

Habitat Assessment Report

Fraser Grain Terminal

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1.0 INTRODUCTION

Hemmera was retained by CMC Engineering and Management Ltd. (CMC) on behalf of Fraser Grain Terminal Ltd.¹ (the “Proponent”) to prepare a Habitat Assessment Report for the property located on 11041 Elevator Road in Surrey, BC (the “Site”), in accordance with the Project and Environmental Review Submission Requirements dated 24 March 2017. The Proponent is proposing to develop the Fraser Grain Terminal Export Facility (the “Project”) on land adjacent to the Fraser Surrey Docks (FSD) facility.

The majority of the Site is leased from Vancouver Fraser Port Authority (VFPA) by the Proponent, and was formerly leased by Bekaert Canada Ltd. (Bekaert). The Project will serve as a trans-shipment storage location for bulk grain products, and will include loading and unloading infrastructure, storage silos, a transfer tower and gallery, and ancillary works. The Site has operated as a port terminal for many years and is therefore fully developed. It is located adjacent to the main arm of the Fraser River.

This report addresses VFPA requirements for vegetation, habitat and species-at-risk for the Project’s construction permit application. This report provides:

- A description of existing conditions, species and habitats potentially affected by Project activities such as in-water works, vegetation removal and earthworks, including effects to riparian vegetation;
- A description of existing vegetation types, characteristics, and relative abundance, including native, listed and invasive species;
- Review of all federal and provincial listed species-at-risk that may be affected by the proposed Project; and
- Potential effects resulting from Project construction, and recommendations for mitigation and monitoring.

2.0 PROJECT OVERVIEW

2.1 PROJECT LOCATION

The Project site is located on VFPA property located along the Fraser River, at 11041 Elevator Road in Surrey, British Columbia. The Project is situated in an urban area between the Fraser River and Highway 17 (South Fraser Perimeter Road or SFPR) within the City of Surrey and adjacent to the Corporation of Delta. The City of New Westminster is located on the east bank of the Fraser River directly across from the Project (**Figure 1**).

¹ Fraser Grain Terminal Ltd. is a Canadian family-owned and operated grain company with more than 100 years of experience in agribusiness and locations across Canada. Serving more than 10,000 Canadian farmers and producers, we market grain to over 40 countries.

The 10.3 ha Project site is located entirely on federal lands. Majority of the land has been leased directly by the Proponent while a small portion of the land has been leased from FSD. The Project will be accessed via an access road that is permitted for development by FSD on a right-of-way over VFPA land.

2.2 PROJECT DATES

Construction of the Project is scheduled to begin following receipt of Project approvals and after demolition of the existing Bekaert Production Building, and will take approximately two years to complete. Proposed construction works may overlap with time periods for environmentally sensitive life history stages. For instance, sensitive life history stages for fish (e.g., spawning, egg incubation) and the breeding bird window are typical time periods that can influence construction plans. Potentially applicable environmental work windows for construction projects of this type will be contingent on consideration of the actual risks of potential effects and the ability to apply alternate mitigation approaches. Dependent on the timing of specific aspects of construction, environmental work windows that may apply are:

- Least risk window for the protection of fish and fish habitat in the Fraser River Estuary is June 16 to February 28 (DFO 2015).
- Least risk work window for breeding birds protected by the *Migratory Birds Convention Act* is between September 1 and February 28 (EC 2015, MoE 2014).
- Least risk work window for raptors is September 15 to December 31 (MoE 2013).

3.0 PROJECT DESCRIPTION

3.1 PROJECT DESCRIPTION

The Proponent, in partnership with FSD, have been operating a port terminal facility that has been handling agri-products at FSD since 2011 (JV Facility). This consists of a small rail unloading facility, a 18,000 t storage shed, portable conveyors to load vessels and a shiploader. In 2015, selected as the baseline year for the environmental assessment, this existing JV Facility handled in excess of 800 000 t of agri-products.

The Project proposes to trans-ship approximately 3.5 million tonnes per annum (Mt/a) of grain products including wheat, barley, oil seeds, and pulses. The Project will make use of some existing FSD facilities for the incoming and outgoing product:

- FSD portion of Berth #3 and Berth #4 to locate a new travelling shiploader and associated feed conveyors
- Portion of FSD trackage at the Port Authority Rail Yard (PARY)

The existing FSD terminal will continue to operate with its own existing receiving, storage and reclaim system, but will integrate with the new vessel loading facilities by means of a new travelling shiploader. This method offers the opportunity to allow the existing facility to be decommissioned in the future if so

desired. The existing bathymetric profiles will limit the maximum useable draft at the FSD berth. As a result, some of the vessels will be only partly loaded at the Project and then will be topped up at other terminals in Vancouver Harbour (most likely the AGT Terminal which is partly owned by the partners of Fraser Grain Terminal Export Facility).

3.2 PROJECT COMPONENTS AND ACTIVITIES

A Site layout is provided in the Overall Site General Arrangement Drawing 1419-G-05-200 (see **Attachment 4** of the Application). **Attachment 4** also provides a detailed description of each component. Of relevance to the habitat assessment, the proposed Project includes the following components:

- A semi-loop rail track connecting to the adjacent PARY.
- This semi-loop track crosses an area of identified streambank lupine (*Lupinus rivularis*) critical habitat (ECCC 2017)
- An unloading station, located on the semi-loop track, to empty railcars.
- Up to twenty-four 3,000 tonne (t) corrugated and galvanized silos and ten 500 t corrugated and galvanized bins for grain storage.
- A travelling shiploader with a cascading-type telescoping loading spout installed on existing FSD Berth #4 and a portion of Berth #3 for loading Panamax class vessels.
- A transfer steel tower containing two bulk weighers, a shipping surge bin, two grain samplers and three bucket elevators. This transfer tower will serve as the central receiving and dispatch point for directing grain flow from the unloading station to storage silos and the shiploader.
- A network of enclosed belt conveyors, supported by steel trusses, connecting the receiving station to storage silos and the shiploader via the transfer tower.
- Multiple, individual dust suppression systems installed around all conveyors, silos and other associated material handling equipment.
- A truck and railcar loading facility.
- A container loading facility with associated empty container yard, container preparation area and full container yard to stuff containers with bulk grain for international markets.
- An administration building and a maintenance shop.

In general, construction of the above-described Project components will include site preparation activities (e.g., clearing and grubbing), excavation, concrete works, pile driving, erection of buildings, and assembly of the grain handling facility.

The Site is a flat, industrial, disturbed site with little native vegetation. Some clearing will be required to accommodate certain temporary Project components (e.g., detention pond) and permanent components (e.g., semi-loop rail track, roads). Approximately 9,500 m² (0.95 ha) of vegetation will be removed during

site preparation. Site clearing is described in more detail in **Section 5.0**. The locations of the areas to be cleared are shown in **Figure 3**. No excavation is planned in areas that are currently vegetated.

An approximately 35 m long section of Ditch N (see **Section 4.2.2.1**) will be infilled as part of construction to accommodate a portion of the container yard footprint.

The storage silos, railcar unloading building, and container loading building will be constructed on top of an existing concrete slab. During construction, a 1.0 m thick concrete raft will then be constructed on the existing slab to act as a raft foundation for the silos and buildings. Additional concrete slabs will be poured to support the truck loading, maintenance shop, and administration buildings. Concrete will be batched offsite and transported to the Project site using concrete trucks.

Due to existing underground contaminated soil and water, foundations for all structures located above the contaminated area will be constructed above the existing ground elevation. Structures requiring excavation, such as the unloading pit structure and its associated support piles, a shallow conveyor trench, and a bucket elevator leg pit, have been located away from the contaminated area.

The construction methodology for the unloading pit and leg pit consists of the following:

- Drive sheet pile around the unloading pit perimeter
- Excavate area inside sheet piles
- Pour tremie concrete
- Pump water out
- Construct concrete walls and slabs to define unloading pit.

The travelling shiploader will be installed on rails supported by new steel piles driven within the existing berth face. The construction of the travelling shiploader system will include the following elements:

- A shiploader tower.
- Eight support bents for the supply shuttle conveyer.
- One concrete support beam on the “land-side” with a steel rail on which the wheels of the travelling shiploader will ride.
- One full-length longitudinal steel support beam plus 28 cross beams on the “water-side” with a steel rail on which the wheels of the travelling shiploader will ride.
- One travelling shiploader.

Construction of the above-listed elements will require the following:

- Saw-cutting and removal of several areas of existing asphalt and gravel ballast in the wharf area.
- Protection/relocation of any exposed services.

- Coring/saw-cutting through the haunched slabs to create the openings required for pile driving.
- Burning back of exposed strand and re-bar, followed by cleaning and patching with grout.
- Preparation of the seabed for water-side pile driving, including:
 - Divers will mark the limits of slope protection material to be cleared.
 - Containment wire mesh will then be cut, folded back, and secured.
 - A barge-mounted long-reach excavator with conventional bucket or small clamshell will remove the coarse slope protection material.
 - Excavated material will be temporarily stored on a barge before being re-installed.
- Pile driving of 54 steel piles (914 mm and 1,219 mm diameter) shoreward of the bulkhead and pouring of pile caps to support the shiploader tower, bents, and the land side shiploader beam.
- Installation of 69 in-water steel piles (610 mm diameter) to support the water-side shiploader beam. This activity is expected to include:
 - The crane-mounted pile driving equipment will either be floating (i.e., barge-based) or land-based and working from on the deck.
 - The contractor may start pile installation with a vibratory (vibro) hammer, but will be required to finish driving with a diesel or similar impact hammer to prove the capacity for each pile.
 - Each of the 69 piles will receive a concrete pile cap following installation.
- Following water-side pile installation, barge-mounted equipment will reinstate the riprap . Once the riprap is confirmed to be installed correctly, the divers will trim and reinstall the wire mesh.
- Duration of In-water work is expected to be 2 to 3 months.

The proposed locations of the new piles are shown in the WorleyParsons Pile and Deck Plan 307071-01159-00-MA-DSK-1504.

All buildings and grain-handling components (e.g., silos, shiploader, conveyors, transfer tower, etc.) will be fabricated offsite and transported to the Project site for final assembly and connection.

3.3 PROJECT STAGING AND SCHEDULE

Project construction will commence upon completion of site demolition activities and receipt of all applicable regulatory and permitting approvals. Construction is anticipated to take approximately two years to complete. The proposed construction schedule and estimated duration of activities are shown in **Appendix A**.

Staging for the non-marine components of the Project is planned generally as follows:

- Mobilization to Site
- Install civil services (water, sewer)
- Site prep in storage area and begin office / maintenance building construction

- Begin earthworks in receiving area
- Begin concrete works in storage area
- Begin concrete works in receiving area
- Main transfer tower foundation
- Construct cones and silos
- Construct railcar/truck loading building
- Begin mechanical/electrical installation
- Main transfer tower steel structure
- Construct galleries, bents and towers in storage area
- Prep container loading area and pour foundation
- Construct container loading building
- Construct main loop and spur time

Staging for the marine components of the Project is planned generally as follows:

- Begin shipping conveyor system
- Begin wharf transfer gallery
- Begin wharf foundation
- Begin shiploader installation

4.0 EXISTING ENVIRONMENT

In general, the terrestrial and aquatic habitat within and surrounding the Project Site has been highly modified from its pre-development setting (~c1930) by industrial and transportation activities (such as filling and paving), as well as urbanization. The Fraser River foreshore, patches of vegetation around the Site, and Gunderson Slough (to the south of the Site) have potential to provide habitat for fish and wildlife species. Drainage within the Site has been generally channelized or culverted and isolated from fish-bearing habitat. These habitats and their respective values are described below.

The Site was investigated for environmental values (**Figures 2 and 3**) through desktop review and site reconnaissance. Special attention was paid to areas where site preparation (i.e., clearing and grubbing) and new construction (e.g. in areas that were not previously built) are planned. The study area, as defined by a 25 m buffer around the Site, was considered in the literature review to include assessment of important environmental components (e.g., Fraser River, Gunderson Slough) that influence the value of habitat and risk of impacts in the Site. The temporal boundary was defined as the construction phase.

Hemmera biologists visited the Site on September 30, 2015 to conduct a field reconnaissance and ground-truth the information obtained from the literature review.

4.1 TERRESTRIAL ENVIRONMENT

4.1.1 Methods

4.1.1.1 Vegetation

Background information used to obtain terrestrial vegetation information for the study area, included:

- Published and unpublished government reports for the areas
- Published scientific reports for the areas
- Hectares BC
- BC Species and Ecosystem Explorer (BC CDC 2015)
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC)
- *Species at Risk Act* (SARA) Registry
- iMapBC
- eFlora
- Other supporting studies for nearby projects
- CMC Drawing 1419-C-07-1010

Review of background information considered ecological sensitivity, rarity on the landscape, Project-related effects, regulatory triggers, and identification by the scientific community.

Vegetation resources assessed included at-risk plant species, including red or blue-list species as defined by the BC Conservation Data Centre (BC CDC), and at-risk plant communities (ecosystems) as defined by regulations under SARA. Potential effects to federally (i.e., SARA) and provincially-listed at-risk plant species and communities were considered. Databases (i.e., BC CDC) were searched for potentially occurring, and confirmed present, at-risk species within the Project footprint.

Terrestrial Ecosystem Mapping (TEM) for the Project Site was conducted using British Columbia Resources Information Standards Committee (RISC) Standards for Terrestrial Ecosystem Mapping (1998) to delineate vegetated polygons. A modified TEM was required, as the Site is already developed as a Port industrial facility, and existing vegetation is characteristic of disturbed, urban environments.

Due to the small number of vegetated polygons, field data collection was performed to Level 2 survey intensity, which requires 50 to 75% of polygons to be field-checked (RISC 1998).

At-risk plant species data collection to investigate the presence of at-risk plants listed provincially (by the BC CDC; blue- or red-listed) and federally (vascular plants on Schedule 1 of SARA or under consideration by COSEWIC in July 2010) followed the Alberta Native Plant Council guidelines (2012)². Special consideration was given to surveys for streambank lupine, a Schedule 1 at-risk plant species with historical occurrences adjacent to the Site (iMap 2015). The Project is located within identified critical habitat for streambank lupine (ECCC 2017).

Field data collection for at-risk plants focused on areas where vegetation was present. At each location, a visual estimate of combined cover and abundance was provided for each species encountered.

4.1.1.2 Wildlife

Desktop methods used to determine potential wildlife species occurring in the Site included:

- Online Databases (BC CDC, WiTS, EFauna, eBird)
- Background documents and previous reports from studies within the surrounding area (RESL 2006, SNC Lavalin 2013, CoD 2003)

Field activities conducted to determine potential presence of wildlife, particularly species at-risk included:

- Checking vegetated areas for evidence of bird nesting activity;
- Checking riparian areas for use by small and medium-sized mammals;
- Observing bird species flying overhead or using the riverine habitat adjacent to the Project Site;
- Observing wildlife sign, such as scat and tracks.

4.1.2 Results

4.1.2.1 Vegetation

The Project is located within the Coastal Western Hemlock Eastern Very Dry Maritime (CWHxm1) biogeoclimatic zone. This zone has warm, dry summers and moist, mild winters with a long growing season (Pojar, Klinka and Demarchi 1994). The Site is generally flat, industrial, and disturbed with little native vegetation. The Site has been industrial since the 1930's (SNC Lavalin 2013). Soils are imported fill and natural ecosystems are absent. The vegetated polygons within the Site were comprised mainly of weedy and invasive plant species. Due to disturbance, ecosystems were described based on their dominant vegetation type, rather than by ecosystem characteristics (**Table 1**).

² In the absence of BC standards for at-risk plant surveys, the Alberta Native Plant Council Guidelines are accepted as a suitable protocol.

Table 1 Plant Communities in the Project Site

Code	Name	Description	Area (ha)	%
Vegetated Communities				
HE*	Herbaceous	Dominated by native and non-native herbaceous plant species	0.34	3.3
SH*	Shrubby	Areas of shrub growth (0-10 m tall), including native and non-native species.	0.36	3.5
TR*	Treed	Treed areas comprised on native and ornamental species	0.25	2.4
Total			0.95	9.2
Unvegetated Areas				
ES	Exposed soil	Open areas with sparse to no vegetation cover	0.25	2.4
RN	Railway Track	Area used for transportation of goods by rail	1.32	12.8
RZ	Road surface	Area compacted and/or paved for the transportation of goods via vehicle	0.46	4.4
UR	Urban	Areas where paved and developed surfaces make up almost a continuous land cover	7.35	71.0
OW	Open water	Shallow open water, < 2m deep	0.02	0.2
Total			9.4	90.8

Note: * Unique code developed for this Project

The majority (71%) of the Site is paved and modified for industrial use. A small detention pond (OW) is located in the middle of the Site, and appears to be fed from a culvert that runs generally northwest to southeast under the pavement. The culvert discharges into a forested area and then into an open ditch that flows into a roadside ditch adjacent to Elevator Road / Robson Road (**Figure 2**). See **Section 4.2.2** for an overview of watercourses in the study area.

Riparian Vegetation

Riparian vegetation is typically limited to shrubby areas along the ditches adjacent to the study area. Species include black cottonwood trees (*Populus balsamifera*), herbaceous species such as Canada goldenrod (*Solidago canadensis*), shrubs such as Himalayan blackberry (*Rubus armeniacus*), and other species such as sword fern (*Polystichum munitum*), and horsetails (*Equisetum* sp.). See **Section 4.2.2** for a discussion on riparian vegetation in the study area.

Herbaceous Vegetation

Herbaceous vegetation is predominantly located on the edges of the Site, adjacent to the fenceline where substrates were unpaved and gravelly. The paved areas and lack of suitable growing medium prevents establishment of most native plant species. These communities are comprised mainly of invasive and non-native plant species such as tansy ragwort (*Senecio jacobaeae*), common tansy (*Tanacetum vulgare*), and common plantain (*Plantago major*) (**Appendix B, Photo 1; Table 2**). Several species defined as noxious by the BC *Weed Control Act* are present in these communities (**Table 2**).

Table 2 Invasive and Noxious Herbaceous Plant Species in the Study Area

Common name	Latin Name	Status
Hound's-tongue	<i>Cynoglossum grande</i>	Invasive
White sweetclover	<i>Melilotus alba</i>	Invasive
Tansy ragwort	<i>Senecio jacobeeae</i>	Noxious
Common tansy	<i>Tanacetum vulgare</i>	Invasive

Shrubby Vegetation

Shrubby plant communities are spread throughout the Site, generally on hummocks of fill. Dominant shrub species are the invasive species Himalayan blackberry and Scotch broom (*Cytisus scoparius*) (**Appendix B, Photo 2**).

Treed Communities

Several larger diameter (30 – 40 cm) cottonwood trees are found along the eastern edge of the Site, outside of the clearing boundaries. These are structural stage 4 and 5 (i.e. pole sapling or young forest as per BC Ministry of Forests *Describing Terrestrial Ecosystems in the Field*, 2010), that are less than 60 years old. Several cottonwood trees are also located within the clearing boundaries at the eastern edge of the property (**Appendix B, Photo 3**) and northeast corner (approx. 6 trees) (**Appendix B, Photo 4**).

A few larger trees are also present adjacent to the office building at the south end of the Site. These trees are mostly shrubby coniferous ornamentals, with an average diameter of 10 to 20 cm (DBH).

Proposed clearing and grubbing is shown in **Figure 3**. Trees proposed to be removed include:

- Two to three smaller trees in **polygon 9**.
- All the trees in **polygon 16**, the hedgerow of trees between the lumber yard and the study area.
- Most of the trees in **polygon 3** at the northeast side of the study area adjacent to the lumber yard.
- Two to three trees in **polygon 13**, but the majority will remain.

4.1.2.2 Wildlife

Due to past and present land uses within the Site, habitat values for wildlife are limited, except for relatively mobile species and species with high tolerance for human-related activities. This section reviews birds, mammals, herptiles and invertebrates observed or potentially occurring in the area. Species at-risk are considered in a separate section.

Birds

Waterbirds, such as gulls, terns, ducks, grebes, herons, and cormorants, may use shoreline areas within this section of the Fraser River and Gunderson Slough for roosting and feeding (FREMP 2006). The series of pilings located within the Fraser River approximately 100 m from the site's foreshore provide perches and roosts for many of these species. Sections of deeper water in the Fraser River may also be used by diving ducks for foraging (FREMP 2006).

Vegetation on Site, in particular the forested portion, is suitable habitat for songbirds, raptors and waders. Robertson Environmental Services Ltd. (RESL 2006) conducted point count observations and winter bird surveys within the treed portion of the study area and areas adjacent (Delta Ravines area) for the SFPR project. Thirty-five songbird species were documented during breeding season, and 34 species of passerines, woodpeckers, raptors, and waders were documented during the winter (**Appendix C**) (RESL 2006), a list which is not considered exhaustive. During the site visit in September 2015, seven bird species were documented, including two species not observed by RESL (**Appendix C**). An inactive red-tailed hawk nest was found by RESL (2006) within the forested area at the south end of the study area however none were found during the 2015 field visit. No other raptor nests have been detected within the study area (WiTS 2015, RESL 2006).

The buildings on Site also provide potential roosting and nesting habitat for birds. Prior to Hemmera's site visit, CMC noted that a "light-coloured raptor" (potentially a barn owl (*Tyto alba*)) had been sighted at night in the Production Building (M. Vander Noot, pers. comm). During Hemmera's site visit, field staff inspected both the exterior and interior of the buildings Production and Storage Buildings, searching for signs of bird nests, and visually scanning the ground other signs of bird activities (i.e., droppings, pluck sites or kills, and pellets). Partially-scavenged songbird and pigeon carcasses were found within the Production Building, suggesting that the building is used by raptors as a plucking site, and potentially used for hunting or roosting. No evidence of long-term residence by raptors (i.e., nests or pellets) was observed. Non-raptor use of the Storage Building was also evidenced by remnants of non-raptor nests in the overhead beams, and droppings on the floor. Based on the nests and droppings observed, these likely belonged to rock doves (*Columba livia*), an exotic species not protected under the *Migratory Birds Convention Act*. No signs of bird activity were present in the Storage Building.

Mammals

RESL (2006) concluded that habitat along the SFPR corridor could support up to 13 species of medium and large mammals, and 29 species of small mammals (e.g., rodents, insectivores, bats, and squirrels). However, the number of mammals that use the terrestrial habitat in the vicinity of the Project is lower; limited to relatively common and widespread species suited to disturbed habitats. Four wildlife crossings (culverts) provide habitat connectivity between the Site and forest patches on the southeast side of the SFPR (MoTI 2015). These crossings may be more heavily used by large mammals rather than small mammals due to culvert length. A previous assessment of habitat available considered the riparian habitat within the study area to be "sink" habitat for small mammals (SNC Lavalin 2013); meaning that it attracts animals whose

survival is consequently adversely affected. A small mammal habitat assessment conducted in the treed area in the southeastern portion of the study area (RESL 2006) concluded that this area provided nil to low value habitat for the following species: Pacific water shrew (*Sorex bendirii*), Trowbridge's shrew (*Sorex trowbridgii*), Keen's long-eared myotis (*Myotis keenii*), snowshoe hare (*Lepus americanus washingtonii*), Southern red-backed vole (*Myodes gapperi occidentalis*), and long-tailed weasel (*Mustela frenata altifrontalis*).

During the 2015 site visit, mammal sign observed included coyote (*Canis latrans*) scat and raccoon (*Procyon lotor*) prints.

Marine mammals, including California sea lion (*Zalophus californianus*), Steller sea lion (*Eumetopias jubatus*), and harbour seal (*Phoca vitulina*) may use Fraser River for foraging and as a movement corridor (Bigg 1985, COSEWIC 2003, FREMP 2006, Page 2012). Other aquatic mammals such as American river otter (*Lontra canadensis*), muskrat (*Ondatra zibethicus*), beaver (*Castor canadensis*), and American mink (*Neovison vison*) have the potential to occur in the study area but none are likely to use aquatic and riparian habitat for foraging or resting due to intensive human activity and the presence of only sub-optimal habitat on Site.

Reptiles and Amphibians

Four species of reptiles have potential to occur within the Surrey and Delta area, including three garter snake species (*Thamnophis* spp.) and alligator lizard (*Elgaria coerulea*) (Gebauer 1999, Knopp and Larkin 1999, RESL 2006). The snake species could use riparian areas and areas of roadside vegetation on Site (Reptiles of BC 2015). Habitat features, such as rock outcrops, grassy openings and abundant debris for shelter essential for alligator lizards, (Reptiles of BC 2015), are absent from the study area. Therefore, this species is not expected to be found on Site.

Ten species of amphibians could occur within the Surrey and Delta area, including four salamander, five frog, one toad, and one newt species (Gebauer 1999, Knopp and Larkin 1999, CoD 2003, RESL 2006). Two of these species, the bull frog (*Rana catesbeina*) and green frog (*Rana clamitans*), are introduced species generally tolerant of human disturbance and poor water quality. These two species, along with the native northwestern salamander (*Ambystoma gracile*), are commonly found in roadside ditches in the Lower Mainland, and likely occur in the ditches on Site. Amphibians are not expected to be found in the Fraser River adjacent to the Site due to lack of suitable habitat (FREMP 2006).

Invertebrates

Many species of invertebrates, including aerial insects, gastropods, and bivalves, could occur within the study area. Surveys conducted along the SFPR alignment in 2004 documented over 100 species of insects alone (RESL 2006), a list which is not considered exhaustive.

4.2 AQUATIC ENVIRONMENT

This section considers existing aquatic (instream) and riparian (terrestrial) fish habitats within the study area, primarily associated with the Fraser River, Gunderson Slough, and minor tributary streams and ditches that drain into the Fraser River.

The Project is located approximately 34 km upstream of the mouth of the Fraser River, within the Lower Fraser Watershed. The Lower Fraser Watershed has the densest human population area in the Fraser River drainage, containing all communities within the Fraser Valley and Metro Vancouver Regional Districts (Fraser Basin Council 2015).

4.2.1 Methods

Information on aquatic habitat classifications and associated fish species likely to use aquatic environments within the study area were gathered from the following sources:

- Fish species distribution from iMap BC;
- Riparian habitat mapping in the study area from FREMP; and
- Fisheries and aquatic information contained in previous documents and reports.

Foreshore classification mapping (FREMP 2015) was used to classify foreshore and riparian habitats adjacent to the Site. The FREMP foreshore classifications are colour-coded and defined as follows:

- Green-coded: habitat with low productivity shorelines where fish habitat features and functions are limited due to existing conditions (e.g., shoreline has been altered or “hardened” for port or other urbanized uses).
- Yellow-coded: habitats with 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.
- Red-coded: habitats with productive and diverse habitat features that support critical fish and wildlife functions and/or areas where habitat compensation has been previously constructed.

The City of Surrey maintains a Watercourse Classification Map online of all city watercourses (including ditches) based on their value as fish habitat for salmonids and regionally significant fish. The classification identifies whether the watercourse is inhabited by fish or whether it contributes food/nutrient value to downstream populations of fish. The classification coding as available in the City of Surrey Mapping Online System (COSMOS) is as follows:

- Red-coded (Class A): watercourses inhabited by fish year-round, or potentially inhabited year-round with access enhancement.
- Dashed Red-coded (Class AO): watercourses inhabited by fish primarily during the overwintering period, or potentially inhabited during the overwintering period with access enhancement.

- Yellow-coded (Class B): non-fish-bearing watercourses that contribute or potentially contribute significant food/nutrient inputs to downstream fish populations (based on connectivity).
- Green-coded (Class C): non-fish-bearing watercourses that do not contribute significant food/nutrient value to downstream fish populations.

Hemmera conducted a site visit September 30, 2015 to ground-truth the desktop research findings and data gaps.

4.2.2 Results

The location of watercourses in relation to the Site is shown in **Figure 2**. The watercourses adjacent to the Site are all minor tributary streams that drain into the Fraser River by way of Gunderson Slough. The lower reaches of these watercourses have been highly modified from their natural channels through the diversion of flow by means of culverts, ditches, and drainage channels. Runoff patterns and water quality within these systems have also experienced substantial alteration due to urbanization as well as surface runoff from roadways becoming a major contributor to flow.

Tributaries to and habitat features of the Fraser River that are adjacent to the Site include, Gunderson Slough, Shadow Brook, Armstrong Creek, Colliers Canal, an unnamed Class AO ditch, and an unnamed Class B ditch. Three Class C (i.e., non-fish-bearing) ditches also directly overlap with the Project Site: Ditch N, Ditch S, and the Robson Road ditch. COSMOS (2016) does not identify any hydraulic connection between these ditches and other fish-bearing watercourses; however, FSD staff have identified a culvert that runs under Elevator Road at the west end of Ditch S, which drains these ditches into Gunderson Slough (A. Ekkert, pers.comm.). The culvert characteristics (e.g., length, material, fish-passability) are unknown; however, based on the COSMOS classification, these ditches are assumed to be impassible to fish from Gunderson Slough and unlikely to provide significant nutrient input to downstream fish habitat/populations.

A description of fish species presence as well as the aquatic and riparian habitats associated with each watercourse that could be affected by the Project is provided in the sections below. Species at-risk are described in **Section 4.3**.

4.2.2.1 Aquatic Features within the Site

Fraser River

The Fraser River is a regionally-important, fish-bearing waterbody. Forty-six species of fish have been documented within the Lower Fraser River (McPhail and Carveth 1994, iMap BC 2015, FISS 2015) several of which support commercial, recreational and/or Aboriginal (CRA) fisheries (**Appendix C**). Fraser River habitat for CRA species in the study area acts as a migratory corridor for eulachon, adult and juvenile salmonids, and provides year-round values for white sturgeon. The Fraser River shoreline bordering the Project, however, is classified by FREMP as green-coded or low productivity for fish habitat (FREMP 2015; **Figure 2**). The shoreline adjacent to the Site is characterized by a sheet pile wall that extends the length of the FSD berthing area and a riprap armoured slope covered with wire mesh (**Appendix B, Photo 6**).

Class C Ditches

Other than the Fraser River, watercourses within the Site are Class C ditches and include Ditch N, Ditch S, and the Robson Road ditch, described in detail below.

The Class C ditch N (Ditch N) is fed by surface water drainage from the Site, as well as a constructed pond that collects surface water runoff and drain water from the existing Production Building. The ditch originates near the on-Site detention pond and flows in a southwest direction into the two other Class C ditches that parallel Robson Road. Given the gradient, flow direction may be dependent on rain runoff volumes. Ditch N is approximately 2 m wide and 150 m long (**Appendix B, Photo 14**). The ditch was dry at the time of the site visit, and is expected to be wetted only during sustained periods of rainfall during fall and winter months. Riparian vegetation around the ditch consists mainly of Himalayan blackberry and black cottonwood (*Populus trichocarpa*). The ditch has no instream vegetation, or other forms of instream cover. The northern portion of this ditch (approximately 35 m) will be infilled as a part of Project site preparation for the container yard. The remaining portion of the ditch is likely to be affected by clearing and grubbing activities, laydown, and material stockpiling.

The Class C ditch S (Ditch S) roughly parallels Elevator Road and connects with Ditch N and the Robson Road ditch via culverts at its east end. The ditch channel is approximately 2.5 m wide and 175 m long (**Appendix B, Photo 15**). The ditch was wetted at the time of the site visit, and contains abundant instream vegetation, including reed canary grass, red osier dogwood, cattail, and willow shrubs (*Salix* spp.). This ditch is anticipated to receive water discharged from the temporary construction sedimentation pond. According to COSMOS, this ditch does not hydraulically connect to Gunderson Slough; however, a culvert apparently connects the south end of the ditch to Gunderson Slough (Ekkert, pers.comm). This ditch will be affected by rail development activities during construction (see **Section 5.0**).

The Robson Road ditch, also Class C, is a 2 m wide and 350 m long ditch that parallels the east side of Robson Road and is connected by culverts to Ditch S and Ditch N (**Appendix B, Photo 13**). During the site visit in September 2015, some surface water and abundant vegetation was observed within the channel including reed canary grass and cattail (*Typha latifolia*).

4.2.2.2 Fish-bearing Aquatic Features Adjacent to the Project Site

Gunderson Slough

Gunderson Slough is a large backwater feature in the Fraser River connected on its downstream end to Annieville Channel (**Appendix B, Photo 7**) and located approximately 165 m south of the Site. During wetter periods of the year, Gunderson Slough could receive flows from the Project Site via Shadow Brook. The shoreline at the outlet of Shadow Brook into Gunderson Slough is characterized by FREMP as red-coded, which indicates productive and diverse habitat features that support critical fish and wildlife functions

on Site or as part of a more regional context, and areas where habitat compensation has been previously constructed to offset habitat losses (FREMP 2015).

Aquatic and riparian habitats of Gunderson Slough are considered to be of high value and very sensitive. As a tidal feature that is fully connected to the Fraser River, the slough and its tidal marshes and other backwater instream habitats provide high value rearing habitat for out-migrating juvenile Pacific salmon. All five species of Pacific salmon may be encountered seasonally within this area, with juvenile coho (*Oncorhynchus kisutch*), chum (*O. keta*), and chinook (*O. tshawytscha*) being most likely present given their ecology and life history traits.

Shadow Brook

Shadow Brook is a Class A watercourse that flows under Robson Road and Elevator Road via a series of culverts, draining into Gunderson Slough approximately 100 m downstream of Elevator Road. Shadow Brook provides year-round salmonid habitat (CoD 2003, CoD 2015, COSMOS 2015) and is fed by two fish-bearing watercourses (creeks in Townline and Kendale Ravines) from the east side of SFPR (CoD 2003, CoD 2015, COSMOS 2015). Two reaches of Shadow Brook were identified during the site visit:

Upstream of Elevator Road: The channel here is approximately 1 m wide, and contains abundant instream vegetation composed mainly of exotic species (reed canary grass (*Phalaris arundinacea*) and Himalayan blackberry (*Rubus armeniacus*)) (**Appendix A, Photo 8**). Substrates are predominantly sand and fines.

Downstream of Elevator Road: Channel width is approximately 3 m (**Appendix A, Photo 9**). Channel substrates consist of angular cobble and sand. Some instream cover is present in the form of undercut banks, overhanging vegetation, and pools.

Both reaches of Shadow Brook represent migration habitat to fish-bearing watercourses upstream. Rearing habitat value is considered to be high downstream of Elevator Road, and moderate upstream. Due to the lack of suitable substrate, neither of these reaches represent spawning habitat. Cutthroat trout (*O. clarki*) and coho salmon have been previously documented within Shadow Brook and its tributaries (iMap BC 2015). Two unidentified sculpins (*Cottus sp.*) were also observed in the reach upstream of Elevator Road during the site visit.

Armstrong Creek/Colliers Canal

Armstrong Creek and Colliers Canal in the vicinity of the Project are Class A habitat which is a continuous ditch approximately 2.5 m wide that parallels the southeast side of the Burlington Northern Santa Fe (BNSF) Railway tracks (**Appendix B, Photo 10**). This ditch flows under the BNSF tracks and Elevator Road via consecutive culverts, and discharges to Shadow Brook on the south side of Elevator Road (COSMOS 2015). Abundant reed canary grass was observed in the ditch at the site of the site visit. Channel substrates are predominantly fines and sands. These watercourses provide no spawning habitat, but provide moderate

rearing and migration habitat to upstream fish-bearing watercourses. Stickleback (*Gasterosteidae sp.*) and cutthroat trout have been documented in these waterbodies, east of the study area (iMap BC 2015).

Unnamed Class AO ditch

An unnamed ditch (~ 2 m wide) flows for roughly 100 m along the southeast side of the Canadian National (CN) Railway tracks (**Appendix B, Photo 11**). According to COSMOS (2015), this ditch is classified as Class AO habitat. During the September site visit, the ditch was dry with no surface flow connection to fish-bearing watercourses. Vegetation observed in the channel (reed canary grass and red osier dogwood (*Cornus sericea*), species that are indicative of moist areas), suggests that the ditch is seasonally wetted. The BNSF access road off of Robson Road at the southern end of the ditch is not culverted and therefore prevents connection to the fish-bearing Shadow Brook to the south (**Figure 2**).

4.3 SPECIES AT-RISK

For this report, species at-risk are defined as species designated as extirpated, endangered, threatened, or of special concern in Appendices 1 through 3 of the federal *Species at Risk Act* (SARA). Hemmera conducted a search of the BC Species and Ecosystem Explorer (BC CDC 2015) to identify species at-risk and provincially listed species with the potential to occur within Metro Vancouver (**Appendix E**). This list was then refined based on habitat conditions available in the Site, known occurrences from previous studies and inventories in the study area, and known habitat associations of each at-risk species. The potential for each species to occur was ranked (i.e., low, medium, or high).

4.3.1 Plant Species at-Risk

The at-risk plant survey assessed the Site for at-risk plants with the greatest potential to occur. No listed plant communities or wetlands or at-risk plant species were encountered during the survey of the study area. Two species (green-sheathed sedge and streambank lupine) had the greatest potential for occurrence (**Table 3**).

Table 3 At-risk Plant Species with Potential to Occur on the Site

English Name	Scientific Name	SARA Schedule ^a	COSEWIC	BC LIST
Green-sheathed sedge	<i>Carex feta</i>	--	--	Blue
Streambank lupine	<i>Lupinus rivularis</i>	1-E (Jan 2005)	E (Nov 2002)	Red

Notes: ^a Federal designation of a species to Schedule 1, 2, or 3 with an associated status code: (Extinct (XX), Extirpated (XT), Endangered (E), Threatened (T), Special Concern (SC), or Not at Risk (NAR). Species listed on Schedule 2 or 3 are not officially protected under SARA.

The only federally at-risk species that may occur on Site was streambank lupine. Streambank lupine is a perennial, herbaceous plant that ranges in height from 0.3 to 1.0 m (COSEWIC 2002a, SLRT 2014, eFlora 2015) which is found along the Pacific coast from B.C. to northern California. In BC, streambank lupine occurs in the Coastal Douglas-fir (CDFmm) and the Western Hemlock (CWH) biogeoclimatic zones (COSEWIC 2002a) where it is restricted to southwestern B.C. All but one known population are found within the Lower Mainland region (COSEWIC 2002a, SLRT 2014). It grows in open, nutrient-poor, sandy or gravelly, river or creek bank sites at low elevations close to coastal regions with little surrounding vegetation and is often found in disturbed habitats, including rights-of-way, railway tracks, and roadsides (COSEWIC 2002a). The provincial recovery strategy for this species suggests that it may occur in highly disturbed habitat where it is not subject to competitive exclusion (SLRT 2014). An extant population that is associated with railway ballast exists approximately 250 m to the southwest of the Project Site (ECCC 2017).

Streambank lupine has been previously documented in a vegetated area north of Elevator Road (**Figure 3**) (ECCC 2017, eFlora 2015, iMap 2015, SNC Lavalin 2013). The last observed occurrence recorded at Fraser Surrey Docks was in 2013 (ECCC 2017), on a location that is now heavily vegetated with Himalayan blackberry and Canada goldenrod (*Solidago canadensis*). This observation was of one juvenile/seedling. No plants were found in this area during the 2015 site visit. The longevity of streambank lupine seeds in the seedbank is unknown (ECCC 2017); however, if the current vegetation community persists, it is unlikely that sufficient suitable growing habitat will be available in the future. Construction of the semi-loop rail track, which will require clearing of existing vegetation and replacement with ballast rock, may represent an improvement in the existing sub-optimal habitat conditions for streambank lupine at this location through the removal of competition and an increase in light.

Given the overlap of the rail loop with critical habitat for this species, a permit under Section 73 of SARA may be required for the Project. Fraser Grain Terminal Ltd. and other FSD business stakeholders will work with FSD and an environmental consultant to prepare an SARA permit application to Environment and Climate Change Canada regarding Project-required alterations to streambank lupine critical habitat in areas adjacent to Elevator Road. This application is intended to address the effects of railway development from proposed projects currently in the VFPA PER process on the FSD lands. Additional mitigation measures for streambank lupine are described in **Section 5.0** of this report.

4.3.2 Wildlife Species at-Risk

Thirteen wildlife species at-risk are considered to have potential to occur within the study area. The general ecology and potential occurrence of each species is detailed in **Table 4** below.

4.3.3 Fish

Two at-risk fish species, the green sturgeon (*Acipenser medirostris*) and eulachon (*Thaleichthys pacificus*), are considered to have low potential to occur in the study area (**Table 4**).

Table 4 Potential Occurrence of At-Risk Wildlife and Fish Species in the Study Area

English Name	Scientific Name	SARA Schedule ^a	COSEWIC	BC List	Potential to be Present in Study Area ^b	Comments
Birds						
Band-tailed Pigeon	<i>Patagioenas fasciata</i>	1-SC (Feb 2011)	SC (Nov 2008)	Blue	Low –nesting and foraging in the treed area	Feeds on plant material, including elderberries and waste grain in rail yards. (COSEWIC 2008a).Nests in pairs in suitable habitat, including forest edges and openings in forests and urban areas from sea level to mid-elevations.
Barn Owl	<i>Tyto alba</i>	1-SC (Jun 2003)	T (Nov 2010)	Red	Medium – foraging in non-treed portion of Site	Nocturnal raptor occasionally found in industrial areas with abundant prey (small mammals). May hunt rodents attracted to grain along railway corridors. No evidence of nests or long-term residence of barn owls within the Production and Storage buildings during site visit, however elevated beams in these buildings could potentially be used for nest sites. The removal of these buildings is not within the proposed Project works, so the potential effects on this species is not considered in this report.
Common Nighthawk	<i>Chordeiles minor</i>	1-T (Feb 2010)	T (Apr 2007)	Yellow	Medium – nesting and foraging	Aerial insectivore, often feeding near water or in urban areas near lights that attract insects (COSEWIC 2007a). Breeds in open habitats, including railways and open urban areas, laying eggs on the ground (COSEWIC 2007a).
Great Blue Heron, <i>fannini</i> subspecies	<i>Ardea herodias fannini</i>	1-SC (Feb 2010)	SC (Mar 2008)	Blue	Medium - foraging	Wading waterbird that forages for small fish, insects, mammals and amphibians in marshes and along waterbodies (COSEWIC 2008b), and are expected to occur along the shoreline of Gunderson Slough and potentially in the riparian areas around the ditches in the study area.
Olive-sided Flycatcher	<i>Contopus cooperi</i>	1-T (Feb 2010)	T (Nov 2007)	Blue	Low-nesting and foraging	Aerial insectivores that breeds and feeds in areas of open habitat such as natural forest openings with perch sites (COSEWIC 2007b). Potential for nesting and foraging within treed portion of site.
Peregrine Falcon, <i>anatum</i> subspecies	<i>Falco peregrinus anatum</i>	1-SC (Jun 2012)	SC (Apr 2007)	Red	Medium-foraging in open parts of study area	Raptor that can occur in urban and industrial areas where prey is found in high abundance (COSEWIC 2007c). Feeds primarily on birds, including waterbirds, pigeons and songbirds (COSEWIC 2007c). May use Production Building for plucking, roosting, and hunting. No suitable nesting sites (e.g., cliff ledges or tall buildings) are available within the study area.

English Name	Scientific Name	SARA Schedule ^a	COSEWIC	BC List	Potential to be Present in Study Area ^b	Comments
Western Screech-Owl, <i>kennicottii</i> subspecies	<i>Megascops kennicottii kennicottii</i>	1-SC (Jan 2005)	T (May 2012)	Blue	Low-foraging	Cavity-nesting raptor, found in lower elevation wooded and riparian sites (COSEWIC 2002b). Prefers foraging in open areas (COSEWIC 2002b). Detected in nearby McAdam Creek in 2003 (RESL 2006).
Mammals						
Little Brown Myotis	<i>Myotis lucifugus</i>	1-E (Dec 2014)	E (Nov 2013)	Yellow	Medium-hunting and roosting	A relatively widespread bat species, recently added to Schedule 1 of SARA due to population decreases resulting from white-nose syndrome in eastern Canada. Unoccupied buildings and mature trees can provide roosting habitat (COSEWIC 2013a). May use the study area and adjacent habitats for foraging.
Pacific Water Shrew	<i>Sorex bendirii</i>	1-E (Jun 2003)	E (Apr 2006)	Red	Low	Riparian habitat specialist, associated with wet forests, and marshes, and occasionally along ditches and sloughs (COSEWIC 2006). Low potential to be present in ditches and watercourses within the study area, however available habitat is an isolated patch of low quality habitat (RESL 2006),
Steller Sea Lion	<i>Eumetopias jubatus</i>	1-SC (Jul 2005)	SC (Nov 2013)	Blue	Medium-foraging	Often occur in the lower Fraser River during the spring eulachon run, and have been observed rafting as in the Fraser River as far upstream as the Project site (FREM 2006, COSEWIC 2003a).
Amphibians and Reptiles						
Northern Red-legged Frog	<i>Rana aurora</i>	1-SC (Jan 2005)	SC (May 2015)	Blue	Low	Prefers slow-moving watercourses with abundant vegetation and overhead cover for breeding (Rithaler 2002). Adults can be found in riparian vegetation and woodlands, up to 200 m away from waterbodies (Rithaler 2003). Potential to occur within ditches and in treed portion of the study area, however habitat available on site is considered to be of poor quality and as sink habitat.
Western Toad	<i>Anaxyrus boreas</i>	1-SC (Jan 2005)	SC (Nov 2012)	Blue	Low	Lays eggs within both permanent and vernal watercourses, including pools and ditches (Rithaler 2002). Has been documented in nearby industrial areas near Tilbury Island (Rithaler 2003). Potential to occur within ditches during breeding period (late March to early May (Rithaler 2002)) and in treed areas of the study area, however habitat available on Site is considered to be of poor quality and sink habitat.

English Name	Scientific Name	SARA Schedule ^a	COSEWIC	BC List	Potential to be Present in Study Area ^b	Comments
Invertebrates						
Dun Skipper	<i>Euphyes vestris</i>	1-T (Jun 2003)	T (Apr 2013)	Red	Low	Occupies mesic grassy areas, often along disturbed habitats such as roadsides and railways. Larval food is sedges (COSEWIC 2013b). Potential to occur in riparian areas along watercourses within the study area.
Fish						
Eulachon	<i>Thaleichthys pacificus</i>	-	E/T (May 2011)	Blue	Low	Spring migration and spawning occurs from Deas Island to as far upstream as Mission. Locations vary considerably among years; however, historically most spawning occurs upstream of New Westminster (Hay and McCarter 2000, Hay et al. 2002). Preferred spawning habitat is on plateaus or edges composed of stable fine-medium and coarse sand, pebbles, and gravel (LGL and Terra Remote Sensing 2009). Due to existing condition of the shoreline and substrates adjacent to the Site, likelihood of spawning habitat is considered low.
Green Sturgeon	<i>Acipenser medirostris</i>	1-SC (Aug 2006)	SC (Nov 2013)	Red	Low	Have been documented in the Fraser River as far upstream as Fort Langley (McPhail 2007), but generally considered rare in freshwater and are more likely to be associated with estuarine and marine habitats (COSEWIC 2004).

Notes: ^a Federal designation of a species to Schedule 1, 2, or 3 with an associated status code: (Extinct (XX), Extirpated (XT), Endangered (E), Threatened (T), Special Concern (SC), or Not at Risk (NAR). Species listed on Schedule 2 or 3 are not officially protected under SARA.

^b **Low:** current understanding of the species' range and/or species habitat associations suggests that the species is unlikely to occur within the site with regularity or in adequate density to provide a functional population; **Medium:** species is expected to occur in the site on a temporary or regular (i.e., predictable) seasonal basis and in densities that facilitate persistence of a functional population within the site; **High:** current understanding of the species' range and/or known species habitat associations suggests that the species is expected to occur in the site regularly and in densities indicative of a preferred habitat type (i.e., moderate or high relative to other areas in which the species occurs).

5.0 ASSESSMENT OF PROJECT-RELATED EFFECTS AND MITIGATION

This report considers potential changes to the biophysical environment and focuses on those environmental components and features with the potential to be affected by the Project. Components and features were selected based on ecological importance and/or conservation status, and relative sensitivity of environmental components to Project influences. The following components were assessed:

- Vegetation
- Birds
- Mammals
- Amphibians and Reptiles
- Aquatic habitat
- Fish
- Species at Risk

The potential for Project interaction with the environmental components was then analyzed based on Project-related activities and other information provided by CMC, and assessment of the environmental setting and temporal and/or spatial conflict, knowledge of the Site, and professional judgment. Potential interactions (prior to implementation of mitigation measures) between Project components/activities and the environment are described in **Table 5**. Detailed descriptions of the identified interactions and measures to mitigate potential adverse effects are provided in **Table 6**.

Table 5 Potential Interactions (Prior to Mitigation) between Project-related Activities and Biophysical Environment

	Vegetation	Birds	Mammals	Amphibians and Reptiles	Aquatic Habitat	Fish	Species at-Risk
Project Phase/ Component/Activity							
Pre-construction and Construction							
Site preparation, including vegetation clearing	P	P	P	P	-	-	P
Use of mobile equipment	-	P	P	P	P	P	P
Excavations, including installation of trémie concrete plugs and dewatering	-	P	P	P	P	P	P
Installation of piles shoreward of the bulkhead, including removal of existing asphalt material, pile driving, and pouring of concrete caps	-	P	P	-	-	-	P
Installation of in-water-piles, including removal of existing asphalt material, temporary removal of mesh and riprap, pile driving, reinstallation of riprap, and concrete pours	-	P	P	-	P	P	P
Erection of shiploading structure on the wharf	-	P	P	-	-	-	P
Pouring of concrete slabs, trenches and pits (upland)	-	P	P	P	P	P	P
Installation of storage silos	-	P	P	P	-	-	P
Installation of steel frame tower, buildings	-	P	P	P	-	-	P
Installation of extensions / realignments of rail lines, rail loop, security fence and gates	-	P	P	P	P	-	P
Removal and on-site permanent stockpiling of excavated material	-	P	P	P	P	P	P
Demobilization from the Site	-	P	P	P	P	P	P

Note: P = Potential effect of Project on Environment

'-' = no interaction

Table 6 Summary of Potential Effects and Mitigation

Environmental Component	Potential Project Interaction with Environment	Mitigation	Residual Effects
Vegetation	<p>Permanent and temporary loss of vegetation in Project footprint during clearing and grubbing</p> <p>Introduction of invasive species through increasing areas of exposed soil, or vectored through imported soil and/or equipment.</p> <p>Potential impact to at-risk vegetation species (streambank lupine) and/or critical habitat during construction and operations.</p>	<p>Limit areas of vegetation clearing and flag clearing boundaries.</p> <p>Revegetate disturbed areas with appropriate seed mix and native plant species as soon as feasible or as a temporary invasive species control measure (see Section 6.0).</p> <p>Implement an invasive species management plan (see Section 6.0), with the following general parameters:</p> <ul style="list-style-type: none"> • Dispose of invasive plant material appropriately. • Remove invasive plant species prior to fruit / seed pod development to prevent spread and regrowth of seeds. • Inspect vehicles for plant material prior to entering site and use truck wash station to prevent the spread of invasive plant species. • Ensure any soil or fill coming onto the site is free of noxious weeds. <p>See “Species at Risk” below for measures specific to streambank lupine.</p>	<p>Permanent loss of 0.95 ha of predominantly invasive and non-native species vegetation.</p> <p>Effects are expected to be very localized.</p> <p>Insignificant residual effects expected with appropriate mitigation measures in place.</p>
Birds	<p>If clearing is required in the period when bird nesting could occur:</p> <p>Destruction of active nests or breeding areas</p> <p>Temporary disturbance of birds present during Project activities</p> <p>Injury or mortality to birds as a result of equipment operation</p>	<p>Comply with the requirements of the <i>Species at Risk Act</i>, the <i>Migratory Birds Convention Act</i>, <i>Wildlife Act</i> and all other applicable laws, legislation, and best management practices (BMPs) provided at the MoE’s Guidelines and BMPs website including <i>Best Management Practices for Raptor Conservation During Urban and Rural Land Development in BC</i> (MoE 2013).</p> <p>Schedule vegetation removal to occur within the least risk work window for breeding birds (September 1 to February 28). If this is not possible, conduct a pre-clearing survey using a qualified environmental professional (QEP) in advance of any works.</p> <p>If clearing is required during the nesting period and evidence of active bird nests is detected during the pre-clearing survey, the QEP shall propose appropriate measures (e.g., suitable buffers around nests).</p> <p>Work areas will be kept clear of all wildlife attractants (i.e. garbage). Food and food waste will be removed from the Site at the end of each day.</p> <p>Implement a wildlife education program as part of worker orientation.</p>	<p>No residual effects are expected with appropriate mitigation measures in place.</p>

Environmental Component	Potential Project Interaction with Environment	Mitigation	Residual Effects
Mammals	<p>Temporary disturbance of wildlife present during Project activities</p> <p>Injury or mortality to wildlife as a result of equipment operation</p>	<p>When employing impact pile driving methods, conduct piling and intrusive construction activities in the Fraser River during the least-risk fisheries work window unless otherwise agreed upon by DFO. The prescribed work window for the Lower Fraser River Estuary (i.e., to Mission Bridge) is June 16 to February 28 (DFO 2015).</p> <p>During pile driving activities follow <i>Best Management Practices for Pile Driving and Related Operations</i> (BCMPDCA and DFO 2003).</p> <p>When employing impact pile driving methods, conduct visual and hydrophone monitoring with a qualified environmental monitor (EM) prior to and during pile driving activities to assess potential effects to marine mammals. Mitigation measures that may be required for impact pile driving activities include halting pile driving when marine mammals are present in the vicinity of the work area and use of bubble curtains to dampen sound pressures over 30 kPa. Refer to the Construction Environmental Management Plan for additional details on monitoring activities.</p> <p>Work areas will be kept clear of all wildlife attractants (i.e. garbage). Food and food waste will be removed from the Site at the end of each day.</p> <p>Implement a wildlife education program as part of worker orientation.</p>	<p>Effects are expected to be localized and temporary. Residual effects are anticipated to be insignificant with appropriate mitigation measures are in place.</p>
Amphibians and Reptiles	<p>Temporary disturbance of wildlife present during Project activities</p> <p>Injury or mortality to wildlife as a result of equipment operation</p> <p>Potential loss of potential amphibian habitat as a result of infilling a portion of Ditch- N</p>	<p>Comply with the requirements of the <i>Species at Risk Act, Wildlife Act</i> and all other applicable laws, legislation, and BMPs provided at the MoE's Guidelines and BMPs website including <i>Best Management Practices for Amphibians and Reptiles in Urban and Rural Environments in British Columbia</i> (MoE 2004), and <i>Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia</i> (Cox and Cullington 2009).</p> <p>If feasible, schedule ditch infilling when ditches are dry. If not feasible, undertake an amphibian salvage in Ditch N if the ditches are wetted at the time of infilling. The need for a salvage will be discussed with the EM, who will also be present on-site during in-water works to monitor activities and efficacy of mitigation measures being implemented on site.</p> <p>Work areas will be kept clear of all wildlife attractants (i.e. garbage). Food and food waste will be removed from the Site at the end of each day.</p> <p>Implement a wildlife education program as part of worker orientation.</p>	<p>Permanent loss of approximately 70 m² of ditch habitat (note: this represents relatively low quality amphibian habitat).</p> <p>No residual effects are expected with appropriate mitigation measures in place.</p>

Environmental Component	Potential Project Interaction with Environment	Mitigation	Residual Effects
Aquatic Habitat	<p>Temporary disruption during removal and reinstallation of slope protection and pile driving activities.</p> <p>Minor permanent loss of aquatic habitat due to installation of new piles along the berth face in the Fraser River.</p>	<p>All work will comply with the requirements of the federal <i>Fisheries Act</i>, Project permits, and all other applicable laws, legislation, and best management practices.</p> <p>The duration of works within the Fraser River should be minimized and scheduled to occur within the least-risk fisheries work window specified by DFO for the region (June 16 to February 28) unless otherwise agreed upon by DFO.</p> <p>BMPs will be implemented as per <i>Standards and Best Practices for Instream Works</i> (MWLAP 2004) and <i>Land Development Guidelines for the Protection of Aquatic Habitat</i> (Chilibeck et al. 1993).</p> <p>Mark the limits of areas along the shoreline to be cleared of slope protection material in advance of removal activities.</p> <p>Use a barge-based excavator with the assistance of divers to remove and reinstall slope protection material.</p> <p>Stockpile removed material to be reinstalled following pile installation.</p> <p>Undertake a post-installation survey to determine if any material has spilled over the edge of the containment sheet pile wall. If so, remove accumulated material.</p> <p>Avoid grounding barges or other vessels on the foreshore or river/seabed or otherwise disturb the foreshore or river/seabed (including disturbance as a result of vessel propeller wash).</p>	<p>Temporary disturbance of approximately 700 m² of green-coded (i.e., low productivity) shoreline habitat.</p> <p>Permanent loss of approximately 20 m² of green-coded (i.e., low productivity) shoreline habitat.</p> <p>Effects are expected to be very localized and affecting only marginal aquatic habitat.</p> <p>Insignificant residual effects expected with appropriate mitigation measures in place.</p>
	<p>Loss of Class C habitat as a result of infilling a portion of Ditch N.</p> <p>Change in habitat quality due temporary loss of riparian vegetation from clearing for the semi-loop rail track.</p>	<p>All work will comply with the requirements of the federal <i>Fisheries Act</i>, Project permits, and all other applicable laws, legislation, and best management practices.</p> <p>BMPs will be implemented as per <i>Standards and Best Practices for Instream Works</i> (MWLAP 2004) and <i>Land Development Guidelines for the Protection of Aquatic Habitat</i> (Chilibeck et al. 1993).</p> <p>Limit extent of vegetation clearing and re-vegetate or seed exposed soils quickly.</p> <p>See above for "Vegetation".</p>	<p>Permanent loss of approximately 70 m² of Class C ditch habitat.</p> <p>Class C watercourses are non-fish-bearing and do not contribute significant food/nutrient value to downstream fish populations.</p> <p>Consequently, this loss of habitat is not expected to adversely affect fish habitat values. and insignificant residual effects are expected for wildlife (i.e., amphibians) that may occupy this habitat (see Amphibians and Reptiles above).</p> <p>Effects to all other aquatic habitat are expected to be very localized and temporary (note: not affecting key riparian habitat values).</p> <p>Insignificant residual effects expected with appropriate mitigation measures in place.</p>

Environmental Component	Potential Project Interaction with Environment	Mitigation	Residual Effects
	<p>Change in water quality due to introduction of deleterious substances during construction works.</p>	<p>Undertake removal and reinstallation of riprap at low tide whenever possible.</p> <p>Use a barge-based excavator to remove and reinstall slope protection material.</p> <p>Monitor turbidity during removal/reinstallation of riprap and pile driving activities in relation to BC Water Quality Guidelines (MOE 2016).</p> <p>Re-fuel and store fuels in secondary containment located a minimum of 30 m away from, and downgradient of any watercourses.</p> <p>Avoid exposing soils up-gradient of drainages and watercourses and schedule earthworks to occur during dry summer conditions.</p> <p>Implement appropriate measures for erosion and sediment control and potential contaminant management while undertaking work in Class C ditches to prevent the release of sediment or other deleterious substances into Gunderson Slough. If possible, work within these ditches should be conducted in the dry.</p> <p>Cover any exposed soil, or institute other erosion protection or sediment control measures until such time that re-vegetation has established.</p> <p>Implement temporary erosion and sediment control measures such as:</p> <ul style="list-style-type: none"> • Covering exposed soils with mulch, erosion mats, geotextiles, filter fabric, polyethylene covers, hydroseed or rip-rap as appropriate. • Locating interceptor ditches or berms to direct runoff away from erodible areas • Installing silt fencing • Directing sediment-laden flow to the sedimentation pond. <p>Soil stockpiles shall be covered with a continuous impermeable barrier and appropriately graded to assist with runoff during periods of rainfall. The area will be bermed to control any run-off, and have appropriate water control as necessary (i.e. pumps and tanks).</p> <p>Once soil is classified it will be disposed of or reused, as appropriate, based on analytical results, and under the direction of an appropriately trained QEP.</p> <p>Soil to be removed from Site will be taken to an appropriate licensed facility, and all trucks will be manifested (if required) and tracked to ensure the soil is disposed of properly. Trucks leaving the site should have covers and be clean to avoid tracking material off-site.</p>	<p>No residual effects are expected with appropriate mitigation measures in place.</p>

Environmental Component	Potential Project Interaction with Environment	Mitigation	Residual Effects
		<p>Any water encountered in open excavations will be treated as contaminated until analytical data shows otherwise. Excavations will be dewatered and treated appropriately prior to discharge (if required).</p> <p>Any discharge of wastewater to a watercourse or Metro Vancouver's sanitary system must meet applicable water quality guidelines.</p> <p>Employ best management practices for concrete works including:</p> <ul style="list-style-type: none"> • Completely isolate all concrete, cement or grout work from any water prior to concrete pours and for a minimum of 48 hours after placement. • Prevent any water that contacts uncured or partly cured concrete during activities like wet curing or equipment washing from directly or indirectly entering any watercourse, including drainage ditches. • Avoid depositing (directly or indirectly), concrete, cement, mortars and other Portland cement or lime-containing construction materials into or about any watercourse. • Provide containment facilities for the wash-out water from concrete delivery trucks, concrete pumping equipment, and other tools and equipment. • Keep a carbon dioxide (CO₂) tank with regulator, hose and gas diffuser readily available during concrete work within 15 m of or work areas above the wetted perimeter of any watercourse. If required, the tank should be used to release carbon dioxide gas into an affected area to neutralize pH levels should a spill occur. Train workers in the use of the CO₂ tank and diffuser system to be able to efficiently deploy in the event of a release of high pH material/ waste water. 	

Environmental Component	Potential Project Interaction with Environment	Mitigation	Residual Effects
Fish	<p>Temporary disturbance of fish present during Project activities</p> <p>Injury or mortality to fish as a result of equipment operation</p>	<p>All equipment will be regularly maintained and kept clean, free of leaks and excess grease buildup.</p> <p>A qualified EM shall be on site on a weekly basis, and more frequently during works in or near environmentally sensitive areas and during inclement weather to monitor activities and efficacy of mitigation being implemented on site. Refer to the Construction Environmental Management Plan for additional details on monitoring activities.</p> <p>All work will comply with the requirements of the federal <i>Fisheries Act</i>, Project permits, and all other applicable laws, legislation, and best management practices.</p> <p>The duration of works within the Fraser River should be minimized and scheduled to occur within the least-risk fisheries work window (June 16 to February 28) unless otherwise agreed upon by DFO.</p> <p>Conduct visual and hydrophone monitoring during in-river impact piling to monitor water quality and potential for fish kill. If sound pressures over 30 kPa are measured, or distressed, injured or dead fish are observed following the initiation of pile driving, work will be halted immediately and measures (e.g., bubble curtain) implemented to reduce the sound. Refer to the Construction Environmental Management Plan for additional details on monitoring activities.</p>	<p>No residual effects are expected with appropriate mitigation measures in place.</p>

Environmental Component	Potential Project Interaction with Environment	Mitigation	Residual Effects
Species at-Risk	Loss or alteration of streambank lupine critical habitat associated with railway construction.	<p>The Proponent and other FSD business stakeholders will work with FSD and an environmental consultant to prepare an application to Environment and Climate Change Canada for permitting Project use of streambank lupine critical habitat in the areas adjacent to Elevator Road. This application is intended to address the effects of railway development from proposed projects currently in the VFPA PER process on the FSD lands.</p> <p>Consistent with the Recovery Plan for Streambank Lupine in BC (Environment Canada 2016), the following mitigation measures will be implemented during construction:</p> <ul style="list-style-type: none"> • Inform workers on the potential presence of streambank lupine and train workers in the recognition of the species. Should streambank lupine be identified on site during construction, the environmental monitor will be notified immediately for further direction. • Avoid the use of chemical herbicides in areas that could affect streambank lupine critical habitat through wind drift or residual effects. • Undertake any maintenance activities on the railway in critical habitat area post-growing season and seed set, such that vegetation management maintains suitability of critical habitat. • To the extent possible, avoid storage or dumping of fill, construction materials or garbage in areas that could potentially cover or bury streambank lupine critical habitat or otherwise degrade critical habitat quality, • Retain soils excavated from Site and manage as potential seedbank for streambank lupine. <p>During operation, to determine effectiveness of mitigation:</p> <ul style="list-style-type: none"> • Post-construction monitoring will be taken annually in late spring on a multi-year basis for the streambank lupine critical habitat affected by the Project. The monitoring plan will include: <ul style="list-style-type: none"> ▫ Purpose and Scope ▫ Methods ▫ Results: <ul style="list-style-type: none"> - Distribution and relative age - Vigour ▫ Recommended Mitigation 	<p>Permanent alteration of 1,922 m² of streambank lupine critical habitat (note: this alteration is not expected to degrade habitat quality, and may represent an improvement compared to existing habitat conditions.</p> <p>Effects to all other species at risk, if applicable, would be expected to be localized and /or temporary.</p> <p>Insignificant residual effects expected with appropriate mitigation measures in place</p>

Based on the proposed clearing and grubbing drawing (**Figure 3**) for the Site, 0.95 ha of vegetated area will be removed, equivalent to 9.1% of the study area. Of this, 3,448 m² (3.3% of the study area) is herbaceous vegetation, 3,580 m² (3.5% of the study area) is shrubby, and 2,472 m² (2.4% of the study area) is treed (**Figure 3, Section 4.1.2.1**). These estimates assume that all vegetation within the Project Site will be removed to accommodate Project activities.

The majority of the cleared vegetation consists of invasive and non-native shrub and herbaceous species (**Section 1.2**). Approximately 20 young cottonwood trees along the southern perimeter of the Project site will also be removed for construction of the semi-loop track; however, these trees are less than 80 years old. These represent habitat for nesting songbirds (see **Section 4.1.2.2**).

6.0 VEGETATION REMOVAL AND REPLANTING PLAN

As the majority of the Site is paved, and vegetation communities are comprised of predominantly invasive and non-native species, the replanting plan focuses on use of native species for revegetation, and use of native flowering and fruiting plant species beneficial to local bird and invertebrate species and prevention of spread of noxious plant species.

General guidelines for vegetation removal and replanting are as follows:

6.1 INVASIVE PLANT MANAGEMENT

- Dispose of invasive plant species material appropriately: bag and/or designated green waste bin and remove material off-site to a landfill location. Do not compost invasive plant material on site.
- Remove blackberry prior to fruit development to prevent spread of seeds, ideally before late July:
 - A preclearing nest survey may be required if removal takes place after March 1.
 - All plant material should be disposed of off-site.
 - Root wads should be removed during grubbing and disposed of off-site.
- Remove Scotch broom during flowering and prior to seed pod development to prevent regrowth and spread of seeds, ideally in late spring:
 - Cut shrubs larger than 1.5 cm in diameter below ground level, smaller shrubs can be hand-pulled (ISC 2014).
 - Replant or pave the area as quickly as possible to prevent germination of seeds in the seed bank.
- Prevent the spread of invasive plant species on and off site by using truck wash station and inspecting vehicles for plant material prior to entering site.
- Ensure any soil or fill coming into the site comes from a location that is free of noxious weeds, specifically Japanese knotweed (*Fallopia japonica*).

6.2 CLEARING AND GRUBBING

- Clearing should take place within the least risk work window for breeding birds (September 1 to February 28).
- If clearing is required during this time, a pre-clearing nest survey may be required.
- Limit areas of vegetation clearing and flag clearing boundaries.

6.3 REVEGETATION

Revegetation of areas surrounding office buildings and temporarily disturbed areas may incorporate the use of native, drought-tolerant species. General revegetation guidelines are:

- Replant or reseed areas with native plant species, and/or an approved seed mix.
- Plant shrub stock that is at least 1.5 m tall.

- Replant with a mix of fruiting and flowering native species (7).
- Retained and replanted areas of vegetation should be fenced to prevent encroachment of equipment during construction.
- Newly replanted areas should be monitored annually for a minimum of two years to ensure that invasive plants, such as Himalayan blackberry, are not out-competing the new plant stock.
- Once plants have been established, regular weeding and maintenance (three years minimum) will prevent re-sprouting and colonization of blackberry and other weedy plant species.

Table 7 Suggested Native Shrubs for Revegetation

Latin Name	Common Name	Ratio
<i>Symphoricarpos albus</i>	Snowberry	2
<i>Rubus spectabilis</i>	Salmonberry	1
<i>Rosa nutkana</i>	Nootka rosa	3
<i>Ribes sanguineum</i>	Red-flowering currant	1
<i>Arctostaphylos uva-ursi</i>	Kinnikinnick	2

7.0 SUMMARY AND CONCLUSIONS

The Project may result in temporary construction disturbances and 0.95 ha permanent loss of vegetated area (predominantly invasive and non-native species). With appropriate mitigation in place and good work practices, most construction effects on vegetation and terrestrial habitat associated with the Project are likely to be of short duration and the potential zone of influence likely localized to the immediate vicinity of the work. The proposed semi-loop railway track overlaps with critical habitat for streambank lupine, and as such, a permit under *SARA* is anticipated to be required for construction in this area. The Proponent and other FSD business stakeholders will work with FSD and an environmental consultant to prepare an application to Environment and Climate Change Canada for permitting the use of *SARA*-designated critical habitat for streambank lupine in the Project areas adjacent to Elevator Road. This application is intended to address the effects of railway development from proposed projects currently in the VFPA PER process on the FSD lands.

Construction of the Project has the potential to result in temporary disturbances to wildlife, including birds and aquatic species, from such activities as vegetation clearing, construction activities around ditches, and pile driving. Adherence to least risk timing windows (or completion of pre-clearing surveys), along with the implementation of other appropriate mitigation and best management practices is anticipated to result in insignificant residual adverse effects.

Effects to aquatic organisms and habitat in the Fraser River could occur during temporary removal of shoreline protection material and pile driving required along the existing berth face. Installation of the shiploader foundation piles will result in a permanent loss of approximately 20 m² of green-coded (i.e., low productivity) shoreline habitat under the existing dock. An additional approximately 700 m² of shoreline will experience temporary disturbance as a result of shoreline protection material removal and replacement.). With mitigation as recommended above for this shoreline work, no significant residual effects are anticipated to the aquatic species that may potentially use this habitat. The infilling of Ditch N will result in the permanent loss of approximately 70 m² of Class C aquatic habitat (i.e., non-fish-bearing aquatic habitat, no significant food/nutrient input). No significant residual effects are anticipated to the aquatic species that may potentially use this ditch. Temporary changes in riparian habitat and water quality in one Class C ditch due to construction activities in the upland area are expected to be of short duration and localized to this ditch. In summary, with the application of appropriate mitigation and adherence to water quality guidelines and best management practices, construction of the Project is unlikely to cause significant adverse effects to aquatic organisms and habitat.

8.0 CLOSURE

This Work was performed in accordance with Contract 403B Environmental Engineering Services for Permit Applications between Hemmera Envirochem Inc. ("Hemmera") and Parrish and Heimbecker Ltd. ("Client"), dated September 9, 2015 ("Contract"). This Report has been prepared by Hemmera, based on fieldwork and desktop work conducted by Hemmera, for sole benefit and use by Parrish and Heimbecker Ltd. In performing this Work, Hemmera has relied in good faith on information provided by others, and has assumed that the information provided by those individuals is both complete and accurate. This Work was performed to current industry standard practice for similar environmental work, within the relevant jurisdiction and same locale. The findings presented herein should be considered within the context of the scope of work and project terms of reference; further, the findings are time sensitive and are considered valid only at the time the Report was produced. The conclusions and recommendations contained in this Report are based upon the applicable guidelines, regulations, and legislation existing at the time the Report was produced; any changes in the regulatory regime may alter the conclusions and/or recommendations.

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10.0 PERSONAL COMMUNICATION

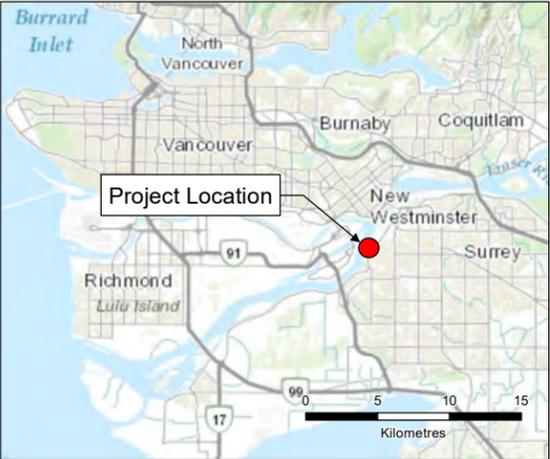
Ekkert, Andre. Fraser Surrey Docks Limited Partnership, Project Manager. Email Correspondence November 4, 2016.

FIGURES



Construction Permit Application
 Fraser Grain Terminal
 11041 Elevator Road, Surrey, BC

Project Location and Construction Boundary



Legend

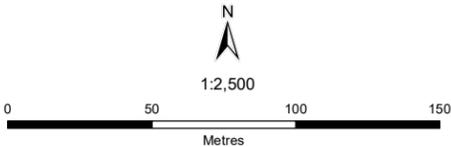
Site Boundary for Construction Works

Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Aerial Image: City of Surrey, 2014



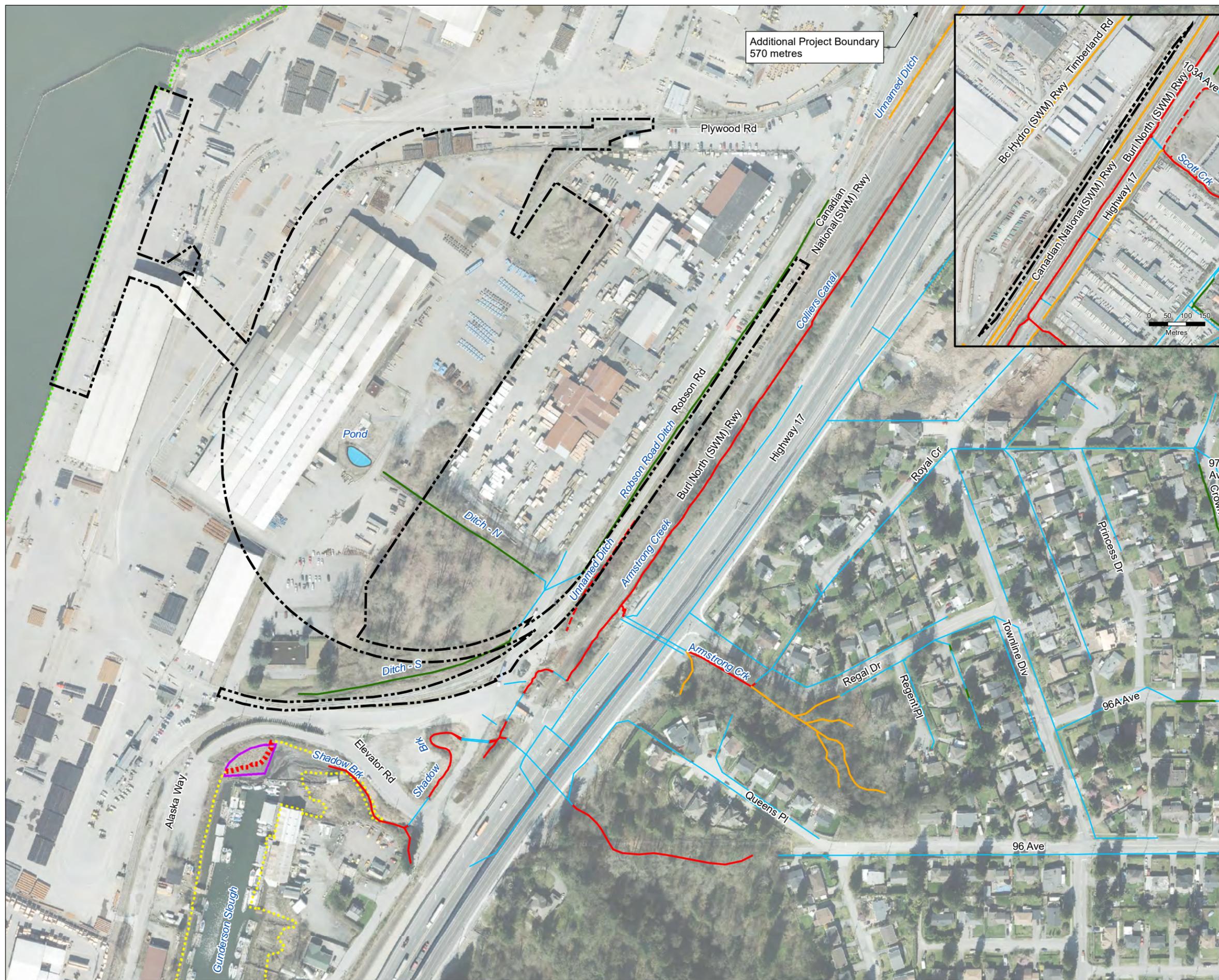
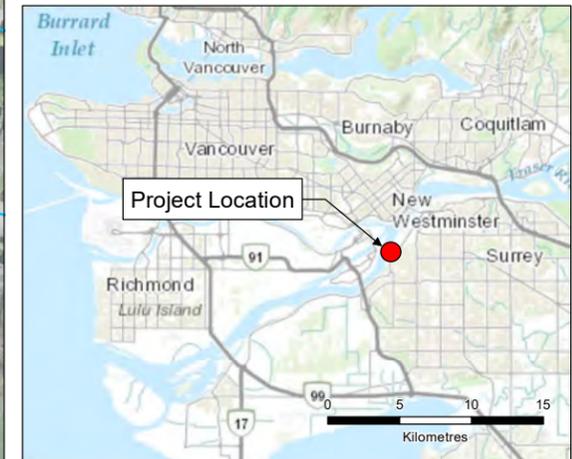
NAD 1983 UTM Zone 10N
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1866-001.01 Production Date: Jun 20, 2017 Figure 1



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Watercourse Classification Map



Legend

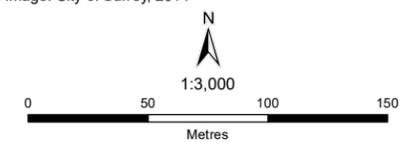
- Site Boundary
- City of Surrey Watercourse Classification**
- A: Watercourse inhabited by fish year round
- AO: Watercourse inhabited by fish during the overwintering period
- B: Non-fish-bearing watercourse but contributes or potentially contributes significant food/nutrient inputs to downstream fish populations
- C: Non-fish-bearing watercourse that does not contribute significant food/nutrient value to downstream fish populations
- Fraser River Estuary Management Program Habitat Classification**
- High productivity habitat
- Moderate productivity habitat
- Low productivity habitat
- Fraser River Estuary Management Program - Habitat Compensation Sites**
- Gunderson Slough Habitat Bench
- Drainage Mains

Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Open Channels: City of Surrey Mapping Online System
- Habitat Classification & Compensation Sites: Fraser River Estuary Management Program
- Aerial Image: City of Surrey, 2014



NAD 1983 UTM Zone 10N

Page Size: 11" x 17"

Vegetation and Site Cover

Legend

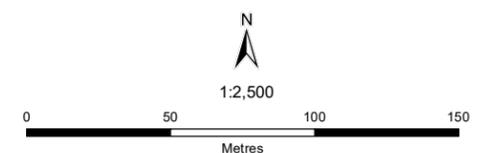
-  Polygon Number (see Table 7 for more detail)
-  Site Boundary
-  Clearing and Grubbing Area
-  Streambank Lupine Critical Habitat
- Terrestrial Ecosystem Mapping (TEM)**
- Vegetated Communities**
-  HE Herbaceous
-  SH Shrubby
-  TR Treed
- Unvegetated Codes**
-  ES Exposed soil
-  OW Open water
-  RN Railway Tracks
-  RZ Road surface
-  UR Urban

Notes

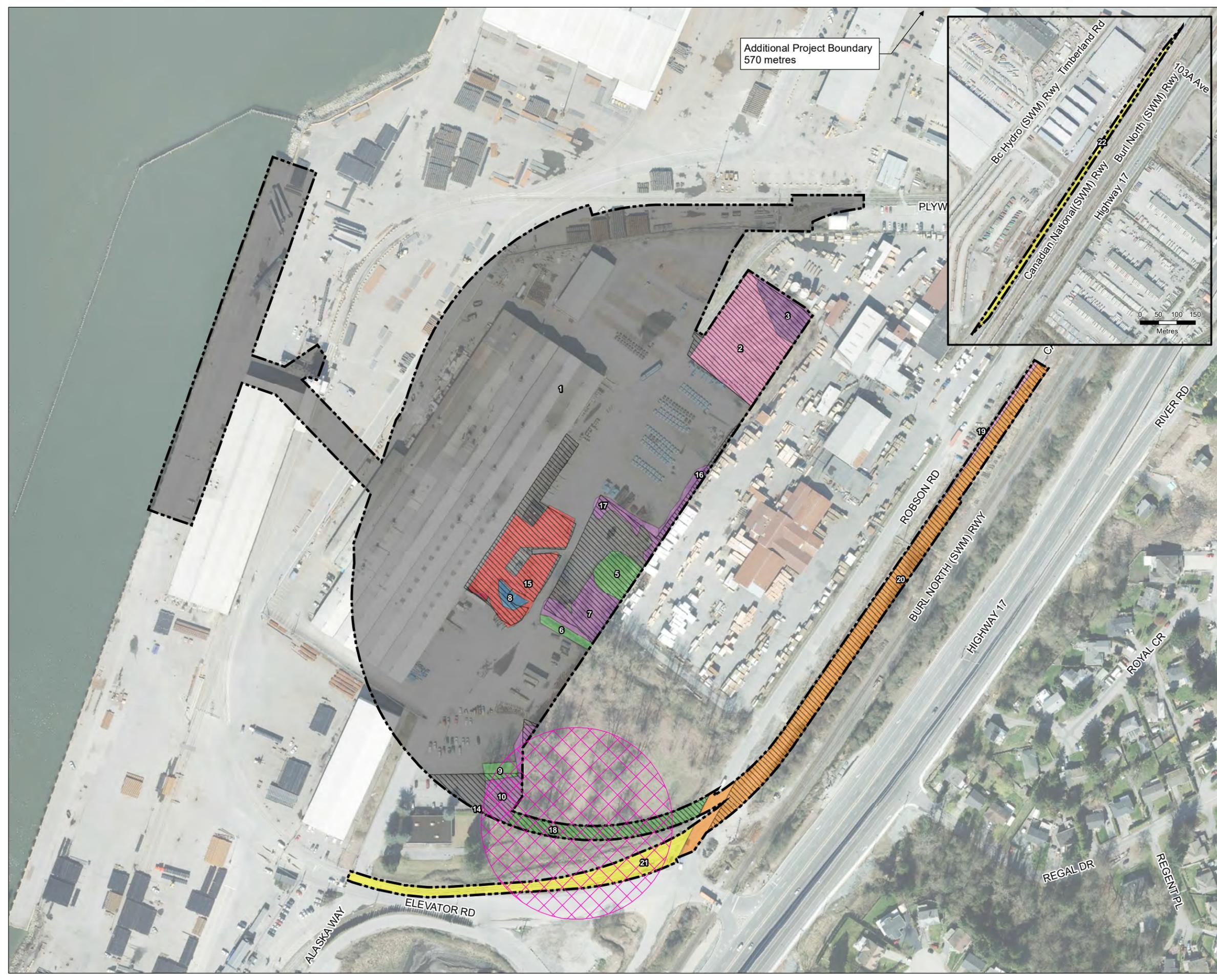
1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Aerial Image: City of Surrey, 2014.



NAD 1983 UTM Zone 10N
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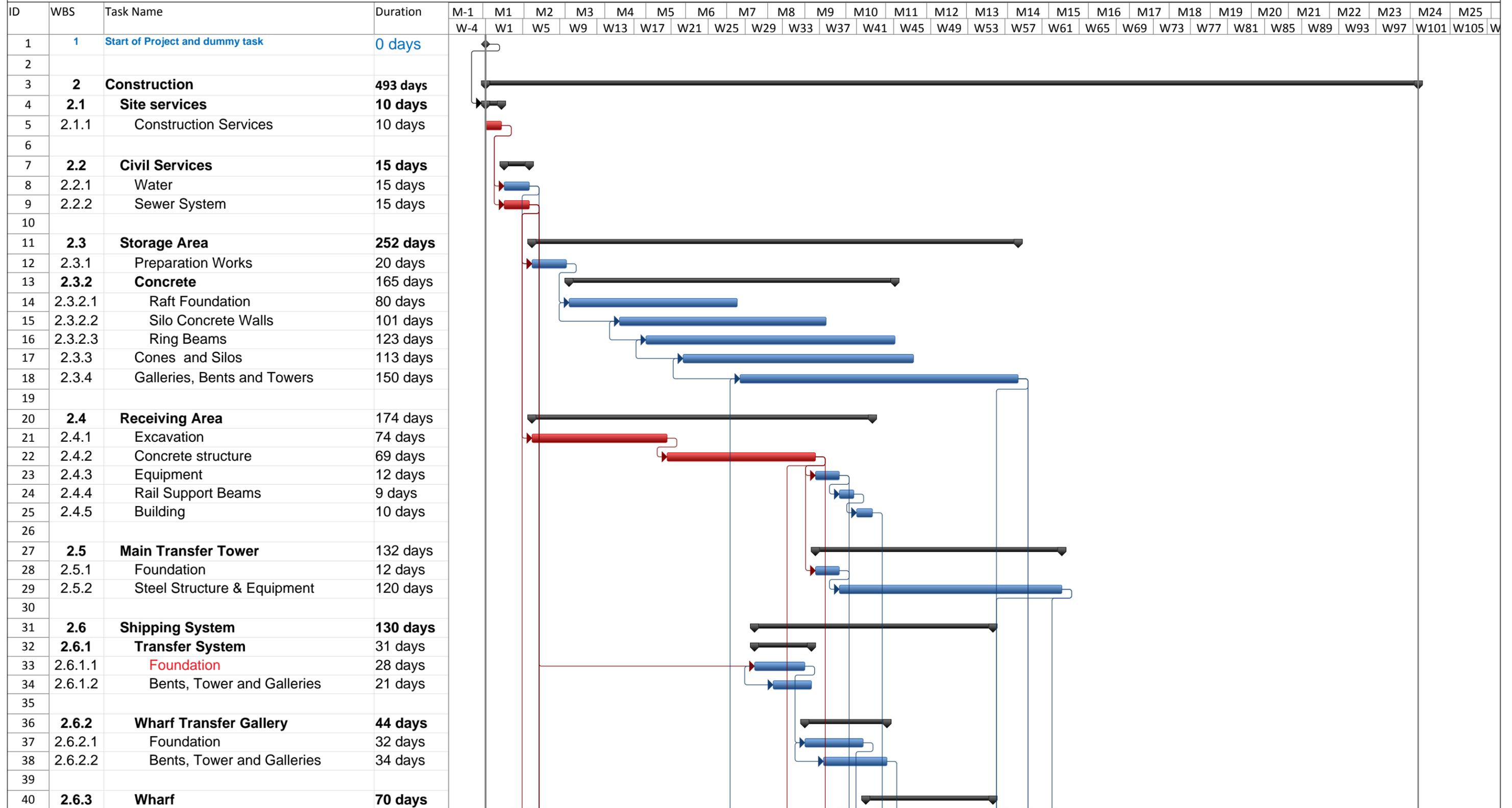
APPENDIX A
Proposed Construction Schedule



FRASER TERMINAL PROPOSED CONSTRUCTION SCHEDULE



Project 1419

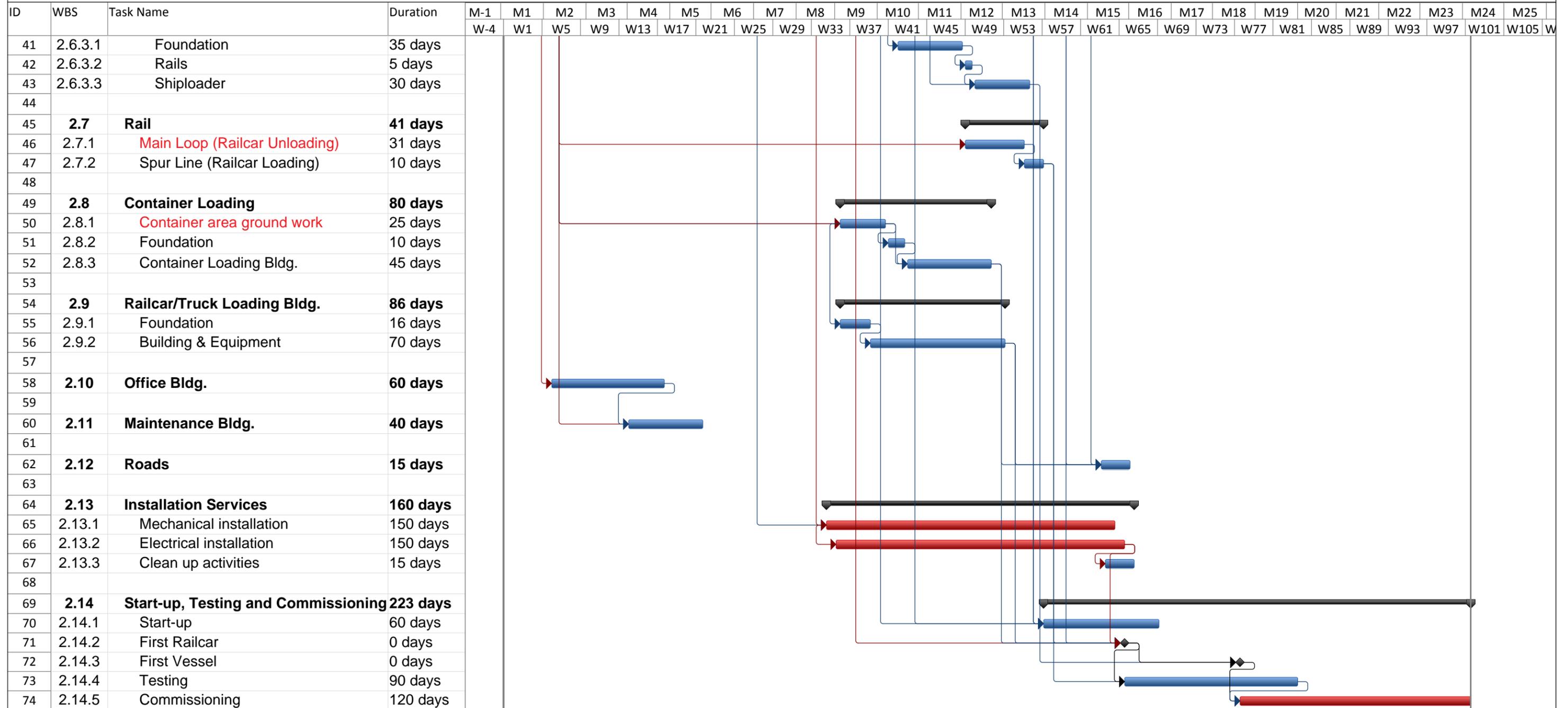




FRASER TERMINAL PROPOSED CONSTRUCTION SCHEDULE



Project 1419



APPENDIX B
Photographs



Photo 1 Herbaceous open area surrounded by shrubs at northeast corner of site. Photo taken September 30, 2015.



Photo 2 Himalayan blackberry growing on fill hummock. Photo taken September 30, 2015.



Photo 3 Larger diameter cottonwoods within the clearing boundary (eastern boundary looking south). Photo taken September 30, 2015.



Photo 4 Larger diameter cottonwoods within the clearing boundary (northeastern corner looking north). Photo taken September 30, 2015.



Photo 5 Ornamental conifers next to office building at site entrance. Photo taken September 30, 2015.



Photo 6 Facing towards the wharf area from the Fraser River. Photo taken November 6, 2015.



Photo 7 Gunderson Slough. View facing south from Elevator Road. Photo taken September 30, 2015.



Photo 8 Shadow Brook, upstream of Elevator Road. View facing southwest. Photo taken September 30, 2015.



Photo 9 Shadow Brook, downstream of elevator road. View facing upstream (southeast). Photo taken September 30, 2015.



Photo 10 Armstrong Creek/Colliers Canal. View facing upstream (northeast). Photo taken September 30, 2015.



Photo 11 Unnamed dashed red-coded Ditch. View facing upstream (northeast). Photo taken September 30, 2015.



Photo 12 Unnamed yellow-coded ditch. View facing northeast. Photo taken September 30, 2015.



Photo 13 Robson Rd Green-coded Ditch. View facing northeast. Photo taken September 30, 2015.



Photo 14 Baekert Ditch-N. View facing northwest from downstream end of ditch. Photo taken September 30, 2015.



Photo 15 Baekert Ditch-S. View facing east towards upstream end of ditch. Photo taken September 30, 2015.

APPENDIX C
Bird Species Documented within
and in Vicinity of Project Site

APPENDIX C BIRD SPECIES DOCUMENTED WITHIN AND IN VICINITY OF PROJECT SITE

Common Name	Scientific Name	Breeding Season (2003)*	Winter Period (2003-2006)*	September 2015**
American Robin	<i>Turdus migratorius</i>	x	x	
Anna's Hummingbird	<i>Calypte anna</i>			x
Bewick's Wren	<i>Thryomanes bewickii</i>	x	x	
Black-capped Chickadee	<i>Poecile atricapillus</i>	x	x	
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>	x		
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	x		
Brown Creeper	<i>Certhia americana</i>	x	x	
Brown-headed Cowbird	<i>Molothrus ater</i>	x		
Cassin's Vireo	<i>Vireo cassinii</i>	x		
Chestnut-backed Chickadee	<i>Poecile rufescens</i>		x	
Common Redpoll	<i>Acanthis flammea</i>		x	
Common Yellowthroat	<i>Geothlypis trichas</i>	x		
Dark-eyed Junco	<i>Junco hyemalis</i>	x	x	x
Downy Woodpecker	<i>Picoides pubescens</i>	x	x	
European Starling	<i>Sturnus vulgaris</i>	x	x	
Fox Sparrow	<i>Passerella iliaca</i>		x	
Golden-crowned Kinglet	<i>Regulus satrapa</i>	x	x	
Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>		x	
Great Blue Heron, <i>fannini</i> subspecies	<i>Ardea herodias fannini</i>		x	
Hairy Woodpecker	<i>Picoides villosus</i>	x	x	
House Finch	<i>Haemorhous mexicanus</i>	x	x	
House Sparrow	<i>Passer domesticus</i>	x	x	
Hutton's Vireo	<i>Vireo huttoni</i>	x	x	
Merlin	<i>Falco columbarius</i>		x	
Northern Flicker	<i>Colaptes auratus</i>		x	x
Northern Pygmy-Owl	<i>Glaucidium gnoma</i>		x	
Northwestern Crow	<i>Corvus caurinus</i>	x	x	x
Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	x		
Pileated Woodpecker	<i>Dryocopus pileatus</i>		x	
Pine Siskin	<i>Spinus pinus</i>	x	x	
Red-breasted Nuthatch	<i>Sitta canadensis</i>	x	x	
Red-breasted Sapsucker	<i>Sphyrapicus ruber</i>		x	x
Red-tailed Hawk	<i>Buteo jamaicensis</i>		x	

Common Name	Scientific Name	Breeding Season (2003)*	Winter Period (2003-2006)*	September 2015**
Rock Dove	<i>Columba livia</i>			x
Ruby-crowned Kinglet	<i>Regulus calendula</i>		x	
Rufous Hummingbird	<i>Selasphorus rufus</i>	x		
Song Sparrow	<i>Melospiza melodia</i>	x	x	
Spotted Towhee	<i>Pipilo maculatus</i>	x	x	
Steller's Jay	<i>Cyanocitta stelleri</i>	x	x	
Swainson's Thrush	<i>Catharus ustulatus</i>	x		
Varied Thrush	<i>Ixoreus naevius</i>		x	
Violet-green Swallow	<i>Tachycineta thalassina</i>	x		
Warbling Vireo	<i>Vireo gilvus</i>	x		
Western Tanager	<i>Piranga ludoviciana</i>	x		
Western Wood-Pewee	<i>Contopus sordidulus</i>	x		
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	x	x	x
Willow Flycatcher	<i>Empidonax traillii</i>	x		
Wilson's Warbler	<i>Cardellina pusilla</i>	x		
Winter Wren	<i>Troglodytes hiemalis</i>	x	x	
Yellow Warbler	<i>Setophaga petechia</i>	x		

Sources: *=RESL 2006, **=Hemmera Surveys

APPENDIX D
Fish Species Documented
within the Lower Fraser River

APPENDIX D FISH SPECIES DOCUMENTED WITHIN THE LOWER FRASER RIVER

Common Name	Scientific Name	Comments
Native Species		
Brassy Minnow	<i>Hybognathus hankinsoni</i>	
Bridgelip Sucker	<i>Catostomus columbianus</i>	presence in Lower Fraser known from a single specimen
Bull Trout*	<i>Salvelinus confluentus</i>	
Burbot	<i>Lota lota</i>	peripheral range only (iMap BC 2015), presence in Lower Fraser known from a single specimen
Chinook Salmon*	<i>Oncorhynchus tshawytscha</i>	
Chiselmouth	<i>Acrocheilus alutaceus</i>	
Chum Salmon*	<i>Oncorhynchus keta</i>	
Coastal Cutthroat Trout*	<i>Oncorhynchus clarki clarki</i>	
Coastrange Sculpin	<i>Cottus aleuticus</i>	
Coho Salmon*	<i>Oncorhynchus kisutch</i>	
Dolly Varden*	<i>Salvelinus malma</i>	
Eulachon*	<i>Thaleichthys pacificus</i>	
Green Sturgeon*	<i>Acipenser medirostris</i>	more likely present within more brackish, estuarine portions near mouth of Lower Fraser
Lake Chub	<i>Couesius plumbeus</i>	
Lake Trout	<i>Salvelinus namaycush</i>	exotic in study area (iMap BC 2015), presence in Lower Fraser known from a single specimen
Largescale Sucker	<i>Catostomus macrocheilus</i>	
Leopard Dace	<i>Rhynchichthys falcatus</i>	
Longfin Smelt	<i>Spirinchus thaleichthys</i>	
Longnose Dace	<i>Rhynchichthys cataractae</i>	
Longnose Sucker	<i>Catostomus catostomus</i>	
Mountain Whitefish*	<i>Prosopium williamsoni</i>	
Northern Mountain Sucker	<i>Catostomus platyhincus</i>	presence in Lower Fraser known from a single specimen
Northern Pikeminnow	<i>Ptychocheilus oregonensis</i>	
Pacific Lamprey*	<i>Lampetra tridentata</i>	
Peamouth Chub	<i>Mylocheilus caurinus</i>	
Pink Salmon	<i>Oncorhynchus gorbuscha</i>	
Prickly Sculpin	<i>Cottus asper</i>	
Pygmy Whitefish	<i>Prosopium coulteri</i>	
Rainbow Trout / Steelhead*	<i>Oncorhynchus mykiss</i>	
Redside Shiner	<i>Richardsonius balteatus</i>	
River Lamprey	<i>Lampetra ayresi</i>	

Common Name	Scientific Name	Comments
Slimy Sculpin	<i>Cottus cognatus</i>	
Sockeye Salmon*	<i>Oncorhynchus nerka</i>	
Staghorn Sculpin	<i>Leptocottus armatus</i>	estuarine or tidal
Starry Flounder	<i>Platichthys stellatus</i>	estuarine or tidal
Surf Smelt	<i>Hypomesus pretiosus</i>	estuarine or tidal
Threespine Stickleback	<i>Gasterosteus aculeatus</i>	
Torrent Sculpin	<i>Cottus rhotheus</i>	
Western Brook Lamprey	<i>Lampreta richardsoni</i>	
Westslope Cutthroat Trout*	<i>Oncorhynchus clarki lewisi</i>	Range does not overlap with study area (iMap BC 2015)
White Sturgeon*	<i>Acipenser transmontanus</i>	
White Sucker	<i>Catostomus commersoni</i>	
Exotic Species		
American Shad	<i>Alosa sapidissima</i>	
Black Crappie	<i>Pomoxis nigromaculatus</i>	
Brook Trout	<i>Salvelinus fontinalis</i>	
Brown Catfish	<i>Ameiurus nebulosus</i>	
Carp	<i>Cyprinus carpio</i>	
Fathead Minnow	<i>Pimephales promelas</i>	
Golden Trout	<i>Oncorhynchus mykiss aguabonita</i>	Range does not overlap with study area (iMap BC 2015)
Goldfish	<i>Carassius auratus</i>	
Lake Whitefish	<i>Coregonus clupeaformis</i>	
Largemouth Bass	<i>Micropterus salmoides</i>	
Pumpkinseed	<i>Lepomis gibbosus</i>	

Notes: * Species expected to represent a CRA fishery

Source: FISS 2015, iMap BC 2015, McPhail and Carveth 1994

APPENDIX E
Species at-Risk Documented
within the Metro Vancouver Regional District

APPENDIX E SPECIES AT RISK DOCUMENTED WITHIN THE METRO VANCOUVER REGIONAL DISTRICT

Common Name	Scientific Name	SARA Schedule ^a	COSEWIC ^a	BC List ^b
Birds				
American Bittern	<i>Botaurus lentiginosus</i>	-	-	Blue
Band-tailed Pigeon	<i>Patagioenas fasciata</i>	1-SC (Feb 2011)	SC (Nov 2008)	Blue
Barn Owl	<i>Tyto alba</i>	1-SC (Jun 2003)	T (Nov 2010)	Red
Barn Swallow	<i>Hirundo rustica</i>	-	T (May 2011)	Blue
Black-crowned Night-heron	<i>Nycticorax nycticorax</i>	-	-	Red
Black Swift	<i>Cypseloides niger</i>	-	E (May 2015)	Blue
Caspian Tern	<i>Hydroprogne caspia</i>	-	NAR (May 1999)	Blue
Common Nighthawk	<i>Chordeiles minor</i>	1-T (Feb 2010)	T (Apr 2007)	Yellow
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	-	NAR (May 1978)	Blue
Great Blue Heron, <i>fannini</i> subspecies	<i>Ardea herodias fannini</i>	1-SC (Feb 2010)	SC (Mar 2008)	Blue
Green Heron	<i>Butorides virescens</i>	-	-	Blue
Marbled Murrelet	<i>Brachyramphus marmoratus</i>	1-T (Jun 2003)	T (May 2012)	Blue
Olive-sided Flycatcher	<i>Contopus cooperi</i>	1-T (Feb 2010)	T (Nov 2007)	Blue
Peregrine Falcon, <i>anatum</i> subspecies	<i>Falco peregrinus anatum</i>	1-SC (Jun 2012)	SC (Apr 2007)	Red
Purple Martin	<i>Progne subis</i>	-	-	Blue
Short-eared Owl	<i>Asio flammeus</i>	1-SC (Jul 2012)	SC (Mar 2008)	Blue
Spotted Owl	<i>Strix occidentalis</i>	1-E (Jun 2003)	E (Mar 2008)	Red
Western Screech-Owl, <i>kennicottii</i> subspecies	<i>Megascops kennicottii kennicottii</i>	1-SC (Jan 2005)	T (May 2012)	Blue
Mammals				
Keen's Myotis	<i>Myotis keenii</i>	3 (Mar 2005)	DD (Nov 2003)	Blue
Little Brown Myotis	<i>Myotis lucifugus</i>	1-E (Dec 2014)	E (Nov 2013)	Yellow
Long-tailed weasel, <i>altifrontalis</i> subspecies	<i>Mustela frenata altifrontalis</i>	-	-	Red
Mountain Beaver	<i>Aplodontia rufa</i>	1-SC (Jun 2003)	SC (May 2012)	Yellow
Mountain Goat	<i>Oreamnos americanus</i>	-	-	Blue

Common Name	Scientific Name	SARA Schedule ^a	COSEWIC ^a	BC List ^b
Olympic Shrew	<i>Sorex rohweri</i>	-	-	Red
Pacific Water Shrew	<i>Sorex bendirii</i>	1-E (Jun 2003)	E (Apr 2006)	Red
Snowshoe Hare, <i>washingtonii</i> subspecies	<i>Lepus americanus washingtonii</i>	-	-	Red
Southern Red-backed Vole, <i>occidentalis</i> subspecies	<i>Myodes gapperi occidentalis</i>	-	-	Red
Townsend's Big-eared Bat	<i>Corynorhinus townsendii</i>	-	-	Blue
Trowbridge's Shrew	<i>Sorex trowbridgii</i>	-	-	Blue
Reptiles and Amphibians				
Coastal Tailed Frog	<i>Ascaphus truei</i>	1-SC (Jun 2003)	SC (Nov 2011)	Blue
Northern Red-legged Frog	<i>Rana aurora</i>	1-SC (Jan 2005)	SC (May 2015)	Blue
Northern Rubber Boa	<i>Charina bottae</i>	1-SC (Jan 2005)	SC (May 2003)	Yellow
Oregon Spotted Frog	<i>Rana pretiosa</i>	1-E (Jun 2003)	E (May 2011)	Red
Painted Turtle - Pacific Coast Population	<i>Chrysemys picta</i> pop. 1	1-E (Dec 2007)	E (Apr 2006)	Red
Western Pond Turtle	<i>Actinemys marmorata</i>	1-XX (Jan 2005)	XT (May 2012)	Red
Western Toad	<i>Anaxyrus boreas</i>	1-SC (Jan 2005)	SC (Nov 2012)	Blue
Invertebrates				
Dun Skipper	<i>Euphyes vestris</i>	1-T (Jun 2003)	T (Apr 2013)	Red
Greenish Blue, <i>insulanus</i> subspecies	<i>Plebejus saepiolus insulanus</i>	1-E (Jun 2003)	E (May 2012)	Red
Monarch	<i>Danaus plexippus</i>	1-SC (Jun 2003)	SC (Apr 2010)	Blue
Northern Abalone	<i>Haliotis kamtschatkana</i>	1-T (Jun 2003)	T (May 2000)	Red
Oregon Forestsnail	<i>Allogona townsendiana</i>	1-E (Jan 2005)	E (Apr 2013)	Red
Puget Oregonian	<i>Cryptomastix devia</i>	1-XX (Jan 2005)	XT (Apr 2013)	Red
Fish				
Bull Trout	<i>Salvelinus confluentus</i>	-	SC (Nov 2012)	Blue
Bull Trout - Coastal Lineage	<i>Salvelinus confluentus - coastal lineage</i>	-	SC (Nov 2012)	Blue
Cutthroat Trout, <i>clarkii</i> subspecies	<i>Oncorhynchus clarkii clarkii</i>	-	-	Blue
Eulachon	<i>Thaleichthys pacificus</i>	-	E/T (May 2011)	Blue

Common Name	Scientific Name	SARA Schedule ^a	COSEWIC ^a	BC List ^b
Green Sturgeon	<i>Acipenser medirostris</i>	1-SC (Aug 2006)	SC (Nov 2013)	Red
Nooksack Dace	<i>Rhinichthys cataractae</i> - <i>Chehalis lineage</i>	1-E (Jun 2003)	E (Apr 2007)	Red
Pygmy Longfin Smelt	<i>Spirinchus</i> sp. 1	-	DD (Nov 2004)	Red
Salish Sucker	<i>Catostomus</i> sp. 4	1-E (Jan 2005)	T (Nov 2012)	Red
White Sturgeon ^c	<i>Acipenser transmontanus</i>	1-E (Aug 2006)	E (Nov 2003)	No Status
Plants				
American Sweet-flag	<i>Acorus americanus</i>	-	-	Red
Atrichum moss	<i>Atrichum flavisetum</i>	-	-	Blue
Beaked Spike-rush	<i>Eleocharis rostellata</i>	-	-	Blue
Bearded Sedge	<i>Carex comosa</i>	-	-	Blue
Blue Vervain	<i>Verbena hastata</i> var. <i>scabra</i>	-	-	Blue
Brachythecium moss	<i>Brachythecium reflexum</i> var. <i>pacificum</i>	-	-	Red
Cadot's Pohlia Moss	<i>Pohlia cardotii</i>	-	-	Blue
California alsia moss	<i>Alsia californica</i>	-	-	Blue
Carolina Meadow-foxtail	<i>Alopecurus carolinianus</i>	-	-	Red
California-tea	<i>Rupertia physodes</i>	-	-	Blue
Callicladium Moss	<i>Callicladium haldanianum</i>	-	-	Blue
Cascade Parsley Fern	<i>Cryptogramma cascadenis</i>	-	-	Blue
Chaffweed	<i>Anagallis minima</i>	-	-	Blue
Common Bladder Moss	<i>Physcomitrium pyriforme</i>	-	-	Blue
Contorted Sphagnum	<i>Sphagnum contortum</i>	-	-	Blue
False-pimpernel	<i>Lindernia dubia</i> var. <i>anagallidea</i>	-	-	Blue
Fissidens Moss	<i>Fissidens ventricosus</i>	-	-	Blue
Flowering Quillwort	<i>Lilaea scilloides</i>	-	-	Blue
Green Parrot's-feather	<i>Myriophyllum pinnatum</i>	-	-	Blue
Green-fruited Sedge	<i>Carex interrupta</i>	-	-	Blue

Common Name	Scientific Name	SARA Schedule ^a	COSEWIC ^a	BC List ^b
Green-sheathed Sedge	<i>Carex feta</i>	-	-	Blue
Grout	<i>Brachythecium holzingeri</i>	-	-	Blue
Henderson's Checker-mallow	<i>Sidalcea hendersonii</i>	-	-	Blue
Hygroamblystegium Moss	<i>Hygroamblystegium fluviatile</i>	-	-	Blue
Hygrohypnum Moss	<i>Hygrohypnum alpinum</i>	-	-	Blue
Immersed Physcomitrium Moss	<i>Physcomitrium immersum</i>	-	-	Red
Joe-pye Weed	<i>Eutrochium maculatum var. bruneri</i>	-	-	Red
Mountain Sneezeweed	<i>Helenium autumnale var. grandiflorum</i>	-	-	Blue
Naked Flag Moss	<i>Disclium nudum</i>	-	-	Red
Needle-leaved Navarretia	<i>Navarretia intertexta</i>	-	-	Red
Northern Water-meal	<i>Wolffia borealis</i>	-	-	Red
Nuttall's Quillwort	<i>Isoetes nuttallii</i>	-	-	Blue
Nuttall's Sunflower	<i>Helianthus nuttallii ssp. rydbergii</i>	-	-	Red
Nuttall's Waterweed	<i>Elodea nuttallii</i>	-	-	Blue
Ovate Spike-rush	<i>Eleocharis ovata</i>	-	-	Blue
Peacock Vinyl	<i>Leptogium polycarpum</i>	-	SC (May 2011)	Red
Pink Water Speedwell	<i>Veronica catenata</i>	-	-	Blue
Platyhypnidium Moss	<i>Platyhypnidium riparioides</i>	-	-	Blue
Pointed Rush	<i>Juncus oxymeris</i>	-	-	Blue
Poor Pocket Moss	<i>Fissidens pauperculus</i>	1-E (Jun 2003)	E (May 2011)	Red
Powder Gun Moss	<i>Diphyscium foliosum</i>	-	-	Blue
Pseudephemerum Moss	<i>Pseudephemerum nitidum</i>	-	-	Red
Roell's Brotherella	<i>Brotherella roellii</i>	-	E (Nov 2010)	Red
Salt Marsh Philadelphia Daisy	<i>Erigeron philadelphicus var. glaber</i>	-	-	Red
Schleicher's Bryum Moss	<i>Bryum schleicheri</i>	-	-	Blue
Schofield's Andreaea Moss	<i>Andreaea schofieldiana</i>	-	-	Red

Common Name	Scientific Name	SARA Schedule ^a	COSEWIC ^a	BC List ^b
Short-flowered Monkey-flower	<i>Erythranthe breviflora</i>	-	-	Blue
Short-tailed Rush	<i>Juncus brevicaudatus</i>	-	-	Red
Slender-spiked Mannagrass	<i>Glyceria leptostachya</i>	-	-	Blue
Small Spike-rush	<i>Eleocharis parvula</i>	-	-	Blue
Small-spored Rock-moss	<i>Andreaea sinuosa</i>	-	-	Red
Snow Bramble	<i>Rubus nivalis</i>	-	-	Blue
Streambank Lupine	<i>Lupinus rivularis</i>	1-E (Jan 2005)	E (Nov 2002)	Red
Three-flowered Waterwort	<i>Elatine rubella</i>	-	-	Blue
Twisted Oak Moss	<i>Syntrichia laevipila</i>	1-SC (Jul 2005)	SC (Nov 2014)	Blue
Two-edged Water-starwort	<i>Callitriche heterophylla var. heterophylla</i>	-	-	Blue
Vancouver Island Beggarticks	<i>Bidens amplissima</i>	1-SC (Jun 2003)	SC (Nov 2001)	Blue
Warnstorfia Moss	<i>Warnstorfia pseudostraminea</i>	-	-	Blue
Washington Springbeauty	<i>Claytonia washingtoniana</i>	-	-	Red
Western St. John's-wort	<i>Hypericum scouleri ssp. nortoniae</i>	-	-	Blue
Yellowseed False Pimpernel	<i>Lindernia dubia var. dubia</i>	-	-	Red

- Notes:**
- ^a Federal designation of a species to Schedule 1, 2, or 3 with an associated status code: (Extinct (XX), Extirpated (XT), Endangered (E), Threatened (T), Special Concern (SC), or Not at Risk (NAR). Species listed on Schedule 2 or 3 are not officially protected under SARA.
 - ^b A provincial designation of species and ecological communities to one of three lists: Red-listed (Extirpated, Endangered, or Threatened), Blue-listed (Special Concern), Yellow-listed (Secure), or Exotic (Invasive).
 - ^c White sturgeon are listed under SARA Schedule 1 as Endangered; however, the Lower and Middle Fraser River populations are not included in this listing.

Source: BC CDC 2016