

Existing Ecological Conditions at Proposed McDonald Tidal Marsh Project PMV Habitat Enhancement Program

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File: 302-035.04 J B
May 2014

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1.0 INTRODUCTION

The proposed McDonald Tidal Marsh Project (the Project) in the City of Richmond, 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 McDonald project site (the Site) near McDonald Slough on the North Arm 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 marsh habitats in the GSA have been adversely affected by historic development. PMV HEP is placing a priority on marsh restoration when seeking habitat creation, 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.

Creation of tidal brackish marsh and associated riparian habitat will improve the overall productivity of McDonald Slough, providing high-quality habitat for juvenile salmonid rearing and wildlife use.

Information considered during the preparation of this report included:

- A review of historical aerial photographs;
- Field reconnaissance information; and,
- Desktop study and background research.

2.0 PROJECT LOCATION

The Project site is located on Sea Island, north of the Vancouver International Airport (YVR) in Richmond, BC (**Figure 1**). Situated just upstream from the mouth of McDonald Slough, the site is located along the south side of the North Arm Fraser River (**Figure 2**). The southern-most portions of the Site are located within the Sea Island Conservation Area (SICA), which is managed for conservation purposes by the Canadian Wildlife Service (CWS) branch of Environment Canada (BC Ministry of Environment 2009).

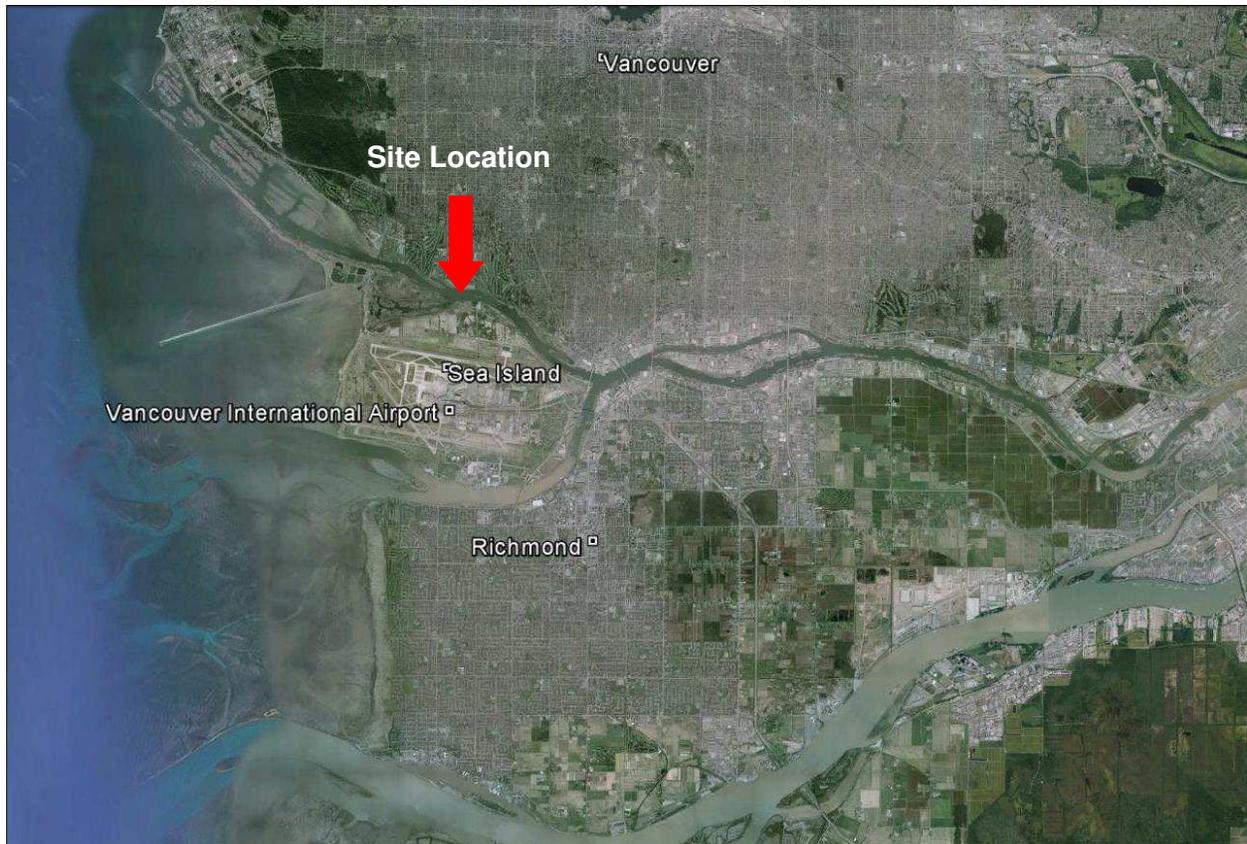


Figure 1 McDonald Tidal Marsh Project Site – Regional Setting (Google Earth Maps)

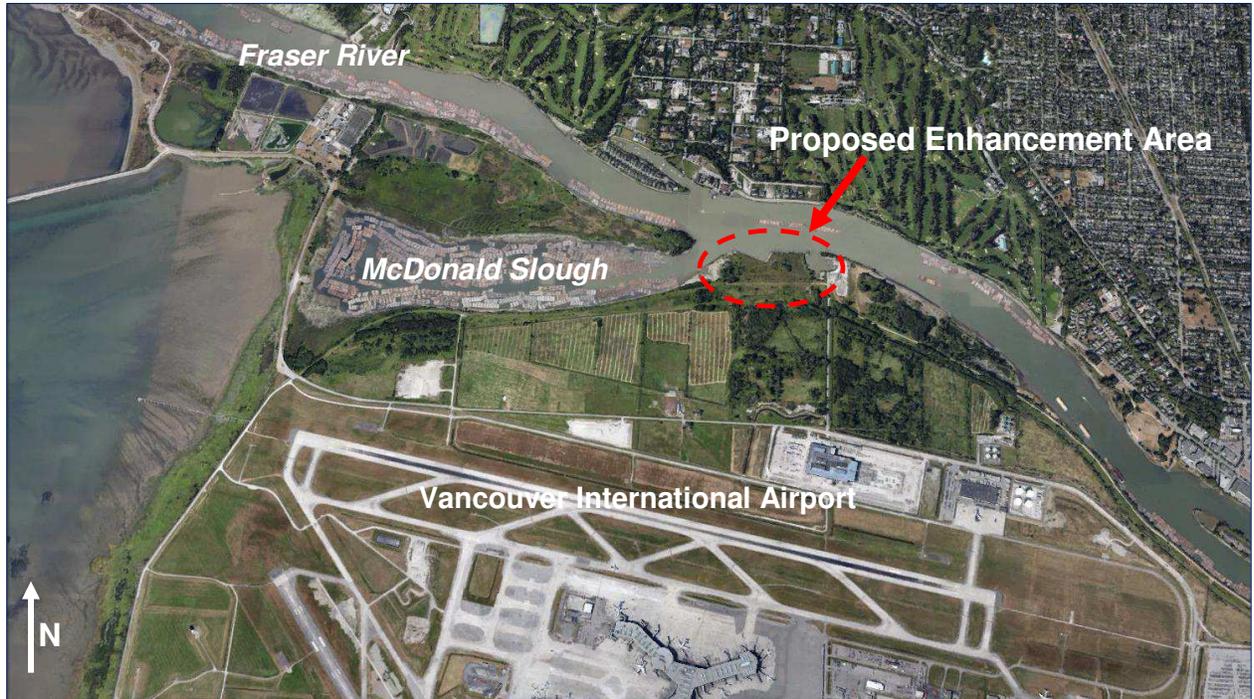


Figure 2 McDonald Tidal Marsh Project Site – Site Location (Google Earth Maps)

3.0 PROPOSED PROJECT

3.1 SITE HISTORY

The Project Site has undergone anthropogenic modification and industrial use since 1938 (**Appendix A: Aerial photography Review**). In 1938, the Site appeared to sustain intertidal marsh and subtidal riverine habitats. Log boom storage was evident within McDonald Slough at this time. Between 1949 and 1974 evidence of spoil placement, presumably associated with dredging of the North Arm Fraser River, was evident. Older photographs (1949) exhibit typical side-cast dredge spoil piles. By 1974 the Project Site appears to have been filled and graded. In the early 1990's, the Project Site was used as an aggregate off-loading site for the construction of YVR Third Runway Project. Portions of the Site were used to transport and store aggregate materials while the northwest corner of the Site was excavated and dredged to accommodate barge access (**Photograph 1**).



Photo 1 Aggregate Off-loading Operation at McDonald Site During YVR Third Runway Construction

Since the completion of the Third Runway Project, portions of the Site have been managed by CWS under the guidance of the SICA Management Plan. The Site has been allowed to re-vegetate. Site use has not included industrial activity since the mid 1990's. Unregulated passive recreational use (e.g. dog walking, hiking, and bird watching) has occurred at the Site since that time although legal access is limited to authorized personnel only.

3.2 PROPOSED WORKS

The Project will involve conversion of the existing upland habitat into a tidal basin and associated riparian habitats including:

- An intertidal marsh with a tidal channel network;
- An intertidal marsh bench; and,
- An adjacent riparian area (**Figure 3** and **Figure 4**).

Habitat enhancement will be accomplished through the excavation of existing upland areas to elevations appropriate for the establishment of the intertidal marsh basin/tidal channel complex, and the placement of fill in the northwest corner of the site to raise elevations for the proposed marsh bench. Sedges will be transplanted at lower design elevations and broadleaf cattail (*Typha latifolia*) will be planted at higher elevations. A debris screen will be installed at the upstream channel entrance to restrict logs and woody debris from entering the basin. The total length of shoreline affected by the project will be approximately 375 m. The total intertidal marsh habitat that would be established is 33,640 m², including 28,610 m² of low sedge marsh (0.0 to 1.2 m Geodetic) and 5,030 m² of high marsh (1.2 to 2.0 m Geodetic) with 5,350 m² of tidal marsh channels. Riparian habitats totalling 13,500 m² (2.0 – 5.0 m Geodetic) will also be established around the perimeter of the site.

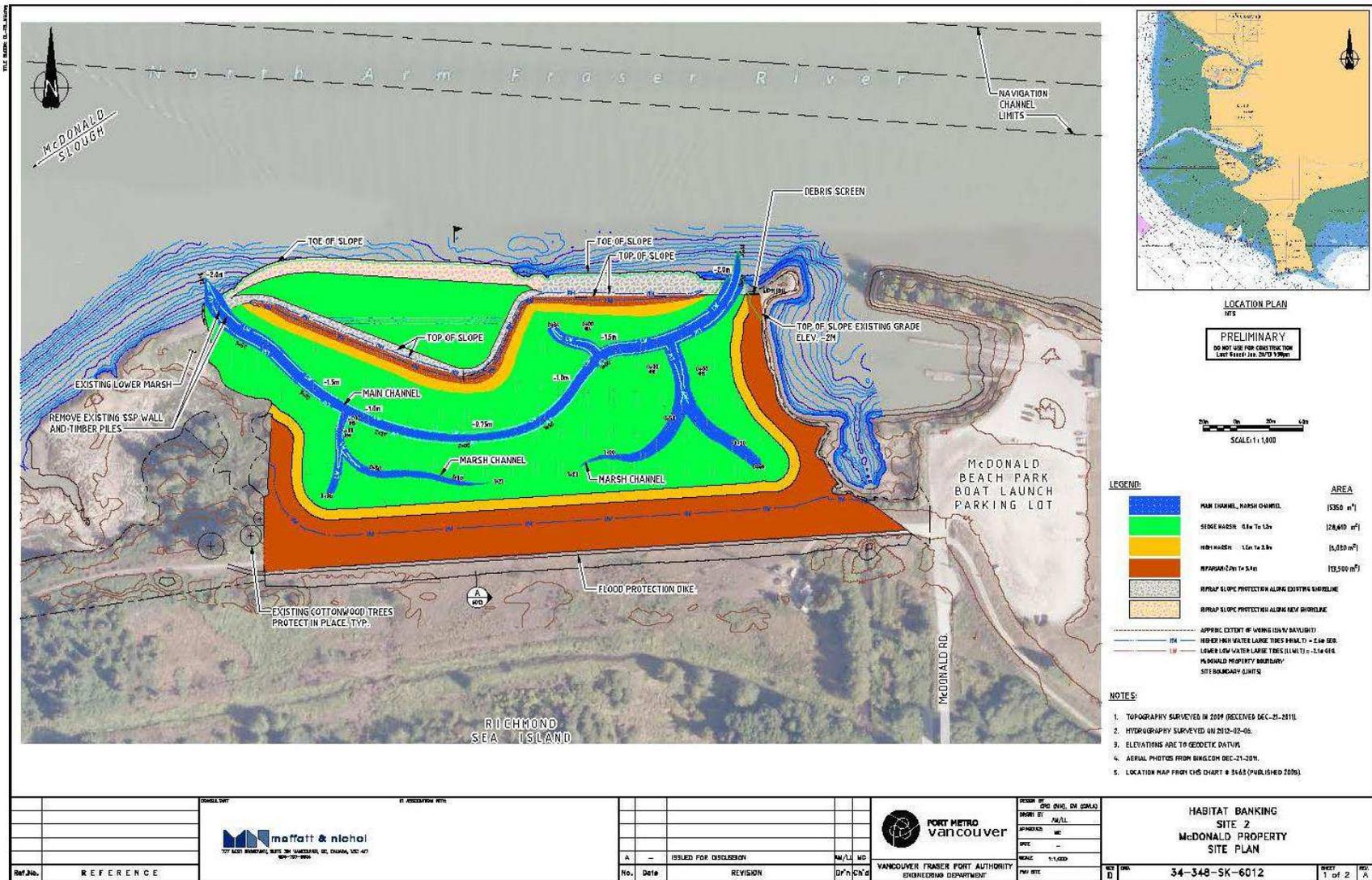


Figure 3 Proposed Habitat Design for the McDonald Tidal Marsh Project

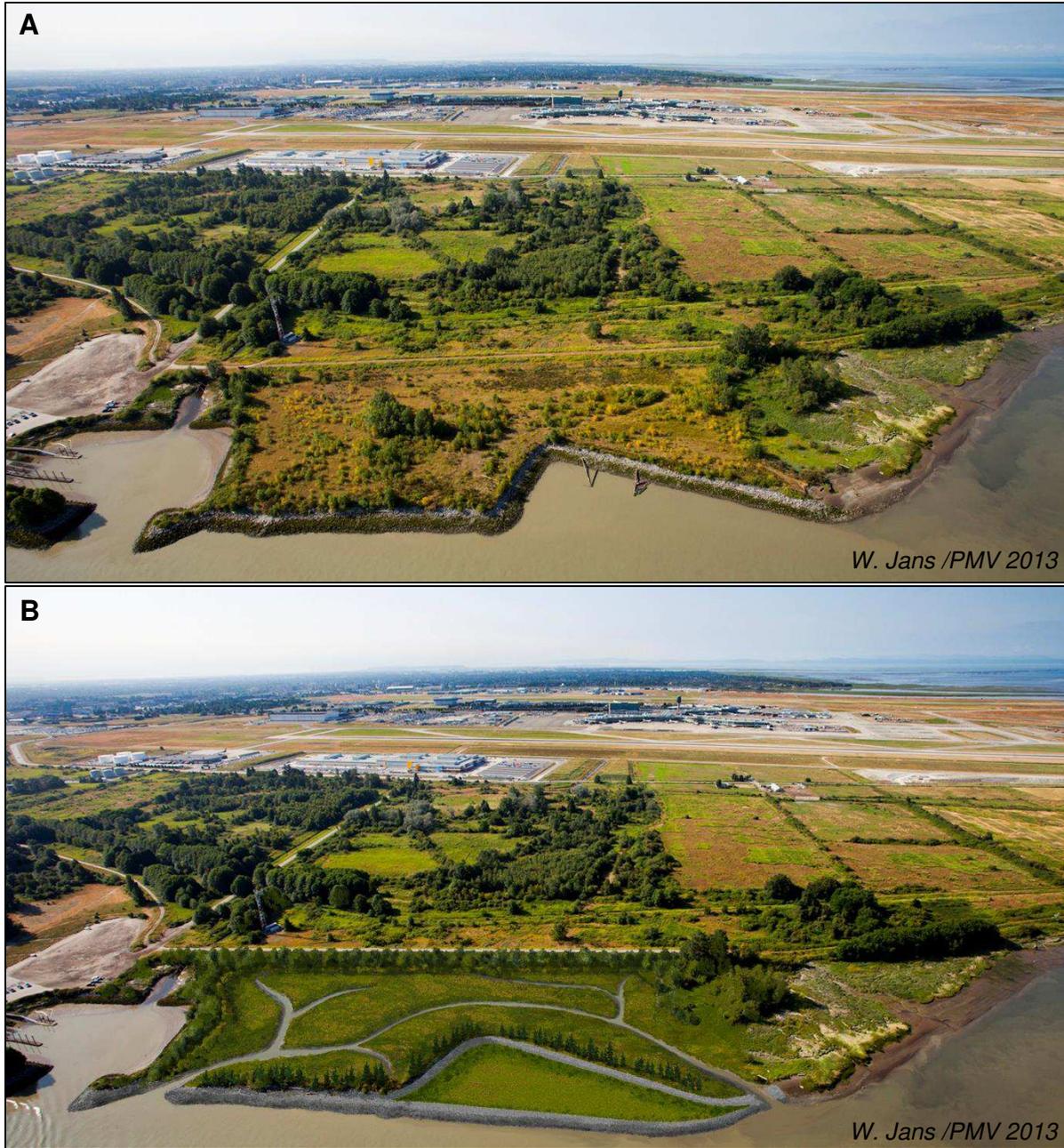


Figure 4 A) Existing Site Conditions, B) Artist's Rendering of Post-Enhancement Conditions

4.0 BIOPHYSICAL CONDITIONS

Information related to the biophysical conditions of the Project was drawn from:

- Online Sensitive Habitat Inventory and Mapping database (SHIM 2013)
- Online Fraser River Estuary Management Program and Burrard Inlet Environmental Action Program Habitat Atlas database (FREMP 2013)
- Online Fisheries Information Summary System database (FISS 2013)
- Online E-fauna BC database (Klinkenberg2013)
- Online BC Species and Ecosystems Explorer database (BC Ministry of Environment 2013)
- Online iMap database (iMap 2013)
- Online City of Richmond mapping system (City of Richmond 2013)
- SICA Bird Survey results (Ryder 2009)
- Aerial photographs

4.1 GENERAL SITE DESCRIPTION

Field assessments of the upland and foreshore portions of the site were undertaken by the project team in 2012, 2013 and 2014.

The Project Site is located on the boundary between the Coastal Douglas Fir Moist Maritime (CDFmm) and Coastal Western Hemlock Eastern Very Dry Maritime (CWHxm1) biogeoclimatic subzones (SHIM 2013; **Figure 5**). The CDFmm subzone is limited to several Georgia Strait islands, a small portion of southeastern Vancouver Island, and a narrow strip of the adjacent mainland, and only occurs at elevations of less than 150 m (Nuszdorfer et al. 1991). The CWHxm1 subzone also occurs at low elevations (0 to 700 m) and in the Lower Mainland extends up the south side of the Fraser River from Delta to Chilliwack (Pojar et al. 1991). Given the site characteristics and elevation, and the inaccuracies of biogeoclimatic boundary mapping due to scale (1:20,000 minimum) (Demarchi 2011), it is more likely that the Project Site is located entirely within the CDFmm. Many of the ecosystem, plant, wildlife and fish species that are considered at-risk in the CWHxm1 are also at-risk in the CDFmm. Therefore, only the CDFmm will be considered in this report.

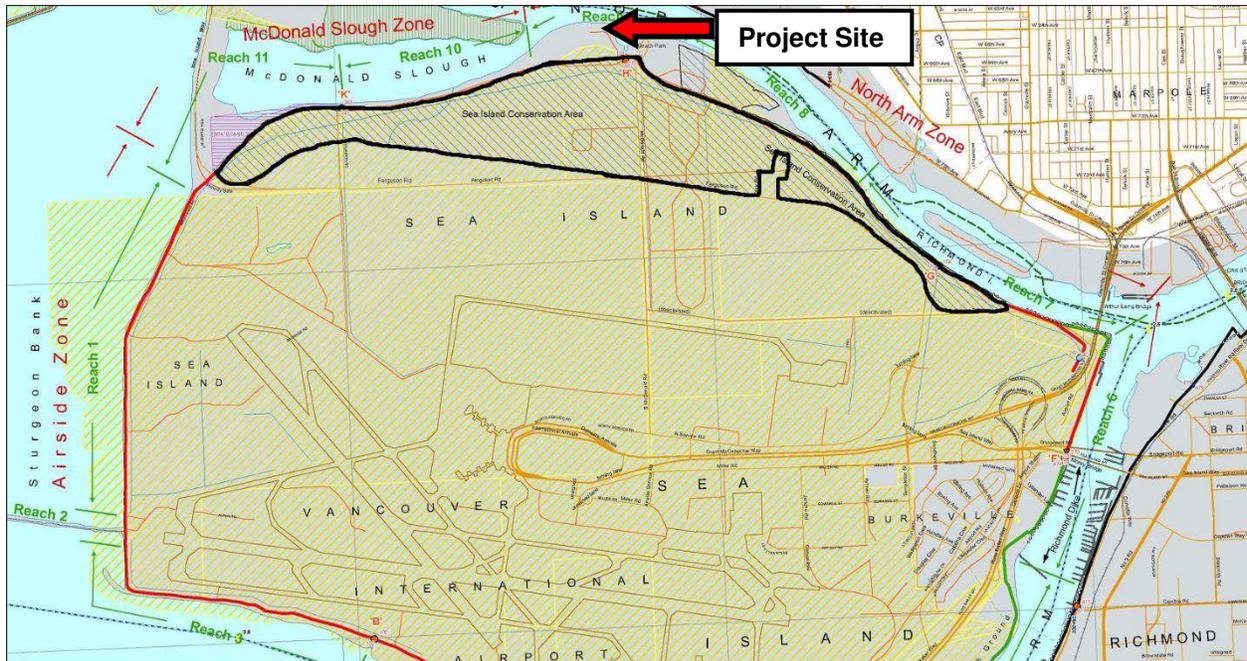


Figure 6 Location of Sea Island Conservation Area in Relation to the McDonald Site (Ministry of Environment 2009)

4.2 PHYSICAL CHARACTERISTICS

4.2.1 Existing Conditions

The shoreline is composed almost entirely of a riprap embankment installed for erosion prevention. A barge offloading facility was established in the early 1990's (**Photo 2**). Substrates are predominantly sand, imported as fill.



Photo 2 Existing Intertidal Zone Consisting of Steep Riprap Slopes (Photo Credit: Hemmera 2012).

4.2.2 Post-Enhancement Conditions

An intertidal marsh basin and adjacent marsh bench will be constructed at the McDonald site (Section 3.2). Native riparian habitat will also be created adjacent to the restored intertidal habitats.

Established marsh surfaces will have a gentle slope to ensure dewatering at low tide (approximately 1 to 2%). The intertidal brackish marsh will have an elevation of approximately 0.3 to 1.2 m Geodetic while the high marsh areas will have a design elevation ranging from 1.2 to 2.0 m Geodetic.

Riparian habitat will be established at or above the Higher High Water Mean tide (HHWMT) (+2.0 m Geodetic).

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 Project Site includes green coded shoreline, and is surrounded by more productive (yellow and red) habitats (**Figure 7**).

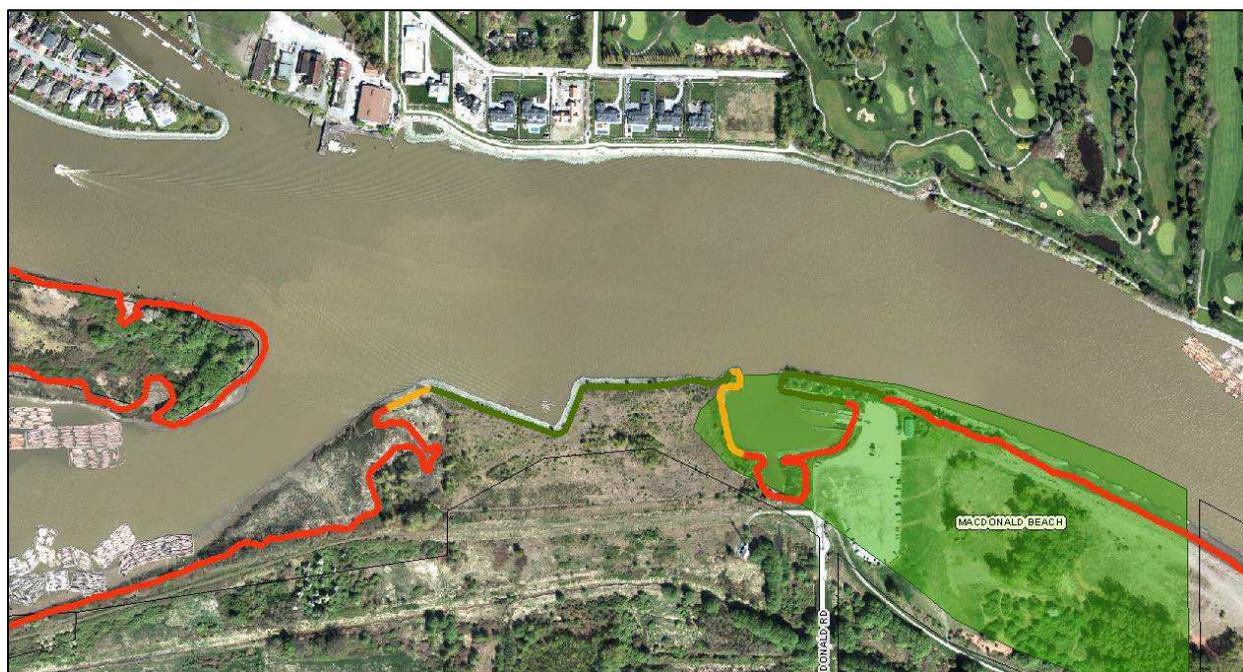


Figure 7 FREMP Habitat Classification at and near the McDonald Site, City of Richmond, BC (FREMP 2013)

4.3.2 Fish and Wildlife Habitats

4.3.2.1 Existing Habitats

The McDonald site is predominately upland shrub and grassland habitat (**Figure 8**).



Figure 8 Current habitat in and adjacent to the McDonald Site (Pink = Grassland, Green = Forest, Blue = Marsh, Yellow = Mud, Orange = Riprap (FREMP 2013).

The existing vegetation community on the McDonald Site is mature old-field, with feral agricultural grasses and reed canarygrass (*Phalaris arundinacea*), stands of shrubs and trees, including the invasive Scotch broom (*Cytisus scoparia*) and Himalayan blackberry (*Rubus armeniacus*), Nootka rose (*Rosa gymnocarpa*) and Pacific crabapple (*Malus fusca*) (**Photo 3**). One or two groves of black cottonwood (*Populus balsamifera*), red-osier dogwood (*Cornus stolonifera*), Hooker's willow (*Salix hookeriana*), and red elderberry (*Sambucus racemosa*) are present. The area is in a transitional state, as invasive plant species, particularly Scotch broom, Himalayan blackberry and reed canarygrass, have established, and appear to be spreading. The site is predominantly characterized by invasive species with the exception of young seral stage red alder (*Alnus rubra*) which are prominent throughout the site.

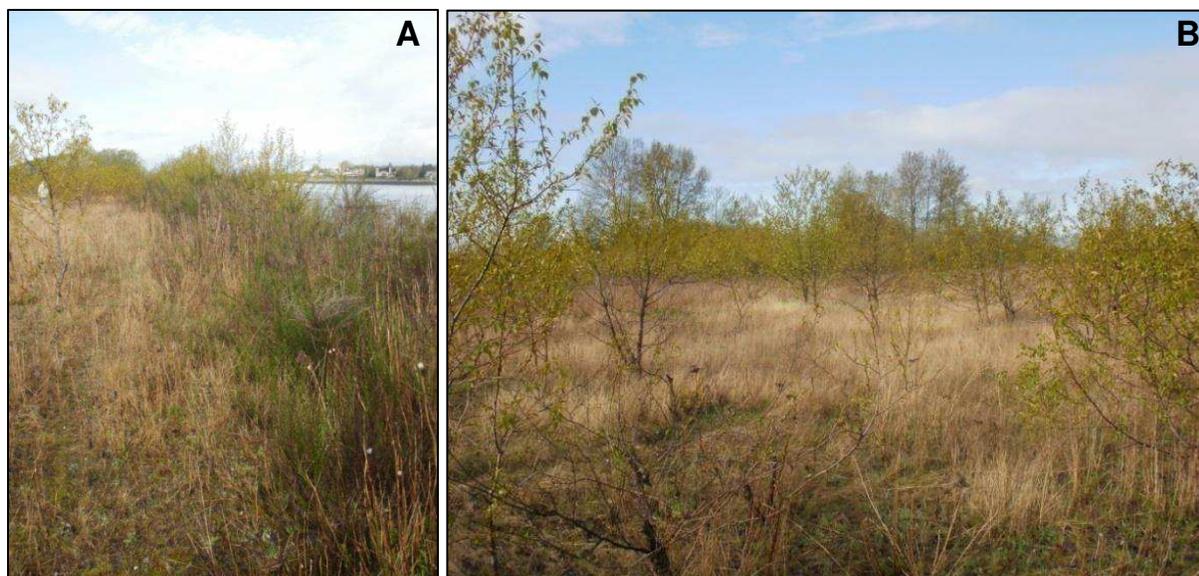


Photo 3 Upland shrub and grassland at the McDonald Site. Part A and B: Scotch broom (*Cytisus scoparia*), Pacific crabapple (*Malus fusca*) throughout grassland (Photo Credit: Hemmera 2012).

The intertidal zone is narrow and abruptly transitions from upland to subtidal habitat. Shrubs line the rip-rap slope, which contains little to no vegetation and offers limited habitat for colonization by plant species from the surrounding area. In comparison, immediately west of the site is a sandy beach and tidal marsh, the latter of which supports numerous vegetation and bird species.

4.3.2.2 Post-Enhancement Conditions

The proposed project will replace existing upland early seral grasses and shrubs with productive tidal marsh habitats.

Low intertidal marsh habitat will be transplanted with Lyngbye's sedge (*Carex lyngyei*) and co-dominants Baltic rush (*Juncus balticus*), spike rush (*Eleocharis palustris*), and softstem bulrush (*Schoenoplectus tabernaemontani*). High intertidal marsh will be transplanted with cattail marsh.

Above the high water mark, riparian vegetation will be established, composed of several native tree and shrub species (**Table A**).

Table A Examples of Proposed Riparian Species for McDonald Project

Scientific Name	Common name
<i>Malus fusca</i>	Pacific crabapple
<i>Rosa gymnocarpa</i>	Nootka rose
<i>Spiraea douglasii</i>	hardhack
<i>Salix hookeriana</i>	Hooker's willow
<i>Cornus stolonifera</i>	red osier dogwood
<i>Populus balsamifera var. trichocarpa</i>	black cottonwood
<i>Alnus rubra</i>	red alder
<i>Picea sitchensis</i>	Sitka spruce
<i>Pinus contorta</i>	shore pine

4.3.3 Listed Plant Communities

Provincial at-risk species and ecosystems are assigned to either the Red or Blue list by the BC Conservation Data Centre (CDC). 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 CDC's rankings highlight species and ecological communities that are subject to 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 generally 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 terrestrial ecosystems may occur in the CDFmm subzone (**Table B1: Appendix B**). A list of these communities with the potential to occur at the Project Site is presented in **Table B** (BC Ministry of Environment 2013).

Table B Listed Terrestrial Ecosystems in the CDFmm Subzone with Potential to Occur at the Project Site (BC Ministry of Environment 2013)

Scientific Name	English Name	Provincial Listing ¹	Comments	Post-Enhancement Effects
<i>Populus trichocarpa</i> - <i>Alnus rubra</i> / <i>Rubus spectabilis</i>	black cottonwood - red alder / salmonberry	Blue	Prefers moist low elevations of coastal British Columbia.	Enhancement works would decrease the amount of habitat available for this ecosystem.
<i>Tsuga heterophylla</i> - <i>Thuja plicata</i> / <i>Blechnum spicant</i>	western hemlock - western redcedar / deer fern	Red	Prefers moist low elevations of the Lower Mainland.	Enhancement works would decrease the amount of habitat available for this ecosystem.

Notes: ¹ **Red** = includes any ecological community that is Extirpated, Endangered, or Threatened in BC, **Blue** = includes any ecological community considered to be of Special Concern (formerly Vulnerable) in BC

A number of listed estuarine and wetland ecosystems occur in the CDFmm subzone (**Table B1: Appendix B**). A list of these communities with the potential to occur at the Project Site is presented in **Table C** (BC Ministry of Environment 2013).

Table C Listed Wetland Ecosystems in the CDFmm Subzones with Potential to Occur at the Project Site (BC Ministry of Environment 2013)

Scientific Name	English Name	Provincial Listing ¹	Comments	Potential to Occur Post-Enhancement
<i>Carex lyngbyei</i>	Lyngbye's sedge herbaceous vegetation	Red	Marsh ecosystem will be created at the Project Site	Enhancement works would provide more suitable habitat for this species.
<i>Distichlis spicata</i> var. <i>spicata</i>	seashore saltgrass Herbaceous Vegetation	Red	Created habitat likely not saline enough to support these communities	Enhancement works would provide more suitable habitat for this species.
<i>Ruppia maritima</i> Herbaceous Vegetation	beaked ditch-grass Herbaceous Vegetation	Red	Physical conditions may be created in tidal channels and at marsh basin outlets	Enhancement works would not affect habitat for this species.
<i>Typha latifolia</i>	Common cattail marsh	Blue	Marsh ecosystem which could occur at the Project Site following creation of marsh habitat	Enhancement works would provide more suitable habitat

Notes: ¹ **Red** = includes any ecological community that is Extirpated, Endangered, or Threatened in BC, **Blue** = includes any ecological community considered to be of Special Concern (formerly Vulnerable) in BC

The intertidal zone at the Project Site is presently very limited in extent, consisting of a short rip-rap slope. Listed wetland and estuarine plant species currently do not occur at the Project Site as there is no suitable habitat area. Many of the ecosystem associations noted are likely to occur in the areas surrounding the Project Site.

4.3.4 Vegetation

A detailed vegetation inventory was not undertaken at the Site, however, a search of the online BC Species and Ecosystems Explorer database indicated that a large number of at-risk vegetation species potentially occur in the CDFmm subzone (BC Ministry of Environment 2013; **Table B2**). **Table D** presents a subset of species (**Table B2: Appendix B**) that have the greatest potential to occur at or near the site, based on their known geographic distributions and habitat associations.

Site visits conducted in support of the project also provided general vegetation observations and habitat conditions (2012, 2013, 2014). A targeted rare plant survey was not included during site reconnaissance field work.

Table D Listed Plant Species in the CDFmm with Potential to Occur at the Project Site (BC Ministry of Environment 2013)

Scientific Name	English Name	Provincial List ¹	SARA ²	Comments	Potential to Occur Post-Enhancement
<i>Alopecurus carolinianus</i>	Carolina meadow-foxtail	Red		Grassland shrub known to occur in low fields, riparian areas and moist open ground.	Enhancement works would decrease the amount of habitat available for this species, if present.
<i>Anagallis minima</i>	chaffweed	Blue		Grassland shrub known to utilize riparian areas such as riverbanks.	Enhancement works would decrease the amount of habitat available for this species, if present.
<i>Bidens amplissima</i>	Vancouver Island beggarticks	Blue	1-SC (Jun 2003)	Shoreline species that occurs near freshwater and marshes. Often inhabits areas utilized by waterfowl.	Enhancement works would provide more suitable habitat for this species.
<i>Caltha palustris</i> var. <i>radicans</i>	yellow marsh-marigold	Blue		Wetland species that occurs in marshes, fens, swamps and ditches.	Enhancement works would provide more suitable habitat for this species.
<i>Carex scoparia</i>	pointed broom sedge	Blue		Grassland shrub known to utilize riparian areas and open meadows.	Enhancement works would decrease the amount of habitat available for this species, if present.
<i>Carex vulpinoidea</i>	fox sedge	Blue		Wetland species known to occur in marsh habitat.	Enhancement works would provide more suitable habitat for this species.
<i>Cuscuta campestris</i>	field dodder	Blue		Wetland species known to occur in marsh habitat.	Enhancement works would provide more suitable habitat for this species.
<i>Elatine rubella</i>	three-flowered waterwort	Blue		Wetland species known to occur in marsh and estuary habitat.	Enhancement works would provide more suitable habitat for this species.
<i>Eleocharis parvula</i>	small spike-rush	Blue		Wetland species occurs most often in brackish habitats, such as intertidal wetlands.	Enhancement works would provide more suitable habitat for this species.
<i>Elodea nuttallii</i>	Nuttall's waterweed	Blue		Lake side plant that occasionally occurs in stream banks.	Enhancement works would provide more suitable habitat for this species.
<i>Eutrochium maculatum</i> var. <i>bruneri</i>	Joe-pye weed	Red		Wetland species that prefers estuarine, riparian and herbaceous habitats.	Enhancement works would provide more suitable habitat for this species.
<i>Glyceria leptostachya</i>	slender-spiked mannagrass	Blue		Wetland species known to occur in marsh habitat.	Enhancement works would provide more suitable habitat for this species.

Scientific Name	English Name	Provincial List ¹	SARA ²	Comments	Potential to Occur Post-Enhancement
<i>Helenium autumnale</i> var. <i>grandiflorum</i>	mountain sneezeweed	Blue		Grassland shrub known to utilize riparian areas and open meadows.	Enhancement works would decrease the amount of habitat available for this species, if present.
<i>Juncus brevicaudatus</i>	short-tailed rush	Red		Stream bank species known to occur in marsh habitat.	Enhancement works would provide more suitable habitat for this species.
<i>Juncus oxymersis</i>	pointed rush	Blue		Grassland shrub known to utilize riparian areas, estuaries and marine habitats.	Enhancement works would decrease the amount of habitat available for this species, if present.
<i>Lindernia dubia</i> var. <i>dubia</i>	yellowseed false pimpernel	Red		Stream bank species rare in Lower Fraser.	Enhancement works would provide more suitable habitat for this species.
<i>Lupinus rivularis</i>	streambank lupine	Red	1-E (Jan 2005)	Stream bank species rare in Lower Fraser.	Enhancement works would provide more suitable habitat for this species.
<i>Myriophyllum ussuriense</i>	Ussurian water-milfoil	Blue		Stream bank species that prefers muddy banks.	Enhancement works would provide more suitable habitat for this species.
<i>Sidalcea hendersonii</i>	Henderson's checker-mallow	Blue		Prefers wet meadows, estuaries and tidal flats. Rare in the Lower Mainland.	Enhancement works would decrease the amount of habitat available for this species, if present.
<i>Verbena hastata</i> var. <i>scabra</i>	blue vervain	Blue		Stream bank species that prefers wet ditches and marshes.	Enhancement works would provide more suitable habitat for this species.

Notes: ¹ Red = endangered or threatened, Blue = special concern

² Schedule 1 = federal species at risk, E = Endangered, SC = Special Concern

An at-risk plant inventory has not been undertaken at the Project Site. The disturbed nature of the Site and its past industrial use make the presence of at-risk plants unlikely. The upland shrub and grassland habitat area has the potential to contain a number of listed species, as described in **Table D**. However, it is unlikely that any of the listed wetland and marsh species are present in the existing intertidal habitats.

4.3.4.1 Post-Enhancement Conditions

The proposed enhancement works will result in the addition of approximately 33,640 m² of intertidal marsh habitat, 5,350 m² of tidal channels, and 13,000 m² of estuarine riparian habitat. Marsh creation will create physical conditions that are suitable for some of the listed species presented in **Table D**. None of the listed species are included in the list of potential transplant species for the project. Therefore, their occurrence in the enhancement areas would be the result of natural seed dispersal or vegetative growth. Conversion of the present upland shrub and grassland habitat will reduce the physical requirements for some species in **Table D**. A pre-construction plant inventory, focussed on the identification of listed species, will be conducted to ensure rare species are not affected by the work.

4.4 FISH

4.4.1 Common Fish Species

4.4.1.1 Existing Conditions

The North Arm Fraser River provides habitat for a variety of fish species, including migrating and rearing Pacific salmon. McDonald Slough, downstream of the Project site, is used extensively for log storage. The region surrounding the Site is highly urbanized. No natural streams, sloughs or tidal channels remain on Sea Island near the Site (Fraser River Action Plan 1999) (**Figure 9**).

McDonald Slough supports a wide range of fish species including: salmonids (coho (*Oncorhynchus kisutch*), Chinook (*O. tshawytscha*), 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). There are no other waterbodies near to the McDonald Site except for small storm drainage channels. These channels are unlikely to provide habitat for important fish species; although some sloughs in Richmond are able to support fish species such as carp (*Cyprinus carpio*), stickleback, suckers (*Catostomus* spp.), and brown bullhead (*Ameiurus nebulosus*), water quality is often poor and they are generally not accessible to anadromous species.

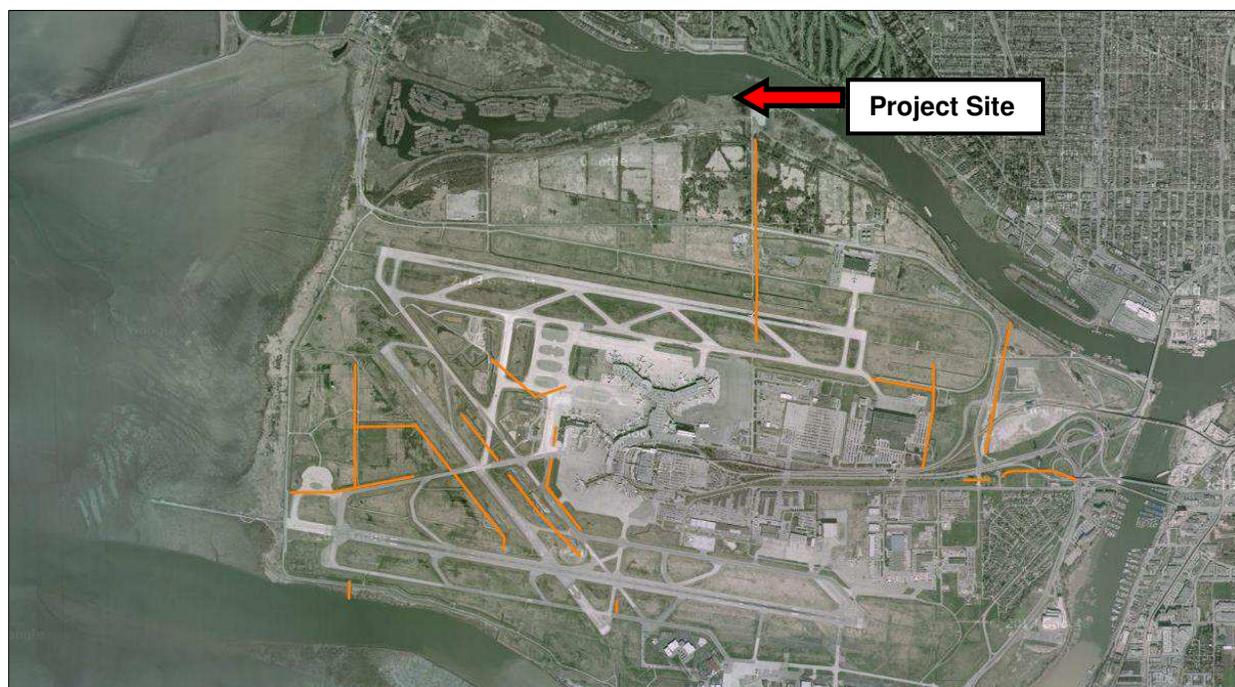


Figure 9 Iona and Sea Island Watercourse Classification near the McDonald Site (Orange = identified watercourses) (FREMP 2013)

4.4.1.2 Post-Enhancement Conditions

At present, intertidal portions of the Project Site consist of a steep riprap slope that has little value for fishes although juvenile salmon may use the interstitial spaces of riprap slopes as refuge habitat (Quigley and Harper 2004). Subtidal mudflat may be used by flatfish such as starry flounder. The proposed enhancement works will result in the addition of approximately 33,640 m² of intertidal marsh habitat and 5,350 m² of tidal channels that will have high habitat value for fish, particularly estuarine rearing salmon species (e.g. Harrison Chinook salmon and chum salmon). The habitat enhancement will create more complex, productive habitat with high value to juvenile salmonids rearing in the lower Fraser River estuary.

4.4.2 Listed Fish Species

4.4.2.1 Existing Conditions

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

Table E Listed Fish Species with the Potential to Occur Near the Project Site (BC Ministry of Environment 2013)

Scientific Name	English Name	Provincial Listing ¹	SARA ²	COSEWIC ³	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)	Juveniles, which prefer shallow water depths, could potentially use the created tidal channels or marsh habitats following enhancement works 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)	Are 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 but historically were nearby.	Not negatively affected by proposed enhancement.

Notes: ¹ Red = endangered or threatened, Blue = special concern
² Schedule 1 = federal species at risk
³ E = Endangered, T = Threatened, SC = Special Concern

Although it was included in **Table E**, 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. Green sturgeon rearing and spawning have not been recorded in Canada although the species may forage along the marine coast of BC.

Individuals from the Lower Fraser population of white sturgeon are likely to use the Project Site. Juvenile white 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 (ranging between 0.1 to 0.5 m/s near the river 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). Proposed enhancement works include the creation of tidal channels which could be used by this species although the inclusion of debris preventing screens at channel entrances may preclude site access for this species.

Eulachon are an anadromous forage fish species considered culturally valuable by a number of First Nations 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 northeast of the McDonald Site. On the north side of the Fraser River near the Oak Street Bridge, several small beaches have been described as historical eulachon spawning sites (Slack et al. 2010). Eulachon have locally been in dramatic decline and are currently Blue-listed provincially and the Fraser River population is listed as Endangered by the Committee on Endangered Wildlife in Canada (COSEWIC). Eulachon (Fraser River population) currently have no status and no schedule under the Species at Risk Act (SARA) although they are being considered for inclusion. Eulachon larvae are flushed to marine waters shortly after emergence and estuarine rearing is poorly understood.

4.4.2.2 Post-Enhancement Conditions

Estuarine tidal channels and marshes provide critical habitat for fish, including juvenile Chinook salmon, as well as numerous species of fish and wildlife (Simenstad 1983). The life history of Chinook salmon can be categorized into two distinct behavioural forms: stream-type and ocean type (Healey 1991). Harrison River Chinook exhibit an immediate fry migration pattern: upon emergence from spawning areas, they migrate downstream to the estuary where they rear for up to six weeks before moving off-shore. Chinook that spawn in the Harrison River belong to the Lower Fraser River fall white¹ Conservation Unit #3, which is also referred to as Fraser Late run under the Pacific Salmon Treaty reporting unit (DFO 2011). Harrison Chinook are the only natural fall white Lower Fraser stock, and as an immediate migrant, they are unique among Fraser River Chinook.

¹ Fraser River Chinook salmon occur in both red- and white-fleshed varieties.

The habitat enhancement works at the McDonald site has been designed to benefit rearing Harrison Chinook salmon. The creation of this type of habitat from a disturbed upland site ensures that existing aquatic habitat will not be adversely affected by proposed works. Listed fish species that frequent the area will benefit from indirect habitat productivity gains provided by the proposed project.

4.5 WILDLIFE

4.5.1 Common Wildlife

4.5.1.1 Existing Conditions

Species representative of the CDFmm subzone within estuaries, shallow bays, intertidal and sub-tidal marine ecosystems are listed in **Table F**.

Table F Common Wildlife Species of the CDFmm Subzone Within Riparian Areas, Wetland, Meadows, Floodplains, Lakes and Streams Ecosystems Likely to be Found On or Near the McDonald Site (Klinka and Demarchi 1991)

Taxa	Representative Species
Mammals	Raccoon (<i>Procyon lotor</i>), coyote (<i>Canis latrans</i>), mink (<i>Neovison vison</i>), river otter (<i>Lontra canadensis</i>), harbour seal (<i>Phoca vitulin</i>), Townsend's vole (<i>Microtus townsendii</i>)
Birds	Sharp-shinned hawk (<i>Accipiter striatus</i>), Canada goose (<i>Branta Canadensis</i>), brant (<i>Branta bernicla</i>), Barrow's goldeneye (<i>Bucephala islandica</i>), mallard (<i>Anas platyrhynchos</i>), American wigeon (<i>Anas americana</i>), lesser scaup (<i>Aythya affinis</i>), green-winged teal (<i>Anas carolinensis</i>), glaucous-winged gull (<i>Larus glaucescens</i>), northwestern crow (<i>Corvus caurinus</i>), American robin (<i>Turdus migratorius</i>)

Several exotic or invasive wildlife species have been observed on or near the Site including green frog (*Lithobates clamintans*), American bullfrog (*Lithobates catesbeiana*) (iMap BC 2013), European fire ant (*Myrmica rubra*) (Campbell 2012) and European starling (*Sturnus vulgaris*).

Tracks and scat of coyote (*Canis latrans*) were observed during site reconnaissance (April 2012 and March 2014). Gnawed and felled trees in the area suggested the presence of North American beaver (*Castor canadensis*). Harbour seal (*Phoca vitulina*) are present on Iona Island year-round (BC Ministry of Environment 2003). Harbour seal and river otter (*Lontra canadensis*) were observed in proximity to the site during a recent reconnaissance visit (March 2014).

Bird species observed during the site reconnaissance include Anna's hummingbird (*Calypte anna*), northern flicker (*Colaptes auratus*), northwestern crow (*Corvus caurinus*), violet-green swallow (*Tachycineta thalassina*), white-crowned sparrow (*Zonotrichia leucophrys*), song sparrow (*Melospiza melodia*), Savannah sparrow (*Passerculus sandwichensis*), dark-eyed junco (*Junco hyemalis*), purple finch (*Carpodacus purpureus*), European starling and American goldfinch (*Carduelis tristis*). Bald eagle (*Haliaeetus leucocephalus*) and Cooper's hawk (*Accipiter cooperii*) were observed flying overhead.

The Fraser River Estuary, which includes the proposed McDonald site, is globally recognized as a key migratory stop-over and wintering area for waterfowl and shorebirds (Butler and Campbell 1987; WHSRN 2005). The area is also utilized by countless other resident species. A large, diverse assemblage of avian species is known to use Iona Island. The wildlife species (only those species that are relevant to the proposed project site) that have been recorded as present within the Iona Island Bird Checklist Area (Figure 10) and the SICA (Figure 6) are presented in Table B4: Appendix B.

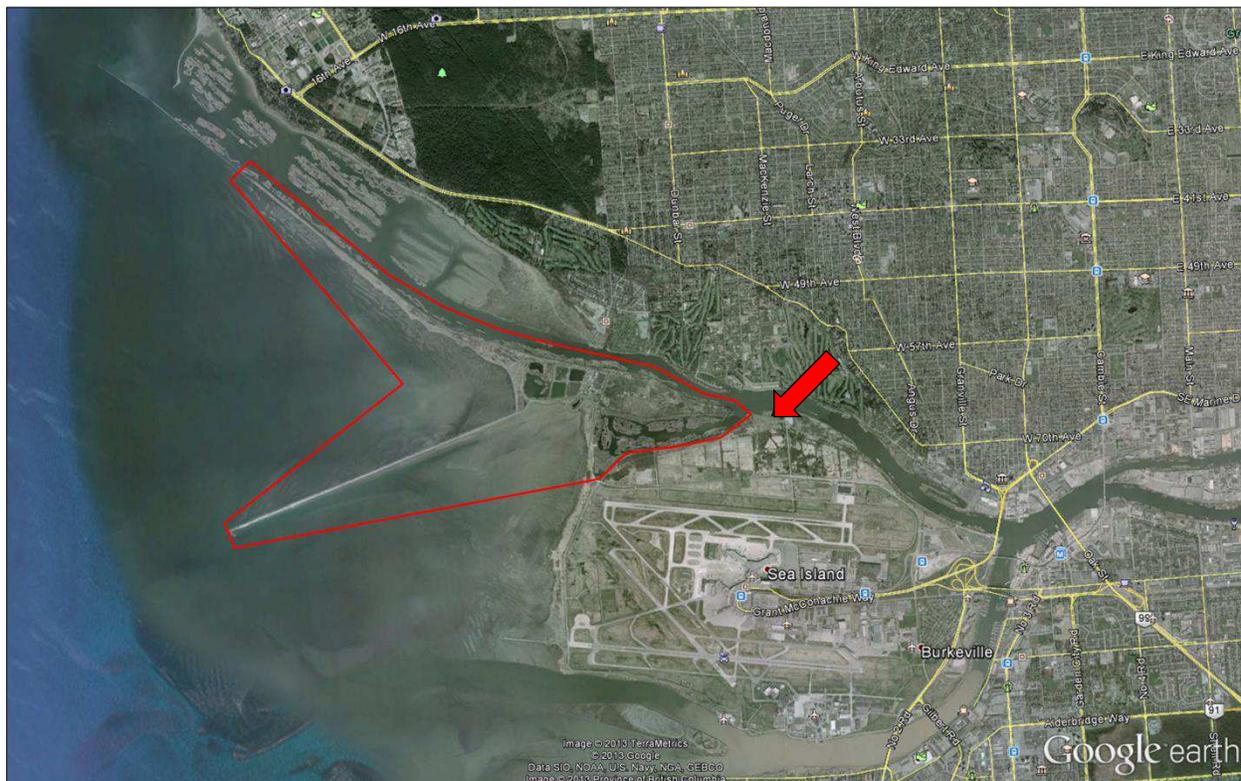


Figure 10 Approximate Iona Island Bird Checklist Area; Red Arrow Indicates Location of Proposed Project Site (Google Earth Maps)

4.5.1.2 Post-Enhancement Conditions

Existing grass and shrub dominated upland habitats are utilized primarily by passerine birds and small mammals. The proposed marsh creation will support a subset of these species as well as other bird and mammal species that utilize the lower Fraser River. Due to the ‘very high’ risk that certain waterfowl pose to nearby YVR airport operations (Searing 2005), the post-enhancement habitat will include design elements aimed at reducing the attractiveness of the site to these waterfowl types. These design elements include relatively-dense intertidal vegetation and the absence of large areas of stable open water. The waterfowl species that are of the greatest concern are dabbling ducks (mallard, green-winged teal, northern pintail (*Anas acuta*) and American widgeon) and Canada goose (Searing 2005). Several species of diving ducks, gulls, and raptors, as well as trumpeter swan (*Cygnus buccinator*) and snow goose (*Chen caerulescens*), were also identified as high risk in the YVR risk assessment. However, the habitat restoration proposed for the McDonald Slough area is not conducive to these species.

4.5.2 Listed Wildlife

4.5.2.1 Existing conditions

Several at-risk wildlife species have been observed at or near the site. The provincially Blue-listed autumn meadowhawk (*Sympetrum vicinum*) and the provincially Red-listed painted turtle - Pacific coast population (*Chrysemys picta pop. 1*) have been observed nearby but are unlikely to currently occur on the site because the habitat there is unsuitable for these aquatic species (**Figure 11**; iMap BC 2013). Additionally, SICA has been described as an important habitat for the provincially Blue-listed great blue heron (*Ardea herodias fannini*) (Butler and Butler 1999).



Figure 11 Known Occurrences of Listed Wildlife Species Near the McDonald Site, B.C.; Red Arrow Indicates the Location of Proposed Project Site (iMap BC 2013)

According to the BC species and ecosystem explorer, 40 listed species can be found in the CDFmm subzone within Metro Vancouver (BC Ministry of Environment 2013; **Table B3, Appendix B**). **Table G** indicates only those species from **Table B3: Appendix B** that have the potential to occur at or near the proposed Project site.

Table G Listed Wildlife Species with the Potential to Occur at the McDonald Site (BC Ministry of Environment 2013)

Scientific Name	English Name	Provincial Listing ¹	SARA Schedule ²	COSEWIC ³	Potential to Occur Comments ⁴	Effects of Post-Enhancement
Birds						
<i>Ardea herodias fannini</i>	great blue heron, <i>fannini</i> subspecies	Blue	1-SC (Feb 2010)	SC (Mar 2008)	May be found loafing at the site; nearest nesting colony is ~6km away at Pacific Spirit Park.	Benefit: creation of foraging habitat
<i>Botaurus lentiginosus</i>	American bittern	Blue	Not listed	Not listed	Not likely found at the site currently; this species is tied to wetlands with tall emergent vegetation (e.g. cattails) year-round.	Benefit: creation of habitat
<i>Nycticorax nycticorax</i>	black-crowned night-heron	Red	Not listed	Not listed	Not likely found at the site currently; this species may forage for fish in marshes.	Benefit: creation of foraging habitat
<i>Buteo lagopus</i>	rough-legged hawk	Blue	Not listed	NAR (May 1995)	Likely forages for rodents over the site; this species may also forage over marsh habitat.	No effect
<i>Patagioenas fasciata</i>	band-tailed pigeon	Blue	1-SC (Feb 2011)	SC (Nov 2008)	May be found at the site, although it is unlikely due to the small amount of treed habitat present.	Possible loss of habitat
<i>Tyto alba</i>	barn owl	Blue	1-SC (Jun 2003)	T (Nov 2010)	Likely forages for rodents over the site; this species may also forage over marsh habitat.	No effect
<i>Asio flammeus</i>	short-eared owl	Blue	1-SC (Jul 2012)	SC (Mar 2008)	Likely forages for rodents over the site; this species may also forage over marsh habitat.	No effect
<i>Chordeiles minor</i>	common nighthawk	Yellow	1-T (Feb 2010)	T (Apr 2007)	May forage for insects high over the site.	Benefit: possible increase in prey abundance
<i>Cypseloides niger</i>	black swift	Yellow	Not listed	C (Jul 2011)	May forage for insects high over the site.	Benefit: possible increase in prey abundance
<i>Falco peregrinus anatum</i>	peregrine falcon, <i>anatum</i> subspecies	Red	1-SC (Jun 2012)	SC (Apr 2007)	Likely forages for avian prey over the site.	No effect

Scientific Name	English Name	Provincial Listing ¹	SARA Schedule ²	COSEWIC ³	Potential to Occur Comments ⁴	Effects of Post-Enhancement
<i>Hirundo rustica</i>	barn swallow	Blue	Not listed	T (May 2011)	May forage for birds over the site; this species may nest under man made coverings close to a source of mud which is used to construct their nests.	Benefit: possible increase in prey abundance
Mammals						
<i>Corynorhinus townsendii</i>	Townsend's big-eared bat	Blue	Not listed	Not listed	May forage for moths over the site; this species forages over forests, grasslands, shrub thickets and riparian areas with limited human disturbances.	Possible loss of foraging habitat
<i>Myotis keenii</i>	Keen's myotis	Blue	³ (Mar 2005)	DD (Nov 2003)	May forage for insects over the site.	Benefit: possible increase in prey abundance
<i>Myotis lucifugus</i>	little brown myotis	Yellow	Not listed	E (Nov 2012)	May be found foraging insects over the site.	Benefit: possible increase in prey abundance
<i>Mustela frenata altifrontalis</i>	long-tailed weasel, <i>altifrontalis</i> subspecies	Red	Not listed	Not listed	Rare species. Not known whether mapped occurrences of this species are historic or recent; this species may occur in open habitats including grasslands and marshes and can tolerate close proximity to humans.	No effect
Amphibians						
<i>Rana aurora</i>	northern red-legged frog	Blue	1-SC (Jan 2005)	SC (Nov 2004)	Not likely found at the site; this species is associated with structurally complex wetlands with slow moving waters relatively free of urban and agricultural runoff.	Benefit: creation of habitat

- Notes:**
- ¹ Red = endangered or threatened, Blue = special concern, Yellow = not at risk
 - ² Schedule 1 = federal species at risk, Schedule 3 = Species under consideration for Schedule 1
 - ³ E = Endangered, T = Threatened, SC = Special Concern, NAR = Not at Risk, C = Candidate for upcoming assessment, DD = Data deficient
 - ⁴ Species information was taken from The Birds of North American Online 2013 and E-Fauna BC 2013

4.5.2.2 Post-Enhancement Conditions

Listed wildlife species occurrences and use of the McDonald site will not likely be negatively affected by the proposed McDonald Tidal Marsh Project. Listed species are not likely to breed on the Project Site. Species that forage for insects may benefit from additional insect production resulting from increased marsh area and productivity. Fish eating species, such as great blue heron may benefit during spring salmon rearing.

Based on relative abundance within the Iona Island bird checklist area (**Figure 9**), the bird species listed in **Table F** that are most likely to occur at the site post-enhancement include American bittern, great blue heron, Peregrine falcon, short-eared owl, barn owl, and barn swallow. Another listed species that is not included in **Table F**, because it is primarily aquatic, but that is likely to occur at the site post-enhancement is short-billed dowitcher (*Limnodromus griseus*).

Great blue heron were categorized as a “moderate” risk for aircraft operations. They would likely use the habitat created near McDonald Slough. However, the project represents a small increase in their foraging habitat (~0.075 ha) from proposed tidal channels.

5.0 CONCLUSION

The Project will create a high-value habitat type (primarily tidal 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).

Construction of an intertidal marsh surrounded by a tidal channel network; an intertidal brackish marsh bench; and, an adjacent riparian area will restore or improve the following ecological functions:

- Increasing primary productivity;
- Supplementing the detritus based food web;
- Creating intertidal habitat for benthic and drift invertebrates (e.g. chironomids) 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 rearing corridor prior to out-migrating to the Strait of Georgia and the Pacific Ocean;
- Increase habitat diversity of the area by converting low quality terrestrial habitat into high quality intertidal and riparian habitat;
- Creation of marsh habitat for waterfowl feeding, nesting, loafing, and refuge; and,
- Creation of riparian habitat for passerine bird feeding, nesting, and refuge.

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.

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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.

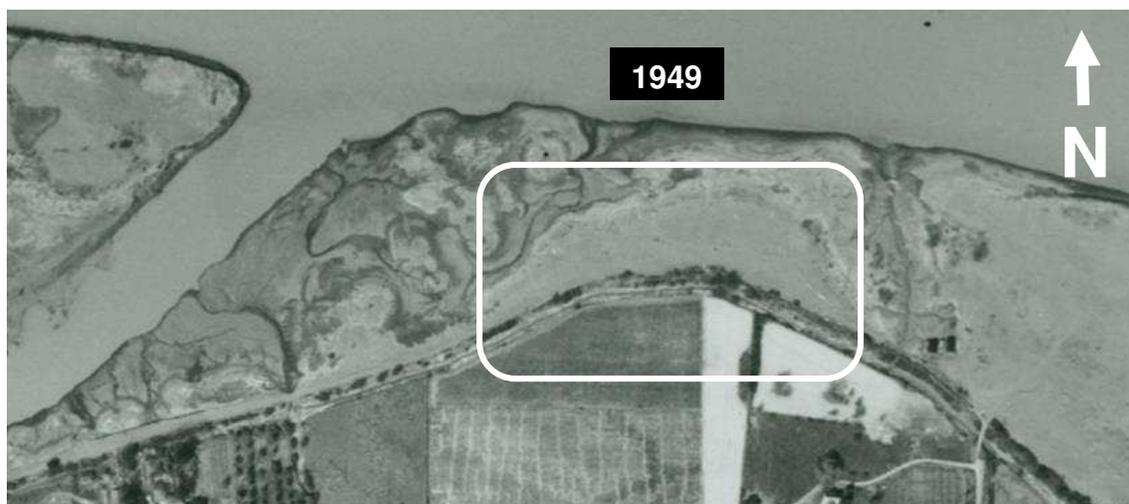
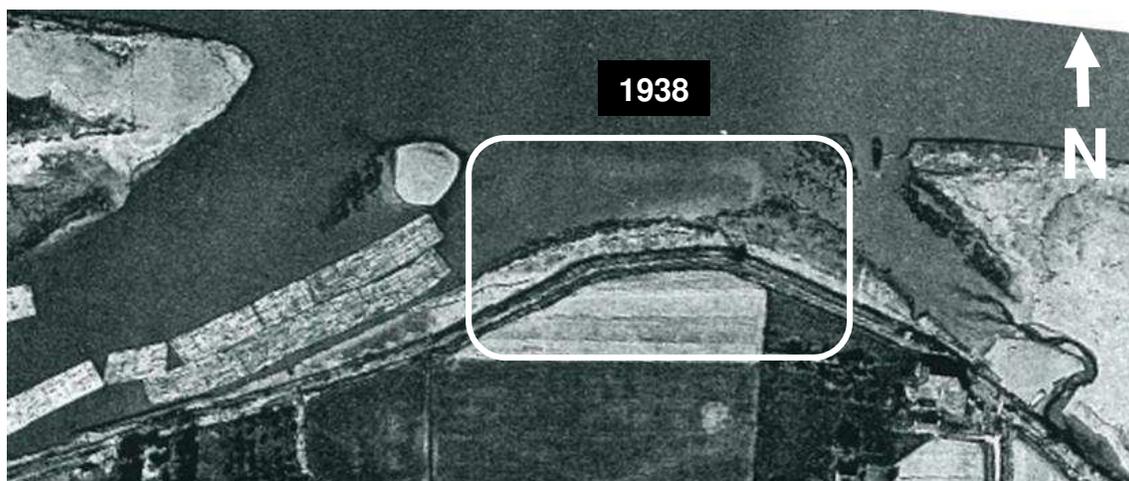
This Report represents a reasonable review of the information available to Hemmera within the established Scope, work schedule and budgetary constraints. It is possible that the levels of contamination or hazardous materials may vary across the Site, and hence currently unrecognised contamination or potentially hazardous materials may exist at the Site. No warranty, expressed or implied, is given concerning the presence or level of contamination on the Site, except as specifically noted in this Report. 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.

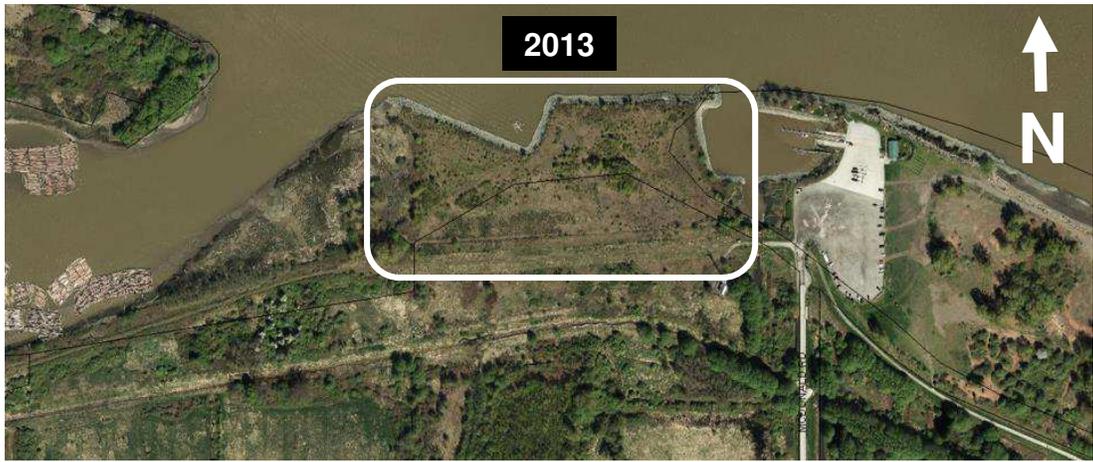
The liability of Hemmera to Port Metro Vancouver shall be limited to injury or loss caused by the negligent acts of Hemmera. The total aggregate liability of Hemmera related to this agreement shall not exceed the lesser of the actual damages incurred, or the total fee of Hemmera for services rendered on this project.

APPENDIX A
Aerial Photography Review

McDonald Historical Aerial Overview







APPENDIX B
CDFmm Species and Ecosystems

Table B1 At-risk Ecosystems Within the Metro Vancouver CDFmm Subzone (BC Ministry of Environment 2013)

Scientific Name	English Name	Provincial Listing ¹	Comments ⁴
Estuarine and Wetland ecosystems			
<i>Alnus rubra</i> / <i>Carex obnupta</i> [<i>Populus trichocarpa</i>]	red alder / slough sedge [black cottonwood]	Red	Unlikely
<i>Alnus rubra</i> / <i>Lysichiton americanus</i>	red alder / skunk cabbage	Red	Unlikely
<i>Carex lasiocarpa</i> - <i>Rhynchospora alba</i>	slender sedge - white beak-rush	Red	Unlikely
<i>Carex lyngbyei</i> Herbaceous Vegetation	Lyngbye's sedge herbaceous vegetation	Red	Likely
<i>Deschampsia cespitosa</i> ssp. <i>beringensis</i> - <i>Hordeum brachyantherum</i>	tufted hairgrass - meadow barley	Red	Probable
<i>Deschampsia cespitosa</i> ssp. <i>beringensis</i> - <i>Symphotrichum subspicatum</i>	tufted hairgrass - Douglas' aster	Red	Probable
<i>Distichlis spicata</i> var. <i>spicata</i> Herbaceous Vegetation	seashore saltgrass Herbaceous Vegetation	Red	Likely
<i>Dulichium arundinaceum</i> Herbaceous Vegetation	three-way sedge	Red	Unlikely
<i>Eleocharis palustris</i> Herbaceous Vegetation	common spike-rush Herbaceous Vegetation	Blue	Unlikely
<i>Juncus arcticus</i> - <i>Plantago macrocarpa</i>	arctic rush - Alaska plantain	Red	Probable
<i>Menyanthes trifoliata</i> - <i>Carex lasiocarpa</i>	buckbean - slender sedge	Blue	Unlikely
<i>Myrica gale</i> / <i>Carex sitchensis</i>	sweet gale / Sitka sedge	Red	Unlikely
<i>Pinus contorta</i> / <i>Sphagnum</i> spp.	lodgepole pine / peat-mosses CDFmm	Red	Unlikely
<i>Rhododendron groenlandicum</i> / <i>Kalmia microphylla</i> / <i>Sphagnum</i> spp.	Labrador tea / western bog-laurel / peat-mosses	Blue	Unlikely
<i>Ruppia maritima</i> Herbaceous Vegetation	beaked ditch-grass Herbaceous Vegetation	Red	Likely
<i>Salix sitchensis</i> - <i>Salix lasiandra</i> var. <i>lasiandra</i> / <i>Lysichiton americanus</i>	Sitka willow - Pacific willow / skunk cabbage	Red	Unlikely
<i>Sarcocornia pacifica</i> - <i>Glaux maritima</i>	American glasswort - sea-milkwort	Red	Likely
<i>Schoenoplectus acutus</i> Deep Marsh	hard-stemmed bulrush Deep Marsh	Blue	Unlikely
<i>Typha latifolia</i> Marsh	common cattail Marsh	Blue	Unlikely
Terrestrial ecosystems			
<i>Abies grandis</i> / <i>Mahonia nervosa</i>	grand fir / dull Oregon-grape	Red	Unlikely
<i>Abies grandis</i> / <i>Tiarella trifoliata</i>	grand fir / three-leaved foamflower	Red	Unlikely
<i>Alnus rubra</i> / <i>Rubus spectabilis</i> / <i>Equisetum arvense</i>	red alder / salmonberry / common horsetail	Blue	Unlikely

Scientific Name	English Name	Provincial Listing ¹	Comments ⁴
<i>Leymus mollis</i> ssp. <i>mollis</i> - <i>Lathyrus japonicus</i>	dune wildrye - beach pea	Red	Probable
<i>Populus trichocarpa</i> - <i>Alnus rubra</i> / <i>Rubus spectabilis</i>	black cottonwood - red alder / salmonberry	Blue	Unlikely
<i>Pseudotsuga menziesii</i> - <i>Arbutus menziesii</i>	Douglas-fir - arbutus	Red	Unlikely
<i>Pseudotsuga menziesii</i> / <i>Mahonia nervosa</i>	Douglas-fir / dull Oregon-grape	Red	Unlikely
<i>Selaginella wallacei</i> / <i>Cladina</i> spp.	Wallace's selaginella / reindeer lichens	Blue	Likely
<i>Thuja plicata</i> / <i>Achlys triphylla</i>	western redcedar / vanilla-leaf	Red	Unlikely
<i>Thuja plicata</i> / <i>Oemleria cerasiformis</i>	western redcedar / Indian-plum	Red	Unlikely
<i>Thuja plicata</i> - <i>Pseudotsuga menziesii</i> / <i>Eurhynchium oreganum</i>	western redcedar - Douglas-fir / Oregon beaked-moss	Red	Unlikely
<i>Thuja plicata</i> / <i>Symphoricarpos albus</i>	western redcedar / common snowberry	Red	Unlikely
<i>Tsuga heterophylla</i> - <i>Thuja plicata</i> / <i>Blechnum spicant</i>	western hemlock - western redcedar / deer fern	Red	Unlikely

Notes: ¹ Red = endangered or threatened, Blue = special concern

⁴ 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 CDFmm Subzone (BC Ministry of Environment 2013)

Scientific Name	English Name	Provincial List	SARA	COSEWIC	Rationale*
<i>Alopecurus carolinianus</i>	Carolina meadow-foxtail	Red			Likely
<i>Anagallis minima</i>	chaffweed	Blue			Likely
<i>Bidens amplissima</i>	Vancouver Island beggarticks	Blue	1-SC (Jun 2003)	SC (Nov 2001)	Likely
<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			Likely
<i>Carex interrupta</i>	green-fruited sedge	Red			Probable
<i>Carex scoparia</i>	pointed broom sedge	Blue			Likely
<i>Carex vulpinoidea</i>	fox sedge	Blue			Likely
<i>Claytonia washingtoniana</i>	Washington springbeauty	Red			Unlikely
<i>Cuscuta campestris</i>	field dodder	Blue			Likely
<i>Elatine rubella</i>	three-flowered waterwort	Blue			Likely
<i>Eleocharis parvula</i>	small spike-rush	Blue			Likely
<i>Eleocharis rostellata</i>	beaked spike-rush	Blue			Probable
<i>Elodea nuttallii</i>	Nuttall's waterweed	Blue			Likely
<i>Erigeron philadelphicus</i> var. <i>glaber</i>	salt marsh Philadelphia fleabane	Red			Probable
<i>Eutrochium maculatum</i> var. <i>bruneri</i>	<i>Joe-pye weed</i>	<i>Red</i>			Likely
<i>Glyceria leptostachya</i>	slender-spiked mannagrass	Blue			Likely
<i>Helenium autumnale</i> var. <i>grandiflorum</i>	mountain sneezeweed	Blue			Likely
<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			Likely
<i>Juncus oxymeris</i>	pointed rush	Blue			Likely
<i>Lilaea scilloides</i>	flowering quillwort	Blue			Unlikely
<i>Lindernia dubia</i> var. <i>anagallidea</i>	false-pimpernel	Blue			Unlikely

Scientific Name	English Name	Provincial List	SARA	COSEWIC	Rationale*
<i>Lindernia dubia</i> var. <i>dubia</i>	yellowseed false pimpernel	Red			Wet, sandy or muddy banks and shores in the lowland and steppe zones; rare in SC BC and the lower Fraser Valley
<i>Lupinus rivularis</i>	streambank lupine	Red	1-E (Jan 2005)	E (Nov 2002)	Wet to moist meadows and riverbanks in the lowland zone; rare on S Vancouver Island and in the lower Fraser Valley
<i>Myriophyllum hippuroides</i>	western water-milfoil	Blue			Unlikely
<i>Myriophyllum pinnatum</i>	green parrot's-feather	Red			Unlikely
<i>Myriophyllum ussuriense</i>	Ussurian water-milfoil	Blue			Lake margins and muddy river banks in the lowland zone; rare on Vancouver Island, lower Fraser River valley and SE BC;
<i>Navarretia intertexta</i>	needle-leaved navarretia	Red			Unlikely
<i>Pleuropogon refractus</i>	nodding semaphoregrass	Blue			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			Likely
<i>Verbena hastata</i> var. <i>scabra</i>	blue vervain	Blue			Likely
<i>Wolffia borealis</i>	northern water-meal	Red			Unlikely

Notes: ¹ Red = endangered or threatened, Blue = special concern

² Schedule 1 = federal species at risk

³ E = Endangered, SC = Special Concern

⁴ 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 Wildlife Species-at-risk within the Metro Vancouver CDFmm Subzone: Potential to Occur in the Proposed McDonald Upland Conversion Project Site (BC Ministry of Environment 2013)

Scientific Name	English Name	Provincial Listing ¹	SARA Schedule ²	COSEWIC ³	Potential to Occur Comments ⁴	Effects of Enhancement
Birds						
<i>Dendragapus fuliginosus</i>	Sooty grouse	Blue	Not listed	Not listed	Site is not within species range.	No effect
<i>Ardea herodias fannini</i>	Great blue heron, <i>fannini</i> subspecies	Blue	1-SC (Feb 2010)	SC (Mar 2008)	May be found loafing at the site; nearest nesting colony is ~6km away at Pacific Spirit Park.	Benefit: creation of foraging habitat
<i>Botaurus lentiginosus</i>	American bittern	Blue	Not listed	Not listed	Not likely found at the site currently; this species is tied to wetlands with tall emergent vegetation (e.g. cattails) year-round.	Benefit: creation of habitat
<i>Butorides virescens</i>	Green heron	Blue	Not listed	Not listed	Not likely found at the site currently; this species may forage in exposed marine environments.	No effect
<i>Nycticorax nycticorax</i>	Black-crowned night-heron	Red	Not listed	Not listed	Not likely found at the site currently; this species may forage for fish in marshes.	Benefit: creation of foraging habitat
<i>Phalacrocorax auritus</i>	Double-crested cormorant	Blue	Not listed	NAR (May 1978)	Not likely found at the site currently; this species forages by diving for fish.	No effect
<i>Accipiter gentilis laingi</i>	Northern goshawk, <i>laingi</i> subspecies	Red	1-T (Jun 2003)	T (Apr 2013)	Not likely found at the site; this species prefers mature forests and old growth.	No effect
<i>Buteo lagopus</i>	Rough-legged hawk	Blue	Not listed	NAR (May 1995)	May forage for rodents over the site; this species may also forage over marsh habitat.	No effect
<i>Grus Canadensis</i>	Sandhill crane	Yellow	Not listed	NAR (May 1979)	Not likely found at this site; nests in isolated wetlands and may forage in intertidal marsh.	No effect
<i>Hydroprogne caspia</i>	Caspian tern	Blue	Not listed	NAR (May 1999)	Not likely found at the site; this species forages for fish obtained from the surface of the water.	No effect
<i>Brachyramphus marmoratus</i>	Marbled murrelet	Blue	1-T (Jun 2003)	T (May 2012)	Not likely found at the site currently; this species forages by diving for fish.	No effect

Scientific Name	English Name	Provincial Listing ¹	SARA Schedule ²	COSEWIC ³	Potential to Occur Comments ⁴	Effects of Enhancement
<i>Patagioenas fasciata</i>	Band-tailed pigeon	Blue	1-SC (Feb 2011)	SC (Nov 2008)	May be found at the site, although it is unlikely.	No effect
<i>Tyto alba</i>	Barn owl	Blue	1-SC (Jun 2003)	T (Nov 2010)	May be found foraging for rodents over the site; this species may also forage over marsh habitat	No effect
<i>Asio flammeus</i>	Short-eared owl	Blue	1-SC (Jul 2012)	SC (Mar 2008)	May be found foraging for rodents over the site; this species may also forage over marsh habitat.	No effect
<i>Strix occidentalis</i>	Spotted owl	Red	1-E (Jun 2003)	E (Mar 2008)	Site is not within species range.	No effect
<i>Megascops kennicottii kennicottii</i>	Western screech-owl, <i>kennicottii</i> subspecies	Blue	1-SC (Jan 2005)	T (May 2012)	Not likely found at this site; this species is primarily associated with riparian or low elevation forests.	No effect
<i>Chordeiles minor</i>	Common nighthawk	Yellow	1-T (Feb 2010)	T (Apr 2007)	May forage for flying insects over the site.	Benefit: possible increase in prey abundance
<i>Cypseloides niger</i>	Black swift	Yellow	Not listed	C (Jul 2011)	May forage for insects over the site.	Benefit: possible increase in prey abundance
<i>Falco peregrinus anatum</i>	Peregrine falcon, <i>anatum</i> subspecies	Red	1-SC (Jun 2012)	SC (Apr 2007)	May forage for birds over the site.	No effect
<i>Contopus cooperi</i>	Olive-sided flycatcher	Blue	1-T (Feb 2010)	T (Nov 2007)	Not likely found at the site; this species forages and breeds in forest openings.	No effect
<i>Hirundo rustica</i>	Barn swallow	Blue	Not listed	T (May 2011)	May forage for birds over the site; this species may nest under man made coverings close to a source of mud which is used to construct their nests.	Benefit: possible increase in prey abundance
<i>Progne subis</i>	Purple martin	Blue	Not listed	Not listed	May be found foraging flying insects over the site; this species may also forage over marsh habitat.	Benefit: possible increase in prey abundance

Scientific Name	English Name	Provincial Listing ¹	SARA Schedule ²	COSEWIC ³	Potential to Occur Comments ⁴	Effects of Enhancement
Mammals						
<i>Aplodontia rufa</i>	Mountain beaver	No Status	1-SC (Jun 2003)	SC (May 2012)	Site not within species range.	No effect
<i>Myodes gapperi occidentalis</i>	Southern red-backed Vole, <i>occidentalis</i> subspecies	Red	Not listed	Not listed	Not likely found at the site; this species is generally associated with mature forest cover with high levels of structural diversity and large woody debris.	No effect
<i>Lepus americanus washingtonii</i>	Snowshoe hare, <i>washingtonii</i> subspecies	Red	Not listed	Not listed	Not likely found at the site; habitat generally includes non-fragmented adequately sized riparian woodlands.	No effect
<i>Sorex bendirii</i>	Pacific water shrew	Red	1-E (Jun 2003)	E (Apr 2006)	Not likely found at the site; habitat generally includes forested riparian habitat with high levels of structural diversity.	No effect
<i>Sorex rohweri</i>	Olympic shrew	Red	Not listed	Not listed	Not likely found at the site; this species is associated with dry riparian habitat around streams and wetlands with high levels of structural diversity and deep organic soil layers.	No effect
<i>Sorex trowbridgii</i>	Trowbridge's shrew	Blue	Not listed	Not listed	Not likely found at the site; this species prefers forest habitat away from water with high levels of structural diversity and deep organic soil layers.	No effect
<i>Corynorhinus townsendii</i>	Townsend's big-eared bat	Blue	Not listed	Not listed	May be found foraging for moths over the site; this species forages over forests, grasslands, shrub thickets and riparian areas with limited human disturbances.	Change in foraging habitat type
<i>Myotis keenii</i>	Keen's myotis	Blue	3 (Mar 2005)	DD (Nov 2003)	May be found foraging for insects over the site.	Benefit: possible increase in prey abundance
<i>Myotis lucifugus</i>	Little brown myotis	Yellow	Not listed	E (Nov 2012)	May be found foraging insects over the site.	Benefit: possible increase in prey abundance

Scientific Name	English Name	Provincial Listing ¹	SARA Schedule ²	COSEWIC ³	Potential to Occur Comments ⁴	Effects of Enhancement
<i>Gulo gulo luscus</i>	Wolverine, <i>luscus</i> subspecies	Blue	Not listed	SC (May 2003)	Site not within species range.	No effect
<i>Mustela frenata altifrontalis</i>	Long-tailed weasel, <i>altifrontalis</i> subspecies	Red	Not listed	Not listed	May be found at the site; this species may be found in open habitats including grasslands and marshes and can tolerate close proximity to humans.	No effect
<i>Ursus arctos</i>	Grizzly bear	Blue	Not listed	SC (May 2002)	Site not within species range.	No effect
Amphibians						
<i>Anaxyrus boreas</i>	Western toad	Blue	1-SC (Jan 2005)	SC (2012)	Site not within species range	No effect
<i>Rana aurora</i>	Northern red-legged frog	Blue	1-SC (Jan 2005)	SC (Nov 2004)	Not likely found at the site; this species is associated with structurally complex wetlands with slow moving waters relatively free of urban and agricultural runoff.	Benefit: creation of habitat
<i>Rana pretiosa</i>	Oregon Spotted Frog	Red	1-E (2003)	E (2011)	Not likely found at the site; this species is restricted to only a handful of disjointed populations within the Fraser lowlands.	No effect
Reptiles and turtles						
<i>Chrysemys picta pop. 1</i>	Painted turtle - pacific coast population	Red	1-E (Dec 2007)	E (Apr 2006)	Not likely found at the site; this species is associated with slow-moving, permanent water bodies.	No effect
<i>Actinemys marmorata</i>	Western Pond Turtle	Red	1-X (2005)	XT (2012)	Species is thought to be extirpated in BC	No effect
<i>Charina bottae</i>	Northern Rubber Boa	Yellow	1-SC (2005)	SC (2003)	Does not occur at the site	No effect

- Notes:**
- ¹ Red = endangered or threatened, Blue = special concern, Yellow = not at risk
 - ² Schedule 1 = federal species at risk, Schedule 3 = Species under consideration for Schedule 1
 - ³ E = Endangered, T = Threatened, SC = Special Concern, NAR = Not at Risk, XT = Extirpated, C = Candidate for upcoming assessment, DD = Data deficient
 - ⁴ Species information was taken from The Birds of North American Online 2013 and E-Fauna BC 2013

Table B3 Non-listed Wildlife Species Common to the Iona Island Bird Checklist Area and the Sea Island Conservation Area (BC Ministry of Environment 2003; Canadian Wildlife Service 2002)

Scientific Name	Common Names ¹	Breed ²	Field ³	Shrub ³	Treed Woodlot ³	Wet habitat ³	Spring ⁴	Summer ⁴	Fall ⁴	Winter ⁴
<i>Taricha granulosa</i>	Rough-skinned newt	?					-	-	-	-
<i>Ambystoma gracile</i>	Northwestern salamander	?					-	-	-	-
<i>Ambystoma macrodactylum</i>	Long-toed salamander	?					-	-	-	-
<i>Pseudacris regilla</i>	Pacific tree frog	Y		Y	Y	Y	-	-	-	-
<i>Thamnophis elegans</i>	Western garter snake	Y					-	-	-	-
<i>Thamnophis ordinoides</i>	Northwestern garter snake	Y					-	-	-	-
<i>Thamnophis sirtalis</i>	Common garter snake	Y					-	-	-	-
<i>Gavia stellata</i>	Red-throated loon		-	-	-	-	c	r	c	f
<i>Gavia pacifica</i>	Pacific loon		-	-	-	-	f	ca	f	u
<i>Gavia immer</i>	Common loon		-	-	-	-	c	u	c	f
<i>Podilymbus podiceps</i>	Pied-billed grebe	Y				?	u	u	u	u
<i>Podiceps auritus</i>	Horned grebe		-	-	-	-	c	r	c	c
<i>Podiceps grisegena</i>	Red-necked grebe		-	-	-	-	c	r	c	f
<i>Podiceps nigricollis</i>	Eared grebe		-	-	-	-	r	ca	r	f
<i>Phalacrocorax pelagicus</i>	Pelagic cormorant		-	-	-	-	u	u	u	u
<i>Anser albifrons</i>	Greater white-fronted goose		-	-	-	-	u	ca	u	r
<i>Chen caerulescens</i>	Snow goose		-	-	-	-	c	ac	c	c
<i>Branta canadensis</i>	Canada goose	Y	-	-	-	-	c	c	c	c
<i>Anas crecca</i>	Green-winged teal	Y	-	-	-	-	a	u	a	a
<i>Anas platyrhynchos</i>	Mallard	Y	-	-	-	-	c	c	c	a
<i>Anas acuta</i>	Northern pintail	Y	-	-	-	-	c	u	c	a
<i>Anas discors</i>	Blue-winged teal	Y	-	-	-	-	f	f	f	
<i>Anas cyanoptera</i>	Cinnamon teal	Y	-	-	-	-	f	f	f	ca
<i>Anas clypeata</i>	Northern shoveler	Y	-	-	-	-	c	u	c	f
<i>Anas strepera</i>	Gadwall	Y	-	-	-	-	c	f	c	c
<i>Anas americana</i>	American wigeon	Y	-	-	-	-	c	u	c	c

Scientific Name	Common Names ¹	Breed ²	Field ³	Shrub ³	Treed Woodlot ³	Wet habitat ³	Spring ⁴	Summer ⁴	Fall ⁴	Winter ⁴
<i>Aythya valisineria</i>	Canvasback		-	-	-	-	c	ca	c	c
<i>Aythya collaris</i>	Ring-necked duck		-	-	-	-	r	r	r	u
<i>Aythya marila</i>	Greater scaup		-	-	-	-	u		c	a
<i>Aythya affinis</i>	Lesser scaup		-	-	-	-	c	u	c	c
<i>Melanitta americana</i>	Black scoter		-	-	-	-	u	r	u	f
<i>Melanitta fusca</i>	White-winged scoter		-	-	-	-	r	u	r	f
<i>Bucephala clangula</i>	Common goldeneye		-	-	-	-	c	r	c	c
<i>Bucephala islandica</i>	Barrow's goldeneye		-	-	-	-	c	r	c	c
<i>Bucephala albeola</i>	Bufflehead		-	-	-	-	c	ca	c	c
<i>Lophodytes cucullatus</i>	Hooded merganser		-	-	-	-	u	r	u	f
<i>Mergus merganser</i>	Common merganser		-	-	-	-	c	u	c	c
<i>Mergus serrator</i>	Red-breasted merganser		-	-	-	-	c	ca	c	c
<i>Oxyura jamaicensis</i>	Ruddy duck	Y	-	-	-	-	c	r	c	c
<i>Cathartes aura</i>	Turkey vulture		-	-	-	-		r	u	
<i>Haliaeetus leucocephalus</i>	Bald eagle		-	-	-	-	f	u	f	f
<i>Circus cyaneus</i>	Northern harrier		-	-	-	-	u	u	u	u
<i>Accipiter striatus</i>	Sharp-shinned hawk		-	-	-	-	u	r	u	u
<i>Accipiter cooperii</i>	Cooper's hawk		-	-	-	-	u	r	u	u
<i>Buteo jamaicensis</i>	Red-tailed hawk		-	-	-	-	f	f	f	f
<i>Falco sparverius</i>	American kestrel		-	-	-	-	u	r	u	r
<i>Falco columbarius</i>	Merlin		-	-	-	-	r	r	r	u
<i>Porzana carolina</i>	Sora	Y				RNF	u	f	u	
<i>Fulica americana</i>	American coot	Y				F*	f	u	f	f
<i>Pluvialis squatarola</i>	Black-bellied plover						c	r	c	f
<i>Charadrius semipalmatus</i>	Semipalmated plover	Y				F*	f	r	f	ac
<i>Charadrius vociferus</i>	Killdeer	Y					f	f	f	u
<i>Tringa melanoleuca</i>	Greater yellowlegs					RF*	c	r	c	u
<i>Tringa flavipes</i>	Lesser yellowlegs					RF*	u	r	c	ca

Scientific Name	Common Names ¹	Breed ²	Field ³	Shrub ³	Treed Woodlot ³	Wet habitat ³	Spring ⁴	Summer ⁴	Fall ⁴	Winter ⁴	
<i>Actitis macularius</i>	Spotted sandpiper	Y				RNF*	f	f	f	ca	
<i>Numenius phaeopus</i>	Whimbrel						u	r	u	ac	
<i>Arenaria melanocephala</i>	Black turnstone		-	-	-	-	r	ca	r	u	
<i>Calidris alba</i>	Sanderling		-	-	-	-	c	r	c	c	
<i>Calidris pusilla</i>	Semipalmated sandpiper		-	-	-	-	r	ca	f		
<i>Calidris mauri</i>	Western sandpiper					RF*	a	u	a	r	
<i>Calidris minutilla</i>	Least sandpiper					RF*	c	u	c	ca	
<i>Calidris melanotos</i>	Pectoral sandpiper					RF*	r	ac	c		
<i>Calidris acuminata</i>	Sharp-tailed sandpiper		-	-	-	-			u	ac	
<i>Calidris alpina</i>	Dunlin					RF*	a	r	a	f	
<i>Limnodromus scolopaceus</i>	Long-billed dowitcher					RNF	f	u	a	r	
<i>Gallinago delicata</i>	Wilson's snipe						u	r	u	f	
<i>Phalaropus tricolor</i>	Wilson's phalarope	Y					u	u	u		
<i>Stercorarius parasiticus</i>	Parasitic jaeger		-	-	-	-	r	ca	u		
<i>Chroicocephalus philadelphia</i>	Bonaparte's gull						c	f	c	r	
<i>Larus canus</i>	Mew gull						c	r	c	a	
<i>Larus delawarensis</i>	Ring-billed gull						f	f	f	f	
<i>Larus argentatus</i>	Herring gull						u	ca	u	u	
<i>Larus thayeri</i>	Thayer's gull						c	ca	c	f	
<i>Larus glaucescens</i>	Glaucous-winged gull	Y				RF*	a	a	a	a	
<i>Sterna hirundo</i>	Common tern		-	-	-	-	c	r	c		
<i>Chlidonias niger</i>	Black tern		-	-	-	-	r	r	r		
<i>Cephus columba</i>	Pigeon guillemot		-	-	-	-	f	f	f	u	
<i>Cypseloides niger</i>	Black swift		Forage over the area					f		f	f
<i>Chaetura vauxi</i>	Vaux's swift		Forage over the area					f	f	f	
<i>Selasphorus rufus</i>	Rufous hummingbird	Y		RNF	RNF		c	f	f		
<i>Megaceryle alcyon</i>	Belted kingfisher	Y				F*	u	u	u	u	
<i>Empidonax traillii</i>	Willow flycatcher	Y		RNF	RNF		u	u	u		

Scientific Name	Common Names ¹	Breed ²	Field ³	Shrub ³	Treed Woodlot ³	Wet habitat ³	Spring ⁴	Summer ⁴	Fall ⁴	Winter ⁴
<i>Tachycineta bicolor</i>	Tree swallow	Y		R	RN		a	c	r	
<i>Tachycineta thalassina</i>	Violet-green swallow	Y		R	RN		a	c	r	
<i>Stelgidopteryx serripennis</i>	Northern rough-winged swallow	Y					c	f	c	
<i>Riparia riparia</i>	Bank swallow	Y					r	ca	u	
<i>Petrochelidon pyrrhonota</i>	Cliff swallow	Y					c	c	c	ac
<i>Corvus corax</i>	Common raven						u	u	u	u
<i>Poecile atricapillus</i>	Black-capped chickadee	Y		RF	RNF		u	u	u	u
<i>Thryomanes bewickii</i>	Bewick's wren	Y		RF	RF		u	u	u	u
<i>Regulus calendula</i>	Ruby-crowned kinglet			RF	RF		f		f	r
<i>Turdus migratorius</i>	American robin	Y		RNF	RNF		c	c	c	f
<i>Anthus rubescens</i>	American pipit		-	-	-	-	c	r	c	r
<i>Bombycilla cedrorum</i>	Cedar waxwing	Y	-	-	-	-	c	c	c	r
<i>Lanius excubitor</i>	Northern shrike		-	-	-	-	u		u	u
<i>Vireo gilvus</i>	Warbling vireo +		-	-	-	-	u		u	
<i>Oreothlypis celata</i>	Orange-crowned warbler		-	-	-	-	c	u	c	
<i>Setophaga petechia</i>	Yellow warbler	Y	-	-	-	-	f	f	f	
<i>Setophaga coronata</i>	Yellow-rumped warbler		-	-	-	-	c		c	u
<i>Geothlypis trichas</i>	Common yellowthroat	Y	-	-	-	-	c	c	c	ca
<i>Cardellina pusilla</i>	Wilson's warbler		-	-	-	-	u		u	
<i>Pheucticus melanocephalus</i>	Black-headed grosbeak	Y		F	RNF		u	u	u	
<i>Spizella arborea</i>	American tree sparrow						r		r	u
<i>Passerculus sandwichensis</i>	Savannah sparrow	Y		RF	RF		a	c	a	r
<i>Passerella iliaca</i>	Fox sparrow						u		u	c
<i>Melospiza melodia</i>	Song sparrow			RF			f	r	f	a
<i>Melospiza lincolnii</i>	Lincoln's sparrow	Y	F	RF			f	ca	f	r
<i>Zonotrichia atricapilla</i>	Golden-crowned sparrow						c	ca	c	f
<i>Zonotrichia albicollis</i>	White-crowned sparrow	Y					c	c	c	c
<i>Junco hyemalis</i>	Dark-eyed junco						r		r	u

Scientific Name	Common Names ¹	Breed ²	Field ³	Shrub ³	Treed Woodlot ³	Wet habitat ³	Spring ⁴	Summer ⁴	Fall ⁴	Winter ⁴
<i>Plectrophenax nivalis</i>	Snow bunting		-	-	-	-	r		f	u
<i>Agelaius phoeniceus</i>	Red-winged blackbird	Y		RF	RF	RNF	c	c	c	c
<i>Sympetrum semicinctum</i>	Western meadowlark	Y	RNF	R			u	ca	u	u
<i>Xanthocephalus xanthocephalus</i>	Yellow-headed blackbird	Y				RNF	u	u	r	ca
<i>Euphagus cyanocephalus</i>	Brewer's blackbird	Y		RNF	RNF	F	c	c	c	c
<i>Molothrus ater</i>	Brown-headed cowbird	Y		RNF	RNF	N	c	c	c	r
<i>Haemorhous mexicanus</i>	House finch	Y		RNF	RF		c	c	c	c
<i>Spinus pinus</i>	Pine siskin	?			RNF		c	u	c	r
<i>Spinus tristis</i>	American goldfinch	Y		RNF	RF		f	f	f	r
<i>Coccothraustes vespertinus</i>	Evening grosbeak+	Y			RF		r		r	u
<i>Lontra canadensis</i>	North American River Otter	?				?	-	-	-	-
<i>Neovison vison</i>	American Mink	?				?	-	-	-	-
<i>Procyon lotor</i>	Raccoons	Y		Y	Y	Y	-	-	-	-

Notes:

- ¹ + = species require more information within the check-list area to assess its status accurately
- ² Y = this indicates species that have been known to breed on Sea Island, ? = thought likely to breed on Sea Island
- ³ R = roosting use, N = nesting use, F = foraging use, Y = species would use this habitat, ? = species, if present, would be expected to use this habitat, - = no information, * = Use would be primarily of airport interceptor ditches which pass through the conservation area
- ⁴ a = abundant (100 or more per day), c = common (25 to 100 per day), f = fairly common (5 to 25 per day), u = uncommon (1 to 5 per day with at least 10 records a year), r = rare (1 to 10 records per year) but regular, ca = casual (2 to 10 in checklist area), ac = accidental (only 1 record in checklist area)