

# Existing Ecological Conditions at Proposed Point Grey Tidal Marsh Project PMV Habitat Enhancement Program

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## **1.0 INTRODUCTION**

The proposed Point Grey Tidal Marsh Creation Project (the Project) in the City of Vancouver, BC, is being considered as a potential project under Port Metro Vancouver's (PMV's) Habitat Enhancement Program. Project planning is being undertaken in accordance with the "Working Agreement Concerning Procedures for Development and Operation of the Port Metro Vancouver Habitat Bank" (2012) between Fisheries and Oceans Canada (DFO) and PMV.

The objective of this assessment was to document the existing ecological features and potential species use of the proposed Point Grey Project Site (the Site) on the North Arm of the Fraser River. General ecosystem conditions and occurrences of species of management concern will inform Project design and construction mitigation at the site.

### **1.1 RATIONALE**

As part of the Habitat Enhancement Program, PMV is applying a landscape approach to identify locations where the productivity of fish habitat can be increased; existing habitat can be enhanced to increase its productivity; or degraded habitat can be restored to benefit fish and wildlife species utilizing the lower Fraser River Estuary and Burrard Inlet.

The Project is located within the "Fraser Estuary, Boundary Bay, Burrard Inlet, Fraser and North Arms" Geographic Service Area (GSA). More than 70% of the original estuarine wetland habitats in this GSA have been adversely affected by historic development (Anon. 1978). PMV is placing a priority on fish habitat enhancement and marsh restoration when seeking restoration and enhancement opportunities in this GSA. The final site selection for this Project was based on factors including: need; habitat productivity; site location; feasibility and cost; sustainable habitat creation; ownership and tenure; and consideration towards First Nations and communities.

Conversion of an intertidal mudflat previously used for industrial log storage, to brackish tidal marsh at this site will increase the productivity of the North Arm Fraser River and provide high-quality habitat at a prime estuarine location for juvenile salmonids, other fish species, birds and wildlife utilizing the Fraser River.

Information considered during preparation of this report included:

- A review of current and historical aerial photographs;
- Field reconnaissance information (May/August 2013); and,
- Desktop study and background research.

## 2.0 PROJECT LOCATION

The Project site is located on the right bank of the North Arm Fraser River near the City of Vancouver. The Site is approximately 1500 m downstream of the Musqueam Indian Band (MIB) Cultural Pavilion and immediately downslope (south) of Pacific Spirit Regional Park. (**Figure 1** and **Figure 2**). The Site is untitled Provincial crown land and is currently administered by PMV under its Head Lease with the Province.

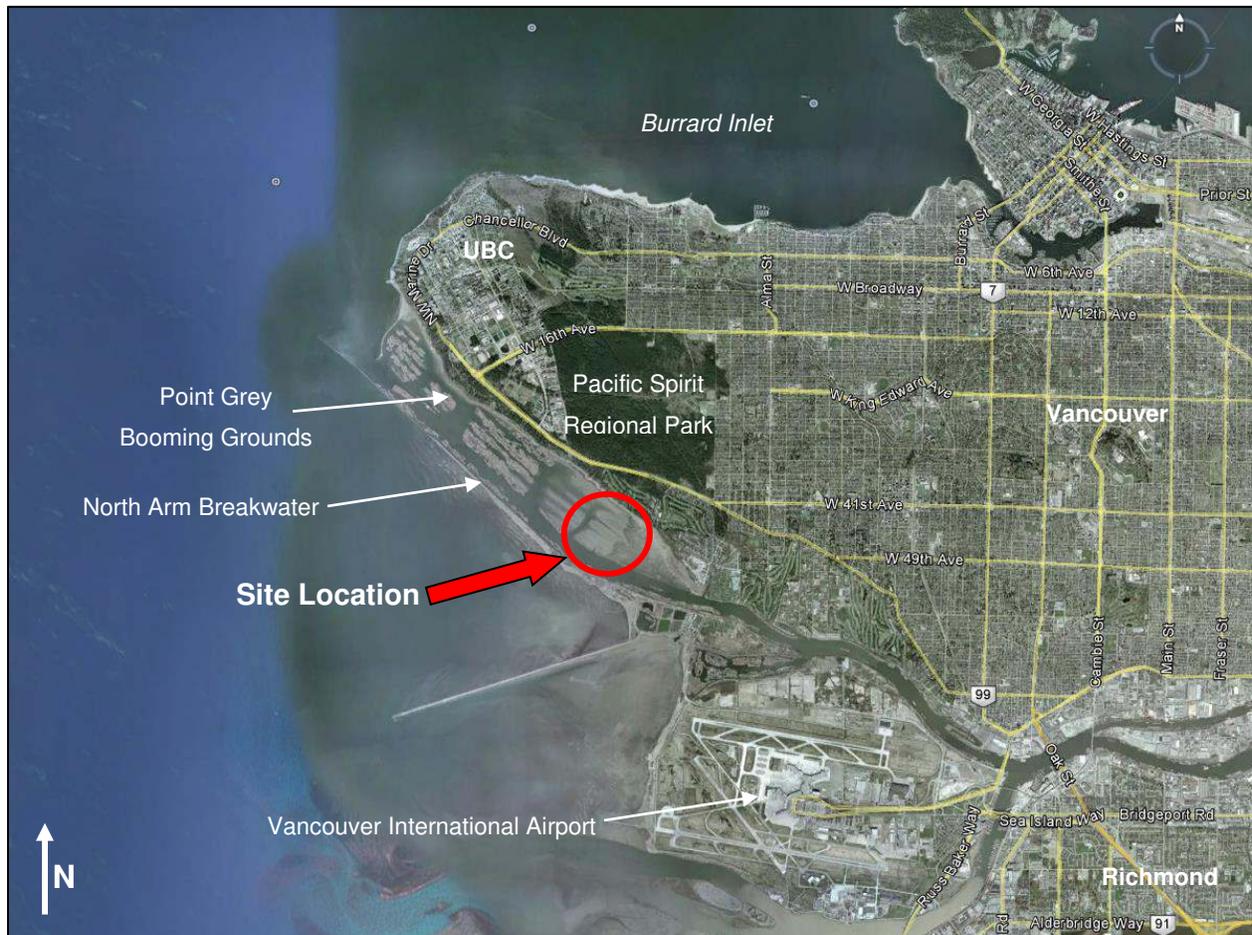


Figure 1 Point Grey Tidal Marsh Creation Project Site – Regional Setting (Google Earth Maps)



Figure 2 Point Grey Tidal Marsh Creation Project Site – Site Location (Google Earth Maps)

## **3.0 PROPOSED PROJECT**

### **3.1 SITE HISTORY**

As early as 1910, the Point Grey area was selected as the site for the University of British Columbia campus, with the Point Grey campus officially opening in 1925 ([http://www.library.ubc.ca/archives/hist\\_ubc.html](http://www.library.ubc.ca/archives/hist_ubc.html)).

The North Arm of the Fraser River, including the Project Site below Point Grey Bluffs, has historically been a log storage centre for the south coast of BC. To protect stored booms, the North Arm Breakwater was installed in 1953, and was improved and extended in 1979 and 1987. Logs are stored near freshwater flows to reduce infestations of marine borers (Sedell et al, 1991). The tidal flat elevation at the Project Site has reduced the usability for log storage; the Project Site has not been in active use since the late 1980's and the area exhibits accumulations of wood waste and remnant dolphins. However, active log storage is still occurs at Point Grey West Booming Grounds, downstream of the Project Site.

Immediately upstream of the Project Site, a tidal brackish marsh encompassing approximately 72 ha is present. Historical aerial photographs of the area suggest that the tidal marsh area was used as a log storage site until at least 1954 and existed as an unvegetated tidal flat until at least 1964 (**Appendix A: Aerial Photography Review**).

Upslope of the project site, the former University Endowment Lands were transferred to the Greater Vancouver Regional District in 1989 and designated as Pacific Spirit Regional Park.

### **3.2 PROPOSED WORKS**

The Project proposes to convert existing intertidal mudflats to productive intertidal brackish marsh. The Project Site is approximately 725 m long and 500 m wide located on the eastern (upstream) end of the Point Grey log storage grounds on the North Arm Fraser River. The area available for habitat enhancement is approximately 411,000 m<sup>2</sup> (41.1 ha).

The existing mudflat is largely exposed at low tide, except for a few deep channels that have formed throughout the area as a result of former log storage activities. The proposed design would involve fill placement over the existing silt and wood waste, followed by site vegetation either through transplantation, natural spread or other means. These enhancement works would result in an intertidal brackish marsh similar to the existing marsh immediately upstream of the Project Site.

The maximum length of the created marsh will be approximately 800 m. The length (at a northwest orientation) of the adjacent existing marsh to the east combined with the new created marsh will be approximately 2 km for a combined marsh surface area of approximately 112 ha (**Figure 3**). The estimated total surface area of created marsh habitat will be approximately 411,000 m<sup>2</sup> (41.1 ha).



**Figure 3 Point Grey Tidal Marsh Creation Project Site A) Existing Site Conditions, B) Rendering of Proposed Conditions**

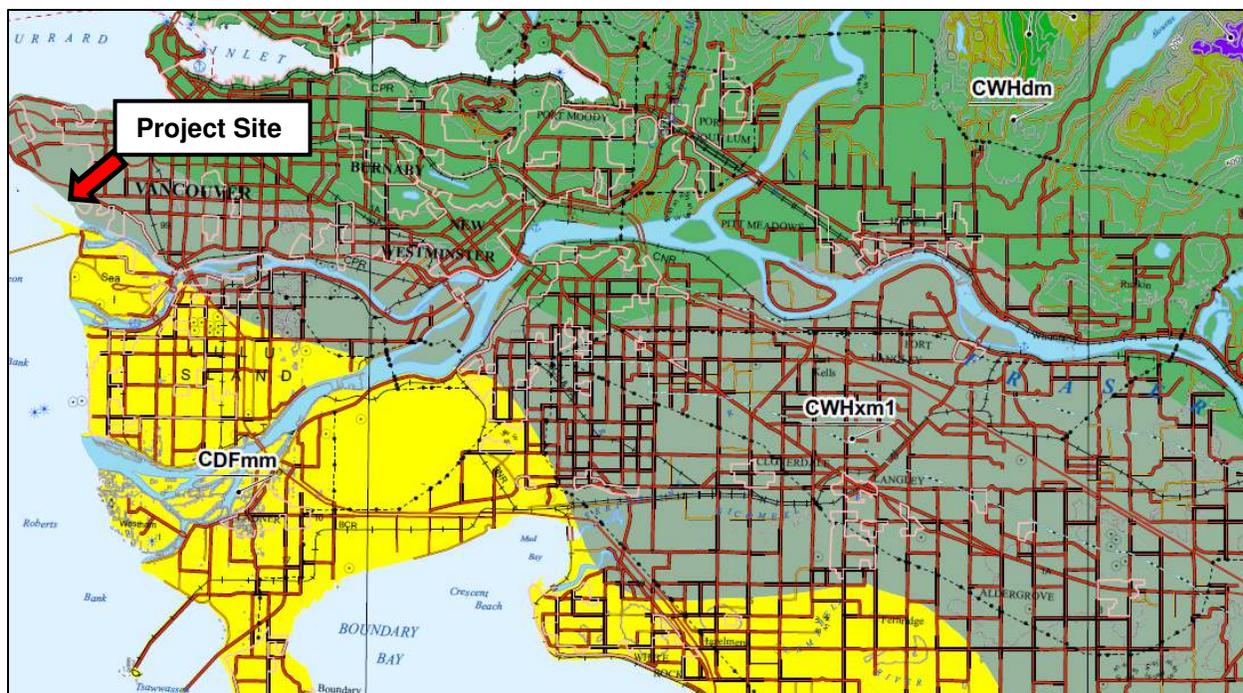
## 4.0 BIOPHYSICAL CONDITIONS

Information related to the biophysical conditions of the Project Site was obtained from the following sources:

- Online Sensitive Habitat Inventory and Mapping database (SHIM 2013);
- Online Fraser River Estuary Management Program & Burrard Inlet Environmental Action Program Habitat Atlas database (FREMP 2013);
- Online Fisheries Information Summary System database (FISS 2013);
- Online E-fauna BC database (Klinkenberg, 2013)
- Online VanMap database (City of Vancouver 2013);
- Online BC Species and Ecosystems Explorer database (BC Ministry of Environment 2013);
- Online iMap database (iMap 2013);
- Aerial photographs; and
- Field reconnaissance.

### 4.1 GENERAL SITE DESCRIPTION

The Project Site occurs within the Very Dry Maritime Coastal Western Hemlock (CWHxm1) biogeoclimatic subzone (SHIM 2013; Government of BC 2012; **Figure 4**). The CWHxm1 subzone occurs at lower elevations (0-700 m) and in the Lower Mainland extends up the south side of the Fraser River from Delta to Chilliwack (Pojar et al. 1991). The Site is also located in close proximity to the Coastal Douglas-fir Moist Maritime (CDFmm) biogeoclimatic subzone (SHIM 2013; **Figure 4**).



**Figure 4 Biogeoclimatic Subzones of Metro Vancouver. Project Site is in the Coastal Western Hemlock (CWHxm1) Subzone (Government of BC 2012).**

The Project Site is located on intertidal land immediately south of the Shaughnessy Golf and Country Club which operates on land owned by MIB. The MIB hold land to the north and east of the Project Site in nearby upland areas. Within the past 15 years, efforts to preserve, protect and rehabilitate this area, including the foreshore, have been led by the Musqueam Ecosystem Conservation Society in partnership with MIB. A small portion of the upland area downstream (northwest) of the Project Site, is part of Pacific Spirit Regional Park managed by Metro Vancouver (BC Ministry of Environment 2009; **Figure 5**) (Metro Vancouver 2011). Pacific Spirit Regional Park was formerly Ecological Reserve #74, established, in part, to protect a great blue heron rookery ([http://ecoreserves.bc.ca/portfolio\\_item/074-ubc-endowment-lands/](http://ecoreserves.bc.ca/portfolio_item/074-ubc-endowment-lands/)).

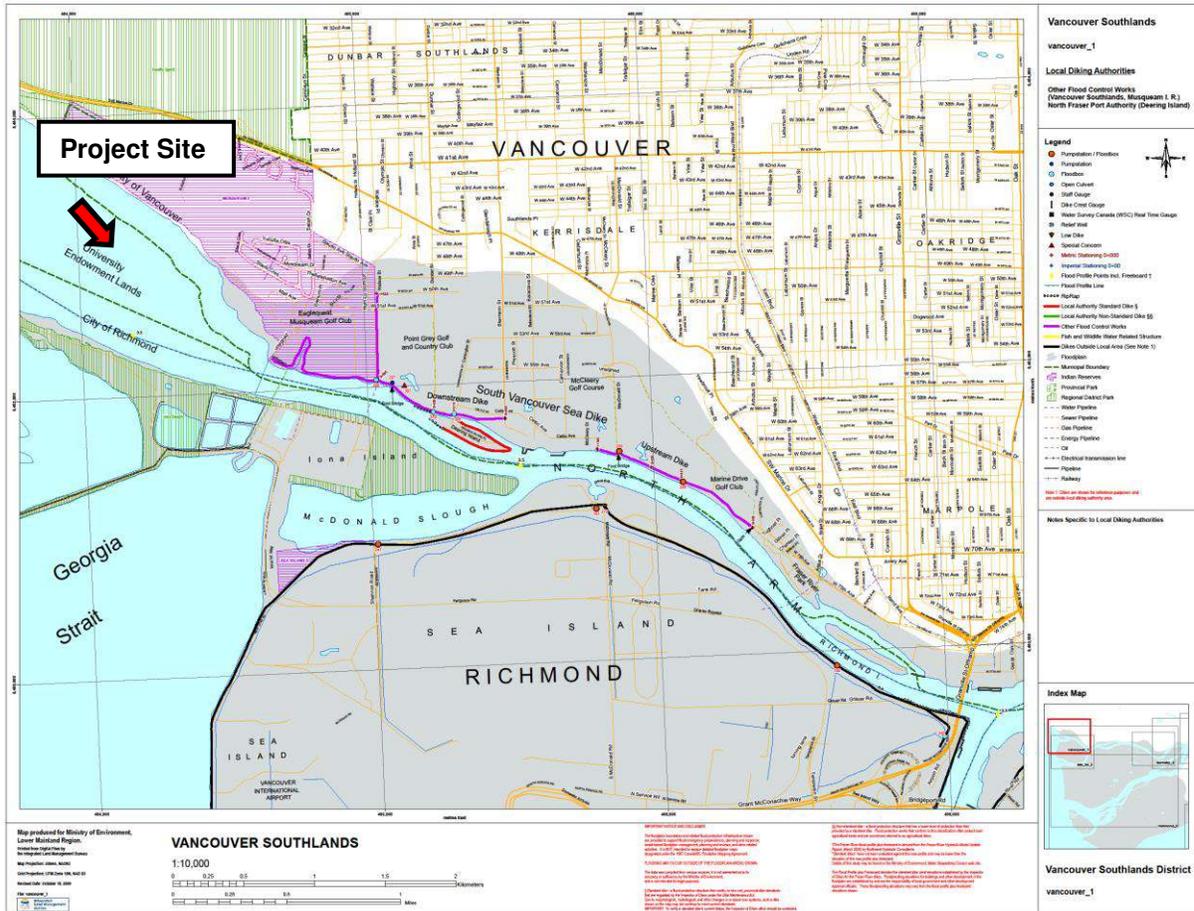


Figure 5 Flood Zone Map and Parks near Project Site (BC Ministry of Environment 2009)

## 4.2 PHYSICAL CHARACTERISTICS

### 4.2.1 Existing Conditions

The Project Site is a large intertidal mudflat with elevations ranging from -1.0m to 0m geodetic. Surface sediments across the Site are predominantly silt/mud/clay (<0.0625 mm) (Hemmera 2014; **Figure 6**). This area sustains relatively sparse vegetation except immediately outside of Site boundaries which sustain intertidal brackish marsh habitats. Large dolphins and abandoned logs are scattered throughout the Project Site (**Photo 1**). In low elevation areas there are deep troughs, or drainage channels (Hemmera 2014). These branching dendritic channels bisect the Project Site, flowing westward from the existing marsh. In the higher ridges between these channels woody debris is evident on the surface and below the surface of the tidal flat (**Figure 6; Photo 2**; Hemmera 2014).

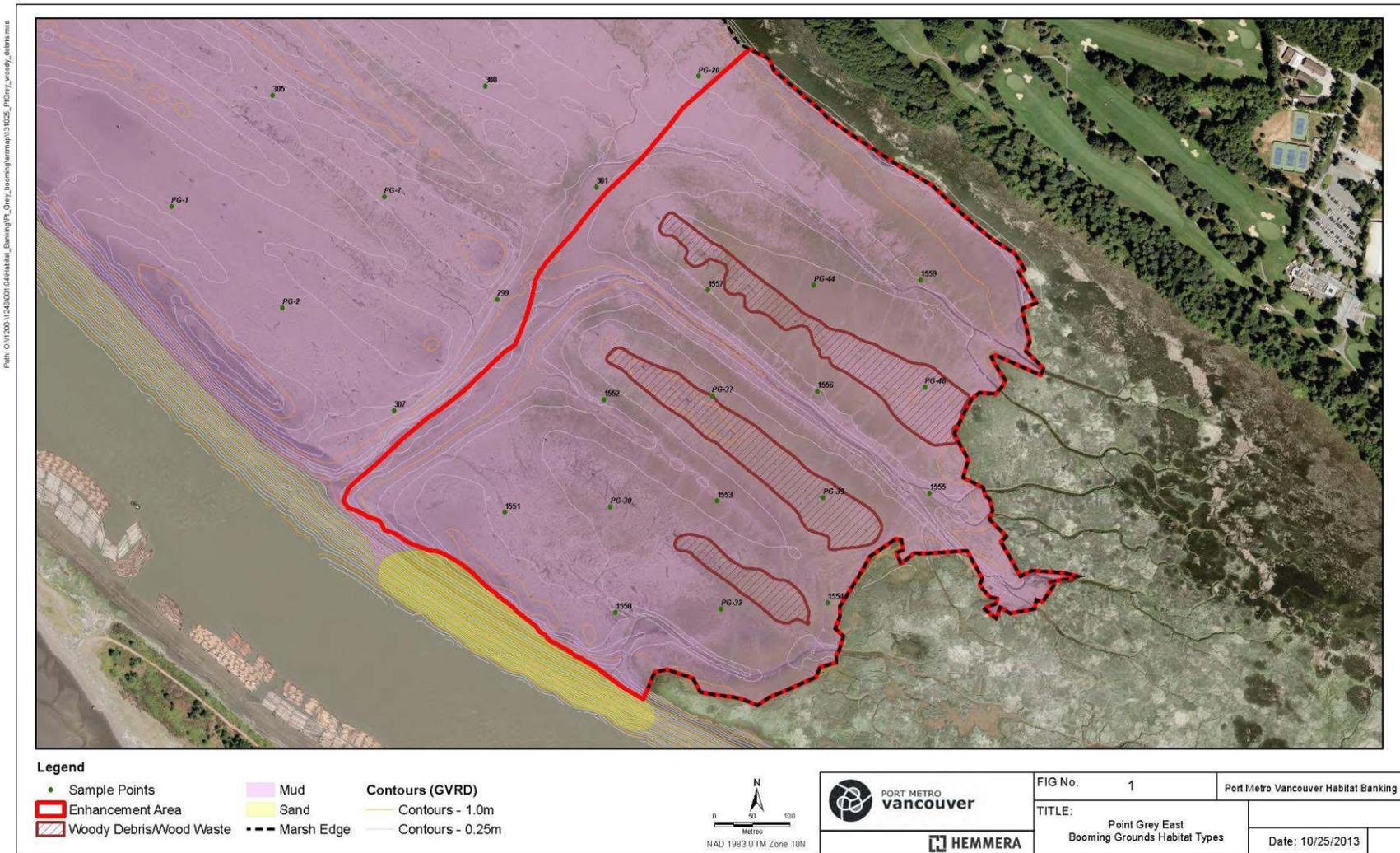


Figure 6 Physical Properties of Point Grey East Booming Grounds, Vancouver, BC



**Photo 1** Wooden Dolphins and Woody Debris at Point Grey Project Site



**Photo 2** Representative Photo of Point Grey Study Area (downstream view)

## 4.2.2 Post-Enhancement Conditions

Following enhancement works, marsh elevation will be raised to 0.3m GD. The introduction of fill will function as a cap for the existing wood waste which has persisted since the cessation of log storage in the late 1980's. The cap will provide for marsh vegetation growth at elevations similar to adjacent intertidal marshes. The introduction of marsh vegetation (either through transplants or natural spread) including Lyngbye's sedge (*Carex lyngbyei*) and American bulrush (*Schoenoplectus pungens*) will add above and below ground physical structure to the site. Depending on project needs, construction methods and the outcome of consultation, dolphins will either be left in place or removed.

## 4.3 HABITAT

### 4.3.1 Habitat Classification

The Fraser River Estuary Management Program (FREMP) classified shorelines within the Fraser River estuary on the basis of the relative values of their habitat features (FREMP 2002). FREMP's shoreline classification system was created from an inventory of habitat types in the estuary, including features such as mudflats, marshes, and riparian habitats. FREMP habitat classifications included:

- Red (High Productivity) habitats include productive and diverse habitat features that support critical fish and wildlife functions on-site or as part of a more regional context and/or areas where habitat compensation has been previously constructed to offset habitat losses.
- Yellow (Moderate Productivity) habitats include habitat features that are of moderate value in structure or diversity due to existing conditions (e.g., surrounding land uses or productivity) and support moderate fish and wildlife functions.
- Green (Low Productivity) habitats include areas where habitat features and functions are limited due to existing conditions (e.g., developed for port or other urbanized uses) (FREMP 2002).

The FREMP habitat classification at the Project Site is Red (**Figure 7**). High marsh and intertidal brackish marsh along the site margins contribute to this coding. Intertidal mudflats are also a contributing factor, however, the presence of large accumulations of wood waste makes the site a prime candidate for habitat enhancement and restoration.



**Figure 7 FREMP Habitat Classification at and near the Point Grey Project Site, Vancouver, BC (FREMP 2013)**

#### 4.3.2 Fish and Wildlife Habitat

##### 4.3.2.1 Existing Habitats

The Project Site consists of intertidal mudflat habitat. Wood waste is common in distinct rows, a remnant of the former use of the site as a log storage area. The mudflat supports sporadic and sparse vegetation: Japanese eelgrass (*Zostera japonica*), sea lettuce (*Ulva lactuca*), and rockweed (*Fucus sp.*), were observed occasionally in the mid to low intertidal (Hemmera 2014). In addition, a diatomaceous or algal mat of unknown composition, is present at the Project Site (Hemmera 2014). Defining the boundary of the Project Site, on the north and south sides, is tidal brackish marsh habitat. An extensive tidal marsh exists upstream of the Site and a narrow band of marsh occurs between the mudflat and the shoreline adjacent to the Shaughnessy Golf and Country Club (**Figure 7**). Within the marsh, common species present are: Lyngbye’s sedge at lower elevations and non-native, invasive narrow-leaved cattail (*Typha angustifolia*) at higher elevations (close to the upland shore) (Hemmera 2014).

##### 4.3.2.2 Post-Enhancement Conditions

Construction of marsh habitat over existing mudflat habitat will create productive tidal brackish marsh habitat. Additionally enhancement of drainage channels will provide good habitat for fish rearing for juvenile Pacific salmon. Marsh habitat will be established through planting of native species from nursery stock (**Table A**).

**Table A Proposed Marsh Plant Species for Point Grey East Booming Grounds**

Scientific Name	Common name
<i>Carex lyngbyei</i>	Lyngby's sedge
<i>Schoenoplectus pungens</i>	American bulrush

#### 4.3.3 Listed Plants Communities

Provincial at-risk species and ecosystems are assigned by the B.C. Conservation Data Centre to either the Red or Blue lists. Red-listed species or ecosystems are considered Threatened or Endangered, i.e., facing imminent extinction or extirpation. Blue-listed species or ecosystems are considered to be of Special Concern, i.e., sensitive to activities which could lead to them becoming extinct or extirpated. The rankings highlight species and ecological communities that have particular threats, declining population trends, or restricted distributions that indicate that they require special attention.

##### 4.3.3.1 Existing Conditions

The occurrence of at-risk ecosystems is restricted to mature seral-stage (structural stages 6 and 7) mature or old-growth forest (McLennan and Ronalds 2000), wetlands, and unique ecosystems such as beach dunes, due to their rarity on the landscape.

A number of listed estuarine and wetland ecosystems potentially occur in the CWHxm1 subzone. **Table B** presents a subset of communities (**Table B1: Appendix B**) that have the potential to occur at or near the site (BC Ministry of Environment 2013). The brackish conditions and tidal influence at the site will preclude most of the listed communities from occurring at the site proposed for enhancement.

**Table B Listed Wetland Ecosystems in the CWHxm1 with Potential to Occur at the Project Site (BC Ministry of Environment 2013)**

Scientific Name	English Name	Provincial Listing <sup>1</sup>	Comments	Post-Enhancement Effects
<i>Schoenoplectus acutus</i>	hard-stemmed bulrush Deep Marsh	Blue	Marsh species which may occur at the Project Site.	Enhancement works may provide more suitable habitat for this species although brackish conditions may preclude this species over most of the site.
<i>Typha latifolia</i>	common cattail Marsh	Blue	Marsh species which may occur at the Project Site.	Enhancement works may provide more suitable habitat for this species at higher elevations although brackish conditions may preclude this species over most of the site.

**Notes:** <sup>1</sup> **Blue** = includes any ecological community considered to be of Special Concern (formerly Vulnerable) in BC

The occurrence of many listed plant species associations at the proposed enhancement site is unlikely due to the present biophysical features of the Project Site. The proposed enhancement area is predominantly mudflat; this is not the preferred habitat of any listed ecosystems in the CWHxm1 subzone.

Common cattail and hardstem bulrush do not occur at the project site at present. During field assessments, narrow leaved cattail (Hemmera 2014) was identified near the shoreline. Common cattail (*Typha latifolia*) could become naturally established at the Project site at higher elevations that are not exposed to brackish conditions. Enhancement works would provide suitable physical habitat conditions for this ecosystem (suitable elevations), as well as for others listed in **Table B**.

At present terrestrial vegetation does not occur at the project site.

#### 4.3.4 Vegetation

A search of the online BC Species and Ecosystems Explorer database indicated that 55 at-risk vegetation species potentially occur in the CWHxm1 subzone (BC Ministry of Environment 2013; **Table B2**). **Table C** presents a subset of species (**Table B2: Appendix B**) that have the potential to occur at or near the site, based on their known geographic distributions and habitat associations.

**Table C Listed Plant Species with Potential to Occur at the Project Site (BC Ministry of Environment 2013)**

Scientific Name	English Name	Provincial Listing <sup>1</sup>	Comments	Post-Enhancement Effects
<i>Elatine rubella</i>	three-flowered waterwort	Blue	Wetland species known to occur in marsh, estuarine, intertidal and mudflat habitats. Not observed at Project Site.	Enhancement works may decrease suitable mudflat habitat for this species.
<i>Eleocharis parvula</i>	small spike-rush	Blue	Wetland species occurs most often in brackish habitats, such as intertidal wetlands. Not observed at Project Site.	Enhancement works would provide more suitable habitat for this species.
<i>Lilaea scilloides</i>	flowering quillwort	Blue	Known to occur in mudflats and marshes in the lowland zone of the Lower Mainland. Not observed at Project Site.	Enhancement works would provide more suitable habitat for this species.
<i>Lindernia dubia</i> var. <i>anagallidea</i>	false-pimpernel	Blue	Known to occur in mudflats and marshes in the lowland zone of the Lower Mainland primarily upstream of brackish portions of the estuary.	Enhancement works may provide suitable physical conditions but brackish conditions may preclude this species.
<i>Sidalcea hendersonii</i>	Henderson's checker-mallow	Blue	Wetland species known to occur in estuaries and tidal flats.	Enhancement works would decrease amount of habitat for this species.

**Notes:** <sup>1</sup> Blue = special concern

The Project Site is sparsely vegetated and no listed species were identified during field assessments (Hemmera 2014). It is unlikely that the mudflat habitat would currently support any of the listed species. Vegetation species identification of the tidal marsh that borders the site was not extensive. Adjacent marsh habitats will not be affected by the current design for habitat enhancement works.

#### **4.3.4.1 Post-Enhancement Conditions**

Proposed enhancement works will result in the creation of approximately 41.1 ha of intertidal brackish marsh (which would be contiguous with approximately 72 ha of existing marsh adjacent to the site). Marsh creation may create physical conditions that are suitable for some of the listed species presented in **Table C**. None of the listed species are included in the list of potential transplant species for the project. As such, their occurrence in the enhancement areas would be the result of natural dispersal or vegetative growth. A few listed species that prefer mudflat habitat may have decreased habitat available following enhancement works, but presently none of these species are present at the Project Site.

### **4.4 FISH**

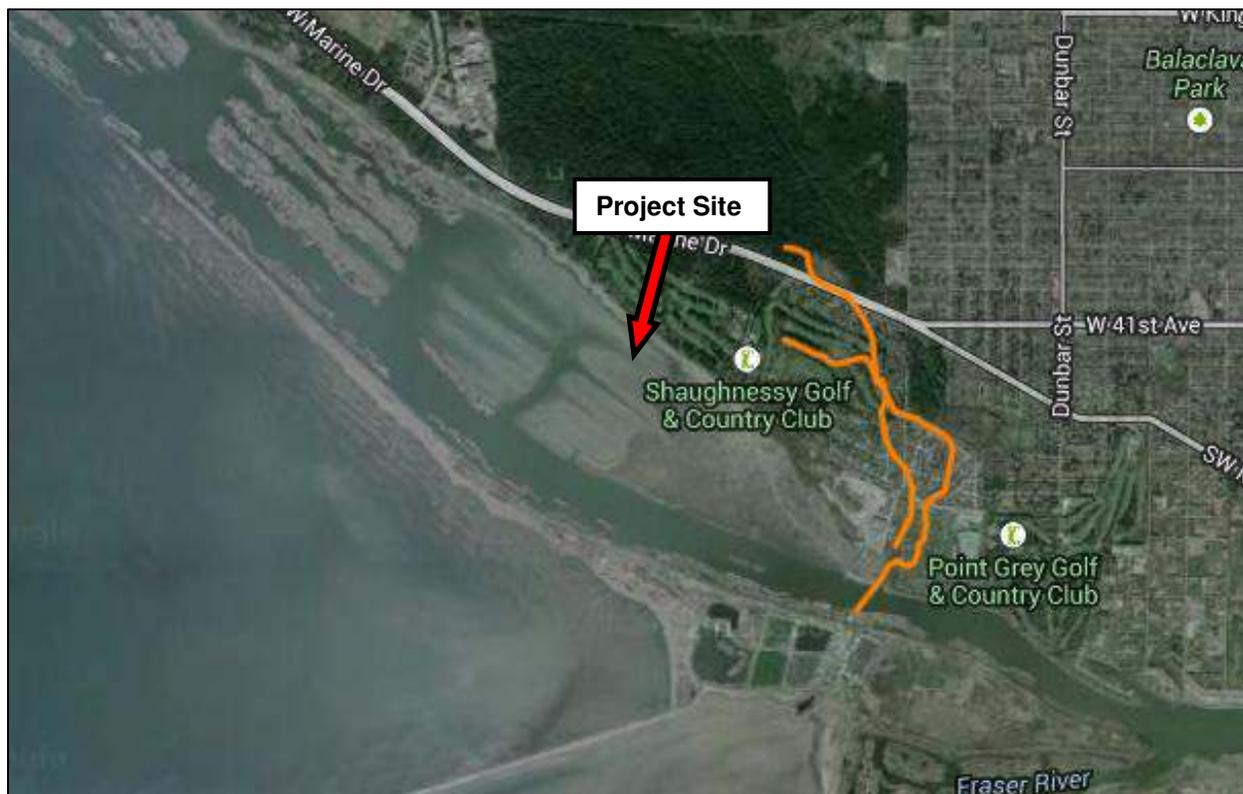
#### **4.4.1 Common Fish Species**

##### **4.4.1.1 Existing Conditions**

The Point Grey Project Site is on the North Arm of the Fraser River, which is known to provide habitat for a variety of fishes, including migrating and rearing salmonids. The North Arm is an important fish passage, and has a direct connection to the Strait of Georgia. It is utilized by migrating coho salmon (*Oncorhynchus kisutch*) and rearing juvenile Harrison run Chinook salmon (*O. tshawytscha*), which are a locally valuable species (SHIM 2013; DFO 1999). Fish species recorded near the site include: salmonids (coho, Chinook, chum (*O. keta*), pink (*O. gorbuscha*) and sockeye (*O. nerka*) salmon, cutthroat trout (*O. clarkii*), rainbow trout (*O. mykiss*), and steelhead (*O. mykiss*), forage fish (eulachon (*Thaleichthys pacificus*) and surf smelt (*Hypomesus pretiosus*)), flatfish (starry flounder (*Platichthys stellatus*)), and white sturgeon (*Acipenser transmontanus*) (FISS 2013).

The Project Site receives freshwater flowing from Booming Ground Creek (also called `West Creek`). Booming Ground Creek is classified as endangered (**Figure 8**). The mouth of this creek may sustain limited habitat features for fish. Musqueam Creek, which occurs upstream of the project site, has been titled “Vancouver’s last wild salmon stream” by the Musqueam Ecosystem Conservation Society who, in partnership with MIB, have led restoration projects within the watershed (FSCI Biological Consultants 2010). Musqueam Creek sustains small runs of coho and chum salmon and cutthroat trout (FSCI Biological Consultants 2010). During the summer months these creeks are known to experience low base flows, which limits the amount of suitable habitat for salmonids (FSCI Biological Consultants 2010).

Upstream of the Project Site, on the north side of the Fraser River near to the Oak Street Bridge, several small beaches have been described as historical eulachon spawning sites (Slack et al. 2010). Eulachon are a valuable anadromous smelt species that have locally been in dramatic decline and are currently blue-listed provincially, endangered (Fraser River population) on COSEWIC (Committee on the Status of Endangered Wildlife in Canada), and are being considered for inclusion in SARA (Species At Risk Act).



**Figure 8 Watercourse Classification Near the Project Site. Orange Streams are Endangered (FREMP 2013)**

#### **4.4.1.2 Post-Enhancement Conditions**

Due to a lack of intertidal vegetation the Project Site currently has low value to rearing juvenile salmonids that require sheltered channels and intertidal marshes for foraging and protection during their Fraser River estuary residence. However, the Project Site's FREMP coding is classified as Red, likely due to the small strip of marsh near the upland area north of the Project Site (**Figure 7**). Following the proposed enhancement works this small marsh area will be substantially expanded, offering a greater amount of tidal brackish marsh for use by fish, such as juvenile salmonids. Additionally, drainage channels will be enhanced, offering optimal habitat for fish species, such as salmonids, that may utilize high productivity habitat.

#### **4.4.2 Listed Fish Species**

##### **4.4.2.1 Existing Conditions**

Eight listed marine and freshwater fish species occur in the CWH zone (BC Ministry of Environment 2013). Several of these have the potential to occur at or near the Project Site and are presented in **Table D**.

Although it was included in **Table D**, green sturgeon (*Acipenser medirostris*) has a low likelihood of occurring near the Project Site. Very little is known about green sturgeon habitat use in Canada. Rearing and spawning by this anadromous species has not been recorded in Canada although the species may forage along the marine coast of British Columbia.

The lower Fraser population of white sturgeon potentially occur in the North Arm Fraser River and near the Project Site. Juvenile sturgeon, which utilize shallower water depths than adults, are known to occur in areas 3 to 15 m deep with slow to moderate water velocities (range 0.1 to 0.5 m/s near the bottom), and fine substrates (silt, and a mix of silt and sand) in side channels, side pools, backwaters, and mainstem channels (Glova et al. 2009). Tidal channels, which will result from proposed works, may be utilized by this species.

Eulachon (*Thaleichthys pacificus*) are an anadromous forage fish species considered culturally valuable to a number of First Nation communities on the BC coast. Documented eulachon spawning areas, typified by the presence of medium and coarse sands and occasionally pebbles with slow current speeds, occur upstream of the Project Site, on the north side of the Fraser River near the Oak street bridge (Slack et al. 2010). Eulachon have locally been in dramatic decline and are currently blue-listed provincially, endangered (Fraser River population) on COSEWIC, and are being considered for inclusion in SARA. Estuarine rearing of this species is poorly understood.

##### **4.4.2.2 Post-Enhancement Conditions**

Following proposed enhancement works, the existing tidal brackish marsh habitat will be extended and drainage channels will be enhanced, providing high quality habitat for listed species including chinook and chum salmon, coho salmon, cutthroat trout, and bull trout. Eulachon and white sturgeon would still have potential to use the Project Site, following enhancement works.

**Table D Listed Fish Species with the Potential to Occur near the Project Site (BC Ministry of Environment 2013)**

Scientific Name	English Name	Provincial Listing <sup>1</sup>	SARA <sup>2</sup>	COSEWIC <sup>3</sup>	Comments	Post-Enhancement Effects
<i>Acipenser medirostris</i>	green sturgeon	Red	1-SC (2006)	SC (1987)	Habitat preferences are poorly understood, but it is unlikely these fish would use the Project Site as they are primarily observed in marine waters off the BC coast.	n/a
<i>Acipenser transmontanus</i>	white sturgeon (Lower Fraser River population)	Red	Not listed	T (2012)	Likely to occur at Project Site as juveniles, which prefer shallow water depths, could potentially use the mudflat or marsh habitats at the Project Site.	Unlikely to be affected by creation of marsh habitat.
<i>Oncorhynchus clarkii clarkii</i>	cutthroat trout, <i>clarkii</i> subspecies	Blue	Not listed	Not listed	May use marsh habitat and habitat edges near the project site.	Would have more highly valued habitat following enhancement works.
<i>Salvelinus confluentus</i>	bull trout	Blue	Not listed	SC (2012)	Known to occur in the lower Fraser River.	Nutrient and prey availability would increase following enhancement
<i>Thaleichthys pacificus</i>	eulachon	Blue	Not listed	E/T (2011)	Distribution within the Lower Fraser is poorly understood. Spawning sites not recorded at the Project site.	Not negatively affected by proposed enhancement.

**Notes:** <sup>1</sup> Red = endangered or threatened, Blue = special concern, Yellow = not at risk  
<sup>2</sup> Schedule 1 = federal species at risk  
<sup>3</sup> E = Endangered, T = Threatened, SC = Special Concern

## 4.5 WILDLIFE

### 4.5.1 Common Wildlife

#### 4.5.1.1 Existing Conditions

The Project Site is largely intertidal mudflat that is characterized by a few benthic organisms. Vegetation is scarce on the surface of the mudflat and benthic invertebrates, including amphipods and polychaete worms, mostly occur in drainage channels (Hemmera 2014). However, the mudflat sustains a variety of infaunal organisms, including numerous juvenile *Macoma spp.* (4-160 individuals per metres squared) (Hemmera 2014). Algal mats and infaunal organisms provide foraging opportunities for numerous bird species.

During field reconnaissance, bird species observed within mudflat included: western sandpiper (*Erolia mauri*), Canada goose (*Branta canadensis*), osprey (*Pandion haliaetus*) and dunlin (*Calidris alpina*) (Hemmera 2014). Other bird species observed within the vicinity of the Project site included: violet-green swallow (*Tachycineta thalassina*), barn swallow (*Hirundo rustica*), mallard (*Anas platyrhynchos*), western sandpiper (*Erolia mauri*), Canada goose and red-winged blackbird (*Agelaius phoeniceus*).

Six over-wintering bird surveys were conducted on a weekly basis during the latter part of this past winter, between February 20 and March 26, 2014. These surveys focused on the use of mudflat habitats by waterbirds and raptors, encompassing the proposed project site and adjacent reference (control) sites. Surveys were centered around low tides, in order to maximize potential bird use and the efficacy of survey efforts. A single surveyor conducted 30-minute long stand watches of 4 different survey sections, observing bird use from stationery positions (stations) located on the edge of the shoreline and centred on the northern boundary of each survey section. Binoculars and spotting scope were used to identify birds near or interacting with the survey sections.

A list of all bird species documented by station is presented in Appendix C. The most abundant species observed over this 2-month winter period were dunlin (*Calidris alpina*; n=1,727), American wigeon (*Anas americana*; n=925), and mallard (*Anas platyrhynchos*; n=614). At the reference sites, shorebirds were the most abundant species group, followed by dabbling waterbirds, and diving waterbirds, respectively. At the treatment sites, dabbling waterbirds were the most abundant species group, followed by shorebirds, and 'gulls and terns', respectively. In general, the existing mudflat habitats provide value for a variety of different water birds, including shorebirds and dabbling ducks. Furthermore, the mudflats are part of a broader habitat mosaic and bird use appears to be influenced by proximity to other habitat types including tidal marshes and riparian/upland forests.

Additional bird surveys are being conducted during the spring and summer of 2014, to more fully characterize bird usage of these mudflat habitats. As with the overwintering bird surveys implemented in February and March of 2014, the focus of these surveys will be on waterbirds.

Marine mammals including harbour seal (*Phoca vitulina*) and sea lions also likely utilize the area.

Representative species that occur in CWH zone riparian areas, wetlands, meadows, floodplains, lakes and streams are presented below (**Table E**, Pojar et al.1991).

**Table E Common Wildlife Species of the CWH Zone within Riparian Areas, Wetland, Meadows, Floodplains, Lakes and Streams Ecosystems (Pojar et al 1991)**

Taxa	Representative Species More Likely to Occur
Mammals	river otter ( <i>Lontra canadensis</i> ), black bear ( <i>Ursus americanus</i> ), mink ( <i>Neovison vison</i> ), deer mouse ( <i>Peromyscus spp.</i> ), wandering shrew ( <i>Sorex vagrans</i> )
Birds	osprey ( <i>Pandion haliaetus</i> ), trumpeter swan ( <i>Cygnus buccinator</i> ), ring-necked duck ( <i>Aythya collaris</i> ), wood duck ( <i>Aix sponsa</i> ), common merganser ( <i>Mergus merganser</i> ), mew gull ( <i>Larus canus</i> ), American dipper ( <i>Cinclus mexicanus</i> )
Amphibians & Reptiles	common garter snake ( <i>Thamnophis sirtalis</i> ), western garter snake ( <i>Thamnophis elegans</i> ), northwestern garter snake ( <i>Thamnophis ordinoides</i> ), bullfrog ( <i>Lithobates catesbeiana</i> ), northwestern salamander ( <i>Ambystoma gracile</i> ), long-toed salamander ( <i>Ambystoma macrodactylum</i> ), rough-skinned newt ( <i>Taricha granulosa</i> )

#### 4.5.1.2 Post Enhancement Conditions

Conversion of existing mudflat habitats at the Project site into tidal marsh habitat will undoubtedly result in some modification in patterns of use by birds and other wildlife; however the overall value of the area for birds (including water birds) is not expected to be substantively changed.

#### 4.5.2 Listed Wildlife

##### 4.5.2.1 Existing Conditions

Several listed species were observed at the Project Site or nearby. Site reconnaissance included observations of the provincially Blue listed barn swallow. The provincially Red listed painted turtle – pacific coast population (*Chrysemys picta*) has been observed on nearby Lulu Island (iMap BC 2013). Additionally, the nearby Sea Island Conservation Area has been described as an important great blue heron (*Ardea herodias fannini*) habitat (Butler and Butler 1999).

In the Greater Vancouver Regional District, 34 listed bird and mammal wildlife species occur within the CWHxm1 (BC Ministry of Environment 2013; **Table B3: Appendix B**). **Table F** indicates listed species from **Table B3: Appendix B** that have the potential to occur at or near the proposed project site.

**Table F Listed Wildlife Species of the Metro Vancouver CWH Zone with Potential to Occur at the Project Site (BC Ministry of Environment 2013)**

Scientific Name	English Name	Provincial Listing <sup>1</sup>	SARA <sup>2</sup>	COSEWIC <sup>3</sup>	Comments <sup>4</sup>
<b>Birds</b>					
<i>Ardea herodias fannini</i>	great blue heron, <i>fannini</i> subspecies	Blue	1-SC (Feb 2010)	SC (Mar 2008)	Species may forage for fish at the Project Site; no nesting colonies located at or near the Project Site.
<i>Botaurus lentiginosus</i>	American bittern	Blue	Not listed	Not listed	May occur in marsh area surrounding the Project Site; this species is tied to wetlands with tall emergent vegetation (e.g. cattails) year-round.
<i>Butorides virescens</i>	green heron	Blue	Not listed	Not listed	May forage for fish in the marsh habitat adjacent to the Project Site.
<i>Nycticorax nycticorax</i>	black-crowned night-heron	Red	Not listed	Not listed	May forage for fish and invertebrates along tidal mudflats and freshwater marsh.
<i>Phalacrocorax auritus</i>	double-crested cormorant	Blue	Not listed	NAR (May 1978)	May over-winter at the Project Site; between foraging for fish on open water it often spends time perched on pilings and rocks.
<i>Buteo lagopus</i>	rough-legged hawk	Blue	Not listed	NAR (May 1995)	May forages in marsh adjacent to the Project Site; this species forage over treeless areas including marshlands.
<i>Grus canadensis</i>	sandhill crane	Yellow	Not listed	NAR (May 1979)	May forage along the intertidal areas at the Project Site.
<i>Hydroprogne caspia</i>	caspian tern	Blue	Not listed	NAR (May 1999)	May forage for fish at the Project Site.
<i>Tyto alba</i>	barn owl	Blue	1-SC (Jun 2003)	T (Nov 2010)	May be found in marsh habitat near the Project Site.
<i>Falco peregrinus anatum</i>	peregrine falcon, <i>anatum</i> subspecies	Red	1-SC (Jun 2012)	SC (Apr 2007)	May forage for birds, bats and rodents within marsh habitat near the Project Site.
<i>Hirundo rustica</i>	barn swallow	Blue	Not listed	T (May 2011)	Observed in marsh habitat near Project Site; this species may nest under bridges near river banks and wetlands from which mud is collected to construct nests; forages over open areas such as water bodies.

Scientific Name	English Name	Provincial Listing <sup>1</sup>	SARA <sup>2</sup>	COSEWIC <sup>3</sup>	Comments <sup>4</sup>
<i>Progne subis</i>	purple martin	Blue	Not listed	Not listed	May forage at the Project Site; species feeds on flying insects, over marsh and mudflat habitat.
<b>Mammals</b>					
<i>Myotis keenii</i>	Keen's myotis	Blue	3 (Mar 2005)	DD (Nov 2003)	Likely found foraging for insects over the Project Site.
<i>Mustela frenata altifrontalis</i>	long-tailed weasel, <i>altifrontalis</i> subspecies	Red	Not listed	Not listed	May be found at Project Site; species prefers slow moving water bodies with soft substrate.

**Notes:** <sup>1</sup> Red = endangered or threatened, Blue = special concern

<sup>2</sup> Schedule 1 = federal species at risk, Schedule 3 = Species under consideration for Schedule 1

<sup>3</sup> E = Endangered, T = Threatened, SC = Special Concern, NAR = Not at Risk, DD = Data deficient

<sup>4</sup> Species information from The Birds of North American Online ( 2013) and E-Fauna BC (2013)

#### 4.5.2.2 Post-Enhancement Conditions

Listed wildlife species occurrence and use of the Project Site will not be negatively affected by proposed tidal marsh enhancement projects. Use of the area by listed species for critical life history functions would be considered relatively low. Insect foraging species may benefit from additional insect production resulting from increased marsh area and productivity. Fish eating species, such as great blue heron and double-crested cormorant may benefit during salmon rearing periods.

## 5.0 CONCLUSION

The Project will create a high-value habitat type (intertidal brackish marsh) that will provide long-term benefits for salmon stocks that depend upon the Fraser River Estuary for rearing, along with other fish and wildlife species (e.g., waterfowl and wading birds). The existing mudflat was subject to years of log storage and although industrial activity ceased at the site in the late 1980's, wood waste is still prevalent at the mud surface over much of the Site.

Expansion of the intertidal marsh will contribute to the following ecological functions:

- Increasing primary productivity;
- Supplementing the detritus based food web;
- Creating intertidal habitat for benthic and drift invertebrates that are important prey items for juvenile salmonids and other fishes;
- Providing intertidal vegetation cover and refuge for juvenile salmonids as they utilize shoreline habitats in the lower Fraser River Estuary rearing corridor prior to out-migrating to the Strait of Georgia and the Pacific Ocean;
- Increasing the habitat diversity of the area by converting low quality terrestrial habitat into high quality intertidal ; and
- Creating marsh habitat for waterfowl feeding, nesting, loafing, and refuge

Existing uses by shorebirds and waterbirds (e.g. ducks and geese), is expected to change as a result of the proposed enhancement works. Use by shorebirds such as western sandpiper and dunlin, that utilize intertidal mudflats, will be reduced whereas more waterfowl (ducks, geese) may use the site once intertidal marsh becomes established. Overall it will represent a shift of use by birds as a result of the project. Surveys to further define bird use of the area are ongoing.

We sincerely appreciate the opportunity to have assisted you with this project and if there are any questions, please do not hesitate to contact the undersigned by phone at 604.669.0424.

Report prepared by:

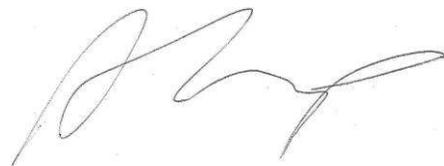
**Hemmera**



Lisa Hedderson, M.Sc.  
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Report peer reviewed by:

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Scott Northrup, R.P.Bio., P.Biol., EP  
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## **7.0 STATEMENT OF LIMITATIONS**

This report was prepared by Hemmera, based on fieldwork conducted by Hemmera, for the sole benefit and exclusive use of Port Metro Vancouver. The material in it reflects Hemmera's best judgment in light of the information available to it at the time of preparing this report. Any use that a third party makes of this Report, or any reliance on or decision made based on it, is the responsibility of such third parties. Hemmera accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

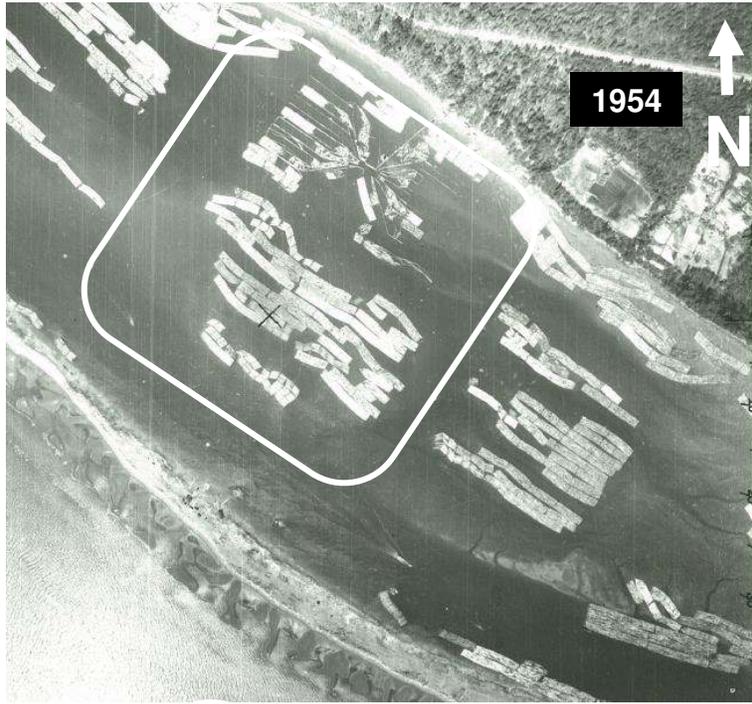
Hemmera has performed the work as described above and made the findings and conclusions set out in this report in a manner consistent with the level of care and skill normally exercised by members of the environmental science profession practicing under similar conditions at the time the work was performed.

This report represents a reasonable review of the information available to Hemmera within the established Scope, work schedule and budgetary constraints. The conclusions and recommendations contained in this report are based upon applicable legislation existing at the time the report was drafted. Any changes in the legislation may alter the conclusions and/or recommendations contained in the report. Regulatory implications discussed in this report were based on the applicable legislation existing at the time this report was written.

In preparing this report, Hemmera has relied in good faith on information provided by others as noted in this report, and has assumed that the information provided by those individuals is both factual and accurate. Hemmera accepts no responsibility for any deficiency, misstatement or inaccuracy in this Report resulting from the information provided by those individuals.

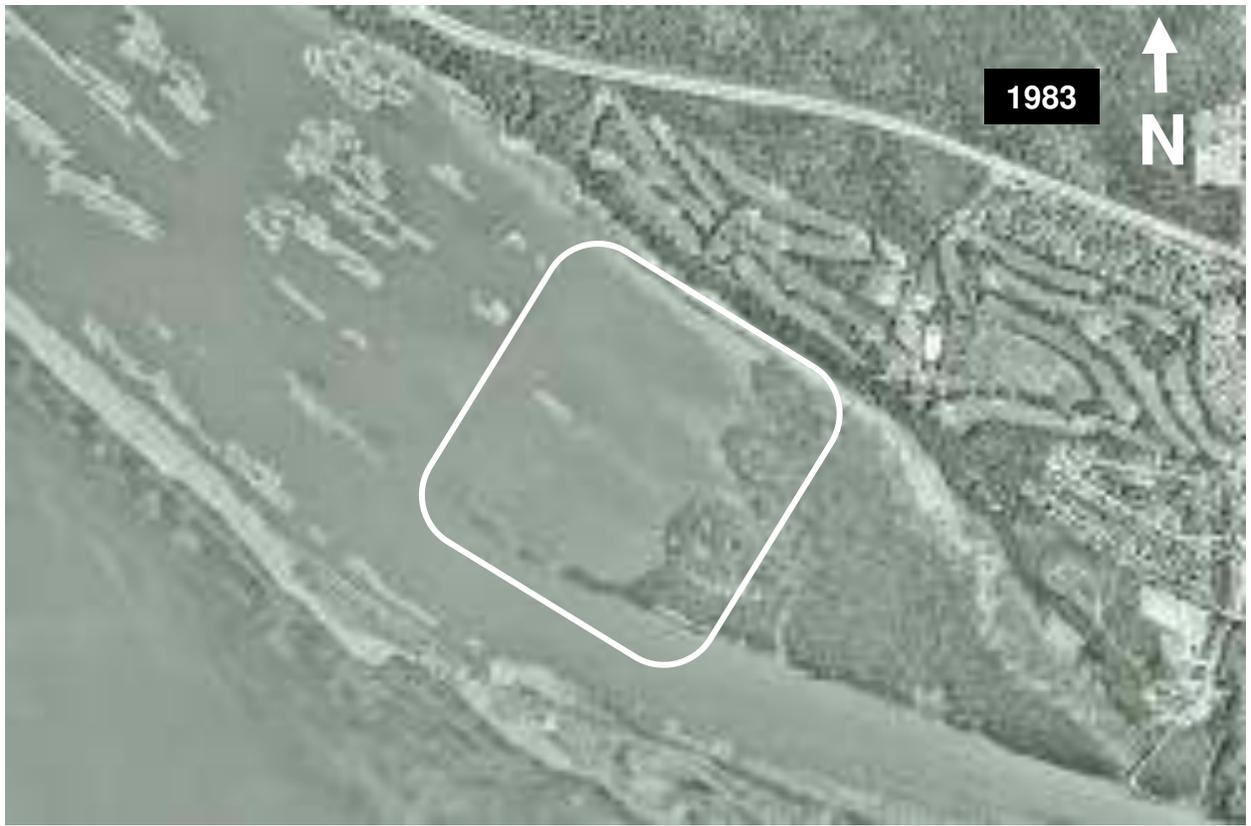
**APPENDIX A**  
**Historic Aerial Photographs**

# Point Grey Historical Aerial Overview



















**APPENDIX B**  
**CWHxm1 Species and Ecosystems**

**Table B1 At-risk Wetland Ecosystems within the Metro Vancouver CWH Zone (BC Ministry of Environment 2013)**

Scientific Name	English Name	Provincial Listing	Comments
<i>Carex lasiocarpa</i> - <i>Rhynchospora alba</i>	slender sedge - white beak-rush	Red	Unlikely
<i>Carex sitchensis</i> - <i>Oenanthe sarmentosa</i>	Sitka sedge - Pacific water-parsley	Blue	<b>Likely</b>
<i>Myrica gale</i> / <i>Carex sitchensis</i>	sweet gale / Sitka sedge	Red	Unlikely
<i>Pinus contorta</i> / <i>Sphagnum</i> spp. Very Dry Maritime	lodgepole pine / peat-mosses Very Dry Maritime	Blue	Unlikely
<i>Rhododendron groenlandicum</i> / <i>Kalmia microphylla</i> / <i>Sphagnum</i> spp.	Labrador tea / western bog-laurel / peat-mosses	Blue	Unlikely
<i>Schoenoplectus acutus</i> Deep Marsh	hard-stemmed bulrush Deep Marsh	Blue	<b>Likely</b>
<i>Spiraea douglasii</i> / <i>Carex sitchensis</i>	hardhack / Sitka sedge	Yellow	Unlikely
<i>Thuja plicata</i> / <i>Carex obnupta</i>	western redcedar / slough sedge	Blue	Unlikely
<i>Thuja plicata</i> - <i>Picea sitchensis</i> / <i>Lysichiton americanus</i>	western redcedar - Sitka spruce / skunk cabbage	Blue	Unlikely
<i>Typha latifolia</i> Marsh	common cattail Marsh	Blue	<b>Likely</b>
<i>Distichlis spicata</i> var. <i>spicata</i> Herbaceous Vegetation	seashore saltgrass Herbaceous Vegetation	Red	<b>Likely</b>
<i>Sidalcea hendersonii</i> Tidal Marsh	Henderson's checker-mallow Tidal Marsh	Red	Unlikely
<i>Zostera marina</i> Herbaceous Vegetation	common eel-grass Herbaceous Vegetation	No Status	Probable

**Notes:** <sup>1</sup> Red = endangered or threatened, Blue = special concern

<sup>2</sup> Schedule 1 = federal species at risk

<sup>3</sup> E = Endangered, SC = Special Concern

<sup>4</sup> Unlikely = site is just outside species range or it is inside the species range but site habitat is not thought to be tolerable, Probable = site is within range and habitat at site is not preferred but may be tolerable, Likely = site is within range and site habitat is preferred

**Table B2 At-risk Plant Species Within the Metro Vancouver CWH Zone (BC Ministry of Environment 2013)**

Scientific Name	English Name	Provincial List	SARA	COSEWIC	Rationale*
<i>Alopecurus carolinianus</i>	Carolina meadow-foxtail	Red			Unlikely
<i>Anagallis minima</i>	chaffweed	Blue			Unlikely
<i>Bidens amplissima</i>	Vancouver Island beggarticks	Blue	1-SC (Jun 2003)	SC (Nov 2001)	<b>Likely</b>
<i>Callitriche heterophylla</i> var. <i>heterophylla</i>	two-edged water-starwort	Blue			Unlikely
<i>Caltha palustris</i> var. <i>radicans</i>	yellow marsh-marigold	Blue			<b>Likely</b>
<i>Carex interrupta</i>	green-fruited sedge	Red			<b>Likely</b>
<i>Carex scoparia</i>	pointed broom sedge	Blue			Unlikely
<i>Carex vulpinoidea</i>	fox sedge	Blue			<b>Likely</b>
<i>Claytonia washingtoniana</i>	Washington springbeauty	Red			Unlikely
<i>Cuscuta campestris</i>	field dodder	Blue			<b>Likely</b>
<i>Elatine rubella</i>	three-flowered waterwort	Blue			<b>Likely</b>
<i>Eleocharis parvula</i>	small spike-rush	Blue			<b>Likely</b>
<i>Eleocharis rostellata</i>	beaked spike-rush	Blue			Probable
<i>Elodea nuttallii</i>	Nuttall's waterweed	Blue			Probable
<i>Erigeron philadelphicus</i> var. <i>glaber</i>	salt marsh Philadelphia fleabane	Red			Unlikely
<i>Glyceria leptostachya</i>	slender-spiked mannagrass	Blue			<b>Likely</b>
<i>Helenium autumnale</i> var. <i>grandiflorum</i>	mountain sneezeweed	Blue			Unlikely
<i>Hypericum scouleri</i> ssp. <i>nortoniae</i>	western St. John's-wort	Blue			Probable
<i>Isoetes nuttallii</i>	Nuttall's quillwort	Blue			Unlikely
<i>Juncus brevicaudatus</i>	short-tailed rush	Red			<b>Likely</b>
<i>Juncus oxymeris</i>	pointed rush	Blue			Probable
<i>Lilaea scilloides</i>	flowering quillwort	Blue			<b>Likely</b>
<i>Lindernia dubia</i> var. <i>anagallidea</i>	false-pimpernel	Blue			<b>Likely</b>
<i>Lindernia dubia</i> var. <i>dubia</i>	yellowseed false pimpernel	Red			<b>Likely</b>
<i>Lupinus rivularis</i>	streambank lupine	Red	1-E (Jan 2005)	E (Nov 2002)	<b>Likely</b>
<i>Myriophyllum hippuroides</i>	western water-milfoil	Blue			Unlikely
<i>Myriophyllum pinnatum</i>	green parrot's-feather	Red			Unlikely

Scientific Name	English Name	Provincial List	SARA	COSEWIC	Rationale*
<i>Myriophyllum ussuriense</i>	Ussurian water-milfoil	Blue			<b>Likely</b>
<i>Pleuropogon refractus</i>	nodding semaphoregrass	Blue			Unlikely
<i>Navarretia intertexta</i>	needle-leaved navarretia	Red			Unlikely
<i>Rubus nivalis</i>	snow bramble	Blue			Unlikely
<i>Rupertia physodes</i>	California-tea	Blue			Unlikely
<i>Sidalcea hendersonii</i>	Henderson's checker-mallow	Blue			<b>Likely</b>
<i>Verbena hastata</i> var. <i>scabra</i>	blue vervain	Blue			Probable
<i>Wolffia borealis</i>	northern water-meal	Red			Unlikely

**Notes:** <sup>1</sup> Red = endangered or threatened, Blue = special concern

<sup>2</sup> Schedule 1 = federal species at risk

<sup>3</sup> E = Endangered, SC = Special Concern

<sup>4</sup> Unlikely = site is just outside species range or it is inside the species range but site habitat is not thought to be tolerable, Probable = site is within range and habitat at site is not preferred but may be tolerable, Likely = site is within range and site habitat is preferred

**Table B3 At-risk Wildlife Species within the Metro Vancouver CWH Zone (BC Ministry of Environment 2013)**

Scientific Name	English Name	Provincial Listing <sup>1</sup>	SARA <sup>2</sup>	COSEWIC <sup>3</sup>	Comments <sup>4</sup>
<b>Birds</b>					
<i>Dendragapus fuliginosus</i>	Sooty grouse	Blue	Not listed	Not listed	Site is not within species range.
<i>Ardea herodias fannini</i>	Great blue heron, <i>fannini</i> subspecies	Blue	1-SC (Feb 2010)	SC (Mar 2008)	Species may forage for fish at the Project Site; no nesting colonies located at or near the Project Site.
<i>Botaurus lentiginosus</i>	American bittern	Blue	Not listed	Not listed	May occur in marsh area surrounding the Project Site; this species is tied to wetlands with tall emergent vegetation (e.g. cattails) year-round.
<i>Butorides virescens</i>	Green heron	Blue	Not listed	Not listed	May forage fish in the marsh habitat adjacent to the Project Site.
<i>Nycticorax nycticorax</i>	Black-crowned night-heron	Red	Not listed	Not listed	May forage fish and invertebrates along tidal mudflats and freshwater marsh.
<i>Phalacrocorax auritus</i>	Double-crested cormorant	Blue	Not listed	NAR (May 1978)	May over-winter at the Project Site; between foraging for fish on open water it often spends time perched on pilings and rocks.
<i>Accipiter gentilis laingi</i>	Northern goshawk, <i>laingi</i> subspecies	Red	1-T (Jun 2003)	T (Apr 2013)	Not likely found at the Project Site; this species prefers mature forests and old growth.
<i>Buteo lagopus</i>	Rough-legged hawk	Blue	Not listed	NAR (May 1995)	May forage in marsh adjacent to the Project Site; this species forage over treeless areas including marshlands.
<i>Grus canadensis</i>	Sandhill crane	Yellow	Not listed	NAR (May 1979)	May forage along the intertidal areas at the Project Site.
<i>Hydroprogne caspia</i>	Caspian tern	Blue	Not listed	NAR (May 1999)	May forage for fish at the Project Site.
<i>Brachyramphus marmoratus</i>	Marbled murrelet	Blue	1-T (Jun 2003)	T (May 2012)	Not likely found at the Project Site; this species generally prefers coastal habitat.
<i>Patagioenas fasciata</i>	Band-tailed pigeon	Blue	1-SC (Feb 2011)	SC (Nov 2008)	Not likely found at the Project Site; this species typically breeds and feeds in open areas within forests.
<i>Tyto alba</i>	Barn owl	Blue	1-SC (Jun 2003)	T (Nov 2010)	May be found in marsh habitat near the Project Site.

Scientific Name	English Name	Provincial Listing <sup>1</sup>	SARA <sup>2</sup>	COSEWIC <sup>3</sup>	Comments <sup>4</sup>
<i>Asio flammeus</i>	Short-eared owl	Blue	1-SC (Jul 2012)	SC (Mar 2008)	Not likely found at the Project Site; this species prefers large open habitat for foraging and nesting.
<i>Megascops kennicottii kennicottii</i>	Western screech-owl, <i>kennicottii</i> subspecies	Blue	1-SC (Jan 2005)	T (May 2012)	Not likely found at the Project Site; this species is primarily associated with riparian or low elevation forests.
<i>Strix occidentalis</i>	Spotted owl	Red	1-E (Jun 2003)	E (Mar 2008)	Site not within species range.
<i>Chordeiles minor</i>	Common nighthawk	Yellow	1-T (Feb 2010)	T (Apr 2007)	May forage for insects over the Project Site.
<i>Cypseloides niger</i>	Black swift	Yellow	Not listed	C (Jul 2011)	May forage for insects at or near to the Project Site.
<i>Falco peregrinus anatum</i>	Peregrine falcon, <i>anatum</i> subspecies	Red	1-SC (Jun 2012)	SC (Apr 2007)	May forage for birds, bats and rodents within marsh habitat near the Project Site.
<i>Contopus cooperi</i>	Olive-sided flycatcher	Blue	1-T (Feb 2010)	T (Nov 2007)	Not likely found at the Project Site; this species forages and breeds in forest openings.
<i>Hirundo rustica</i>	Barn swallow	Blue	Not listed	T (May 2011)	Likely found at the Project Site; this species may nest under bridges near river banks and wetlands from which mud is collected to construct nests; forage over open areas such as water bodies.
<i>Progne subis</i>	Purple martin	Blue	Not listed	Not listed	May forage at the Project Site; species feeds on flying insects, over marsh and mudflat habitat.
<b>Mammals</b>					
<i>Aplodontia rufa</i>	Mountain beaver	No Status	1-SC (Jun 2003)	SC (May 2012)	Site not within species range.
<i>Myodes gapperi occidentalis</i>	Southern red-backed vole, <i>occidentalis</i> subspecies	Red	Not listed	Not listed	Not likely found at the Project Site; this species is generally associated with mature forest cover with high levels of structural diversity and large woody debris.
<i>Sorex bendirii</i>	Pacific water shrew	Red	1-E (Jun 2003)	E (Apr 2006)	Not likely found at the Project Site currently; this species prefers small riparian systems and wetland habitat with high levels of structural diversity and low levels of disturbance.

Scientific Name	English Name	Provincial Listing <sup>1</sup>	SARA <sup>2</sup>	COSEWIC <sup>3</sup>	Comments <sup>4</sup>
<i>Lepus americanus washingtonii</i>	Snowshoe hare, <i>washingtonii</i> subspecies	Red	Not listed	Not listed	Not likely found at the Project Site; habitat generally includes non-fragmented adequately sized riparian woodlands.
<i>Sorex rohweri</i>	Olympic shrew	Red	Not listed	Not listed	Not likely found at the Project Site; this species is associated with dry riparian habitat around streams and wetlands with high levels of structural diversity and deep organic soil layers.
<i>Sorex trowbridgii</i>	Trowbridge's shrew	Blue	Not listed	Not listed	Not likely found at the Project Site; this species prefer upland areas away from water.
<i>Corynorhinus townsendii</i>	Townsend's big-eared bat	Blue	Not listed	Not listed	Not likely found at the Project Site currently; species prefers grasslands and mixed forest.
<i>Myotis keenii</i>	Keen's myotis	Blue	<sup>3</sup> (Mar 2005)	DD (Nov 2003)	Likely found foraging insects over the Project Site.
<i>Myotis lucifugus</i>	Little brown myotis	Yellow	Not listed	E (Nov 2012)	Likely found foraging insects over the Project Site.
<i>Gulo gulo luscus</i>	Wolverine, <i>luscus</i> subspecies	Blue	Not listed	SC (May 2003)	Site not within species range.
<i>Mustela frenata altifrontalis</i>	Long-tailed weasel, <i>altifrontalis</i> subspecies	Red	Not listed	Not listed	May be found at Project Site; species prefers slow moving water bodies with soft substrate.
<i>Ursus arctos</i>	Grizzly bear	Blue	Not listed	SC (May 2002)	Site not within specie range.

**Notes:** <sup>1</sup> Red = endangered or threatened, Blue = special concern, Yellow = not at risk

<sup>2</sup> Schedule 1 = federal species at risk, Schedule 3 = Species under consideration for Schedule 1

<sup>3</sup> E = Endangered, T = Threatened, SC = Special Concern, NAR = Not at Risk, DD = Data deficient

<sup>4</sup> Species information was taken from The Birds of North American Online (2013) and E-Fauna BC (2013)

**APPENDIX C**  
**Bird Observations**

**Table 1 Bird Species Observed during Overwintering Bird Surveys**

Species		Station*				
Common Name	Scientific Name	Control West	Control East	Treatment West	Treatment East	Total
American Robin	<i>Turdus migratorius</i>	0	0	3	3	6
American Wigeon	<i>Anas penelope</i>	2	192	483	248	925
Bald Eagle	<i>Haliaeetus leucocephalus</i>	8	7	6	10	31
Black-bellied Plover	<i>Pluvialis squatarola</i>	134	139	130	31	434
Black-capped Chickadee	<i>Poecile atricapillus</i>	2	0	2	1	5
Bufflehead	<i>Bucephala albeola</i>	32	41	31	8	112
Canada Goose	<i>Branta canadensis</i>	15	18	21	20	74
Common Loon	<i>Gavia immer</i>	1	0	1	0	2
Common Raven	<i>Corvus corax</i>	0	0	0	2	2
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	34	11	1	0	46
Dunlin	<i>Calidris alpina</i>	598	574	505	50	1,727
Eurasian Wigeon	<i>Anas penelope</i>	0	0	2	2	4
Gadwall	<i>Anas strepera</i>	0	0	1	6	7
Glaucous-winged Gull	<i>Larus glaucescens</i>	0	6	1	5	12
Golden-crowned Kinglet	<i>Regulus satrapa</i>	4	1	0	0	5
Great Blue Heron	<i>Ardea herodias</i>	0	1	0	1	2
Greater Yellowlegs	<i>Tringa melanoleuca</i>	0	0	0	10	10
Green-winged Teal	<i>Anas crecca</i>	5	0	0	22	27
House Finch	<i>Carpodacus mexicanus</i>	0	0	0	3	3
Mallard	<i>Anas platyrhynchos</i>	18	185	173	238	614
Marsh Wren	<i>Cistothorus palustris</i>	15	19	12	14	60
Mew Gull	<i>Larus canus</i>	32	18	52	0	102
Northern Flicker	<i>Colaptes auratus</i>	1	0	0	0	1
Northern Pintail	<i>Anas acuta</i>	0	65	185	316	566
Northwestern Crow	<i>Corvus caurinus</i>	1	2	0	11	14
Pelagic Cormorant	<i>Phalacrocorax pelagicus</i>	1	0	3	0	4
Peregrine Falcon	<i>Falco peregrinus</i>	0	0	1	0	1
Red-breasted Merganser	<i>Mergus serrator</i>	36	5	7	0	48
Red-tailed Hawk	<i>Buteo jamaicensis</i>	0	0	0	3	3
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	1	0	0	3	4
Rough-legged Hawk	<i>Buteo lagopus</i>	0	0	0	1	1

Species		Station*				
Common Name	Scientific Name	Control West	Control East	Treatment West	Treatment East	Total
Sanderling	<i>Calidris alba</i>	20	20	0	0	40
Song Sparrow	<i>Melospiza melodia</i>	7	6	5	2	20
Species Unknown	na	0	0	0	14	14
Spotted Towhee	<i>Pipilo maculatus</i>	0	1	1	0	2
Unidentified Cormorant	<i>Phalacrocorax sp.</i>	0	1	0	0	1
Unidentified Duck	na	5	8	52	13	78
Unidentified Gull	na	8	0	31	93	132
Unidentified Swan	<i>Cygnus sp.</i>	0	0	0	51	51

\* Note: the following is a description of the 4 different survey stations

Control West: western most section, closest to existing log booming grounds

Control East: section between the “Control West” and the proposed project site (western side of “Treatment West”)

Treatment West: western ½ of the proposed project site; between “Control East” and “Treatment East”

Treatment East: eastern ½ of the proposed project site; located between “Treatment West” and natural tidal marsh habitats, immediately to the east