

WESTRIDGE MARINE TERMINAL ENVIRONMENTAL  
TECHNICAL REPORT

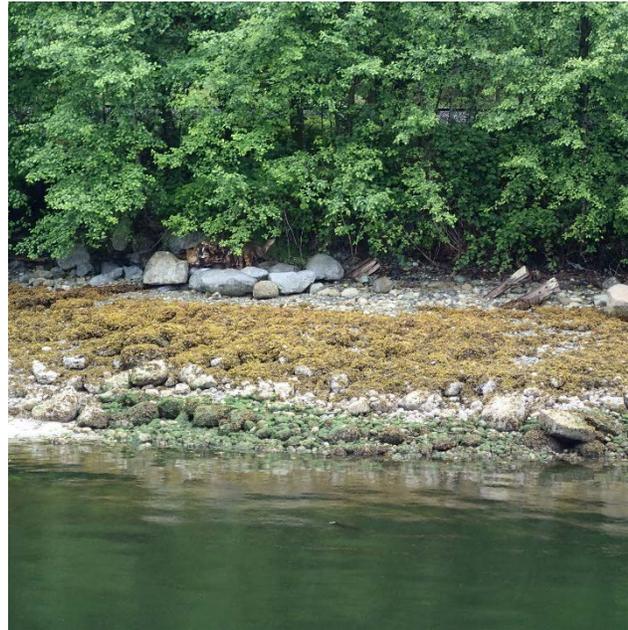
# WESTRIDGE MARINE TERMINAL UPGRADE AND EXPANSION PROJECT APPLICATION TO VANCOUVER FRASER PORT AUTHORITY



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# Acronyms and Abbreviations

AIS	Aquatic Invasive Species
BC	British Columbia
BC CDC	British Columbia Conservation Data Centre
BC MFLNRO	BC Ministry of Forests, Lands and Natural Resource Operations
BC MoE	British Columbia Ministry of Environment
BIEAP	Burrard Inlet Environmental Action Program
BMP	Best Management Practices
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DFO	Fisheries and Oceans Canada
EPP	Environmental Protection Plan
IAPP	Invasive Alien Plant Program
IBA	Important Bird Area
ISCMV	Invasive Species Council of Metro Vancouver
IVMP	Integrated Vegetation Management Plan
KMC	Kinder Morgan Canada
NEB	National Energy Board
RCA	Rockfish Conservation Area
SARA	Species at Risk Act
TERMPOL	Technical Review Process of Marine Terminal Systems and Transshipment Sites
TMEP/the Project	Trans Mountain Expansion Project
Trans Mountain	Trans Mountain Pipeline ULC
VFPA	Vancouver Fraser Port Authority
WMT	Westridge Marine Terminal
WVMP	Weed and Vegetation Management Plan

# Introduction

Trans Mountain Pipeline ULC (Trans Mountain) submitted a Facilities Application to the National Energy Board (NEB) in December 2013 for the Trans Mountain Expansion Project (the Project or TMEP). On November 29, 2016 the Government of Canada concluded the Project was in the public interest of Canada. A Certificate of Public Convenience and Necessity and other authorizations allowing the Project to proceed, subject to 157 conditions, was issued and became effective on December 1, 2016. As part of the Project, the Westridge Marine Terminal (WMT) will require expansion, including construction of three new loading berths within an expanded water lot and infilling along the existing shoreline to accommodate new onshore infrastructure. As a result of the Project, marine traffic volume calling at the WMT will increase, however, the types of vessels calling at the WMT (i.e., barges, Panamax and Aframax size tankers) will not change.

The purpose of this report is to support a Designated Project Application to the Vancouver Fraser Port Authority (VFPA), which is intended to cover several environmental components while other reports and drawings (found under separate cover) are necessary to complete the VFPA Permit Application. This report provides the environmental setting and results of Project-specific surveys associated with the increase in tanker traffic and expansion of WMT in VFPA jurisdiction. This report has been organised into sections that address specific VFPA requirements and is a summation of information gathered to date as part of the NEB Facilities Application and the Technical Review Process of Marine Terminal Systems and Transshipment Sites (TERMPOL) conducted by Trans Mountain for shipping activities under Transport Canada's jurisdiction.

The VFPA requirements addressed in this report include:

- Vegetation Plan
- Biophysical Survey
- Nesting Bird Report
- Species at Risk Assessment
- Invasive Species Assessment

This Environmental Technical Report should be read in conjunction with the Project Description of the VFPA Permit Application, which identifies potential residual effects related to expansion and operations of WMT and includes a Mitigation Summary.

# Vegetation Plan

The following subsections characterize and describe existing vegetation and related conditions and Project-specific surveys.

## 2.1 Topography

The WMT is located within the Georgia Depression Physiographic Region, which is characterized by a flat valley floor 1 km to 5 km wide, steep valley walls, gently rolling uplands, and ridges, gently rolling to flat lowlands of terraces and plains, and deltas (Armstrong 1984, Holland 1976).

The topography in the area of the WMT is sloping from south (high) to the north (low) toward Burrard Inlet and the elevation ranges from approximately 30 m to 0 m above sea level. Where activities are planned within the WMT, soils have been disturbed for industrial use and construction of the new infrastructure will be conducted within the boundaries of the existing terminal.

An offshore geophysical survey of WMT is provided in TR-3, Geotechnical Report, of the VFPA Permit Application. The existing seabed elevations in the area of the proposed new berths generally range from approximately - 16 m near the western end to approximately - 21 m near the eastern end, and rise to the existing shoreline near the southern end of the access jetty. Previous dredging (below-water excavation) operations were carried out at the existing berth and the surrounding area as indicated by the presence of a localized steeper submarine slope in the subject area.

## 2.2 Hydrology

No work at the WMT will occur within 30 m of any freshwater waterbodies and Project activities are not expected to affect surface freshwater. The facility is incorporated into the Kinder Morgan Canada (KMC) Groundwater Monitoring Program with a network of 18 wells monitored on a semi-annual basis. In addition, there are nine water extraction wells currently out of service pending decommissioning and removal. Groundwater at the WMT is not anticipated to be affected by the Project.

Activities in Burrard Inlet include vessel traffic, recreational boating, port facilities (petroleum products, bulk cargo, metal concentrates, coal, sulphur, sugar, wheat), Lions Gate Wastewater Treatment Plant effluent, and urban runoff. There are approximately 173 municipal storm water outfalls, 13 combined sanitary and storm water outfalls, several emergency sanitary system outfalls (for sanitary sewer overflows and lift station overflows), 31 British Columbia Ministry of Environment (BC MoE) permitted effluent outfalls for industries, and a number of oil interceptors. Numerous streams draining residential, commercial and industrial areas also enter Burrard Inlet.

Currents in most of Burrard Inlet range from 0.3 to 1 m/s (Nijman 1990). Currents are strongest in areas of constricted flow and at the outflows of large rivers. The WMT is located in a broad section of Burrard Inlet (Central Harbour) with no large river outflows nearby. Currents in the vicinity of the WMT are likely to be at the lower end of the 0.3 to 1 m/s range. The inner portions of Burrard Inlet are sheltered from prevailing winds and generally have limited fetch. Data on wave heights in Burrard Inlet are limited. Maximum wave heights in English Bay (off West Vancouver) were below 0.61 m 90% of the time during one year of monitoring (Thomson 1981). Given the more sheltered location of the terminal, wave heights in this area would be considerably lower than those measured in English Bay.

## 2.3 Soils

Activities on the VFPA lands at the WMT will be conducted within an existing fenced, industrial site. All soils to be disturbed on the VFPA lands at the WMT have been previously disturbed by industrial activity. Some topsoil/root zone material will be disturbed during construction activities.

## 2.4 Vegetation

Project activities on VFPA lands at the WMT involve clearing of some vegetation, however, the lands have been previously disturbed. A survey of vegetation was conducted on September 26, 2012 (Stantec 2013). Riparian habitats have been extensively modified by historical development activities, including the original construction of the WMT in 1954. Riparian vegetation on VFPA lands at the WMT is limited to a narrow fringe (approximately 2-4 m wide) of shrubs and low growing vegetation. A total of 26 vascular plant species were identified during the survey. The vegetation study identified two vegetation communities on the VFPA portion of the WMT. West of the dock is a tall shrub community. Common species here are red alder (*Alnus rubra*), salmonberry (*Rubus spectabilis*), Himalayan blackberry (*Rubus armeniacus*), Scotch broom (*Cytisus scoparius*), sword fern (*Polystichum munitum*), common horsetail (*Equisetum arvense*) and a grass (*Poaceae* sp). East of the dock is a low shrub community dominated by Himalayan blackberry and grass.

A second survey was conducted on December 13, 2016 to determine if any of the red alder on site are 10 m tall, the minimum standard to define a tree (British Columbia Ministry of Forests and Range, and British Columbia Ministry of Environment, 2010). It was observed that all red alder plants present are under 10 m tall (tall shrubs). Therefore, no trees will be cleared on VFPA lands as part of the Project.

Refer to the Species at Risk Assessment (Section 5) and Invasive Species Assessment (Section 6) in this report for further information on potential listed and invasive plant species.

### 2.4.1 Vegetation Mitigation Plan

The area of riparian vegetation that will be disturbed as a result of the terminal expansion is approximately 2,710 square metres (m<sup>2</sup>).

Following construction, vegetation mitigation measures will include the following two steps:

1. Revegetate the areas that will be disturbed during WMT expansion that will not be part of Terminal Operations.
2. Enhance existing riparian vegetation that is within the Terminal property boundary.

The proposed measures will restore 2,352 m<sup>2</sup> of riparian habitat at the WMT, which is a loss of 357 m<sup>2</sup> of riparian habitat at the Terminal.

Refer to Section 6.1 of this document for information on the Weed and Vegetation Management Plan, and the Riparian Habitat Mitigation Plan for more details about riparian vegetation disturbance and mitigation.

# Biophysical Survey

The following subsections characterize and describe existing biophysical conditions and related Project-specific surveys of marine fish and fish habitat, marine mammals and terrestrial wildlife and wildlife habitat. Vegetation, nesting birds, and species at risk are specifically addressed in Sections 2, 4 and 5, respectively. No work at WMT will occur within 30 m of any freshwater fish-bearing waterbodies and, therefore, detailed information on freshwater fish and fish habitat is not considered necessary. Potential effects and mitigation are identified in the Mitigation Summary in the Project Description of the VFPA Permit Application.

## 3.1 Marine Fish and Fish Habitat

At least 75 species of fish are known to use Burrard Inlet including a number of species targeted in commercial, recreational, and Aboriginal fisheries such as all five species of Pacific salmon, Pacific herring, anchovy, lingcod, copper rockfish, quillback rockfish, and kelp greenling (Hanrahan 1994 in Haggarty 2001, Renyard 1988).

Marine riparian, intertidal, and subtidal habitats are used by marine fish and invertebrates for spawning, rearing, migration, and foraging (Healey 1980, Lemieux et al. 2004, Levings and Jamieson 2001, Levings and Thom 1994).

Subtidal habitats of Burrard Inlet are dominated by soft, muddy substrates (BC Marine Conservation Analysis 2009, Burd 1990, Burd et al. 2008). Adult Pacific salmon have been observed to return to at least 17 streams in Burrard Inlet. Four populations of Pacific salmon have been designated as species of conservation concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), however, none of these populations spawn in streams entering Burrard Inlet (COSEWIC 2002a, 2003a, 2003b, 2006). Burrard Inlet has been identified as a Department of Fisheries and Oceans Canada (DFO) Important Area for Pacific salmon (Jamieson and Levesque 2012a, b).

Quillback rockfish and copper rockfish are the most likely rockfish species to occur in Burrard Inlet (Renyard 1988). The quillback rockfish has been designated as Threatened by COSEWIC but is not currently listed under the Species at Risk Act (SARA) (COSEWIC 2009). The copper rockfish has not been identified as a species of conservation concern. Three Rockfish Conservation Areas (RCAs) are located within the Port of Vancouver including Indian Arm – Crocker Island RCA, Indian Arm – Twin Islands RCA, and Eastern Burrard Inlet RCA. The WMT lies at the eastern edge of the Eastern Burrard Inlet RCA.

Dungeness crabs are common in Burrard Inlet and are expected to occur throughout the year (DFO 2012, Jamieson and Levesque 2012a, b). Several areas in eastern Burrard Inlet have been identified as DFO Important Areas for Dungeness crab, one of which is in the Project vicinity (Jamieson and Levesque 2012a, b).

A survey of intertidal habitat was conducted from August 18 to 19, 2012 in and around the WMT. The intertidal zone is dominated by coarse substrate types, particularly boulder and cobble rip rap. Two shore types were identified in the intertidal zone including man-made rock ramps and rock cliffs. A total of 17 marine invertebrate species and eight marine algae species were identified. The most common sessile invertebrate species were common acorn barnacles and blue mussels, and the most common motile invertebrate species were periwinkles and limpets. The most common algae species were rockweed, Turkish washcloth, and green ribbon.

A camera-mounted remotely-operated vehicle was used to survey subtidal habitat in and around the WMT from September 17 to 20, 2012. The substrate observed consisted almost entirely of soft bottom (silt, mud, sand) with traces of broken shells and wood debris. A small section of steeply-sloping riprap was identified inshore of the existing berth. A total of 32 species of fish and invertebrates were observed including eight species of arthropod, seven species of echinoderm, nine species of fish, four species of cnidarian, three species of mollusc, and one species of tunicate. The dominant invertebrate species include Dungeness crab, sunflower stars (*Pycnopodia helianthoides*), ochre stars (*Pisaster ochraceus*), giant plumose anemones (*Metridium farcimen*) and sea pens (*Ptilosarcus gurneyi*). Algal diversity was relatively low, with the majority of species occurring on the small section of rip rap. The dominant algal species include brown bladed algae (*Laminaria spp.*) and sea lettuce (*Ulva spp.*).

Several fish species were observed during the subtidal survey. Pricklebacks and flatfish were abundant on soft bottom habitat, and two sculpins were also observed. Flatfish were not identified to species level, but likely included English sole (*Parophrys vetulus*), rock sole (*Lepidopsetta bilineata*) and starry flounder (*Platichthys stellatus*) based on the known distributions and habitat requirements of flatfish in British Columbia (BC). Other fish that were not identified, but likely to be present in the area include gobies (*Gobiidae*) and ronquils (*Bathymasteridae*).

In the shallow rip rap sections and around pilings, several species of perch were observed, including shiner perch (*Cymatogaster aggregata*), pile perch (*Rhacochilis vacca*), kelp perch (*Brachyistius frenatus*) and striped perch (*Embiotoca lateralis*). Two lingcod were also observed in the rip rap habitat. Several small fish, likely juveniles, were also observed in the survey area. These fish could not be identified due to poor visibility and swift movement. Although rockfish and Pacific salmon were not observed in the survey area, both are known to utilize Burrard Inlet. Historically, Pacific herring, anchovy and eulachon (*Thaleichthys pacificus*) have also been documented in Burrard Inlet (Stacey 1995, Hay 1985, Pierson 2011); however, all three species have undergone drastic population declines in the region (Pierson 2011). Little information is available on eulachon in the area; however, the population is thought to be sparse in the Strait of Georgia (Hay 1985). The first herring spawning event in Burrard Inlet in many years occurred in False Creek in 2009 (Hume 2009); however, there are no recent records of herring spawning in the vicinity of the WMT.

## 3.2 Marine Mammals

Marine mammal diversity and abundance in Burrard Inlet is generally considered low. The most abundant and commonly observed species by far is the Pacific harbour seal, which is resident within the Inlet and throughout the coastal waters of BC (DFO 2010, Hanrahan 1994 in Haggarty 2001). Over the years, there have been occasional but rare sightings in Burrard Inlet of other marine mammal species such as Steller and California sea lions, northern fur seal and harbour porpoise (Marine Mammal Research Unit 2012). Killer whale, Pacific white-sided dolphin, false killer whale, grey whale, humpback whale, and minke whale have also made the occasional appearance in Burrard Inlet or nearby waters (BC Cetacean Sightings Network 2013), though their use of this habitat is limited and sightings are relatively uncommon.

No marine mammal field work was conducted for the Project, as available information suggests that aside from harbour seals, marine mammal diversity and abundance in Burrard Inlet is low.

Harbour seals use both aquatic and terrestrial environments and do not migrate but instead reside in BC's coastal waters and inlets year-round (Baird 2001, Bigg 1981, DFO 2010). They are likely the most commonly-sighted marine mammal in BC and prefer nearshore habitats including sounds, inlets, straits, marinas and harbours; they have also been known to occur in river estuaries (Baird 2001). Terrestrial haul out sites are used for resting, mating and pupping, and include isolated rocks or islets, sandbars, log booms, and recreational floats (Baird 2001).

No DFO Important Areas or critical habitat for marine mammal species at risk have been identified or designated in Burrard Inlet. Burrard Inlet is considered to have less common sightings of marine mammals relative to other areas in BC that have been identified as either DFO Important Areas or critical habitat, or that have been identified as concentration areas or important life history areas in: the scientific literature; DFO Recovery Strategies, Action Plans, or Management Plans; COSEWIC status reports; Canadian Science Advisory Secretariat reports; government, academic or marine research group reports and websites; and expert opinion.

### 3.3 Wildlife and Wildlife Habitat

The WMT is not located within a provincially identified wildlife area (BC MoE 2012, 2014). The WMT is located at the edge of the English Bay and Burrard Inlet Important Bird Area (IBA) (Bird Studies Canada and Nature Canada 2016), and in close proximity to the Burnaby Mountain Conservation Area and the Barnet Marine Park. These areas support a diversity of wildlife species. Within the boundary of the WMT no wetlands or watercourses occur to support breeding amphibians. The forested areas of the WMT provide suitable habitat for birds, and a bald eagle's nest has been identified. Bald eagles are yellow listed in BC meaning they are apparently secure and not at risk of extinction (BC Conservation Data Centre 2016), and are protected year-round by the BC Wildlife Act. Although the bald eagle nest will not be removed as a result of Project activity, construction at the WMT is anticipated to occur over an extended period, therefore a Nest Management Plan will be prepared to identify mitigation measures in consultation with BC Ministry of Forests, Lands and Natural Resource Operations (BC MFLNRO). The proposed expansion of the WMT will not require clearing of all forest cover within the terminal boundary, or expansion into the adjacent forest.

# Nesting Bird Report

The following subsection characterizes and describes existing conditions and related Project-specific surveys on nesting birds. Potential effects and mitigation are identified in the Mitigation Summary in the Project Description of the VFPA Permit Application.

## 4.1 Marine Birds

Information on marine birds and their habitat use was primarily derived from a review of relevant literature and databases from peer-reviewed journals, agency publications, technical reports (e.g., COSEWIC status reports), and local and regional data (e.g., Bird Studies Canada, BC Coastal Waterbird Survey, BC Marine Conservation Analysis Atlas, Project Feederwatch, Great Backyard Bird Count, eBird). Data from 45 years of North American Breeding Bird Survey data and 14 years of overwintering BC Coastal Waterbird Survey data, and two years of Burrard Inlet and Indian Arm Marine Bird Survey data were used to characterize marine bird habitat use in Burrard Inlet. Key sources include Birds of Burrard Inlet (Breault and Watts 1996, Burrard Inlet Environmental Action Program [BIEAP] 2002) and the IBA program coordinated by BirdLife International (2013).

Bald eagles are relatively abundant and nest in large mature trees at approximately 15 locations, with an average of 3.5 km between nests, along the shores of Burrard Inlet, Indian Arm, and Port Moody Arm. They have large home ranges and high nest site fidelity. It is suggested that they are a primary reason for the decline of some marine bird breeding colonies (Cook 2008) and despite increasing human disturbance, their numbers are increasing.

A great blue heron breeding colony has been active for many years in Stanley Park (187 breeding individuals recorded in 2007). A smaller colony was previously recorded along Heron Creek several kilometres upstream of the WMT near Cliff Avenue, Burnaby. On June 16, 2014, the area of Heron Creek was surveyed for the presence of great blue heron colonies. No active great blue heron colonies were found (refer to the response to City of Burnaby F-IR 1.27.08b [Filing ID A4F4Z7]).

Within Burrard Inlet, breeding colonies of pelagic cormorants have been identified at Second Narrows, Prospect Point, and occasionally the Burrard dry dock facility (Chatwin et al. 2002, Campbell et al. 1990, Hobson and Wilson 1985, Vermeer and Rankin 1984).

Glaucous-winged gulls nest on the roofs of buildings and the supports of the Ironworkers Memorial Second Narrows Crossing (Hobson and Wilson 1985, Vermeer et al. 1988). In Burrard Inlet, they are abundant and widespread in all seasons. The closest known colony to the Project footprint is to the east approximately 1 km from the WMT and located on the south shoreline at the entrance to Port Moody Arm.

Burrard Inlet is part of the English Bay and Burrard Inlet IBA (IBA020) (Bird Studies Canada and Nature Canada 2016, BirdLife International 2013). The IBA is globally important for western grebes, Barrow's goldeneye and surf scoter, and is nationally important for great blue heron (BIEAP 2002, BirdLife International 2013).

Tens of thousands of migratory birds stop in Burrard Inlet along the Pacific Flyway. Parks that border the Inlet include Indian Arm Provincial Park, Belcarra Regional Park and Stanley Park. There are extensive tidal flats, remnant mudflats and saltwater marshes at the Maplewood Conservation Area and in Port Moody Arm. Maplewood Flats, located approximately 4 km west across Burrard Inlet from the WMT, is regionally known for its importance as a conservation area for more than 200 species of aquatic and terrestrial birds including the rare passerine, purple martin, which nests in nestboxes installed on pilings offshore in the Inlet. Maplewood Flats has the largest area of tidal mudflats on the Lower Mainland's North Shore.

Bird abundance in Burrard Inlet has been recorded at more than 24,000 birds during the peak of spring migration (Breault and Watts 1996, BIEAP 2002). The marine areas of the Central Harbour typically have the greatest abundance of waterbirds within the Inlet. The highest diversity of species has been recorded at Port Moody, First Narrows and Second Narrows (Breault and Watts 1996).

Field studies were completed on October 17, 2012, and on January 16, April 9, and July 15, 2013. These surveys were intended to validate and/or update existing information on marine bird seasonal distribution and abundance in and around the WMT. Field studies included a structured shore-based survey at stationary points and were supplemented with incidental observations. A total of 405 individuals of 25 species were recorded during both 2012 and 2013 surveys. Species of concern observed were the Red-listed pelagic cormorant, and the following Blue-listed species: double-crested cormorant; surf scoter; California gull; and great blue heron (also listed in Schedule 1 of SARA as of Special Concern).

# Species at Risk Assessment

The following subsection identifies all federal and provincial listed species at risk associated with the proposed Project. A complete list of potential effects and mitigation is provided in the Mitigation Summary in the Project Description of the VFPA Permit Application.

## 5.1 Onshore Species

There are no known occurrences of provincially (British Columbia Conservation Data Centre [BC CDC]) or federally-listed (SARA or COSEWIC) plant species or rare ecological communities within the WMT (BC CDC 2016). Roell's brotherella moss (*Brotherella roellii*, S1S2 red-list [provincially imperiled], Endangered, [COSEWIC 2010]) and Washington springbeauty (*Claytonia washingtoniana*, S2 red-list [provincially imperiled]) are the listed plants known to occur close to the WMT location (BC CDC 2016). Roell's brotherella moss is found in the cool and humid environments of mixed deciduous and coniferous second-growth forests (BC MoE 2013); this habitat is not present on the VFPA lands. Early critical habitat for Roell's brotherella moss is over 1.5 km from the WMT location (Environment Canada 2014b and 2015). Washington springbeauty occurs on coastal bluffs and disturbed places associated with red alder and moss mats in boulder and cliffs of moist coastal forests (FNA 1993+). Although elements of these habitats are present on VFPA lands, they are deemed too modified to support this species.

A 2014 vegetation survey conducted in the forested lands to the south of the VFPA lands did not identify any provincially or federally-listed plant species or ecological communities within WMT property.

As noted in Section 3.3, a bald eagle's nest is located within the forested boundary of the WMT. Bald eagles are yellow listed in BC. Terrestrial wildlife species listed on Schedule 1 of SARA or red-listed in BC have not been identified at the WMT. Potential effects to species at risk (vegetation and terrestrial wildlife) are not expected since the WMT is an existing facility, all terrestrial work will occur within the existing fenced area, and clearing will not require removal of all forested areas within the terminal boundary.

## 5.2 Marine Species

There are two marine fish species of conservation concern that are likely to be found in vicinity to the WMT: quillback rockfish (Threatened, COSEWIC 2009); and spiny dogfish (Special Concern, COSEWIC 2011a). Yelloweye rockfish (Special Concern, COSEWIC 2008) may also occur within the Project vicinity at very low abundance.

Other fish species that are considered unlikely to occur near the Project but which have inferred ranges that overlap Burrard Inlet are: bluntnose sixgill shark (Special Concern, COSEWIC 2007; Special Concern under SARA, Environment Canada 2012), Bocaccio (Threatened, COSEWIC 2002b), green sturgeon (Special Concern, COSEWIC 2004), eulachon – Fraser River population (Endangered, COSEWIC 2011b), coho salmon – Interior Fraser population (Endangered, COSEWIC 2002a); and sockeye salmon – Cultus population (Endangered, COSEWIC 2003a).

The following SARA-listed marine mammal species may occasionally be observed in Burrard Inlet: Steller sea lion (Special Concern), harbour porpoise (Special Concern), southern resident killer whale (Endangered), Bigg's (previously transient) killer whale (Threatened), grey whale (Special Concern) and humpback whale (Threatened) (BC Cetacean Sightings Network 2013, Environment Canada 2012, Marine Mammal Research Unit 2012). Additionally, the northern fur seal is listed as Threatened by COSEWIC (Environment Canada 2012).

Based on a review of COSEWIC (2013), the federal SARA public registry list (Schedule 1) (Environment Canada 2012) and the BC CDC (2013) Red and Blue-lists, 21 marine bird species of conservation concern could occur seasonally within Burrard Inlet due to range overlap (including migration). Under the BC Wildlife Act, 17 of these species are designated as Blue-listed (Special Concern) and 4 are designated as Red-listed (Endangered or Threatened). Under SARA, four of these species are considered Threatened and four are of Special Concern.

There is currently no critical habitat identified for any SARA-listed marine bird species within the vicinity of the Project. The only SARA-listed species regularly occurring in the Project vicinity that has an existing recovery strategy or action plan is marbled murrelet. This recovery strategy identifies 14 threats to marbled murrelet, including three that are considered a high level of concern (Environment Canada 2014b). Three of the 14 threats are related to potential residual effects of the Project – chronic and acute oil spills (both medium), and disturbance from boat traffic (low). Potential residual effects will all be addressed through mitigation and monitoring for the Project (see the Project Description for more information on potential effects).

The NEB review has effectively addressed potential adverse effects of the Project on southern resident killer whale, including commitments that Trans Mountain has made to the Enhancing Cetacean Habitat and Observation Program through the VFPA.

# Invasive Species Assessment

The following subsections characterize and describe existing conditions, invasive species of concern, and related Project-specific surveys on terrestrial and aquatic invasive species. Potential effects and mitigation are identified in the Mitigation Summary in the Project Description of the VFPA Permit Application.

## 6.1 Terrestrial Invasive Species

In BC, Provincial Noxious weeds must be controlled in all regions and Regional Noxious weeds are controlled in the region(s) in which they are listed. There are many additional, non-listed species that are introduced in BC (i.e., non-native), including some agronomic and horticultural species, that can be invasive in certain land uses. Additional invasive non-native species of concern are identified through consultation.

Stakeholders, including attendees of the Burnaby Community Workshop and the Greater Vancouver Regional District represented by the Invasive Species Council of Metro Vancouver, were contacted regarding weeds of concern and the associated websites were consulted. These stakeholders expressed concerns regarding a number of native and non-native species along the Burnaby to Westridge segment of the pipeline, which ends at the WMT. The Provincial Noxious weeds of concern identified by stakeholders are listed in Table 6-1.

The Invasive Alien Plant Program (IAPP) database did not show any infestations of invasive plants on the WMT (BC MFLNRO 2016).

During the vegetation survey of the foreshore on September 26, 2012 three invasive plants of concern were observed: Scotch broom, Himalayan blackberry, and English ivy.

Offsite forested lands near the WMT to the south of the VPFA lands were surveyed for weeds on September 3, 2014. One patch of provincial Noxious weed, Japanese knotweed, was observed during the survey. Additional invasive plants of concern observed in the forested lands included: policeman's helmet, morning glory, and foxglove.

Japanese knotweed and foxglove are listed as Target Species to Contain by the Invasive Species Council of Metro Vancouver (ISCMV). Contain Species are species with a wide enough distribution that eradication is not likely but the species often occur in isolated sites. The management goal for these species is to prevent the establishment of new sites (ISCMV 2016). The remaining five weeds identified are listed by the ISCMV as Target Species to Control. Control Species are widespread throughout the region and eradication is very unlikely. Treatment of these species is typically limited to special areas, such as parks (ISCMV 2016).

Table 6-1. Provincial Noxious Weed Species Identified During Stakeholder Consultation for the Burnaby to Westridge Segment

Common Name <sup>1</sup>	Scientific Name <sup>1</sup>	Provincial Status	Observed in Proximity to the WMT
Bohemian knotweed	<i>Fallopia x bohemica</i>	Provincial Noxious	No
bur chervil	<i>Anthriscus caucalis</i>	Provincial Noxious	No
Canada thistle	<i>Cirsium arvense</i>	Provincial Noxious	No
common reed	<i>Phragmites australis ssp. australis</i>	Provincial Noxious	No
Crupina	<i>Crupina vulgaris</i>	Provincial Noxious	No
Dalmatian toadflax	<i>Linaria genistifolia ssp. dalmatica</i>	Provincial Noxious	No

Table 6-1. Provincial Noxious Weed Species Identified During Stakeholder Consultation for the Burnaby to Westridge Segment

Common Name <sup>1</sup>	Scientific Name <sup>1</sup>	Provincial Status	Observed in Proximity to the WMT
diffuse knapweed	<i>Centaurea diffusa</i>	Provincial Noxious	No
English cordgrass	<i>Spartina anglica</i>	Provincial Noxious	No
flowering-rush	<i>Butomus umbellatus</i>	Provincial Noxious	No
garlic mustard	<i>Alliaria petiolata</i>	Provincial Noxious	No
giant hogweed	<i>Heracleum mantegazzianum</i>	Provincial Noxious	No
giant knotweed	<i>Fallopia sachalinensis</i>	Provincial Noxious	No
Gorse	<i>Ulex europaeus</i>	Provincial Noxious	No
Himalayan knotweed	<i>Persicaria wallichii</i> ( <i>Polygonum</i> )	Provincial Noxious	No
Japanese knotweed	<i>Fallopia japonica</i>	Provincial Noxious	Yes
leafy spurge	<i>Euphorbia esula</i>	Provincial Noxious	No
milk thistle	<i>Silybum marianum</i>	Provincial Noxious	No
scentless mayweed	<i>Tripleurospermum inodorum</i>	Provincial Noxious	No
spotted knapweed	<i>Centaurea stoebe ssp.</i> <i>micranthos</i>	Provincial Noxious	No
tansy ragwort	<i>Senecio jacobaea</i>	Provincial Noxious	No
yellow iris (yellow flag iris)	<i>Iris pseudacorus</i>	Provincial Noxious	No
yellow starthistle	<i>Centaurea solstitialis</i>	Provincial Noxious	No

Table Note:

<sup>1</sup> Species nomenclature is determined according to the BC Species and Ecosystem Explorer (BC CDC 2016). Where the BC Weed Control Act nomenclature differs, the Weed Control Act name for the species has been provided in brackets following the BC CDC name. Where no species nomenclature is available from the BC Species and Ecosystem Explorer, only the BC Weed Control Act name is provided.

The Weed and Vegetation Management Plan (WVMP) (Volume 6 of the Environmental Plans) provides details on invasive species management and mitigation measures. An invasive plant treatment program will occur, pre to post-construction. The WMT Environmental Protection Plan (EPP) (NEB Condition 81) includes measures for weed and vegetation management related to the expansion of WMT. These documents address mitigation and treatment of invasive species of concern on the VFPA lands at the WMT such as Himalayan blackberry and Scotch broom. Japanese knotweed in particular is a special management invasive plant species. In the event this plant is observed on the VFPA lands specific mitigation is provided in the WVMP. Both the WMT EPP and the WVMP are included with this report.

Trans Mountain manages invasive plants according to the principles and best management practices (BMPs) documented in the WVMP and the KMC Integrated Vegetation Management Plan (IVMP) (KMC 2016). The IVMP applies to Trans Mountain pipelines and facilities and outlines the process and methods for invasive plant and vegetation management. The IVMP describes an adaptive management process that uses several vegetation control methods in a cost effective and responsible manner. Program goals are to reduce the use of herbicides, promote healthy ecosystems, provide measurable results and facilitate better management of invasive plants. Trans Mountain will utilize the KMC IVMP practices by incorporating non-chemical, cultural, and chemical techniques for invasive plant management.

## 6.2 Aquatic Invasive Species

Aquatic invasive species (AIS) are non-native aquatic species that are intentionally or unintentionally introduced to Canadian waters by human activity and whose introduction will likely cause damage to the ecosystem, existing species, the economy, or human well-being (Johannessen and McCarter 2010). The main pathways through which AIS species enter and spread through Canadian waters include shipping, recreational and commercial boating, the use of live bait, the aquarium/water garden trade, live food fish, unauthorized introductions and transfers, and canals and water diversions (DFO 2013). Ballast water in ships is considered to be the single greatest source of new AIS (DFO 2013).

Ballast water is brought on board a vessel to increase the draft, change the trim, regulate the stability, or to maintain stress loads within acceptable limits (Transport Canada 2010). Ballast water that is pumped into vessels in foreign ports can contain foreign aquatic organisms. Although grates or mesh installed on ballast water intakes prevent larger objects or organisms from entering the ship's hull while ballast water is pumped into the ballast tanks or cargo holds, they do not screen out smaller organisms such as bacteria and microscopic algae, or plants and animals (Transport Canada 2010). Aquatic organisms taken up in ballast water at one port of call may be released at another port of call during ballast exchange where they can spread and become established.

There are at least 89 non-native species in the Strait of Georgia, representing nearly three times the number of non-native species in other parts of coastal BC (Johannessen and McCarter 2010). According to Johannessen and McCarter (2010), the number of non-native species reported in the Strait of Georgia has increased 40-fold over the last century; although they note that this increase is likely due in part to increased awareness and surveillance and the resolution of long-standing taxonomic issues.

Aquaculture, estuarine circulation patterns, and international shipping have been identified as the main pathways of introduction in the Strait of Georgia (Gillespie 2007, Johannessen and McCarter 2010, Levings et al. 2002). Along the BC coast, the Japanese mahogany clam (*Nuttallia obscurata*) and dinoflagellates of the genus *Alexandrium* are thought to have been introduced in ballast water (Rankin et al. 2004, Transport Canada 2010). To date, no detrimental effects from non-native species in the Strait of Georgia have been identified (Johannessen and McCarter 2010, Levings et al. 2002).

The most effective way to mitigate the introduction of AIS is to regulate and manage pathways of introduction (DFO 2013). In Canadian waters, the release of ballast water is regulated by the Ballast Water Control and Management Regulations (Ballast Water Regulations) pursuant to subsection 35(1) and section 190 of the Canada Shipping Act. According to Transport Canada (2012), the purpose of the Ballast Water Regulations is to protect waters under Canadian jurisdiction from non-indigenous aquatic organisms and pathogens that can be harmful to ecosystems. The Ballast Water Regulations minimize the probability of future introductions of harmful aquatic organisms and pathogens from ships' ballast water while protecting the safety of ships. Ballast water is considered managed if it is exchanged, treated, transferred to a reception facility once sediment has settled into tanks, or retained onboard the vessel (Transport Canada 2012). The Ballast Water Regulations outline a number of mandatory ballast water management procedures related to ballast water management plans, ballast water exchange and treatment, reporting requirements, compliance and enforcement, and research.

The Ballast Water Regulations also establish reporting requirements for ship operators. The Master of a ship destined for a Canadian port must complete a ballast water reporting form and send it to Transport Canada as soon as possible after a management process is performed (Transport Canada 2012). If a ship is unable to comply with the legislation prior to entering Canadian water, they are required to notify Transport Canada at least 96 hours before entry into Canada's territorial sea and provide an explanation as to the inability to carry out exchange, and what equivalent process the ship intends to carry out to minimize the threat of introduction of AIS (Transport Canada 2012).

# Conclusion

As part of TMEP, the WMT will require expansion, including construction of three new loading berths within an expanded water lot and infilling along the existing shoreline to accommodate new onshore infrastructure. As a result of the Project, marine traffic volume calling at the WMT will increase, however, the types of vessels calling at the WMT (i.e., barges, Panamax and Aframax size tankers) will not change.

This report provides background information required by VFPA in the Vegetation Plan, the Biophysical Survey, the Nesting Bird Report, the Species at Risk Assessment and the Invasive Species Assessment. In general, the WMT environment is disturbed, (as the WMT has been in service since 1956.

The impact assessment related to the reports found in this document, where required by the VFPA, can be found in the Mitigation Summary located in the Project Description in the VFPA Permit Application under separate cover.

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