PotashCorp Marine Terminal Expansion Environmental Impact Assessment

Registration Document

142865.00 ● Final Report R3 ● March 2015

ISO 9001
Registered Company

Prepared for:

PotashCorp
Helping Nature Provide

Prepared by:

CBCL LIMITED
Consulting Engineers

Final Report R3	Amy Winchester	Mar. 23/15	
Final Report R2	Amy Winchester	Mar. 19/15	Peter Lane
Final Report R1	Amy Winchester	Mar. 16/15	Peter Lane
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CBCL LIMITED
Consulting Engineers

ISO 9001
Registered Company

Project No. 142865.00

CBCL LIMITED
Consulting Engineers

March 19, 2015

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Dear Mr. Hamilton:

RE: PotashCorp Marine Terminal Expansion – EIA Registration

CBCL Limited (CBCL) is pleased submit the Registration Document, pursuant to New Brunswick's Environmental Impact Assessment Regulations, for PotashCorp NB Division's proposed Marine Terminal Expansion Project (the Project), located at and in proximity to PotashCorp's existing Marine Terminal in Saint John, NB.

The Project is proposed to accommodate potash and salt shipping requirements from the new Picadilly Mine Site, which will be ramping up production throughout 2015.

We look forward to working with you throughout the assessment process. Please feel free to contact me at your earliest convenience with any comments, questions or further requests for information you may require at this time.

Yours truly,

CBCL Limited

Amy Winchester

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Project Manager
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Project No: 142865.00

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EXECUTIVE SUMMARY

PotashCorp NB Division (PotashCorp) proposes to undertake an expansion of their existing Marine Terminal in Saint John, New Brunswick, to accommodate increase potash and salt production related to the Picadilly Expansion Project. PotashCorp's existing mine in Penobsquis, NB has an operating capacity of 800,000 Tpy (tonnes per year) of potash. In 2008, the company began an expansion project adjacent to the existing Penobsquis Mine. Development mining in the Picadilly mine began in the fourth quarter (Q4) of 2014. Development of the expanded mine will see an increase in total potash production capability over the next several years up to 1.8 M Tpy.

The Marine Terminal Expansion Project (the Project) is subject to a Determination Review pursuant to the Environmental Impact Assessment (EIA) Regulation under New Brunswick's Clean Environment Act. CBCL Limited was retained by PotashCorp to assess the potential Project-related environmental effects, the results of which are presented in this Registration Document. PotashCorp proposes to begin construction mid 2015 pending regulatory approvals.

The Project includes expansion of the existing rail yard with the addition of two sidings, construction of a new access road from the Courtenay Bay Causeway to the site, addition of four new bays to the existing garage and construction of a new locker room / lunchroom facility connected to the existing garage. The rail expansion and new access road will require the construction of a new intersection at the Courtenay Bay Causeway and infill parallel to the existing shore line, with a width varying on location from 40-80 m.

Operational activities will be similar to those currently at the Marine Terminal, with potash arriving at the site by rail, transferred to a storage shed, and loaded onto ships. Truck traffic will access the site using the proposed access road. As per the existing operation, brine will arrive at the site by truck and be discharged into Courtenay Bay.

Maintenance activities typical of those for roadways, railways, buildings and equipment will be conducted and access to the site will be maintained for trucks, maintenance vehicles and emergency vehicles.

Potential interactions between Project-related activities and environmental components are described in the EIA, outlining potential issues and concerns related to specific environmental components. Mitigation measures were identified to minimize or avoid potential Project-related adverse environmental effects and, where interactions can be anticipated to persist after mitigation measures have been implemented, a determination of significance was made.

Given adherence to the mitigation measures as outlined for the environmental components, no significant adverse environmental effects are anticipated for construction, operation or maintenance of the Project. The Project is likely to interact with past, present and future projects in the area, resulting in cumulative effects to several environmental components; however, given adherence to the Project mitigation measures, these cumulative effects are not anticipated to be significant in nature.

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List of Acronyms

ADT	Average Daily Traffic
ACAP	Atlantic Coastal Action Program
ACCDC	Atlantic Canada Conservation Data Centre
ATR	Automatic Traffic Recorder
BoFEP	Bay of Fundy Ecosystem Partnership
BTEX/TPH	Benzene Toluene Ethylbenzene and Xylenes/Total Petroleum Hydrocarbons
CBD	Central Business District
CD	Chart Datum
CCME	Canadian Council of Ministers of the Environment
CEAA	Canadian Environmental Assessment Act
CN	Canadian National
CO	Carbon Monoxide
CoPC	Contaminants of Potential Concern
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CRA Fisheries	Commercial, recreation, and/or aboriginal fisheries
CSA	Canada Shipping Act
CWS	Canadian Wildlife Service
dBA	Decibel
DDT	Dichloro Diphenyl Trichloroethane
DFO	Department of Fisheries and Oceans
DPM	Diesel Particulate Matter
EEP	Environmental Emergency Plan
EIA	Environmental Impact Assessment
FTA	United States Federal Transit Administration
GD	Geodetic Datum
HC	Hydrocarbons
HHWLT	Higher High Water Large Tide
HHWMT	Higher High Water Mean Tide
ILA	International Longshoreman's Association

IMO	International Maritime Organization
ISCST	Industrial Source Complex Short Term
LLWLT	Lower Low Water Large Tide
LLWMT	Lower Low Water Mean Tide
LOA	Length Overall
MBCA	Migratory Bird Convention Act
MBR	Migratory Bird Regulations
MCTS	Marine Communications and Traffic Services
MSSP	Marine Sediment Sampling Program
M TPY	Million Tonnes/year
MWL	Mean Water Level
NBDELG	New Brunswick Department of Environment and Local Government
NBDNR	New Brunswick Department of Natural Resources
NBSR	New Brunswick Southern Railway
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NOx	Oxides of Nitrogen
NPA	Navigation Protection Act
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PM	Particulate Matter
PULSE	People United in the Lower South End
PTS	Permanent Threshold Shift
RBCA	Risk-based Corrective Action
SARA	Species at Risk Act
SPA	Scallop Production Area
SRANK	Subnational Rarity Rank of Taxon
SO_2	Sulphur Dioxide
TAC	Transportation Association of Canada
TC	Transport Canada
TCLP	Toxicity Characteristic Leachate Procedure

TSS	Total Suspended Solids
TTS	Temporary Threshold Shift
UNB	University of New Brunswick
USEPA	United States Environmental Protection Agency
VEC	Valued Ecosystem Component
WAWA	Watercourse and Wetland Alteration

CHAPTER 1 INTRODUCTION

PotashCorp NB Division (PotashCorp) proposes to undertake an expansion of their existing Marine Terminal in Saint John, New Brunswick, to accommodate increase potash and salt production related to the Picadilly Expansion Project. PotashCorp's existing mine in Penobsquis, NB has an operating capacity of 800,000 Tpy (tonnes per year) of potash. In 2008, the company began an expansion project adjacent to the existing Penobsquis Mine. Development mining in the Picadilly mine began in the fourth quarter (Q4) of 2014. Development of the expanded mine will see an increase in total potash production capability over the next several years up to 1.8 M Tpy.

The proposed Marine Terminal Expansion (the Project) includes expansion of the existing rail yard with the addition of two sidings, construction of a new access road from the Courtenay Bay Causeway to the site, addition of four new bays to the existing garage and construction of a new locker room / lunchroom facility connected to the existing garage. The rail expansion and new access road will require the construction of a new intersection at the Courtenay Bay Causeway and infill parallel to the existing shore line, with a width varying on location from 40-80 m.

Construction is anticipated to begin in 2015 (pending regulatory approvals).

The existing Marine Terminal is owned by PotashCorp, operated by Furncan Marine Ltd., and is used to ship potash and salt produced at the Penobsquis Mine Site and from the Picadilly Mine near Sussex, NB, to a worldwide market. Operations at the Terminal include transportation of potash by rail and salt by truck to the Terminal, unloading of product to the dumper and reclaim facility, transfer of product to the storage sheds, delivery of the product to a radial telescopic luffing shiploader, and loading of ships. Additional activities include the discharge of brine, originating at the mine site, from trucks into Courtenay Bay through a series of diffusers.

This document has been prepared to satisfy Project requirements for a Determination Review pursuant to the Environmental Impact Assessment (EIA) Regulation under New Brunswick's *Clean Environment Act*. The Regulation requires that projects be registered with the New Brunswick Department of Environment and Local Government (NBDELG) and that the registration document address all requirements specified in the Registration Guide including, but not limited to: adequate project detail, environmental baseline information, evidence of public and First Nations consultation, potential and known adverse environmental effects of the project undertakings, and proposed methods for mitigating the adverse effects.

Proponent details and contacts are provided in Table 1.1 below.

Table 1.1: Proponent Information

Project Name	PotashCorp Marine Terminal Expansion
Project Location	Saint John, New Brunswick
Proponent	PotashCorp NB Division Potash Corporation of Saskatchewan Inc. PO Box 5039 Sussex, NB E4E 5L2 (506) 432-8400
Proponent Contact Person	Jean-Guy Leclair, General Manager, NB Division Telephone: (506) 432-8400 Fax: (506) 433-6617 Email: Jean-Guy.leclair@potashcorp.com
Consultant	CBCL Limited 22 King Street PO Box 20040 Saint John, NB E2L 5B2
Consultant Contact Person	Amy Winchester, M.A.Sc., P.Eng. Project Manager Telephone: (506) 633-6650 Fax: (506) 633-6659 Email: amyw@cbcl.ca

CHAPTER 2 DESCRIPTION OF UNDERTAKING

2.1 Project Scope

PotashCorp proposes to expand their existing Marine Terminal facility in Saint John, NB. The following section summarizes the Project components as outlined in Table 2.1 and illustrated on Figure 2.1. The individual Project components are described in detail in Section 2.6 and considered in the assessment of potential Project and environmental component interactions.

The Project includes expansion of the existing rail yard with the addition of two sidings, construction of a new access road from the Courtenay Bay Causeway to the site, addition of four new bays to the existing garage and construction of a new locker room / lunchroom facility connected to the existing garage. The rail expansion and new access road will require the construction of a new intersection at the Courtenay Bay Causeway and infill parallel to the existing shore line, with a width varying on location from 40-80 m.

As the facility is anticipated to be in operation for as long as the Picadilly mine site is operational (30+ years), specific decommissioning activities are not being proposed at this time and the facility will be decommissioned as per regulatory requirements and best management practices of that time.

CBCL LIMITED Consulting Engineers	Client: PotashCorp — Helping Nature Provide	Project Description: MARINE TERMINAL EXPANSION CONCEPTUAL OVERVIEW OF PROPOSED PROJECT	Revision or Issue: ISSUED FOR EIA REGISTRATION DOCUMENT (FEB 19, 2015)

Contract No	142865.00	Drawn	SO	Approved	AW
Scale	1:5,500	Date	SEPT 2014	Figure No	2.1

Table 2.1: Project Components and Activities

Component	Description
Access Road and Rail	• Infilling adjacent to the Courtenay Bay Causeway, on both Forebay and Bay sides; • Infilling from the Causeway to the existing Marine Terminal site; • Construction, operation and maintenance of an access road and off-ramp; • Construction, operation and maintenance of two additional storage tracks parallel to the existing tracks with room for two more additional storage tracks; and • Increased road, rail, and marine transportation of salt and potash, including increased ship loading.
Garage Expansion	• Construction and operation of a single-storey locker room/lunchroom on east side of existing garage for International Longshoreman's Association (ILA) workforce; and • Construction and operation of four additional bays on the west side of the garage.

2.2 Need for Project

PotashCorp's existing mine in Penobsquis, NB has an operating capacity of 800,000 Tpy (tonnes per year) of potash. In 2008, the company began an expansion project adjacent to the existing Penobsquis Mine. Development mining in the Picadilly mine began in the fourth quarter (Q4) of 2014. Development of the expanded mine will see an increase in total potash production capability over the next several years up to 1.8 M Tpy.

Approximately 95 percent of the product produced at PotashCorp NB's mines is shipped by rail to the Marine Terminal in Saint John for export to a worldwide market; the remaining potash is sold domestically. The salt produced at the mine supplies the domestic market. Salt production above the domestic demand is exported from the Marine Terminal.

The Project is proposed to accommodate the increased shipping requirements resulting from the Picadilly Expansion. Potash production is expected to increase from 0.8 M Tpy to 1.8 M Tpy and salt has the potential to increase from 0.5 M Tpy to 0.75 M Tpy over the same time period. It is anticipated that vessels calls will increase from 60-70 to 125-135 calls per year, resulting in increased rail and truck traffic, and storage and maintenance requirements.

Potash currently arrives at the site by rail, is unloaded at the rail dumper onto conveyors and is transferred to storage sheds. From the sheds, the potash is delivered via reclaim conveyors to a radial telescopic luffing shiploader and loaded onto ships. The facility typically receives 35 to 40 rail cars of potash per day, 5 days per week. The increased production at the mine site will lead to approximately 61 rail cars per day under normal operating condition. Under peak conditions, the number of rail cars per day could increase to approximately 91. Rail traffic will also increase from 5 days per week up to 7 days per week.

Salt and brine are currently brought to the site by truck. With the development of the Picadilly mine site in 2015 and 2016, salt and brine truck volume is expected to peak at approximately 200 per day. However, the heavy volume of salt production will decrease as potash production increases. Within five years, the number of trucks traveling to Saint John from the mine is expected to be approximately 150 per day.

2.3 Project Alternatives

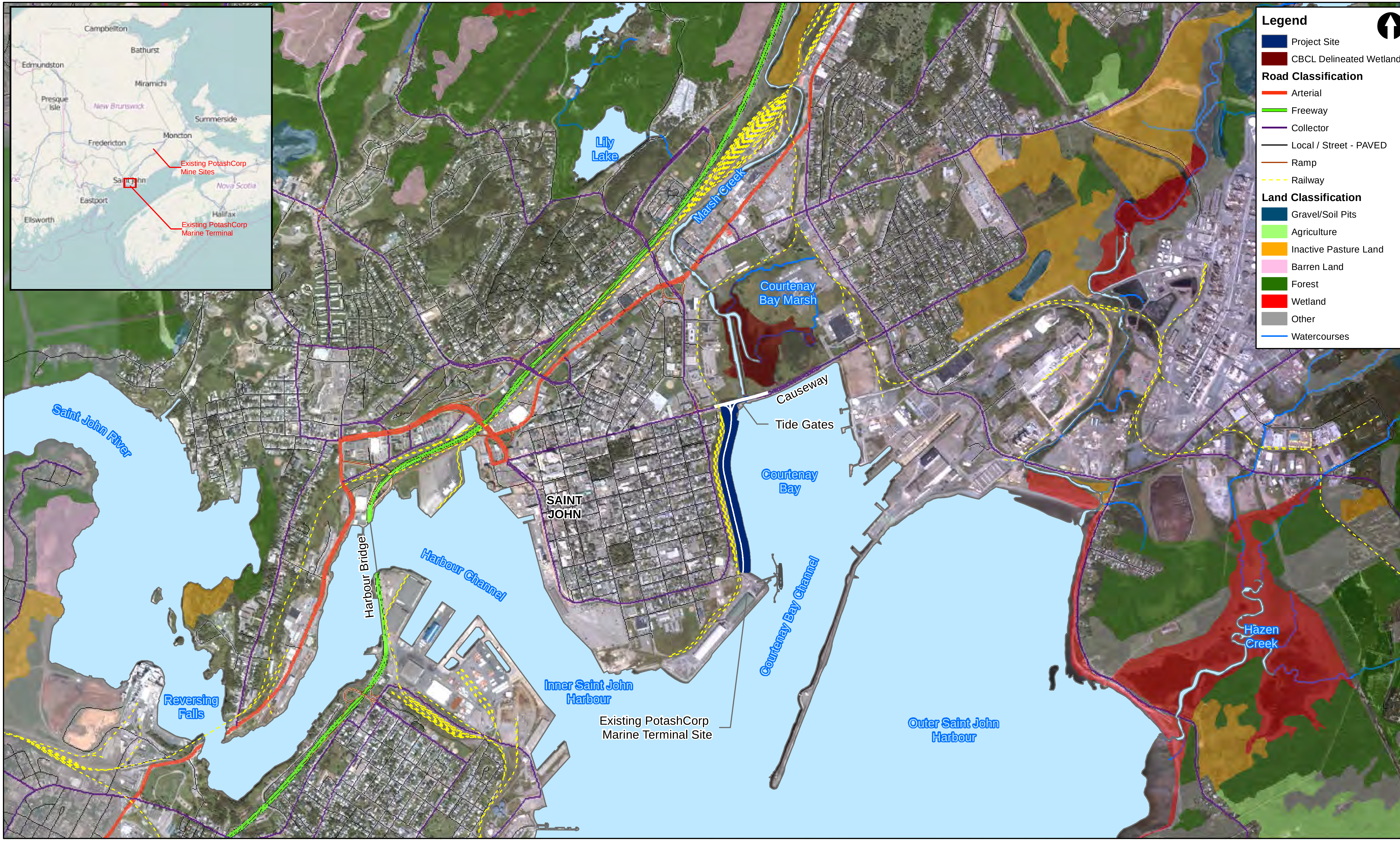
PotashCorp has reviewed multiple alternatives to handle the increased production of potash and salt from the Picadilly Expansion. The feasibility of various layouts was assessed through PotashCorp-commissioned studies completed by CBCL. The Project, as described in this document, was selected as the most feasible and sustainable option. The following alternatives were also considered:

1. Operate Existing Marine Terminal – PotashCorp has reviewed the capacity of the existing Marine Terminal to determine the feasibility of shipping the increased production of potash out of the existing Terminal without an expansion. It has been determined that the existing rail storage area is undersized to accommodate the increase in rail traffic;
2. Relocate Marine Terminal – PotashCorp has examined the possibility of relocating the Marine Terminal. It has been determined that the costs and environmental impacts associated with developing an alternative marine terminal location are prohibitive and not a viable option;
3. Operate Two Marine Terminals – The option of constructing a new terminal facility on the west side of Saint John was investigated. The existing facility on the east side would continue to ship standard grade potash and salt; the new west side facility would be dedicated to shipping granular potash. This option would require procurement of land and the construction of a new shiploader. There are other operations and leased properties that would restrict the land base on which to lay out the site, and any increase in rail traffic would require a detailed review of the rail system in that area. It was determined that this is not a viable option; and
4. Alternate Expansion to Existing Marine Terminal – The feasibility of several potential expansion layouts was assessed. The existing layout as described in this document was selected as the most feasible and sustainable expansion option and, therefore, is the option being proposed.

2.4 Project Location

The PotashCorp Marine Terminal is located in the city of Saint John, County of Saint John and province of New Brunswick. The Terminal is situated on the southeastern corner of the south central peninsula, also referred to as Barrack's Point. Figure 2.2 is a 1:20,000 scale map which shows the site in relation to existing surrounding features. Expansion is proposed along Courtenay Bay, from the Courtenay Bay Causeway which crosses Marsh Creek to the existing facilities near the corner of Broad Street and Crown Street.

See Section 5.6.1 and Appendix B for a detailed description of existing land uses within and around the Project footprint.



CBCL LIMITED
Consulting Engineers

Client
PotashCorp
Helping Nature Provide

Project Description
MARINE TERMINAL EXPANSION
LOCATION OVERVIEW

Revision or Issue
ISSUED FOR EIA REGISTRATION DOCUMENT (FEB 19, 2015)

Contract No	142865.00	Drawn	MD	Approved	AW
Scale	1:20,000	Date	OCT 2014	Figure No	2.2

The following Property Identifiers are associated with the Project location and are shown on Figure 2.3:

PID 55190821	J.D. Irving Limited
PID 55155097	City of Saint John
PID 55061766	City of Saint John
PID 55037758	Saint John Port Authority – Leased by City of Saint John
PID 00018341	Saint John Port Authority – Leased by PotashCorp
PID 00018762	Canadian National Railway Company
PID 55034581	Saint John Port Authority
PID 00018374	Saint John Port Authority – Leased by PotashCorp
PID 55099592	Canadian National Railway Company – Leased by PotashCorp and Saint John Port Corporation
PID 55034573	Saint John Port Authority – Leased by PotashCorp
PID 00018317	Saint John Port Authority – Leased by PotashCorp
PID 55099584	Canadian National Railway Company – Leased by PotashCorp and Saint John Port Corporation
PID 55151351	Saint John Port Authority
PID 55176234	Irving Oil Limited

The Marine Terminal is owned by PotashCorp, however the land is owned by the Saint John Port Authority (SJPA). PotashCorp and SJPA have a lease for the property and are working on an updated lease to cover the project components (rail / road and garage expansion).

A small amount of slope fill may be placed on PID 55176234 (Irving Oil Limited) during widening of the Causeway. PotashCorp has discussed this potential with Irving Oil and will work out an agreement in the event that their property is impacted.

2.5 Project Schedule

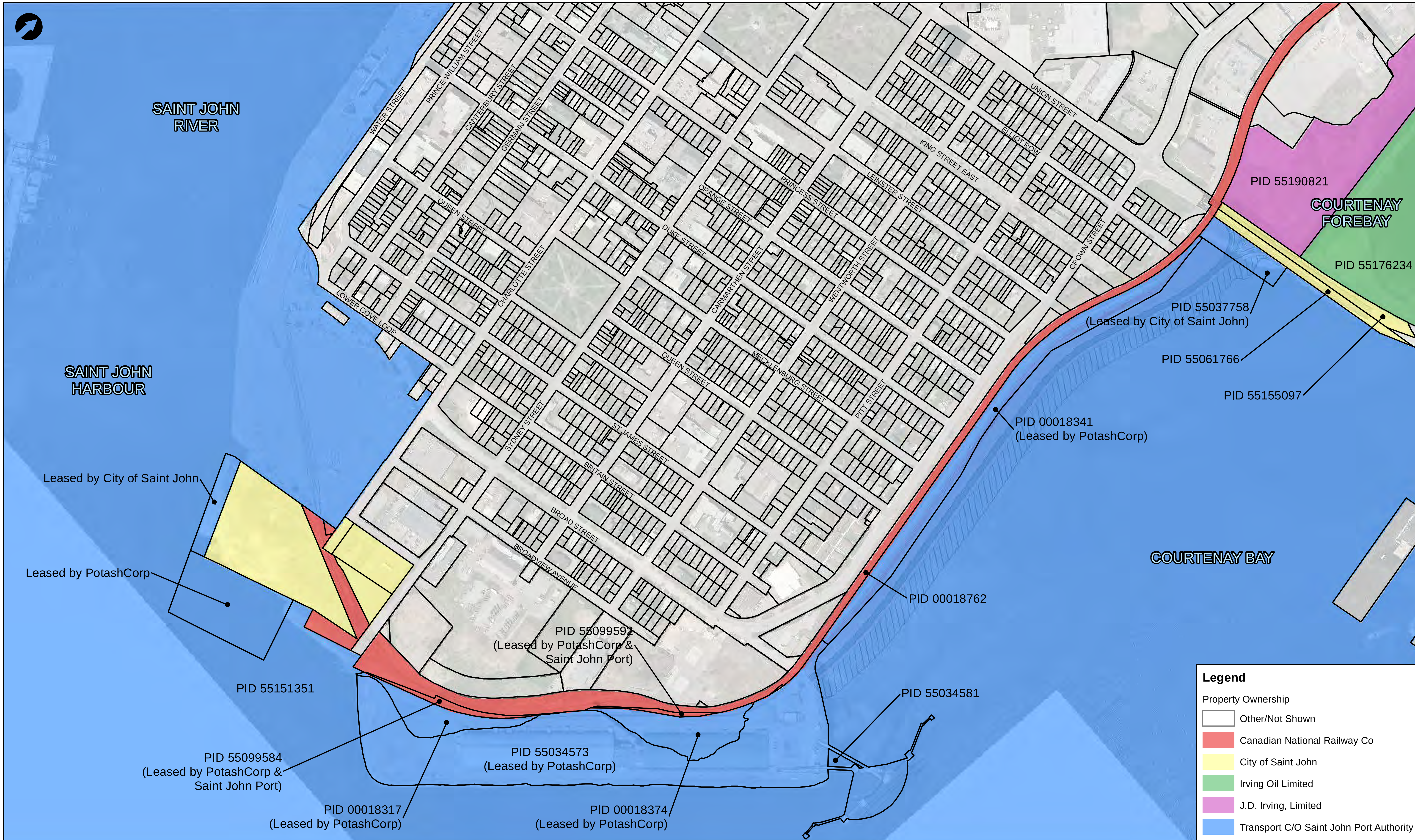
2.5.1 Rail / Road Expansion

The following schedule is anticipated for the detail design and construction of the Rail / Road Expansion. The schedule is subject to the terms and conditions of regulatory approval and funding decisions.

March 2015	Environmental Impact Assessment
March to August 2015	Applicable Environmental Permits and Approvals
October 2015 to October 2017	Project Construction
October 2017	Project Operation

2.5.2 Garage Expansion

It is anticipated that the garage expansion will occur concurrently with the road expansion, as described above. However the construction of the Garage Expansion will take approximately 6 months.



CBCL LIMITED
Consulting Engineers

Client: PotashCorp — Helping Nature Provide

Project Description: MARINE TERMINAL EXPANSION
ASSOCIATED PROPERTY IDENTIFIERS, OWNERSHIP, AND LESSEES

Revision or Issue: ISSUED FOR EIA REGISTRATION DOCUMENT (FEB 19, 2015)

Contract No	142865.00	Drawn	JD	Approved	AW
Scale	1:5,500	Date	OCT 2013	Figure No	2.3

2.6 Project Components

2.6.1 Construction

The scope of work was developed based on a consideration of the existing facility operations and the need for expansion/upgrades to accommodate the anticipated increase in production related to the Picadilly Expansion.

The project is divided into two separate components, to be constructed independently of each other: the Rail / Road Expansion and the Garage Expansion.

The following section details elements of each component. See Section 2.7 for additional construction details and construction sequencing. Section 2.8 details additional environmental design components that will mitigate some potential environmental impacts during construction.

2.6.1.1 Rail / Road Expansion

The project includes expansion of the existing rail yard with the addition of two sidings, construction of a new access road from the Courtenay Bay Causeway to the site, addition of four new bays to the existing garage and construction of a new locker room / lunchroom facility connected to the existing garage. The rail expansion and new access road will require the construction of a new intersection at the Courtenay Bay Causeway and infill parallel to the existing shore line, with a width varying on location from 40-80 m. See Figure 2.1.

The driving factor necessitating the need for the rail / road expansion is to expand the amount of rail car storage at the terminal. Under existing conditions, there is enough storage for approximately 150 rail cars. Since CN has confirmed that they will continue to only pull one train of full cars to the site a day (and haul one train of empties from the site), during peak operations, the terminal will have to be able to store 2x91 (or 182) rails cars at any given time.

Vehicle access to the facility is currently provided at the corner of Broad Street and Crown Street. Vehicles must cross the rail tracks in order to access the site. There is sufficient tail track past the dumper for 22 rail cars; however, only 12 to 14 cars can be unloaded at a time without blocking the main entrance. Blocking the main access road with rail cars is acceptable as long as they are actively managed and access can be granted to emergency vehicles by splitting cars, if required. PotashCorp prefers to limit the rail cars to 12 to 14 in order to maintain access to the site for emergency vehicles and regular truck traffic, thereby preventing truck traffic from backing up on Broad Street and Crown Street.

The most effective method to accommodate the need to unload 60-91 rail cars is to use a unit train concept whereby splitting trains during unloading is minimized, significantly reducing the amount of new infrastructure required and increasing the speed and efficiency of offloading.

In order to implement this concept at the existing facility, the rail and vehicle entrances to the site require separation, accommodated by the intersection and access road. This will also allow continuous access for emergency vehicles and regular truck traffic. It will reduce the noise and disruption associated with repeatedly breaking and moving rail cars. Heavy truck traffic (approximately 200 / day on peak days) will be eliminated from Crown Street south of Union Street.

The access road is proposed to extend from the Courtenay Bay Causeway to the existing facility and be approximately 1 km in length. The construction of the new rail sidings and access road will require infilling a portion of Courtenay Bay, extending in width between 40 and 80 m from the existing shoreline into Courtenay Bay. The total footprint below higher high water mean tide (HHWMT) of the infill within Courtenay Bay is approximately 63,400 m^2. The access road would also include the construction of a new Courtenay Bay intersection, involving placement of fill on the Courtenay Forebay side of the Causeway. No infilling activities on the Courtenay Forebay side of the Causeway will be below HHWMT or within the boundaries of the Courtenay Bay Wetland as delineated by CBCL (see Figure 2.2 and Appendix C); however, the placement of fill will occur within 30 m of the provincially-significant wetland.

The rail / road expansion infill consists of a toe berm, access road, shoreline protection and intersections at either end of the road. Multiple culverts and outfalls are located along the existing shoreline at the base of the slope protection, and existing culverts will be extended to reach the extent of the proposed infill.

The contractor will be required to work with the tidal cycles in order to conduct infilling activities in the dry where practical. The placement of material in water during the tide cycle will be permitted only if appropriate mitigate measures are in place and if conditions are such that the impacts to water quality are unlikely. If a sediment plume is observed outside of the boundaries of the worksite during in water infilling, the contractor will be required to stop work and implement additional sediment control measure prior to continuation of in water infilling activities.

Infill Material will be free of excessive fines.

The following components are involved in the Rail / Road Expansion:

- Construction of a new three-way intersection at the Courtenay Bay Causeway, with on and off ramps;
- Infilling areas on both sides of the Causeway (Courtenay Forebay and Bay);
- Widening the existing roadway to accommodate a new westbound left-hand turning lane;
- Infilling for new road from the Causeway to the Marine Terminal Facility;
- Slope stabilization and armour stone protection;
- The access road to accommodate two way traffic of heavy vehicles
- The installation of two new railway tracks, with room for two additional tracks in the future (for a total of four new tracks); and
- Installation of guide rail and light standards, as needed.

2.6.1.2 Garage Expansion

The Terminal's existing garage (see Figure 2.1) will be expanded to increase personnel and storage capacity. Construction of a single-storey addition with an approximate footprint of 115 m^2 on the northeast side of the existing garage for ILA workforce will include adequate space for 20 to 25 people; lunchroom; kitchen; staff lockers and washrooms; space for hanging of coveralls and other PPE; and janitor's room for storage of cleaning supplies.

The garage expansion will also include construction of a storage area on the southwest side of the existing garage with a footprint of approximately 280 m^2, consisting of four additional bays (one of the expanded bays is to include a mezzanine for storage); an additional work bench along the new garage wall; and welding station. The extensions will be constructed using materials similar to those at the existing garage (i.e., pre-engineered steel structure with insulated metal panels and standing seam metal roof and slab on grade floor). The existing oil water separator will be relocated during construction. The drain line in the garage will send all water through the oil water separator.

The following components are included in the Garage Expansion:

- Construction of a single-storey addition on northeast side of existing garage with an approximate footprint of 115 m^2; and
- Construction of garage/storage addition on southwest side of garage with an approximate footprint of 280 m^2, consisting of four additional bays (one of the expanded bays is to include a mezzanine for storage); additional work bench along the new garage wall; and welding station.

2.6.2 Operation/Maintenance

During operation, potash will arrive at the site by rail; unloaded to a dumper and reclaim facility; transferred to one of the storage sheds; delivered to a radial telescopic luffing shiploader; and loaded onto ships. The facility would typically receive 61 rail cars of potash per day and, under peak operating conditions, 91 cars per day. Rail delivery and unloading activities will occur seven days a week, and the facility will unload unit trains of approximately 22 car-lengths at a time. On account of the new access road and separated vehicle/rail entrances, the unit trains will not block access to the facility. Truck traffic will access the site using the newly constructed access road east of the existing tail track. As per the existing operation, brine from the mine site will arrive at the site by truck and be discharged into Courtenay Bay, with brine discharge volumes and locations unchanged from current operations.

Maintenance activities typical of roadways, railways and buildings will be carried out during the operation of the facility. Equipment maintenance will also be conducted to support the safe and effective operation of the facility. Access to the site during maintenance activities will be maintained for trucks, maintenance vehicles, and emergency vehicles.

2.7 Construction Sequence

Construction of the two components will be carried out independently of one another, in accordance with the schedule presented in Section 2.5. A brief description of the construction sequence for the rail / road expansion and garage expansion are included in the following table.

Table 2.2: Description of Construction Activities

CONSTRUCTION ACTIVITY	DESCRIPTION
ACCESS ROAD AND RAIL	
Site access and staging area	• Construction access provided primarily from Courtenay Bay Causeway; • Lay-down area set up to store contractor's equipment and materials; • Hazardous materials stored at least 100 m from any waterbody and in a secure location to maintain containment and avoid discharge to the waterbody. If it is not practical to handle or store these products at this setback, dyking will be constructed to contain any spills; and • Construction equipment will be refuelled at a designated (paved, level) location, a minimum of 100 m from any waterbody. If it is not practical to handle or store these products at this setback, dyking will be constructed to contain any spills.
Installation of environmental controls	• Sediment control measures will be installed prior to commencement of construction and will be maintained appropriately; and • Localized silt fence will be installed in areas of culvert extensions along new access road.
Removal of existing armour stone	• Top 1.5 m of existing armour stone will be peeled off allow for placement and compaction of rail and roadway base materials. • All removal activities will be carried out using land-based equipment; and • Should any contaminants be discovered, appropriate mitigation techniques will be applied.
Infilling and stabilization	• Design of infill varies from 40-80m wide extension, sloping at 3H:1V down to a 2 m thick toe berm structure; • Toe berm will extend flat approximately 17 m beyond bottom of infill slope and will be constructed on an initial layer of structural geotextile fabric for added stability; • All construction activities will be carried out using land-based equipment; and • Bay side of infill, including toe berm, will be constructed with an armour rock lining to protect against erosion.
Intersection at Causeway	• A three-way intersection with on and off ramps will be constructed to connect at the Courtenay Bay Causeway; • North side of Causeway designed to be widened to accommodate new westbound left-hand turning lane, therefore minimal infilling along the northern bank of the Causeway will be required; • Construction activities will be carried out using land-based equipment within silt fences; and • Intersection layout has been designed to requirements of the Transportation Association of Canada (TAC) standards.

CONSTRUCTION ACTIVITY	DESCRIPTION
Access road and rail	• Road will be constructed similar to the City of Saint John typical road sections for two-way traffic of large industrial heavy vehicles with lane widths of 4.3 m; • Northbound lane designed with 4 m shoulder to allow space for a shoulder and guide rail; • Southbound lane was designed with 2 m shoulder and ditching complete with catch basins to convey stormwater runoff from new road surface; • Access road will terminate at Guardhouse; and • Two new railway tracks will be constructed between the road and existing tracks - proposed tracks and associated turnouts will each be able to accommodate 45 rail cars (approximately 820 m of track).
Removal of construction materials	• All construction materials and hazardous wastes will be disposed of properly prior to reinstatement of Project site.
GARAGE EXPANSION	
Installation of environmental controls	• Installation of silt fences where appropriate and temporary stabilization of disturbed surfaces with hay-mulch or clean gravel/clear stone.
Site access and staging area	• A lay-down area directly to the southwest of the Administration Building would not impede vehicle traffic in and out of the site and would be a useful location for the Contractor's equipment and materials; • Hazardous materials will be stored in a secure location to maintain containment and avoid discharge to the waterbody; and • Construction equipment will be refuelled at a designated (paved, level) location at a minimum of 100 m from any waterbody. If it is not practical to handle or store these products at this setback, dyking will be constructed to contain any spills.
Groundwork	• Excavation and dewatering requirements for the garage expansion are expected to be minimal for the construction of a frost wall and slab on grade; and • If contaminants are detected, proper mitigation techniques will be applied.
Building construction	• All materials, construction methods, and testing procedures shall be undertaken in accordance with industry standards; • The existing three-bay garage will be expanded by adding a 7.6 m x 12 m single storey locker room/ lunch room to the northeast and an extra four garage bays to the southwest;

CONSTRUCTION ACTIVITY	DESCRIPTION
	• The new garage space on the southwest side will mimic the existing construction – pre-engineered steel structure with insulated metal panels and standing seam metal roof and slab on grade floor; and • The office space will likely bear on a perimeter frost wall concrete foundation and be framed with load bearing reinforced concrete block walls for durability; roof will likely be flat and at a lower elevation than the roof of the adjacent garage.
Removal of construction materials	• Proper disposal of all construction materials and hazardous wastes will occur prior to the reinstatement of the Project site.

2.8 Environmental Protection Design Components

The following section details environmental protection measures incorporated as part of the design to mitigate potential environmental impacts during construction and operation activities of the proposed Project. With the implementation of the environmental protection design components described below, only the Project activities that still show a potential adverse effect will be brought forward for further assessment.

2.8.1 Handling and Disposal of Impacted Soils and Sediment

The construction activities associated with the Garage Expansion will involve the excavation of soil. The excavated soil has the potential to be impacted with Contaminants of Potential Concern (CoPC) because of past land use. As such, soil quality in the proposed areas of excavation activities will be characterized prior to the commencement of excavation activities. The soil quality assessment will be carried out by experienced professionals using industry accepted sampling methodologies. Soil samples will be sent to an accredited laboratory for analysis of CoPC. If CoPC are identified, recommendations will be made for appropriate management of impacted soil in accordance with all applicable guidelines and regulations, prior to the commencement of excavation activities.

2.8.2 Sedimentation

The contractor will be required to work with the tidal cycles in order to conduct infilling activities in the dry where practical. The placement of material in water during the tide cycle will be permitted only if appropriate mitigate measures are in place and if conditions are such that the impacts to water quality are unlikely. If a sediment plume is observed outside of the boundaries of the worksite during in water infilling, the contractor will be required to stop work and implement additional sediment control measure prior to continuation of in water infilling activities.

Infill Material will be free of excessive fines.

The contractor will also be required to mechanically place armour stone for the toe berm. This will reduce the mobilization and fluidization of the sediment bed during infilling activates. A geotextile will be placed on top of sediment before infilling occurs to reduce the fluidization of the sediment bed which will also reduce sedimentation.

The top 1.5 m of existing armour stone will be removed to facilitate the rail / road expansion; the remaining armour stone will remain in place and new construction will occur on top of the existing armour stone. This method will provide slope protection during high tide events, thereby reducing the likelihood of undermining the existing track and limiting sedimentation.

General sediment control measures will include the installation of silt fences. Silt fences will be installed around culverts and tidal channels during culvert extension construction activities. Silt fences will also be installed during the placement of fill material on the Courtenay Forebay side of the Courtenay Bay Causeway.

2.8.3 Lighting

Project-related lighting during construction and operation could affect the use and enjoyment of surrounding residential properties; these potential effects are somewhat attenuated given that the Terminal is surrounded predominantly by other industrial uses, however increased lighting may particularly affect residences along Crown Street, as the new access road is proposed to include new light standards placed every 50 to 60 m. In order to mitigate potential effects due to exposure to additional light, Project design has included directional lighting where practicable to provide the safety and security benefits of light, while minimizing its nuisance to surrounding residents.

The contractor will conduct construction activities between hours of 7:00 AM and 9:00 PM as per the City of Saint John Noise Bylaw. In the event that the contractor receives a variance from the City to conduct construction activities outside the 7:00 AM and 9:00 PM window, all construction activities conducted will require approval from PotashCorp. Security lighting will be permitted during 9:00PM – 7:00AM.

2.8.4 Environmental Emergency Plan

PotashCorp has developed an Environmental Emergency Plan (EEP) that is to be implemented in the event of an environmental emergency during operation of the facility to reduce potential adverse environmental effects from such an event. The EEP will remain in force during operations and may be updated through the Provincial regulatory approvals. The EEP (attached in Appendix D) details procedures to address accidental spills, dust emissions and additional mitigations such as:

- Required maintenance of hydraulic hoses, and containment in the event of a hydraulic fluid leak;
- Spill response and containment procedures to minimize the likelihood of egress into the Bay through storm drains; and
- Dumper and shiploader scrubbers to minimize dust emissions.

CHAPTER 3 REGULATORY FRAMEWORK

The following section details the likely regulatory permitting and approval requirements to which the Project will be subject. It also details the environmental legislation and regulations in which the proponent and contractors must comply with during construction and operational activities. The review is based on current legislations; amendments to existing legislation may modify permitting and approval requirements for the Project. Additional permitting and approval requirements may exist. The permitting and approvals processes described below are not exhaustive and represent the more significant regulatory requirements.

3.1 Federal Regulatory Requirements

3.1.1 Navigation Protection Act

The *Navigation Protection Act* (NPA) protects Scheduled Navigable Waters from potential threats to navigation. The Atlantic Ocean including all connecting water bodies that intersect with the ocean's higher high water mean tide level, i.e., Saint John Harbour, and the Saint John River are Scheduled Navigable Waters. An approval from Transport Canada (TC) will be required under the NPA. A completed Project Description and accompanying design drawings will be submitted to TC for their review and approval.

3.1.2 Fisheries Act

The fisheries protection provisions under Section 35 of the *Fisheries Act* prohibits "serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery," unless otherwise authorized by DFO. The definition of serious harm is, "*death of fish or any permanent alteration to, or destruction of, fish habitat*". It is understood that *Fisheries Act* authorization under Section 35(2) is required; therefore, an application must be submitted to DFO which satisfies the information requirements set out in the *Fisheries Act* regulations. The application must also include an appropriate fisheries impact offsetting plan. In consultation with DFO, PotashCorp is evaluating their potential authorization and offsetting requirements.

The Marine Mammal Regulations pursuant to the *Fisheries Act* states that no person shall disturb a marine mammal except when fishing for marine mammals under the authority of the *Fisheries Act*. Prohibited activities include those related to negligence that result in the disruption of marine mammals from their normal behaviour and activities.

3.1.3 Canada Shipping Act

The *Canada Shipping Act* (CSA) is the principal legislation governing safety in marine transportation and recreational boating, as well as protection of the marine environment. The Act applies to Canadian vessels operating in all waters and to all vessels operating in Canadian waters. Project-related vessels will be required to adhere to the CSA and attendant regulations such as the Collision Regulations; Natural and Man-made Harbour Navigation and Use Regulations; Fire Safety Regulations; Vessel Clearance Regulations; Vessel Certificates Regulations; and Ballast Water Control and Management Regulations, among others.

3.1.4 Notice to Mariners

The Canadian Coast Guard issues a Notice to Mariners publication, informing mariners of important navigational safety matters affecting Canadian Waters. These Notices provide a continuous means to disperse necessary information to those responsible for vessel navigation, including updates on the enactment of regulations and the establishment of procedures governing vessel entry into and transit in Canadian waters. The Notices to Mariners also contain the information necessary to ensure that publications such as nautical charts, sailing directions and lights lists are up-to-date.

The Notice to Mariners includes the following requirements to reduce potential impacts to navigation:

1. Adhere to the Saint John Port Authority Practices and Procedures;
2. Prohibited to interfere with the use of the harbour or interfere with navigation;
3. Prohibited to pass another vessel at a speed that will adversely affect the vessel being passed;
4. Required to remain in defined traffic lane except in the case of an emergency;
5. Required carry on board light, shape, sound-signalling and radar reflector;
6. Required to avoid high density fishing areas and maintain a continuous radio watch on VHF Channel;
7. Required to contact MCTS centre at Saint John “Fundy Traffic” for detailed information concerning fishing vessel concentrations;
8. Required to advise ship captains to avoid any observed fishing buoys; and
9. Avoid high density fishing areas and maintain a continuous radio watch on VHF Channel 16.

The Notice to Mariners includes the following requirements to reduce potential impacts to marine mammals:

1. It is prohibited to hunt, chase, follow, disperse, drive, herd or encircle any marine mammal;
2. Between the months of June 1 and December 31, post lookouts to avoid collisions and slow down to 10 knots while passing by the Grand Manan conservation area whether or not marine mammals are observed;
3. If a marine mammal is observed, vessels must either stop or travel parallel to the observed marine mammal; and
4. Wait until marine mammal is 400 m away before resuming speed.

3.1.5 Canadian Environmental Assessment Act

The Regulations Designating Physical Activities of the *Canadian Environmental Assessment Act* (CEAA) 2012 include a Marine Terminal designed to handle vessels larger than 25 000 DWT, unless the Terminal is located on lands that are routinely and have been historically used as a Marine Terminal. The proposed Project location is routinely and historically used as a Marine Terminal and therefore should not require a federal environmental assessment. The Canadian Environmental Assessment Agency has reviewed the proposed Project Description and confirmed that an environmental assessment pursuant to CEAA is not required.

3.2 Provincial Regulatory Requirements

3.2.1 Clean Environment Act

The Project will be subject to a Determination Review pursuant to the Environmental Impact Assessment Regulation under New Brunswick's *Clean Environment Act*. The Regulation requires that projects be registered with NBDELG and that the registration document address all the requirements specified in the Registration Guide including, but not limited to, adequate project detail, environmental baseline information, evidence of public and First Nations consultation, identify potential and known adverse environmental effects of the project undertakings, and proposed methods for mitigating the adverse effects.

3.2.2 Crown Lands and Forests Act

The Project does not require an approval from the New Brunswick Department of Natural Resources (NBDNR) pursuant to the *Crown Lands and Forests Act*, as the Project is located on federal (SJPA) Crown land. NBDNR confirmed that the applicable Crown land is not within their jurisdiction and a Coastal Land Use application is, therefore, not required.

3.2.3 Clean Water Act

The Project will require an approval pursuant to the Watercourse and Wetland Alteration Regulations of the *Clean Water Act*. A Watercourse and Wetland Alteration (WAWA) Permit is required to conduct an activity that may cause unnecessary harm to a watercourse or wetland. The Courtenay Forebay is designated as a provincially-significant wetland; therefore a WAWA Permit is required to undertake construction activity within 30 m of the wetland.

The Project will require an industrial approval to release a source of water and air contaminant pursuant to the Water Quality regulations of the *Clean Environment Act* and the *Clean Air Act*. An application form titled Requesting Approval for a Source must be submitted to the NBDELG for review and approval. It is anticipated that the WAWA approval and conditions will be incorporated into the industrial approval.

3.3 Species of Conservation Concern Designation and Legislation

Species at risk and of conservation concern in New Brunswick are tracked and designated at four levels: federal *Species at Risk Act* (SARA); New Brunswick *Species at Risk Act*; NBDNR General Status of Wild Species; and Atlantic Canada Conservation Data Center (ACCDC). The *Species at Risk Act*, New Brunswick Species at Risk Act, NBDNR and ACCDC each provide databases or a list of species with rankings. A rare taxa sightings report was acquired from ACCDC to identify species of concern for the study area. References referred to in the ACCDC report were used to acquire information on the other databases.

3.3.1 Species at Risk Status

The SARA aims to prevent Canadian endangered or threatened species from becoming extinct and to promote their recovery. The Act facilitates the management of species listed as special concern to prevent them from becoming endangered or threatened. The SARA also protects critical habitat and stipulates compensation, permits and enforcement. Critical habitat is the habitat necessary for the survival or recovery of a species listed as endangered, threatened or extirpated on Schedule 1 of SARA. It is an offence to kill, harm, harass, capture, take, possess, collect, buy, sell or trade an individual of a species listed as endangered, threatened or extirpated in Schedule 1 of SARA. The SARA also makes it an offence to damage or destroy the residence of one or more individuals of a species listed in Schedule 1 as endangered, threatened or extirpated (SARA, 2011). The species identified in the ACCDC databases were checked against the SARA database to obtain their species at risk status.

3.3.2 New Brunswick Species at Risk Act

The New Brunswick *Species at Risk Act* was updated in April 2012 from the previous New Brunswick *Endangered Species Act*. The Act states that no person shall kill, harm, harass or take any individual that is listed as an extirpated species, an endangered species or a threatened species. Protected species are listed in Schedule A of the Prohibitions Regulations made under the *New Brunswick Species at Risk Act*.

3.3.3 NB Department of Natural Resources: General Status of Wild Species

The NBDNR General Status of Wild Species assesses the security of wildlife species in New Brunswick, designating each species with one of the following ranks: extinct; extirpated; at risk; may be at risk; sensitive; secure; undetermined; not assessed; exotic/alien; accidental/vagrant; and occurrence not verified.

3.3.4 Migratory Birds Convention Act

The *Migratory Birds Convention Act* (MBCA) is administered by Environment Canada (EC). The Act protects over 500 species of migratory birds, including the protection of their eggs and their nests (MBCA, 1994). The Canadian Wildlife Service is a division of EC and is responsible of administering the Act with assistance from the enforcement branch of EC. It is illegal, under Section 6 of the Migratory Bird Regulations (MBR) of the MCBA, to disturb, destroy or take migratory birds and their nests and eggs (MBR, 2012), except by permit for scientific, educational or other specific purposes. Section 5 of the MBCA prohibits the possession, selling, buying or exchanging of a migratory bird or nest, and also prohibits the deposition of substances that may be harmful to migratory birds. Such substances cannot be deposited into waters frequented by migratory birds, or into an area that may enter those waters. The MBCA applies to vessels operating within the Exclusive Economic Zone of Canada and Canadian vessels operating in international waters.

3.3.5 Atlantic Canada Conservation Data Centre

The ACCDC provides technical tracking lists of observations of rare and endangered flora and fauna. An ACCDC listing of rare and endangered species sightings was acquired for a 5 km radius around the proposed study area. Species on the ACCDC list are ranked according to Subnational Rarity Rank of Taxon (SRANK) (Appendix F). Appendix F lists all the species from the ACCDC report. Each entry includes the SARA status, provincial status, SRank, NBDNR general status, observation data, survey location and reference. The list is divided into associated groups (i.e., birds, mammals, reptiles, invertebrates and vascular plants) and are discussed further their respective section in Chapter 3. In total, 117 different species at risk and species of conservation concern were found within a 5 km radius.

3.3.6 Maritime Breeding Bird Atlas

The Maritime Breeding Bird Atlas is a database used to assess the status and determine distribution and abundance throughout the Maritimes. The current version of the database displays data from 2006 to 2010. Five 10X10 km grids were chosen from the atlas that overlapped or were adjacent to the Project study area: 19GL32, 20KR62, 20KR61, 19GL31 and 19GL21. Each grid displays its corresponding number of confirmed, possible and probable breeding bird species. In total, 123 species were detected in the five grids (Appendix G).

CHAPTER 4 PUBLIC ENGAGEMENT

4.1 Objectives

This Project may impact a number of individuals and requires meaningful community engagement and public consultation. The objectives of engagement for this Project are to:

- Ensure that those potentially affected by the project are aware of the Registration;
- Advise stakeholders how to obtain additional information about the Project;
- Ensure stakeholders are able to ask any questions or express any potential concerns they may have about the Project;
- Respond to stakeholders openly and promptly, resolving as many potential concerns as possible and identifying those which remain outstanding; and
- Provide a report documenting the public involvement process including comments received to the NBDELG.

4.2 Stakeholder List

A list of stakeholders has been developed and will be updated as required throughout the Project. This list will be used to maintain two-way communication prior to and throughout the public engagement program. The following stakeholder groups in Table 4.1 have been identified to date.

Table 4.1: List of Stakeholders

Category	Organization
Elected Officials	Mayor Mel Norton, Councillors Donna Reardon and Gerry Lowe, Saint John Harbour MLA Hon. Ed Doherty, MP Rodney Weston
Port Industry Representatives	Port Saint John, Marine Communications and Traffic Services, Port of Saint John Harbour Pilots, NB Southern Railway, Irving Oil Limited, City of Saint John Planning and Development, CN Railway and Port of Saint John Employers Association
Community Groups	P.U.L.S.E., Human Development Council, Fusion Saint John, Uptown Saint John, The Greater Saint John Community Foundation and Saint John Waterfront Development
Economic Development Groups	Atlantic Canada Opportunities Agency, Enterprise Saint John, The Saint John Region Chamber and Saint John Construction Association
Environmental Groups	Atlantic Coastal Action Program (ACAP) Saint John, Conservation Council of New Brunswick, Fundy Baykeeper, Canadian Rivers Institute, Citizens Coalition for Clean Air, Bay of Fundy EcoSystem Partnership and Fundy North Fishermen's Association
First Nations	15 First Nations (see Table 4.2)
Neighbouring Businesses on the Lower Cove Loop	Department of National Defence, Select Printing, Global Convention Services, Saint John YMCA-YWCA, EMCO, The Ensuite, HVAC, Tabufile, The Dive Shack, The Eddy Group, Port City Pawn Shop, Fundy Energy, Harbourfront Condominium and Brass "n" Things

4.3 Planned Public Consultation

4.3.1 Direct Communication with Identified Stakeholders (Step 1)

PotashCorp will communicate directly with the following stakeholders:

- Elected Officials – Mayor Mel Norton, Councillors Donna Reardon and Gerry Lowe, Saint John Harbour MLA Hon. Ed Doherty, MP Rodney Weston;
- Port Industry Representatives – Port Saint John;
- Community Groups – P.U.L.S.E., Uptown Saint John, Saint John Waterfront Development;
- Economic Development Groups – Enterprise Saint John, The Saint John Region Chamber;
- Environmental Groups – ACAP Saint John, Conservation Council of New Brunswick, Fundy Baykeeper, and UNB Canadian Rivers Institute;
- First Nations – All First Nations of New Brunswick (See Table 4.2).

This direct communication will consist of organizing one or more meetings with each stakeholder to enable them to become more familiar with the proposed project, ask questions and/or raise potential concerns.

4.3.2 First Nations Consultation

With respect to the First Nations of New Brunswick, PotashCorp will undertake to engage with them directly and individually, with due regard and deference to representational groups as may be indicated by those First Nations themselves. The approach will be collaborative and consultative to assist and ensure reasonable efforts are made to share project information with the First Nations in a manner and format deemed appropriate and consistent with the scope of the project.

Table 4.2: First Nations Communities of New Brunswick

Community	First Nation
Buctouche	Mi'kmaq
Eel Ground	Mi'kmaq
Eel River Bar First Nation	Mi'kmaq
Elsipogtog First Nation (Big Cove)	Mi'kmaq
Esgenoôpetitj First Nation	Mi'kmaq
Fort Folly	Mi'kmaq
Indian Island	Mi'kmaq
Kingsclear	Maliseet
Madawaska Maliseet First Nation	Maliseet
Metepenagiag Mi'kmaq Nation	Mi'kmaq
Oromocto	Maliseet
Pabineau	Mi'kmaq
Saint Mary's	Maliseet
Tobique	Maliseet
Woodstock	Maliseet

4.3.3 Written Communication to Potentially Affected (Step 2)

PotashCorp will provide direct, written notification in letter format to potentially affected area residents, businesses, landowners and individuals. This notification will include the following:

- A brief description of the proposed Project;
- Information on how to view the registration document;
- A description of the proposed location (with map);
- The status of the Provincial approvals process;
- A statement indicating that people can ask questions or raise potential concerns with the proponent regarding the environmental impacts;
- Proponent contact information (name, address, phone number, E-mail); and
- The date by which comments must be received.

4.3.4 Notifications on the NBDELG Website and at the Head Office (Step 3)

The NBDELG shall place notice of the EIA registration on its website and shall have the EIA document available for public review at the Project Assessment Branch head office located on the second floor of 20 McGloin Street in Fredericton, New Brunswick. To satisfy this requirement, PotashCorp will provide an electronic version of the registration document (i.e., as a PDF document) and three hard copies to the NBDELG.

4.3.5 Documentation Availability for Stakeholders at NBDELG Regional Office (Step 4)

Copies of the Undertaking registration document, and any subsequent submissions made in response to issues raised by the Technical Review Committee (TRC), will be made available to any interested member of the public, stakeholder group, and/or First Nations group. A copy of the EIA document along with any subsequent revision will be placed at the Saint John NBDELG regional office where it will be made available to the public.

4.3.6 Public Notice Announcement (Step 5)

PotashCorp will place a public notice in the Telegraph Journal which will allow for general circulation in the area of the proposed Project. This notice will include (at minimum) the information outlined below:

- Date of registration submission;
- The purpose of the Project;
- The Project location;
- The address for the NBDELG Regional Office, Saint John Regional Library and the office of CBCL which are publicly accessible viewing locations local to the Project area;
- The PotashCorp contact information where comments may be submitted;
- The date and time details for the Public Open House;
- The date by which comments must be received, participants need to be invited to comment;
- A link for additional information about the proposal and the public involvement process; and
- Notice placed by: PotashCorp

4.3.7 Local Area Availability of the Registered Document (Step 6)

Copies of the Undertaking registration document, and any subsequent submissions made in response to issues raised by the TRC, will be made available at the Saint John Regional Library and the CBCL Limited office at 22 King Street. A copy of the Undertaking registration document and any subsequent information will be made available to any member of the public, stakeholder, or First Nations group upon request.

4.3.8 Public Open House (Step 7)

PotashCorp will host a public open house to provide an opportunity for the public to become familiar with the proposed Project and ask questions and/or raise potential concerns. The open house will be held at a time convenient to the public and will be located at a facility near the Project site. This open house will be publicized via advertisements in the Telegraph Journal to ensure the public will know when and where the meetings are taking place. Special invitations will also be sent to key stakeholders and neighbouring homes and businesses within 2km of the Project site.

This open house offers a visible and effective way to directly engage in two-way communication with key stakeholders associated with the Project. The attendees will learn about the Project from information displays, handouts and discussions with PotashCorp representatives.

Attendees will also be given the opportunity to provide feedback through exit questionnaire forms if they choose to complete them.

4.3.9 Documentation of Public Consultation Activities (Step 8)

The Public Consultation Activities will be documented and submitted to the Sustainable Development, Planning and Impact Evaluation Branch within 60 days of Project registration. Documentation will include the following as a minimum:

- A description of all public involvement activities;
- A list of all key public and private stakeholders contacted;
- A list of First Nations contacted;
- Copies of all correspondence sent to and received from stakeholders and the public;
- A description of any issues or concerns received during the Public Consultation period;
- An explanation of how these issues and concerns have or will be considered/addressed;
- A plan for any proposed future public involvement; and
- Any comments on the involvement of Crown Land in relation to the Project.

4.4 Crown Consultation

Pursuant to Section 35 of the *Constitution Act*, the federal and provincial governments have the legal Duty to Consult with Aboriginal peoples where it contemplates decisions or actions (Crown conduct) that may adversely impact asserted or established Aboriginal rights or title. Crown conduct includes providing approvals for project activities proposed by private proponents. The following Crown entities will likely be contemplating Crown conduct:

- New Brunswick Department of Environmental and Local Government;
- Saint John Port Authority;
- Department of Fisheries and Oceans; and
- Transport Canada.

The determination of First Nations Crown consultation requirements and processes will be made by the provincial and federal Crown entities contemplating Crown conduct. To facilitate a meaningful consultation process, PotashCorp will cooperate with Crown officials as necessary and where appropriate.

CHAPTER 5 EXISTING ENVIRONMENT

5.1 Atmospheric Environment

The atmospheric environment for the purpose of this environmental assessment consists of climate and meteorological conditions, air quality and acoustic environment. Climate and meteorological baseline conditions were derived from historic climate data. The air quality baseline was derived from historical air quality data from existing air quality monitoring conducted within Saint John. The baseline acoustic environment was established through a noise monitoring program conducted in and around the proposed Project site.

5.1.1 Climate and Meteorological Conditions

At the regional scale, Atlantic Canada lies within a zone of prevailing westerly winds that carry air from the interior of the North American continent. This zone experiences the passage of high and low pressure systems which are in turn influenced by ocean currents and continental topography. The low pressure systems moving through this area typically track across the continent, or up the seaboard, resulting in the onset of wind from an easterly direction, thickening cloud and a gradual drop in pressure. The frequent movement of such systems through Atlantic Canada brings significant precipitation. Winters are usually cold with frequent snowfall and freezing precipitation. Spring is typically late (sometime in May), cool and cloudy. Summers are short in duration, warm and are characterized by less precipitation than in other seasons.

In recent years, extreme weather events have been occurring more frequently. The Province has been subjected to both drought and intense storms. Tropical weather events are expected to be both more intense and frequent as the effects of climate change influence ocean warming and coastal currents. Climate models predict an increase in extreme local weather events throughout this century.

This section provides a general description of the region's climate (climate norms) over a 30-year period and the meteorological conditions at Project site. The site is situated on the Bay of Fundy and the climate is influenced by ocean temperatures. The Bay of Fundy water temperatures average between 0-4°C in the winter and 8-12 °C in the summer causing mild winters and cool wet summers.

Climate norms (30-year averages) for the 1971 to 2000 period are from the weather station located in Saint John (45°19'05.000" N, 65°53'08.050" W) for temperature, fog, and precipitation; these are tabulated in the sections that follow. Extreme weather data are also provided for the period of record.

Precipitation data recorded are summarized in Table 5.1. The total annual precipitation (1390.3 mm) is defined as the total rainfall plus water equivalent of snowfall and other forms of frozen precipitation. Rainfall is generally higher in the fall with snow and freezing precipitation frequent between October and March. Monthly precipitation ranges from 94 mm in February to 149.4 mm in December.

Table 5.1: Precipitation Normals and Extremes

Month	Mean Rainfall (mm)	Mean Snowfall (cm)	Total Precipitation (mm)	Extreme Daily Rainfall (mm)	Extreme Daily Snowfall (cm)	Extreme Daily Precipitation (mm)
Jan.	78.2	66.5	139.4	83	42.4	83
Feb.	48.8	50	94	82.3	34.8	95
Mar.	71.7	47.4	117.9	74	40.1	74
Apr.	81.7	22.2	104.2	125.5	26.2	125.5
May	115.9	1.4	117.5	66.5	10.2	66.5
June	100.9	0	100.9	108.2	0	108.2
July	101.5	0	101.5	79.4	0	79.4
Aug.	89.6	0	89.6	125.2	0	125.2
Sept.	117.4	0	117.4	83.2	0	83.2
Oct.	122.6	2.2	124.8	85.3	19.8	85.3
Nov.	121.6	12.5	133.7	**154.4**	28.4	**154.4**
Dec.	98.2	54.7	149.4	92.4	**58.2**	105.7
Year	1147.9	256.9	1390.3			

Source: Environment Canada Climate Normals: 1971-2000.

Saint John experiences a large annual temperature variation. Daily mean temperatures range from -8.1°C in January to 22.4°C in July. The annual daily mean is 5°C. Daily maximums, minimums and extreme temperatures at the Saint John weather station are reported in Table 5.2.

Table 5.2: Temperature Norms and Extremes

Month	Daily Average (°C)	Daily Maximum (°C)	Daily Minimum (°C)	Extreme Maximum (°C)	Extreme Minimum (°C)
Jan.	-8.1	-2.7	-13.6	14	-31.7
Feb.	-7.3	-1.9	-12.7	13.3	**-36.7**
Mar.	-2.5	2.3	-7.3	17.5	-30
Apr.	3.6	8.3	-1.2	22.8	-16.7
May	9.4	14.8	4	33	-7.8
June	14	19.5	8.4	32	-2.2
July	17.1	22.4	11.7	32.8	1.1
Aug.	16.9	22.2	11.6	34.4	-0.6
Sept.	12.8	17.7	7.7	31	-6.7
Oct.	7.3	11.9	2.7	25.6	-10.6
Nov.	2	6	-2.1	21.7	-16.9
Dec.	-4.7	0.3	-9.7	16.1	-34.4
Year	5	0.7	10.1	-0.1	

Source: Environment Canada Climate Normals: 1971-2000.

The Saint John weather station has recorded visibility statistics from the period of 1971-2000. The month with the greatest number of hours with less than 1 km of visibility is July with 113.9 hours. The average number of hours per year with visibility less the 1 km is 590.3 hours. Table 5.3 presents a visibility statistics for the 1960 to 2000 period of record.

Table 5.3: Summary of Visibility Statistics: Saint John Weather Station

Month	Hours of Visibility < 1km	Hours of Visibility 1 to 9 km	Hours of Visibility > 9km
Jan.	23.9	138.5	581.6
Feb.	21.4	125.8	530.8
Mar.	29.8	146.1	568.1
Apr.	31.5	134.5	554.1
May	48.5	118.7	576.9
June	84	125	511
July	113.9	128.4	501.7
Aug.	106.8	117.3	519.9
Sept.	60.8	103.5	555.8
Oct.	31.7	111.1	601.2
Nov.	19.1	125.6	575.3
Dec.	19.2	148.8	576
Year	590.3	1523.3	6652.4

Source: Environment Canada Climate Normals: 1971-2000.

5.1.2 Air Quality

NBDELG has established ambient air quality objectives as identified in Table 5.4. Air quality objectives have been established for carbon monoxide, hydrogen sulfide, sulfur dioxide, nitrogen dioxide and total suspended particulates. The Province of New Brunswick is also signature to the Canada Wide Standards for ozone and fine particulate matter ($PM_{2.5}$) as shown in Table 5.5.

Table 5.4: New Brunswick Air Quality Objectives

Pollutant	Averaging Period			
	1 Hour	8 Hour	24 Hour	1 Year
Carbon Monoxide	35,000 µg/m^3	15,000 µg/m^3		
Hydrogen Sulfide	15 µg/m^3		5 µg/m^3	
Nitrogen Dioxide	400 µg/m^3		200 µg/m^3	100 µg/m^3
Sulfur Dioxide[1]	450 µg/m^3		150 µg/m^3	30 µg/m^3
Total Suspended Particulate			120 µg/m^3	70 µg/m^3

*Source: NBDELG, 2012

[1]The standards for sulphur dioxide are 50% lower in Saint John than elsewhere in the province.

Table 5.5: National Ambient Air Quality Standards for Ozone and Fine Particulate Matter ($PM_{2.5}$)

Pollutant	Averaging Time	Standards (concentration)	
		2015	2020
$PM_{2.5}$	24-Hour (calendar day)	28 µg/m^3	27 µg/m^3
$PM_{2.5}$	Annual (calendar year)	10.0 µg/m^3	8.8 µg/m^3
Ozone	8-Hour	63 ppb	62 ppb

NBDELG has been conducting ambient air quality monitoring in and around the City of Saint John since the 1960s. There are a total of sixteen air quality monitoring sites located within Saint John. Seven air pollutants - nitrogen dioxide, sulfur dioxide, carbon monoxide, ozone, fine particulate matter, total reduced sulfur and volatile organic compounds are monitored at these sites. The Customs Building Monitoring Station is the closest ambient air quality monitoring site to the Project site, located approximately 1 km northwest of the facility (45° 16' 10" N, 66° 03' 42" W). The Customs Building Monitoring Station monitors concentrations of carbon monoxide, sulfur dioxide, nitrogen dioxide and ozone (NBDELG, 2012).

According to the latest New Brunswick Air Quality Monitoring Results report for the year 2010, the Customs Building Monitoring Station reported 4 exceedances of the hourly sulfur dioxide objective and 17 exceedances of the 24 hour sulfur dioxide objective. No sulfur dioxide exceedances were reported in the previous six year. No other exceedances were reported at this station (NBDELG, 2012).

Emission rates from existing operational activities were estimated using pollutant source characteristics and activity levels. Four key air pollutant sources were identified; material handling, rail operations, truck operations and shipping operations. However, material handling is conducted within a controlled building enclosure with minimum risk of fugitive air emissions. Fugitive and exhaust emissions from indoor sources are considered insignificant and, therefore, material handing was not included in the model. Table 5.6 summarizes the results of the model and identifies the pollutant source, type and the modeled maximum emission rate for current activities.

Table 5.6: Summary of Pollutant Source Characteristics and Emissions Rates of Current Activity

Activity	Source Description	Source Type	Emission Type		Existing Maximum Emission Rate(g/s)
Shiploading	Vessel Maneuvering - Diesel Engine	Area	Diesel Exhaust	PM_{10}	0.080
				$PM_{2.5}$	0.075
				CO	0.125
				NO_x	1.574
				VOC	0.045
				SO_2	0.698
	Shiploader - Wet Scrubber	Point Source Exhaust Vent	Fugitive Dust	TSP	0.108
				PM_{10}	0.051
				$PM_{2.5}$	0.016
Railway	Locomotive – Diesel Engine	Area	Diesel Exhaust	PM_{10}	0.020
				$PM_{2.5}$	0.018
				CO	0.813
				NO_x	5.600
				VOC	0.450
	Railcar Dumping - Wet Scrubber	Point Source Exhaust Vent	Fugitive Dust	TSP	0.406
				PM_{10}	0.192
				$PM_{2.5}$	0.060
Trucks	Truck Travel on Roads – Diesel Engine	Area	Diesel Exhaust	PM_{10}	<0.001
				$PM_{2.5}$	<0.001
				CO	0.015
				NO_x	0.0.017
				VOC	0.003
	Truck Travel on Roads	Area	Fugitive Dust	TSP	0.614
				PM_{10}	0.117
				$PM_{2.5}$	0.018

An air quality assessment was conducted to assess the maximum ground level concentration of air pollutants due to existing terminal activities at potential receptors. The dispersion model selected for this assessment was the USEPA Industrial Source Complex Short Term (ISCST) dispersion model. The ISCST dispersion model is a plume model that provides a sequential analysis of ground level concentrations over an extended period of time, using actual meteorological data and time variant emission rates. A Cartesian receptor grid with receptors spaced 65 metres apart for the area surrounding the site was configured. The study airshed surrounding the site included a 5,000 square metre grid, centered at the PotashCorp facility. Local terrain elevation data were estimated in the model. The terrain data were representative of the immediate surrounding area. Offsite receptors included residential and commercial properties along adjacent streets (i.e., Broadview Avenue, Broad Street). Receptors were selected based on their close proximity to site sources. NOx was the only pollutant to exceed the regulatory criteria with a maximum Ground Level Concentration result of 636 µg/m^3. The model indicated a number of 1-hour exceedance of NOx at residential and commercial properties located near the terminal.

Table 5.7: Model Results for Maximum Ground Level Concentrations for Current Activity

Air Emissions Parameter	Existing Maximum GLC Result(1) (µg/m^3)	Regulatory(1) Criteria (µg/m^3)	Criteria Source
Diesel Exhaust			
PM_{10} (2)	--	50	USEPA
$PM_{2.5}$ (2)	--	28	CWS, 2015
CO	220	35,000(3)	NBDELG, 2002
NOx	636	400(3)	NBDELG, 2002
VOC	63	N/A	--
SO_2	18 / 125	150 / 450(4)	NBDELG, 2002
Particulate Matter			
TSP	35	120	NBDELG, 2002
PM_{10}	9	50	USEPA
$PM_{2.5}$	2	28	CWS, 2015

1 Results and criteria are based on 24-hour averaging period unless indicated otherwise.
2 Particulate fractions from diesel exhaust are included as part of the Particulate Matter category.
3 Criteria based on 1-hour averaging period.
4 Criteria based on 24-hour/1-hour averaging periods, respectively.

5.1.3 Acoustic Environment

A noise assessment was conducted and documented existing noise exposure levels measured at several residential receiver locations adjacent to the Marine Terminal. The acoustic noise environment adjacent to Terminal operations was recorded during noise measurements performed within the surrounding neighbourhood at seven sites identified in Table 5.8 over a number of time periods within four days in June and September, 2013. These sites are considered to be representative of noise sensitive receptors within the study area.

Table 5.8: Noise Monitoring Locations

Site No.	Address	Representative Environment	Dominant Noise/Vibration Sources	Description
S1		First row of residences fronting (overlooking) railcar dumping station and salt truck deliveries.	Street Traffic (Crown Street) Rail Noise (shunting/unloading) Ship Loading	Monitor located at end of Avenue, approx. 130 m from railcar dumping station and adjacent Terminal roadway to Shed #2.
S2		Vacant property fronting (overlooking) site near salt truck deliveries.	Site Truck Traffic (salt) Street Traffic (Broad Street)	Monitor located at end of Sydney Street in vacant parking area, approx. 250 m from Shed #2.
S3		ENCO parking lot. Closest commercial property to railcar dumping station.	Site Truck Traffic (salt truck deliveries) Street Traffic (Broad Street)	Monitor located at rear ENCO parking lot overlooking Terminal, approx. 65 m from railcar dumping station.
S4		First row of residences fronting rail yard. Street traffic heavy at times.	Street Traffic (Crown Street) Rail Noise (Shunting & idling)	Monitor located at corner of Crown Street & Duke Street, approx. 60 m from rail yard. Grade is approx. 5 m above rail yard.
S5		First row of residences fronting rail yard. Street traffic heavy at times.	Street Traffic (Crown Street) Rail Noise (shunting & idling) Train arrival @ Terminal	Monitor located at corner of Crown Street & Queen Street, approx. 65 m from rail yard. Grade is approx. 4 m above rail yard grade.
S6		Residences overlooking rail corridor in Terminal rail yard during train arrival	Rail Noise (pass-by)	Monitor located at end of street extension, approx. 55 m from rail corridor. Grade is approx. 20 m above track elevation.
S7		Residences overlooking rail corridor into Terminal rail yard during train departure	Rail Noise (idling @ full throttle)	Monitor located at end of street, approx. 50 m from rail corridor. Grade is approx. 15 m above track elevation.

Recording sessions were conducted using a Quest SoundPro DL sound level meter which meet the Type 2 specifications in ANSI S1.4: 1983 (ANSI, 1983). The microphone was field calibrated before and after each monitoring period using a Quest Calibrator.

Details of instrument placement and site conditions are provided in the Noise Assessment (Appendix H). Table 5.9 shows the results of the community noise monitoring survey at each site in terms of average noise levels (L_{eq}) during different periods throughout a 24-hour day. Maximum levels (L_{max}) during recording sessions are also provided.

Table 5.9: Noise Survey Results

Site No.	Street Address	Session Period	Working Hours		After Hours		Dominant Sources
			L_{eq} [1] (dBA)	L_{max} [2] (dBA)	L_{eq} (dBA)	L_{max} (dBA)	
S1	Broadview Avenue	Morning Evening Morning Afternoon	56 59 60[3]	70 71 70[3]	 52	 70	Ship loading Terminal trucks Kids playing Dumping Station Ship loading Flock of birds
S2	Sydney Street	Afternoon Evening	58	71	 45 [3]	 54[3]	Salt Trucks Non Terminal Source No rail or ship Car horn excluded
S3	Wentworth Street	Morning Morning	58 63	64[3] 80[3]			Dumper Scrubber Railcar Dumper Light traffic
S4	Crown Street and Duke Street	Early a.m. Morning	 75	 100	53	76	Rail Yard Switching Street traffic
S5	Crown Street and Queen Street	Morning Early a.m.	73	89	 58[3]	 76[3]	Rail Yard Switching Street traffic Rail Yard Switching
S6	King Street Extension	Early a.m.			60	83	Pass-by Train
S7	Elliot Row	Early a.m.			74	89	Locomotive Idling (max revs)

[1] L_{eq} - Energy Equivalent Noise Level
[2] L_{max} - Maximum Noise Levels
[3] Value estimated based on a review of the logged data chart for session

Audio recordings at a number of "near-source" locations within the Terminal property were used to analyze specific noise sources. Table 5.10 provides a summary of the "near-source" analysis for ship loading, railcar unloading, truck traffic, whistling and train shunting noise events.

Table 5.10: Terminal Noise Events

Noise	Noise Type	L_{eq}(1) (dBA)	L_{pk}(2) (dBA)	L_{max}(3) (dBA)	L_{90}(4) (dBA)	Distance to Source (m)
Rail Operations(1)						
Railcar Dumper	Continuous	75	90	80	na(2)	10
Locomotive Idling	Continuous	75	90	80	na	10
Shunting	Impulsive	88	108	90	na	10
Whistling	Impact	90	117	102	na	10
Wheel Squeal	Intermittent	90	117	102	na	10
Ship Loading & Conveyance:						
Shiploader (Event #1)	Continuous	74	102	80	67	65
Shiploader (Event #2)	Continuous	78	125	94	59	60
Trucks:						
Brine	Intermittent	63	103	82	53	40
Salt	Intermittent	70	110	90	55	20
Trucks (@ Crown)	Intermittent	75	118	100	55	10
After Hours:						
Shed #2	Continuous	47	92	75	45	NA
Shed #1	Continuous	50	91	67	48	NA
Rail yard	Continuous	53	88	73	50	65

[1] L_{eq} - Energy Equivalent Noise Level
[2] L_{pk} - Highest Instantaneous Noise Level
[3] L_{max} - Maximum Noise Levels
[4] L_{90} – 90 Minute Average Noise Level

5.1.3.1 Rail Noise

Rail operations noise at the Terminal includes the switching of rail cars in the tail track and railcar unloading at the dumper station. Rail noise is comprised of whistling, pass-by locomotives and rail cars, shunting (by rail or Terminal operators), idling locomotives and wheel squeal. Noise from whistling, wheel squeal and pass-by trains is intermittent in nature. Wheel squeal also contains strong tonal components. Idling locomotive noise is generally continuous in nature and contains strong low frequency components.

Railcar switching noise was recorded onsite with noise levels ranging between 80 and 100 dBA, depending on the type of rail noise. Locomotive idling and railcar movement onsite represents the largest portion of overall rail noise, with whistling and shunting occurring intermittently throughout the day.

5.1.3.2 Truck Traffic

Terminal truck traffic noise is an intermittent, steady noise; defined as a given broadband sound pressure level experienced several times during a normal day. Two (2) monitoring events recorded truck traffic noise levels at two separate locations onsite.

Location 1 was established in close proximity to brine truck operations near the existing shiploader. A noise level (L_{eq}) of 65 dBA was measured at a distance of approximately 35 metres from the source. Location 2 was set-up between the railcar dumping station and Shed #1, near salt truck delivery operations. Noise levels of 70 dBA were recorded at a distance of 20 metres from site trucks.

5.1.3.3 Industrial Terminal Noise

Industrial Terminal noise is continuous in nature, defined as "broadband noise" of approximately constant levels and spectrum. The industrial noise is primarily from mechanical noise sources required to facilitate the transfer and storage of goods received by rail and trucks. Ship loading and the various conveyance systems onsite are the main industrial noise sources at the Terminal. Two separate monitoring events recorded constant shiploader (L_{eq}) of 78 dBA and 74 dBA at a distance of approximately 60 m from the shiploader. The noise is primarily generated from the operation of the conveyance system.

5.1.3.4 Street Traffic

Street traffic noise is an intermittent source that can be a significant noise source during periods of heavy traffic volumes. Street traffic noise on Crown Street was found to dominate the overall noise environment at S4 and S5.

The early morning recording session (1 a.m.) at S4 measured a L_{eq} value of 53 dBA, with levels ranging between 50 and 65 dBA. Street traffic was light with no truck traffic. Truck traffic noise at 9 a.m. increased the L_{eq} value to 75 dBA, with levels ranging between 58 and 87 dBA. There was switching of rail cars in the adjacent rail yard.

The early morning session (1 a.m.) at S5 recorded an L_{eq} value of 71 dBA. Switching of rail cars in the adjacent rail yard contributed to the total noise environment. Street traffic was light. Truck traffic noise at 9 a.m. was between 60 and 80 dBA. Truck traffic on Crown Street is the dominant noise source at S4 and S5. Light duty vehicle traffic can represent a significant source as well, when traffic volumes are heavy. Rail yard activity is a secondary source during work hours.

5.2 Geology

The geological baseline was derived from available data sources, desktop studies and field studies. The geological baseline was divided into bedrock, soil and sediment components detailed below. Bedrock and soil data was obtained from the Geological Surveys Branch of the NB Department of Energy and Mines. Soil and Sediment was characterized as part of a geotechnical program, which included drilling boreholes in the marine and terrestrial Project footprint. A surface marine sediment sampling program was completed and the data was used to characterize the physical and chemical sediment characteristics.

5.2.1 Bedrock

The Project site is located in the Caledonia Geological Zone of New Brunswick. The Caledonia Geological Zone is underlain by a Middle Proterozoic quartzite-carbonate sequence and a succession of Late Proterozoic volcanic and associated intrusive rocks. A Cambrian to Early Ordovician platformal sequence containing a distinctive Acado-Baltic trilobite fauna unconformably overlies Precambrian rocks. The

Caledonia Zone is generally considered to represent a crustal fragment rifted from the margin of Gondwana during opening of the Early Paleozoic Iapetus Ocean (Energy and Mines, 2013). The Project site is located on stratified Cumberland Group, Lancaster Formation bedrock According to the Bedrock Geology of New Brunswick mapping, Department of Natural Resources and Energy Minerals Division, NB.

A geotechnical investigation (Appendix I) was conducted as part of the design studies required for the construction phase of the Project. The geotechnical investigation included 18 marine and terrestrial boreholes. Bedrock was assessed and multiple borehole locations confirmed the general bedrock description detailed above. Bedrock consisted of grey sandstone/siltstone with smooth and slightly weathered discontinuities and angles varying from 30° to 70° with respect to the longitudinal core axis. See Appendix I for the complete geotechnical investigation report.

5.2.2 Soils

It is anticipated that the majority of the soils within the Project area are non-native and have been brought to the study area as fill material. According to the Generalized Surficial Geology Map of New Brunswick, native soils in the area are classified as Blanket and Veneer and consist of Loamy lodgment till, minor ablation till, silt, sand, gravel, rubble. The surficial geology is further generalized to be mainly stony till (Rampton, 1984).

A geotechnical investigation included 9 terrestrial boreholes. Surface soil for all terrestrial boreholes consisted of granular fill. The depth of granular fill varied throughout. Within the existing rail road track the granular fill consisted of sand, gravel, cobbles, boulders and silt. Within the area around Shed #1, the granular fill consisted of dense greyish brown rock fill. The fill material was underline by brown silty/clayey sand with gravel to silty/clayey gravel with sand, typical of Saint John till deposits.

5.2.3 Sediment

A Marine Sediment Sampling Program (MSSP) was completed in May 2013 and consisted of 12 sample locations within the Project footprint. Twelve sample locations were located within the Courtenay Bay rail / road expansion footprint. One surface sample was collected at each sample location including two duplicated samples. Samples were sent to an accredited laboratory for physicochemical analysis. The results of the analysis are described below. The completed marine sediment sampling program is attached in Appendix J.

The majority of the samples collected within the access road footprint, Area A and Area B, consisted of Clayey Silt and Sandy Silt sediment. The reported total carbon content for samples ranged from 10 to 78 mg/kg.

Marine sediment samples were also analysed for CoCP. Samples were analyzed for Benzene Toluene Ethylbenzene and Xylenes/Total Petroleum Hydrocarbons (BTEX/TPH), metals, Polycyclic Aromatic Hydrocarbons (PAH), Polychlorinated Biphenyls (PCBs) and dichloro diphenyl trichloroethane (DDT). The following guidelines were used to assess the environmental sediment quality:

- RBCA Tier I – Risk-Based Corrective Action, Risk-Based Screening Levels for Petroleum Hydrocarbon Impacted Sites, commercial property, non-potable, coarse grained soil (July 2012);
- RBCA Sediment Ecological Screening Levels for the Protection of Marine Aquatic Life (July 2012);

- CCME SQG - Canadian Council of Ministers of the Environment Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health (1999; last updated 2007);
- CCME Sediment Quality Guidelines PEL - Canadian Council of Ministers of the Environment Canadian Sediment Quality Guidelines for the Protection of Marine Aquatic Life - Probable Effects Limit (1998); and
- CEPA Ocean Disposal Lower Level Screening Criteria, Section 4 of the Disposal at Sea Regulations (SOR/2001-275) pursuant to the *Canadian Environmental Protection Act,* 1999.

Toxicity Characteristic Leachate Procedure (TCLP) analysis was conducted on samples with greatest concentrations of CoPC above applicable guidelines. Leachate results were compared to the following guidelines:

- CCME WQG MAL- Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Marine Aquatic Life (last updated 2011); and
- Health Canada's Canadian Drinking Water Quality Guidelines (CDWQG) (last updated 2010).

The MSSP had the following exceedances of applicable guidelines:

- No samples were reported to have BTEX/Modified TPH concentrations exceeding RBCA Tier I RBSLs for non-potable commercial property with coarse grained soil;
- Most samples from both Areas were reported to have Modified TPH concentrations exceeding RBCA Sediment Ecological Screening Levels for the Protection of Marine Aquatic Life;
- One sample in Area B was reported to have metal concentrations exceeding the CCME SQGs for commercial and industrial land uses;
- One sample in Area B was reported to have metal concentrations exceeding the CCME Sediment Quality Guidelines for the Protection of Marine Aquatic Life, Probable Effects Limits;
- One sample in Area A was reported to have metal concentrations exceeding the CEPA Disposal at Sea Screening Criteria;
- One sample in Area B was reported to have metals leachate concentrations exceeding Canada's Canadian Drinking Water Quality Guidelines Maximum Acceptable Concentration;
- One sample in Area B was reported to have metals leachate concentrations exceeding CCME Water Quality Guidelines for the Protection of Marine Aquatic Life;
- Six samples in Area A and seven samples in Area B were reported to have PAH concentrations exceeding the CCME SQGs for the Protection of Human Health;
- Six samples in Area A and three samples in Area B were reported to have PAH concentrations exceeding the CCME Sediment Quality Guidelines for the Protection of Marine Aquatic Life, Probable Effects Limits;
- Six samples in Area A and four samples in Area B were reported to have PAH concentration exceeding CEPA Disposal at Sea Screening Criteria;
- No samples were reported to have PAH leachate concentrations exceeding Canada's Canadian Drinking Water Quality Guidelines Maximum Acceptable Concentration or Canadian Drinking Water Quality Guidelines;
- Two samples were reported to have PCB concentrations exceeding the CEPA Disposal at Sea Screening Criteria; and
- No samples were reported to have DDT concentrations exceeding the applicable CCME SQGs for commercial land uses or Sediment Quality Guidelines.

A review of sediment quality data within Saint John Harbour was conducted in order to establish background sediment quality. A sediment sampling program was completed for the Saint John Harbour in the summer of 2013 by the Canadian Water Network and the Saint John Harbour – Environmental Monitoring Partnership. Five grab samples were taken at each sample site and the top 5 cm of each grab was collected for contaminant analysis. The locations of the sample sites are provided in Appendix K. CBCL was provided with the preliminary results for 3 sites located within Courtenay Bay (Site 20, Site 21 and Site 22) to evaluate background sediment quality.

Sediment samples from each site underwent grain size, metals and PAH analysis. The preliminary results provided mean and standard deviations for each analysis. The results for mean metals concentrations were compared to CCME Sediment and Soil Quality Guidelines and CEPA Ocean Disposal Low Level Screening Criteria. No exceedances of the above guidelines were noted in the preliminary metals results for the 5 sample sites.

The results for mean Total PAH and individual PAH concentrations were compared to CCME Sediment Quality Guidelines Probable Effects Limits, CCME Soil Quality Guidelines and CEPA Ocean Disposal Low Level Screening Criteria. No exceedances of the above guidelines were noted in the preliminary results for sample sites 18, 19, 20 and 21. Results for sample sites 18, 19 and 21 showed low concentrations of individual PAHs and had mean Total PAH concentration of 0.07, 0.15 and 0.17 mg/kg respectively. Site 20 preliminary results had slightly elevated PAH concentration with a mean Total PAH concentration of 1.29 mg/kg. Sample 22 had a mean Total PAH concentration of 3.11 mg/kg which is above CEPA Ocean Disposal Low Level Screening Criteria of 2.5 mg/kg. One of the five grab samples that made up the Site 22 mean concentrations had 5 individual PAH concentrations above CCME Sediment Quality Guidelines Probable Effects Limits and a Total PAH concentration of 12.85 mg/kg. Site 22 was the closest sample site to the proposed project located approximately 200 m east of the road construction. See Appendix J for the preliminary results for the five sample sites.

A geotechnical investigation (Appendix I), including 9 marine boreholes, was conducted as part of the design studies required for the construction phase of the Project. Dark brown to greyish brown organic silt/clay was encountered in all marine boreholes. Boreholes within the Courtenay Bay footprint show a clay/silt layer at depths varying between 3 and 6 m.

5.3 Hydrology

The project is located in Courtenay Bay, in the Saint John inner harbour at the terminus of Marsh Creek. The Saint John Harbour consists of an inner and outer harbour. The outer harbour extends from Partridge island seaward and is unprotected from open seas and the Bay of Fundy. The inner harbour extends from Partridge Island to the Saint John River Channel and Courtenay Bay. The inner harbour is protected by a long southeast breakwater on the eastern side of the harbour that extends in front of Courtenay Bay and the PotashCorp Terminal and the Partridge Island Breakwater located further south on the western side of the harbour.

The tides in Saint John Harbour are semi-diurnal with a 14-day spring-neap cycle. The tidal height (higher high water) is 7.7 m Chart Datum (CD) for mean tides and 8.9 m for large tides (2012 Canadian Tide and Current Tables). The unusual characteristic of Saint John Harbour is that the large tides of the Bay of Fundy are being countered by an equally strong river outflow from the Saint John River. A summary of tidal heights, extremes and mean water level is shown in Table 5.11, based on the permanent tide gauge maintained by DFO and located at the Bay Ferry Wharf.

Table 5.11: Tidal Characteristics

Parameter	Chart Datum (m)	Geodetic Datum (m)
Recorded Extreme High	9.2	5.01
Higher High Water Large Tide (HHWLT)	8.9	4.71
Higher High Water Mean Tide (HHWMT)	7.7	3.51
Mean Water Level (MWL)	4.4	0.21
Geodetic Datum (GD)	4.19	0
Lower Low Water Mean Tide (LLWMT	1.0	-3.19
Lower Low Water Large Tide(LLWLT)	0.0	-4.19
Recorded Extreme Low	-0.4	-4.59

The Saint John Harbour is dredged annually to remove accumulated sediment. A sedimentation study was completed to determine the influence of infilling sedimentation rates. The study found that infilling will not cause any noticeable changes in the flow and sedimentation patterns of Courtenay Bay or the Harbour in general. The difference with existing conditions for sedimentation rates is expected to be within ±5 cm per year. The Sedimentation study is available in Appendix K.

5.3.1 Marsh Creek

The project is located at the terminus of Marsh Creek in Courtenay Bay. The Marsh Creek Watershed has an area of 41 km^2 with its headwaters located in the Renforth Bog. Marsh Creek discharges into Courtenay Bay under the Courtenay Bay Causeway and through four culverts and tide gates (Figure 2.2). The river flows into Marsh Creek Forebay prior to discharging through the tide gates into the Bay. The Forebay consist of a large basin and channel and provide buffer and flood protection during periods of heavy rain. The majority of Marsh Creek is located in urbanized areas with heavy industrial activity.

5.3.2 Saint John River

The Saint John River is the longest river in eastern Canada and has a basin area of over 55,000 km^2. The head waters of the Saint John River are located in northern Main and eastern Quebec and terminate into the Bay of Fundy. The river has an approximate mean discharge of 1100 m^3/s with peak discharge occurring in late spring and late fall (Kidd et al., 2011).

The Saint John River discharges into the Saint John Harbour through an upstream sill and then a narrow rock gorge which is only about 100 m wide at its narrowest point. The sill and passage though the constriction, known as the Reversing Falls, only allow a relatively small volume to discharge in and out over a tidal cycle. This hydraulic control allows a significant difference in the water levels to build on either side of the constriction, creating locally strong currents alternating in direction. Currents flow in the seaward direction when the river level is higher than the tide level, and reverse when the tide is higher than the river.

5.4 Aquatic Environment

The aquatic environment potentially affected by the construction activities and operations include marine, freshwater and estuarine habitats identified as follows (see Figure 2.2):

- Courtenay Bay;
- Saint John Harbour; and
- Marsh Creek.

This section describes each of the above environments in terms of water quality, fish and fish habitat and marine mammals. With the exception of the environment on the actual Project footprint, the information presented here is based on existing literature and third party data.

5.4.1 Saint John Harbour including Courtenay Bay

The inner Saint John Harbour is a stratified estuarine system due to the significant freshwater inflows from the Saint John River. The density differences (from salinity and/or temperature gradients) induce a mean up-harbour bottom current that increases exchange rates and harbour sedimentation. The saline and sediment-laden bottom layer moves up the channel inside the harbour during the flood tide, and when averaged over a tidal cycle, extends approximately up to the harbour bridge.

The Saint John Harbour Channel is located at the terminus of the Saint John River within the Bay of Fundy. The channel divides uptown Saint John and West Saint John and is traversed by multiple bridges. Strong tidal currents within the channel occur during low tide maintaining a deep natural channel for marine shipping activities. The channel is well protected from the open ocean by two large breakwaters, the Courtenay Bay Breakwater to the southeast and Partridge Island Breakwater to the southwest. See Figure 2.2 in Chapter 2 for a location map detailing the Saint John Harbour.

Facilities within the Saint John River channel include ferry and cruise ship terminals, dry and liquid bulk terminals and container terminals. The harbour also berths fishing vessels and there are multiple vacant lots along the shoreline for potential future developments.

Courtenay Bay is located on the northeastern side of Saint John Harbour and is protected to the south by the Courtenay Bay Breakwater which extends approximately 1.5 km into the harbour. Marsh Creek terminates into Courtenay Bay through the Courtenay Bay Causeway and the outflowing freshwater has created a deep channel which extends from the Causeway approximately 500 m to a basin and shipping channel which require yearly dredging to maintain appropriate water depth for shipping traffic. The waters of Courtenay Bay are saline but are influenced by freshwater during low tide.

The eastern shoreline of Courtenay Bay shows heavy industrial use including ship loading. To the west, the bay shoals to an extensive mud flat the landward extent of which is bound by shoreline protection and the Potash Corp tail track. The PotashCorp facility, including a dock and radial loader, is located at the southern end of Courtenay Bay.

5.4.1.1 Bottom Substrate

In Saint John Harbour, the combination of ample sediment supply and hydrodynamic regime cause extensive sedimentation in the shallow waters of Courtenay Bay and several areas are regularly dredged. Sediment sources include the seabed of the Bay of Fundy, the river and eroding coastlines. This sedimentation dominates the benthic habitat, with only small sections in high current areas displaying hard surfaces to provide a habitat for attached fauna and flora. Sediment samples in the Project footprint of the proposed development indicate primarily sandy silt and clayey silt mixed with gravel (Appendix L).

To the southwest of Courtenay Bay, the channel of Saint John Harbour is approximately 20 m deep. The bottom towards the Project site shoals steeply to a depth of approximately 7 m and is comprised of boulders or bedrock and gravel in a silty sand matrix. Closer to the shore in shallower water, a soft bottom occurs with occasional patches of boulders and cobbles.

5.4.1.2 Water Quality

Extensive water quality sampling was conducted in 2007 in the outer harbour for the Eider Rock Marine Terminal Project (Jacques Whitford/Stantec Limited, 2009) at the Eider Rock site. The samples were analyzed for polycyclic aromatic hydrocarbons, petroleum hydrocarbons, volatile organic compounds, phenolic compounds, total dioxins and furans, trace metals, total organic carbon, major ions and nutrients, alkalinity, pH, total suspended solids, turbidity and conductivity. Of the 79 samples taken in all four seasons, the concentrations of hydrocarbon compounds and trace metals were either below detection limit or below CCME guidelines. Total phosphorus ranged from 0.023 to 0.081 mg/L and Nitrite + Nitrate ranged from <0.05 to 0.240 mg/L. Because these samples were taken in the outer harbour, they are not indicative of water quality in the Project area, but may serve as a baseline for a control site for future monitoring.

5.4.1.3 Flora and Fauna

Benthic sampling was conducted near the study area (Figure 5.1) in 1959 and 1961 (MacLellan and Sprague, 1966) and 1973 (Wildish, 1976). These investigators identified 65 and 31 species, respectively, primarily polychaete worms; other species included small arthropods, clams and mussels.

A benthic habitat study carried out in May 2013 (Appendix L) surveyed the Project footprint. While this study did not include taxonomic identification, it did find that polychaete worms were the dominant benthic organisms in fine and soft sediments followed by burrowing bivalves such as clams. Crustaceans, such as small amphipods, are abundant in shallow areas where seaweed grows on hard substrates.

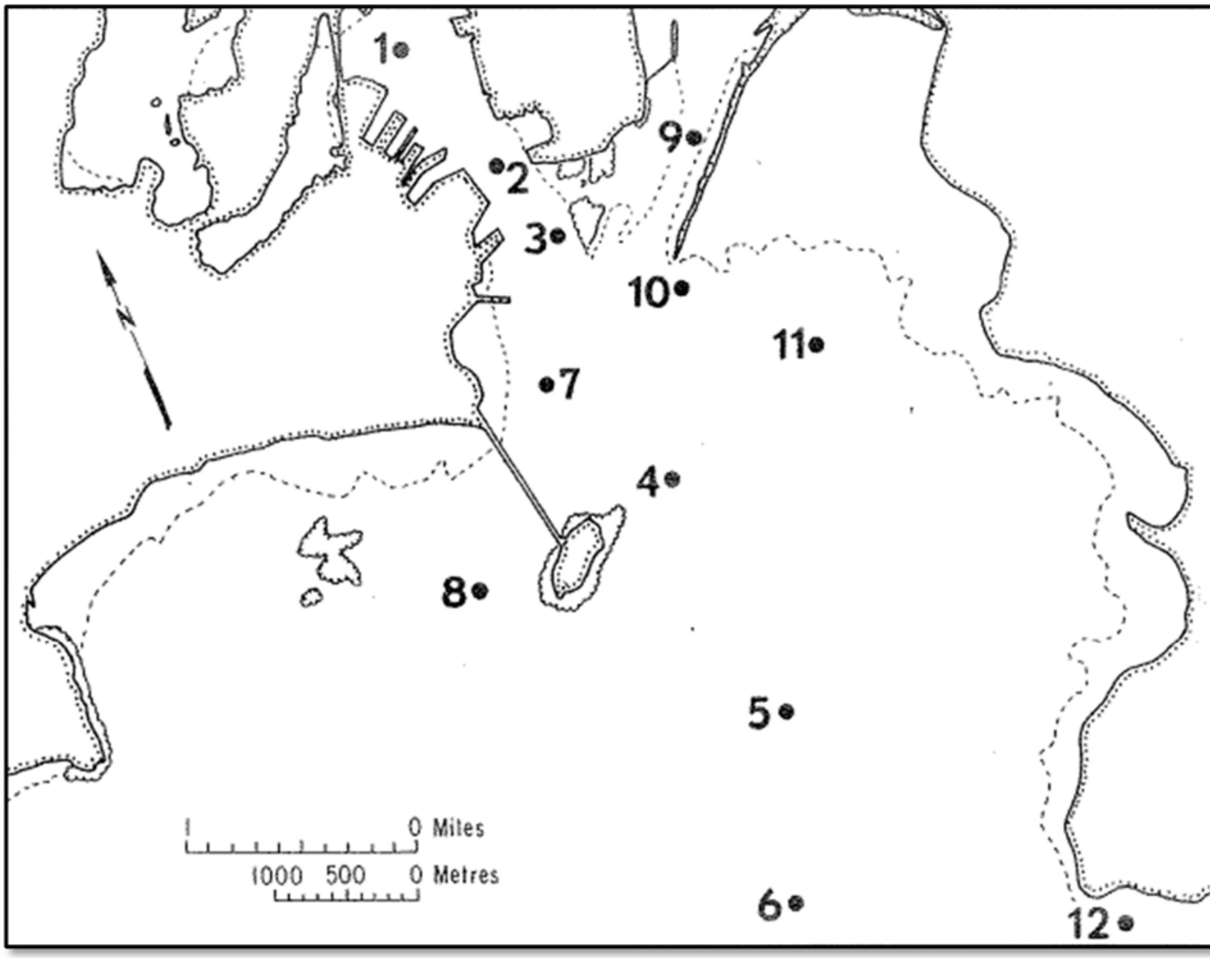


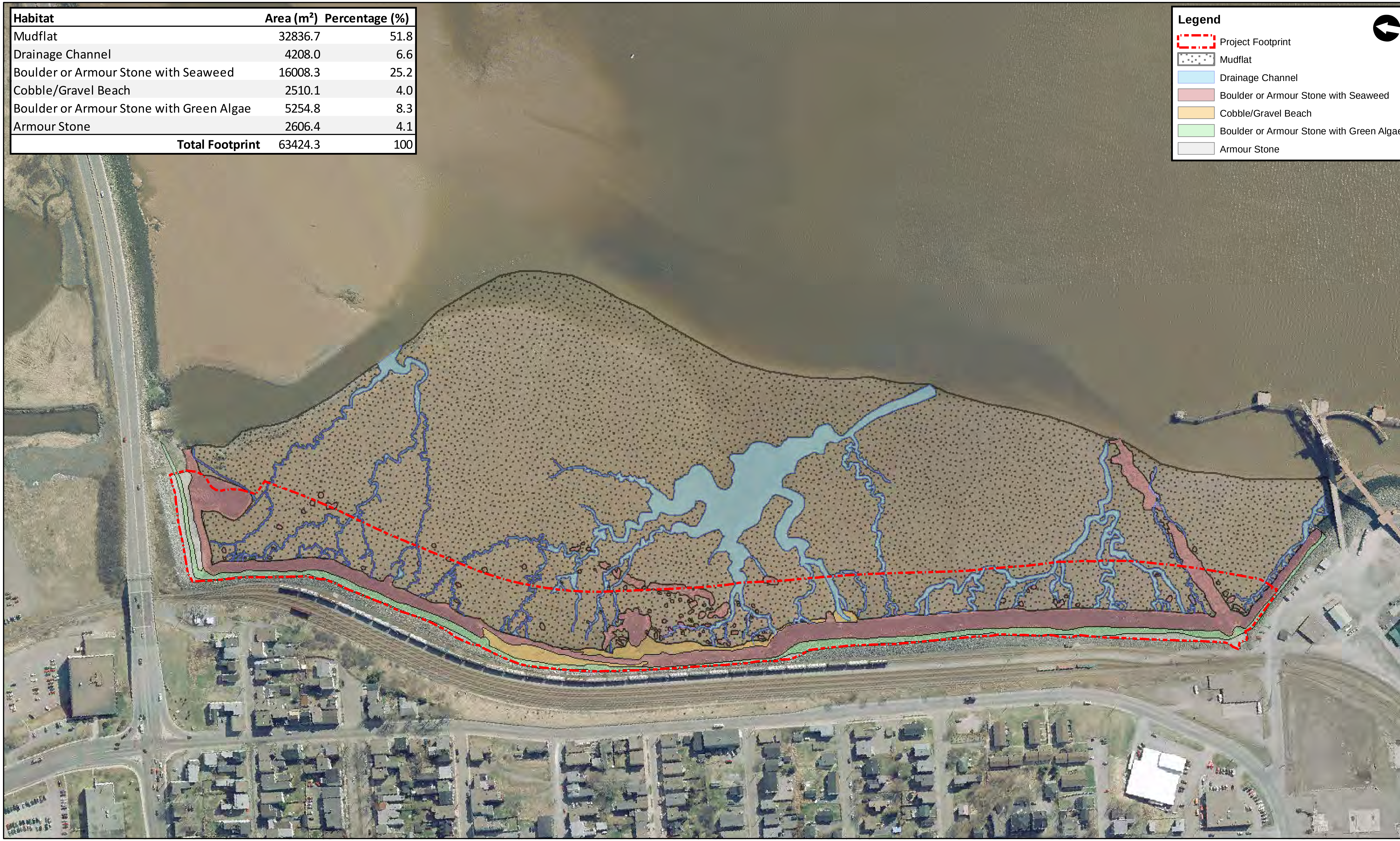
Figure 5.1: **Benthic Sampling Locations for 1959, 1961 and 1966 Sampling in the Saint John Harbour (Wildish 1976)**

Marine vegetation is limited to hard substrates made up of armour stone, boulders on the mud flat and outcroppings of bedrock in the channel side of the Project area. The vegetation is dominated by seaweed of species Fucus vesiculosus and Ascophyllum nodosum and an unidentified filamentous green alga occurring in the upper limit of the intertidal zone (Appendix L).

5.4.1.4 Habitat Classification

Habitat in the project area is primarily mudflat with some sections of boulder outcrops and cobble fields covered with seaweed. The total area covered by each habitat type and its percentage contribution is provided in Table 5.12. Drainage channels drain the mud flat during low tide, and multiple stormwater and wastewater outfalls discharge into the drainage channels. The mud flats were densely populated with burrowing polychaete worms whose bioturbation activity helps to oxygenate the sediment to a depth of 2.5 to 8 cm. Other macroinvertebrates are rare on the mudflat itself, but the seaweed covered boulders provide habitat for a number of other intertidal species, including mussels, amphipods, snails and epibenthic polychaetes. The mudflat appears to be a nutrient rich and may provide a foraging area for fish, lobster and crabs at high tide. Locals may occasionally use the area to collect worms for bait, but the commercial fishery for shellfish is presently closed. See Figure 5.2 for Project footprint habitat types.

Habitat	Area (m²)	Percentage (%)
Mudflat	32836.7	51.8
Drainage Channel	4208.0	6.6
Boulder or Armour Stone with Seaweed	16008.3	25.2
Cobble/Gravel Beach	2510.1	4.0
Boulder or Armour Stone with Green Algae	5254.8	8.3
Armour Stone	2606.4	4.1
Total Footprint	63424.3	100



CBCL LIMITED
Consulting Engineers

Client: PotashCorp
Helping Nature Provide

Project Description:
MARINE TERMINAL EXPANSION
BENTHIC HABITAT MAP

Revision or Issue: ISSUED FOR EIA REGISTRATION DOCUMENT (FEB 19, 2015)

Contract No	142865.00	Drawn	SO	Approved	CB
Scale	1:3,000	Date	AUG 2013	Figure No	5.2

Table 5.12: Percent Area and Total Area of Project Habitat Types

Habitat	Area (m^2)	%
Mudflat	32,836.7	51.8%
Drainage Channel	4,208.0	6.6%
Boulder or Armour Stone with Seaweed	16,008.3	25.2%
Cobble/Gravel Beach	2,510.1	4.0%
Boulder or Armour Stone with Green Algae	5,254.8	8.3%
Armour Stone	2,606.4	4.1%
Total Footprint	**63,424.3**	**100.0%**

5.4.1.5 Habitat Function

As part of the intertidal environment, the mud flats of Courtenay Bay are not a primary habitat for commercially fished species. However, commercial species such as lobster, American shad, Atlantic tomcod and striped bass (DFO, 2009) customarily venture into mudflats during high tide to forage and the presence of forage species such as worms and small crustaceans attests to this function of the habitat. In addition to being a forage area, the mud flat at the Project site is likely to have a buffering function between land and sea. For example, it provides protection to the shoreline from waves and high water and it processes the wastewater discharged into it through pipes in the rubble mound.

5.4.1.6 Fish

Studies on marine fish are currently being conducted in the Saint John Harbour by the Canadian Rivers Institute and the University of New Brunswick (Hunt 2013, UNB, pers. comm.); the data are not available at this time. Relatively recent data are available for the following marine fish near the study area (Casselman et al., 2005, Casselman 2007, ACAP 2012c):

- Atlantic silverside (*Menidia menidia*);
- Alewife (*Alosa pseudoharengus*);
- American eel (*Anguilla rostrata*);
- Big skate (*Raja ocellata*);
- Blackspotted stickleback (*Gasterosteus wheatlandi*);
- Blueback herring (*Alosa aestivalis*);
- Grubby (*Myoxocephalus aenaeus*);
- Herring (*Clupea harengus*);
- Little skate (*Raja erinacea*);
- Longhorn sculpin (*Myoxocephalus octodecemspinosus*);
- Lumpfish (*Cyclopterus lumpus*);
- Pollock (*Pollachius virens*);
- Rainbow smelt (*Osmerus mordax*);
- Sandlance (*Ammodytes americanus*);
- Shorthorn sculpin (*Myoxocephalus scorpius*);
- Threespine stickleback (*Gasterosteus aculeatus*);
- Tomcod (*Microgadus tomcod*);
- White hake (*Urophycis tenuis*);
- White perch (*Morone americana*); and
- Winter flounder (*Pseudopleuronectes americanus*).

5.4.2 Lower Saint John River

The Saint John River is the second largest river in northeastern North America; however, according to The Saint John River: A State of the Environment Report (Kidd et al., 2011), quantification of aquatic habitat in the Saint John River is "sorely lacking."

5.4.2.1 Water Quality

The most consistent data for water quality of the Saint John River come from 15 sites on the main stream of the river reaching from Claire upstream to Saint John at the downstream end (Kidd et al., 2011). Among the parameters measured (pH, metals, dissolved oxygen, coliform bacteria, nitrogen, phosphorus and chlorophyll a) most do not present an immediate cause for concern. Coliform bacteria used to be a major problem prior to the 1970 and related to the discharge of untreated sewage into the river. Since then, coliform bacteria counts have drastically declined, but are still detectable along the entire length of the river and concentrated near wastewater outfalls and food processing industries.

The concentrations of the plant nutrients phosphorus and nitrogen were not measured in the lower Saint John River. The closest measurements come from Gagetown, a considerable distance upstream from the Project site. Phosphorus is the primary nutrient of concern as it was found to limit the growth of algae in Saint John River. Similar to the improvements in the concentration of coliform bacteria in the 1970s, nutrient levels decreased as well. Today, most of the river is classified as mesotrophic and 'moderately impaired' with total nitrogen concentrations around 0.4 mg/L and total phosphorus concentrations 0.015 mg/L at the most downstream location (Kidd et al., 2011).

5.4.2.2 River Habitat, Flora and Fauna

To the best of our knowledge, there is no technical account of the river habitat, riverine plants and animals for the lower Saint John River. Kidd et al. (2011) summarize findings of invertebrate sampling which occurred at nine sites upstream of Fredericton, only. The species diversity and abundance of macroinvertebrates confirms the good state of the river with respect to pollution with organic compounds, but data is sparse and further monitoring is recommended.

5.4.2.3 Fish

In total, 70 species of fish are known to inhabit the Saint John River which includes fish found near the mouth of the Saint John River which only live in salt water (Kidd et al., 2011). DFO (2009) has reported the following species of fish in the lower Saint John River during seasonal flooding between 2000 and 2001:

- Alewife (*Alosa pseudoharengus*);
- American eel (*Anguilla rostrata*);
- American shad (*Alosa sapidissima*);
- Atlantic salmon (*Salmo salar*);
- Atlantic sturgeon (*Acipenser oxyrinchus*);
- Banded killifish (*Fundulus diaphanus*);
- Blueback herring (*Alosa aestivalis*);
- Brook trout (*Salvelinus fontinalis*);
- Brown bullhead catfish (*Ameiurus nebulosus*);
- Burbot (*Lota lota*);
- Chain pickerel (*Esox niger*);
- Minnow.
- Pumpkinseed (*Lepomis gibbosus*);
- Rainbow smelt (*Osmerus mordax*);
- Redbreast sunfish (*Lepomis auritus*);
- Shortnose sturgeon (*Acipenser brevirostrum*);
- Smallmouth bass (*Micropterus dolomieu*);
- Stickleback;
- Striped bass (*Morone saxatilis*);
- White perch (*Morone americana*);
- White sucker (*Catastomus commersoni*); and
- Yellow perch (*Perca flavescens*).

5.4.3 Marsh Creek

The Marsh Creek watershed covers an area of 4,180 ha in eastern Saint John (McKenna et al., 2007). The Marsh Creek stream is fed by five tributaries (Figure 5.3):

- Cold Brook;
- Ashburn Creek;
- Little Marsh Creek;
- Majors Brook; and
- Fisher Lakes Tributary.

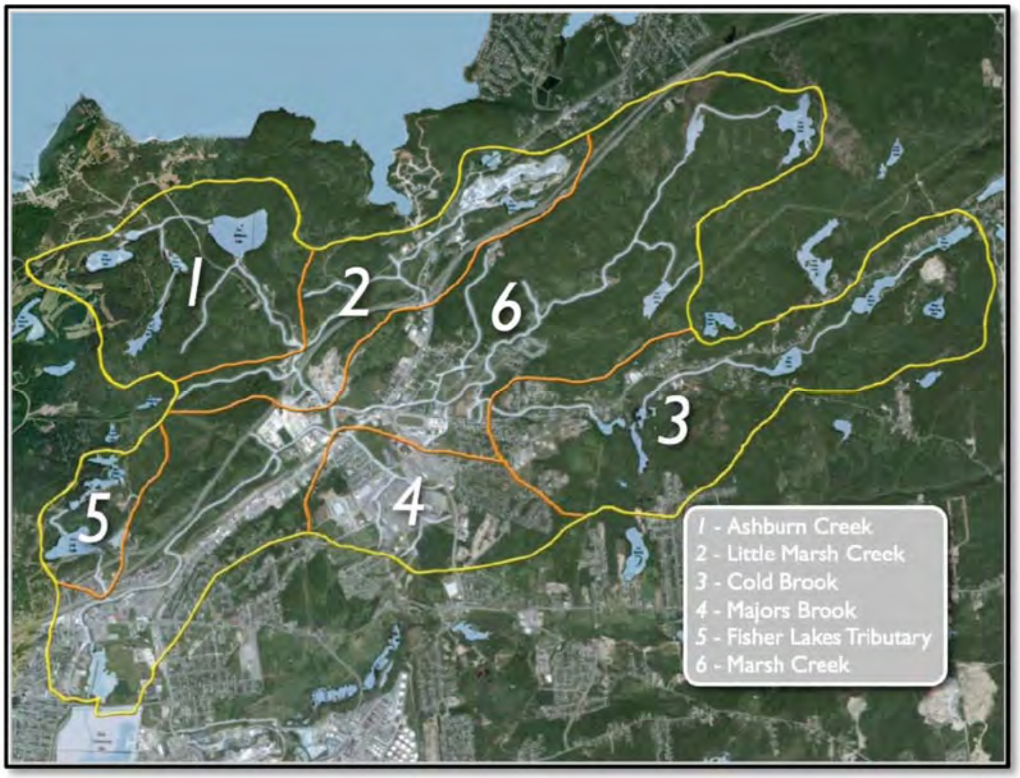


Figure 5.3: Marsh Creek Watershed and Sub-drainage Basins (from McKenna et al., 2007)

The watershed is highly urbanized with heavy industrial, dense commercial and residential development. For management purposes, the Marsh Creek sub-watershed is divided into eight zones (Figure 5.4), as follows (McKenna et al., 2007):

- Zone 1: This zone is located at Renforth Bog in the headwaters of Marsh Creek. The area consists of native flora and fauna including fish. Illegal dumping in the bog is a major problem in this zone as well as the inappropriate use of ATVs;
- Zone 2: A channelized creek flows out of the bog. A fish barrier is located underneath a bridge due to logs, branches and other debris. The creek in this zone is located within a cedar bog. Little human disruption occurs in this section;
- Zone 3: This zone has numerous waterfalls with natural plunge pools. This zone also contains several dams:
  - An earthen dam which consists of a concrete flood control structure which may represent a barrier to fish;
  - A man made rock dam which allows fish to pass;
  - A concrete dam which does not allow fish passage;

- Zone 4: The creek flows through a marsh environment and then into a residential area without riparian vegetation. Invasive species can be found downstream from this zone. Several culverts exist in this zone and are in bad condition. A sewage lift station caused an accidental release of raw sewage into the creek in 2006;
- Zone 5: The creek is about 7 m in width and abundant aquatic plants and algae grow on the bottom. This section is highly impacted by commercial, industrial and residential activities prevalent garbage along the banks and in the water. Vegetation along the creek is sparse near some of the industrial areas;
- Zone 6: The creek in this section has been channelized and raw sewage outfalls exist. Natural riparian vegetation is present such as alders, willows, spruce, birch and cedar;
- Zone 7: Approximately 10 raw sewage and storm water outfalls empty into this section of the creek. Two railway bridges and in-stream piers result in the obstruction of the flow via woody debris. In this zone, approximately 10,000 cubic meters of sediment containing creosote was deposited into the creek and garbage and flushed litter are ubiquitous. Riparian zones are poorly established; and
- Zone 8: The zone consists of the Courtenay Bay Marsh and flows through tide gates which control upstream flooding. The tide gates allow saltwater to enter the marsh resulting in the growth of salt tolerant vegetation.

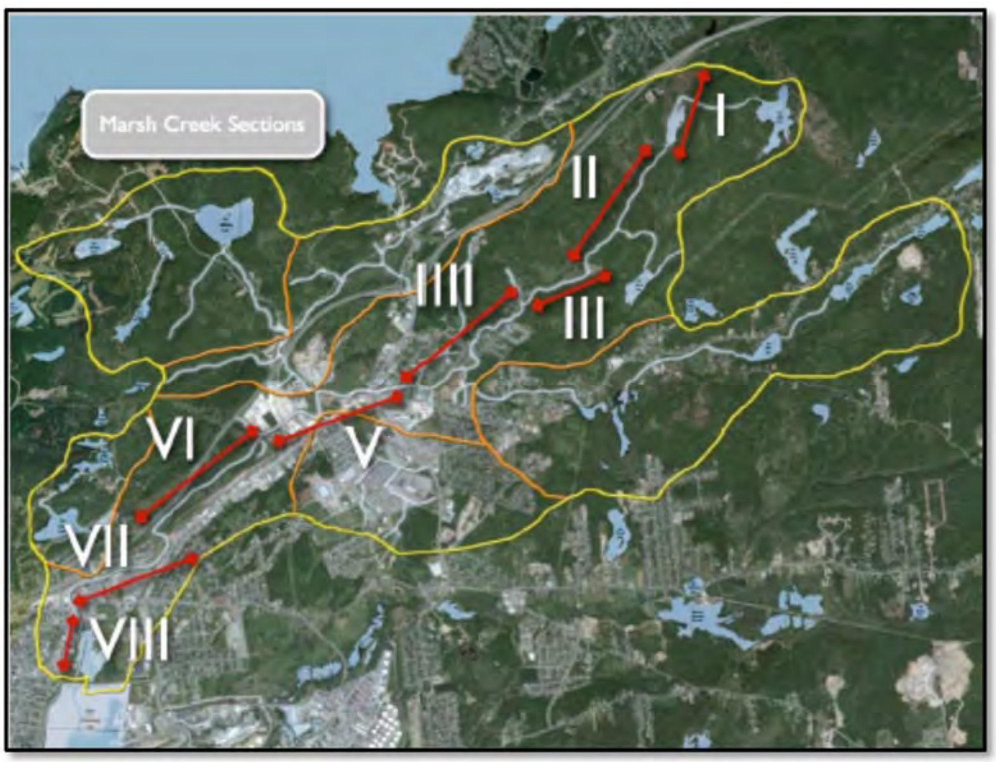


Figure 5.4: Marsh Creek Management Zones (McKenna et al., 2007)

5.4.3.1 Water Quality

Water quality samples collected from sections VII to V (Figure 5.4) in November 1999 (Astephen, 2000) indicated a healthy range of pH and dissolved oxygen and low turbidity. The most downstream sample came from section VI and showed high turbidity, strong odour of creosote and surface oils. Salinity measurements indicated traces of salt water intrusion as far as the downstream end of section VI.

Prior to 2014, fecal coliform concentrations in Marsh Creek were typically well above 1000 CFU/100ml between the Courtenay Bay March and the upstream end of section VII (ACAPa, 2012). This was due to the discharge of raw sewage at several locations.

The concentration of dissolved oxygen can be critically low, <2 mg/L, in the downstream section VII at times, and appears variable with respect to season and location (ACAP, 2012 a, b, Astephen, 2000).

5.4.3.2 Invertebrate Fauna

Invertebrate samples show a community indicative of organic and chemical pollution (sewage and creosote, respectively). For example, the sensitive stoneflies (order plecoptera) were absent while pollution tolerant oligochaete worms were abundant (Astephen, 2000).

5.4.3.3 Fish and Fish Habitat

Marsh Creek shows strong man-made alteration of the streambed and banks. Only in Section III and upstream (Figure 5.4) contained healthy banks with overhanging vegetation, a firm substrate and deep sections (Astephen, 2000, McKenna et al., 2007). This area also showed the highest abundance and diversity of benthic invertebrates (Astephen, 2000).

Fish habitat upstream of Courtenay Bay Marsh was characterized in 2003 and 2004 (Vallières, 2005) and in 1999 (Astephen, 2000). The section immediately above the marsh was characterized as fine substrate with organic matter. The water depth was 0.6-0.9 m and the wetted width was 13-15 m in a 17 m channel. The salinity was 0.6 ppt and the tidal influence was high.

Electro-fishing sites along the main branch of Marsh Creek (Astephen, 2000) and immediately upstream of Courtenay Bay Marsh 2004 (Vallières, 2005) found the following species:

- American eel (*Anguilla rostrata*);
- Banded killifish (*Fundulus diaphanus*);
- Blacknose dace (*Rhinichthys atratulus*);
- Brook stickleback (*Culaea inconstans*);
- Brook trout (*Salvelinus fontinalis*);
- Creek chub (*Semotilus atromaculatus*);
- Fourspine stickleback (*Apeltes quadracus*);
- Mummichog (*Fundulus heteroclitus*);
- Ninespine stickleback (*Pungitius pungitius*);
- Rainbow trout (*Oncorhynchus mykiss*);
- Threespine stickleback (*Gasterosteus aculeatus*); and
- White sucker (*Catastomus commersoni*).

5.4.4 Courtenay Bay Marsh

The Courtenay Bay Marsh is the most downstream section of Marsh Creek (Section VIII in Figure 5.4) and is an estuarine bay marsh of which approximately half is permanently covered by water. The wetland vegetation shows the influence of salt water intrusion and is further described in Section 5.5. Salt water enters the marsh at high tide through the deteriorated flood gates and through a number of leaks in the Courtenay Bay Causeway. The intrusion of saltwater produces a gradient of salinity which varies over the tidal cycle between about 25 ppt on the marsh side of the tide gates to about 5 ppm at the marsh's upstream end (ACAPa 2012).

5.4.4.1 Water Quality

Water quality data exist from years 2008, 2009 and 2012 (ACAP 2012a, b). The data suggest the following similar issues to those found in the downstream sections of Marsh Creek:

- Dissolved oxygen ranges from 2 to 6 mg/L and can therefore cause problems for fish and invertebrates;
- Fecal coliform concentrations are indicative of heavily sewage-polluted water; and
- Nutrients (phosphorus and nitrogen) are high and suggest eutrophic conditions.

5.4.4.2 Fish and Fish Habitat

Courtenay Bay Marsh is a transitional habitat between freshwater and marine end-members and therefore contains strong and variable gradients of characteristics such as salinity, temperature, turbidity, currents and contaminants such as sewage and chemicals. The water level in the marsh goes up and down with the tides; however, peak tidal stages are delayed by about one hour with respect to Courtenay Bay due to hydraulic restrictions through the Causeway.

Much of the bottom of the marsh is an intertidal mudflat of very soft sediment with mats of green algae and bacteria. A straight rock berm creates a channel running from the Courtenay Bay Causeway for about 350 m towards the head of the marsh. This berm trains the incoming and outgoing water, creating strong tidal flows which scoured the bottom to expose large boulders and cobble. Seaweed (*Fucus vesiculosus* and *Ascophyllum nodosum*) grow on this firm substrate and provide habitat for marine invertebrates such as crabs and periwinkles.

Fish sampling in 2012 (ACAP 2012c) was conducted where Marsh Creek flows into Courtenay Bay Marsh. The following species were caught:

- American eel (*Anguilla rostrata*);
- Mummichog (*Fundulus heteroclitus*);
- Pumpkin seed sunfish (*Lepomis gibbosus*);
- Rainbow smelt (*Osmerus mordax*);
- Threespine stickleback (*Gasterosteus aculeatus*);
- White sucker (*Catastomus commersoni*); and
- Yellow perch (*Perca flavescens*).

5.4.5 Protected Fish Species

Several species at risk are known to occur in the area affected by the proposed development including Atlantic salmon, redbreast sunfish, short nose sturgeon and striped bass. Descriptions of each species and their status in the study area are provided in the sections below.

Atlantic Salmon (Outer Bay of Fundy Population) (Salmo Salar)

Atlantic salmon (Outer Bay of Fundy population) are federally SARA-listed as Endangered, Schedule 1 (SARA, 2012). Atlantic salmon are found within the Saint John Harbour (Jones et al., 2010 and Appendix F). A recent study on Atlantic salmon was conducted in 2010 on the Saint John River (DFO, 2011). DFO found Atlantic salmon in the Saint John River in 2000 to 2001 (DFO, 2009). Atlantic salmon were also observed in the Kennebecasis Bay from 1968 to 1997.

Three mainstream hydroelectric dams in the Saint John River present a major problem for salmon migration and caused a reduction in juvenile salmon rearing habitat by 44% and a barrier for the seaward migration of salmon smolt water (Kidd et al., 2011).

Redbreast Sunfish (Lepomis auritus)

The redbreast sunfish in New Brunswick is federally-listed as Special Concern, Schedule 3 (SARA, 2012). Redbreast sunfish was identified by ACCDC as occurring near the study area (Appendix F). Redbreast sunfish have been observed in the lower Saint John River (DFO, 2009) and in the Kennebecasis River from 1948 to 2005 (COSEWIC, 2008 multiple sources).

Shortnose Sturgeon (Acipenser brevirostrum)

Shortnose sturgeon is federally-listed as Special Concern, Schedule 1 (SARA, 2012). The Saint John River is the only river system known in Canada to support the shortnose sturgeon (Gorham and McAllister, 1974). Shortnose sturgeon was identified by ACCDC as occurring near the study area (Appendix F) (ACCDC, 2012, COSEWIC, 2005). Between 2000 and 2001, shortnose sturgeons were found in the lower Saint John River during a fish sampling program to determine fish habitat use during flooding (DFO, 2009).

Recent research has been conducted on the overwintering habitat and spawning habitat of the shortnose sturgeon in the Saint John River system (Xinhai et al., 2007, Usvyatsov et al., 2012a, Usvyatsov et al., 2012b). Between January and March 2005, an estimated 4,836 shortnose sturgeons overwintered in the upper Kennebecassis River (Xinhai et al., 2007). An area of concentration was observed at the confluence of the Kennebecasis River and the Hammond River (approximately 22 km from the Project). The authors suggest that this area can be defined as critical habitat for the species. In 2009 and 2011, shortnose sturgeons were also observed overwintering at the same location on the Kennebacasis River at similar densities as in 2005, which suggests that the site is important to shortnose sturgeon (Usvyatsov et al., 2012).

Striped Bass (Morone saxatilis)

Striped bass are not listed federally but they are provincially-listed as At Risk, which suggests that they may be considered for listing under the new provincial Species at Risk Act. Although striped bass were once thought to be potentially extirpated from the Saint John River, they were identified by ACCDC as occurring near the study area (Appendix F) which suggests that a native population may still exist there (Bradford et al., 2012).

Atlantic Cod (Gadus morhua)

Atlantic cod within the Bay of Fundy are part of the Southern population. The Southern population of cod are not federally-listed but they are listed as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC; SARA, 2013; COSEWIC, 2010). The Southern population includes the Bay of Fundy and the Atlantic Ocean extending approximately south of Halifax, Nova Scotia to North Carolina, US. Directed fisheries for cod in this area occur in units 4X5Y and 57jm. Commercial fishing is considered to be one of the reasons for population decline in this population (COSEWIC, 2010). Spawning can occur at all depths up to 182 m (Scott, 1983) between January-February, September-October and July and August (Hanke et al., 2000). Once the eggs hatch, the larvae inhabit the upper 10 to 15 meters of the water. As juveniles, cod live on the ocean bottom for 1 to 4 years and may favour eelgrass, Zostera marina, in nearshore waters and macroalgae and other deep-water emergent structures in deeper water such as corals. Corals such as sea pens may be favoured by young and adults. Not much is known about the depth and bottom-substrate requirements of adult cod. Habitat suitability for all life stages is likely dependant on food availability and temperature. Vertical structures on the ocean floor such as plants, rocks and corals provide protection from predators and habitat for prey such as small fish and invertebrates (COSEWIC, 2010).

Atlantic Wolffish (Anarhichas lupus)

Atlantic wolffish is listed federally as Special Concern, Schedule 1 (SARA, 2011) and was identified by DFO as a non-commercially important species in the Review of the Environmental Impact Assessment for the Proposed Eider Rock Petroleum Refinery and Marine Terminal in Saint John, NB (DFO, 2010). The Atlantic wolffish is known to occur near the study area (COSEWIC, 2000).

5.4.6 Marine Mammals

The marine mammals included below were identified by ACCDC within 5 km of the study area (ACCDC, 2011) and/or by DFO in the Review of the Environmental Impact Assessment for the Proposed Eider Rock Petroleum Refinery and Marine Terminal in Saint John, NB (DFO, 2010).

Atlantic White-sided Dolphin (Lagenorhynchus acutus)

The Atlantic white-sided dolphin is not federally or provincially-listed; however, it has an SRANK of S3S4. In 1988, an Atlantic white-sided dolphin was documented in Red Head, which is within 5 km of the study area (ACCDC, 2012). Atlantic white-sided dolphins inhabit subarctic and temperate water in the Canadian Atlantic. Information is lacking on the life history of the Atlantic white-sided dolphin in the northwest Atlantic (Palka et al., 1997).

Long-finned Pilot Whale (Globicephala melas)

The long-finned pilot whale is not federally or provincially-listed; however, it has an SRANK of S2S3. In 1970, a long-finned pilot whale was documented in Red Head, which is within 5 km of the study area (ACCDC, 2012).

North Atlantic Right Whale (Eubalaena glacialis)

The North Atlantic right whale is federally-listed as Endangered, Schedule 1 (SARA, 2011). It was identified by DFO in the Review of the Environmental Impact Assessment for the Proposed Eider Rock Petroleum Refinery and Marine Terminal in Saint John, NB (DFO, 2010). In Canada, critical habitat areas are located in the Roseway Basin off the south-eastern coast of Nova Scotia and in the Grand Manan Basin in the Bay of Fundy (Pershing et al., 2009). These areas are summer concentration areas (SARA, 2012) known to have high densities of copepods, which is a preferred food source for the right whale (COSEWIC, 2003). These areas are not located within the study area; however, small numbers of right whale may occur near the study area during the summer months.

Harbour Porpoise (Phocoena phocoena)

The harbour porpoise is federally-listed as Threatened, Schedule 2 (SARA, 2012). In 1995, the harbour porpoise was documented in Saint John Harbour (ACCDC, 2012) and it was identified by DFO in the Review of the Environmental Impact Assessment for the Proposed Eider Rock Petroleum Refinery and Marine Terminal in Saint John, NB (DFO, 2010).

5.5 Terrestrial Environment

The terrestrial environment section includes available information on vegetation and wetlands, birds, herptiles and terrestrial mammals within the Project area. Component studies were completed to characterize wetlands and bird communities within the study area. The component studies are included in Appendix C and Appendix M respectively. For these sections, a summary of the findings are provided in this report with reference to the full report for more detailed information.

5.5.1 Vegetation and Wetlands

The Project includes infilling and rail / road expansion to accommodate a new intersection within close proximity to the Courtenay Bay Marsh, a provincially significant wetland as defined by NBDELG (Appendix C). The proposed works will occur within 30 m of the wetland. The New Brunswick Wetlands Conservation Strategy States that the province will not accept works within 30 m of a provincially significant wetland with the exception of activities deemed necessary for public function upon completion of an Environmental Impact Study with public review (NBDNR, 2002). As such, wetland delineation and functional assessment was required as part of the EIA and to support the WAWA permit that will likely be required prior to construction. A vegetation survey was also conducted as part of the wetland delineation and functional assessment. A summary of the findings are provided in the sections below. Further details of the wetland delineation and functional assessment are available in Appendix C.

5.5.1.1 Wetland Delineation and Functional Assessment

A wetland delineation and functional assessment was conducted on July 24, 2012 by CBCL Limited personnel. Only the section of the wetland closest to the Project area was delineated. The remainder of the wetland edge was inferred from aerial photography and provincial wetlands mapping. See Appendix C for a map showing the delineated area. Wetland determination and delineation focused on establishing the wetland-upland edge which was based upon the presence of positive indicators for three parameters:

- Hydric soils;
- Hydrophytic vegetation; and
- Wetland hydrology.

A functional assessment of the subject wetland was conducted using an adaptation of the Wisconsin Rapid Assessment Methodology (Hanson et al., 2008). The complete methodologies for wetland delineation and functional assessments are available in Appendix C.

The results of the study confirmed that the Courtenay Bay Marsh is an estuarine bay marsh[1] , located at the upper-most end of Courtenay Bay. The Courtenay Bay Marsh is part of the Marsh Creek watershed, which covers an area of 4,180 ha in eastern Saint John (McKenna et al., 2007). Courtenay Bay Marsh is approximately 13 ha and is influenced by both fresh and tidal waters, with exposed mudflats during low

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[1]**Estuarine Bay Marsh**: "These marshes develop along the fringes of tidal flats, bars or tidal channels located within tidal inlets or bays which receive water from rivers and streams. Situated at or below low tide levels, the estuarine Courtenay Bay Marsh is subjected to regular inundation by tidal saltwater and freshwater. Characteristic features are: (a) intertidal or supratidal zone of estuaries. (b) situated in embayments or inlets of estuaries" (National Wetlands Working Group.1997).

tide. Tide gate culverts at the base of the Causeway control flooding by separating the Marsh from the Bay. See Section 5.4.4 for a description of the tide gates and their function and influence on the Marsh.

In the case of Courtenay Bay Marsh, field delineation of the wetland boundary differed from the GeoNB Regulated wetlands layer, and the new delineated boundary is presented in Appendix C. As per the Long Term Wetland Management Strategy (February 2012), NBDELG will consider the field-delineated boundary as part of their mapping verification process. Discussions with NBDELG regarding the delineation should take place in conjunction with other regulatory consultation for the Project.

Courtenay Bay Marsh's main wetland functions include:

- Stormwater attenuation and buffering;
- Water quality protection;
- Shoreline protection;
- Wildlife habitat; and
- Fish habitat.

Further details regarding the wetland functions and site descriptions are provided in Appendix C. A summary of the findings is provided in Table 5.13 below.

Table 5.13: Wetland and Watershed Information for Courtenay Bay Marsh

Wetland Name	Courtenay Bay Marsh
Size of Wetland	13.26 ha
Type of Wetland	Estuarine Bay Marsh
Provincial Designation	Provincially Significant Wetland
Watershed Name	Marsh Creek Watershed
Size of Watershed	4,180 ha
Watershed Drainage	From Courtenay Bay into Bay of Fundy
% of Watershed Covered by Wetland	0.32%
Number of Wetlands within 1 km of Project Site	None

The Project footprint does not impact the Courtenay Bay Marsh (as defined by the field-delineated boundary) and the proposed works will not result in a hydrological change to the Courtenay Forebay/Marsh. Since hydrological changes were not anticipated as a result of the Project as proposed, a rare plant investigation was not conducted for the back end of the Marsh.

5.5.1.2 Vegetation Survey

A plant survey for species at risk and of conservation concern was required as part of the functional assessment of the wetland. No hydrological changes to Courtenay Forebay/Marsh will occur as part of the Project; therefore, the field delineation and plant survey were limited to the wetland edge closest to the proposed works. The remainder of the wetland edge was inferred from aerial photography and provincial wetlands mapping. Desktop research and existing information enhanced the field survey for the functional assessment of the 13-ha wetland.

Vegetation information was collected in tandem with data required for the wetland delineation program. Quantitative vegetation data were gathered at plot sampling locations as a component of the delineation exercise. These data were supplemented by a general plant survey over the entirety of the portion of the wetland surveyed. The various plant communities encountered at each wetland sampling location site were documented in terms of their dominant species and relative abundance. Any rare or endangered species encountered were documented and georeferenced accordingly.

In total, 90 vascular plant species were identified during the July 2012 plant survey. The complete list of plants and associated maps are provided in Appendix C. Vegetation in the surveyed area of Courtenay Bay Marsh consists of tidal-influenced species, confirming that Courtenay Bay is an estuarine marsh. These include brass buttons (*Cotula cornonopifloa*), soft-stem bulrush (*Schoenoplectus tabernaemontari*), saltmarsh bulrush (*Bolboschoenus robustus*) and saltmarsh cordgrass (*Spartina alterniflora*). Upland species include several non-native species such as garden heliotrope (*Valeriana officinalis*) and reed-canary grass (*Phalaris arundinacea*), as well as wild parsnip (*Pastinaca sativa*), creeping buttercup (*Ranunculus repens*) and several goldenrod species (*Solidago*). Speckled alder (*Alnus incana*) and satiny willow (*Salix pellita*) provide the only noticeable shrub species in the upland areas adjacent to the marsh. There were no tree canopies within the surveyed area.

5.5.1.3 Plant Species at Risk and Conservation Concern

The ACCDC database identified 26 rare plant species within 5 km of the Project area (ACCDC, 2012). Furthermore, six species of moss were identified by ACCDC. No federally or provincially-listed plants were identified by ACCDC. The list of plants, including provincial and federal ranking, SRANK, age of data, location of sightings and references are provided in Appendix F, as well as definitions of New Brunswick General Status of Wild Species and SRANK designations.

In July 2012, a plant survey was conducted within and within close proximity impact for the Project (CBCL, 2012). No rare plants were observed in the area surveyed (Appendix C).

5.5.2 Birds

Avifauna at the Project site and the immediate vicinity have been assessed at the desktop level and complemented by a comprehensive, all-season field survey. The desktop level analysis comprised of an ACCDC data request. The ACCDC database identified 33 species of birds of conservation concern within 5 km of the Project area (ACCDC, 2012) (Appendix F). The list of birds, including provincial and federal ranking, age of data, location of sightings and reference, are provided in Appendix F. Further details on bird species at risk are provided in Section 5.5.2.5.

Bird surveys were conducted within the Project area to determine if species at risk or conservation concern are presently using the Project area, as well as, to determine if the Project area is an important food source and habitat for birds during the breeding season, migration period and the winter months. Bird surveys were conducted during all seasons in order to best assess the species using the Project area throughout the year. The studies completed for this Project include the following:

- Winter Residency Survey (conducted in March 2013);
- Spring Migration and Shorebird Survey (conducted in April and May 2013);
- Breeding Season Survey (conducted in June and July 2012); and

- Fall Migration Shorebird Surveys (conducted in August and October 2012).

A summary of each survey is provided in the sections below. Full reports for each survey are provided in Appendix M. Maps providing data obtained from each field survey are provided in the report appendices (Appendix M).

5.5.2.1 Winter Residency Survey

The winter residency survey was conducted primarily to determine if species at risk or conservation concern are overwintering in the Project area. Secondly the survey was conducted to document the diversity and abundance of birds overwintering within the Project area. These results can suggest if the Project area is an important food source for birds during the winter months.

Winter residency surveys were conducted March 12 and 13, 2013 (Appendix M). Seven locations were surveyed throughout the Project area, incorporating the entire Project area and Courtenay Bay Marsh. The first survey corresponded with a rising mid-tide and the second survey with a rising low tide. The surveys were conducted at different tides in order to best assess the species that may use the area for foraging purposes.

A total of 18 different bird species were identified during the two winter residency surveys, five of which are species of conservation concern. None of the species identified are listed federally under the Species at Risk Act or provincially under the *New Brunswick Species at Risk Act*. The following list identifies the species of conservation concern observed during the winter residency survey and provides the provincial status identified by New Brunswick General Status of Wild Species and/or SRANK[2]:

- *Bufflehead (Bucephala albeola):* The bufflehead has an SRANK of S3B and is designated as Sensitive during the winter by New Brunswick General Status of Wild Species (ACCDC, 2010; NBDNR, 2013a);
- *Greater Scaup (Aythya marila):* The greater scaup has an SRANK of S1B, S2N and is designated by New Brunswick General Status of Wild Species as Sensitive in the winter and May be at Risk during the breeding season (ACCDC, 2010; NBDNR, 2013a);
- *Ring-billed Gull (Larus delawarensis):* The ring-billed gull has an SRANK of S3B (ACCDC, 2010);
- *Red-breasted Merganser (Mergus serrator):* The red-breasted merganser has an SRANK of S3B (ACCDC, 2012); and
- *Surf Scoter (Melanitta perspicillata):* The surf scoter is designated by New Brunswick General Status of Wild Species as Sensitive during the winter (NBDNR, 2013a).

Further details on species at risk and species of conservation concern are provided in Section 5.5.2.5 and in Appendix M.

The Project area does appear to provide food sources for a variety of waterfowl species, including species of conservation concern, during the winter months. This may be due to the known abundance of crustaceans, molluscs, and fish known to be in the area. No federally or provincially-listed species were observed foraging in the Project area.

[2] Definitions for SRANK and New Brunswick General Status of Wild Species are provided in Appendix F.

5.5.2.2 Spring Migration Survey

Shorebirds (plovers, sandpipers, curlews, godwits and phalaropes) are highly migratory. Many of the 27 species of shorebird that regularly pass through New Brunswick breed in the Arctic latitudes of North America in spring and early summer. During these long-distance migrations, many shorebirds require mudflat-type habitat in order to forage on aquatic invertebrates and replenish stores. Courtenay Bay, south of the Causeway, contains several hectares of mudflats that are exposed at low tide which presents itself as a potential feeding ground for migrating shorebirds.

The primary objective of the Spring Migration Survey was to assess the use of Courtenay Bay and the surrounding area by shorebirds. Secondary objectives were to assess the use of Courtenay Bay and the surrounding area by waterfowl and other avifauna. A total of five spring migration surveys were conducted at peak low tide between April 25 and May 16, 2013 to determine if migrating shorebirds were indeed using Courtenay Bay as a migration stop-over feeding area.

In total, 38 species were identified during the spring migration and shorebird surveys (Appendix M). Nine of the 38 species are species of conservation concern. None of the species identified are listed federally under the *Species at Risk Act* or provincially under the *New Brunswick Species at Risk Act*. The following list identifies the species of conservation concern observed during the spring migration and shorebird survey and provides the provincial status identified by New Brunswick General Status of Wild Species and/or SRANK:

- *American Wigeon (Anas Americana):* The American wigeon has an SRANK of S2B (ACCDC, 2012);
- *Black Scoter (Melanitta nigra):* The black scoter has an SRANK of S3M, S2S3N and is designated as Sensitive during the migration and winter season by New Brunswick General Status of Wild Species (ACCDC, 2010; NBDNR, 2013a);
- *Bufflehead (Bucephala albeola):* The bufflehead has an SRANK of S3B and is designated as Sensitive during the winter by New Brunswick General Status of Wild Species (NBDNR, 2013a);
- *Gadwall (Anas strepera):* The gadwall has an SRANK of S2B (ACCDC, 2012);
- *Greater Scaup (Aythya marila):* The greater scaup has an SRANK of S1B, S2N and is designated by New Brunswick General Status of Wild Species as Sensitive in the winter and May be at Risk during the breeding season (ACCDC, 2010, NBDNR, 2013a);
- *Northern Pintail (Anas acuta):* The northern pintail has an SRANK of S3B and is listed as Sensitive during the breeding season by New Brunswick General Status of Wild Species (ACCDC, 2010; NBDNR, 2013a);
- *Ring-billed Gull (Larus delawarensis):* The ring-billed gull has an SRANK of S3B (ACCDC, 2010);
- *Red-breasted Merganser (Mergus serrator):* The red-breasted merganser has an SRANK of S3B (ACCDC, 2012); and
- *Surf Scoter (Melanitta perspicillata):* The surf scoter is designated by New Brunswick General Status of Wild Species as Sensitive during the winter (NBDNR, 2013a).

The greater yellowlegs was the sole shorebird species observed during the Spring Migration Survey, and it was only ever detected in the Courtenay Bay Marsh, not the Bay itself. There were, however, large numbers of waterfowl observed within Courtenay Bay. The majority of birds were observed within 40 m of the water's edge at low tide and well away from the shoreline, with the exception of ring-billed and herring gulls which often congregated at one of the sewage outfalls. A complete breakdown of daily species counts by location can be found in Appendix M.

Shorebird diversity and abundance during the spring migration and shorebird survey was low, perhaps due to low diversity of invertebrates in Courtenay Bay or low abundance of preferred invertebrate species. It is possible that the input of sewage into Courtney Bay at the time of assessment may impact diversity and abundance of preferred invertebrate species for shorebird foraging, however this is hypothesis only. Waterfowl species of conservation concern were observed within further into the inner Saint John Harbour, perhaps due to the abundance of molluscs and crustaceans in that area (Appendix L).

5.5.2.3 Breeding Bird Survey

A breeding bird survey was completed for this Project in order to identify bird species breeding in and around the Project area. The vast majority of birds are engaged in nesting activities during June and early July, and in eastern North America this time period is widely regarded as the "Peak Breeding Period." During this period the Project site was surveyed on June 25 and July 5, 2012 (Wilson 2012a; Appendix M). Survey 'point counts' were conducted at seven designated locations selected throughout the Project area so that all habitat types present were represented. A 'point count' consists of a fixed-length time period where all birds observed or heard are recorded to species and distance from the surveyor. For this survey the length of a 'point count' was five minutes.

In total, 25 species of birds were detected. No federally-listed species were detected during the surveys. A bald eagle (*Haliaeetus leucocephalus*), observed flying over Courtenay Bay, was the only provincially-listed species at risk under the *New Brunswick Species at Risk Act* detected during the breeding bird surveys (Wilson 2012a). Killdeer (*Charadrius vociferous*) were observed in the proposed study area in June and July 2012, and are likely nesting near the proposed study area (Wilson 2012a; CBCL, 2012). Killdeer have an SRANK of S3, which indicates that they are uncommon in the province of New Brunswick (Appendix F). One purple finch was also observed during the breeding bird survey in July (Wilson 2012a). Purple finches are listed as Sensitive during the breeding season by New Brunswick General Wild Species (NBDNR, 2013a). Additional details on species at risk and conservation concern are provided in Section 4.5.2.5. Furthermore, species descriptions and habitat evaluations for species of conservation concern are provided in Appendix M.

The diversity of abundance of birds observed during the breeding season was typical for the time of year. The bald eagle was the only Provincially-listed species observed. The Project area likely provides foraging habitat for eagles throughout the year. However, nesting habitat was not observed. Some species are likely nesting within or near the Project area including one species of conservation concern.

See Appendix M for additional details regarding the breeding bird survey.

5.5.2.4 Fall Migration Survey

The autumn migration of birds in Northeastern New Brunswick can be first detected in mid-July with the passage of sandpipers on their journey from the Arctic and boreal nesting grounds to the Gulf of Mexico, the Caribbean, Central and South America. Many other species, including local nesting birds, begin their southward journey in August with the peak fall migration occurring from the last week of August to early

October. By mid-October and early November peak migration is generally over and most remaining birds intend to spend the winter or move to more southerly or coastal areas later on if food supplies become scarce.

As mentioned in Section 5.5.2.1, shorebirds are highly migratory and Courtenay Bay offers a potential migration stop-over feeding location for these birds. The primary objective of the Fall Migration Survey was to assess the use of Courtenay Bay and the surrounding area by shorebirds. Secondary objectives were to assess the use of Courtenay Bay and the surrounding area by waterfowl and other avifauna. The Project site was visited and surveyed on seven occasions between August 2 and Oct 5, 2012 (Wilson 2012c, Appendix M).

In total, 19 species of birds were detected. An incidental observation was made of two bald eagles (Wilson 2012c). Bald eagles are provincially-listed as Regionally Endangered under the *New Brunswick Species at Risk Act*, which are a provincially-listed species. Ring-billed gulls were also identified and they have an SRANK of S3B (ACCDC, 2010). Further details on species at risk and species of conservation concern are provided in Section 5.5.2.5.

The following five shorebird species were identified during the fall migration shorebird surveys:
- Black-bellied plover;
- Greater yellowlegs;
- Semipalmated plover;
- Semipalmated sandpiper; and
- Whimbrel.

The most abundant species was the semipalmated sandpiper, with 1,729 individuals observed between August and October. However, relatively low numbers were observed of the other shorebird species. The main conclusions drawn from the spring migration and shorebird survey are summarized briefly below:
- The diversity and abundance of shorebirds was relatively low compared to other areas in the Bay of Fundy; and
- Shorebird foraging was consistently noticed to primarily occur along the water's edge at low tide.

See Appendix M for additional details regarding the fall migration survey.

5.5.2.5 Avian Species at Risk and of Conservation Concern

The ACCDC database identified 33 species of birds of conservation concern within 5 km of the Project area between 1960 and 2010 (ACCDC, 2012) (Appendix F). The list of birds, including provincial and federal ranking, SRANK, age of data, location of sightings and references are provided in Appendix F. Seven of the 33 species are federally-listed under SARA and one species is provincially-listed under the *Species at Risk Act*. Species descriptions and habitat evaluations for those species listed federally by ACCDC under the *Species at Risk Act* and species listed provincially are provided under the headings below.

In total, 12 species of conservation concern were identified between 2012 and 2013 during the birds surveys conducted in the Project area (see Table 5.14). The bird surveys consisted of a breeding bird, fall migration, winter residency and spring migration. Four of the species identified during the field programs were previously identified as being within the Project area by ACCDC (ACCDC, 2012). None of the species identified are listed under the federal *Species at Risk Act*. Only one species, the bald eagle, is listed under the *New Brunswick Species at Risk Act* as Regionally Endangered. The remaining species have been classified as species of concern since the provincial SRANK was identified between S1 and S3 or the New Brunswick General Status of Wild Species identified the species as At Risk, May Be At Risk, or Sensitive (see Appendix F for complete definitions). Species descriptions, habitat evaluations as well as maps for the species of concern identified during the field programs are provided in Appendix M.

Bald Eagle (Haliaeetus leucocephalus)
The bald eagle is provincially-listed as Regionally Endangered under the previous *New Brunswick Species at Risk Act*, and is also provincially-listed as At Risk (ACCDC, 2012). The ACCDC database has a record of the bald eagle in Saint John East in 2007 (ACCDC, 2012; Lepage, 2009). A bald eagle was also detected in the study area on June 25 and July 5 during breeding bird surveys (Wilson, 2012a). At the time of the surveys, there was no evidence of bald eagles nesting in the study area.

Bald eagles prefer to nest in open sites near water. The Bay of Fundy attracts eagles during the winter months, owing to its plentiful and readily available food source (NBDNR, 2013b). The study area for this Project provides good foraging habitat for bald eagles.

Canada Warbler (Wilsonia canadensis)
The Canada warbler is federally-listed as Threatened, Schedule 1 (SARA, 2013) and provincially-listed as At Risk (ACCDC, 2012). The ACCDC database has a record of the Canada warbler in Saint John East in 1988 (ACCDC, 2012; Erskine, 1992; Appendix F). No Canada warblers were identified during any of the field studies.

The Canada warbler inhabits a variety of forest habitats (deciduous, coniferous, and mixed-wood), but prefers mature forest, with a well-developed deciduous understory (Sibley, 2003; Erskine, 1992). They are also found in riparian areas, shrub forests on slopes, in ravines and in old-growth forests with canopy openings, as well as regenerating stands (SARA, 2013). The study area is not considered to be good habitat for Canada warblers.

Table 5.14: Species of Concern Observed During Bird Surveys, 2012 and 2013, Saint John, NB*

Common Name	Scientific Name	Observed by	Total Number of Individuals	SARA	COSEWIC	NB ESA	SRANK	NB General Status
Ring-billed Gull	*Larus delawarensis*	Jim Wilson Chris Kennedy	374 47	-	-	-	S3B	B – Secure
Bald Eagle	*Haliaeetus leucocephalus*	Jim Wilson	4	-	NAR	Regionally Endangered	S3B	B – At Risk W – At Risk
Killdeer	*Charadrius vociferous*	Jim Wilson Carrie Bentley	3 1	-	-	-	S3B	B – Secure
Greater Scaup	*Aythya marila*	Jim Wilson Chris Kennedy	1 123	-	-	-	S1B, S2N	B – May be at Risk M – Secure W – Sensitive
Purple Finch	*Carpodacus purpureus*	Jim Wilson	1	-	-	-	S4S5	B – Sensitive
Bufflehead	*Bucephala albeola*	Chris Kennedy	225	-	-	-	S3N	W – Sensitive
Surf Scoter	*Melanitta perspicillata*	Chris Kennedy	77	-	-	-	S4M, S4N	M – Secure W – Sensitive
Black Scoter	*Melanitta nigra*	Chris Kennedy	25	-	-	-	S3M, S2S3N	M – Sensitive W – Sensitive
Red-breasted Merganser	*Mergus serrator*	Chris Kennedy	73	-	-	-	S3B, S4S5N	B – Secure M – Secure W – Secure
Gadwall	*Anas strepera*	Chris Kennedy	19	-	-	-	S2B	B – Secure
American Wigeon	*Anas americana*	Chris Kennedy	226	-	-	-	S3B	B – Wigeon
Northern Pintail	*Anas acuta*	Chris Kennedy	24	-	-	-	S3B	B – Sensitive

Common Nighthawk (Chordeiles minor)

The common nighthawk is federally-listed as Threatened, Schedule 1 (SARA, 2013) and provincially-listed as At Risk (ACCDC, 2012). The ACCDC database has a record of the common nighthawk in Saint John East in 1990 (ACCDC, 2012; Erskine, 1992) (Appendix F). Common nighthawk was confirmed as nesting near the Red Head/Anthony's Cove area in 2002 (Jacques Whitford Stantec Limited 2009). No common nighthawks were identified during any of the field studies.

The common nighthawk is a ground-nesting species that uses a wide variety of habitats including logged forests, open woodlands, grasslands, rock outcroppings, barren ground and even gravel rooftops (Cornell, 2008; Sibley, 2003). This species forages for flying insects at dawn and dusk and can be attracted to insects drawn to lighted towers. The study area is not considered to be good habitat for nighthawks due to the highly commercial, industrial, and residential nature of the area.

Eastern Whip-Poor-Will (Caprimulgus vociferus)

The eastern whip-poor-will is federally-listed as Threatened, Schedule 1 (SARA, 2013). The ACCDC database has a record of the whip-poor-will in Saint John East in 1990 (ACCDC, 2012; Erskine, 1992; Appendix F). No observations were made of the whip-poor-will during any of the field surveys.

Whip-poor-wills prefer to nest in forests with openings such as barrens and sections regenerating from old burns or other disturbances. They prefer mixed forests and are often associated with pine and oak. They prefer to feed in shrubby areas and wetlands and they tend to avoid dense areas, likely due to their need to forage by air (SARA, 2013). The study area is not considered to be good habitat for whip-poor-wills due to the highly commercial, industrial, and residential nature of the area

Least Bittern (Lxobrychus exilis)

The least bittern is federally-listed as Threatened, Schedule 1 (SARA, 2013) and is provincially-listed as At Risk (ACCDC, 2012). The ACCDC database has a record of the least bittern within 5 km of the study area in 2007 (ACCDC, 2012; Lepage, 2009; Appendix F). The least bittern has been observed infrequently in the study area since the 1960s, with the most recent observation being in 2007. The information was provided to ACCDC from Denis Lapage, manager of Avibase. Avibase is a multi-national database website that is hosted by Bird Studies Canada for people to report their observations. No least bitterns were seen or heard during the field surveys.

Large clear water marshes with consistent water levels and dense sections of emergent vascular plants are the most preferred sites for nesting. The preferred plant species appears to be cattails; however, other emergent vascular and woody vegetation are also selected. Nests are typically constructed within 10 m of open clear water (SARA, 2013). The Courtenay Bay marsh does not meet the preferred breeding requirements for the least bittern due to its highly fluctuating waters.

Peregrine Falcon (Falco peregrinus)

The peregrine falcon is federally-listed as Special Concern, Schedule 1 (SARA, 2013) and provincially-listed as At Risk (ACCDC, 2012). The ACCDC database has a record of the peregrine falcon in Saint John in 2010 (ACCDC, 2012; Kennedy, 2010; Appendix F). Surveys for peregrine falcons have been completed in the Saint John region for 2010, 2011 and 2012 by biologists from NBDNR and the New Brunswick

Museum. A peregrine falcon nest was historically active on the Saint John Harbour Bridge (McAlpine, 2012) during the 1980s and 1990s (Wilson, 2012b). Presently, an active peregrine falcon nest is suspected upstream of the Saint John Harbour Bridge at Reversing Falls, which is within 5 km of the study area (Wilson, 2012b pers. comm.). Another pair of falcons is known to presently be nesting annually on the cliffs on the east side of Manawagonish Island (Wilson, 2012b pers. comm.); however, this is outside of the study area radius. Peregrine falcons are also known to use the Courtenay Bay area for foraging (McAlpine, 2012). No peregrine falcons were identified during any of the field surveys.

In New Brunswick, peregrine falcons typically nest in cliffs and can sometimes nest on bridges and buildings (NBDNR, 2013b). The Saint John Harbour Bridge, the reversing falls and Manawagonish Island have all been identified as either active or historical nesting sites of the falcon. Although falcons are not known to be nesting in the study area, they are nesting nearby therefore, there is potential for them to be found within the study area.

Piping Plover (Charadrius melodus melodus)

The piping plover is federally-listed as Endangered, Schedule 1 (SARA, 2012) and provincially-listed as At Risk (ACCDC, 2012). The ACCDC database has a record of the piping plover in Courtenay Bay in 1996 during the Maritime Shorebird Survey (ACCDC, 2012; Morrison, 2011) (Appendix F). This survey was conducted by the Canadian Wildlife Service. No piping plovers were identified during any of the field surveys conducted for the Project.

Piping plovers are migratory and can be found on Nova Scotia beaches from mid-April to September (MTRI, 2008). Piping plovers prefer sparsely vegetated sandy and gravelly coastal beaches. Nests are typically lined with shells and small pebbles and egg laying typically starts in May (NSMNH, 1998). Exposed sandy or gravelly beaches are typically selected above the normal high-water mark (SARA, 2013). Piping plovers can also be found along mudflats (MTRI, 2008). The Project area does not contain piping plover critical nesting habitat; however, mud flats are available for foraging during spring and fall migrations stop-overs. It is possible that piping plovers would use the Project area for foraging during migration.

Red Knot (Calidris canutus rufa)

The red knot is federally-listed as Endangered, Schedule 1 (SARA, 2012) and provincially-listed as At Risk (ACCDC, 2012). The ACCDC database has a record of the red knot in Courtenay Bay in 1998 during the Maritime Shorebird Survey (ACCDC, 2012; Morrison, 2011) (Appendix F). This survey was conducted by the Canadian Wildlife Service. No red knots were identified during any of the field surveys conducted for the Project.

The red knot is a common fall migrant and uncommon spring migrant in Nova Scotia (NSMNH, 1998). This species does not breed in New Brunswick. During migration, this species inhabits large sandflats, mudflats along the coastal shore, peat banks, salt marshes, brackish lagoons and mussel beds (MTRI, 2008). The Project area does contain mudflats which can provide foraging habitat for red knots during migration stop-overs.

5.5.3 Herptiles

The Marsh Creek watershed and the Courtenay Bay Marsh would provide the best potential habitat for herptiles within the vicinity of the Project area. A desktop level assessment was conducted on herptiles within the study area. No specific field studies were conducted on herptiles in the proposed study area. Herptile species which have been known to occur within the Marsh Creek watershed include, but are not limited to the eastern newt, red back salamander and green frogs (McKenna et al., 2007). Other species that could be found within the Saint John area including the Marsh Creek watershed and the Courtenay Bay Marsh are provided in Table 5.15 (University of Guelph, 2012).

Table 5.15: Herptile Species Potentially Found Within the Saint John Area

Common Name	Species Name
Maritime garter snake	*Thamhophrs sirtalis pallidula*
Eastern smooth green snake	*Liochlorophis vernalis vernalis*
Northern redbelly snake	*Storeria occipitomaculatus occipitomaculatus*
Northern ring snake	*Diadophis punctatus edwardsii*
Eastern painted turtle	Chrysemys picta picta
Wood turtle	Glyptermys insculpta
Common snapping turtle	Chelydra serpentina serpentine
Eastern American toad	*Bufo americanus americanus*
Northern spring peeper	*Pseudacris crucifer crucifer*
Green frog	*Rana clamitans melanota*
Wood frog	*Rana sylvatica*
Gray tree frog	*Hyla versicolor*
Northern leopard frog	*Rana pipiens*
Pickerel frog	*Rana palustris*
Mink frog	*Rana septentrionalis*
Bull frog	*Rana catesbeiana*
Red-spotted newt	*Notophthalmus viridescens viridescens*
Yellow-spotted salamander	*Ambystoma maculatum*
Blue-spotted salamander	*Ambystoma laterale*
Northern two-lined salamander	*Eurycea bislineata*
Eastern red-backed salamander	*Plethodon cinereus*
Northern dusky salamander	*Desmognathus fuscus*

The desktop level analysis consisted of an ACCDC data request. The ACCDC database identified the wood turtle as being found within 5 km of the study area (Appendix F). No other herptile species at risk or species of concern were identified. The provincial and federal rankings, SRANK, age of data, location of sightings and reference, are provided in Appendix F. Species descriptions were conducted only for species listed federally under the Species at Risk Act and those listed provincially.

Wood Turtle (Glyptemys insculpta)

Wood turtles are listed federally as Threatened, Schedule 1 (SARA, 2013) and provincially-listed as At Risk (ACCDC, 2012). The ACCDC database has identified the wood turtle within 5 km of the study area

(ACCDC, 2012; McAlpine, 1998). Although no studies for wood turtles were conducted for this Project, no wood turtles were observed during any of the field programs.

Wood turtles require freshwater for nesting, hibernation and temperature regulation; however, they also spend time on land, typically within 300 m of a water source (SARA, 2013). They prefer clear meandering watercourses with moderate flow and with sandy or gravel/sand substrate, and they will nest along sandy or gravel/sand banks with diverse patchy cover (COSEWIC, 2007). Marsh Creek and the Courtenay Bay area are not considered wood turtle habitat (McAlpine, 2012 pers. comm.).

5.5.4 Terrestrial Mammals

The Project area is located in Saint John, New Brunswick which is a highly urbanized city consisting of residential, commercial, industrial areas as well as some limited green space such as the Courtenay Bay Marsh, Marsh Creek, and the area around Lily Lake (Figure 2.2). Most remaining wildlife habitat in the Saint John area has been highly fragmented by developments over the past several decades. The main, and possibly only, wildlife corridor for terrestrial mammals into the city would be via the Marsh Creek watershed. Therefore, the City of Saint John provides limited habitat for terrestrial mammals with limited access into the City.

A desktop level assessment was conducted on terrestrial mammals in the study area. No specific field studies were conducted on terrestrial mammals in the proposed study area. Although no specific terrestrial mammal field survey was undertaken, it is expected that the area in proximity to the Project area provides limited habitat for mammals due to the dominance of commercial, residential, and industrial areas. The Courtenay Bay Marsh would provide habitat for mammals within the vicinity of the Project area. In July 2012, CBCL found that the area is used by white-tailed deer (*Odocoileus virginianus*) during a Wetland Functional Assessment in the Courtenay Bay Marsh. Marsh Creek would provide a wildlife corridor for mammals to enter into the Courtenay Bay Marsh. Other mammals that have the potential to use the corridor may include but not be limited to: snowshoe hare (*Lepus americanus*), red fox (*Vulpes vulpes deletrix*), Eastern moose (*Alces alces americana*), mink (*Mustela vison*), raccoon (*Procyon lotor*), muskrat (*Ondatra zibethicus*) (McKenna et al., 2007), coyote (*Canis latrans*), weasel (*Mustela ermine*) and beaver (*Castor canadensis*). Other mammals that could be potentially found in and adjacent to the Project site would likely include those mammals typically found in developed areas such as the Norway rat (*Rattus norvegicus*), house mouse (*Mus musculus*), deer mouse (*Peromyscus maniculatus*), and red squirrel (*Tamiasciurus hudsonicus*).

The desktop level analysis comprised of an ACCDC data request. The ACCDC database identified six terrestrial mammals of conservation concern within 5 km of the study area (Appendix F). The list of mammals, including provincial and federal ranking, SRANK, age of data, location of sightings and references, are provided in Appendix F. Species descriptions were conducted only for those species listed federally under the *Species at Risk Act* and species listed provincially, with the exceptions of bats. The Nova Scotia government has recently released information that three species of bats are now endangered in the province due to White-nose-Syndrome which is caused by the fungus, Geomyces destructans (NSDNR, 2013). Approximately 7 million little brown bats (*Myotis lucifugus*) have been lost in eastern Northern America due to the syndrome. The species most impacted include: little brown myotis; northern myotis (*Myotis septentrionalis*); and the tri-colored bat (*Perimyotis subflavus*).

Little Brown Myotis (Myotis lucifugus)
Although the little brown myotis (also known as the little brown bat) is not listed federally or in New Brunswick, its numbers in eastern North America are in rapid decline (NSDNR, 2013). In addition, COSEWIC has listed the bat as being endangered in New Brunswick. The ACCDC database identified the little brown bat within 5 km of the study area. The bat was observed in the Saint John area in 1983 (Sollows, 2008). Although no specific field programs were conducted for bats, no bats were observed during any of the field programs.

The little brown bat typically congregates in caves and abandoned mines for winter hibernation (NSDNR, 2013). During the breeding season, female bats will use buildings, tree cavities or bat boxes (Langlois, 2013). The Project area is not considered to contain good natural habitat for the little brown bat due to the lack of preferred overwintering locations. Buildings and abandoned buildings in the area could provide shelter for bats during the breeding season.

5.5.5 Terrestrial and Aquatic Insects
Due to the highly urbanized nature of the city of Saint John, the Marsh Creek watershed and the Courtenay Bay Marsh would provide the best potential habitat for terrestrial insects within the Project area.

A desktop-level assessment was conducted on terrestrial insects in the study area. The desktop level analysis comprised of an ACCDC data request. The ACCDC database identified 10 aquatic and terrestrial insects of conservation concern within 5 km of the study area (Appendix F). The list of insects, including provincial and federal ranking, SRANK, age of data, location of sightings and reference, are provided in Appendix F. Species descriptions were conducted only for those species listed federally under the Species at Risk Act and species listed provincially.

Monarch Butterfly (Danaus plexippus)
The monarch butterfly is federally-listed as Special Concern, Schedule 1 (SARA, 2013). ACCDC lists a monarch butterfly observation in 1908, within 5 km of the study area (ACCDC, 2012; Speers, 2008). In 2011, the Cambridge Butterfly Conservatory (CBC) reported that a team of scientists from the CBC were tagging monarch butterflies in the Irving Nature Park in Saint John, which is just over 7 km from the Project site (CBCL, 2011). Although no specific field study was conducted for butterflies, no monarch butterflies were observed in the study area during any of the other field programs.

Monarch butterflies habitat centers on the availability and abundance of milkweed and wildflowers (e.g., asters, golden rods). Due to the presence of some wildflowers in the study area, Monarch butterflies may use the Courtenay Bay area during migration for feeding; however, there are no known features that concentrate numbers within the Courtenay Bay area (Wilson, 2012b personnel communication). Since there was no milkweed found during the plant survey in July 2012; therefore, it is unlikely that monarchs breed in the area.

5.6 Land Use and Socio-economic Environment
The description of land use and the socio-economic environment was developed through desktop studies, existing data sources and field studies. The land use and socio-economic environment consists

of the existing land uses such as marine traffic, terrestrial traffic and existing view plans, and an economic profile including an assessment of existing Commercial, Recreational and Aboriginal (CRA) fisheries. The following section summarizes the land use and socio-economic environment as described further in Appendix B.

5.6.1 Land Use

5.6.1.1 Land Use Inventory

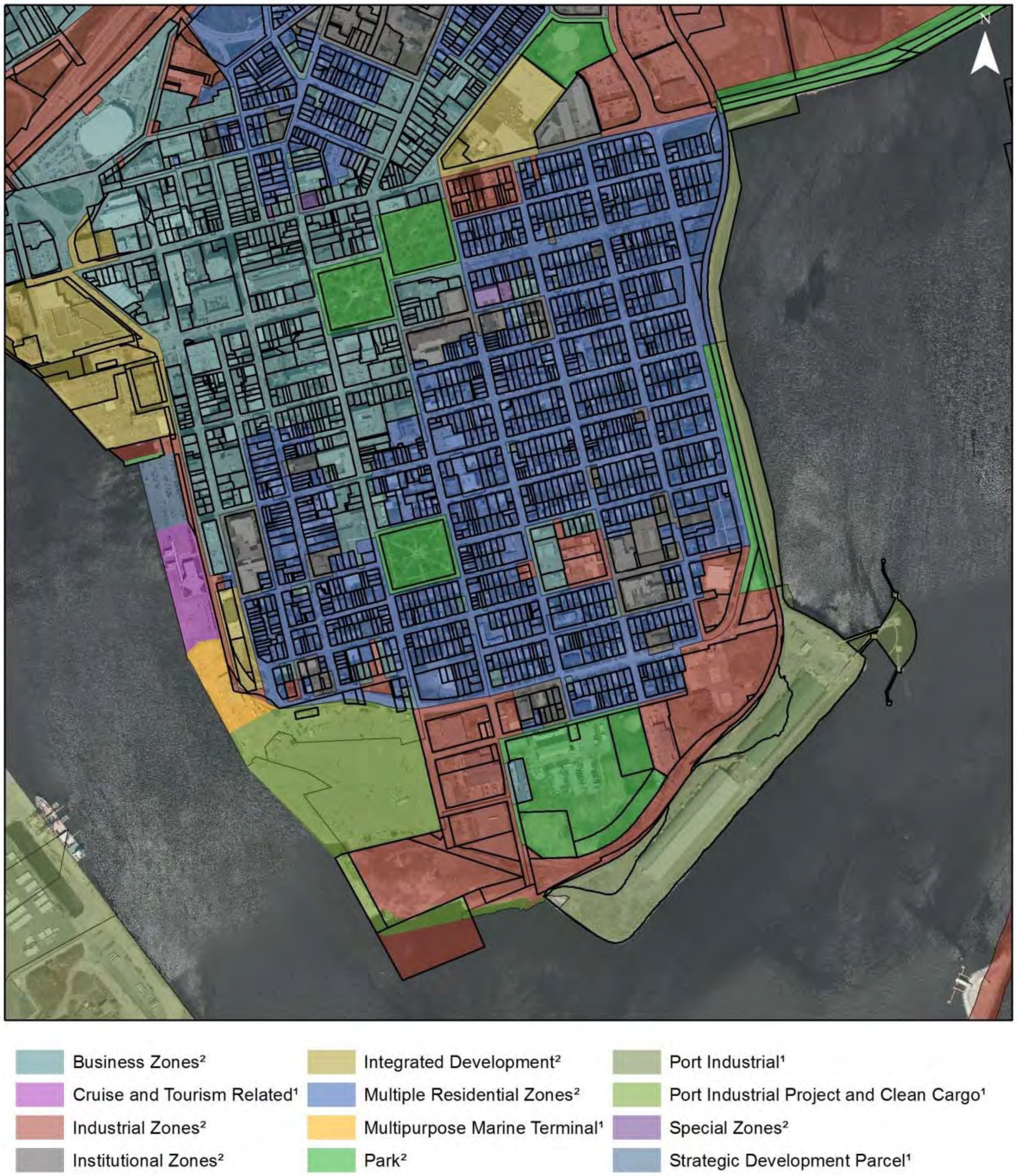
The Uptown Saint John area in which the existing PotashCorp Marine Terminal is located has a mix of land uses including residential, parkland, commercial and industrial uses (Figure 5.5). The land use identified in Figure 5.5 and described in detail in Appendix B was obtained from both the City of Saint John Municipal Plan (PlanSJ) and Saint John Port Authority Land Use Plan. Uptown Saint John is primarily residential, consisting of several neighbourhoods and districts. Central and eastern areas of the Uptown Saint John Peninsula including north of the existing Terminal and adjacent to Crown Street and rail line currently used for transportation to the Terminal.

Commercial land is concentrated in the Central Business District (CBD), which is located between the waterfront and Union Street, Sydney Street and Princess Street. The CBD includes a mix of relatively newer and taller commercial buildings (such as Brunswick Square) and grandiose heritage buildings that offer a range of commercial services, including office space, banks, hotels, restaurants and shops.

Saint John has a considerable amount of industrial land, which includes light to heavy industrial uses and lands associated with transportation and utilities. There are few, if any, examples of heavy industrial activity occurring on the peninsula. Marine transportation is the predominant type of industrial use found in the area. The Port of Saint John occupies the majority of land along the peninsula coastline. Marine industrial land continues along the coastline toward the west of peninsula, which includes the SJPA Westside Docks and the Digby Ferry Terminal.

Uptown Saint John includes a mix of park and recreational amenities, including large urban park squares, historic burial grounds, plazas and parklets, sports fields, playgrounds, trails, indoor facilities, and community centres. Furthermore, several abandoned industrial sites are also being using for passive recreational purposes, such as Tin Can Beach near the old Lantic Sugar site.

Tin Can Beach is situated between the exiting Potash Terminal and former Lantic Sugar lands. The rocky beach is occupied by remnants of previous uses such as wood piles, rip-rap, decaying concrete foundations marked with graffiti. Domestic waste and other debris is often found on the site. Although the area is a neglected brownfield site, it is frequented by locals for its relatively undisturbed view of the Harbour, Partridge Island, and beyond. The site is also easily accessed and has a large parking area.



[1] Land use obtained from the Saint John Port Authority Land Use Plan
[2] Land use obtained from the Saint John Municipal Plan

Figure 5.5: Existing Land Use Map - Uptown Saint John

5.6.1.2 Saint John Port Authority Land Use

Land use planning for property owned by Saint John Port Authority is described in the Saint John Port Authority 2011 Land Use Plan. The following section details the land use zoning for Saint John Port Authority properties in the vicinity of the Project area.

Barracks Point – Port Industrial

Potash and salt are handled through Barrack Point Potash Terminal, under a long term lease agreement with the Potash Corporation of Saskatchewan. Barracks Point will continue to be used for dry and liquid bulk cargoes. The storage and movement of potash is an important contributor to the longevity and financial sustainability of the Port. Expansion of the terminal may be required in the long-term and must be taken into consideration in this land use plan. Should this occur, consideration will be given to the impacts on the surrounding residential area.

Cruise and Tourism Related

The land use for the Marco Polo Terminal, Pugsley C terminal and Long Wharf is intended to service the cruise ship industry. The SJPA plans to continue strengthening and upgrading operations and facilities and develop strategies to attract new cruise product opportunities on these properties. The Pugsley C Terminal will complement the primary cruise terminal, the Marco Polo, and will allow the Port Authority to accommodate multiple same day calls of larger vessels. While the priority will be on cruise operations, the terminal area will remain sufficiently flexible to allow for utilization of the berth and dock apron by cargo vessels for handling cargo over Lower Cove. Other plans include exploring opportunities for complementary development on Pugsley Park such as boutique hotel, retail opportunities and potential restaurant/ entertainment/special event components that will generate revenue opportunities for the SJPA.

Lower Cove Terminal – Port Industrial and Clean Product

Lower Cove Terminal is a large and secured open asphalt area interspersed with high-tower commercial lighting. Lower Cove is situated as a marine cargo facility and most recently has been used for lumber and project cargo. Road access to this terminal utilizes the municipal designated truck route. The increased use of Long Wharf for cruise and the subsequent displacement of cargo space, increased pressure will be brought onto Lower Cove as a marine cargo facility. The Port Authority's intends to continue to use this facility for marine cargo operations.

5.6.1.3 Tourism

According to a recent report by Enterprise Saint John, the tourism sector has been growing steadily over recent years, and is expected to continue to grow over the next ten to twenty years. On average, approximately 1.5 million people visit Saint John every year, many of which arrive via cruise ship at the Port of Saint John. In the 2013 cruise ship season, 73 ships visited Saint John bringing more than 187,000 passengers and 65,000 crew members. Saint John features several key tourist attractions. The main attraction is the Bay of Fundy and its unique tidal range, and other key tourist attractions include:

- Reversing Falls;
- Trinity Royal Heritage Conservation Area;
- Historic built environment of Saint John;

- Partridge Island;
- St. Martins Caves;
- Stonehammer Geopark;
- Irving Nature Park;
- Fort Howe National Historic Site;
- Carlton Martello Tower National Historic Park;
- Rockwood Park;
- The Three Sisters lamp; and
- Cultural attractions (e.g., historic churches, New Brunswick Museum, and Barbour's General Store).

5.6.1.4 Vehicle Traffic

The new PotashCorp access road will connect directly with the existing Courtenay Bay Causeway. The Project study area includes the Causeway and the signalized intersections at each of its ends. Please refer to Figure 5.6.

The Courtenay Bay Causeway is a major arterial roadway within the City of Saint John, representing the primary link between the Uptown peninsula and the heavily industrialized East Saint John. As implied, it crosses the Courtenay Bay portion of the Saint John Harbour with an east-west orientation. There is open water to the south while most of the land to the north is undevelopable marshland. It carries four lanes of traffic (two per direction) and has a posted speed limit of 70 km/h.

The Causeway extends approximately 1,200 m between Crown Street to the west and Bayside Drive to the east. Most of this length is undivided, but approximately 375 m of it in the middle has a Jersey barrier median. There is a concrete sidewalk along the south side of the roadway, and guide rails along most of the length. There is a grade-separated rail crossing about 130 m east of Crown Street and another about 120 m west of Bayside Drive; in both cases, the road passes over the railroad. There are also tide gates about 290 m east of Crown Street. There is only one access point between the two intersections: a large industrial driveway into an Irving property on the north side adjacent to Bayside Drive.

The intersection of the Causeway, Crown Street and Union Street is a large four-leg signalized intersection; Crown Street is oriented north-south through it, the Causeway forms the east leg, and Union Street comprises the west leg. There are multiple lanes at all four approaches, including a southbound double-left turn lane. There are two through lanes for the eastbound and westbound approaches, and three approaches have channelized right turn lanes. The traffic signal uses a four-phase timing plan, including a southbound advance and an east-west protected left turn phase. There are sidewalks on all but the northeast quadrant and crosswalks with pedestrian signals across the west and south legs. Adjacent land uses include an Irving office building, the Telegraph-Journal building, and multi-unit residential buildings.

The intersection of the Causeway, Bayside Drive and Mt. Pleasant Avenue East is another signalized intersection with four legs; with Bayside Drive is oriented north-south through it, the Causeway forms the west leg, and Mt. Pleasant Avenue East comprises the east leg. All approaches have dedicated left turn lanes, and the north-south Bayside Drive approaches each have two through lanes. The traffic signal uses a four-phase timing plan; the eastbound and northbound approaches both have advance phases. There

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Project Description
MARINE TERMINAL EXPANSION
ACCESS ROAD TRAFFIC STUDY AREA

Revision or Issue	ISSUED FOR EIA REGISTRATION DOCUMENT (FEB 19, 2015)				
Contract No	142865.00	Drawn	SO	Approved	AW
Scale	1:4,000	Date	FEB 2015	Figure No	5.6

are sidewalks on all but the northwest quadrant and crosswalks with pedestrian signals across the east and south legs. Adjacent land uses include a gas station on the southeast corner, a Tim Hortons on the northwest corner, commercial buildings on the northeast corner, and a vacant lot on the southwest corner.

The City of Saint John used an Automatic Traffic Recorder (ATR) to carry out a directional count of traffic on the Causeway near the proposed intersection location for a 72-hour period in early November 2012. The count was conducted from 7:00 a.m. on Tuesday, November 6 until 7:00 a.m. on Friday, November 9. The Average Daily Traffic (ADT) during this time is summarized in Table 5.16.

Table 5.16: Summary of Average Daily Traffic Count

Courtenay Bay Causeway	Nov.6-9, 2012 ADT
Eastbound	11,050
Westbound	13,525
Total	24,575

Manual turning movement counts were carried out at both study intersections during the weekday morning, midday (m.d.) and afternoon peak periods - the data from these traffic counts are provided in Appendix N. The Causeway/Crown/Union intersection was counted during the periods 7:30 to 9:30 a.m., 11:30 a.m. to 1:30 p.m., and 4:00 to 6:00 p.m. on Tuesday, November 6, 2012. The Causeway/Bayside/Mt. Pleasant East intersection was counted during the same times on Wednesday, November 7, 2012. The following classifications were captured for both count locations:

- Passenger vehicles (cars, SUVs, minivans, light trucks, etc.);
- Heavy vehicles (heavy trucks and buses); and
- Pedestrians/bicycles.

It was found that both intersections have significant volumes of heavy vehicles, with approximately 4.8% at the Crown Street end of the Causeway and 6.3% at the Bayside Dr. end. Some approaches are particularly high with northbound Bayside Dr. at 10.4%, southbound Bayside Dr. at 7.4%, and southbound Crown Street at 6.9%. Pedestrian volumes at the two locations were not high, but also not inconsequential. There were a total of 124 pedestrian crossings observed at the Crown Street intersection during the six a.m., m.d., and p.m. hours of counts on November 6. This compares with a total of 50 pedestrian crossings observed at the Bayside Dr. intersection during the same periods on November 7.

The a.m., m.d., and p.m. peak hours at the Crown Street intersection were found to begin at 7:45a.m., 12:00 p.m., and 4:30 p.m. , respectively. Those for the Bayside Dr. intersection began at 7:30a.m., 11:45a.m., and 4:15p.m. Figure 5.7 shows the existing a.m. and p.m. peak hour traffic volumes for both study intersections, adjusted as per the DTI factor provided for counts conducted in November.

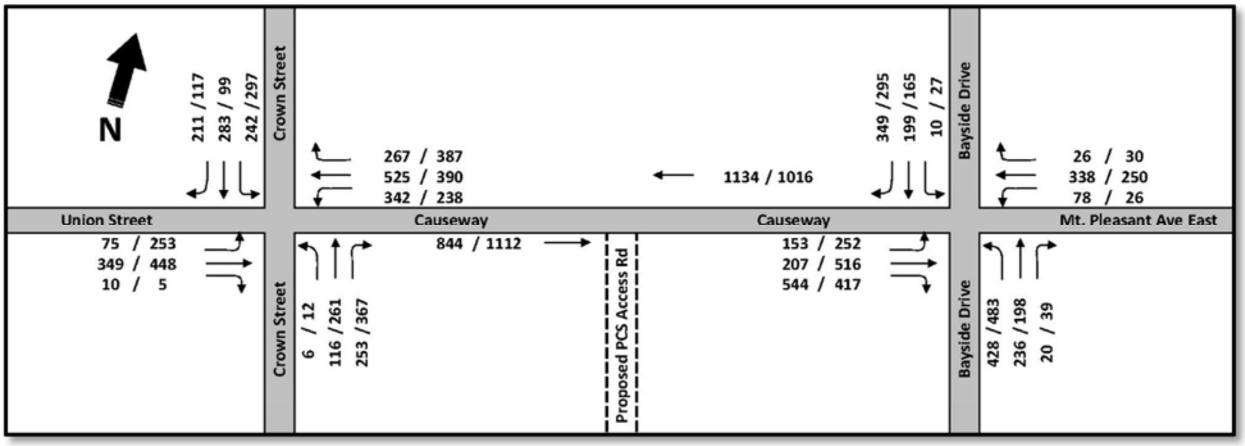


Figure 5.7: 2012 Existing Peak Hour Intersection Traffic Volumes

5.6.1.5 Harbour Usage and Marine Traffic

The Port of Saint John is accessed through two main shipping channels from the Bay of Fundy. The main channel is maintained at 150 m wide and a depth of 8.6 m CD. The Courtenay Bay Channel has a minimum width of 150 m and a depth of 5.3 m CD.

The Port houses a number of terminals and berths for shipment of dry bulk cargo, liquid bulk cargo, containerized cargo, general cargo, and cruise ships. According to the latest annual summary, the port handled over 31 million tonnes of cargo in 2011. The vast majority of tonnage was attributed to liquid bulk shipment from private petrochemical facilities outside the main harbour. Over 2 million tonnes were handled at terminals within the SJPA and the cruise facilities handled 65 ship calls and over 184,000 passengers (PSJ, 2012).

The terminals within the harbour maintain water depths of 9.1 to 13 m CD. Terminal lengths range from 107 to 369 m. Given the Terminal depths, typical cargo vessels are likely to be Panamax size or less. Longer vessels can be accommodated provided the draught of the ships is small enough. The Carnival Dream cruise ship calls at Saint John with a length overall (LOA) of 306 m with a maximum draught of 8.4 m.

A navigation study was completed as part design of the Marine Terminal expansion and included an assessment of the existing marine traffic within Saint John Harbour and shipping channels. The assessment detailed the existing marine traffic volumes, channel utilization and waiting times. See Table 5.17 for a summary of existing marine traffic characteristics within the shipping channels.

Table 5.17: Estimated Existing Marine Vessel Waiting time for Saint John Channel

Marine Traffic Characteristics	2011 Traffic
Cargo Volume (t/yr)	13,900,000
Average Shipment Size (t)	17,000
Avg Tidal Window (hrs/day)	18
Avg Ship Time in Channel and Mooring (hrs)	1.5
Number of Ships/year	810
Channel Utilization Ratio	0.39
Waiting Time (%)*	0.47%

5.6.1.6 Visual Aesthetics

As an industrialized city, Saint John has refineries, Marine Terminals, docks and factories located throughout and dotting along the majority of the Saint John waterfront. The visual aesthetic of the existing facility does not particularly stand out from other existing Marine Terminals. Specific view plains have been identified that may be impacted by the proposed Project, and a Visual Impact Assessment has been included in Appendix B. See Figure 5.8 for existing view plains that may be impacted by the Project.

Figure 5.8: Existing View Plains

5.6.2 Socio-economic Profile

5.6.2.1 Population Profile

The population of the City of Saint John in 2011 was 70,063. With the exception of the most recent 2011 census year, the population of the City has been in steady decline since 1971. Between 1971 and 2011, Saint John lost more than 20% of its population, dropping from 89,000 to 68,000. Despite this substantial population loss, the City remains the second largest in the Maritimes and the largest in New Brunswick. This negative trend ended in the last census period, which saw a 3% population increase.

While the Saint John population declined over 20% in the City since 1971, the population in surrounding communities more than doubled over the same period. The development of adjacent communities in Rothesay and Quispamsis triggered a process of suburban flight that saw the population of the surrounding area balloon from approximately 17,500 residents in 1971 to almost 58,000 in 2011. The majority of growth in the area occurred between 1971 and 1996, when the Saint John Throughway and the Mackay Highway extension made it easier to commute into the City, making the suburbs more attractive. See Table 5.18 for detailed yearly population data for Saint John and surrounding areas.

Table 5.18: Populations Data, Saint John, NB

Year	City of Saint John		Surrounding Areas		Total CMA	
	Population	% change	Population	% change	Population	% change
2011	70,063	+3.0%	57,698	6.17%	127,761	4.4%
2006	68,043	-2.3%	54,346	2.51%	122,389	-0.2%
2001	69,661	-3.9%	53,017	-0.36%	122,678	-2.4%
1996	72,494	-3.3%	53,211	4.60%	125,705	-0.1%
1991	74,969	-1.8%	50,869	13.35%	125,838	3.8%
1986	76,381	-5.1%	44,879	33.81%	121,260	6.3%
1981	80,521	-6.3%	33,539	24.06%	114,060	1.0%
1976	85,950	-3.5%	27,035	53.03%	112,985	5.9%
1971	89,039	-	17,666	-	106,705	-

The average age of the population of the City of Saint John is consistently increasing. Almost a quarter of residents fall between the ages of 45 and 59. Furthermore, the median age has increased from 38.6 to 42.3 over the past ten years, which is younger than the provincial median age (43.7), but higher than the national median (40.6). See Figure 5.9 for a breakdown of population demographics within the City of Saint John.

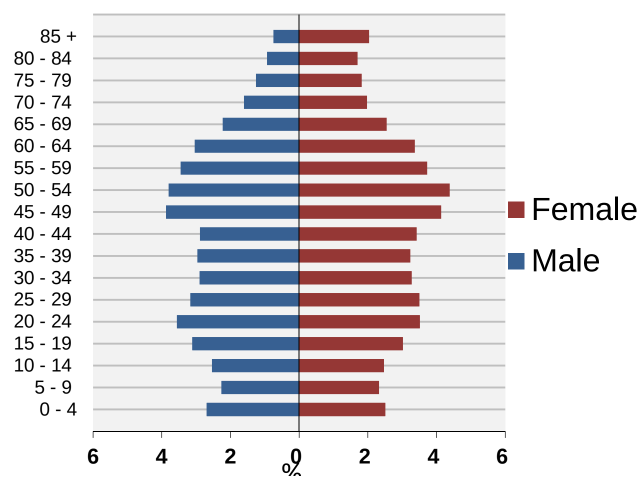


Figure 5.9: Population Demographics, Saint

5.6.2.2 Economic Profile

Saint John is recognized as the economic hub of New Brunswick due to its strategic port location and deep roots in trade, manufacturing and industrial activity. The global shift to a more serviced-based economy in recent decades has resulted in stronger local economies in Moncton and Fredericton, while Saint John has also diversified its economy. Today, all three economic areas feature a diverse economy but specialize in different areas, with Saint John continuing to lead the way in trade and industry.

In Saint John, almost 65% of the population over the age of 15 (just over 67,000 people) participated in the labour force. Amongst the participating labour force, 8.6% were unemployed, which is higher than elsewhere in the country (7.8%), but lower than the provincial rate (11.0%). The unemployment rate has increased since 2006 when it was 8.0%, as it has throughout most of the province and country.

Historically, the Saint John economy has been underpinned by a strong industrial sector. Although the economic region has transitioned to a service-based industry, it still maintains its industrial roots. In

2011, around 80% of the Saint John labour force was employed in the service sector, compared to around 87% in Fredericton and Moncton. Approximately 4% were employed in the primary sector and 16% in the secondary sector.

Table 5.19: Sector Breakdown of Labour Force

	Saint John CMA	
2011	**Total**	**%**
Total Labour Force	67,355	-
Primary sector	2,680	4.0%
Secondary sector	12,115	15.8%
Service sector	11,670	80.2%

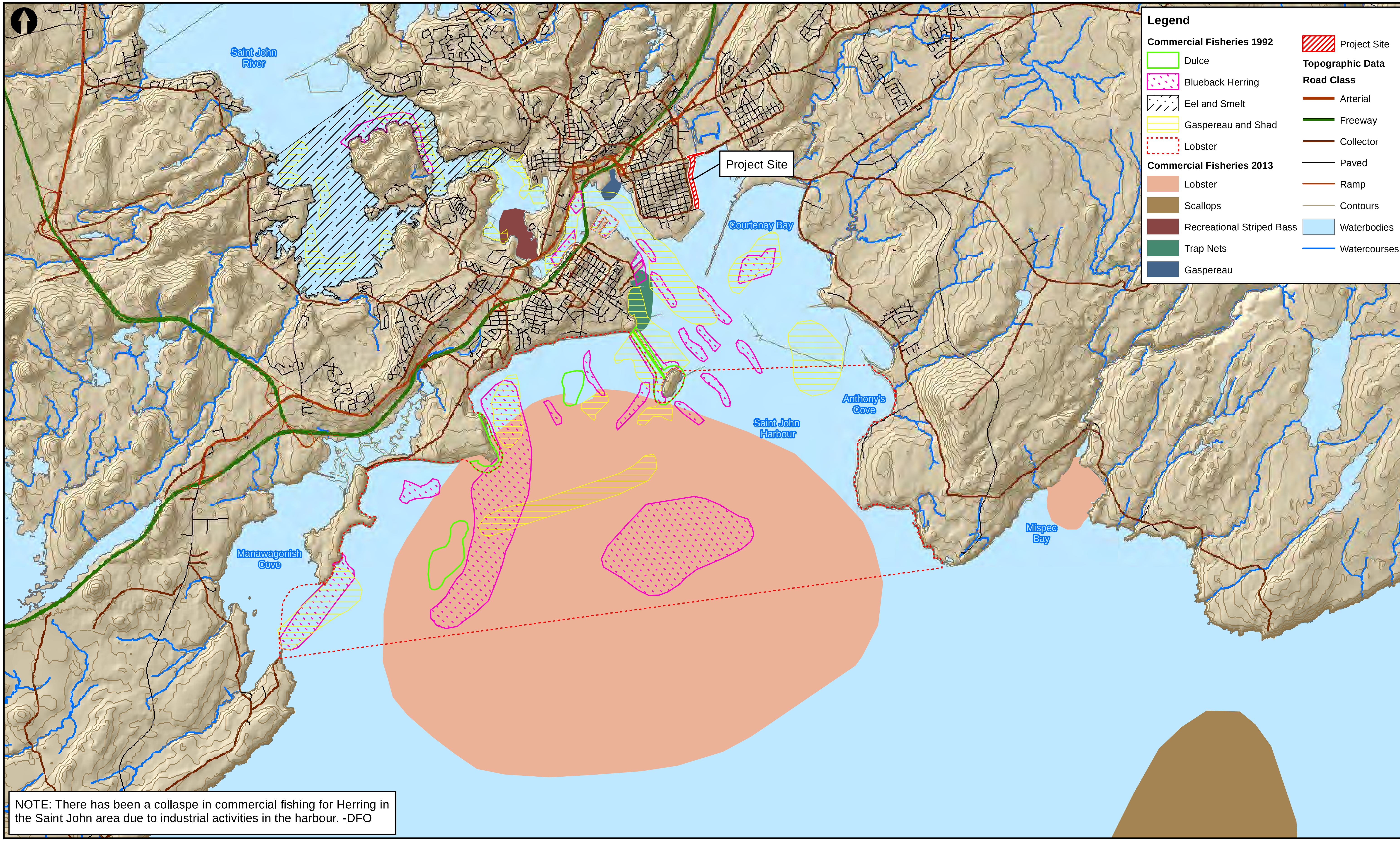
5.6.3 Commercial, Recreational and Aboriginal Fisheries

The Saint John Harbour and the surrounding areas support the local commercial, recreational and aboriginal (CRA) fishery. CRA fisheries are valuable to the economy and are a livelihood and important way of life for many people. There has been an overall general decrease in the number of commercial fishing licenses over the years; however, commercial, commercial-aboriginal and recreational licenses are still being issued annually.

The Saint John Harbour is divided into the inner and outer harbour and the proposed Project is near the borders of DFO Fisheries Statistical Districts #48 (Saint John County, east of the Saint John River) and #49 (Saint John County, west of the Saint John River). Together the districts span from Fundy National Park to Point Lepreau (Figure 5.10). Marine traffic within the Harbour is regulated by the SJPA under the *Canada Marine Act*. Marine traffic and access into the Harbour are major issues with CRA fisheries. Marine traffic increases in the harbour during peak commercial fishing seasons. Noticeable increases in marine traffic should typically occur in May and June since the majority of commercial fishing in the Harbour occurs during this time. Lobster fishing is one of the largest in the area. Vessels fishing for lobster are closest to the Saint John Harbour during May and June due to seasonal lobster movement.

No marine aquaculture sites are located near the Saint John Harbour; however, a freshwater aquaculture facility is located at Carters Point for sturgeon (18 km) and at Drury Cove for salmon smelt (6.5 km).

CRA fisheries identified within close proximity to the Project area are listed in Table 5.20. The locations of some of the CRA fisheries are provided in Figure 5.11. The fishing seasons for each directed commercial fishery is provided in Table 5.21. Most commercial fishing appears to occur between May and June, which should noticeably increase marine traffic in the Saint John Harbour. The commercial fishery within proximity to the Project area with the most landings in the New Brunswick Maritimes Region is herring at 11,416 metric tonnes, followed by Lobster and Scallops (see Table 5.22). A more detailed description of each directed CRA fishery is provided in the sections below.



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Client: PotashCorp — Helping Nature Provide

Project Description
MARINE TERMINAL EXPANSION
COMMERCIAL, RECREATIONAL AND ABORIGINAL FISHERIES

Revision or Issue: ISSUED FOR EIA REGISTRATION DOCUMENT (FEB 19, 2015)

Contract No	142865.00	Drawn	MD	Approved	PL
Scale	1:65,000	Date	MAY 2014	Figure No	5.11

Figure 5.10: ***Fisheries and Oceans Fisheries Statistical Districts (DFO, 2013a)***

Table 5.20: CRA Fisheries in Close Proximity to the Project Area*

Commercial	Recreational	Aboriginal
Lobster	Striped Bass	Striped Bass
Gaspereau/Alewife	Brook Trout	American Eel
Shad	Sea Worms	Sturgeon
Sturgeon	Mackerel	
American Eel	Brown trout	
Scallop	Shark (potential)	
Blueback Herring		
Mackerel		
Ground Fish		
Dog Fish Shark (incidental)		
Striped Bass (incidental)		
Sea Urchin (potential)		
Atlantic Salmon (closed)		
Clams (closed)		

*Data Sources: Stevens 2012, pers. comm.; Young 2013, pers. comm.; Gaudet 2012, pers. comm.; Kierstead 2013, pers. comm.; Connell 2013, pers. comm., Jacques Whitford Stantec Limited, 2009, AMEC, 2011, Washburn & Gillis Associates LTD.1993.

Table 5.21: Directed Commercial Fishing Seasons

Directed Commercial Fishery	Season*
Lobster	March 31 to June 30. 2nd Tuesday in November to January 15th
Gaspereau/Alewife	May 1 to June 30
Shad	May 1 to June 20
Sturgeon	End of June until quota is reached
American Eel	All year
Scallop	2nd Tuesday in January to March 31
Blueback Herring	Spring to October (fishing coincides with runs)
Mackerel	Spring to Fall (fishing coincides with runs)
Ground Fish	All year

*Data Source: Young 2013, pers. comm.

Table 5.22: 2012 New Brunswick Maritimes Region Commercial Landings*

Species	Metric Tonnes
Herring	11,416
Lobster	5,022
Scallop	1,489
Gaspereau/Alewife	82
Mackerel	25
Groundfish	21
Eel	9
Shark	0

*Data Source: DFO, 2013b

Lobster (Homarus americanus)

Lobster is considered to be the most valuable fishery in the outer harbour of Saint John. The Project area is closest to the Lobster Fishing Area (LFA) 36 which is a DFO licenced unit (Young 2013, pers. comm.). The commercial lobster seasons in this area extends from March 31 to June 30 and the second Tuesday in November to January 15. In the spring season, commercial fishing vessels migrate up the cost starting east and move west to follow the migration of Lobster which is associated with the increase in water temperature. Most vessels would be near the Saint John areas between May and June.

Lobster trapping was conducted within close proximity of the study area (Lawton et al., 2005). American lobster uses certain depositional areas within the Saint John Harbour during the summer months and possibly into the fall. Anthony's Cove (Figure 5.11) has been identified as an area with a depositional habitat that is used by lobsters during the summer months (Lawton et al., 2009). Lobsters are thought to migrate into the Saint John Harbour from the Bay of Fundy. The highest concentration of lobster occurs near coastal waters, with lower concentrations in deeper warm waters (e.g., Gulf of Maine). Lobsters are not fished within the Project area (Figure 5.11).

Lobsters typically spawn in a sheltered area chosen by the male (MacKenzie and Moring, 1985). Young are planktonic from 3-10 weeks (DFO, 2012a). They prefer areas with crevices for hiding such as boulders, clay mounds. Larger cobbles will also provide cover for juveniles (Lawton et al., 2009). Sand, gravel and rock shell habitats are also selected (Banner and Hayes 1996). Lobster typically feed on bottom invertebrates, crabs, sea urchins, mussels, polychaetes, periwinkles, sea stars, fish and plants (MacKenzie and Moring 1985). Habitats present within the Project area include foraging habitat.

Gaspereau: Alewife (Alosa pseudoharengus)

Gaspereau is one of the most important marine commercial fisheries within the Saint John Harbour and area. They are commercially fished for bait in the Saint John River (Bradford 2012 pers. comm.; Gaudet, 2012 pers. comm.), the Saint John Harbour (DFO, 2001; Washburn & Gillis Associates, 1993) and off of Partridge Island (Kierstead 2013, pers. comm.). Several reports have been produced on the gaspereau (alewife and blueback herring) commercial fishery and stock status in the Saint John River (DFO, 2001, Jessop, 1990, Jessop, 1999, Jessop, 2001a and b). Between 1990 and 2011, the average river catches (8%) were noticeably higher than the harbour catches (17.3%) (Jessop, 2001a).

Gaspereau migrations up the Saint John River are known to begin as early as late-April and end by mid-July (Jessop, 1999). The fishing season in the Saint John area is open from May 1 to June 30 (Young 2013, pers. comm.). The fishing season is most active when the fish enter the river. Trap nets are mainly used in the Saint John River (DFO, 2001). However, Jessop (2001a) states that Gaspereau are fished downstream of the Reversing Falls with fixed and drift nets. Drift nets and set gill nets are used in the Saint John Harbour (DFO, 2001); but DFO would like to get trap nets approved in the Harbour since it is considered more selective to avoid salmon (Kierstead 2013, pers. comm.). Gaspereau are fished within close proximity to the Project area (Washburn & Gillis Associates Ltd.1993). Figure 5.11 shows the locations of gaspereau fishing within proximity to the Project area.

Gaspereau spawn between March and July in fresh and brackish water in gravel, sand, detritus and aquatic vegetation. Nursery areas are located in freshwater and estuarine waters and overwinter locations are typically along coast, estuaries or brackish waters. They primarily feed on zooplankton, also feed on fish eggs, insects, small fish and other eggs (Pardue, 1983). Habitats present within the Project area include those for adult foraging.

American Shad (Alosa sapidissima)

American shad is one of the most important marine commercial fisheries within the Saint John Harbour and area. Shad are fished off Partridge Island (Kierstead 2013, pers. comm.) and in the Saint John River (Bradford 2012, pers. comm.; Gaudet 2012, pers. comm.). Within the Saint John River, Shad are fished inland and within the tidal waters above and below the Saint John River. The important fisheries for American shad occur in the Saint John River and along the coast on both sides of the Saint John River estuary. Above and below the Reversing Falls, the season is open from May 1 to June 20. Gillnets (set and drift), dipnets and trapnets are used at the tidal waters of the Saint John River above and below the Reversing Falls (Chaput and Bradford 2003). Shad are fished within close proximity to the Project area (Washburn & Gillis Associates LTD.1993). Figure 5.11 shows the locations of shad fishing within proximity to the Project area.

American shad spawn in freshwater rivers (Stier and Crance 1985) and nursery areas are in freshwater and estuarine waters (Stier and Crance 1985). They are known to spawn in the Saint John River (Chaput and Bradford 2003). Overwintering occurs in coastal waters where zooplankton is abundant. They primarily feed on plankton, also feed on copepods, mysids, small fish and planktonic crustaceans (Stier and Crance 1985). Habitats in the Project area include adult foraging.

American Eel (Anguilla rostrata)

American eel are commercially fished in the Saint John River (Stevens, 2012 pers. comm.; Gaudet 2012, pers. comm.) and off Partridge Island (Kierstead 2013, pers. comm.). There is also an elver fishery outside of the Saint John Harbour on the tidal boundaries (Kierstead 2013, pers. comm.). Within the Harbour eels are caught with pots. The fishing season for eels within the Saint John area is open year round (Young 2013, pers. comm.). Figure 5.11 shows the locations of eel fishing within proximity to the Project area.

American eels spawn in the Sargasso Sea which is located within the Atlantic Ocean. Nursery areas can be located in salt or freshwater and they typically overwinter in muddy bottoms in bays and estuary habitats, however, winter habitat is poorly known. For cover, they prefer shallow, protected waters, as well as, rock, sand, mud, woody debris and aquatic vegetation for cover. Eelgrass and interstitial spaces are also important for cover. They forage on fish, molluscs, crustaceans, insect larvae, surface-dwelling insects, worms, and plants (COSEWIC, 2012). Habitats present in the study area include those for adult foraging.

Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus)
Atlantic sturgeon are commercially fished in the Saint John River (Stevens, 2012 pers. comm.; Gaudet, 2012 pers. comm.; COSEWIC, 2011; Jacques Whitford, 2009). There are very few sturgeon licenses in the Saint John Harbour (Kierstead 2013, pers. comm.). The fishing season for sturgeon is open from the end of June until the quota is reached (Young 2013, pers. comm.). In 2013, the quota was achieved on August 7.

Atlantic sturgeon spawn in freshwater and in the Saint John River estuary. They are believed to spawn in the Saint John River (multiple citations in Atlantic Sturgeon Status Review Team, 2007) (Dadswell, 2006 in COSWIC 2011). Nursery areas are located in freshwater and estuaries (DFO, 2009). Overwintering habitat is located close to shore; however, some remain upstream in freshwater. Juveniles overwinter in fresh or brackish water. Adults prefer to forage on polychaete worms, shrimp, amphipods, isopods and small fish (COSEWIC, 2011). Habitats present in the Project area include those for adult foraging.

Scallop (Placopecten magellanicus)
Scallops are fished just outside of the Saint John Harbour (Gaudet 2012, pers. comm.) within the Scallop Production Area (SPA) 6C. Scallop fishing season is open from the second Tuesday in January until March 31 (Young 2013, pers. comm.). Figure 5.11 shows locations of scallop fishing within proximity to the Project area.

Adults prefer seabed areas with firm sand, gravel, shells and cobble substrate and juveniles prefer gravel, small rocks, shells, and branching animals/plants. Larvae prefer gravelly sand, shell fragments, hydroids, bryozoans and sponges. They feed primarily on phytoplankton and microzooplankton and also on particles of detritus (Hart and Chute 2004). The project footprint does not contain any spawning, rearing orfeeding habitats for scallops.

Herring, Mackerel and Ground Fish
There are some remnant commercial fishing licenses for herring (Alosa aestivalis), Atlantic mackerel (Scomber scombrus) and ground fish (e.g.haddock, flounder, cod, halibut, plaice). The commercial fishing season for herring occurs from the spring until October and coincides with herring runs (Young 2013, pers. comm.). The herring fishery in the Harbour has recently collapsed due to industrial activity in the Harbour (Kierstead 2013, pers. comm.). The Mackerel fishery occurs from spring until fall and coincides with mackerel runs (Young 2013, pers. comm.). The ground fish fishery is very minimal in the Harbour (Kierstead 2013, pers. comm.). The season for groundfish is open year round (Young 2013, pers. comm.). Figure 5.11 shows the locations of herring fishing within proximity to the Project area.

Atlantic mackerel spawn in the southern Gulf of St. Lawrence (Grégoire et al., 2013) from end of May to mid-August. They are also known to spawn in the Mid-Atlantic Bight and Gulf of Maine from mid-April to June (Studholme et al., 1999). Rearing habitat is typically between depths ranging from 10-130 m at temperatures ranging from 6-22°C (Studholme et al., 1999). During the fall and winter they are usually found at the edge of the continental shelf (DFO, 2012b) and at depths of 10-270 m, with the majority between 20-30 m (Studholme et al., 1999). In the spring and summer, they are found in inshore waters (DFO, 2012b) and at depths of 10-180 m with the majority between 50-70 m (Studholme et al., 1999). They primarily feed on plankton, copepod nauplii, copepod larvae, and fish larvae (yellowtail flounder, silver hake, redfish, conspecifics) (Studholme et al., 1999). Habitats present within the Project area include adult foraging habitat.

Blueback herring spawn in freshwater rivers and streams. Nursery areas are located in freshwater and estuarine waters and they typically overwinter in coastal areas. For cover they prefer 75% silt/fines with detritus and vegetation. They primarily feed on zooplankton but can also feed on fish eggs, insects, small fish, and other eggs (Pardue 1983). Habitats present in the Project area include adult foraging habitat.

Atlantic Salmon (Salmo salar)

No commercial fisheries are occurring in the Project area for Atlantic salmon. A historical Atlantic salmon fishery existed for the area, but it has not been active since 1984 (Stevens, 2012, pers. comm.). Salmon populations are going down even though there is a hatchery up river. Approximately 250 fish were counted returning at the dam elevator. The Atlantic salmon fishery is anticipated to remain closed (Kierstead 2013, pers. comm.).

5.6.3.1 Recreational Fisheries

The following recreational fisheries have been identified in and around the Project area:

- Sea Worms: Sea worms are collected by recreational fisherman for bait and they are possibly collected in Courtenay Bay (Kierstead 2013, pers. comm.);
- Striped Bass: There is a large recreational fishery for striped bass (Kierstead 2013, pers. comm.). They are recreationally fished upstream of the reversing falls (Figure 5.11). In 2013, the recreational fishing season for striped bass occur year round in tidal waters (NBDNR, 2013);
- Trout: There is a significant recreational trout fishery in Hazen Creek (Kierstead 2013, pers. comm.). In 2013, the recreational fishing season for trout in rivers, brooks and streams is April 15-September 15 (NBDNR, 2013); and
- Shark: There is a potential recreation fishery for shark (Connell 2013, pers. comm.).

A brief life history and habitat evaluation is provided for each of the main recreational fisheries in the sections below.

Brown Trout

Brown trout (*Salmo trutta*) spawn exclusively in freshwater and young reaming in freshwater until at least the end of the first growing season. Then the young will go to sea and spend one to two years before returning to freshwater. Some adults will overwinter at sea. They prefer to forage on terrestrial and aquatic insects; fish and crustaceans (Raleigh 1986). Habitats present in the Project area include adult foraging and some overwintering habitat.

Brook Trout

Brook trout (*Salvelinus fontinalis*) spawn in gravelly areas in rivers. Nursery habitat is also located in freshwater rivers. Some adults will overwinter at sea. They prefer to feed on macroinvertebrates and terrestrial insects (Raleigh 1982). Habitats present in the Project area include adult foraging and some overwintering habitat.

Striped Bass

Striped bass (*Morone saxatilis*) spawn in fresh or mostly fresh water (Bain and Bain 1982). Belleisle Bay, located approximately 35 km north on the Saint John River, is a known spawning area for striped bass (Kierstead 2013, pers. comm.). The early life-history of Saint John River striped bass is unknown. Striped bass are known to overwinter in freshwater (Bradford et al., 2012). They prefer sandy beaches, rocky shores, and shallow bays are inhabited in both marine and estuarine environments and they primarily feed on fish (Bain and Bain 1982). Habitats present in the Project area include adult foraging.

5.6.3.2 Aboriginal Fisheries

Commercial and food, social and ceremonial aboriginal fisheries are known to occur in the Saint John River, Inner Saint John Harbour and Outer Saint John Harbour. A total of 7 communities hold 64 Commercial <u>Communal</u> Licences that could potentially harvest in the Saint John Harbour vicinity:

- Lobster;
- Scallop;
- Rock Crab;
- Groundfish;
- Herring;
- Mackerel;
- Sea Urchin;
- Gaspereau;
- Shad;
- Smelt;
- Clams; and
- Eels.

A total of 5 communities hold Communal <u>Food/Social/Ceremonial</u> licences that could potentially harvest in the lower Saint John River and/or Harbour. Each of the 5 licences authorizes fishing for several species. Following is a list of species:

- Striped Bass;
- Lobster;
- Shad;
- Gaspereau;
- Trout;
- Pickerel;
- Perch;
- Smelt;
- Eel;
- Lampray Eels;
- Sturgeon;
- Scallop;
- Muskellunge;
- Groundfish;
- Burbot;
- Clams;
- Smallmouth Bass;
- Herring and Mackerel;
- Catfish;
- Whitefish;
- Tomcod; and
- Sunfish, Pike, Chub and Suckers.

There are no known aboriginal fisheries located in Courtenay Bay.

5.7 Archaeological and Heritage Resources

An Archaeological Impact Assessment was conducted to determine the likelihood of archeological resources being present within the footprint of the proposed Project and to provide mitigations reduce potential impacts to archaeological resources. The archaeological impact assessment was completed to assess potential impacts to both terrestrial and submerged resources. The assessment included both a desktop study and a site reconnaissance. The site reconnaissance completed through multiple site visits conducted in 2013 on June 6, August 11 and August 24. The assessment of submerged resources included review of underwater video and LiDAR remote sensing data.

No archaeological sites were found in the terrestrial component of the study area. Six archaeological resources were identified in the submerged portion of the study area, identified in Table 5.23 and described below. The Archaeological Impact Assessment is attached as Appendix O.

Table 5.23: Potential Submerged Archaeological Resources

Site	Location	Coordinates (NAD 83)
Orange Street Wharf	Courtenay Bay	45°16’20” N, 66°02’55” W
Duke Street Pier	Courtenay Bay	45°16’19” N, 66°02’55” W
Esso Wharf	Courtenay Bay	45°16’00” N, 66° 02’55” W

Orange Street Wharf

The Orange Street wharf ballast and cribwork is one of three archaeological sites in the submerged zone of the Courtenay Bay study area.

Duke Street Pier

One block south of the Orange Street Wharf, five emergent posts in line with Duke Street comprise of the second archaeological site, recorded as the Duke Street Pier.

Esso Wharf

The final archaeological site in Courtenay Bay is the ballast for the long wharf that in the 1935 air photo appears to be associated with the cluster of oil storage tanks. On the nautical chart this is referred to as Esso Petroleum Canada site. The site has been recorded as the Esso Wharf.

CHAPTER 6 ENVIRONMENTAL ASSESSMENT METHODOLOGY

6.1 Environmental Assessment Methods

The assessment of environmental effects of a project requires a clear understanding and description of all project components and activities, and the environment as it exists prior to undertaking the project. The remaining steps in undertaking the evaluation of a proposed project's environmental effects involve:

- Scoping the assessment: identifying interactions between project activities and the existing environment; establishing parameters against which to measure potential effects.
- Assessing Project-related effects: describing mechanisms by which project/environment could result in an environmental effect; proposing measures to mitigate adverse effects and enhance positive effects; and predicting whether, following the application of mitigation measures, significant adverse environmental effects may result.
- Establishing follow-up and/or monitoring programs.

6.1.1 Project-Environment Interactions

A project can only result in an environmental effect where a linkage or pathway exists between a project component or activity (identified in Chapter 2) and the receiving environment (described in Chapter 3). Identifying these project/environment interactions and focusing the assessment on those issues of greatest potential impact and concern is accomplished through scoping of the assessment (Sadar, 1994), a mechanism to support meaningful and effective evaluation of environmental effects accomplished by:

- Identifying potential interactions between the Project and the physical, ecological and socio-economic environments; and
- Determining which project/environment interactions will be carried forward through the assessment as Valued Ecosystem Components (VECs).

6.1.2 Valued Environmental Components

Environmental assessments generally follow the method originally proposed by Beanlands and Duinker (1983), whereby the assessment focuses on those components that have the greatest potential for environmental effects and which, should they be altered by the project, would be of concern or interest to stakeholders (e.g., regulators, scientists, special interest groups, Aboriginal peoples, and/or members of the public). VECs can include both biophysical and human environments, and are selected based on consideration of factors such as regulatory guidelines and legislative requirement; regulatory and stakeholder direction and consultation; field reconnaissance; professional judgment; and vulnerability of the potential VEC to project effects. Each VEC is subject to spatial boundaries (probable geographical extent of the environmental effects) and temporal boundaries (timing and duration of the environmental effects). Temporal boundaries for most VECs are continuous and include all Project phases. Spatial boundaries are VEC-dependent but generally include the Project footprint, its immediate environs, and an area potentially affected by the undertaking.

6.1.3 Mitigation Measures, Residual Effects and Significance Determination
Mitigation considers temporal or spatial procedures or changes that can be incorporated into the project, or means by which project construction, operation or decommissioning activities can limit or correct project-related effects. It is the environmental effects following the application of proposed mitigation measures (i.e., residual effects) for which a significance determination is made regarding whether, following the application of mitigation measures, the effect is likely to be of a significant nature.

6.1.4 Follow-up and Monitoring
Follow-up and monitoring, in some cases developed in conjunction with regulators, may be recommended to assess effectiveness of measures implemented to mitigate adverse environmental effects.

6.1.5 Cumulative Environmental Effects
When two non-related projects are assessed independently, each may be determined to not be likely to cause significant adverse environmental effects; however, it is possible that the incremental effects of each project could, when considered jointly, result in an overall effect to a VEC and be likely to result in a significant environmental effect. For this assessment, existing and planned projects that could interact with the proposed project are identified, and cumulative effects are considered where:

- The project is determined to have a residual environmental effect;
- There is overlap or interaction of environmental effects between the two projects; and
- It is reasonable to expect that the project's contribution to cumulative environmental effects could affect the viability or sustainability of the VEC.

6.2 Scope of Assessment

6.2.1 Scope of Factors to be Considered
This environmental assessment is being completed to satisfy provincial environmental registration requirements pursuant to the *Clean Environment Act*. The assessment includes consideration of the following factors:

- The environmental effects of the Project, including the environmental effects of accidental events or malfunctions that may occur in connection with the Project, and cumulative environmental effects that are likely to result from the Project in combination with other projects or activities that have been or will be carried out;
- Measures that are technically and economically feasible and that would mitigate any significant Project-related adverse environmental effects;
- Significance determination of residual environmental effects (i.e., following the application of mitigation); and
- Any other matter relevant to the assessment, such as the need for the project, alternatives to the project, and effects of the environment on the project.

6.2.2 Scope of Project

Project components and associated activities are outlined and in Chapter 2 and summarized below in Table 6.1. Accidental events and malfunctions (Section 7.12) and potential effects of the environment on the Project (Section 7.13) have been assessed for the Project. The decommissioning phase was not assessed at this time, as the Picadilly mine expansion is anticipated to result in an increased need for shipping for more than 30 years; the Project will be decommissioned as per regulatory requirements and best management practices at that time.

Table 6.1: Project Components and Activities

Project Component	Project Activity
Construction	
Rail / Road Expansion	Infilling, Shoreline Protection, Road and Rail Construction, Culvert Extension
Garage Expansion	Excavation, Building Construction
Operation	
Transportation of Salt/Potash	Road and Rail Transportation Activities
Ship Loading	Ship Traffic, Ship Loading
Brine Discharge	Road Transportation, Brine Discharge
Maintenance	Standard Building, Road and Equipment Maintenance

6.3 Project-Environment Interactions

The following details the results of the assessment of interactions between the Project activities described in Section 2.6 and summarized above, and environmental components determined through a review of the existing environment as detailed in Chapter 5. Potential Project/ environment interactions are identified in Table 6.2 below, which also details the nature of the potential interaction between the Project activity and environmental components. A number representing the degree of potential effect to each Project/environment interaction is assigned, whereby:

- 0 = no interaction occurs between project activities and the environment;
- 1 = interaction occurs between project activities and the environment; however, based on professional judgment and past experience, the interaction would either not result in a significant effect, even without mitigation, or would not be significant due to project design elements that have inherently mitigated the potential effect; and
- 2 = interaction occurs between project activities and the environment that requires further assessment.

Table 6.2: Project/Environmental Component Interaction Matrix

Project Components	***Environmental Components***																			
	Air Quality	**Acoustic Environment**	**Soil Quality**	**Groundwater Quality/Quantity**	**Freshwater Quality/Quantity**	**Marine Water Quality**	**Marine Sediment Quality**	**Vegetation/Wetlands**	**Terrestrial Wildlife**	**Fish and Fish Habitat**	**Marine Mammals**	**Birds**	**Commercial/Recreational/ Aboriginal Fisheries**	**Land Use**	**Transportation**	**Navigation**	**Visual Aesthetics**	**Socio-economic Environment**	**Archaeological, Cultural and Paleontological Resources**	**Current Use of Traditional Lands and Resources**
Construction																				
Road / Rail Expansion	2	2	1	0	2	2	2	2	1	2	0	2	2	1	1	1	2	2	2	1
Garage Expansion	1	1	1	0	0	1	1	0	0	1	0	0	0	1	0	0	0	2	1	1
Operation																				
Transportation of Salt/Potash	2	2	0	0	0	0	0	0	1	0	2	1	0	0	1	1	1	2	0	1
Ship Loading	1	1	0	0	0	0	0	0	0	0	2	2	2	0	2	2	0	2	0	1
Brine Discharge	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Maintenance	0	2	0	0	0	1	0	1	1	1	0	1	0	0	0	0	0	1	0	1

‘0’ = no project/environment interaction; ‘1’ = interaction occurs however would not result in significant effect (even without mitigation) or project design elements have mitigated potential adverse effect; ‘2’ = potential effect to be assessed.

Project/environmental component interactions as identified in Table 6.2 are described in the following sections.

6.3.1 No Interaction Between Project Activity and Environmental Component ('0')

Project activities are not anticipated to interact with groundwater quality/quantity. Project-related water requirements will be accessed through the municipal water supply, and the Project activities and components do not provide the potential for groundwater intrusion. It is possible, however, that an accidental event or malfunction, such as a hazardous materials spill or train derailment, could result in adverse effects to groundwater quality, as discussed in Section 7.12.

6.3.2 No Significant Interaction Between Project Activity and Environmental Component ('1')

Based on professional judgment and past experience, the interactions between Project activities and the following environmental components are not anticipated to result in significant adverse effects, even without mitigation, and/or due to Project design elements that have inherently mitigated the potential effect, as discussed in the sub-sections below:

- Soil Quality;
- Terrestrial Wildlife;
- Land Use; and
- Current Use of Traditional Lands and Resources.

6.3.2.1 Soil Quality

Project activities are not anticipated to result in significant adverse effects to soil quality given the environmental protection design components described in Section 2.8.1. The construction activities associated with the Garage will involve the excavation of soil that has the potential to be impacted with CoPC. Soil quality in the proposed areas of excavation activities will be characterized prior to the commencement of excavation activities and if CoPC are identified, impacted soil will be handled and disposed of in accordance with all applicable federal and provincial guidelines and regulations.

It is possible, however, that an accidental event or malfunction, such as a hazardous materials spill or train derailment, could result in adverse effects to soil quality, as discussed in Section 7.12.

6.3.2.2 Terrestrial Wildlife

Project activities are not anticipated to result in significant adverse effects to terrestrial wildlife (aside from Birds, which are assessed in Section 7.6), even without mitigation. The Project area is already highly industrialized and does not provide valuable or sensitive habitat for terrestrial mammals. Most remaining habitat for mammals in the City of Saint John area has been highly fragmented by developments over the past several decades. The main, and possibly only, corridor for terrestrial mammals into the City would be the Marsh Creek watershed. It is possible, however, that an accidental event or malfunction, such as a large spill leaking into the Marsh Creek watershed, could result in an adverse effect to terrestrial mammals, as discussed in Section 7.12.

6.3.2.3 Land Use

Project-related nuisances such as light, air emissions and noise during construction activities and operation (train transport) could affect the use and enjoyment of surrounding residential properties, however, these potential effects are somewhat attenuated given that the Terminal is surrounded predominantly by other industrial uses. Project-related air emissions and noise are assessed through the Air Quality VEC (Section 7.1) and the Acoustic Environment VEC (Section 7.2), respectively. Effects due to increased Project-related lighting will be mitigated through use of directional lighting design for the new access corridor light standards (see Section 2.8.3). The Projects proposed land use is included in the Saint John Port Authorities Land Use Plan.

6.3.2.4 Current Use of Traditional Lands and Resources

A significant adverse effect to current use of traditional lands and resources would be defined as one that impacts asserted aboriginal rights and title. No significant adverse effects to traditional land use and resources are anticipated due to the lack of aboriginal rights and title known to interact with project activities. Potential adverse effects to aboriginal rights and title will be further mitigated through the Crown consultation process and PotashCorp aboriginal engagement process.

6.3.3 Interaction Between Project Activity and Environmental Component Requires Further Assessment ('2')

Interactions that may occur between Project activities and those environmental components identified in Table 6.3 require further assessment. Valued environmental components were determined based on regulatory guidelines and legislative requirements; regulatory and stakeholder consultation; field reconnaissance; professional judgment; and vulnerability of the ecosystem component to Project effects. Components identified in Table 6.3 that require further evaluation (i.e., those assigned as a '2') have been integrated into a VEC and brought forward into the effects assessment (Chapter 6). Where similar mitigation measures would be applicable to more than one environmental component, these components were, at times, combined under one 'umbrella' VEC. Table 6.3 outlines the environmental component, describes the Project/environment interaction and potential effect, and identifies the VEC through which the significance of potential environmental effects is assessed.

Table 6.3: Selection of Valued Environmental Components for Assessment (Type 2 Interactions)

<table>
<tr><th>Environmental Component</th><th>Project/Environment Interaction and Potential Effect</th><th>VEC to be Assessed</th></tr>
<tr><td>Air Quality</td><td>• Suspension of particulate material during construction activities;
• Increased material handling; and
• Increased marine and vehicle traffic.</td><td>Air Quality</td></tr>
<tr><td>Acoustic Environment</td><td>• Construction and operation activities; and
• Increased rail and vehicle traffic.</td><td>Acoustic Environment</td></tr>
<tr><td>Fish and Fish Habitat</td><td>• Destruction of fish habitat due to infilling; and
• Suspension of sediment in water column.</td><td rowspan="2">Fish and Fish Habitat</td></tr>
<tr><td>Commercial, Recreational and/or Aboriginal Fisheries</td><td>• Effects to fish and fish habitat could affect the productivity of the fisheries.</td></tr>
</table>

Environmental Component	Project/Environment Interaction and Potential Effect	VEC to be Assessed
Marine Water Quality	• Suspension of sediment during construction activities.	
Marine Vegetation	• Suspension of sediment during construction activities.	
Sediment Quality	• Deposition of sediment during construction activities.	
Marine Mammals	• Vessel collision due to increased vessel traffic and increased submarine noise due to increased vessel traffic.	**Marine Mammals**
Vegetation/Wetlands	• Loss of vegetation; • Introduction of exotic species; and • Indirect disturbances to the Courtenay Bay Marsh such as erosion and sedimentation.	**Vegetation and Wetlands**
Freshwater Water Quality	• Siltation during road work along the Courtenay Bay Causeway.	
Birds	• Noise generated from construction and operation activities; • Disturbance of marine birds due to increased marine traffic; • Accidental mortality; and • Alteration and direct loss of foraging habitat.	**Birds**
Navigation	• Increased marine traffic.	**Navigation**
Transportation	• Construction of new interchange impeding traffic flow; and • Operation of new road network decreasing truck traffic and increasing traffic flow.	**Transportation**
Visual Aesthetics	• Visual impacts due to access road construction.	**Visual Aesthetics**
Socio-economic Environment	• Job creation resulting from Project construction and operation; and • Increased direct and indirect revenue.	**Socio-economic Environment**
Archaeological Resources	• Construction-related ground disturbance/excavation damaging archaeological resources.	**Archaeological Resources**

CHAPTER 7 ENVIRONMENTAL EFFECTS ASSESSMENT

7.1 Air Quality

The Air Quality VEC for the purpose of this assessment relates to Project-related effects to ambient air quality that have the potential to adversely affect human and ecological health. Indoor air quality and greenhouse gas emissions are not included in this VEC as the Project is unlikely to cause adverse environmental effects to these environmental components. The assessment of the Air Quality VEC is based on desktop studies, field programs, air quality dispersion modelling and regulatory air quality criteria.

7.1.1 Effects Assessment Boundaries

The effects assessment of Air Quality is subject to the spatial and temporal limitations described below.

7.1.1.1 Spatial Boundaries

The spatial boundaries for assessment of Project-related impacts to the Air Quality VEC were limited to the Saint John Air Shed. Ambient air quality plume dispersion modelling was conducted to determine the maximum ground level concentration of air pollutants of potential concern. The spatial boundaries of the dispersion model varied depending on climate conditions but were always within the Saint John airshed.

7.1.1.2 Temporal Boundaries

Air quality could be adversely affected by Project activities for the 30+ year life span of the Project. Air quality could also be adversely affected during construction activities which are estimated to take approximately two years. Air emissions could be released for the entire 24-hour period of each day, with the most significant emissions being during train shunting activities during daytime hours.

7.1.2 Project-VEC Interactions and Potential Environmental Effects

Project activities have the potential to cause adverse environmental effects to air quality during construction and operation activities. Table 6.2 in Section 6.3 details the Project-environment interactions for all Project activities with the air quality environmental component. The following Project activities have the potential to interact with air quality after the implementation of environmental protection design components and have been included in the Air Quality VEC for further assessment:

- Rail / Road Expansion; and
- Transportation of Salt/Potash.

Construction activities during the Rail / Road Expansion will cause an increase in dust and exhaust emissions. Operational activities have the potential to increase dust and exhaust emissions, particularly exhaust emitted from trains during shunting associated with transporting potash to the facility. Project related emissions include air pollutants that have the potential to negatively impact the environment.

An Ambient Air Quality Assessment for construction and operation activities was completed for the Project. The assessment quantified Project-related construction and operation emissions for those air pollutants detailed below.

7.1.2.1 Fugitive Dust Emissions

Dust emissions generated during construction and operation activities include Total Suspended Particulates, Particulate Matter as PM_{10} (aerodynamic diameters less than 10 microns) and particulate Matter as $PM_{2.5}$ (aerodynamic diameters less than 10 microns). PM_{10} and $PM_{2.5}$ are considered the particle size ranges of greatest regulatory interest, with the limiting effect being human health. Provincial jurisdictions across the country are adopting the use of federal guidelines when establishing criteria for respirable particulate matter levels from industrial and construction activity (see Section 5.1.1). Total suspended particulate (TSP) is commonly defined as the mass of airborne particles having aerodynamic diameters less than 44 microns (µm) and commonly used as a measure of fugitive dust emissions.

7.1.2.2 Diesel Exhaust Emissions

Diesel exhaust emissions will be generated during construction and operation activities. Diesel exhaust is composed of a mixture of toxic chemicals. The toxic chemicals of most concern are the oxides of nitrogen (NOx), sulphur dioxide (SO_2), particulate matter (PM) and various hydrocarbon particles. Carbon monoxide (CO) is also present.

SO_2 is a colorless toxic gas with a characteristic odour. Oxidation of SO_2 produces sulphur trioxide (SO_3), the precursor of sulfuric acid, which is responsible for the sulphate particulate matter emissions. Sulphur oxides are the major cause of acid rain. SO_2 is generated from the sulphur present in diesel fuel. Low sulphur fuels (less than 0.05% sulphur) are being introduced for most diesel engine applications throughout the North America (EC, 2012). Low sulphur diesel is commercially available in the Saint John area and the air assessment assumed SO_2 levels from locomotive and truck use onsite will be insignificant. However, older ships require marine diesel oil in their auxiliary engines that is not low sulphur. The assessment took into consideration SO_2 levels from ship traffic (hoteling at dock) using auxiliary engines fueled by marine diesel that is not a low sulphur type.

NOx are generated from nitrogen and oxygen under the high pressure and temperature conditions in the engine cylinder. NOx consists mostly of nitric oxide (NO) and a small fraction of nitrogen dioxide (NO_2), which has a significant role in smog formation. The higher average temperature and pressure of combustion in diesel engines results in the production of significant levels of NOx (EC, 2012).

Diesel particulate matter (DPM) is the particulate component of diesel exhaust, which includes diesel soot and aerosols such as ash particulates, metallic abrasion particles, sulfates and silicates. When released into the atmosphere, DPM can take the form of individual particles or chain aggregates. The main particulate fraction of diesel exhaust consists of fine particles ($PM_{2.5}$). PM_{10} and $PM_{2.5}$ particulate fractions were considered in the assessment of diesel exhaust emissions.

Carbon monoxide (CO), hydrocarbons (HC) and aldehydes are generated in exhaust as the result of incomplete combustion. A substantial portion of exhaust hydrocarbons is also derived from the engine lube oil.

7.1.2.3 Air Quality Impacts from Construction Activities

Dust emissions during construction activities have the potential to be significant if unmitigated. Depending on the moisture content of the roadway, truck travel on unpaved road surfaces can generate significant levels of dust. Bulldozer placement of infill materials will account for the second largest portion of fugitive dust emissions. It is anticipated that dry soil conditions will occur sometime during the construction period, when dry weather persists onsite. Fugitive dust emissions can also be generated from wind erosion of continuously active temporary storage piles used during soil handling activities; however, with proper materials handling practices, these levels are not anticipated to be substantial.

7.1.2.4 Air Quality Impacts from Operational Activities

Both dust emissions and diesel exhaust during operational activities have the potential to be significant if unmitigated. Potential air pollutant sources include rail operations, truck operations and shipping operations. Air pollutants from material handling were not considered in the assessment as material handling will occur in a controlled facility with minimum risk of fugitive air emissions. An air quality assessment was conducted to model existing operational emissions and anticipated emissions for Project operational activities using pollutant source characteristics and activity levels. Emission rates from shiploading and railway operational activities are expected to remain the same. The emission rates for truck travel from diesel exhaust is expected to decrease due to the reduction in idling and wait times with the construction of the new access road; the emission rates for truck travel from fugitive dust are expected to remain the same. The results from this model are summarized in Table 7.1. The full air quality assessment is available in Appendix P.

Table 7.1: Summary of Pollutant Source Characteristics and Modeled Emission Rates for Current and Anticipated Operational Activities

Activity	Source Description	Source Type	Emission Type		Maximum Emission Rate	
					Existing (g/s)	Future (g/s)
Shiploading	Vessel Maneuvering - Diesel Engine	Area	Diesel Exhaust	PM_{10}	0.080	0.080
				$PM_{2.5}$	0.075	0.075
				CO	0.125	0.125
				NO_x	1.574	1.574
				VOC	0.045	0.045
				SO_2	0.698	0.698
	Shiploader Wet Scrubber	Point Exhaust Vent	Fugitive Dust	TSP	0.108	0.108
				PM_{10}	0.051	0.051
				$PM_{2.5}$	0.016	0.016
Railway	Locomotive	Area	Diesel Exhaust	PM_{10}	0.020	0.020
				$PM_{2.5}$	0.018	0.018
				CO	0.813	0.813
				NO_x	5.600	5.600
				VOC	0.450	0.450
	Railcar Dumping Wet Scrubber	Point Exhaust Vent	Fugitive Dust	TSP	0.406	0.406
				PM_{10}	0.192	0.192
				$PM_{2.5}$	0.060	0.060
Trucks	Truck Travel on Roads	Area	Diesel Exhaust[1]	PM_{10}	<0.001	<0.001
				$PM_{2.5}$	<0.001	<0.001
				CO	0.015	0.007
				NO_x	0.0.017	0.006
				VOC	0.003	0.002
	Truck Travel on Roads	Area	Fugitive Dust	TSP	0.614	0.614
				PM_{10}	0.117	0.117
				$PM_{2.5}$	0.018	0.018

[1] Diesel exhaust emissions from trucks experiencing a few prolonged idle periods at the rail crossing; Project scenarios assume prolonged idling periods at crossing are eliminated with the construction of the new access road to the Terminal.

Project related emission rates (Table 7.1) were incorporated into an air quality plume ISCT dispersion model to assess the maximum ground level concentrations of air pollutants at potential receptors. The dispersion model is an advanced Gaussian plume model that provides a sequential analysis of ground level concentrations over an extended period of time, using actual meteorological data and time variant emission rates. A Cartesian receptor grid with receptors spaced 65 metres apart for the area surrounding the site was configured, centering on the PotashCorp facility. Offsite receptors included residential and commercial properties along adjacent streets (i.e., Broadview Avenue, Broad Street). See Table 7.2 for the results of the Dispersion model.

Table 7.2: Modeled Maximum Ground Level Concentration Results for Operational Activities

Air Emissions Parameter	Maximum GLC Result(1) Existing (µg/m³)	Maximum GLC Result(1) Project (µg/m³)	Regulatory(1) Criteria (µg/m³)	Criteria Source
Diesel Exhaust				
PM_{10}	-	-	N/A	
$PM_{2.5}$	-	-	28	CCME, 2014
CO	220	103	35,000[3]	NBDELG, 2002
NO_x	636	830	400[3]	NBDELG, 2002
VOC	63	56	N/A	-
SO_2	18/125	13/125	150/450[4]	NBDELG, 2002
Particulate Matter				
TSP	35	35	120	NBDELG, 2002
PM_{10}	9	10	N/A	-
$PM_{2.5}$	2	3	28	CCME, 2014

[1] Results and criteria are based on 24-hour averaging period unless indicated otherwise.
[2] Particulate fractions from diesel exhaust are included as part of the Particulate Matter category.
[3] Criteria based on 1-hour averaging period.
[4] Criteria based on 24-hour/1-hour averaging periods, respectively.

The relative change in emission rates due to anticipated Project activities were calculated based on average hourly operation and daily operation and the relative change in emission rates and maximum ground level concentrations determined (Table 7.3). Hourly, all emissions show a decrease in emission rates due to an increase in efficiency from the construction of the access road or remain the same. However, due to the increase in production capacity, daily emissions rates increase for fine particulate matter (PM_{10} and $PM_{2.5}$), nitrous oxides (NO_X), and volatile organic compounds (VOC). Maximum ground level concentrations, based on peak production, increase for fine particulate matter (PM_{10} and $PM_{2.5}$), nitrous oxides (NO_X) and volatile organic compounds (VOC).

Table 7.3: Relative Change in Emission Rates and Ground Level Concentrations for Operational Activities

Air Emissions Parameter	Project Emission Rates vs Current Emission Rates Hourly (%)	Project Emission Rates vs Current Emission Rates Daily (%)	Project GLC vs Current GLC Maximum
Diesel Exhaust			
CO	-23	-3	-53
NO_x	-4	26	30[1]
VOC	-9	31	-11[1]
SO_2	0	0	-28/0[2]
Particulate Matter			
TSP	0	-3	0
PM_{10}	-3	22	11
$PM_{2.5}$	-5	21	50

[1] Based on maximum 1-hour GLC results.

[2] Based on 1-hour/24-hour model results, respectively.

7.1.3 Mitigation and Residual Environmental Effects

The following mitigation measures will be employed to limit potential adverse environmental effects to air quality during construction:

- The contractor will provide a site-specific Environmental Protection Plan detailing environmental protection measures for the mitigation of impacts to air quality during construction activities;
- The contractor will be required to implement an anti-idling strategy as part of their EPP to ensure that the idling of vehicles and motorized equipment on site will be limited;
- All vehicles and motorized equipment will be operating properly;
- Water spray will be applied to unpaved surfaces when dry and windy weather persist onsite;
- Unpaved road surfaces onsite will be monitored continually during dry periods to ensure water applications are timely and effective. Visible signs of dust plumes will trigger an immediate response from onsite construction managers and field supervision; and
- Infill work areas will be continuously monitored during dry-windy weather conditions; visible signs of dust plumes will trigger an immediate response from onsite construction managers and field supervision.

The following mitigation measures will be employed to limit potential adverse environmental effects to air quality during operation:

- An Environmental Emergency Plan, as outlined in Section 2.8.4, details contingency measures to be applied in case of failure of any of the Facility's scrubbers;
- All scrubbers will be interlocked and operate simultaneously during ship loading;
- All scrubbers will be inspected on a regular basis and run at optimum performance based on performance indicators;
- Idling of vehicles and motorized equipment will be minimized; and
- Shunting activities will be minimized, where practicable.

7.1.4 Significance Criteria

A significant environmental effect to Air Quality is considered to be a Project-related change to air quality such that the maximum ground level concentration (GLC) of an air contaminant of interest (as detailed in Section 7.1.2.1) results in ambient concentrations that exceed the provincial or federal ambient air quality standards, as defined in Table 7.2.

7.1.5 Significance Determination

All maximum GLC results from dispersion modelling were well below regulatory criteria for a meteorological year, with the exception of NOx levels. The model indicated a number of one-hour exceedances of the NOx criterion at residential and commercial properties located near the Terminal for all operating scenarios. Model sensitivity analysis indicated that elevated offsite NOx levels can be attributed to locomotive operations onsite.

Although the dispersion model identifies a potential exceedance of the NOx criteria near the facility from current and future activities, no significant change in NOx levels is anticipated due to the facility expansion (Table 7.4).

With adherence to the mitigation measures described above, the Project is not anticipated to result in a significant environmental effect to Air Quality.

Table 7.4: Summary of Project-Related Environmental Effects: Air Quality

Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effects (Y/N)	Significance Determination (Significant or Not Significant)
Construction	Emission of Air Pollutants from Diesel Exhaust (A)	• Contractor will provide a site-specific Environmental Protection Plan detailing environmental protection measures for the mitigation of impacts to air quality; • Idling of vehicles and motorized equipment will be minimized; and • Operating condition of all vehicles and motorized equipment will be maintained to ensure good performance.	Y	NS
Construction	Emission of Fugitive Dust (A)	• Contractor will provide a site-specific Environmental Protection Plan detailing environmental protection measures for the mitigation of impacts to air quality; • Apply water spray to unpaved surfaces when conditions are dry and windy weather persists onsite; • Unpaved road surfaces onsite will be monitored during dry periods to ensure water application is timely and effective; visible signs of dust plumes will trigger an immediate response from onsite construction managers and field supervisors; • Soils will be placed using a leading-edge infill method	Y	NS

Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effects (Y/N)	Significance Determination (Significant or Not Significant)
		with minimum disturbance of surface materials; and • Infill work areas will be monitored during dry-windy weather conditions; visible signs of dust plumes will trigger an immediate response from onsite construction managers and field supervisors.		
Operation	Emissions of Air Pollutants from Diesel Exhaust and Fugitive Dust (A)	• An Environmental Emergency Plan will detail contingency measures to be applied in case of failure of any of the facility's scrubbers; • Idling of vehicles and motorized equipment will be minimized; and • Shunting activities will be minimized where possible.	Y	NS

7.1.6 Monitoring

Air quality monitoring will be required during construction activities. The contractor will be required to detail the air quality monitoring plan in a site-specific Environmental Protection Plan to include, at a minimum, visual monitoring of fugitive dust emissions during dry windy conditions.

7.2 Acoustic Environment

The Acoustic Environment VEC addresses Project-related effects to the acoustic environment from noise impacts generated from construction and operation activities. The Acoustic Environment VEC addresses terrestrial noise impacts to human receptors. Potential Project-related effects to marine mammals and birds from noise generated from construction and operation activities are assessed in the Marine Mammal VEC and Bird VEC, respectively. The assessment of the Acoustic Environment VEC is based on desktop studies, field programs and a noise assessment completed for the Project, attached in Appendix H.

7.2.1 Effects Assessment Boundaries

The effects assessment of Acoustic Environment is subject to the spatial and temporal limitations described below.

7.2.1.1 Spatial Boundaries

The spatial boundaries for the assessment of adverse effects to the Acoustic Environmental VEC are limited to those residential receptors that may be influenced by Project-related noise. Given their close proximity to rail yard operations, the first row of residences along Crown Street and fronting the Terminal are those most susceptible receptors to noise exposure increases. Other susceptible receptors are the residential and commercial properties near railcar dumping and the ship loading onsite on Broadview Avenue and Wentworth Street. See Table 5.8 for further details on potential receptors. See Figure 2.1 for the site layout.

7.2.1.2 Temporal Boundaries

The temporal boundary of the assessment of Project-related effects to the Acoustic Environment VEC includes construction and operation activities for the lifespan of the Project.

7.2.2 Project-VEC Interactions and Potential Environmental Effects

Project activities have the potential to cause adverse environmental effects to the acoustic environment during construction and operation activities. Table 6.2 in Section 6.3 details the Project-environment interactions for all Project activities with the acoustic environment component. Project construction and operation activities have the potential to interact with the acoustic environment after the implementation of environmental protection design components have been included in the Acoustic Environment VEC for further assessment.

Noise generated during Project construction and operation activities can cause adverse environmental effects to the acoustic environment by generating noise at volumes and/or frequencies such that it is considered to be a nuisance to adjacent receptors. Residential receptors adjacent to the Project have been identified and are detailed in Table 5.8 and the Noise Assessment attached in Appendix H. Noise impacts can be classified as either continuous or intermittent, with intermittent noises being considered to be of more significance, as they are more likely to cause annoyance.
Potential noise sources during construction activities include:

- Construction equipment operation (e.g., dozers, compactors, excavators, dump trucks, graders and pavers); and
- Materials handling.

Typical construction activities onsite will involve two or three heavy duty pieces of construction equipment operating as a group, such as a bulldozer, loader and trucks. Typical construction equipment noise generation levels are detailed below in Table 7.5. Noise levels from this equipment would be in the order of 90 dBA at 15 m. Construction equipment and train operation would likely be intermittent, and not necessarily simultaneous, noise sources. The total emission could be momentarily higher than 90 dBA onsite, but probably not for a one-hour averaging period.

Table 7.5: Typical Construction Equipment Noise Levels

Equipment Type	Noise Level(2) L_{eq} (dBA)	Comments
Backhoe	59 – 82(3)	Idle to full operations
Bulldozer	68 – 99	Idle to full operations
Compactor	81 – 91	Idle to full operations
Crane	75 – 78	
Excavator	85	
Front-end Loader	73 – 90	Range of operating tasks
Grader	67 – 95	Idle to full operations
Self-propelled Roller	71 – 86	Range of operating tasks
Scraper	72 – 91	Idle to full operations
Sheet Pile Driver	95 - 99	Range of materials

Notes:

1. Source: American Road Builders Association, 1973.
2. Noise level at 15 metres.
3. Levels indicate range of idling to various operating tasks.

For most construction activities, separation distances from residential receivers will be in the order of 100-500 m, with resulting noise levels will likely range from 59 to 74 dBA during daytime working hours. Residential receptors along Crown Street will be most affected due to their close proximity (approximately 100 m) to proposed infill operations. No receptors will be subjected to maximum impacts for extended periods.

Potential noise sources during operation activities include:

- Truck traffic;
- Rail operations; and
- Ship loading.

Table 7.6 summarizes existing and predicted noise levels for Project operations at sensitive receptors. Increases in total noise relative to existing conditions are provided within parentheses under Project operations.

Table 7.6: Average Predicted Noise Levels During Operation of the Facility Post Construction

Site No.*	Existing Conditions			Project Operations Post Construction			FTA Criteria	
	L_d (dBA)	L_n (dBA)	L_{dn} (dBA)	L_d (dBA)	L_n (dBA)	L_{dn} (dBA)	Medium Impact	High Impact
S1	61	52	62	63 (2)	52 (0)	63 (1)	1.50	4.25
S2	51	47	54	51 (0)	47 (0)	54 (0)	3.50	8.00
S3	59	50	60	63 (4)	50 (0)	62 (2)	2.25	5.25
S4 & S5	69	59	69	64 (-5)	63 (4)	69 (0)	1.00	2.50
S6 & S7	59	60	65	57 (-2)	64 (4)	66 (1)	1.25	3.50

*See Section 5.1.3 Acoustic Environment for site descriptions
Note:
Ld – daytime equivalent sound level (dB)
Ln - nighttime equivalent sound level (dB)
Ldn - day-night sound level (dB)

Railcar dumping and switching operations onsite are predicted to have the most substantial noise increases during daytime working hours. Railcar switching activity during a 30-min period each night (approximately 2 a.m.) is predicted to be substantial. Analysis of predicted Ldn results for noise increases indicates a moderate impact to residential receptors closest to the railcar dumping stations. No Project-related noise impacts are anticipated during Project operations for the remaining community sites surrounding the Terminal.

7.2.3 Mitigation and Residual Environmental Effects

Construction has the potential to create substantial noise. The following mitigation measures will be implemented to limit potential adverse effects to the acoustic environment during construction activities.

- The contractor will conduct construction activities between hours of 7:00 AM and 9:00 PM as per the City of Saint John Noise Bylaw. In the event that the contractor receives a variance from the City to conduct construction activities outside the 7:00 AM and 9:00 PM window additional noise abatement mitigations will be implemented. All construction activities conducted outside this window will also require approval from PotashCorp;
- All vehicles and equipment maintained with appropriate mufflers and not permitted to idle for prolonged periods;
- Equipment will be placed in engine enclosures, and use intake silences and acoustic shielding, where appropriate;
- Equipment power level will be appropriate for given task;
- Stationary construction equipment to be located as far away from sensitive receptors as practicable;
- Material storage areas will be strategically located;
- Construction traffic in and around site will be limited, with reduced speed limits in construction zone limits;
- Compression braking by trucks not permitted; and
- Construction tasks with elevated noise levels will be monitored to ensure noise compliance.

Noise will be monitored during operational activities and if operational noise levels are determined to be within the "High Impact" range of the FTA guidelines, additional noise abatement measures will be implemented.

Even with adherence to the mitigation measures as outlined, residual environmental effects to the acoustic environment are likely to occur. Construction tasks with elevated noise levels will be monitored to ensure noise compliance, and additional mitigation measures will be implemented if regulatory noise criteria are exceeded.

7.2.4 Significance Criteria

New Brunswick noise guidelines were used as screening criteria to determine if further investigation was warranted during assessment of Project-related construction activity. An increase of 10 dBA above existing noise levels was considered significant for this assessment.

The Environmental Management Manual (NBDOT, 2010) states that "Where complaints of excess noise are received during construction, noise monitoring shall be conducted and corrective action taken if warranted where noise levels exceed 65 dBA over a 24-hour period (Leq). Construction activities may be restricted to daylight hours if complaints and follow-up noise monitoring identify a problem." This guideline applies to the sound level being received by the receptor and not the actual sound level generated by construction operations. The Equivalent Sound Level (Leq) is a logarithmic average of noise levels due to all sources of noise in a given area over a stated period of time. The Leq is commonly used to measure steady state sound or noise that is usually dominant, and it is typically expressed on a one-hour basis.

The NBDTI noise policy is intended to address noise impacts from highway construction projects only and does not include a nighttime noise penalty. The FTA guidelines, which include a 10 dBA nighttime penalty, are more appropriate for the mixed noise environment in the study area during Terminal operations.

The US Federal Transit Administration's (FTA) document 'Transit Noise and Vibration Impact Assessment' (Harris Miller Miller Hanson Inc., 2006) is used to assess the significance of operation noise increases. The FTA guideline uses the day-night equivalent sound level (Ldn) which applies a +10 dB penalty to the equivalent nighttime (2200 – 0700 hours) sound level. Nighttime traffic noise levels are typically lower than daytime levels. The Ldn has been found to be more closely correlated to the percentage of "highly annoyed" people in residential communities subject to transportation noise than the 24-hour equivalent sound level (Leq24).

7.2.5 Significance Determination

Noise resulting from construction activities is not anticipated to exceed provincial or municipal noise criteria, with adherence to mitigations as described above. Noise monitoring will be required during construction activities, and additional mitigation measures will be implemented if regulatory noise criteria are exceeded.

The significance of noise increases relative to modeled existing conditions for Project scenarios was assessed according to US Federal Transit Administration's noise impact assessment criteria. Assessment of Project operations predicted a low or insignificant noise impact for all modeled community receivers.

The FTA guideline stresses the need for mitigation measures when post-project noise levels fall within the "High Impact" range for noise impacts, as noise impacts within the high impact range would have the greatest adverse effects on the community. No high impacts have been predicted for Project operations.

Table 7.7: Summary of Project-Related Environmental Effects: Acoustic Environment

Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effect (Y/N)	Significance Determination (Significant or Not Significant)
Construction	Nuisance due to elevated noise (A)	• The contractor will conduct construction activities between hours of 7:00 AM and 9:00 PM as per the City of Saint John Noise Bylaw. In the event that the contractor receives a variance from the City to conduct construction activities outside the 7:00 AM and 9:00 PM window additional noise abatement mitigations will be implemented. All construction activities conducted outside this window will also require approval from PotashCorp; • All vehicles and equipment maintained with appropriate mufflers and not permitted to idle for prolonged periods; • Equipment will be placed in engine enclosures, and use intake silences and acoustic shielding, where appropriate; • Equipment power level will be appropriate for given task; • Stationary construction equipment to be located as far away from sensitive receptors as practicable;	Y	NS

Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effect (Y/N)	Significance Determination (Significant or Not Significant)
		• Material storage areas will be strategically located; • Construction traffic in and around site will be limited, with reduced speed limits; • Compression braking by trucks not permitted; and • Construction tasks with elevated noise levels will be monitored to ensure noise compliance.		
Operation	Nuisance due to elevated noise (A)	• Should operational noise levels be determined to be within the "High Impact" range of the FTA guidelines, additional noise abatement measures will be implemented.	Y	NS

7.2.6 Monitoring

To ensure and demonstrate regulatory compliance, noise monitoring will be implemented during those construction activities with the potential to generate substantial noise, such as infilling activities.

7.3 Fish and Fish Habitat

The Fish and Fish Habitat VEC addresses Project-related direct and indirect effects to fish and fish habitat, and includes environmental components upon which fish depend such as marine water quality, marine vegetation and sediment quality. The fish and fish habitat VEC also includes an assessment of effects to productivity of CRA fisheries. Potential Project-related navigation effects to fishing vessels and fishing gear are assessed in the Navigation VEC. The assessment of the Fish and Fish Habitat VEC is based on desktop studies, field programs, benthic habitat studies and regulatory environmental quality guidelines.

7.3.1 Effects Assessment Boundaries

The effects assessment of fish and fish habitat is subject to the spatial and temporal limitations described below.

7.3.1.1 Spatial Boundaries

The spatial boundaries for the assessment of Project-related adverse effects to the fish and fish habitat VEC varied for each environmental component of the VEC. The assessment of adverse effects to environmental components of the fish and fish habitat VEC were limited to the following spatial boundaries:

- Effects to fish habitat due to habitat loss was limited to the footprint of the Project;
- Effects to fish and CRA fisheries was limited to the fisheries district which spans from the Fundy National Park to Point Lepreau; and
- Effects to water quality, sediment quality and marine vegetation were limited to the Inner Saint John Harbour.

7.3.1.2 Temporal Boundaries

The temporal boundaries for the assessment of Project-related adverse effects to the fish and fish habitat VEC varied for each environmental component of the VEC. Fish habitat, fish and CRA fisheries, water quality, sediment quality, and marine vegetation could be adversely affected during infilling activities. The temporal boundaries of effects associated with infilling is limited to construction activities which is expected to be approximately 1 year. Water quality, sediment quality and marine vegetation could be adversely affected by Project activities for the +30 years life span of the Project. Impacts to fish habitat and the productivity of CRA fisheries and fish that support a CRA fishery are indefinite.

7.3.2 Project-VEC Interactions and Potential Environmental Effects

Project activities have the potential to cause adverse environmental effects to fish and fish habitat. Table 6.2 details the Project-environment interactions for all Project activities and the fish and fish habitat environmental component. Project activities that have a potential interaction with fish and fish habitat after the implementation of environmental protection design components have been included in the Fish and Fish Habitat VEC for further assessment.

These activities include:

- Road / Rail Expansion; and
- Brine discharge.

Construction activities involved with the Rail / Road Expansion have the potential to impact fish habitat, sediment quality and water quality. Operational activities have the potential to cause adverse effects to water quality from the discharge of brine water. A Benthic Habitat Survey was completed that assessed habitat types within the Project footprint. The assessment characterised the habitat types within the Project footprint. See Appendix L for the Benthic Habitat Survey.

Adverse effects to fish and fish habitat from accidental events including hazardous materials spills are addressed in Section 7.12.

7.3.2.1 Habitat Destruction and Direct Mortality

Construction activities will result in the destruction of fish and fish habitat and could result in direct mortality to fish. The Rail / Road Expansion has a permanent approximate footprint of 63,400 m^2 below HHWMT in Courtenay Bay.

The Rail / Road Expansion will involve infilling approximately 6.3 ha of intertidal marine habitat in Courtenay Bay. The majority of the habitat to be lost within Courtenay Bay has been characterized as mudflats and provides foraging habitat for fish. The loss of mudflat will also reduce habitat for marine invertebrates. Other habitats that will be lost during the Rail / Road Expansion include boulder and armour stone, cobble beach and drainage channels. See the Benthic Habitat Survey report in Appendix L for details on habitat assessment methodologies and for further habitat characterization details. The area and habitat types to be destroyed during Rail / Road Expansion are detailed in Table 7.8. The loss of armour stone habitat will be temporary as marine flora and fauna will re-populate the new armour stone toe berm and shoreline protection which has an approximate area of 27,275 m^2 below HHWMT. The 27,275 m^2 of new armour stone habitat will partially offset the loss of existing armour stone habitat as it provides similar function as the existing armour stone once it has been repopulated with marine flora and fauna. The mudflat habitat provides a minimal contribution to CRA fisheries productivity but due to the size of magnitude of the habitat loss there is a potential significant adverse effect to fish and CRA fisheries. The Project area does not provide limiting habitat to any known species of conservation concern.

Table 7.8: Percent Area and Total Area of Habitat Types

Habitat	Area (m^2)	%
Mudflat	32,836.7	51.8%
Drainage Channel	4,208.0	6.6%
Boulder or Armour Stone with Seaweed	16,008.3	25.2%
Cobble/Gravel Beach	2,510.1	4.0%
Boulder or Armour Stone with Green Algae	5,254.8	8.3%
Armour Stone	2,606.4	4.1%
Total Footprint	**63,424.3**	**100.0%**

Fish and fish habitat could also be adversely affected by the introduction of alien and invasive species to the marine and freshwater ecosystems from construction activities. Construction equipment mobilized to the site may introduce alien or invasive aquatic species that have adhered to the equipment from previous work sites. The likelihood of introducing alien or invasive aquatic species is minimal with adherence to proper equipment cleaning procedures.

Multiple fish species of conservation concern are known to occur within the study area and have been detailed above in Section 5.4.5.

7.3.2.2 Water Quality

Project construction and operational activities have the potential to cause adverse effects to water quality. Water quality could be adversely affected due to the release of sediment into Courtenay Bay and Marsh Creek during the rail / road expansion construction activities and the placement of armour stone. Water quality could also be adversely affected from the discharge of brine water into Courtenay Bay. The Project is not anticipated to increase brine discharge from its existing operation and will be required to meet the requirements of approval from the NBDELG that limits the change in salinity at the discharge point. It is not anticipated that brine discharge will cause a residual environmental effect due to there being no increase in brine effluent from the existing operations.

7.3.2.3 Sediment Quality/Quantity

Project construction activities could cause an adverse effect to sediment quality. The Rail / Road Expansion construction activities, including infilling, have the potential to mobilize sediment. There is a potential for sediment impacted by CoPC from historical industrial activities in Courtenay Bay to become mobilised during construction and deposit on non-impacted sediments. CoPC have been identified in sediment within the Project construction footprint.

A marine sediment sampling program was conducted to assess the quality of the sediment within the Project footprint. CoPC above CCME Sediment Quality Guidelines for the Protection of Marine Aquatic Life were identified in the Project footprint. CoPC identified include PAHs, Total Petroleum Hydrocarbons and Metals. The Rail / Road Expansion footprint shows significantly higher concentration of CoPC. See the Marine Sediment Sampling Program in Appendix J of all identified CoPC and sample locations.

Marine sediment sampling results obtained from the University of New Brunswick show concentrations of CoPC in references points collected in Courtenay Bay outside the footprint of the proposed Project. These results are comparable to the results obtained within the Project footprint. It is anticipated that impacted sediment would have to mobilize outside the Inner Saint John Harbour to deposit on pristine sediments.

A Sedimentation study was completed to determine the influence of infilling sedimentation rates. The study found that infilling will not cause any noticeable changes in the flow and sedimentation patterns of Courtenay Bay or the Harbour in general. The difference with existing conditions for sedimentation rates is expected to be within ±5cm per year. The Sedimentation study is available in Appendix K.

7.3.3 Mitigation and Residual Environmental Effects

The construction of the access road will incorporate environmental protection design components as identified in Section 2.8. In addition, the following describes mitigation measures that will be implemented to reduce Project-related adverse environmental effects to fish and fish habitat during construction:

- The contractor will prepare a site-specific Environmental Protection Plan detailing environmental protection measures for the containment of sediment during rail / road expansion construction activities. The sediment control measures will include but not be limited to sediment control fences;
- The site-specific Environmental Protection Plan will also include a water quality monitoring plan which will detail a water quality sampling program during construction activities. If total suspended solids (TSS) or turbidity exceed action thresholds based on CCME Water Quality Guidelines for the Protection of Aquatic Life, work will stop and additional sediment control measures will be implemented;
- A fisheries offsetting project, if required by DFO, will be completed to compensate for a loss in fisheries productivity due to Project construction activities, offsetting for the Project-related loss in productivity to CRA fisheries. The impacts to CRA fisheries productivity will be quantified for Project impacts and an appropriate compensation project will be selected. The compensation project will

require approval from DFO prior to initiating any construction activities that could impact fisheries productivity; and
- All construction equipment will operate from a dry platform or staging area. Construction equipment that has the potential to become immersed in water will be cleaned and inspected to ensure that the equipment is free of marine growth;
- The contractor will be required to work with the tidal cycles in order to conduct infilling activities in the dry where practical. The placement of material in water during the tide cycle will be permitted only if appropriate mitigate measures are in place and if conditions are such that the impacts to water quality are unlikely;
- If a sediment plume is observed outside of the boundaries of the worksite during in water infilling, the contractor will be required to stop work and implement additional sediment control measure prior to continuation of in water infilling activities;
- Infill Material will be free of excessive fines; and
- Armour stone will be placed mechanically and not end dumped.

The following mitigation measures will be applied to limit potential adverse environmental effects to air quality during operational activities:
- Brine discharge will not increase from existing discharge volumes and salinity concentration will be monitored at the discharge point as required by the NBDELG.

Even with adherence to the mitigation measures as outlined, residual environmental effects to Fish and Fish Habitat are likely to occur.

7.3.4 Significance Criteria
With respect to water quality, a significant residual environmental effect is defined as one that causes a change in water quality whereby the concentration of CoPC (characterized by TSS and turbidity for sedimentation and salinity for brine discharge) results in an exceedance of CCME Water Quality Guidelines. With respect to CRA fisheries, a significant residual environmental effect is defined as one that results in a change to productivity of a CRA fishery or fish that supports a CRA fishery. With respect to fish species of conservation concern, a significant residual environmental effect is defined as the death of a fish of a species listed as endangered and protected under federal or provincial legislation.

7.3.5 Significance Determination
Project construction activities are not likely to result in significant adverse environmental effects to water quality following the implementation of environmental protection design components, sediment control measures, and the application of a water quality monitoring program. CCME Water Quality Guidelines for TSS and turbidity are relative to background concentrations and are known to be elevated in Courtenay Bay. Additional sediment control measures will be immediately implemented if water quality monitoring indicates unacceptable elevated TSS and turbidity concentrations due to construction activities.

No significant residual adverse environmental effect associated with habitat loss and loss of fisheries productivity is anticipated, as no net loss in fisheries productivity is anticipated with completion of a suitable fisheries offsetting project to compensate for Project-related loss of CRA fisheries productivity. The quantification of impacts to fisheries productivity and the offsetting project will require approval from DFO prior to initiating construction activities that may impact fish habitat.

Table 7.9: **Summary of Project-Related Environmental Effects: Fish and Fish Habitat**

Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effect (YES/NO)	Significance Determination: Significant (S) or Not Significant (NS)
Construction	Impacts to water quality from rail / road expansion (A)	• Contractor will prepare a site-specific Environmental Protection Plan detailing environmental protection measures for: - Sediment control measures including sediment control fences; and - Water quality monitoring plan detailing construction water quality sampling program. • Should TSS or turbidity exceed thresholds based on CCME Water Quality Guidelines for the Protection of Aquatic Life, work will stop and additional sediment control measures will be implemented; • All construction equipment will operate from a dry platform or staging area; • Construction equipment with potential to become immersed in water will be cleaned and inspected to ensure it is free of marine growth; • The contractor will be required to work with the tidal cycles in order to conduct infilling activities in the dry where practical. The placement of material in water during the tide cycle will be permitted only if appropriate	Y	NS

Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effect (YES/NO)	Significance Determination: Significant (S) or Not Significant (NS)
		mitigate measures are in place and if conditions are such that the impacts to water quality are unlikely; • If a sediment plume is observed outside of the boundaries of the worksite during in water infilling, the contractor will be required to stop work and implement additional sediment control measure prior to continuation of in water infilling activities; • Infill Material will be free of excessive fines; and • Armour stone will be placed mechanical and not end dumped.		
Construction	Impacts to sediment quality from rail / road expansion (A)	• Contractor will prepare a site-specific Environmental Protection Plan detailing environmental protection measures for: - Sediment control measures including sediment control fences; and - Water quality monitoring plan detailing construction water quality sampling program. • Should TSS or turbidity exceed thresholds based on CCME Water Quality Guidelines for the Protection of Aquatic Life, work will stop and additional sediment	Y	NS

Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effect (YES/NO)	Significance Determination: Significant (S) or Not Significant (NS)
		control measures will be implemented; • The contractor will be required to work with the tidal cycles in order to conduct infilling activities in the dry where practical. The placement of material in water during the tide cycle will be permitted only if appropriate mitigate measures are in place and if conditions are such that the impacts to water quality are unlikely; • If a sediment plume is observed outside of the boundaries of the worksite during in water infilling, the contractor will be required to stop work and implement additional sediment control measure prior to continuation of in water infilling activities; • Infill Material will be free of excessive fines; and • Armour stone will be placed mechanical and not end dumped.		
Construction	Impacts to fish habitat and fisheries from access road construction (A)	• A project offsetting the loss of CRA fisheries productivity will be completed; impacts to CRA fisheries productivity will be quantified and an appropriate project will be undertaken following DFO approval; and	Y	NS

Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effect (YES/NO)	Significance Determination: Significant (S) or Not Significant (NS)
		• No construction activities that could impact fisheries productivity will occur prior to DFO approval of the offsetting project.		
Operation	Impacts to fish habitat and fisheries from access road construction (A)	• Brine discharge will not increase beyond existing volumes and salinity concentration will be monitored at the discharge point, as required by NBDELG.	N	NS
Operation	Impacts to water quality from brine discharge (A)	• Brine discharge will not increase beyond existing volumes and salinity concentration will be monitored at the discharge point, as required by NBDELG.	N	NS

7.3.6 Monitoring

A water quality monitoring program will be implemented during construction activities. The contractor will be required to detail their water quality monitoring plan in their site-specific Environmental Protection Plan. The program will be designed to demonstrate compliance with the water quality provisions of the *Fisheries Act*. The program will include water quality sampling and baseline sampling at a predetermined background location. Water quality sampling parameters will include TSS and turbidity, and if these are elevated above background levels and exceed thresholds based on CCME Water Quality Guidelines for the Protection of Aquatic Life, work will stop and additional sediment control measures will be implemented.

Water sampling will continue to be conducted to assess changes in salinity due to the discharge of brine at the facility. The salinity sampling program will satisfy the requirements of the approval for discharge from NBDELG.

PotashCorp participates in the implementation of the Saint John Harbour Environmental Monitoring as part of the Saint John Harbour Environmental Monitoring Network and will continue to participate in this initiative during operational activities. The Saint John Harbour Environmental Monitoring Framework is currently being developed by Canadian Water Network and will involve monitoring marine sediment quality, marine invertebrates and fish. The results of the Saint John Harbour Monitoring will be used to assess the cumulative effects of industrial development within Saint John Harbour.

7.4 Marine Mammals

The Marine Mammal VEC addresses Project activities and components that result in environmental effects on marine mammals. Of particular concern are the species of conservation concern (either an SRANK of S3 or lower, or listed provincially or federally as sensitive, endangered, or at risk) found in the Saint John Harbour and the Bay of Fundy. These species are the Atlantic white-sided dolphin, the long-finned pilot whale, the North Atlantic right whale, and the harbour porpoise.

Information for the Marine Mammal VEC is primarily based on scientific literature on marine mammals, DFO recommendations and guidelines, and Marine Transport Canada data.

7.4.1 Effects Assessment Boundaries

The effects assessment of Marine Mammals is subject to the spatial and temporal limitations described below.

7.4.1.1 Spatial Boundaries

The spatial boundary of the assessment of impacts to marine mammals is Saint John Harbour and the Bay of Fundy.

7.4.1.2 Temporal Boundaries

The temporal boundary of the assessment of impacts to marine mammals is the construction and operational phase.

7.4.2 Project-VEC Interactions and Potential Environmental Effects

Potential Project-environment interactions are identified in Table 6.2. As indicated in the matrix, the operation of ship loading and marine transportation has the potential to result in environmental effects to Marine Mammals.

The above-noted components and activities may result in adverse effects on Marine Mammals resulting from an increase in collisions with vessels and increased submarine noise from the increased marine traffic in the Port and Bay during operation. Construction noise is not a concern as the rail / road expansion will be performed primarily in the dry during low tide and infill will be placed not dumped into location.

Increased marine traffic throughout Project operation may have adverse effects on marine mammal behaviour, communication, and increase collision likelihood. Increased vessel noise may result in behavioural shifts, such as feeding and socializing activities, and cause undue stress. Underwater vessel noise may mask sounds and disrupt communication and echolocation, important in navigating and feeding. Increased marine traffic may increase the likelihood of vessel collisions. This is of particular concern to the North Atlantic right whale population that congregates annually in the Bay of Fundy for feeding, nursing and mating. Between 1970 and 1999, vessel collision was the primary cause of death for this endangered species (Knowlton and Kraus, 2001).

In 2014, there were 797 ships in the Port of Saint John. Potashcorp traffic associated with the Project expansion is expected to increase from 65 to 126. Therefore, the overall increase in ship traffic is expected to increase this number to 858 ships, an increase of 8%.

7.4.2.1 Behavioural Changes

Increased noise from vessel activity may result in associated behavioural changes in local marine populations. Approaching vessels may interrupt feeding or important breeding and social activities, displacing marine mammals from a particular region. However, displacement may decrease the risk of vessel collision, and it is not likely to be permanent. In a case study of harbour porpoises at the LNG Canaport Terminal off the Bay of Fundy, porpoise presence dropped significantly when a tanker arrived at port, however, porpoise presence began to increase again within three hours (Babin, 2012).

Of more significant concern would be an increase in general stress levels, thereby lowering the immune system and resiliency of a marine mammal. In the wake of the terrorist attacks of September 11, 2001, shipping in the Bay of Fundy dropped significantly, reducing average noise levels by 6 dB below 150 Hz, which resulted in a decrease in baseline levels of stress-related faecal hormone metabolites (glucocorticoids) in North Atlantic right whales (Rolland et al., 2012).

7.4.2.2 Auditory Masking

Another potential effect of increased marine traffic is sound, or auditory, masking due to underwater vessel noise. Sound masking occurs when anthropogenic noises interfere with a marine mammal's ability to recognize natural sounds of the same frequency, whereby a marine mammal may not be able to recognize its own echo or the call of another animal. Echolocation, used extensively in navigating and locating food sources, is used by the odontocetes (toothed whales, dolphins and porpoises). Baleen whales, such as the North Atlantic right whale, do not use echolocation, but do use sound for communicating.

Vessel noise is predominantly low frequency, within the 40-200 Hz range (Hildebrand 2009; McKenna et al., 2012). Harbour porpoise sound occurs at high frequency, between 110-170 kHz, thought to be an adaptation to avoid predation particularly from orca whales, who cannot hear frequencies in that range (Mohl and Andersen 1973; Au et al., 1999; Teilmann et al., 2002). The long-finned pilot whale and Atlantic white-sided dolphin are in the delphinidae family, whose calls can vary from 1-50 kHz (Au and Würsig 2004; Soldeville et al., 2008; Woods Hole Oceanographic Institution 2013). In the Bay of Fundy, vessel-generated noise levels greater than 120 dB re 1 µPA (within frequency levels heard by harbour porpoises) occur approximately 3% of the time (Babin 2012). As odontocete sounds are of a much higher frequency than that of vessel noise, it is unlikely that sound masking will occur.

Amongst baleen whale, sounds are traditionally of a much lower frequency than those of odontocetes, ranging from 100-400 Hz (Nieukirk et al., 2004; Woods Hole Oceanographic Institution 2013). However, the North Atlantic right whale's sounds are of a higher frequency than other baleen whales (around 400 Hz; Wood Hole Oceanographic Institution 2013) and this frequency appears to be increasing as an adaptation to increased low-frequency noise from anthropogenic sources (Parks et al., 2007). Vessel noises are lower than this range the majority of the time. Due to its adaptability, the North Atlantic right whale does not appear to be particularly susceptible to vessel noise.

7.4.2.3 Vessel Collisions

An increase in marine traffic may increase the likelihood of deaths of marine mammals due to vessel collisions. While, the pilot whale, the harbour porpoise and the Atlantic white-sided dolphin show great ability to detect and avoid oncoming vessels, this is not the case with the North Atlantic right whale. Between the years of 1970-1999, at least 35% of the recorded deaths of the endangered Atlantic right whale in the Bay of Fundy were due to vessel collisions (Knowlton and Kraus, 2001).

The Bay of Fundy is a traditionally important feeding ground for the North Atlantic right whale, with two-thirds of its population (estimated to be between 300-350 individuals; DFO, 2013) congregating in the Bay annually between June 1 and December 31. New shipping lanes imposed in June 2003 circuit important feeding grounds and have reduced the risk of collisions in the shipping lanes by 80%, with no recorded collisions since then within the Bay of Fundy (The Globe and Mail 2012; New England Aquarium 2013). However, an increase in the marine traffic passing through the Bay of Fundy may again increase the risk of vessel collision.

7.4.3 Mitigation and Residual Environmental Effects

Section 7 of the Marine Mammals Regulation of the *Fisheries Act* states 'No person shall disturb a marine mammal except when fishing for marine mammals under the authority of (the Fisheries Act),' which includes intentional acts and those resulting from negligence that result in the disruption of marine mammals from their normal behaviour and activities. PotashCorp will direct Project-related vessel operators to review the regulatory and legislative requirements as outlined in the Notice to Mariners, as described in Section 3.1.4.

To minimize the effects of Project activities on marine mammal populations within the Saint John Harbour and the Bay of Fundy, the following mitigation measures will be implemented during operation:

- Project-related vessel operators will be directed to review and comply with regulatory and legislative requirements outlined in the Notice to Mariners, as described in Section 3.1.4.

7.4.4 Significance Criteria

A significant adverse effect on Marine Mammals is defined as one that would directly or indirectly result in marine mammal mortality or result in physiological and behavioural changes substantially weakening the health of local marine mammal populations.

7.4.5 Significance Determination

Even with adherence to the proposed mitigation measure, there is still a risk that marine mammals will be adversely affected by vessels. However, with proper implementation of mitigative techniques as outlined above and considering the low likelihood of collision given the known effectiveness of the shipping lanes, this potential is considered to be not significant.

Table 7.10 summarizes the residual environmental effects for the Marine Mammals VEC.

Table 7.10: Summary of Project-Related Environmental Effects: Marine Mammals

Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effect (Y/N)	Significance Determination: Significant (S) or Not Significant (NS)
Operation	Mortality or injury due to vessel collision, behavioural disruptions from marine traffic (A).	• Project-related vessel operators will be directed to review and comply with regulatory and legislative requirements outlined in the Notice to Mariners, as described in Chapter 3.	Y	NS

7.4.6 Monitoring

As outlined in the Notice to Mariners, marine mammal observations are required to be conducted during shipping activities within the proximity of Grand Manan conservation area between June 1 and December 31. If marine mammals are observed, shipping vessels are required to decrease speed to 10 knots and take evasive action, if required.

7.5 Vegetation and Wetlands

The Vegetation and Wetlands VEC addresses potential Project-related effects on vegetation and wetlands within the Project footprint. Data sources for vegetation and wetlands included existing information such as the ACCDC database, and the Wetland Delineation, Functional Assessment and Plant Survey study completed for the Project (see Appendix C and Appendix F).

7.5.1 Effects Assessment Boundaries

The effects assessment of Vegetation and Wetlands is subject to the spatial and temporal limitations described below.

7.5.1.1 Spatial Boundaries

The spatial boundaries for the Vegetation and Wetlands VEC include the marine and terrestrial footprint of Project components (see Figure 2.2).

7.5.1.2 Temporal Boundaries

The temporal boundary for the Vegetation and Wetlands VEC is during the Project construction phase.

7.5.2 Project-VEC Interactions and Potential Environmental Effects

Potential Project-environment interactions are identified in Table 6.2. As indicated in the matrix, the Vegetation and Wetlands VEC interacts with the rail / road expansion and infilling during construction.

7.5.2.1 Construction Phase: Rail / Road Expansion and Infilling

The rail / road expansion and infilling component of the construction phase has the potential to result in the following adverse environmental effects to Vegetation and Wetlands:

- Loss of vegetation;
- Introduction of exotic species; and
- Indirect disturbances to Courtenay Bay Marsh.

Construction of the access road and infilling will result in a direct loss of vegetation, anticipated to occur along the Courtenay Bay Causeway and along the shore. Vegetation losses can impact the overall diversity and species abundance, especially if species at risk and conservation concern are present.

Construction activities associated with rail / road expansion and infilling, especially near the Courtenay Bay Marsh, have the potential to introduce exotic species into the Marsh and adjacent areas. Once introduced, exotic plants can quickly invade an area. Some species can be difficult to eradicate as the entire root systems require removal. Exotic species can be detrimental to diversity and abundance of vegetation within a given area, as they often out-compete native species (Callaway and Aschehoug, 2000).

Although no direct impacts are proposed in the Courtenay Bay Marsh, construction activities are proposed within 30 m of the wetland and could result in indirect effects to the wetland such as:

- Introduction of exotic species;
- Erosion and sedimentation; and
- Increase in wetland turbidity.

Sediment which is not properly covered, contained or handled may enter into the wetland environment, potentially altering natural habitat. In addition, dewatering into a wetland without a proper filtration system can cause an increase in wetland turbidity. An increase in turbidity can temporarily impact aquatic organisms living within the wetland. Furthermore, untreated and unfiltered wastewater from construction-related activities can negatively impact a wetland by negatively impacting the water quality.

7.5.3 Mitigation and Residual Environmental Effects

Potential effects of construction-related activities to vegetation and wetlands can be minimized with the application of the following mitigation measures:

- Contractor will be required to prepare a site-specific Environmental Protection Plan detailing environmental protection measures for the containment of sediment, including sediment control fences;
- Sediment and erosion controls will be used and maintained, and remain in place until vegetation regrowth is fully established;
- Wherever possible, existing disturbed areas and clearings will be used for staging and laydown areas;
- Soil and material piles will be located where materials cannot enter a waterbody/wetland and in a manner that limits the potential for wind or water erosion;
- All vehicles and machinery will be cleaned and inspected for invasive species prior to arriving at the Project site and no equipment will enter the Courtenay Bay Marsh; and

- A WAWA permit will be acquired under the New Brunswick Watercourse and Wetland Alteration Regulation pursuant to the *Clean Water Act*, and all terms and conditions adhered to.

Given that the Project area does not contain critical habitat for any plant species at risk, and post-construction monitoring will occur to determine whether Project activities have introduced any invasive species and controls implemented if required, no residual effects to Vegetation and Wetlands are anticipated.

It is anticipated that installation, monitoring and maintenance of appropriate erosion and sedimentation control measures and will mitigate potential adverse effects to Vegetation and Wetlands, including to Courtenay Bay Marsh. Potential failure of erosion and sedimentation control measures is discussed in Accidental Events and Malfunctions, Section 7.12.5.

7.5.4 Significance Criteria

A significant Project-related effect to Vegetation and Wetlands is defined as one that results in a long-term change to the population of a one or more species; an impact to a species at risk or of conservation concern; a loss of wetland function within Courtenay Bay Marsh; or a significant reduction in vegetation species diversity.

7.5.5 Significance Determination

The Project area proposed to be cleared contains plants that are not at risk and the Project area is not known to contain critical habitat for a plant species at risk. Vegetation clearing as a result of infilling is not anticipated to result in residual adverse effect to the abundance of a species or to the overall species diversity of the area.

Table 7.11 summarizes the residual environmental effects for the Vegetation and Wetlands VEC.

Table 7.11: Summary of Project-Related Environmental Effects: Vegetation and Wetlands

Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effect (YES/NO)	Significance Determination: Significant (S) or Not Significant (NS)
Construction	Indirect disturbances to Courtenay Bay Marsh (A)	• Site-specific sediment and erosion control plan will be developed and adhered to; • Adhere to terms and conditions of WAWA permit; • Contractor will prepare a site-specific Environmental Protection Plan detailing	N	NS

Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effect (YES/NO)	Significance Determination: Significant (S) or Not Significant (NS)
		environmental protection measures for the containment of sediment, including sediment control fences; and • Adhere to mitigation described above under Introduction of Exotic Species.		
Construction	Loss of vegetation (A)	• Use existing disturbed areas and clearings for staging and laydown areas.	N	NS
Construction	Introduction of exotic species (A)	• Construction equipment will be cleaned and inspected to ensure it is free of vegetation prior to arriving at the construction site; • No equipment will enter the Courtenay Bay Marsh (except in emergency situations); • Staging and laydown areas will be located away from water bodies and wetlands; and • Appropriate containment measures will be implemented if material is stockpiled at site.	N	NS

7.5.6 Monitoring

Implemented erosion control measures will be monitored during construction to ensure they are effective and maintained; should any be found to be ineffective or failing, erosion control methods and installation techniques will be re-evaluated and adapted to adequately control erosion and sedimentation.

Post-construction monitoring of vegetation re-growth in disturbed areas will be conducted to ensure establishment of vegetation and to check for the introduction of invasive species. Monitoring will identify areas where vegetation is not thriving and recommendation will be made to encourage vegetation growth in the specific area. Monitoring will compare the approximate levels of invasive plant species pre-construction to post-construction to ascertain whether new species were introduced or whether a specific species is invading the area. If new species or invasions are detected and are determined to be a result of the Project, measures will be taken to control the species.

7.6 Birds

The Bird VEC addresses Project-related environmental effects on migratory and residential birds residing in and around the Project area. Information sources include existing studies and databases such as ACCDC, MBBA and the following field studies completed for the Project:

- Winter Bird Residency Survey;
- Spring Migration and Shorebird Survey;
- Breeding Bird Survey; and
- Fall Migration Shorebird Survey.

The ACCDC and MBBA databases provided historical information on bird species at risk and of conservation concern that have been previously identified in and around the Project area. In addition, the field studies provided information as to whether the Project area provides an important food source and habitat for birds during the breeding season, migration periods and the winter months. A summary of each field study and the ACCDC results are provided in Section 5.5.2 of this report. The component studies are provided in Appendix M and a complete list of all species identified by the ACCDC data is provided in Appendix F.

7.6.1 Effects Assessment Boundaries

The effects assessment of Birds is subject to the spatial and temporal limitations described below.

7.6.1.1 Spatial Boundaries

The spatial boundaries for the Bird VEC includes the Courtenay Bay Marsh, Courtenay Bay, Courtenay Bay Channel and the Harbour Channel (see Figure 2.2).

7.6.1.2 Temporal Boundaries

The temporal boundaries for the Bird VEC include construction and operation as birds are present in and around the Project area year-round.

7.6.2 Project-VEC Interactions and Potential Environmental Effects

Potential Project-environment interactions are identified in Table 6.2. As indicated in the matrix, the following activities have the potential to result in environmental effects to Birds:

- Construction of the rail / road expansion;
- Infilling for the rail / road expansion; and
- Operation of ship loading.

7.6.2.1 Construction Phase: Rail / Road Expansion and Infilling

Project-related construction activities may disturb birds through increased noise and the presence of construction equipment and machinery, result in accidental mortality to birds, and cause a direct loss of foraging habitat. A detailed description of each potential effect is provided below.

Increased noise and disturbance may temporarily adversely affect birds in the immediate vicinity of Project activities. Studies have shown that being subjected to traffic noise can cause females to lay smaller clutches and reduce the number of fledglings (Halfwerk et al., 2011), and mask breeding songs for birds that vocalize at the same frequency (Goodwin and Shriver, 2011). Noises and disturbances can also cause birds to leave nests for extended periods of time thereby negatively impacting the incubation of eggs or care of young, or even to abandon nests permanently.

Additionally, increased noise during the construction phase may temporarily discourage birds from using adjacent habitat or cause them to temporarily displace. For example, Burton et al. (2002) found that densities of shorebirds and waterfowl using intertidal mudflat habitat significantly declined due to construction disturbances. Feeding activity also declined for certain species during construction. Parris and Scheider (2009) found that the number of bird species decreased with an increase in traffic volume and noise.

Accidental mortality during Project construction could occur directly via collisions with vehicles, machinery and equipment, or through accidental destruction of active nests with eggs or young.

Project construction will result in direct loss of foraging habitat due to infilling. In the Project footprint, approximately 63,400m^2 of potential foraging habitat will be removed. A loss of foraging habitat can adversely affect birds by reducing the availability of food in those locations, potentially resulting in a reduction in the overall abundance or diversity of preferred food sources such as amphipods, molluscs and crustaceans. A loss of foraging habitat can also cause birds to be permanently displaced from the area.

7.6.2.2 Operation Phase

A Project-related increase in marine traffic and ship loading has the potential to disturb birds and foraging behaviours, potentially resulting in displacement from the area. Bellefleur et al. (2009) found that most murrelets (a seabird) reacted negatively when boats came within 40 m, and faster boats were found to cause the most overall disturbances. Hentze (2006) determined that birds were displaced at 70 m and that the distance was greater during bad weather. Boats approaching at angles less than 45° were also found to be disruptive.

7.6.3 Mitigation and Residual Environmental Effects

Potential Project-related adverse effects on birds can be minimized with the application of appropriate mitigation measures. All mitigation measures intended to reduce noise emissions, as outlined in the Acoustic Environment VEC, Table 7.8 will also help mitigate potential noise-related adverse effects on birds. In addition, the following mitigation measures will be adhered to:

- Concentrations of seabirds, waterfowl or shorebirds will be avoided;

- The contractor will conduct nest surveys during the breeding bird season (May 1 to August 15) in advance of infilling to identify the presence of migratory bird nests as part of the Environmental Monitoring Program during construction activities. Upon discovery of any active nest, construction activities at the nest and adjacent vegetation will not occur until fledging is complete; and
- Project-related vessel operators will be directed to review and comply with regulatory and legislative requirements outlined in the Notice to Mariners, as described in Section 3.1.4.

With adherence to the mitigation measures as outlined above, the Project is not anticipated to result in residual effects associated with accidental mortality of birds. However, Project-related residual effects including disturbance, habitat avoidance and foraging habitat loss are anticipated even with the application of mitigation measures.

7.6.4 Significance Criteria

A significant Project-related effect to Birds is defined as one that results in a long-term change in the population of one or more species; a permanent change in bird species diversity; a permanent change in use of the area by a species at risk or of conservation concern; or a permanent change in availability of critical habitat for a species at risk or of an important breeding ground/colony of any bird species.

7.6.5 Significance Determination

Even with the application of mitigation measures, habitat alteration as a result of infilling will result in a direct loss of foraging habitat; however, the residual effects of habitat alteration and habitat loss are not anticipated to be significant. The main concentration areas of foraging birds are located within 40 m of the low tide mark and within Courtenay Bay Marsh. No infilling is proposed in these areas. Foraging habitat in the Project footprint will be permanently removed; however, an abundance of alternative feeding locations are available within close proximity of the Project area. In addition, the Project area is not known to contain critical habitat or provide an important food source for species at risk. Infilling and habitat alteration are not predicted to result in significant changes in the abundance of a species or to overall species diversity of the area.

Even with the application of mitigation measures, Project-related noise will likely disturb birds and may result in behaviour changes such as avoidance or displacement; however, these residual effects are anticipated to be not significant on Birds. Noise and disturbance may cause birds to temporary leave or avoid the area, even after the implementation of mitigation measures. However, construction impacts will be temporary, and operation activities will be intermittent as ships approach and leave the dock. Table 7.12 summarizes the residual environmental effects and significance determinations on Birds.

Table 7.12: Summary of Project-Related Environmental Effects: Birds

Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effect (YES/NO)	Significance Determination: Significant (S) or Not Significant (NS)
Construction	Disturbance and habitat avoidance (A)	• Idling of vehicles and motorized equipment will be minimized; • Engine enclosures, mufflers, intake silencers and power appropriate for the task will be used for vehicles and equipment, as appropriate; • Vehicle speed limits will be reduced in construction zones; • Concentrations of seabirds, waterfowl or shorebirds will be avoided; and • Operating condition of all vehicles and motorized equipment will be maintained to ensure good performance.	Y	NS
Construction	Accidental mortality or destruction of nests (A)	• The contractor will conduct nest surveys during the breeding bird season (May 1 to August 15) in advance of infilling to identify the presence of migratory bird nests as part of the Environmental Monitoring Program during construction activities; • Should active nests be discovered, construction activities at the nest and adjacent vegetation will not occur until fledging is complete; • Concentrations of seabirds, waterfowl or shorebirds will be avoided; and • Vehicle speed limits will be reduced in construction zones.	N	NS
Construction of Access Road	Direct loss of foraging habitat (A)	• No mitigations are proposed for this potential effect.	Y	NS

Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effect (YES/NO)	Significance Determination: Significant (S) or Not Significant (NS)
Operation	Disturbance and habitat avoidance (A)	• Project-related vessel operators will be directed to review and comply with regulatory and legislative requirements outlined in the Notice to Mariners, as described in Chapter 3.	Y	NS

7.6.6 Monitoring

The contractor will conduct nest surveys during the breeding bird season (May 1 to August 15) in advance of infilling to identify the presence of migratory bird nests as part of the Environmental Monitoring Program during construction activities. Upon discovery of any active nest, construction activities at the nest and adjacent vegetation will not occur until fledging is complete.

Any noticeable disturbances to birds during Project construction will be brought to the attention of the Canadian Wildlife Service to discuss possible mitigation measures.

7.7 Transportation

The Transportation VEC addresses potential Project-related effects on land-based transportation flows and patterns. Given that the Project involves movement of salt, brine and potash by a combination of truck, rail and marine transportation, and that the Project location is in a populated and mixed use area of Saint John, maintaining the current level of service provided by the existing transportation network is of key importance. Marine navigation is assessed in the Navigation VEC. Information for the Transportation VEC is based primarily on the Access Road Traffic Study completed for the Project (Appendix N).

7.7.1 Effects Assessment Boundaries

The effects assessment of Transportation is subject to the spatial and temporal limitations described below.

7.7.1.1 Spatial Boundaries

The spatial boundary of the assessment of impacts to Transportation is limited to the Uptown Saint John area. The Traffic Study focused specifically on the intersections located at either side of the Causeway (Crown Street/Causeway/Union Street and Bayside Drive/Causeway/Mt. Pleasant Avenue East) and on whether the Project would require additional infrastructure such as lanes and stop lights; however, the Transportation VEC considers potential effects to land-based transportation in the general area.

7.7.1.2 Temporal Boundaries

The temporal boundary of the assessment of impacts to Transportation is the lifespan of the Project, including all Project phases, with construction impacts specifically focused around Causeway Interchange construction, and operation impacts spanning the operation phase.

7.7.2 Project-VEC Interactions and Potential Environmental Effects

Potential Project-environment interactions are identified in Table 6.2. As indicated in the matrix, the following activities have the potential to result in environmental effects to Transportation:

- Construction of the rail / road expansion; and
- Transportation of salt/potash during operations.

The Project proposes to replace the existing Marine Terminal entrance at the south end of Crown Street as the main site access. This driveway is crossed by railroad tracks, which also serve the facility. The level crossing represents a conflict point that adversely affects Terminal operations and capacity, as the use of longer trains blocks the driveway while the freight cars are being unloaded. Currently, it is often necessary to disconnect trains to maintain driveway access, but this will be even more difficult as rail traffic increases. The new road will permit direct access for trucks and staff vehicles, and will also allow long trains to enter and exit the Terminal without having to be disconnected. The Causeway Interchange expansion and the addition of the Access Road will increase traffic efficiency around the Project area and will reduce the amount of truck and vehicle traffic on Crown Street. The Project will result in increased rail traffic, but not beyond what the current rail system can accommodate.

The study determined that a signalized T-intersection would be appropriate for the proposed intersection, which would remain green for through-traffic on the Causeway until actuated by PotashCorp traffic. Right-turn lanes on the eastbound and northbound approaches would accommodate truck movements. A westbound left turn lane from the Causeway with at least 75 m of storage length and a taper of approximately 42 m is warranted, but would require widening to the north of the Causeway.

Project-related construction, particularly at the Causeway Interchange, will result in restricted access for the duration of interchange construction and expanded operations are anticipated to increase the overall volume of truck and rail traffic in the Project area. However, these adverse effects will be countered by the operation of the dedicated access road. The new access road will remove brine and salt trucks off of Crown Street (south of Union Street), offsetting or even improving traffic conditions for residential neighbourhoods in the East Side.

7.7.3 Mitigation and Residual Environmental Effects

Traffic delays and detours associated with construction of the Causeway Interchange will be minimized by establishing appropriate mitigations, such as time of day/year restrictions and best practices for flagging, temporary signal lights and maintaining one lane, in consultation with the City. Despite a Project-related increase in truck and rail traffic, the Project is anticipated to have an overall positive effect on transportation in the Project area throughout the operation phase, as all existing and new PotashCorp truck traffic will be diverted off of Crown Street (south of Union Street) and the current site accessibility and truck/rail conflicts will be eliminated. PotashCorp is currently working with the City to determine the appropriate traffic and maintenance requirements. There is anticipated to be an overall positive residual environmental effect on Transportation.

7.7.4 Significance Criteria

A significant adverse effect on Transportation is defined as one that would decrease accessibility of the road network for an extended period of time, such that the current level of service could not be maintained, and/or an effect that resulted in substantive infrastructure damage.

7.7.5 Significance Determination

The Project will substantially improve the current transportation situation at the Terminal by eliminating the conflict between trains and trucks. It will also divert almost all of the Terminal-related truck traffic off of Crown Street, improving the transportation system for local residents. These positive effects will serve to offset the Project's overall increase in truck and train traffic levels, resulting in the overall residual effects to Transportation to be not significant. Table 7.13 summarizes the residual environmental effects for the Transportation VEC.

Table 7.13: Summary of Project-Related Environmental Effects: Transportation

Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effect (YES/NO)	Significance Determination: Significant (S) or Not Significant (NS)
Construction of Rail / Road Expansion	Delays and detours during Interchange construction (A)	• Road construction scheduling will be determined in consultation with the City, including time of day/year restrictions; and • Road construction best practices such as flagging, temporary signal lights and temporary traffic flow will be adhered to.	Y	NS
Operation of Rail / Road Expansion	Reduction in Crown Street (south of Union Street) traffic, improved traffic flow on Causeway, eliminated rail/truck traffic conflict (P)	• No mitigations are proposed for this potential effect.	Y	NS
Transportation of salt/potash	Increase in truck and rail traffic levels (A)	• Project-related increase in traffic mitigated by diverting almost all existing PotashCorp traffic off of Crown Street.	Y	NS

7.7.6 Monitoring

Periodic monitoring of traffic flow and delays during peak travel times will be undertaken during construction of the Causeway Interchange. If delays/detours are found to be unacceptable to the City, phasing/timing of existing signals or flagging/lane adjustments would be made.

7.8 Navigation

The Navigation VEC addresses potential Project-related effects on marine-based vessels. The Navigation VEC addresses increased wait times in the harbour and interactions with commercial fishermen.

The vast majority of the 20 million tonnes of cargo handled by the Port of Saint John in 2012 was liquid bulk shipment from private petrochemical facilities, outside of the main harbour. Nevertheless, given the Terminal depths in the Harbour (9.1-13 m CD), the Saint John Harbour is well utilized, handling two million tonnes of cargo, and cruise facilities with 65 ship calls and more than 184,000 passengers in 2011 (SJPA, 2012).

7.8.1 Effects Assessment Boundaries

The effects assessment of Navigation is subject to the spatial and temporal limitations described below.

7.8.1.1 Spatial Boundaries

The spatial boundary of the assessment of impacts to Navigation is the Saint John Harbour and the shipping routes in the Bay of Fundy.

7.8.1.2 Temporal Boundaries

The temporal boundary of the assessment of impacts to Navigation is the lifespan of the Project, with impacts specifically focused around increased marine vessel traffic.

7.8.2 Project-VEC Interactions and Potential Environmental Effects

Potential Project-environment interactions are identified in Table 6.2. As indicated in the matrix, the following activities have the potential to result in environmental effects to Navigation:

- Operation of ship loading.

These Project-environmental interactions have the ability to impact navigation by impeding channel traffic, creating congestion, impeding access to fishing sites, or damaging fishing gear.

7.8.2.1 Increased Wait Times and Channel Congestion

The Project will increase marine traffic in the Port of Saint John by 8%, increasing vessel calls at the PotashCorp Terminal to the existing Terminal to 125-135 annually. As infilling will occur on the east side of the harbour in Courtenay Bay, construction is not anticipated to interfere with marine traffic navigation through the harbour channels. However, based on a navigational study done during the initial design phase, the proposed traffic increase will increase the number of vessels in the harbour experiencing wait times to enter or exit the harbour during high tide from 0.46% to 1.76% (Moffatt and Nichol, 2013). These predicted wait time values are well within acceptable levels (less than 20%) and the Terminal Expansion will not increase congestion entering and exiting the Harbour to critical levels. However, modelling did not include projections for increase in throughput elsewhere in the Port of Saint John. It is possible that other proposed projects could further increase wait times.

7.8.2.2 Interference with Commercial Fishing

Local fishermen are concerned generally about an increase in fishing gear loss and reduced access to fishing grounds (Sharing the Water 2011). Marine traffic bisects important lobster fishing areas, and gaspereau and shad are fished within close proximity to the Project area.

Annually, 30-60 lobster traps in the region are lost, incurring up to $9,000 in replacement costs (Sharing the Water 2011), and with increased development in the Harbour the amount of vessel-associated gear damage is apt to increase. However, shipping vessels are required to follow strict shipping channels within the Port of Saint John and within the Bay of Fundy, thereby minimizing potential interaction with fishing gear. Project-related tugboats and support vessels will not be required to travel outside of these channels.

7.8.3 Mitigation and Residual Environmental Effects

To minimize potential adverse effects on Harbour navigation and wait times, as well as adverse effects on the local commercial fishing industry, the following mitigation measures will be employed:

- Project-related vessel operators will be directed to review and comply with SJPA Practices and Procedures (Port Authority Regulations, *Canada Marine Act*), and legislative and regulatory requirements outlined in the Notice to Mariners, described in Section 3.1.4;
- SJPA will be consulted regarding shipping schedules;
- Project-related vessel operators will be directed to avoid any observed fishing buoys; and
- PotashCorp will coordinate with other harbour users, including the Fundy North Fishermen's Association, to resolve access issues through regularly scheduled Port Operations Committee meetings.

Although increasing vessel traffic inherently increases the likelihood of interference with commercial fishing activities and the potential for damage to fishing gear, the incremental contribution of the Project is not anticipated to result in residual effects to the local commercial fishing industry, with the proper adherence to the mitigation measures outlined above.

The Project is anticipated to result in residual effects to Navigation, even with the application of the above mitigation measures. Marine traffic will increase as a result of the Project, contributing incrementally to any existing Harbour congestion and wait-times.

7.8.4 Significance Criteria

A significant effect on Navigation is defined as a change to navigation wait times or channel congestion, such that the number of vessels experiencing wait times is substantially decreased from current levels (positive effect) or is increased beyond acceptable levels (20% or more).

7.8.5 Significance Determination

The Project will increase the number of vessels in the harbour experiencing wait times to 1.76%, which is well within the acceptable level of less than 20% and the residual effects on Navigation are considered to be not significant. Table 7.14 summarizes the residual environmental effects to the Navigation VEC.

Table 7.14: Summary of Project-Related Environmental Effects: Navigation

Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effect (YES/NO)	Significance Determination: Significant (S) or Not Significant (NS)
Operation	Increased marine traffic and congestion (A)	• Project-related vessel operators will be directed to review and comply with SJPA Practices and Procedures (Port Authority Regulations, *Canada Marine Act*), and legislative and regulatory requirements outlined in the Notice to Mariners, described in Chapter 3; and • SJPA will be consulted regarding shipping schedules.	Y	NS
Operation	Damage to fishing gear (A)	• Project-related vessel operators will be directed to review and comply with SJPA Practices and Procedures (Port Authority Regulations, *Canada Marine Act*), and legislative and regulatory requirements outlined in the Notice to Mariners, described in Chapter 3; • Project-related vessel operators will be directed to avoid any observed fishing buoys; • SJPA will be consulted regarding shipping schedules; and • PotashCorp will coordinate with other harbour users including the Fundy North Fishermen's Association to resolve access issues through regularly scheduled Port Operations Committee meetings.	N	NS

7.8.6 Monitoring

Ongoing monitoring of tides and seasons will contribute to scheduling of transits during large tidal windows and to avoid vessel manoeuvering during the freshet period.

7.9 Visual Aesthetics

The Visual Aesthetics VEC addresses effects to the viewscape in the Project area. The Project includes the construction of a new 1-km long, 2-lane waterfront access road and two additional rail tracks (with an additional two in the future). Information for the Visual Aesthetics VEC is primarily based on desktop studies, existing data sources and field studies, including a Visual Aesthetics Assessment conducted for the Project (see Appendix B).

7.9.1 Effects Assessment Boundaries

The effects assessment of Visual Aesthetics is subject to the spatial and temporal limitations described below.

7.9.1.1 Spatial Boundaries

The spatial boundary of the assessment of impacts to visual aesthetics is limited to locations in the Project area that have access to the viewscape of the Project infrastructure that could be affected by changes to visual aesthetics.

7.9.1.2 Temporal Boundaries

The temporal boundary of the assessment of impacts to Land Use is the lifespan of the Project, including all Project phases.

7.9.2 Project-VEC Interactions and Potential Environmental Effects

Potential Project-environment interactions are identified in Table 6.2. As indicated in the matrix, the following activities have the potential to result in environmental effects to Visual Aesthetics:

- Construction of rail / road expansion.

The above-noted components and activities will result in alterations to existing viewscapes, potentially affecting the aesthetic appreciation for residents and visitors. Construction of the rail / road expansion has the potential to alter the shape of land and appearance of the waterfront on the east side of the Saint John peninsula and from the Courtenay Bay Causeway.

The following is a summary of key landmarks, sites and view corridors that would be affected by the proposed Terminal expansion. More details and corresponding photographs are located in Appendix B.

7.9.2.1 Crown Street

Views along Crown Street toward Courtenay Bay would be affected along the majority of the street due to the addition of infill for the new access road and rail tracks. An additional 40 m of asphalt, armour stone and crushed stone would separate the views of Courtenay Bay from viewers on Crown Street.

7.9.2.2 Courtenay Bay Causeway

Scanning views of Courtenay Bay from the Causeway would be affected, as the banks of the peninsula would be extended into the Bay with 40 m of asphalt and aggregate, decreasing the visual extent of the Bay.

7.9.3 Mitigation and Residual Environmental Effects

Although the infill into Courtenay Bay for the new access road will reduce the view of the Bay from Crown Street, the overall effect to the visual aesthetics may be partially mitigated by providing a vegetation buffer between the infill area and residential dwellings.

The Saint John area, including Courtenay Bay, is an industrialized area where the visual aesthetics of the area are already substantially altered by existing infrastructure and industrial activity, and natural viewscapes, vistas and scenery are plentiful in adjacent areas. As part of the environmental assessment process, renderings of the proposed viewscape will be available at public meetings, and provide a forum for feedback and discussion on potential adverse effects and mitigation measures.

Even with implementation of the mitigation measures outlined above, residual effects to Visual Aesthetics will occur, as the Project will inherently alter the viewscape from numerous locations.

7.9.4 Significance Criteria

A significant adverse residual effect to Visual Aesthetics would be considered to be one that altered the viewscape to such an extent that it disrupts the public enjoyment of the area.

7.9.5 Significance Determination

With proper implementation of mitigation measures as outlined above, the Project is not anticipated to result in significant adverse effects on Visual Aesthetics. Table 7.15 summarizes the residual environmental effects for the Visual Aesthetics VEC.

Table 7.15: Summary of Project-Related Environmental Effects: Visual Aesthetics

Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effect (Y/N)	Significance Determination: Significant (S) or Not Significant (NS)
Construction	Decreased views of Courtenay Bay from Crown Street (A); Decreased visual extent of Courtenay Bay from Courtenay Causeway (A).	• A vegetation buffer will be provided between the infill area and residential dwellings.	Y	NS

7.9.6 Monitoring

No monitoring is proposed to assess the effects prediction for the Visual Aesthetics VEC.

7.10 Socio-economic Environment

The assessment of socio-economic effects primarily considers the potential Project-related impacts to local employment and labour, and the direct and indirect effects to the economy. Existing data sources were used to baseline the existing socio-economic environment, and anticipated inputs were used to project the Project-related effects to the socio-economic environment in a socio-economic assessment completed for the Project (see Appendix B).

7.10.1 Effects Assessment Boundaries

The assessment of the Socio-economic Environment VEC is subject to the spatial and temporal limitations described below.

7.10.1.1 Spatial Boundaries

The spatial boundary of the assessment of impacts to Socio-economic Environment VEC is limited to the employment and local business catchment area, properties in Uptown Saint John, and the jurisdictions to which taxes will be paid (Municipality of Saint John, and provincial and federal governments).

7.10.1.2 Temporal Boundaries

The temporal boundary of the assessment of impacts to the Socio-economic Environment VEC is the lifespan of the Project, including all Project phases.

7.10.2 Project-VEC Interactions and Potential Environmental Effects

Potential Project-environment interactions are identified in Table 6.2. As indicated in the matrix, the following activities have the potential to result in environmental effects to the Socio-economic Environment:

- Construction;
- Operation; and
- Maintenance.

The Project will generate extended employment, primarily during construction, with construction anticipated to extend from June 2015 into mid-2016. Some of this labour will be drawn from the local area. Construction workers will also seek local services and supplies for gas, accommodations and related items, and specialized equipment and services will be sourced from the immediate area, and from elsewhere in the province and beyond, and these expenditures will benefit a range of suppliers. While employment generated during operation and maintenance will not be as substantial as that during construction, generally as industry expands in the province the need for local market area services also increases.

The following dimensions of the economic impact of the proposed expansion of the PotashCorp Terminal have been assessed:

- **Construction Impacts:** The economic impact of the proposed construction – more than $22 million in proposed industrial, commercial, and related infrastructure construction activity, the majority of which will leverage local employment and locally/provincially based suppliers of goods and services;

- **Operational Impacts:** The economic impacts relating to the principal objective of the project itself – the impact of ongoing and expanded operations capacity. This includes the enabling effect of the expansion, which will increase terminal capacity, with the expectation that the increased activity and throughput will lead to a measurable increase in annual employment at the terminal, as well as the mine site. The added capacity will positively impact the competitiveness of the mine-site the expansion is designed to accommodate, thereby helping to ensure the sustained viability of the mine itself. The assessment only looks at the employment impacts of the expanded marine terminal and the additional jobs that are expected as a result of the increased capacity and activity; and
- **Municipal Impacts:** The impact of the development on the City's tax base, through either positive or negative impacts on assessment valuation and or additions or reductions in the taxable value of real-estate.

7.10.2.1 Construction-Related Effects

When completed, the Project is anticipated to have resulted in $22.4 million in direct construction-related spending, mixed among commercial/institutional and municipal servicing -related construction costs. Approximately 160 of the estimated 248 person-years of employment will be within the non-residential construction sector. Construction spending will generate estimated direct and spin-off economic effects as outlined in Table 7.16.

Table 7.16: Estimated Project-Related Construction Economic Impact

Category of Impact from Construction	Region	Estimated Impact
Total direct and spinoff jobs in *(Person-Years)*	Saint John	158
	Rest of NB	91
	Total NB	**248**
Total direct and spinoff household income in *(millions)*	Saint John	$8.0
	Rest of NB	$3.5
	Total NB	**$11.5**
Total direct and spinoff GDP *(millions)*	Saint John	$9.5
	Rest of NB	$8.2
	Total NB	**$17.7**
Total direct and spinoff Federal Tax *(millions)*	Saint John	$0.8
	Rest of NB	$0.7
	Total NB	**$1.6**
Total direct and spinoff Provincial Tax *(millions)*	Saint John	$0.7
	Rest of NB	$1.2
	Total NB	**$1.9**
Total direct and spinoff Municipal Tax *(millions)*	Saint John	$0.0
	Rest of NB	$0.2
	Total NB	**$0.3**

7.10.2.2 Operation-Related Effects

Operating costs are estimated from information provided by PotashCorp New Brunswick Division. Operationally, the expanded facility will double in production capacity, allowing for expanded operations at the facility. Focusing on operations, employment is expected to increase by 13 full-time positions from current levels.

Table 7.17: Estimated Project-Related Operation Economic Impact

Category of Impact from Operations	Region	Estimated Impact
Total direct and spinoff jobs in *(Person-Years)*	Saint John	16
	Rest of Saint of NB	3
	Total NB	**20**
Total direct and spinoff household income in *(millions)*	Saint John	$0.77
	Rest of Saint of NB	$0.14
	Total NB	**$0.91**
Total direct and spinoff GDP *(millions)*	Saint John	$1.13
	Rest of Saint of NB	$0.28
	Total NB	$1.41
Total direct and spinoff Federal, Provincial, and Local Tax *(millions)*	Saint John	$0.25
	Rest of Saint of NB	$0.05
	Total NB	**$0.30**

7.10.2.3 Effects to the Municipality

The planned expansion of the terminal, including its own access road, will not likely have an adverse impact on road traffic in the surrounding areas and may have the impact of decreasing road traffic along Crown. In either case and given current uses and planned traffic improvements that are part of this project, there may be a measurable and positive impact on property values, from either at the resale market or tax assessment perspective, as a result of moving truck traffic along a dedicated route.

7.10.3 Mitigation and Residual Environmental Effects

The Project will result in a neutral or positive impact to the various aspects of the socio-economic environment discussed above, therefore no mitigation is required. PotashCorp will endeavour to maximize the magnitude of the positive effects.

The anticipated residual economic effects are as follows:

Construction: In terms of construction impacts, the $22.4 million expenditure will cause an estimated:

- 248 in total direct and spinoff jobs in (Person-Years);
- $11.5 million in total direct and spinoff household income in;
- $17.7 million in total direct and spinoff GDP;
- $1.6 million in total direct and spinoff Federal Tax;
- $1.9 million in total direct and spinoff Provincial Tax; and
- $300,000 in total direct and spinoff Municipal Tax.

Operations: On an annual basis, the combination of operations of the terminal will generate the following. An estimated:

- 20 in total incremental direct and spinoff jobs in (Person-Years);

- $0.91 million in total direct and spinoff household income in;
- $1.41 million in total direct and spinoff GDP; and
- $300,000 in total direct and spinoff Federal, Provincial, and Municipal Tax.

7.10.4 Significance Criteria

A significant effect on the Socio-economic Environment is defined as one that would result in a change in employment numbers, local economy of services and suppliers, real estate, or tax revenue such that it manifests as a perceptible increase or decrease in these values for the majority of local residents.

7.10.5 Significance Determination

Due to the temporary nature of the construction phase, the minimal increase in employment during the operation phase, the incremental spinoff effects on the local economy, the neutral effect on local real estate values, and the moderate generated tax revenues, the effects on the socio-economic environment are considered to be not significant. Table 7.18 summarizes the residual environmental effects for the Socio-economic Environment VEC.

Table 7.18: Summary of Project-Related Environmental Effects: Socio-economic Environment

Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effect (YES/NO)	Significance Determination: Significant (S) or Not Significant (NS)
Construction of Rail / Road Expansion	Temporary increase in employment and revenue (P)	• No mitigations are proposed for this potential effect.	Y	NS
Transportation of salt/potash	Increase in tax revenue and the addition of employment opportunities (P)	• No mitigations are proposed for this potential effect.	Y	NS

7.10.6 Monitoring

There is no proposed monitoring for the Socio-economic VEC.

7.11 Archaeological Resources

The Archaeological Resource VEC addresses Project-related effects to archaeological and heritage resources. Archaeological and heritage resources provide scientific value and the social values attached to such concepts as cultural tradition, national/cultural identity, patrimony and sovereignty. An Archaeological Impact Assessment was completed for the Project as required by the Province of New

Brunswick (see Appendix O). The assessment of adverse effects to archaeological resources was based on desktop studies, bathymetric survey data and site reconnaissance surveys.

7.11.1 Effects Assessment Boundaries

The effects assessment of the Archaeological VEC is subject to the spatial and temporal limitations described below.

7.11.1.1 Spatial Boundaries

The spatial boundary of the assessment of impacts to the Archaeological VEC is limited to the terrestrial and marine Project footprint.

7.11.1.2 Temporal Boundaries

The temporal boundary of the assessment of impacts to the Archaeological VEC is the construction phase of the Project, as effects to archaeological resources occur during construction activities such as excavating and infilling.

7.11.2 Project-VEC Interactions and Potential Environmental Effects

Project activities have the potential to cause adverse effects to archaeological resources. Table 6.2 details the Project-environment interactions for all Project activities and archaeological resources. As indicated in the matrix, construction has the potential to result in environmental effects to archaeological resources.

Project related construction activities have the potential to destroy or conceal archaeological resources. Infilling activities could destroy or damage archaeological resources through displacement and fracturing of archaeological items. Infilling can also cause archaeological resources to be concealed, limiting the potential for conducting studies to assess and preserve the resource. Excavation activities have the potential to remove and dispose of archaeological resources with soils or damage them through mishandling and the use of large machinery.

No terrestrial archaeological resources were identified within the project footprint. Three submerged archaeological resources were identified within the footprint of the proposed infilling for the rail / road expansion, as identified in Table 7.19.

Table 7.19: Archaeological Resources within the Project Footprint

Site	Location	Coordinates (NAD 83)
Orange Street Wharf	Courtenay Bay	45°16’20” N, 66°02’55” W
Duke Street Pier	Courtenay Bay	45°16’19” N, 66°02’55” W
Esso Wharf	Courtenay Bay	45°16’00” N, 66° 02’55” W

7.11.3 Mitigation and Residual Environmental Effects

The Archaeological Impact Assessment concluded that no archaeological mitigations are required for the Esso Wharf (see Appendix O).

The Archaeological Impact Assessment has been submitted to the NB Department of Tourism, Heritage and Culture for approval and includes for following mitigation measures to minimize the potential for Project-related adverse environmental effects to Archaeological Resources during construction activities:

- The five emergent posts from the remnants of the Duke Street Wharf and the remnants of the Orange Street Wharf will be mapped precisely;
- One of the five emergent posts of the Duke Street Wharf will be dated through dendrochronology;
- Additional archaeological mitigations may be required depending on the results of the Duke Street Wharf dating; and
- Should archaeological resources be encountered during excavation or infilling activities, work in the area will cease and the Archaeological Service Branch of the NB Department of Tourism, Heritage and Culture will be contacted for further archaeological mitigations.

7.11.4 Significance Criteria

A significant adverse effect to archaeological resources is defined as one that would destroy, displace or conceal an existing archaeological resource and limit the ability for future generations to study the resource.

7.11.5 Significance Determination

No significant residual adverse environmental effects are anticipated, given the application of appropriate archaeological mitigation as described above and in the Archaeological Impact Assessment attached as Appendix O. Table 7.20 summarizes the residual environmental effects for the Archaeological Resources VEC.

Table 7.20: Summary of Project-Related Environmental Effects: Archaeological Resources

Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effect (YES/NO)	Significance Determination: Significant (S) or Not Significant (NS)
Construction – Access Road, Garage Expansion	Destruction or concealment of existing archaeological resources (A)	• Five emergent posts from the remnants of the Duke Street Wharf and the remnants of the Orange Street Wharf will be mapped precisely; • One of five emergent posts of the Duke Street Wharf will be dated through dendrochronology; • Additional archaeological mitigations may be required depending on the results of the Duke Street Wharf dating; • The contractor will be required to complete a site-specific Environmental Protection Plan and include a monitoring plan for archaeological resource during construction activities; and • Should archaeological resources be encountered during excavation or infilling activities, work in the area will stop and the Archaeological Service Branch of the NB Department of Tourism, Heritage and Culture will be contacted for further archaeological mitigation.	N	NS

7.11.6 Monitoring

Monitoring of excavation activities will include examining excavated soils and sediments for potential archaeological resources. The contractor's site-specific Environmental Protection Plan will detail the monitoring for archaeological resources during construction activities.

7.12 Accidental Events and Malfunctions

Accidental events and malfunctions are unplanned events with a low probability for occurrence. Although unlikely, an accidental event or malfunction can cause significant adverse environmental effects and have the potential to affect all environmental components identified in Table 6.2. This section details the potential adverse environmental effects associated with accidents and malfunctions during construction phase activities and provides mitigation measures to reduce potential impacts. Accidental events and malfunctions during Project operation are mitigated in the facility's Environmental Emergency Plan as detailed in Section 2.8.5 and attached in Appendix D. This section details the proposed environmental protection measures that will be implemented to reduce the likelihood of occurrence and to limit potential adverse effects should an accidental event or malfunction occur.

7.12.1 Hazardous Materials Spills

Project activities could result in a hazardous material spill. Fuel storage, refuelling and the operation of vehicles and construction equipment have the potential to be involved in a hazardous material spill. Hazardous material spills have the potential to adversely affect air quality, soil quality, and water quality and could pose risks to human health and safety. Such events could also result in the alteration of terrestrial and aquatic habitat and the direct mortality of wildlife. A hazardous material spill has the potential to cause significant adverse environmental effects depending the size and location of the spill. The likelihood and significance of the environmental effects associated with a hazardous material spill can be reduced with the application of appropriate mitigation measures.

7.12.1.1 Mitigation Measures

The construction contractor will be required to include an Emergency Response Plan as part of the site-specific Environmental Protection Plan. The Emergency Response Plan will include, but not be limited to, the following mitigation measures to minimize the likelihood of, and contingency measures to minimize effects in the event of, a hazardous material spill:

- Description of the handling and storage procedures for hazardous materials in use;
- Detailed description of spill prevention, containment and clean-up equipment to be kept on site and include, at a minimum:
  - Absorbent materials for immediate response in the event of a spill or leak;
  - Adequate personal protective equipment (e.g., face masks, gloves, protective suits); and
  - Suitable equipment to contain and gather contaminants (e.g., open-ended barrels, shovels, bags, buckets, rakes, tarps, floating booms).
- Location of on-site spill response equipment, in an easy to access area close to the Project activities;
- Spill response procedures including, but not limited to, the following:
  - Stop work;
  - Adhere to health and safety policy procedures;
  - Stop further discharge and contain spill if safe to do so;
  - Attempt to ventilate area if necessary;
  - Initiate clean-up if safe/feasible to do so (dependent on material type and quantity of spill);
  - Remain at the site at a safe distance and wait for response crew; and
  - Report spill of any quantity to owner or owner's designate and appropriate regulatory authorities.

- Communication and response procedures to be implemented in the event of a hazardous material spill:
  - Hazardous material spills in an outdoor terrestrial environment shall be reported to the joint federal/provincial environmental emergencies contact centre (1-800-565-1633);
  - All spills or releases of a potentially deleterious substance entering fresh or marine waters frequented by fish must also be reported to the joint federal/provincial environmental emergencies contact centre (1-800-565-1633); and
  - All spills and releases of hazardous materials and deleterious substances will be reported to PotashCorp.

If a spill occurs on federal lands, reporting requirements under the Transportation of Dangerous Goods Regulations apply, and reporting concentrations requirements under the Transportation of Dangerous Goods Regulation will be adhered to.

7.12.2 Transportation-Related Accidents

Accidents and malfunctions of vehicles, vessels and construction equipment have the potential to adversely affect the Project and the environment, and could pose human health and safety risks. Accidents and malfunction can cause the release of fuels, oils and lubricants. Accidents leading to the release of hazardous materials, including impacted sediment and soil, could result in contamination of soil, groundwater, terrestrial habitat and aquatic habitat.

Potential train derailments and accidents en-route between the Picadilly Mine site and the Marine Terminal will be addressed through CN's emergency response procedures. Potential train derailment and accidents at the PotashCorp Marine Terminal, including at the tail track, will be addressed through the implementation of the Facility's Environmental Emergency Plan. Marine vessel accidents and malfunctions will be addressed by the SJPA, Transport Canada and the Canadian Coast Guard through their emergency response procedures as defined by the Collision Regulations of the *Canada Shipping Act*.

7.12.2.1 Mitigation Measures

The construction contractor will be required to include an Emergency Response Plan as part of the site-specific Environmental Protection Plan. The Emergency Response Plan will include, but not be limited to the following mitigation measures, to minimize the likelihood of, and contingency measures, to minimize effects in the event of, a transportation accident:

- Accident, collision and malfunction response procedures;
- Vehicles will travel at speeds no greater than posted speed limits and will reduce speeds during inclement weather conditions; and
- Spill response procedures in the event of an accident during the transportation of impacted soil or sediment.
- Communication and response procedures to be implemented in the event of a transportation accident or malfunction:
  - In the event of an emergency, New Brunswick Emergency Services will be contacted immediately (911);
  - The Department of Natural Resources will be contacted in the event of a collision with wildlife;

- Marine vessel collisions will be reported as per the Collision Regulations of the *Canada Shipping Act*;
- Hazardous material communication procedures will be implemented in the event of a hazardous material spill resulting from a transportation accident; and
- Vehicle accidents will be reported to PotashCorp.

7.12.3 Fires

Project activities could result in fires and explosions; although unlikely to occur, fires and explosions have the potential to adversely affect air quality and soil quality and could pose risks to human health and safety. Such events could also result in terrestrial habitat alteration and the direct mortality of wildlife. Firefighting chemicals and spilled materials could enter aquatic habitat and adversely affect biota and habitat. Sustained fire events and those that lead to explosions may cause significant adverse environmental impacts.

Construction activities could potentially cause a fire, and fuel storage, buildings, mechanical shops, construction equipment and vehicles all have the potential to be involved in a fire. The contractor's Emergency Response Plan will include fire prevention and response procedures to be implemented during construction activities.

7.12.3.1 Mitigation Measures

The construction contractor will be required to include an Emergency Response Plan as part of the site-specific Environmental Protection Plan. The Emergency Response Plan will include, but not be limited to the following mitigation measures, to minimize the likelihood of, and contingency measures, to minimize effects in the event of, a fire:

- Fire response procedures;
- Flammable waste will be disposed in an appropriate manner;
- Fire prevention and response training will be provided for all on-site personnel; and
- Firefighting equipment, sufficient to mitigate on-site fire hazards, will be maintained in proper operating condition and to the manufacturer's / National Fire Protection Association standards.
- Communication and response procedures to be implemented in the event of a fire:
  - Saint John Fire Department will be contacted immediately (911);
  - All nearby personnel will be notified immediately; and
  - Contractor will immediately notify PotashCorp.

7.12.4 Extreme Weather Event

Extreme weather events have the potential to adversely affect the Project and the environment, and could pose risks to human health and safety. Extreme weather events may include high wind, heavy rainfall or snowfall, extreme cold, lightning and fog. Severe weather could cause failure of sediment containment and catchment basins, thereby releasing contaminants and adversely impacting water quality, aquatic habitat and terrestrial habitat. Extreme weather will also affect driving/navigating conditions and increase the likelihood of vehicle and vessel accidents. The likelihood and significance of the environmental effects associated with a potential extreme weather event can be reduced with the application of the following mitigations.

7.12.4.1 Mitigation Measures

The construction contractor will be required to include an Emergency Response Plan as part of the site-specific Environmental Protection Plan. The Emergency Response Plan will include, but not be limited to the following mitigation measures, to minimize the likelihood of, and contingency measures, to minimize effects in the event of, weather events:

- Weather conditions will be assessed on a daily basis to determine the potential risk of extreme weather on the Project;
- Work will be scheduled to avoid extreme weather events; and
- The Project site will be secured during periods of extreme weather.

7.12.5 Failure of Erosion and Sediment Control Measures

Failure of erosion and sediment control measures has the potential to adversely affect the Project and the environment. Although unlikely, it is possible that erosion and sediment control measures (e.g., sediment fences and catch basins) could fail during construction activities. The failure of these control measures during a severe weather event could cause the release of sediment and has the potential to cause localized significant adverse environmental effects to water quality, fish habitat and terrestrial habitat.

7.12.5.1 Mitigation Measures

The construction contractor will be required to include an Emergency Response Plan as part of the site-specific Environmental Protection Plan. The Emergency Response Plan will include, but not be limited to the following mitigation measures, to minimize the likelihood of, and contingency measures, to minimize effects in the event of, a failure of erosion and sediment control measures:

- Sediment and erosion controls structures will be installed as per manufacturer's recommendations;
- Site-specific Environmental Protection Plan will detail the specific location and installation procedures for all erosion and sediment control structures; and
- The contractor will conduct regular monitoring of all sediment and erosion control structures to ensure they are functioning optimally and not at risk of failure.

7.13 Effects of the Environment on the Project

Environmental events which could potentially have an adverse effect on the Project and Project activities include: Extreme weather events, fire; climate change, wave action, and flooding. No other environmental event would likely have a significant effect on the Project site. Some of the identified environmental events (e.g., flooding) have influenced the design of the structures for the proposed Project.

7.13.1 Effects Assessment Boundaries

The effects assessment of the Effects of the Environment is subject to the spatial and temporal limitations described below.

7.13.1.1 Spatial Boundaries

The spatial boundary of the assessment of impacts for Effects of the Environment is limited to the Project footprint.

7.13.1.2 Temporal Boundaries

The temporal boundary of the assessment of impacts for Effects of the Environment includes the construction and operational phases of the proposed Project. Some environmental events such as flooding, fire and extreme weather events could adversely impact the Project schedule, especially during the construction phase, but such events are likely to be of short duration.

7.13.2 Potential Environmental Effects

Environmental events which have the potential to cause adverse effects to the construction and operational phases of the Project include:

- Extreme weather;
- Climate change;
- Fire;
- Wave action; and
- Flooding.

7.13.2.1 Extreme Weather

Extreme weather includes events such as severe thunderstorms, tornados, high winds and hurricanes. Some of these events can cause storm surges and when combined with high tides they can be damaging to coastal developments. During construction, these events could delay construction or damage equipment and materials being used during construction. During operation, any of these events has the potential to cause damage to the facilities which could delay shipments and/or Project activities to be temporarily shut down.

7.13.2.2 Climate Change

Climate change can be defined as a change in normal temperature or weather patterns such as abnormal or frequent extreme weather events that are thought to be caused by natural events such as solar activity, plate tectonics, ocean changes (e.g., ice melt, current changes), volcanic activity and/or anthropogenic events such greenhouse gas emissions and the destruction of large forests. Changes in weather patterns caused by climate change could occur during the construction or operational phases of the Project; however, climate change is most likely to impact the operational phase of the Project which occurs over 30+ years. Climate change may result in more frequent or extreme weather events and the events could adversely interfere with the regular operation of the Project.

Predicted sea levels rises can also be theorized to be a result of climate change. Over time, a rise in sea level could have an adverse effect on new structures proposed in the Project area.

7.13.2.3 Fire

Fires could be initiated naturally (e.g., lightning) or by humans. Fires could occur during the construction or operational phase of the Project. During the construction phase, fires could delay construction or damage equipment and materials being used during construction. During the operational phase, a fire could potentially damage the installed facilities, delay shipments and/or cause operation of the Project to be temporarily shut down.

7.13.2.4 Wave Action

Wave action can be caused by high wind and storm events. High waves could occur during any of the Project phases. During construction high waves could delay activities occurring during high tides. During operation high waves could temporarily cause a delay in shipments to the Marine Terminal or cause damage in the Project area if waves reach above the armour stone rocks. However, the rail / road expansion has been designed to incorporate an amour stone wall and slope stabilization for protection from waves and high tide events (see Section 7.13.3).

A tsunami is an abnormally large wave caused by events such as underwater earthquakes or volcanoes. Although extremely unlikely to occur since the Bay of Fundy is mostly protected by mainland Nova Scotia, an underwater earthquake could cause a tsunami to impact the Saint John Harbour. A tsunami would be detrimental to the Project and would likely cause all operations associated with the Project to be shut down for an extended period of time.

7.13.2.5 Flooding

Flooding can be caused by events such as heavy rain fall, storm surges and extreme high tides (usually in combination with flooding or storm surges). Flooding could occur during any of the Project phases. Similar to wave action, flooding could delay construction activities occurring in the Project area. During operations, flooding could cause parts of the Project area to be temporarily underwater.

7.13.3 Mitigation and Residual Environmental Effects

Potential adverse effects of environmental events can be minimized with the application of appropriate mitigation measures. Many of the proposed structures have been designed to withstand wave action, high tide events and minor flooding events. For example, the access road has been designed with an armour stone wall and a stabilized slope.

An Emergency Response Plan for construction will be prepared by the contractor and will include response protocol during extreme weather and environmental events, such as ceasing work activities during extreme weather events, referring to weather forecasts regularly, and taking measures to protect certain equipment and infrastructure from anticipated severe weather.

Mitigation measures to prevent the risk of fires in the Project area include the following:

- During construction and operation have a fire response plan and protocol in place to ensure fires are reported immediately and that an efficient emergency response is activated; and
- Install lightning rods on buildings when deemed appropriate.

7.13.4 Significance Criteria

An adverse significant residual effect with respect to Effects of the Environment would be a catastrophic event that causes long-term damage to facilities or long-term disruption of day-to-day operations.

7.13.5 Significance Determination

With the implementation of mitigation measures, the identified environmental events are not anticipated to pose a significant adverse effect on the Project, as most of the identified events would only cause repairable damages and temporary delays in construction or operation. However, even with the implementation of mitigation measures, some rare environmental events have the potential to cause significant residual effects to the Project, although the likelihood of occurrence is considered very low:

- Extreme climate change events, such as sea level rise occurring sooner than anticipated or rising higher than predicted levels (see Appendix K);
- Extreme wave event (tsunami);
- Catastrophic, uncontrollable fires;
- Hurricanes or tornadoes with high wind speeds (e.g., hurricanes Category 2 [154-177 km/h] to Category 5 [252 km/h+] and tornadoes F1 [138–177km/h] to F5 [322km/hr+]); and
- Extreme storm surge coinciding with high tide and an extreme storm (e.g., hurricane).

7.14 Effects Assessment Summary

VECs with anticipated residual environmental effects are listed in Table 7.21. It was determined that with the application of appropriate mitigation measures, the project will not have any significant effects on the environment, either positive or adverse.

Table 7.21: **Effects Assessment Summary Table**

Project Component / Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effects (Y/N)	Significance Determination: Significant (S) or Not Significant (NS)
Air Quality				
Construction	Emission of Air Pollutants from Diesel Exhaust (A)	• Contractor will provide a site-specific Environmental Protection Plan detailing environmental protection measures for the mitigation of impacts to air quality; • Idling of vehicles and motorized equipment will be minimized; and • Operating condition of all vehicles and motorized equipment will be maintained to ensure good performance.	Y	NS
Construction	Emission of Fugitive Dust (A)	• The contractor will provide a site-specific Environmental Protection Plan detailing environmental protection measures for the mitigation of impacts to air quality; • Apply water spray to unpaved surfaces when conditions are dry and windy weather persists onsite; • Unpaved road surfaces onsite will be monitored during dry periods to ensure water application is timely and effective. Visible signs of dust plumes will trigger an immediate response from onsite construction managers and field supervisors; and • Infill work areas will be monitored during dry-windy weather conditions. Visible signs of dust plumes will trigger an immediate response from onsite construction managers and field supervisors.	Y	NS
Operation	Emissions of Air Pollutants from Diesel Exhaust and Fugitive Dust (A)	• An Environmental Emergency Plan will detail contingency measures to be applied in case of failure of any of the facility's scrubbers; • Idling of vehicles and motorized equipment will be minimized; and • Shunting activities will be minimized where possible.	Y	NS

Project Component / Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effects (Y/N)	Significance Determination: Significant (S) or Not Significant (NS)
Acoustic Environment				
Construction	Nuisance due to elevated noise (A)	• The contractor will conduct construction activities between hours of 7:00 AM and 9:00 PM as per the City of Saint John Noise Bylaw. In the event that the contractor receives a variance from the City to conduct construction activities outside the 7:00 AM and 9:00 PM window additional noise abatement mitigations will be implemented. All construction activities conducted outside this window will also require approval from PotashCorp; • All vehicles and equipment will be maintained with appropriate mufflers and not permitted to idle for prolonged periods; • Equipment will be placed in engine enclosures and use intake silences and acoustic shielding, where appropriate; • Equipment power level will be appropriate for given task; • Stationary construction equipment to be located as far away from sensitive receptors as practicable; • Material storage areas will be strategically located; • Construction traffic in and around site will be limited, with reduced speed limits; • Compression braking by trucks not permitted; and • Construction tasks with elevated noise levels will be monitored to ensure noise compliance.	Y	NS
Operation	Nuisance due to elevated noise (A)	• Should operational noise levels be determined to be within the "High Impact" range of the FTA guidelines, additional noise abatement measures will be implemented.	Y	NS

Project Component / Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effects (Y/N)	Significance Determination: Significant (S) or Not Significant (NS)
Fish and Fish Habitat				
Construction	Impacts to water quality from access road construction (A)	• Contractor will prepare a site-specific Environmental Protection Plan detailing environmental protection measures for: - Sediment control measures including sediment control fences; and - Water quality monitoring plan detailing construction water quality sampling program. • Should TSS or turbidity approach thresholds based on CCME Water Quality Guidelines for the Protection of Aquatic Life, work will stop and additional sediment control measures will be implemented; • All construction equipment will operate from a dry platform or staging area; • Construction equipment with potential to become immersed in water will be cleaned and inspected to ensure it is free of marine growth; • The contractor will be required to work with the tidal cycles in order to conduct infilling activities in the dry where practical. The placement of material in water during the tide cycle will be permitted only if appropriate mitigate measures are in place and if conditions are such that the impacts to water quality are unlikely; • If a sediment plume is observed outside of the boundaries of the worksite during in water infilling, the contractor will be required to stop work and implement additional sediment control measure prior to continuation of in water infilling activities; • Infill Material will be free of excessive fines; and • Armour stone will be placed mechanical and not end dumped.	Y	NS
Construction	Impacts to sediment	• Contractor will prepare a site-specific Environmental Protection Plan detailing environmental protection measures for:	Y	NS

Project Component / Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effects (Y/N)	Significance Determination: Significant (S) or Not Significant (NS)
	quality from access road construction (A)	- Sediment control measures including and sediment control fences; and - A water quality monitoring plan detailing construction water quality sampling program. • Should TSS or turbidity approach thresholds based on CCME Water Quality Guidelines for the Protection of Aquatic Life, work will stop and additional sediment control measures will be implemented; • The contractor will be required to work with the tidal cycles in order to conduct infilling activities in the dry where practical. The placement of material in water during the tide cycle will be permitted only if appropriate mitigate measures are in place and if conditions are such that the impacts to water quality are unlikely; • If a sediment plume is observed outside of the boundaries of the worksite during in water infilling, the contractor will be required to stop work and implement additional sediment control measure prior to continuation of in water infilling activities; • Infill Material will be free of excessive fines; and • Armour stone will be placed mechanical and not end dumped.		
Construction	Impacts to fish habitat and fisheries from access road construction (A)	• A project offsetting the loss of CRA fisheries productivity will be completed. The impacts to CRA fisheries productivity will be quantified and an appropriate project will be undertaken following DFO approval; and • No construction activities that could impact fisheries productivity will occur prior to DFO approval of the offsetting project.	Y	NS
Operation	Impacts to water quality	• Brine discharge will not increase beyond existing volumes and salinity concentration will be monitored at the discharge point, as required by NBDELG.	N	NS

Project Component / Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effects (Y/N)	Significance Determination: Significant (S) or Not Significant (NS)
	from brine discharge (A)			
Marine Mammals				
Operation	Mortality or injury due to vessel collision, behavioural disruptions from marine traffic (A).	• Project-related vessel operators will be directed to review and comply with regulatory and legislative requirements outlined in the Notice to Mariners, as described in Chapter 3.	Y	NS
Vegetation and Wetlands				
Construction	Indirect disturbances to Courtenay Bay Marsh (A)	• Site-specific sediment and erosion control plan will be developed and adhered to; • Adhere to terms and conditions of the WAWA permit; • Contractor will prepare a site-specific Environmental Protection Plan detailing environmental protection measures for the containment of sediment, including sediment control fences; and • Adhere to mitigation described above under Introduction of Exotic Species.	N	NS
Construction	Loss of vegetation (A)	• Use existing disturbed areas and clearings for staging and laydown areas.	N	NS
Construction	Introduction of exotic species (A)	• Construction equipment will be cleaned and inspected to ensure it is free of vegetation prior to arriving at the construction site; • No equipment will enter the Courtenay Bay Marsh (except in emergency situations);	N	NS

Project Component / Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effects (Y/N)	Significance Determination: Significant (S) or Not Significant (NS)
		• Staging and laydown areas will be located away from water bodies and wetlands; and • Appropriate containment measures will be implemented if material is stockpiled at site.		
Birds				
Construction	Disturbance and habitat avoidance (A)	• Idling of vehicles and motorized equipment will be minimized; • Engine enclosures, mufflers, intake silencers and power appropriate for the task will be used for vehicles and equipment, as appropriate; • Vehicle speed limits will be reduced in construction zones; • Concentrations of seabirds, waterfowl or shorebirds will be avoided; and • Operating condition of all vehicles and motorized equipment will be maintained to ensure good performance.	Y	NS
Construction	Accidental mortality or destruction of nests (A)	• The contractor will conduct nest surveys during the breeding bird season (May 1 to August 15) in advance of infilling to identify the presence of migratory bird nests as part of the Environmental Monitoring Program during construction activities; • Should active nests be discovered, construction activities at the nest and adjacent vegetation will not occur until fledging is complete; • Concentrations of seabirds, waterfowl or shorebirds will be avoided; and • Vehicle speed limits will be reduced in construction zones.	N	NS
Construction of Access Road	Direct loss of foraging habitat (A)	• No mitigations are proposed for this potential effect.	Y	NS

Project Component / Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effects (Y/N)	Significance Determination: Significant (S) or Not Significant (NS)
Operation	Disturbance and habitat avoidance (A)	• Project-related vessel operators will be directed to review and comply with regulatory and legislative requirements outlined in the Notice to Mariners, as described in Chapter 3.	Y	NS
Transportation				
Construction	Delays and detours during Interchange construction (A)	• Road construction scheduling will be determined in consultation with the City, including time of day/year restrictions; and • Road construction best practices such as flagging, temporary signal lights and temporary traffic flow will be adhered to.	Y	NS
Operation	Reduction Crown Street traffic, improved traffic flow on Causeway, eliminated rail/truck traffic conflict (P)	• No mitigations are proposed for this potential effect.	Y	NS
Operation	Increase in truck and rail traffic levels (A), reduced rail/truck conflict (P)	• Project-related increase in traffic mitigated by diverting almost all existing PotashCorp traffic off of Crown Street.	Y	NS

Project Component / Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effects (Y/N)	Significance Determination: Significant (S) or Not Significant (NS)
Navigation				
Operation	Increased marine traffic and congestion (A)	• Project-related vessel operators will be directed to review and comply with SJPA Practices and Procedures (Port Authority Regulations, *Canada Marine Act*), and legislative and regulatory requirements outlined in the Notice to Mariners, described in Chapter 3; and • SJPA will be consulted regarding shipping schedules.	Y	NS
Operation	Damage to fishing gear (A)	• Project-related vessel operators will be directed to review and comply with SJPA Practices and Procedures (Port Authority Regulations, *Canada Marine Act*), and legislative and regulatory requirements outlined in the Notice to Mariners, described in Chapter 3; • Project-related vessel operators will be directed to avoid any observed fishing buoys; • SJPA will be consulted regarding shipping schedules; and • PotashCorp will coordinate with other harbour users including the Fundy North Fishermen's Association to resolve access issues through regularly scheduled Port Operations Committee meetings.	N	NS
Visual Aesthetics				
Construction	Decreased views of Courtenay Bay from Crown Street (A); Decreased visual extent of Courtenay	• A vegetation buffer will be provided between the infill area and residential dwellings.	Y	NS

Project Component / Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effects (Y/N)	Significance Determination: Significant (S) or Not Significant (NS)
	Bay from Courtenay Causeway (A).			
Socio-economic Environment				
Construction	Temporary increase in employment and revenue (P)	• No mitigations are proposed for this potential effect.	Y	NS
Operation	Increase in tax revenue and the addition of employment opportunities (P)	• No mitigations are proposed for this potential effect.	Y	NS
Archaeological Resources				
Construction	Destruction or concealment of existing archaeological resources (A)	• Five emergent posts from the remnants of Duke Street Wharf and remnants of Orange Street Wharf will be mapped precisely; • One of five emergent posts of Duke Street Wharf will be dated through dendrochronology; • Additional archaeological mitigations may be required depending on the results of Duke Street Wharf dating; • The contractor will be required to complete a site-specific Environmental Protection Plan to include a monitoring plan for archaeological resources during construction activities; and	N	NS

Project Component / Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Residual Environmental Effects (Y/N)	Significance Determination: Significant (S) or Not Significant (NS)
		• Should archaeological resources be encountered during excavation or infilling activities, work in the area will stop and the Archaeological Service Branch of the NB Department of Tourism, Heritage and Culture will be contacted for further archaeological mitigation.		

CHAPTER 8 CUMULATIVE EFFECTS ASSESSMENT

A cumulative effects assessment was undertaken to determine how the proposed Project activities may interact with past, current or proposed future activities within identified spatial and temporal boundaries. Cumulative effects can be defined as changes to the physical, biophysical, cultural and socio-economic environments which are caused by the additive combination of past, current and future activities. For example, a single project may not cause significant residual effects, but when the effects of the project are combined or "added" to the effects of another project or activity, the effects may be significant. Cumulative effects for the Project are assessed where:

- The Project is determined to have a residual environmental effect;
- There is overlap or interaction of environmental effects between the project and other activities; and
- It is reasonable to expect that the Project's contribution to cumulative environmental effects could affect the viability or sustainability of the VEC.

Only those VECs with a likely residual environmental effect were used to determine whether past, current or future activities have the potential to interact cumulatively with the proposed Project. Spatial and temporal boundaries are VEC-dependent and would not, therefore, interact cumulatively with projects beyond the boundaries as described in their respective VEC sections in Chapter 7.

8.1 Assessment of Potential Cumulative Interactions with Project VECs

The Saint John Harbour and its surrounding area is historically and currently significantly industrialized, and is a major shipping and delivery area for cargo and cruise ships. Given the industrial and commercial complexity of the Harbour, a list of major known potential past, current and future activities that may interact cumulatively with the Project is provided in Table 8.1, which also describes the potential cumulative interactions for each identified activity. Project VECs with the potential to interact with past, present or future activities are discussed in the following sections.

A significant cumulative adverse effect would be a residual effect caused by the proposed Project and a past, present or future activity which would cause an additive effect that would be considered significant as defined in Chapter 7 significance criteria section for each VEC.

Table 8.1: Past, Current and Future Activities and the Potential Cumulative Adverse or Positive Environmental Interactions with Project VECs

Other Past, Current and Future Activities and Project VEC Interaction	Project VECs							
	Air Quality	Acoustic Environment	Fish and Fish Habitat	Marine Mammals	Birds	Navigation	Transportation	Socio- Economic Environment
Past Projects/Activities								
Esso Marine Fueling Terminal	-	-	X	-	-	-	-	-
Current Projects/Activities								
Marine Shipping Terminals	-	-	-	X	X	X	-	-
Irving Oil Refinery	X	-	X	-	-	-	-	-
Canaport LNG Facility	X	-	-	X	X	X	-	-
Cruise Ships	-	-	-	X	X	X	-	-
Municipal Wastewater Discharge	-	-	X	-	-	-	-	-
Seasonal Maintenance Dredging	-	-	X	X	X	-	-	-
One Mile House Interchange	-	X	-	-	-	-	X	-
Irving Pulp and Paper	X		X	-	-	-	-	-
Moosehead Brewery	X	-	X	-	-	-	-	-
Digby Ferry Terminal	-	-		X	-	X	-	-
Irving Wall Board	X	-			-	X	-	-
Commercial Fisheries	-	-	X	X	-	X	-	-
Future Projects/Activities								
Canaport Energy East Marine Terminal	X	X	X	X	X	X	-	X
Irving Oil Company Limited: Eider Rock Petroleum Refinery	X	X	X	X	X	X	-	X
Fundy Quay Development	X	-	-	-	-	-	X	X
Seasonal Road Maintenance	-	X	-	-	-	-	X	X

'-' = no anticipated cumulative interaction with Project VEC; 'X' = Potential cumulative interaction with Project VEC

8.1.1 Air Quality

Air emissions generated from the proposed Project have the potential to have an adverse cumulative effect with the air emissions generated from the identified current and proposed future activities. There are a number of industrial and commercial facilities in Saint John and there are also several proposed facilities. All these facilities emit air emissions which have the potential to interact cumulatively with air emissions generated from the proposed Project.

The proposed Project has the potential to interact cumulatively with any other project impacting or proposing to impact air quality in the Saint John area. The NBDELG conducts regular ambient air quality monitoring on seven pollutants in and around the City of Saint John, carbon monoxide, nitrogen dioxide, sulphur dioxide, fine particulate matter, ground level ozone, total reduced sulphur , and volatile organic compounds. The NBDELG has standard guidelines to detect exceedances. Therefore, air quality is regularly monitored to identify exceedances within the Saint John Area. The mitigation measures described in Section 7.1.3, Air Quality VEC, will be implemented and will reduce the likelihood of significant adverse cumulative effects from occurring.

The residual cumulative effects of air emissions from the Project and current or future activities is not anticipated to be significant after the implementation of mitigation measures described in Chapter 7.

8.1.2 Acoustic Environment

Noise may have an adverse cumulative impact during the construction phase of the proposed Project when combined with the noises from other construction activities occurring simultaneously in the immediate vicinity. Seasonal municipal or provincial transportation construction projects would have the highest likelihood of occurring at the same time as the proposed Project. The operational phase of the Project may have a positive cumulative impact when combined with the One Mile House Interchange project by reducing vehicle traffic noise in uptown Saint John.

The mitigation measures described in Section 7.2.3, Acoustic Environment VEC, will be implemented and will reduce the likelihood of significant adverse cumulative effects from occurring. The following additional mitigation measure will be implemented to reduce the potential adverse cumulative impacts to noise during the construction phase:

- Consult with the City of Saint John and the NBDTI to determine construction schedules and plan to stagger constructions activities whenever practicable.

The residual cumulative effects to the acoustic environment are not anticipated to be significant with the implementation of mitigation measures identified above and in Chapter 7.

8.1.3 Fish and Fish Habitat

A loss of fish habitat from the proposed Project infilling has the potential to have adverse cumulative effects with similar future activities causing a loss of fish habitat in the Saint John Harbour. The construction of two other marine terminals is known to have been proposed for the Saint John Harbour (Table 8.1). These losses have the potential to have an additive adverse cumulative impact on fish habitat in the Harbour.

Decreased water quality from the proposed Project construction activities has the potential to interact cumulatively with identified past, present and future activities. Seasonal maintenance dredging in Courtenay Bay has the potential to temporarily increase sediment in the Harbour. If Courtenay Bay maintenance dredging activities occur simultaneously with the proposed Project, there is the potential for a temporary cumulative increase in turbidity in the Harbour. Discharge of municipal and industrial effluent into the Harbour has the potential to interact cumulatively with the Project-related effects on water quality.

The mitigation measures described in Section 7.3.3, Fish and Fish Habitat VEC, will be implemented and will reduce the likelihood of significant adverse cumulative effects from occurring. The residual cumulative effects to fish and fish habitat are not anticipated to be significant with the implementation of mitigation measures identified above and in Chapter 7.

8.1.4 Marine Mammals

An increase in noise and the risk of marine mammal collisions from shipping activities have the potential to have an adverse cumulative effect to marine mammals with identified similar current and future activities. Marine vessel traffic is anticipated to increase in the Harbour due to the proposed Canaport Energy East Marine Terminal and Eider Rock Marine Terminal. The additional noise caused by increased ship traffic has the potential to have an adverse cumulative effect to marine mammals, such as an increase in behavioural changes and stress. In addition, an increase in shipping traffic in the Harbour and the Bay of Fundy shipping lanes would increase the risk of marine mammal collisions which could have an adverse cumulative effect.

The mitigation measures described in Section 7.4.3, Marine Mammal VEC, will be implemented and will reduce the likelihood of significant adverse cumulative effects from occurring.

The residual cumulative effects to marine mammals are not anticipated to be significant with the implementation of mitigation measures identified in Chapter 7.

8.1.5 Birds

Disturbance, accidental mortality and loss of habitat either permanently or temporarily from the construction and operational Project activities have the potential to have an adverse cumulative interaction with similar identified current and future activities. The increased noise caused by anticipated additional ship traffic in the future has the potential to have an additive adverse cumulative effect to birds such as permanent displacement or overall decrease in diversity in the area. Future projects causing a permanent removal of foraging habitat have the potential to have an additive negative cumulative effect to bird populations and species diversity.

The mitigation measures described in Section 7.6.3, Bird VEC, will be implemented and will reduce the likelihood of significant adverse cumulative effects from occurring. The residual cumulative effects to birds are not anticipated to be significant with the implementation of mitigation measures identified in Chapter 7.

8.1.6 Transportation

A delay in truck traffic during construction has the potential to have an adverse cumulative effect with the identified current and future road construction and maintenance projects (see Table 8.1). Seasonal municipal or provincial transportation construction projects have the potential to increase traffic congestion. If these activities are conducted simultaneously with the proposed Project there is the potential for a temporary additive adverse cumulative effect.

The operational phase of the proposed Project has the potential to have a positive cumulative interaction with the One Mile House Interchange by improving traffic in uptown Saint John. Both projects are anticipated to improve traffic flow and congestion in uptown Saint John.

Project related rail traffic does not involve the transportation of dangerous goods and does not pose a significant risk to human and environmental health and safety. It is not anticipated to interact cumulatively with other rail traffic including a potential increase in future rail shipment of hydrocarbons.

The mitigation measures described in Section 7.7.3, Transportation VEC, will be implemented and will reduce the likelihood of significant adverse cumulative effects from occurring. In addition to the mitigation measures described in the Transportation VEC, the following mitigation measure will be implemented to reduce potential adverse cumulative impacts:

- Consult with the City of Saint John and the DTI to determine construction schedules and plan to stagger constructions activities whenever possible.

The residual cumulative effects to transportation are not anticipated to be significant with the implementation of mitigation measures identified above and in Chapter 7.

8.1.7 Navigation

The increase in marine vessel traffic from the proposed Project and any future increases in marine vessel traffic within the Harbour have the potential to have an additive cumulative increase to congestion and delays. The potential increase in marine traffic may also cause an additive cumulative effect to the access of fishing grounds and the destruction of fishing gear.

The mitigation measures described in Section 7.8.3, Navigation VEC, will be implemented and will reduce the likelihood of significant adverse cumulative effects from occurring including.

The residual cumulative effects to navigation are not anticipated to be significant with the implementation of mitigation measures identified in Chapter 7.

8.1.8 Socio-economic Environment

The construction phase of the proposed Project has the potential to have a positive cumulative effect with other future construction projects. The proposed Project will create a noticeable increase in jobs during the construction activities and may have a positive cumulative impact with seasonal construction activities related to current and future projects. Additional jobs created during the operational phase of the Project may also have a positive cumulative impact on the economy with other proposed Projects identified in Table 8.1.

The residual cumulative effects to the socio-economic environment are not anticipated to be significant.

Table 8.2: **Summary of the Cumulative Effects Assessment of the Project**

Project VEC	Potential Positive (P) or Adverse (A) Cumulative Environmental Effect	Mitigation	Residual Cumulative Environmental Effect (YES/NO)	Significant Cumulative Residual Effect Significant(S) Not Significant(NS)
Air Quality	Increased air emissions (A)	• The mitigation measures described in Section 7.1.3, Air Quality VEC.	Y	NS
Acoustic Environment	Increased noise during construction (A) Improved vehicle traffic noise in uptown Saint John (P)	• The mitigation measures described in Section 7.2.3, Acoustic Environment VEC; and • Consult with the City of Saint John and the NBDTI to determine construction schedules and plan to stagger constructions activities whenever possible.	Y	NS
Fish and Fish Habitat	Decreased water and sediment quality from sedimentation (A)	• The mitigation measures described in Section 7.3.3, Fish and Fish Habitat VEC.	Y	NS
Marine Mammals	Increased shipping noise (A) Increased risk of collisions (A)	• The mitigation measures described in Section 7.4.3, Marine Mammals VEC.	Y	NS
Birds	Disturbance, accidental mortality, tentative alteration of foraging habitat, permanent loss of habitat (A)	• The mitigation measures described in Section 7.6.3, Birds VEC.	Y	NS

Project VEC	Potential Positive (P) or Adverse (A) Cumulative Environmental Effect	Mitigation	Residual Cumulative Environmental Effect (YES/NO)	Significant Cumulative Residual Effect Significant(S) Not Significant(NS)
Transportation	Delay of traffic during construction (A) Improved traffic in uptown Saint John (P)	• The mitigation measures described in Section 7.7.3, Transportation VEC; and • Consult with the City of Saint John and NBDTI to determine construction schedules and plan to stagger constructions activities whenever possible.	Y	NS
Navigation	Increase in marine traffic (A)	• The mitigation measures described in Section 7.8.3, Navigation VEC.	Y	NS
Socio-economic Environment	Temporary increase in jobs during the construction phase (P) Increase in jobs during the operational phase (P)	• No mitigations proposed.	Y	NS

CHAPTER 9 ENVIRONMENTAL MONITORING PROGRAM

An environmental monitoring program including environmental effects and environmental compliance monitoring will be implemented during Project construction and operational activities. Environmental compliance monitoring will be used to determine if the Project-related adverse environmental effects are within acceptable regulatory and environmental protection design criteria. If environmental compliance monitoring determines that these criteria are being exceeded, appropriate regulatory agencies will be contacted and additional mitigations measures will be implemented. Environmental effects monitoring will be implemented to characterize residual adverse environmental effects on the receiving environment from Project-related activities.

Adaptive management principles will be incorporated into the environmental monitoring program and adaptive management criteria established. In general, adaptive management is a planned and systematic process for continuously improving environmental management practices by learning about their outcomes. Adaptive management provides flexibility to identify and implement new mitigation measures or to modify existing ones during the life of a project.

The following section details the minimum monitoring requirements for the proposed Project. Additional monitoring requirements may be determined through the regulatory approvals process.

9.1 Monitoring Requirements during Construction Activities

Environmental compliance monitoring requirements during construction activities will include the monitoring of noise emissions, air quality, marine mammals, birds and water quality. The compliance monitoring will also include identifying and resolving environmental issues observed by Project personnel on site and public complaints (both formal and informal). The contractor will advise PotashCorp and appropriate regulatory agencies if personnel observe an environmental issue or receive a complaint from a member of the public. Additional environmental protection measures will be applied if environmental issues are observed. The environmental compliance monitoring will include, but not be limited to, the following:

- Noise emissions will be observed on site during construction activities. Noise monitoring will be implemented during construction activities that have the potential to generate significant noise (i.e., infilling activities will be required to show regulatory compliance). The Contractor will be responsible for maintaining reasonable controls on excessive noise. The Environmental Monitor will be responsible for identifying and resolving noise issues, including public complaints about noise emissions;

- Air quality monitoring will be required during construction activities. The contractor will be required to detail air quality monitoring plans in their site-specific Environmental Protection Plan. The air quality monitoring will include, at a minimum, visual monitoring of fugitive dust emissions during dry windy conditions. Site personnel will report any observed excessive emissions from construction equipment or unusual strong odours. Any observed air quality issues and complaints (both formal and informal) will be reported to the PotashCorp and the NBDELG. If an issue is observed additional environmental protection measures will be applied;
- The contractor will conduct nest surveys during the breeding bird season (May 1 to August 15) in advance of the infilling into Courtenay Bay and construction activities that may disturb a nest to identify the presence of migratory bird nests as part of the Environmental Monitoring Program during construction activities. Upon discovery of an active nest, construction activities at the nest and adjacent vegetation will not occur until fledging is complete;
- The Project personnel will report the presence of birds located at the Project site. The Contractor will make an effort to avoid the disturbance of birds. The Contractor will report any negative interaction with or any accidental takes of migratory birds. If migratory birds are identified as being negatively affected by the Project, additional environmental protection measures will be implemented;
- Marine mammal observations will be conducted during shipping activities within the proximity of the Grand Manan conservation area between June 1 and December 31. If marine mammals are observed, shipping vessels will decrease speed to 10 knots and take evasive action if required; and
- A water quality monitoring program will be implemented during construction activities. The program will be designed to demonstrate compliance with the water quality provisions of the *Fisheries Act*. The program will include water quality sampling adjacent to construction activities and baseline sampling at a predetermined background location. Water quality sampling parameters will include TSS or turbidity. If water quality is elevated above background levels and exceeds thresholds based on the CCME Water Quality Guidelines for the Protection of Aquatic Life, work will stop and additional sediment control measures will be implemented.

9.2 Operational Monitoring Requirements

Selected components of the Project will have monitoring requirements during the operational phase. These monitoring requirements are discussed in the sections below.

9.2.1 CRA Fisheries Offsetting Monitoring Requirements

Preliminary discussions with DFO have identified that an offsetting (i.e., compensation) project could be required for the proposed impacts to CRA fisheries resulting from the proposed infilling for the Rail / Road Expansion. PotashCorp will be responsible for monitoring as per the conditions and specifications in the approval which will largely depend on the type of project(s) selected. Monitoring will be conducted to evaluate the increase in fisheries productivity and the success of the offsetting project. Results will be reported to DFO as per the requirements in the approval and decisions will be made by DFO in conjunction with PotashCorp as to whether or not changes or improvements will be required.

9.2.2 Brine Effluent Monitoring

Brine discharge will not increase beyond current discharge volumes. However, water quality monitoring will be required to satisfy the requirements of the approval for discharge from NBDELG, which limits the change in salinity at the discharge point. Monitoring will assess changes in salinity and results will be reported to NBDELG as per the requirements in the approval.

9.2.3 Air Quality Monitoring

NBDELG conducts regular ambient air quality monitoring on seven pollutants in and around the City of Saint John. There are a total of sixteen air quality monitoring sites located within the City. The Customs Building Monitoring Station is the closest monitoring site to the Project, located approximately 1 km away from the facility. This station monitors concentrations of carbon monoxide, sulfur dioxide, nitrogen dioxide and ozone (NBDELG, 2010). NBDELG has standard guidelines to detect exceedances at these stations. Historically, exceedances of hourly and 24-hour sulfur dioxide levels were reported at this station. These stations are anticipated to continue conducting air quality monitoring for the +30 year Project lifespan. Any acute air quality issues at the site will be reported to NBDELG for evaluation and further air quality protection measures may be required by NBDELG if identified issues cannot be resolved.

9.2.4 Saint John Harbour Environmental Monitoring

PotashCorp participates in the implementation of Saint John Harbour Environmental Monitoring as part of the Saint John Harbour Environmental Monitoring Network and will continue to participate in this initiative during operational activities. The Saint John Harbour Environmental Monitoring Framework is currently being developed by the Canadian Water Network and will involve monitoring marine sediment quality, marine invertebrates and fish. The results of the Saint John Harbour Monitoring will be used to assess the cumulative effects of industrial development within Saint John Harbour.

CHAPTER 10 CLOSURE

The services performed as described in this report were conducted in a manner consistent with the level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

This report provides a professional opinion and therefore no warranty is expressed, implied, or made as to the conclusions, advice, and recommendations offered in this report. This report does not provide a legal opinion regarding compliance with applicable laws. With respect to regulatory compliance issues, it should be noted that regulatory statutes and interpretation of regulatory statues are subject to change.

Please feel free to contact the undersigned at your convenience, if you have any questions or require additional information.

Yours truly,

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APPENDIX A

Design Drawings

APPENDIX B

Land-use and Socio-economic Study

APPENDIX C

Wetland Study

APPENDIX D

Environmental Emergency Plan

APPENDIX E

New Brunswick Species at Risk

APPENDIX F

ACCDC List of Species at Risk and Conservation Concern and Ranking Definitions

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Maritime Breeding Bird Atlas

APPENDIX H

Noise Assessment

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Geotechnical Report

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Marine Sediment Sampling Program

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Sediment Deposition Modeling Study

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Benthic Habitat Survey

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Air Quality