKS
Environmental Protection

APPENDIX C-2
to Permit No. PE-6819

MONITORING Cont'd...

3. ANALYSES

Analyses are to be carried out in accordance with procedures described in the second edition of "A Laboratory Manual for the Chemical Analysis of Waters, Wastewaters, Sediments and Biological Materials (1976 edition including updates)", April 1989, 615 pp., or by suitable alternative procedures as authorized by the Regional Waste Manager.

Copies of the above manual are available from the Environmental Protection Division, Ministry of Environment, Lands and Parks, 777 Broughton Street, Victoria, British Columbia, V8V 1X5, at a cost of $70.00, or if Part 1 only, 1976 edition, 389 pp., $40.00 and Part 2 only, supplement, 226 pp., $40.00, and are also available for inspection at all Environmental Protection Offices.

Analyses for determining the toxicity of liquid effluent to fish shall be carried out in accordance with the procedures described in the "Laboratory Procedures for Measuring Acute Lethal Toxicity of Liquid Effluents to Fish", November, 1982.

Copies of the above manual are available from the Environmental Protection Division, Ministry of Environment, Lands and Parks, 777 Broughton Street, Victoria, British Columbia, V8V 1X5, at a cost of $5.00, and are also available for inspection at all Environmental Protection Offices.

4. FLOW MEASUREMENTS

Provide and maintain suitable flow measuring devices and:

(1) Record once per month the volume of sewage discharged in accordance with Appendix 01 over a 24-hour period on the sampling day.

(2) Record daily the volume of effluent discharged in accordance with Appendix 02 over a 24-hour period.

5. REPORTING

Maintain data of analyses and flow measurements for inspection and quarterly submit the data, suitably tabulated, to the Regional Waste Manager for the previous calendar quarter. The first report is to be submitted by January 31, 1993. Subsequent reports shall be submitted every three months thereafter.

Date Issued June 28, 1983

Date Amended December 19, 1984

November 24, 1989

DEC 2 3 1992

Assistant Regional Waste Manager

APPENDIX 6

Wastewater Treatment Plant Upgrade (Associated Engineering 2013)

Associated Engineering GLOBAL PERSPECTIVE. LOCAL FOCUS.

Date:	October 18, 2013 **File:** 20132393.00.E.04.00
To:	Greg Andrew, P.Eng. - Chief Engineer, Westshore Terminals
From:	Sahar Kosari, Christian Brumpton and Hugh Hamilton
Project:	Westshore Terminals Wastewater Treatment Plant
Subject:	Wastewater Treatment Plant Upgrade

MEMO

1 BACKGROUND AND OBJECTIVE

Westshore Terminal Limited Partnership (Westshore Terminals) operates the coal terminal at Roberts Bank in Delta, B.C. Westshore Terminals is currently working on a project to replace the existing administration and maintenance buildings, with new facilities located at the northwest corner of the coal terminal site. As part of this project, the current facilities for treating domestic wastewater in the existing complex will be replaced with a new wastewater treatment plant (WWTP).

Westshore Terminals retained Associated Engineering (AE) to proceed with preliminary design of a new WWTP to treat the domestic wastewater and address the operational challenges experienced by the operation of the current system. AE has studied alternative options for the WWTP location, and is confirming the process design criteria. Regulatory requirements for updating the discharge permit are currently being confirmed.

The objective of this memorandum is to provide general concept information in support of the permit application to Port Metro Vancouver. This memorandum is based on information available at this time and work completed to date.

2 WWTP DESIGN BASIS AND REGULATORY INFORMATION

Table 2-1 summarizes the current and projected staffing levels and operation schedule of the Terminals, based on information received from Westshore Terminals. AE has used these numbers as the basis for understanding the existing flows and loads to the WWTP, and for development of a design basis for future flows and loads.

Table 2-1
Westshore Terminals Population and Operation Schedule

Weekdays Westshore Terminals Staffing Levels	
Shifts	**Total Number of Staff**
12:00 am-8:00 am	42
8:00 am-4:00 pm	125
4:00 pm-12:00 am	55

Weekends Westshore Terminals Staffing Levels	
Shifts	Total Number of Staff
12:00 am-8:00 am	42
8:00 am-4:00 pm	85
4:00 pm-12:00 am	55

Based on historical sampling data at Westshore Terminals described in two earlier studies (Leslie, 1989 and Dayton & Knight (D&K), 1991), the design criteria were calculated; Table 2-2 indicates estimated current loads and flow rates. Westshore Terminals is performing a sampling program developed by AE to confirm the characterization of the raw wastewater generated on the site. The results of sampling program will be used to update the results in previous reports. Westshore Terminals has reported that new water-conserving plumbing fixtures have recently been installed, which are expected to result in higher BOD_5 and TSS concentrations in the generated wastewater.

Table 2-2
Current Design Basis

Flow Rates, Concentration and Loads (Weekdays)	
Average Day Design Flow (ADDF, m^3/d)	17
Maximum Day Design Flow (MDDF, m^3/d)	24
Average Wastewater BOD_5 Concentration (mg/L)	280
Average Wastewater TSS Concentration (mg/L)	250
Average BOD_5 Day Mass Loading (kg/d)	3
Average TSS Day Mass Loading (kg/d)	2.7
Maximum BOD_5 Day Mass Loading (kg/d)	3.6
Maximum TSS Day Mass Loading (kg/d)	3.2

2.1 Existing Permit Requirements

The existing WWTP is currently operating under discharge permit PE-06819, which was issued by the BC Ministry of Environment (MoE) in 1983. Table 2-3 indicates the current effluent requirements for marine discharge based on permit

PE-06819. AE staff is currently in discussion with MoE regarding updating the effluent discharge permit for the new treatment plant.

Table 2-3
Permit Effluent Requirements - PE-06819

Effluent Requirements	
BOD_5	130 mg/L - maximum-grab sample
TSS	130 mg/L - maximum- grab sample
Maximum Flow	30 m^3/day

2.2 Expected/Proposed Amended Permit Requirements

Westshore Terminals submitted an application for registration under the Municipal Sewage Regulation (MSR) in October 2000. This application was related to upgrades to the WWTP that were being planned at that time, and included changes to the effluent quality and discharge volume. As part of the work for this application, an Environmental Impact Study (EIS) was carried out by Dayton and Knight in September 2000. The EIS included modelling work on the existing outfall. The registration was accepted by MoE in December 2000. However, the WWTP upgrades that were being planned in 2000 did not proceed and therefore the existing WWTP facilities have continued to operate under the existing permit PE-06819.

The MSR has since been replaced by the Municipal Wastewater Regulation (MWR) in 2012. Construction of the new WWTP will require registration of the discharge under the MWR. Based on our preliminary discussions with MoE regarding the status of the permit, it is our understanding that this will involve preparing a notification letter to MoE containing the proposed details of the new WWTP, to update the registration application previously submitted in 2000 and amend the existing discharge requirements. The revised discharge requirements are summarized in Table 2-4.

Table 2-4
Revised Effluent Limits

BC MWR Effluent Requirements	
BOD_5	45 mg/L- maximum - grab samples
TSS	45 mg/L- maximum - grab samples
Max. Flow	40 m^3/day

The outfall discharge will also be modified to meet the requirements of the MWR as part of the new WWTP construction. This will include extending the outfall pipe along the pier to achieve a minimum discharge depth of 10 m and minimum distance of 30 m from the low water mark (as required in Sections 99 and 100). The modeling work, completed by D&K in 2000, indicated that water quality guidelines for ammonia and fecal coliforms would be met at the edge of the initial dilution zone (IDZ), with the outfall at its current location (depth of 3.3 m) and with the current effluent quality. Given the outfall will be moved to a new location at greater depth and farther from shore, with the improved effluent quality outlined in table 2.2, we believe the same conclusions regarding ammonia and fecal coliforms will apply.

2.3 WWTP Location

Determination of the optimum location for the WWTP was the first step in preliminary design stage. The following factors were taken into consideration to situate the WWTP:

- Force mains and pump stations capital cost;
- Energy consumption of the wastewater collection and conveyance system;
- Mitigation of odour issues; and
- Footprint and electrical load of WWTP.

Westshore Terminals has decided to locate the WWTP at the northeast corner of the site, close to the Operations Control Centre (O.C.C) and seamen's mission trailers, shown in Figure 2-1. Lower capital investment due to the construction of the optimum number of force mains to collect and convey the wastewater to WWTP, mitigation of the odour issues for administration building and site visitors, and sustainable design due to lower energy consumption through the lifespan of the WWTP are main reasons to locate the treatment facility at the northeast of the site.

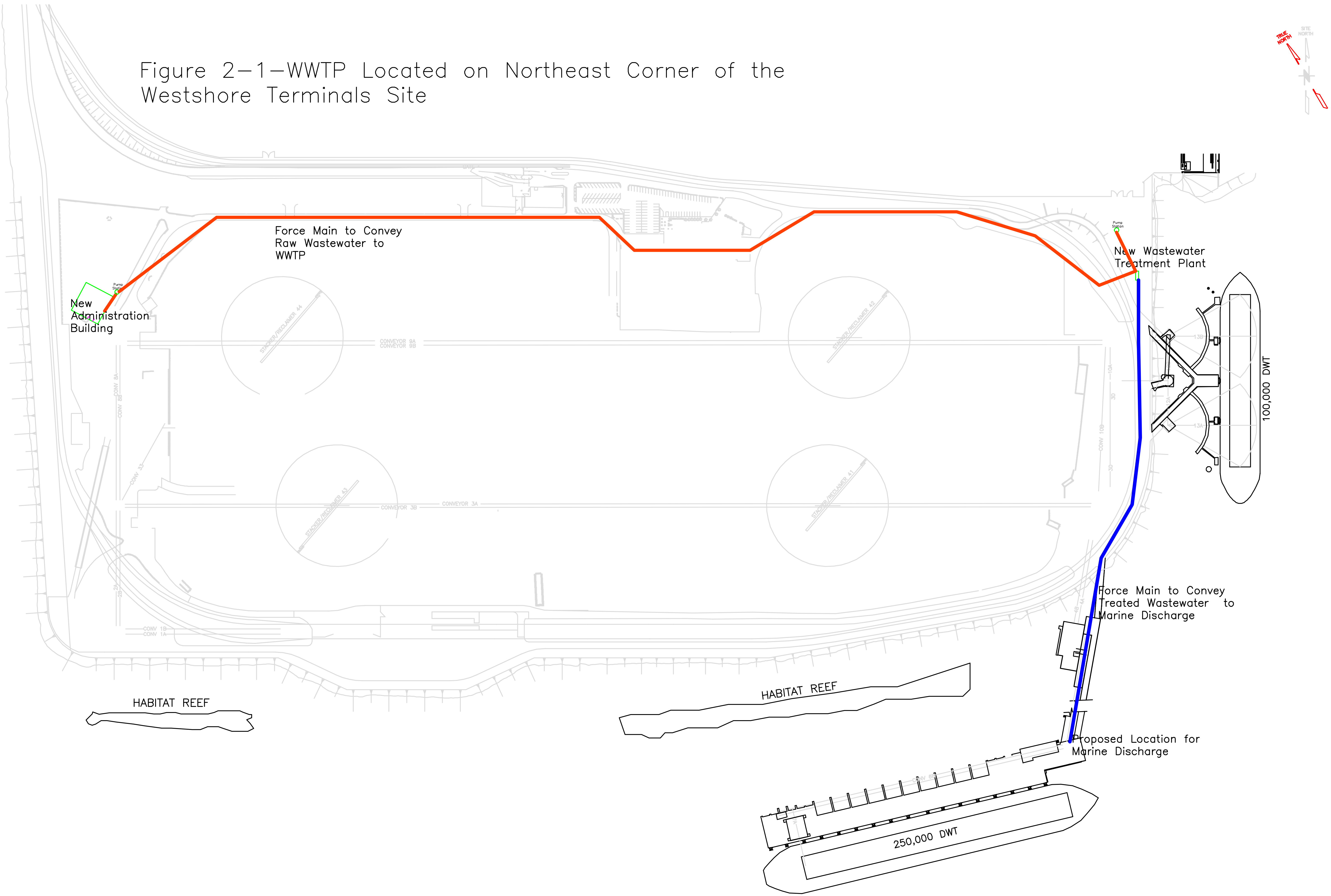
2.4 Force Main

Most of the pipelines to collect and convey and discharge the raw wastewater and treated effluent will be operated as force mains. For sizing the force mains, the following criteria were considered:

- Minimum velocity 1 m/s for transport of solids.
- Minimum diameter 100 mm for raw wastewater, to help prevent plugging.
- Alternatively provide grinder pumps for lines that need to be smaller than 100 mm for other reasons.
- Generally maintain velocities less than 2 m/s to keep head losses low to minimize power consumption.

One force main is required to convey the wastewater from the new administration building to the WWTP and is referred to as "Force Main 1". The effluent from the WWTP to the marine discharge requires another force main referred to as "Force Main 2". (See Figure 2-1).

Figure 2-1—WWTP Located on Northeast Corner of the Westshore Terminals Site



Based on calculations for “Force Main 1” and “Force Main 2”, the 4 inch DR-17 (100 mm, PC 100) pipe provides a reasonable balance between Total Dynamic Head (TDH), flow rates to meet the minimum velocity, and the ability to transfer the solids without clogging.

The wastewater from the O.C.C. and seamen’s mission trailers can be transferred to the WWTP through the current pipeline and required upgrades will be taken into consideration in the detail design stage.

2.5 Pump Stations and Pump Selection

Three pump stations will be required to convey raw wastewater to the WWTP and treated effluent to the marine outfall. A new pump station will be installed close to the new administration building. The existing pump station by the OCC trailer will be modified to pump to the new WWTP. A third pump station will be located at the WWTP to pump effluent to the marine outfall. Each pump station will have a duplex submersible pump arrangement, operated in duty-standby mode. The discharge rate of each pump station was selected based on the anticipated flows into each station and the minimum velocity required in each force main. Pump selection is based on the required discharge rate, total dynamic head (TDH) of each force main, and energy efficiency of the pumps.

Westshore Terminals has requested AE to provide precautionary measures to prevent any interruption in the operation of the wastewater collection, conveyance and treatment system. These include system redundancy in case of equipment failure, and measures to handle large solids in the raw wastewater flow. For the wastewater transfer applications from the new administration building to the WWTP, through “Force Main 1”, a pump station with the following features is being considered in the preliminary design:

- Six cubic metres of storage (used in event of pump station failure or when the force main is out of service).
- Submersible duplex grinder pumps.
- Aluminum trash basket installed in front of wet well inlet to catch large solid.
- Four inch (100 mm) emergency pump out/suction pipe.
- Safety ladders.
- Carbon filter box mount with gooseneck on top of the station to eliminate the odour.
- Explosion proof light.

The controls at the administration building pump station will be programmed to run both pumps simultaneously once every 24 hours to flush out the force main. After considering a number of alternatives, the semi-open, multi-channel impellers grinder pumps with 4.5 kW motor has emerged as a suitable selection based on how well it fits the estimated TDH for this application. It would have an operating point of approximately 8 L/s. The control panel of the sanitary pump station is designed to be located in the new building.

The raw wastewater from the O.C.C. will be transferred to the WWTP through the current pump station and required upgrades will be taken into consideration in the detail design stage.

The effluent pump station will be a supplied as a package, with the control panel located in the building adjacent to the WWTP. To transfer treated effluent to the proposed marine discharge, multi-channel pumps with 3.7 kW motor are selected.

The detail of the both raw wastewater and effluent pump stations will be determined in the detailed design stage once the design of the flow rates and loads are confirmed.

3 AVAILABLE TREATMENT OPTIONS

AE t has studied various vendor-supplied liquid-stream treatment systems to select a suitable, robust, packaged facility to meet Westshore Terminals' WWTP requirements. To assess the feasibility and cost of the options, AE sought input from suppliers of packaged wastewater treatment facilities. The design basis presented in Table 2-2, and MoE requirements based on the new registration, were sent to the suppliers. Suppliers were informed that the treatment plant will be an outdoor facility. Proposals for the following treatment technologies were received:

- Rotating Biological Contactor system (RBC)
- Extended Aeration Activated Sludge process
- Moving Bed Biofilm Reactor (MBBR)
- Membrane Bioreactors (MBRs)

MBRs produce a high quality of effluent; however, they have greater operations and maintenance requirements. AE anticipates that the discharge permit requirements will not require a high enough level of treatment to justify proceeding with a membrane bioreactor, and that either the extended aeration or attached growth process would be the preferred option. The process will be finalized in the detailed design stage once the flow rates and loads are finalized. In the following section one of proposed configuration for treatment package is explained.

3.1 Proposed Configuration of Treatment Plant and its Component

Figure 3-1 illustrates a proposed layout of the wastewater treatment plant based on current estimated wastewater flow rates and loads. The dimensions are subjected to be changed once the sampling program is completed and new flow rates and loads are confirmed. Blowers/control panels and spare pumps are going to be covered in a small prefabricated building as shown in Figure 3-1. Rain shelters and required insulation for the rest of treatment plant has been considered in preliminary design and will be finalized in the detailed design stage.

The main components of the proposed wastewater treatment package are as following:

3.1.1 Fine Screen

A fine screen is an important compound of the treatment plant to remove coarse materials to protect subsequent equipment. The fine screen must be located before the equalization tank.

3.1.2 Equalization Tank

Including an equalization tank in the wastewater treatment facilities with high fluctuation rate is a necessary step to mitigate the impact of wastewater quality and quantity. A resilient, efficient and cost effective treatment process can be designed by provisioning an equalization tank in the treatment plant.

3.1.3 Biological Treatment (Extended Aeration Process)

In biological treatment, oxygen is being introduced into mixture of screened treated wastewater combined with aerobic microorganism to develop a biological treatment process to reduce the level of BOD_5 to permitted level. To suppress the growth of filamentous bacteria, an anoxic bioreactor is been considered before aerobic tank.

For the purpose of aeration and mixing, a fine bubble aeration system will be installed in the EA tank.

3.1.4 Secondary Clarifier

The mixed liquor, the combination of wastewater and biological mass, flows from the EA tank into settling tanks. Part of settled materials is returned to the head of aeration system, while the waste activated sludge (WAS) is discharged into sludge tank.

3.1.5 Sludge Handling

A small aerated sludge tank is dedicated to sludge storage and thickening on site. The sludge tank will be aerated to prevent aerobic condition and provide some treatment prior to thickening and disposal. Thickened sludge will be hauled away to the final disposal site and the liquid from sludge (supernatant) will be return to the EA tank.

3.1.6 Monitoring and Control

The wastewater treatment system is designed to be operated automatically. A control panel will be located in a prefabricated building to control the treatment plan. The WWTP control system will be connected to the existing control system to allow alarms to be transmitted to the operators.

3.1.7 Prefabricated Building

As can be seen in the layout, a prefabricated building is included in design to provide a mechanical/electrical room and storage for the WWTP. Blowers and control panels are going to be located in the building. A storage room is design to be on site to store spare pumps and equipment.

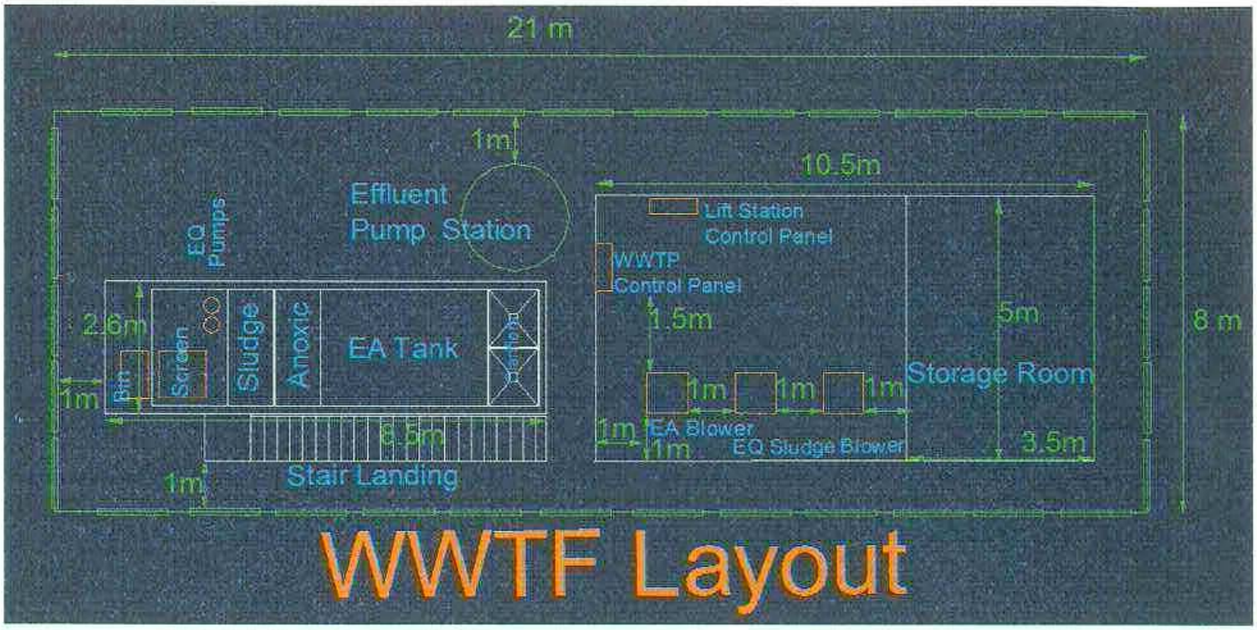


Figure 3-1 - Proposed configuration of WWTP for Westshore Terminals

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ATTACHMENTS

Engineering Drawings