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Revision 1

March 2018

Terrestrial Resources Assessment
Report

TERRESTRIAL RESOURCES ASSESSMENT REPORT

BHP Potash Export Facility at Fraser Surrey Docks

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EXECUTIVE SUMMARY

BHP Billiton Canada Inc. (BHP) is considering a portion of the Fraser Surrey Docks (FSD) in Surrey, British Columbia (BC), as a potential site for the construction of a potash export facility (Project).

This terrestrial resources assessment report has been prepared in accordance with the Vancouver Fraser Port Authority (VFPA) Project and Environmental Review (PER) Guidelines for Habitat Assessment (PMV 2015). It presents the environmental assessment for vegetation and wildlife components within the vicinity of the Project.

The vegetation component of the terrestrial resources assessment includes an assessment of plant communities and at-risk plant species in the Project development area (PDA). Natural vegetation in the PDA is limited; most of the site (97.7 percent (%)) has been developed and is currently used for industrial activities. Vegetated areas make up 2.3% of the PDA and comprise treed and herbaceous habitat. No at-risk plant communities or wetland habitat was documented; however, the PDA does overlap with designated critical habitat for streambank lupine (*Lupinus rivularis*). The Project study team did not observe streambank lupine specimens during sampling efforts, and observed that suitable substrate within the critical habitat is currently dominated by invasive and weedy herbaceous and shrubby vegetation.

The wildlife component of the terrestrial resources assessment includes an overview assessment of habitat availability, birds, mammals, amphibians and reptiles, and species of conservation concern. The PDA provides limited wildlife value, except for relatively mobile species and species with high tolerance for human-related activities. Double-crested cormorant (*Phalacrocorax auritus*), great blue heron (*Ardea herodias fannini*), and barn swallow (*Hirundo rustica*) are species of conservation concern that have been observed in habitat adjacent to the PDA (i.e., the Fraser River); however, the lack of natural ecosystems at the site minimises its capacity to support substantial wildlife populations.

Construction of the Project may disturb vegetation and wildlife as a result of building demolition, vegetation clearing, and construction activities; however, the application of appropriate mitigation measures and adherence to best management practices will offset residual effects. Habitat loss is limited to low-quality vegetated areas that are dominated by invasive and weedy species. The Project is unlikely to cause significant adverse residual effects to vegetation or wildlife.

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ACRONYMS, ABBREVIATIONS, SYMBOLS, AND UNITS OF MEASURE

Acronym	Definition
BC	British Columbia
BHP	BHP Billiton Canada Inc.
ECCC	Environment and Climate Change Canada
FSD	Fraser Surrey Docks
PDA	Project Development Area
PER	Project and Environmental Review
Project	proposed potash export facility
QEP	qualified environmental professional
SARA	<i>Species at Risk Act</i>
SFPR	South Fraser Perimeter Road
VFPA	Vancouver Fraser Port Authority
ZOI	zone of influence
Symbol, Unit of Measure	Definition
%	Percent
ha	Hectare
m	Metre

1.0 INTRODUCTION

Terrestrial resources were selected for assessment because of the potential interaction between the proposed potash export facility (Project) and ecological values such as vegetation, wildlife, and species of conservation concern, and their importance to Aboriginal groups and the public, based on literature review. Project activities that may affect terrestrial resources during construction include demolition of existing infrastructure, vegetation removal, and construction of Project-related infrastructure. During the Project's operation phase, rail maintenance, rail traffic, and marine vessel traffic comprise the activities that may interact with terrestrial resources. A full description of Project activities, materials, equipment, proposed work plan, and schedule is provided in **Section 2.0 Project Description Requirements**.

In recognition of the importance of minimising the potential effects of the Project on terrestrial resources, the Project and Environmental Review (PER) Application Submission Requirements specifies the completion of a biophysical survey and species of conservation concern assessment.

The Vancouver Fraser Port Authority (VFPA) has developed the *Project and Environmental Review Guidelines – Habitat Assessment* (PMV 2015) to assist applicants of projects on lands and waters managed by VFPA in the assessment of potential effects on biophysical resources including terrestrial resources. This section summarises the work conducted to assess potential effects to terrestrial resources as a result of the Project.

The terrestrial resources assessment focused on determining the potential effects on vegetation, wildlife, and species of conservation concern. Work conducted to support the terrestrial resources assessment is presented in the following sections and provides:

- A review of existing baseline information for vegetation, wildlife, and species of conservation concern that may be affected by the Project
- Information from field surveys for ecosystem mapping, at-risk plants, raptor nests, and waterbirds
- An assessment of potential effects resulting from Project construction and operation with vegetation, wildlife, and species of conservation concern, and recommendations for mitigation.

Information on the Project location and rationale are provided in **Section 2.0 Project Description Requirements**.

2.0 SCOPE

2.1 SCOPE OF ASSESSMENT

The terrestrial resources assessment considers potential changes and effects to terrestrial resources, and focuses on those environmental components that may be influenced by the Project. Components were selected based on ecological importance and conservation status, and their likelihood to be affected by Project activities. The following components were selected for further evaluation in this report:

- Vegetation: plant communities and species of conservation concern
- Wildlife: birds (i.e., raptors, waterbirds, and songbirds), mammals, amphibians and reptiles, and species of conservation concern.

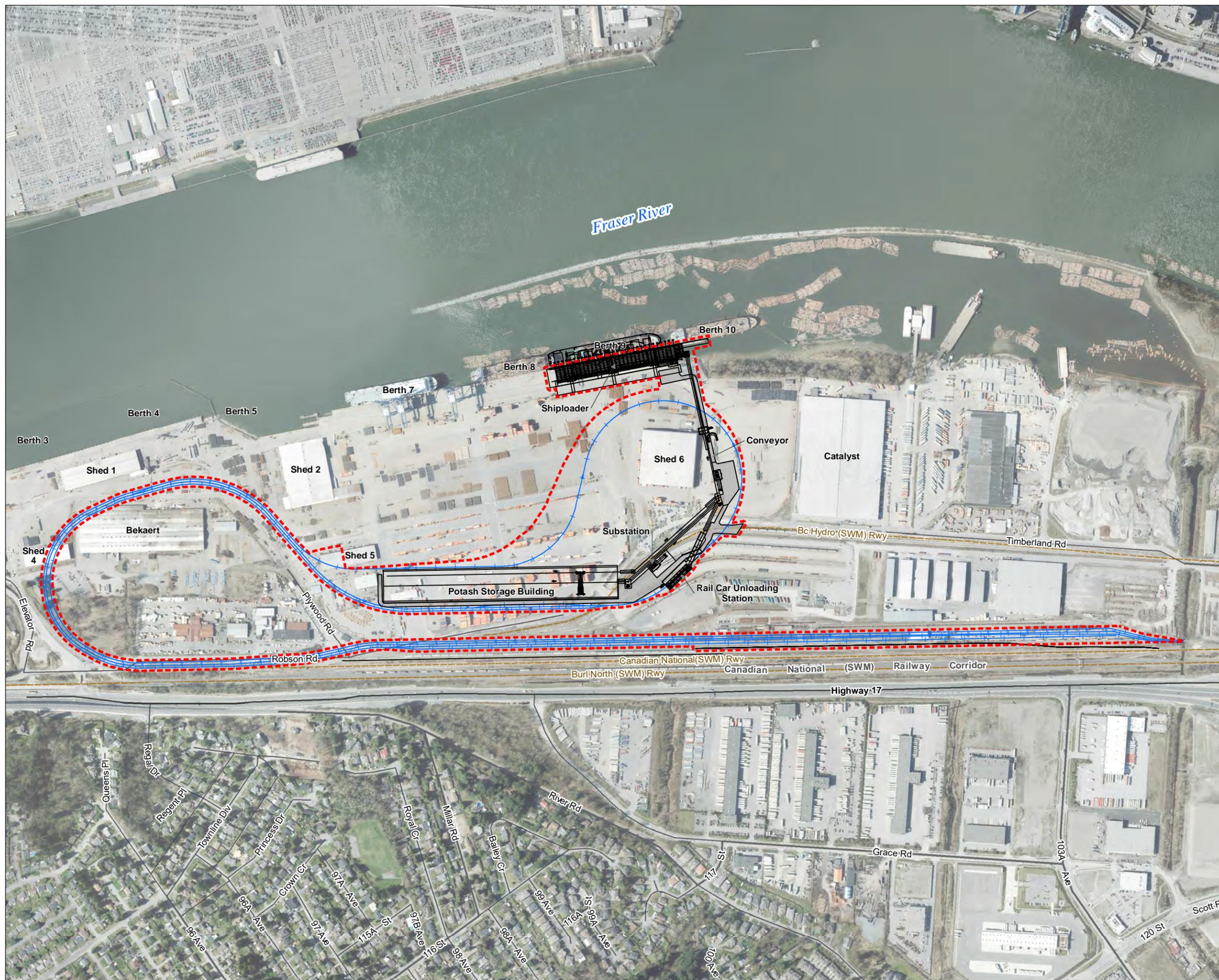
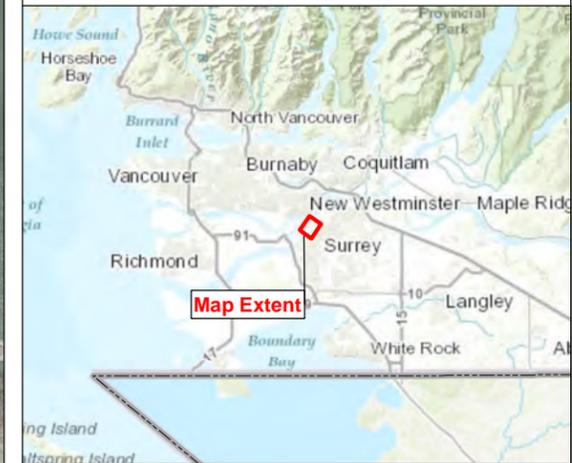
2.2 SPATIAL SCOPE

The Project is located in the Fraser Surrey Docks (FSD) site on the south bank of the Fraser River's South Arm, adjacent to Highway 17 (South Fraser Perimeter Road (SFPR)) in the City of Surrey, British Columbia (BC). The Project will include Berth #9, Yard Area 9, and the current container yard of the FSD site. All aspects of the Project will be confined to lands within the FSD site, which is leased to FSD by VFPA. The Project's intended use is consistent with the current and zoned uses of the site, both by the City of Surrey and VFPA. An overview of the Project and its orientation on the FSD site is shown in the Site Overview Map (**Figure 1**).

The spatial boundaries for characterising effects on terrestrial resources are identified as follows:

- Vegetation zone of influence (ZOI): equivalent to the PDA, which is 28.6 hectares (ha).
- Wildlife ZOI: includes the PDA and an approximate 500-metre (m) buffer along the north, west, and south boundaries, encompassing the spatial extent of potential interactions between Project activities and wildlife. The east boundary of the wildlife ZOI is defined by the western edge of the SFPR, beyond which direct and indirect Project-related effects are not likely to extend. The wildlife ZOI, which includes terrestrial and aquatic habitat, is 284.3 ha.

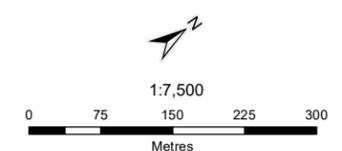
Site Location and Aerial View



- Legend**
- Project Development Area
 - Project Access Corridor
 - Project Infrastructure
 - Proposed Project Rails
 - Highway
 - Road (Collector)
 - Road (Local)
 - Road (Gravel)

- 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.
 2. This extent should be considered approximate only.

- Sources**
- PDA obtained from BHP Billiton Ref: 40600-LO-DWG-00129.dwg
 - Basemap: Ortho Imagery from City of Surrey.



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2.3 TEMPORAL SCOPE

Construction will take approximately three to four years to complete and timing is subject to approval of the Board of BHP, and receipt of construction permits. This would not occur before Q1 2019. Proposed construction works may overlap with environmentally sensitive periods for wildlife. Potentially applicable environmental work windows for construction projects of this type are contingent on consideration of the actual risks of potential effects and the ability to apply mitigation measures. Environmental work windows that may apply are identified as follows:

- Least-risk work window for raptor species likely to nest in the wildlife ZOI is September 1 to February 15 (Bird Studies Canada 2017, Davidson et al. 2015)
- Least-risk work window for waterbirds likely to nest in the wildlife ZOI is August 15 to February 28 (Bird Studies Canada 2017, Davidson et al. 2015)
- Least-risk work window for songbirds likely to nest in the wildlife ZOI is September 15 to March 15 (Bird Studies Canada 2017, Davidson et al. 2015)
- The instream work window for beaver dam removal (including blocked culverts) is June 15 to September 15 (MFLNRO 2011).

3.0 REGULATORY STANDARDS AND GUIDELINES

The Project site is located entirely on federal lands within the jurisdiction of VFPA. Under the *Canada Marine Act*, SC 1998, c. 10, VFPA is responsible for the administration, management, and control of land and water within its authority. The PER process applies to all proposed physical works and activities on federal lands and waters that are located partially or wholly within VFPA's authority.

Provincial and federal legislation and regulation exist to manage activities that can affect terrestrial resources. An overview of regulatory standards and guidelines that may apply is provided below.

Legislation

Species at Risk Act

The federal *Species at Risk Act*, SC 2002, c. 29 (SARA), aims to prevent species of conservation concern from becoming extirpated or extinct, and ensures the appropriate management of species of special concern to prevent them from becoming threatened or endangered¹. Listing recommendations are provided to the federal government by the Committee on the Status of Endangered Wildlife in Canada. An endangered, threatened, or extirpated status in Schedule 1 of SARA protects individuals and their residences on federal lands. Critical habitat is defined as the habitat necessary for the survival or recovery of listed species, which is further described in each respective recovery strategy or action plan. Included in SARA is a prohibition against destroying any part of critical habitat of endangered or threatened species listed in Schedule 1 or any listed extirpated species if a recovery strategy has recommended the reintroduction of the species into the wild in Canada.

Migratory Birds Convention Act

The *Migratory Birds Convention Act*, 1994, SC 1994, c. 22, regulates human activities that may be harmful to migratory birds through the enforcement of the *Migratory Birds Regulations*, CRC, c. 1035. Among other restrictions, these regulations protect the nests and eggs of migratory birds, as listed in the regulations, and restrict the possession of live and dead migratory birds and bird parts including eggs. Migratory birds are protected whether the species occurs on federal, provincial, public, or private land.

¹ Status codes for SARA are defined as follows: extinct: a species that no longer exists; extirpated: a species that no longer exists in the wild in Canada, but occurring elsewhere; endangered: a species facing imminent extirpation or extinction; threatened: a species that is likely to become endangered if limiting factors are not reversed; special concern: a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.

British Columbia *Wildlife Act*

The provincial *Wildlife Act*, RSBC 1996, c. 488, protects most vertebrates from direct harm or harassment, as well as nesting birds and the nests of certain bird species, and certain species of conservation concern. The nests and eggs of eagles, peregrine falcon (*Falco peregrinus anatum*), and osprey (*Pandion haliaetus*) are protected year-round under the Act, even when unoccupied.

Weed Control Act

The provincial *Weed Control Act*, RSBC 1996, c.487, aims to control the spread of designated noxious plants on all provincial Crown and private land. The Act requires all land occupiers to avoid establishment and dispersal of noxious weeds as defined by the Act.

Guidelines

Best Management Practices for Amphibian and Reptile Salvages in British Columbia

Amphibians and reptiles often require salvage operations, and are also susceptible to effects related to this activity. The purpose of this document is to provide standard guidance on how to plan and implement salvage operations that minimise effects to both translocated and recipient wildlife populations (MFLNRO 2016).

British Columbia Conservation Data Centre

The BC Conservation Data Centre is part of the BC Ministry of Environment's Environmental Stewardship Division. Based on scientific data, conservation status ranks have been identified and assigned to endangered species and ecological communities in BC as follows (BC CDC 2015):

- Red-listed – Any species or ecosystem that is at risk of being lost (i.e., extirpated, endangered, or threatened). Extirpated taxa no longer exist in the wild in BC, but do occur elsewhere. Endangered taxa are facing imminent extirpation or extinction. Threatened taxa are likely to become endangered if limiting factors are not reversed.
- Blue-listed – Any species or ecosystem that is of special concern. Taxa of special concern have characteristics that make them particularly sensitive or vulnerable to human activities or natural events.
- Yellow-listed – Any species or ecosystem that is at the least risk of being lost. Yellow-listed species may have red- or blue-listed subspecies.

Although a species or ecological community may be placed on the Red or Blue List, this does not automatically confer protection to the species or its habitat; however, it does identify the species or ecological community to provincial regulators as being potentially sensitive in the context of the proposed development, and potentially requiring permits, approvals, or further consideration.

Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia

Provides general information on raptors, including life history and habitat requirements, for those species whose ranges overlap with urban and rural development in BC, and provides guidelines for activities undertaken in those ranges (MOE 2013).

Guidelines for Rare Vascular Plant Surveys in Alberta

These guidelines consider information on rare plant species, population dynamics, plant ecology, phenology, current survey methods, and the knowledge and experience of field botanists in Alberta (ANPC 2012). These are the only rare plant survey guidelines that pertain to Western Canada, and provide guidance for rare plant surveys conducted in BC.

4.0 STUDY METHODS

Existing conditions for components of the terrestrial resources assessment were determined using a combination of literature review, desktop analysis of geospatial and regulatory databases, and field studies (Table 4-1).

Detailed study methods for the vegetation component are provided in **Appendix 4.2-L Draft Plant Communities and At-risk Plants Technical Data Report**. Detailed study methods for the wildlife component are provided in **Appendix 4.2-M Draft Wildlife Technical Data Report**.

Table 4-1 Assessments Conducted for Terrestrial Resources Components

Component	Assessment Methods and Techniques
Vegetation	
Plant communities	Existing conditions in the vegetation ZOI were initially assessed through a desktop review of existing literature and geospatial databases. The <i>Standard for Terrestrial Ecosystem Mapping in British Columbia</i> (RIC 1998c) guided the classification and delineation of vegetated and non-vegetated land cover types. The classification of mapped polygons was validated through field surveys.
Species of Conservation Concern	The presence and distribution of plant species of conservation concern that may occur in the vegetation ZOI were initially assessed through a desktop review of existing literature and geospatial databases. Field surveys of vegetated areas were conducted in accordance with the Alberta Native Plant Council guidelines (ANPC 2012). Known historical locations were surveyed intensively, while a cursory assessment was conducted to assess the potential for occurrence within the adjacent habitats. Additional streambank lupine (<i>Lupinus rivularis</i>) surveys were conducted by Micaele Florendo of Maddison Consultants Ltd., a consultant with species-specific expertise.
Wildlife	
Birds	The presence and distribution of bird species that may occur in the wildlife ZOI were initially assessed through a desktop review of existing literature and geospatial databases. Field surveys of vegetated areas were conducted to locate large stick nests, and structures were assessed for the presence of barn swallow nests. Nest activity was assessed through stand watches, in accordance with established inventory methods (RIC 2001). Waterbird presence and distribution were assessed through seasonal stand watches of the Fraser River, which were conducted in accordance with the survey methodology implemented by the Deltaport Third Birth Adaptive Management Strategy coastal waterbird survey program (Hemmera et al. 2009). Songbird field surveys were not conducted as songbird presence in the area is well documented and assumed. Incidental observations were documented during site visits.
Mammals	The presence and distribution of mammal species that may occur in the wildlife ZOI were assessed through a desktop review of existing literature and geospatial databases. Specifically, recent data collected as part of the SFPR, George Massey Tunnel, and Direct Transfer Coal Facility projects provided extensive information to inform presence and distribution of species for this Project. Additional information on species presence and habitat suitability was collected through incidental observations made while conducting surveys for other terrestrial resource components.

Component	Assessment Methods and Techniques
Amphibians and reptiles	<p>The presence and distribution of amphibian and reptile species that may occur in the wildlife ZOI were assessed through a desktop review of existing literature and geospatial databases. Specifically, recent data collected as part of the SFPR and Direct Transfer Coal Facility projects provided extensive information to inform presence and distribution. Additional information on species presence and habitat suitability was collected through incidental observations made while conducting surveys for other terrestrial resource components.</p>
Species of Conservation Concern	<p>The presence and distribution of wildlife species of conservation concern that may occur in the wildlife ZOI were initially assessed through a desktop review of existing literature and geospatial databases.</p> <p>Field surveys were conducted for great blue heron, Caspian tern (<i>Hydroprogne caspia</i>), and common nighthawk (<i>Chordeiles minor</i>), in accordance with established inventory methods (RIC 1998a, 1998b). Specifically, stick nest surveys were conducted for great blue heron, call-playback surveys were carried out for common nighthawk, and habitat assessments were completed for Caspian tern and common nighthawk nesting habitat.</p>

5.0 EXISTING CONDITIONS

The Project is situated in an area designated as Port Terminal (VFPA 2016) between the Fraser River and the SFPR, and is surrounded by other commercial and industrial uses and local residential neighbourhoods. The existing land use on the PDA is industrial; the PDA has been in operation as part of a marine terminal since the 1930s (SNC-Lavalin 2013). The lack of natural ecosystems within the PDA minimises its capacity to support wildlife populations not habituated to industrial activity. The Project study team investigated the vegetation ZOI and wildlife ZOI for environmental values through desktop review and field studies.

5.1 TRADITIONAL KNOWLEDGE

Historically, the lower Fraser River basin was used heavily by Aboriginal groups, as the fertile river valley supported a variety of vegetation and wildlife species valued for food, social, and ceremonial purposes. Traditional Knowledge information for the lower reaches of the Fraser River has been collected from a variety of public sources, including academic literature and other past and present project reviews, and is summarised in **Appendix 4.2-K Traditional Land Use Technical Data Report**. No specific information for plant species presence and distribution or wildlife and wildlife habitat has been provided directly by First Nations at the time of writing. The present lack of natural ecosystems at the Project site minimises its capacity to support significant populations of plant species or wildlife used for current and traditional purposes.

5.2 VEGETATION

5.2.1 *Plant Communities*

The Project is located within the Coastal Western Hemlock Eastern Very Dry Maritime (CWHxm1) biogeoclimatic zone, which is characterised by warm, dry summers and moist, mild winters with a long growing season (Green and Klinka 1994). Located in an industrialised section of the Fraser River, which has experienced high levels of commercial and industrial port activity since the 1930s, the site is relatively flat with low topographic relief, and surficial materials are predominantly composed of imported fill. The terrestrial habitat has been highly modified from its pre-development setting, and continues to be used for industrial purposes.

Due to the lack of natural ecosystems, vegetated polygons were described by dominant vegetation type rather than by ecosystem characteristics (**Table 5-1, Figure 2**). The vegetation ZOI is predominantly composed of disturbed habitat (97.7 percent (%)), which includes paved surfaces and railway tracks. Only a minor (2.3%) portion of the ZOI is vegetated, comprising treed and herbaceous habitat. Treed habitat is limited to the forested area adjacent to Elevator Road and Robson Road, and is primarily composed of mature black cottonwood (*Populus balsamifera*) (**Appendix A: Photo 1**). Polygons dominated by herbaceous habitat are predominantly composed of non-native and invasive species (Table 5-2). No at-risk plant communities or wetland habitats were documented in the vegetation ZOI.

**Terrestrial Ecosystem Mapping
within the Technical Study Area**

Legend

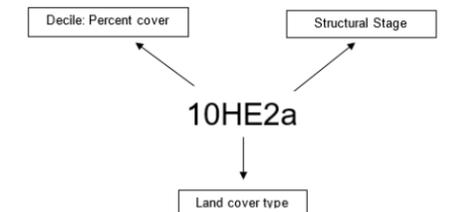
Project Development Area

Terrestrial Ecosystem Mapping Polygons

Polygon #	Name	Label
	1 Urban	10UR
	2 Rural Development	10RW
	3 Tree	10TR4B
	4 Herbaceous	10HE2a
	5 Railway Tracks	10RN

Structural Stage

2a – forb-dominated
4B – pole/sapling trees, deciduous

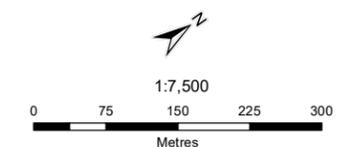


Notes

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2. All mapped features are approximate and should be used for discussion purposes only.

Sources

- PDA obtained from BHP Billiton Ref: 101051-03-G-SK-20 REV B.dwg
- Imagery provided by Cosmos - City of Surrey and ESRI Topo Imagery



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Table 5-1 Vegetated and Disturbed Habitat Land Cover Codes in Vegetation Zone of Influence

Code ¹	Name	Description	Area (ha)	Percent
Vegetated Habitat				
TR ²	Tree	Areas dominated by native and ornamental tree species	0.1	0.4
HE ²	Herbaceous	Sparsely vegetated areas dominated by native and non-native plant species	0.5	1.9
Disturbed Habitat				
RN	Railway tracks	A roadbed with fixed tracks	5.8	20.7
RW	Rural development	Areas where buildings are interspersed with vegetation	0.1	0.4
UR	Urban	Areas where hard surfaces represent an almost continuous cover on the landscape	22.0	76.7
Total			28.5³	100.0

Notes: ¹ Codes defined by Standard for Terrestrial Ecosystem Mapping in British Columbia (RIC 1998c)

² Unique code developed for this Project

³ Due to rounding error, the vegetation zone of influence area sums to slightly less than the study area (28.6 ha)

Table 5-2 Plant Species Present in the Vegetation Zone of Influence

Common Name	Latin Name	Status*
Trees		
Black cottonwood	<i>Populus balsamifera</i>	Native
Shrubs		
Himalayan blackberry	<i>Rubus armeniacus</i>	Invasive
Herbaceous		
Blueweed	<i>Echium vulgare</i>	Invasive
Canola	<i>Brassica</i> sp.	Non-native
Clover	<i>Trifolium</i> sp.	Non-native
Common horsetail	<i>Equisetum arvense</i>	Native
Common hound's-tongue	<i>Cynoglossum officinale</i>	Invasive
Common plantain	<i>Plantago major</i>	Invasive
Common St. John's-wort	<i>Hypericum perforatum</i>	Non-native
Common tansy	<i>Tanacetum vulgare</i>	Invasive
English ivy	<i>Hedera helix</i>	Invasive
Fireweed	<i>Epilobium angustifolium</i>	Native
Great mullein	<i>Verbascum Thapsus</i>	Invasive
Pearly everlasting	<i>Anaphalis margaritacea</i>	Native
Perennial sow-thistle	<i>Sonchus arvensis</i>	Invasive
Snowberry	<i>Symphoricarpos alba</i>	Native
Tansy ragwort	<i>Senecio jacobea</i>	Noxious
White sweet clover	<i>Melilotus alba</i>	Invasive

Notes: *Native - naturally occurring within their natural range and habitats

Invasive - occurring outside natural range and growing aggressively, potentially outcompeting native species

Noxious - identified by the provincial *Weed Control Act* as noxious

5.2.2 *Species of Conservation Concern*

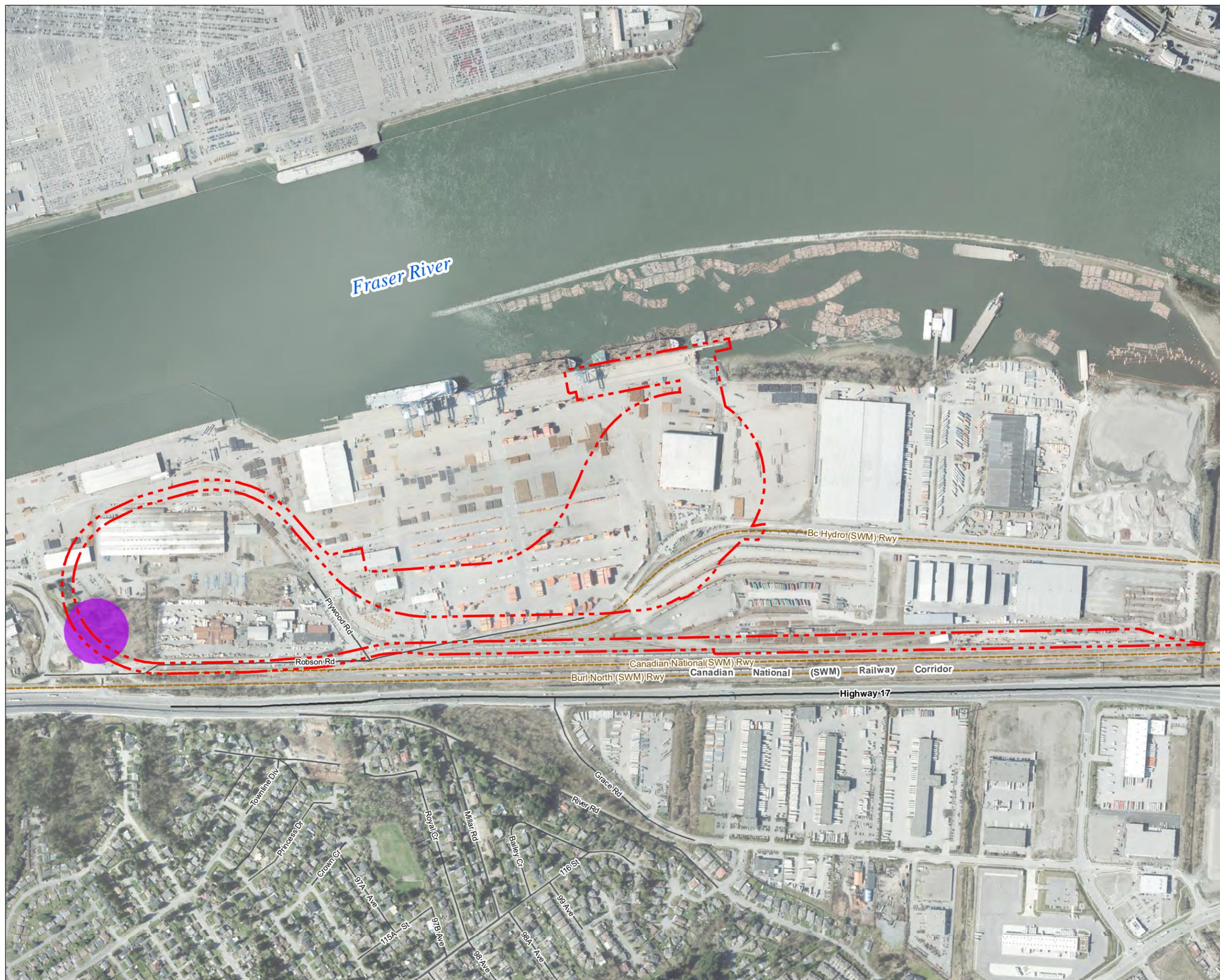
Streambank lupine (*Lupinus rivularis*), listed as endangered on Schedule 1 of SARA and provincially Red-listed (BC CDC 2017), is the only species of conservation concern with the potential to occur in the vegetation ZOI. Globally, streambank lupine is only found along the Pacific coast, from southwestern BC to northern California (COSEWIC 2002, SLRT 2014). In Canada, only one population is located outside of the Lower Mainland region, near Sooke on Vancouver Island (SLRT 2014). This species occurs at low elevations, growing in sandy or gravelly substrate with little ground cover (COSEWIC 2002). Habitat is usually prone to flooding and is frequently scoured and modified; as such, streambank lupine may use highly disturbed habitat for colonisation and to minimise competitive exclusion from other plants (SLRT 2014). Streambank lupine is commonly associated with railway rights of way, roadside edges, open industrial sites, and dykes, as they are frequently cleared of vegetation or subject to other disturbance (SLRT 2014).

Surveys conducted in 2001 for the Committee on the Status of Endangered Wildlife in Canada status report identified a natural population of streambank lupine in Delta (Population #3) and three subpopulations at FSD (Population #4) (COSEWIC 2002). Current extant populations of streambank lupine in the vicinity of the Project site are Population #2a (formerly Population #3) and Population #2b, while Population #2c (Population #4) has been extirpated by development and rail maintenance activities (COSEWIC 2002, SLRT 2014). Population #2b was assessed in 2008 (1 plant), 2009 (3 seedlings/juveniles), 2010 (13 seedlings/juveniles), and 2013 (1 seedling/juvenile) (SLRT 2014). Critical habitat for Population #2b has been designated within the vegetation ZOI as a result of these documented occurrences (**Figure 3**).

**Streambank Lupine (*Lupinus rivularis*)
Critical Habitat: Subpopulation 2b**

Legend

-  Project Development Area
-  Streambank Lupine Critical Habitat Area

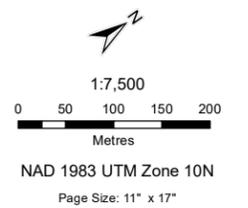


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2. All mapped features are approximate and should be used for discussion purposes only.

Sources

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- Streambank Lupine data provided by Government of Canada; Environment and Climate Change Canada Open Government Web site - <http://open.canada.ca/en>
- Imagery provided by Cosmos - City of Surrey



Additional streambank lupine surveys were conducted in the FSD site for the Direct Transfer Coal Facility in 2013 and BHP in 2017; however, no specimens were observed during these sampling efforts (SNC-Lavalin 2013, Maddison Consultants Ltd. 2017). Suitable substrate within the critical habitat identified for Population #2b is dominated by invasive and weedy herbaceous and shrubby vegetation, which has likely resulted in competitive exclusion of streambank lupine. The longevity of streambank lupine's 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.

At the time of writing, the proponent submitted a SARA permit application to Environment and Climate Change Canada (ECCC) to conduct work in designated critical habitat (**Appendix B**).

5.3 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 habitat availability, birds, mammals, amphibians and reptiles, and species of conservation concern that may occur in the study area. A list of species detected and possibly present in the wildlife ZOI are provided in **Appendix C**.

5.3.1 *Habitat Overview*

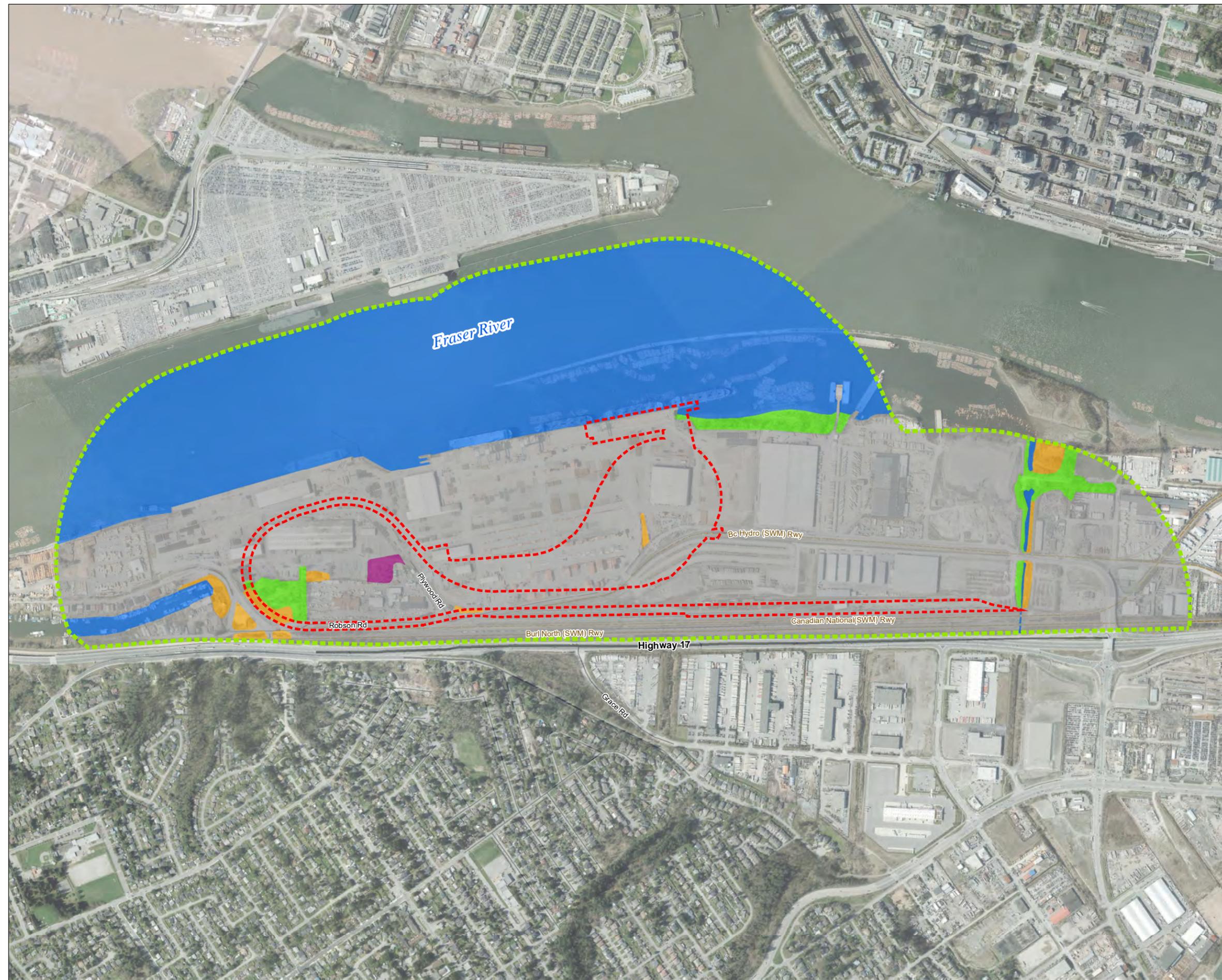
The lack of natural ecosystems within the PDA and the wildlife ZOI minimise ecosystem capacity to support wildlife populations. The wildlife ZOI is dominated by habitat classified as disturbed (59.2%) and aquatic (37.2%), with a minor component (3.6%) of natural vegetation (i.e., herbaceous, treed, and shrub habitat) (**Table 5-3, Figure 4**). Suitable wildlife habitat is primarily associated with the Fraser River foreshore, Gunderson Slough, Manson Canal, and treed and herbaceous habitat in the vicinity of Elevator Road and Robson Road. Common native species and non-native plants comprise the majority of the treed and herbaceous habitat potentially used by wildlife (**Appendix 4.2-L Draft Plant Communities and At-risk Plants Technical Data Report**).

Table 5-3 Summary of Habitat Types Present in the Wildlife Zone of Influence

Name	Description	Area (ha)	Percent
Vegetated Habitat			
Herbaceous	Sparsely vegetated areas dominated by native and non-native herbaceous plant species	3.5	1.2
Tree	Areas dominated by native and ornamental tree species	6.1	2.2
Shrub	Vegetated areas dominated by shrubs, usually Himalayan blackberry	0.6	0.2
Aquatic Habitat			
Aquatic*	Permanent water features (i.e., Fraser River, Gunderson Slough, and Manson Canal)	105.7	37.2
Disturbed Habitat			
Development	Areas where hard surfaces represent an almost continuous cover on the landscape, including railway tracks and rural and urban development	168.3	59.2
Total		284.2	100.0

Note: *Ditch habitat excluded from the areal calculations due to the relatively small areas involved. More detailed information pertaining to assessed watercourses can be found in **Section 4.2.12 Aquatic Assessment**.

**Wildlife Zone of Influence,
Project Development Area
and Habitat Types Present**



Legend

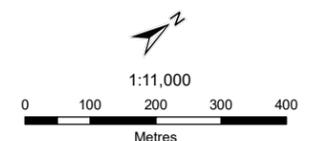
- Project Development Area
- Wildlife Zone of Influence
- Aquatic
- Development (Urban, Rural Development, and Railway Tracks)
- Herbaceous
- Shrub
- Tree

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.
2. All mapped features are approximate and should be used for discussion purposes only.

Sources

- PDA obtained from BHP Billiton Ref: 101051-03-G-SK-20 REV B.dwg
- Imagery provided by Cosmos - City of Surrey and ESRI Topo Imagery



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NAD 1983 UTM Zone 10N
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5.3.2 *Birds*

The wildlife ZOI is located in the easternmost extent of the Fraser River Estuary Important Bird Area (BC017) (BirdLife Canada 2013); however, the wildlife ZOI does not contain habitat that can support appreciable populations of wintering, migratory, or breeding raptors, songbirds, or waterbirds. The highly developed nature of the area is dominated by disturbed and aquatic habitat with a minor component of natural vegetation (e.g., trees, shrubs, and herbaceous plant communities). Suitable habitat is primarily associated with the Fraser River foreshore (**Appendix A: Photos 2 – 4**), Gunderson Slough, Manson Canal, and treed and herbaceous habitat in the vicinity of Elevator Road and Robson Road.

A desktop review indicated that 126 bird species could occur in the wildlife ZOI, based on known geographic ranges and habitat preferences (**Appendix C**). For most of these species, the wildlife ZOI is predominantly used for foraging and roosting and to a lesser extent for nesting (**Appendix 4.2-M Wildlife Technical Data Report**). Waterbirds may use the Fraser River, Gunderson Slough, Manson Canal, and intermittently wetted ditches in the vicinity of Elevator Road / Robson Road for feeding, while shorelines and pilings in the Fraser River provide suitable roosting and perching habitat. Raptors and songbirds may use vegetated areas for roosting, nesting, and foraging. The railway corridor provides additional foraging habitat, while structural buildings may be used to a lesser extent for roosting and nesting.

Thirty-one bird species were documented in the wildlife ZOI, incidentally and during seasonal waterfowl surveys (**Appendix 4.2-M Wildlife Technical Data Report**). In addition, evidence of nesting activity was documented for the following bird species:

- A potential bald eagle nest is located in a strip of black cottonwood trees approximately 100 m north of the PDA and Shed 6 (scheduled for demolition) (**Appendix A: Photos 5 - 6**). Although no nesting activity was observed during standwatches (June 2016 and May 2017), the presence of bald eagles within 250 m of the nest suggests that it may be used as an alternate site (U.S. Fish and Wildlife Service 2007).
- An active red-tailed hawk nest may be located in the wildlife ZOI, in the forested area adjacent to Elevator Road and Robson Road. This assumption is based on a pair of adults exhibiting agitated behaviour during vegetation surveys.
- A barn owl (*Tyto alba*) nest has been documented outside of the PDA in the wildlife ZOI; however, structures in the PDA do not provide suitable nesting habitat (C. Palmer, Hemmera, Personal Communication 2017).
- House sparrow (*Passer domesticus*), an exotic species not protected by provincial or federal regulation, was documented nesting in the PDA (Shed 5).

No other nests were detected within the wildlife ZOI. Double-crested cormorant, great blue heron, and barn swallow are species of conservation concern that were documented in the wildlife ZOI (**Section 5.3.5**).

5.3.3 *Mammals*

A desktop review indicated that 23 mammal species could occur in the wildlife ZOI, based on known geographic ranges (**Appendix C**). This list is dominated by introduced species or species habituated to urban environments, which may use both vegetated and disturbed habitat within the wildlife ZOI. Specifically, bat species may forage along the Fraser River, but there is little suitable habitat in the wildlife ZOI for nesting or roosting. Aquatic mammals such as American beaver (*Castor canadensis*) and North American river otter (*Lontra canadensis*) may use the Fraser River and associated waterbodies (i.e., Manson Canal and Gunderson Slough) for foraging and associated shoreline for resting. Small mammal species (e.g., rodents, insectivores, and squirrels) may use naturally vegetated habitat, rail rights of way, and structures in developed areas for foraging, breeding, and resting; however, a small mammal habitat assessment conducted in the vegetated habitat adjacent to Elevator Road and Robson Road concluded that the area provides nil to low-value habitat for pacific water shrew and nil value for southern red-back vole (*Myodes gapperi*) (RESL 2006). Large mammal species, such as coyote (*Canis latrans*) and yellow-bellied marmot (*Marmota flaviventris*), are more limited in habitat availability; they may use rail rights of way and naturally vegetated areas for foraging and resting.

The following five mammal species were incidentally documented in the wildlife ZOI (**Appendix 4.2-M Wildlife Technical Data Report**):

- Coyote scat was documented in the VFPA rail yard.
- Eastern cottontail (*Sylvilagus floridanus*) scat was documented in the vegetated area south of Elevator Road.
- Two North American river otter (*Lontra canadensis*) were observed in the Fraser River from Berth 6.
- Townsend's vole (*Microtus townsendii*) runways and scat were documented in the vegetated area south of Elevator Road (**Appendix A: Photo 7**).
- Five yellow-bellied marmot were observed in the VFPA rail yard.

In general, the wildlife ZOI contains low-quality habitat for mammal species. In addition, operation of the SFPR and ongoing industrial activity limit habitat availability, with the exception of highly mobile wildlife with a high tolerance for human activity (SNC-Lavalin 2013).

5.3.4 *Amphibians and Reptiles*

Amphibians are an important component of aquatic and terrestrial ecosystems, and the Lower Mainland region supports a diversity of amphibian species. Based on known geographic ranges and habitat preferences, native amphibian species that may occur in the wildlife ZOI are northern red-legged frog (*Rana aurora*) and northwestern salamander (*Ambystoma gracile*) (**Appendix C**). Invasive amphibians likely to occur in the wildlife ZOI are bull frog (*Lithobates catesbeianus*) and green frog (*Lithobates clamitans*).

Northwestern salamander and non-native ranid tadpoles (likely green frog) were captured in Robson Ditch during aquatic surveys (**Appendix 4.2-A Aquatic Technical Data Report**). These two species, along with bull frog, are tolerant of conditions in anthropogenic channels that often have little habitat complexity and poor water quality. They are commonly found in roadside ditches in the Lower Mainland. Suitable amphibian habitat in the wildlife ZOI is limited to Gunderson Slough and associated tributaries (i.e., Bekaert South Ditch, Bekaert North Ditch, Robson Ditch, Shadow Brook, and Unnamed Ditch), as well as Manson Canal and Canadian National Rail North Ditch (**Section 4.2.12 Aquatic Assessment**) (**Appendix A: Photo 8**). Amphibians will not likely be found in the Fraser River adjacent to the PDA due to lack of suitable habitat (CMN 2006).

Based on known geographic ranges and habitat preferences, reptile species that may occur in the wildlife ZOI are terrestrial gartersnake (*Thamnophis elegans*), northwestern gartersnake (*T. ordinoides*), and common gartersnake (*T. sirtalis*) (**Appendix C**). Specifically, riparian areas and vegetated terrestrial habitat may provide suitable habitat for the gartersnake species (Reptiles of BC 2015). Northwestern and common gartersnakes were observed during surveys conducted for SFPR (RESL 2006), and common gartersnake have been documented in the wildlife ZOI on the BC Frogwatch Atlas (MOE 2016).

5.3.5 Species of Conservation Concern

Species of conservation concern are defined as species being provincially Red- or Blue-listed or species designated as extirpated, endangered, threatened, or of special concern in Schedule 1 of SARA. Species of conservation concern with the potential to occur in the wildlife ZOI were determined upon a review of current habitat conditions, known occurrences from previous studies and inventories, and known habitat associations for each species of conservation concern (**Table 5-4**) (**Appendix 4.2-M Wildlife Technical Data Report**). Sixteen wildlife species of conservation concern may occur within the wildlife ZOI; the potential for occurrence for each species was ranked as low, moderate, or high. Species with low potential for occurrence are unlikely to occur within the wildlife ZOI with regularity or in adequate density to provide a functional population. A moderate potential for occurrence indicates that a species is expected to occur in the site on a temporary or regular (i.e., predictable) seasonal basis and in densities that facilitate persistence or a function population within the wildlife ZOI. Species with a high potential for occurrence are expected to occur in the site regularly and in densities indicative of a preferred habitat. Species with a moderate or high potential for occurrence in the wildlife ZOI are considered in the terrestrial resources assessment (**Section 6.0**).

Table 5-4 Summary of Wildlife Species of Conservation Concern likely to Occur in the Wildlife Zone of Influence and Potential for Occurrence

Species Common Name	Scientific Name	BC List ^a	SARA Schedule 1 ^b	Potential Occurrence ^c	Foraging / Breeding Habitat	Comments
Birds						
Barn owl	<i>Tyto alba</i>	Red	Special Concern	Moderate	Yes / Yes	Barn owl primarily forage in old fields but they also use grassy roadsides and rail corridors (COSEWIC 2010). They have been observed foraging along the corridor, and a barn owl nest has been documented in the wildlife ZOI; however, the structures in the PDA do not provide suitable nesting habitat (C. Palmer, Hemmera, Personal Communication 2017).
Peregrine falcon, <i>anatum</i> subspecies	<i>Falco peregrinus anatum</i>	Red	Threatened	Moderate	Yes / No	Peregrine falcon have been documented at New Westminster Quay (eBird 2016), approximately 500 m outside of the wildlife ZOI, and may hunt birds in the study area. Peregrine falcon traditionally nest on cliffs, but have also been found nesting on ledges of tall, multi-storey artificial structures and using corvid and raptor nests (White et al. 2002). However, there are no structures in the PDA that provide suitable nesting habitat.
Caspian tern	<i>Hydroprogne caspia</i>	Blue	-	Low	Yes / No	Caspian tern forage in aquatic habitat and nest in sparsely vegetated areas adjacent to water (including roofs) (Boyd 2015a). Although Caspian tern have been documented at New Westminster Quay (eBird 2016), approximately 500 m outside of the wildlife ZOI, no observations were made during species-specific standwatches (Appendix 4.2-M Wildlife Technical Data Report). In addition, the PDA does not provide suitable nesting habitat (Appendix 4.2- M Wildlife Technical Data Report).
Double-crested cormorant	<i>Phalacrocorax auritus</i>	Blue	-	Moderate	Yes / No	Double-crested cormorant is a migratory species that occurs in the wildlife ZOI; the Project site does not overlap with the species' known breeding range (Dorr et al. 2014). During waterfowl surveys, observations were made of double-crested cormorant feeding and loafing in the Fraser River (Appendix 4.2-M Wildlife Technical Data Report). They may use other aquatic features within the wildlife ZOI (e.g., Manson Canal and Gunderson Slough).

Species Common Name	Scientific Name	BC List ^a	SARA Schedule 1 ^b	Potential Occurrence ^c	Foraging / Breeding Habitat	Comments
Great blue heron, <i>fannini</i> subspecies	<i>Ardea herodias fannini</i>	Blue	Special Concern	Moderate	Yes / No	A wading waterbird that forages for small fish, insects, mammals, and amphibians in marshes and along the shoreline of waterbodies (COSEWIC 2008), great blue heron were documented along the Fraser River and in Gunderson Slough (Appendix 4.2-M Wildlife Technical Data Report), and may use other aquatic features within the wildlife ZOI for feeding and roosting. Great blue heron typically nest in colonies located in isolated locations that discourage predation and disturbance by humans (Vennesland and Butler 2011). They are unlikely to be found nesting in the wildlife ZOI due to the lack of natural forested habitat.
Green heron	<i>Butorides virescens</i>	Blue	-	Low	Yes / No	A small waterbird that is present in the Lower Mainland during the breeding season, green heron occur in various environments that provide secluded nest sites and wetland feeding habitat (Davis and Kushlan 1994). They prefer thick vegetation throughout their range, but will feed in the open when food is available (Davis and Kushlan 1994). Green heron nest in forest and swamp patches, usually nesting on or over water. A green heron was observed at Manson Canal (eBird 2016), but they have not been documented regularly in the wildlife ZOI, which provides low-quality foraging and nesting habitat for green heron.
Western grebe	<i>Aechmophorus occidentalis</i>	Red	-	Low	No / No	Western grebe prefer large bodies of fresh water bordered by emergent vegetation during the breeding season, and saltwater or brackish bays or estuaries during the winter (LaPorte et al. 2013). They occasionally occur on rivers and have been documented on the Fraser River (eBird 2016). However, the wildlife ZOI does not provide high-quality foraging or nesting habitat for this species.

Species Common Name	Scientific Name	BC List ^a	SARA Schedule 1 ^b	Potential Occurrence ^c	Foraging / Breeding Habitat	Comments
Barn swallow	<i>Hirundo rustica</i>	Blue		Moderate	Yes / Yes	Barn swallow is a migratory species that occurs in the wildlife ZOI during the summer. Barn swallow was observed foraging in the wildlife ZOI, but no nests were documented in the PDA (Appendix 4.2-M Wildlife Technical Data Report). Overall, the wildlife ZOI provides suitable foraging and nesting habitat for barn swallow, although nesting is not likely to occur on metal structures located in the PDA.
Black swift	<i>Cypseloides niger</i>	Blue	-	Low	Yes / No	A migratory species that has been documented at New Westminster Quay (eBird 2016), approximately 500 m outside of the wildlife ZOI, black swift is an aerial forager that will travel up to 40 kilometres (km) from nesting colonies to feed on blooms of aerial insects (Lowther and Collins 2002). They nest on ledges or shallow caves in steep rock faces and canyons, usually near or behind waterfalls (Lowther and Collins 2002). Although black swift may forage in the wildlife ZOI, this zone does not provide suitable nesting habitat.
Common nighthawk	<i>Chordeiles minor</i>	Yellow	Threatened	Low	Yes / Yes	Common nighthawk is a breeding migrant that occurs across most of BC (Boyd 2015b), arriving in the Lower Mainland region in late May and leaving by early September (Brigham et al. 2011, eBird 2016). Common nighthawk breeding habitat includes urban areas where individuals use flat gravel roofs for nesting (Savignac 2007). Observations have been made in the vicinity of the wildlife ZOI (eBird 2016); however, a habitat assessment suggests that there is no suitable nesting habitat in the PDA (Appendix 4.2-M Wildlife Technical Data Report).
Olive-sided flycatcher	<i>Contopus cooperi</i>	Blue	Threatened	Low	Yes / Yes	An aerial insectivore that breeds and feeds in areas of open habitat such as natural forest openings with perch sites (COSEWIC 2007), olive-sided flycatcher has been documented in Tannery Park (eBird 2016). Potential for nesting and foraging within forested areas of the wildlife ZOI.

Species Common Name	Scientific Name	BC List ^a	SARA Schedule 1 ^b	Potential Occurrence ^c	Foraging / Breeding Habitat	Comments
Purple martin	<i>Progne subis</i>	Blue	-	Low	Yes / No	A migratory species that has been documented at New Westminster Quay (eBird 2016), approximately 500 m outside of the wildlife ZOI, purple martin is an aerial insectivore that nests in natural or man-made cavities (Brown and Tarof 2013). Although purple martin may forage in the wildlife ZOI, it is unlikely to provide suitable nesting habitat without the installation of nest boxes.
Mammals						
Little brown myotis	<i>Myotis lucifugus</i>	Yellow	Endangered	Moderate	Yes / No	A relatively widespread bat species, little brown myotis has been added to Schedule 1 of SARA due to population decreases resulting from white-nose syndrome. This species uses buildings and other anthropogenic structures to roost, but will also use natural cavities and crevices (EC 2015). Little brown myotis feeds nocturnally on insects and spiders, and is often associated with open habitats (EC 2015). Although this species may forage in the wildlife ZOI, suitable nesting and roosting habitat is not present (C. Palmer, Hemmera, Personal Communication 2017).
Pacific water shrew	<i>Sorex bendirii</i>	Red	Endangered	Low	No / No	Pacific water shrew is a riparian habitat specialist, associated with wet forests, marshes, and occasionally ditches and sloughs (COSEWIC 2006). Habitat suitability assessments were conducted in 2003 and 2004 for SFPR, which determined that Bekaert North Ditch lacked suitable habitat and Manson Canal had low suitability for Pacific water shrew; however, no individuals were captured in Manson Canal during sampling. SNC-Lavalin, Triton Environmental Consultants Ltd. (Triton), and Levelton Consultants (Levelton) (2013) assessed the area in 2013 and concluded that the generally poor condition of riparian areas would limit their suitability for use by Pacific water shrew. Habitat conditions have not improved since these assessments were conducted; the wildlife ZOI is not considered to provide suitable feeding or breeding habitat for Pacific water shrew.

Species Common Name	Scientific Name	BC List ^a	SARA Schedule 1 ^b	Potential Occurrence ^c	Foraging / Breeding Habitat	Comments
Southern red-backed vole	<i>Myodes gapperi occidentalis</i>	Red	-	Low	No / No	Southern red-backed vole is a mature forest species that inhabits coniferous forests with abundant shrub and ground cover (BC CDC 2015). Habitat suitability assessments were conducted in 2003 and 2004 for SFPR, which determined that Bekaert North Ditch and Manson Canal lacked suitable habitat for southern red-backed vole. Habitat conditions have not improved since these assessments were conducted; the wildlife ZOI is not considered to provide suitable feeding or breeding habitat for southern red-backed vole.
Amphibians and Reptiles						
Northern red-legged frog	<i>Rana aurora</i>	Blue	Special Concern	Low	No / No	Habitat quality assessments conducted for SFPR and FSD both concluded that habitat in the wildlife ZOI is unsuitable for northern red-legged frog due to the lack of slow-flowing, shallow water with emergent vegetation for egg-laying in upland watercourses (Hemmera et al. 2009, SNC-Lavalin, Triton, and (Levelton 2013). No observations of northern red-legged frog documented on BC Frogwatch Atlas (MOE 2016) or during aquatic surveys conducted for BHP (Section 4.2.12 Aquatic Assessment).

Notes: ^a **Red:** any species that is at risk of being lost (i.e., extirpated, endangered, or threatened). Extirpated taxa no longer exist in the wild in BC, but do occur elsewhere. Endangered taxa are facing imminent extirpation or extinction. Threatened taxa are likely to become endangered if limiting factors are not reversed. **Blue:** any species of that is of special concern. Taxa of special concern have characteristics that make them particularly sensitive or vulnerable to human activities or natural events. **Yellow:** any species that is at the least risk of being lost. Yellow-listed species may have red- or blue-listed subspecies.

^b **Endangered:** a species facing imminent extirpation or extinction. **Threatened:** a species that is likely to become endangered if limiting factors are not reversed. **Special Concern:** a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.

^c **High:** current understanding of the species' range and habitat associations suggests that the species is expected to occur in the site regularly and in densities indicative of a preferred habitat. **Moderate:** 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. **Low:** current understanding of the species' range and habitat associations suggests that the species is unlikely to occur within the site with regularity or in adequate density to provide a functional population.

6.0 TERRESTRIAL RESOURCES ASSESSMENT

6.1 PROJECT INTERACTIONS

Physical works, including activities required for construction and operation of Project components (**Section 2.2, Section 2.3**) may interact with environmental components. The following criteria have been used to indicate the degree of the effect from the interaction between the environmental component and each activity (prior to the implementation of mitigation measures):

- 0 indicates no or negligible² interaction is likely.
- 1 indicates minor interaction, i.e., an adverse effect may result from an interaction; however, the potential for interaction is considered minor due to spatial or temporal separation between the proposed activity and the component.
- 2 indicates significant interactions that may result in an adverse effect.

A complete interactions matrix is provided in **Appendix D**. Detailed descriptions of the identified interactions (i.e., interactions classified as 1 or 2) and measures to mitigate potential adverse effects are provided in **Table 6-1** for the vegetation component and **Table 6-2** for the wildlife component. Project activities with no or negligible interaction are not discussed further.

² Negligible potential interactions are those that result in effects before mitigation that are so small that they are not detectable or measurable, and will not likely influence the short-term or long-term viability of the component.

Table 6-1 Summary of Potential Effects and Mitigation for the Vegetation Component

Component	Potential Effect	Mitigation	Residual Effect
Construction			
Plant communities	Loss of native plant communities as a result of vegetation removal and construction of the terminal rail loop.	Clearing will be staged and minimised to the extent practical, and ground disturbance will be avoided where possible. Clearing limits will be surveyed and clearly demarcated (e.g., flagged) in the field prior to undertaking any clearing work to minimise the amount of vegetation removal. Disturbed and temporarily cleared areas not required for operation will be revegetated with a mix of regionally suitable, non-invasive seed mixtures and plants as soon as growing conditions permit.	Permanent loss of up to 0.5 ha (1.9%) of low quality herbaceous habitat and 0.1 ha (0.4%) of treed habitat in the PDA.
	Introduction of invasive species.	BHP will develop and implement a Vegetation Management Plan (see Appendix E for an outline of this plan) as part of the Construction Environmental Management Plan (CEMP) to protect native vegetation and ecosystems from the introduction / spread of noxious plant species. Measures to manage noxious plant species will be developed with consideration for the <i>Weed Control Act</i> . Additional guidance provided by the Invasive Species Council of BC and the Invasive Species Council of Metro Vancouver will be considered.	No residual effects are anticipated following implementation of mitigation measures.
Species of conservation concern	Loss of at-risk plant species as a result of vegetation removal and construction of terminal rail loop. Streambank lupine is the only at-risk plant species likely to occur in the PDA.	BHP is one of three project proponents seeking approval from ECCC for the development of a shared rail loop. Following consultation with ECCC and associated landowners, BHP (and the other proponents) have submitted a SARA permit application for approval to use designated streambank lupine critical habitat (Population #2b). The application will address the effects associated with the construction of the terminal rail loop. Consistent with the <i>Recovery Plan for Streambank Lupine (Lupinus rivularis) in British Columbia</i> (SLRT 2014) BHP will implement the following measures prior to and during construction: <ul style="list-style-type: none"> • Reducing the number of railway tracks to the minimum possible for achieving Project objectives. • Flag and stake the construction zone in the streambank lupine critical habitat area to prevent accidental encroachment outside the construction zone. 	The 2017 surveys conducted for BHP and for the SARA permit application found no individual streambank lupine plants in the critical habitat area (Population #2b); therefore, Project-related rail construction will not likely have direct effects on the current population. Mitigation measures will also mitigate potential impacts to streambank lupine germination at critical habitat area 2b.

Component	Potential Effect	Mitigation	Residual Effect
		<ul style="list-style-type: none"> • Limiting effects at Critical Habitat area 2b by designing the railway lines as close as possible while maintaining railway safety and design standard requirements. • Avoiding the portion of Critical Habitat area 2b that is most-suitable for streambank lupine (the moderately open area in the north of the critical habitat circle). • Informing 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. • Avoiding storing 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 area 2b quality. • Removing vegetation (trees and ground cover) in a manner to avoid the mixing of soils. • Retaining and separating top soils from the 0 to -3 cm and -3 to -6 cm layers excavated from the site for ex-situ use as a seedbank for streambank lupine enhancement. 	
Operation			
Plant communities	Introduction of invasive species.	BHP will develop and implement a Vegetation Management Plan (see Appendix E for an outline of this plan) as part of the CEMP to protect native vegetation and ecosystems from the introduction / spread of noxious plant species. Measures to manage noxious plant species will be developed in accordance with the <i>Weed Control Act</i> . Additional guidance provided by the Invasive Species Council of BC and the Invasive Species Council of Metro Vancouver will be considered.	No residual effects are anticipated following implementation of mitigation measures.

Component	Potential Effect	Mitigation	Residual Effect
<p>Species of conservation concern</p>	<p>Disturbance to at-risk plant species critical habitat area (i.e., streambank lupine) as a result of rail rights of way maintenance.</p>	<p>Consistent with the <i>Recovery Plan for Streambank Lupine (Lupinus rivularis) in British Columbia</i> (SLRT 2014), BHP will implement the following measures during Project operation, where feasible:</p> <ul style="list-style-type: none"> • Avoiding the use of chemical herbicides for vegetation control because it affects streambank lupine either directly or indirectly through wind drift. • Undertaking any maintenance activities on the railway in Critical Habitat area 2b post-growing season and seed set (typically July), such that vegetation management maintains the suitability of critical habitat. • Remove invasive and weedy species with potential to affect streambank lupine. <p>Develop and implement an annual post-construction monitoring plan for streambank lupine critical habitat. The monitoring plan will be undertaken annually in late spring for a minimum of two years to determine population trends and monitor the effects of invasive species and vegetation succession. The monitoring plan will include:</p> <ul style="list-style-type: none"> • Purpose and scope • Methods • Results (distribution, relative age, vigour) • Recommended mitigation. 	<p>No residual effects are anticipated following implementation of mitigation measures.</p>

Table 6-2 Summary of Potential Effects and Mitigation for the Wildlife Component

Component	Potential Effect	Mitigation	Residual Effect
Construction			
Birds	Habitat loss as a result of vegetation clearing and construction of terminal rail loop.	<p>Clearing will be staged and minimised to the extent practical, and ground disturbance will be avoided where possible. Clearing limits will be surveyed and clearly demarcated (e.g., flagged) in the field prior to undertaking any clearing work.</p> <p>Disturbed and temporarily cleared areas not required for operation will be revegetated with a mix of regionally suitable, non-invasive seed mixtures and plants as soon as growing conditions permit.</p>	Permanent loss of up to 0.5 ha (14.3%) of low quality herbaceous habitat and 0.1 ha (1.6%) of treed habitat in the wildlife ZOI.
	Mortality as a result of vegetation clearing and demolition of existing infrastructure.	<p>To the extent practical, vegetation removal will be scheduled to occur during the following least risk work windows to avoid contravention of the <i>Wildlife Act</i> and SARA:</p> <ul style="list-style-type: none"> • September 1 to February 15 for raptors (Bird Studies Canada 2017, Davidson et al. 2015) • September 15 to March 15 for songbirds (Bird Studies Canada 2017, Davidson et al. 2015) • August 15 to February 28 for waterbirds (Bird Studies Canada 2017, Davidson et al. 2015). <p>If vegetation removal / building demolition must occur during the nesting window, pre-clearing nest surveys will be conducted by a qualified environmental professional (QEP). The surveys will be conducted in accordance with the guidance provided by the <i>Active Migratory Bird Nest Surveys</i> (CWS 2010) and the <i>Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia (2013)</i> (MOE 2013). This includes ensuring that no active nests will be affected within 100 m of the working area for raptors, 50 m for songbirds, and 60 m for waterbirds. If an active nest is located, the QEP will propose appropriate mitigation measures (e.g., nest buffers).</p> <p>The <i>Wildlife Act</i> protects the nests of bald eagle, peregrine falcon, osprey, and great blue heron year-round, whether active or not. A pre-clearing nest survey will be conducted by a QEP to confirm that these identified species do not have a nest in areas designated for vegetation removal.</p>	No residual effects are anticipated following implementation of mitigation measures.

Component	Potential Effect	Mitigation	Residual Effect
	Sensory disturbance during various Project activities.	<p>A QEP will monitor active nests prior to construction to establish nest status. During construction, monitoring will be conducted to determine if Project activities are causing substantial disturbance. The QEP will propose appropriate mitigation to reduce sensory effect on nesting birds.</p> <p>BHP will develop a Noise Management Plan to describe existing noise conditions at FSD and propose mitigation measures to minimise additional noise during construction and operation.</p> <p>Potential for lighting effects to wildlife were reviewed. Research is limited with respect to two key factors: dosage (amount of light) and duration (how long lighting is on for) as it relates to impacts on a given species. Effects of lighting on wildlife are not well known for these two factors. However, based on the additional lighting proposed for the site, the dosage on the shoreline and Fraser River would be very low and therefore is considered insignificant.</p>	No residual effects are anticipated following implementation of mitigation measures.
Mammals	Habitat loss / alteration as a result of vegetation clearing, building demolition, and rail loop construction.	Clearing will be staged and minimised to the extent practical, and ground disturbance will be avoided where possible. Clearing limits will be surveyed and clearly demarcated (e.g., flagged) in the field prior to undertaking any clearing work.	Permanent loss of up to 0.5 ha (14.3%) of low quality herbaceous habitat and 0.1 ha (1.6%) of treed habitat in the wildlife ZOI.
	Mortality as a result of building demolition, vegetation clearing, excavation, and equipment operation.	<p>If steep-walled excavations occur on site, they will be inspected to protect against wildlife entrapment. If wildlife is in the excavation and cannot escape unimpeded, a QEP will implement measures to confirm the safe removal of wildlife. This will prevent contravention of the <i>Wildlife Act</i>.</p> <p>If mammal presence is observed during building demolition, the QEP will be immediately notified, and will propose appropriate mitigation measures to confirm the safe removal of wildlife. This will prevent contravention of the <i>Wildlife Act</i>.</p> <p>Work areas will be kept clear of wildlife attractants (e.g., garbage).</p>	No residual effects are anticipated following implementation of mitigation measures.
	Sensory disturbance during various Project activities.	<p>BHP will develop a Noise Management Plan as part of the CEMP to describe existing noise conditions at FSD and propose mitigation measures to offset additional noise during Project construction.</p> <p>BHP will develop a Marine Mammal Management Plan as part of the CEMP to minimise underwater noise resulting from Project-related construction activities. This will minimise effects to American beaver, American mink, and North American river otter. Additional details are provided in Section 4.2.12 Aquatic Resources Assessment.</p>	No residual effects are anticipated following implementation of mitigation measures.

Component	Potential Effect	Mitigation	Residual Effect
Amphibians and reptiles	Habitat loss as a result of vegetation clearing and construction of the terminal rail loop.	<p>Clearing will be minimised to the extent practical, and ground disturbance will be avoided where possible. Clearing limits will be surveyed and clearly demarcated (e.g., flagged) in the field prior to undertaking any clearing work.</p> <p>Disturbed and temporarily cleared areas not required for operation will be revegetated with a mix of regionally suitable, non-invasive seed mixtures and plants as soon as growing conditions permit.</p>	Permanent loss of Unnamed Ditch (approximately 150 square metres (m ²) instream habitat) and Bekaert South Ditch (approximately 450 m ² instream habitat), and part of Robson Ditch (approximately 350 m ² instream habitat) (Section 4.2-A Aquatic Resources Assessment).
	Habitat degradation (i.e., reduced water quality) as a result of increased erosion and sedimentation resulting from various construction activities.	Mitigation measures provided for aquatic species in Section 4.2.12 Aquatic Resources Assessment will mitigate potential effects to amphibian habitat.	No residual effects are anticipated following implementation of mitigation measures.
	Mortality as a result of vegetation clearing and construction of the terminal rail loop.	<p>Prior to culverting Robson Ditch, Unnamed Ditch, and Bekaert South Ditch, amphibian salvages will be conducted by a QEP in accordance with the <i>Best Management Practices for Amphibian and Reptile Salvages in British Columbia</i> (MFLNRO 2016) to demonstrate compliance with SARA and the <i>Wildlife Act</i>. Northwestern salamander can be aquatic year-round in permanent waterbodies and will require salvage during all seasons.</p> <p>If feasible, ditch culverting will be scheduled when ditches are driest and water in ditches will be pumped to an approved vegetated area for infiltration prior to culverting.</p> <p>During drawdown, a QEP will be on site to salvage native amphibians. Due to the anticipated conditions, salvage methods will primarily focus on traps and visual observations during dewatering.</p>	No residual effects are anticipated following implementation of mitigation measures.

Component	Potential Effect	Mitigation	Residual Effect
Species of conservation concern (Section 5.3.5)	Habitat loss as a result of vegetation clearing and building demolition.	Potential Project-related effects were considered for at-risk species with a moderate or high probability of occurrence in the wildlife ZOI. Mitigation measures outlined above encompass wildlife species of conservation concern, specifically: Raptor mitigation measures also pertain to barn owl. Waterbird mitigation measures also pertain to double-crested cormorant and great blue heron. Songbird mitigation measures also pertain to barn swallow. Mammal mitigation measures also pertain to little brown myotis (<i>Myotis lucifugus</i>).	Residual effects outlined above for birds and mammals apply to species of conservation concern.
	Mortality as a result of vegetation clearing and building demolition.		
	Sensory disturbance during various Project activities.		
Operation			
Birds, mammals, and species of conservation concern	Mortality as a result of increased rail traffic.	All rail movement within FSD and adjacent VFPA Rail Yard will be restricted to 16 kilometres per hour (km/hr) or less.	No residual effects are anticipated following implementation of mitigation measures.
	Sensory disturbance including train and vessel traffic and unloading operations.	BHP will work with rail service providers to restrict rail movement within FSD and adjacent VFPA Rail Yard to 16 km/hr or less. The conveyor system connecting the railcar unloading system with the potash storage building and the shiploader will be covered, which will limit the travel of noise. BHP will develop a Noise Management Plan as part of the Operations Environmental Management Plan to describe existing noise conditions at FSD and propose mitigation measures to offset additional noise during Project operation.	
Amphibians and reptiles	Habitat degradation resulting from a reduction in stormwater quality.	Mitigation measures provided for aquatic species in Section 4.2.12 Aquatic Resources Assessment will mitigate potential effects to amphibian habitat.	No residual effects are anticipated following implementation of mitigation measures.

7.0 SUMMARY AND CONCLUSION

A summary of potential Project-related effects, proposed mitigation measures, and any associated residual effects is provided in Section 6.1.

Based on the site layout (Figure 1), the PDA contains 0.6 ha of vegetated land cover. Specifically, 0.5 ha of herbaceous habitat and 0.1 ha of treed habitat will be removed to accommodate Project activities; this corresponds to a loss of 5.9% of vegetated habitat in the wildlife ZOI, which has 10.2 ha of vegetated land cover (i.e., 3.5 ha of herbaceous habitat, 0.6 ha of shrub habitat, and 6.1 ha of treed habitat).

Plant communities in the PDA consist of small, isolated islands of habitat that have been substantially disturbed by previous development. Vegetation primarily comprises common weedy and non-native plant species, which are surrounded by an industrial landscape. The loss of habitat is limited to areas that are of marginal value to wildlife, including species of conservation concern. Although the loss of plant communities is permanent, the residual effect to birds and mammals will likely be insignificant due to the low quality of habitat present.

The Project overlaps with designated streambank lupine critical habitat for Population #2b; however, no streambank lupine specimens have been observed since 2013 (Section 5.2.2). While streambank lupine does survive in non-natural habitats (e.g., railway line verges) it only does so where growing conditions are suitable. The conditions required for the survival of streambank lupine at Critical Habitat 2b are absent. Despite the assumed presence of a seedbank, the lack of disturbance and mobile substrates and shading and competition from other plants act in concert to prevent germination (establishment) and then growth. Project-related rail construction will therefore not likely have direct effects on the current population because neither individuals nor viable habitat will be affected.

The value of Critical Habitat area 2b for streambank lupine survival and recovery lies in the seedbank that is assumed to be present. Mitigation in association with the Project has been designed to maintain, salvage, and use the seedbank at Population #2b for use in the survival and recovery of Population #2 at the only location of extant plants (i.e., Population #2a at Alaska Way). BHP and other FSD business stakeholders will work with FSD and an environmental consultant to prepare an application to ECCC for permitting the use of SARA-designated critical habitat for streambank lupine (Population #2b). This application is intended to address the effects of railway development from proposed projects currently in the VFPA PER process on FSD lands. The implementation of mitigation measures consistent with the streambank lupine recovery plan will offset residual effects.

Construction of the terminal rail loop requires culverting Robson Ditch, Unnamed Ditch, and Bekaert South Ditch, and will involve the permanent loss of up to 0.04 ha, 0.02 ha, and 0.07 ha of non fish-bearing aquatic habitat, respectively. Sampling indicated the presence of northwestern salamander and non-native ranid species in Robson Ditch, while no amphibians were captured in the Bekaert South Ditch. Unnamed Ditch is seasonally wetted depression that does not provide suitable habitat for native amphibians. The generally poor condition of the riparian areas limits habitat suitability for northern red-legged frog and is considered

poor quality for the species. The loss of aquatic habitat is limited to ditches that provide marginal value to amphibians. The residual effects will not likely be significant with the implementation of mitigation measures.

In summary, the Project has the potential to disturb vegetation and wildlife as a result of building demolition, vegetation clearing, and construction activities; however, the application of appropriate mitigation measures and adherence to best management practices will offset residual effects. Habitat loss is limited to low-quality vegetated areas that are dominated by invasive and weedy species. The Project is unlikely to cause significant adverse residual effects to vegetation or wildlife.

8.0 CLOSING

This work was performed in accordance with Contract 8500085638 between Hemmera Envirochem Inc. (Hemmera) and BHP Billiton Canada Inc. (BHP), dated September 11, 2015. This report has been prepared by Hemmera, based on fieldwork and desktop work conducted by Hemmera, for the sole benefit and use by BHP. 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.

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

Report prepared by:

Hemmera Envirochem Inc.



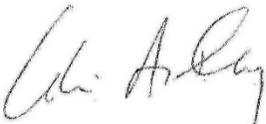
Vanessa Sadler, R.P.Bio.
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APPENDIX A
Photographs



Photo 1: Green space west of Robson Road and north of Elevator Road.



Photo 2: Looking west from Berth 9. Waterbirds present on Fraser River.



Photo 3: Looking south from Berth 6, with gulls and cormorants perching on the rip rap and pilings.



Photo 4: The east shore of the Fraser River, looking south from Berth 2.



Photo 5: Potential bald eagle nest located in cottonwood trees north of project development area.



Photo 6: East bank of Fraser River, looking north from Berth 9. Potential bald eagle nest evident in cottonwood trees.



Photo 7: Evidence of small mammal activity (i.e., burrows and runways), possibly Townsend's vole, in Elevator Road roundabout.



Photo 8: Shadow Brook, located in Elevator Road roundabout, characterized by sandy substrate and steep banks.

APPENDIX B

Streambank Lupine Critical Habitat Area 2b *Species at Risk Act* §73 Permit Application

Streambank Lupine Critical Habitat Area 2b

Species at Risk Act §73 Permit Application

Prepared for:

Fraser Surrey Docks

11060 Elevator Road
Surrey, BC V3V 2R7

BHP Billiton Canada, Inc.

130 3rd Avenue South
Saskatoon, SK S7K 1L3

Fraser Grain Terminal Ltd.

355 Burrard St, Suite 640
Vancouver, BC V6C 2G8

Prepared by:

Hemmera Envirochem Inc.

18th Floor, 4730 Kingsway
Burnaby, BC V5H 0C6

File: 1614-006.01
August 2017



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August 30, 2017
File: 1614-006.01

Fraser Surrey Docks
11060 Elevator Road
Surrey, BC V3V 2R7

BHP Billiton Canada, Inc.
130 3rd Avenue South
Saskatoon, SK S7K1L3

Fraser Grain Terminal Ltd.
355 Burrard St, Suite 640
Vancouver, BC V6C2G8

Attn: Jurgen Franke, Roger Tremblay, Valerie Bond, Casey McCawley, and Tanya Hayes

Dear Jurgen, Roger, Valerie, Casey, and Tanya,

Re: Streambank Lupine Species at Risk Act Section 73 Permit Application

Hemmera Envirochem Inc. is pleased to provide you with a copy of the final application.

The application, without this letter, will be sent to Environment and Climate Change Canada on 30 August 2017.

Please feel free to contact the undersigned by phone or email regarding any questions or further information that you may require.

Regards,
Hemmera Envirochem Inc.

A handwritten signature in black ink, appearing to read "Charlie Palmer".

Charlie Palmer, M.Sc., P.Biol, R.P.Bio
Practice Leader (EIA)
604.669.0424 (125)
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A handwritten signature in blue ink, appearing to read "Darrell Desjardin".

Darrell Desjardin, B.Comm., B.Sc.
Project Director
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EXECUTIVE SUMMARY

This application under §73 of the *Species at Risk Act* (SARA) seeks authorisation from Environment and Climate Change Canada (ECCC) for alteration to designated streambank lupine (*Lupinus rivularis*) critical habitat. The proponents of the Project are Fraser Surrey Docks (FSD), Fraser Grain Terminal (FGT), and BHP Billiton Canada, Inc. (BHP). The proponents' collective projects propose the construction of a terminal rail loop through designated streambank lupine Critical Habitat area 2b (Surrey-Elevator Road) on FSD-leased land at Elevator Road.

The terminal rail loop is anticipated to consist of six railway lines and will connect the main terminal and marine berths to the Port Authority Rail Yard, the Canadian National Railway mainline rail, and the Burlington Northern and Santa Fe Railway mainline rail. The number of railway tracks accommodate the daily, weekly and ultimately the annual volume of product to be exported or imported through the marine terminal. The terminal rail loop was designed to best use the limited space available at the FSD site and was selected as the preferred layout from six alternatives.

The 2017 surveys conducted for this permit application found no streambank lupine plants in Critical Habitat area 2b. Therefore, construction of the terminal rail loop will not have direct effects on the current population. There may, however, be a reservoir of seeds in the substrate at Critical Habitat area 2b (i.e., seed bank) and there may be Project-related effects on the seed bank.

The Critical Habitat area 2b has value for the survival and recovery of the species because soils at this location (likely imported) are a reservoir of seeds / seed bank. Hence, mitigation for the proposed Project centers on the provision of measures to (i) maintain and salvage the seed propagules of streambank lupine at the site, and (ii) use the salvaged seed resource to augment the unaffected portions of the population where there are appropriate conditions for streambank lupine, and where there are individuals in the extant Critical Habitat area 2a at Alaska Way. Evidence of the efficacy of these mitigation measures has been presented, from the literature, and from examples of the positive responses of streambank lupine to deliberate conservation efforts or incidental actions.

Taking into account the proposed mitigation, the alteration to streambank lupine critical habitat in area 2b during Project construction is not expected to affect the population, or the survival and recovery of the species as a whole. Key in reaching this conclusion is the absence of a viable population and habitat at the affected area (Critical Habitat area 2b), and the positive outcomes from management proposed at Critical Habitat area 2a. Further, the need for active management including augmentation of seed supply in the nearby population at Critical Habitat area 2a will increase the knowledge of streambank lupine, and the measures required to maintain populations, which at this time is lacking.

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1.0 INTRODUCTION

This application under §73 of the *Species at Risk Act* (SARA) seeks authorisation from Environment and Climate Change Canada (ECCC) for alteration to designated streambank lupine (*Lupinus rivularis*) critical habitat. This alteration of streambank lupine habitat would occur as a result of the construction of a terminal rail loop (the Project). As the proposed Project is on federal land, there is also a requirement for the federal authority to ensure there are no significant adverse effects associated with its implementation, as per §67 of the *Canadian Environmental Assessment Act 2012* (CEAA 2012). The authority for CEAA 2012 is the Vancouver Fraser Port Authority (VFPA), and they manage this authorisation through their Project and Environmental Review (PER) process. This application also supports VFPA PER processes.

A SARA permit may only be issued if the competent minister is of the opinion that all three preconditions are met:

- (a) all reasonable alternatives to the activity that would reduce the impact on the species have been considered and the best solution has been adopted
- (b) all feasible measures will be taken to minimize the impact of the activity on the species or its critical habitat or the residences of its individuals
- (c) the activity will not jeopardize the survival or recovery of the species

This application addresses these three preconditions, and presents supporting science-based information.

A recovery strategy to “arrest the or reverse the decline of the species” has been produced (ECCC 2017). It adopts the population and distribution goal set out in Part 2 (the Province of BC Recovery Plan):

“to maintain the abundance of all known extant populations as well as any other extant populations that may be identified or established at a later date within the species’ known and potential range.”

Streambank lupine populations are defined in the SARA Recovery Strategy, and of key relevance to this Project, Population #2 consists of two sub-populations (Sub-population 2a at Alaska Way, and Sub-population 2b at Elevator Road).

2.0 PROJECT INFORMATION

The proponents of the Project are Fraser Surrey Docks (FSD), Fraser Grain Terminal (FGT), and BHP Billiton Canada, Inc. (BHP). The proponents' collective projects propose the construction of a terminal rail loop for their developments through designated critical habitat for streambank lupine Sub-population 2b (Surrey-Elevator Road) on FSD-leased land at Elevator Road (**Figure 1**). A completed SARA permit application form is provided in **Appendix A**.

The construction of the terminal rail loop would alter approximately 7,730 m² of the 11,950 m² Critical Habitat area 2b (all of Area B in **Table 1** and **Figure 2**). The terminal rail loop project requires flexibility to accommodate dependencies between individual developments. The location and number of individual railway lines may vary relative to the completion dates for each development. As such a permit to alter the entire area (~7,730 m² in Figure 2) is being sought.

The geographic coordinates of the center of the critical habitat is approximately 506243 m E, 5447305 m N UTM10N NAD83.

Table 1 Streambank lupine Critical Habitat area 2b statistics

Description of Area within Critical Habitat area 2b	Approximate Area (m ²)	Current Number of Individuals (Peak Historic Population)
Altered by terminal rail loop construction (Fig 2, Area B)	7,730	0 (13 seedlings, in 2010)
Undisturbed (Fig2, Area C)	4,200	0 (0)
Total area of Critical Habitat area 2b (Fig 2, Area B+C)	11,930	0 (13 seedlings, in 2010)
Does not meet Recovery Strategy requisites (i.e., paved road) (Fig 2, Area A)	1,305	0 (0)
Total area of Critical Habitat area 2b (Fig 2, Area A+B+C)	13,325	0 (13 seedlings, in 2010)

Under §73(2) of the SARA, permits may only be issued if the proposed activity meets one of the following categories:

- a) Is scientific research relating to the conservation of the species,
- b) Benefits the species, or
- c) Affecting the species is incidental to the carrying out of the activity.

This Project fall into a category (c) activity, as affecting the lupine critical habitat area is incidental to carrying out the Project (i.e., constructing the railway line loop track).

Provided a permit from ECCC is granted, and pending VFPA approval, construction of the terminal rail loop would begin in phases, with the first phase to be constructed in mid-2018.

**The Project and Streambank Lupine
Critical Habitat (Population 2b)
at Fraser Surrey Docks**

Legend

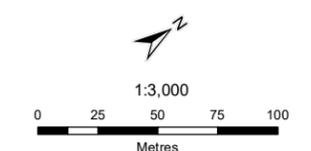
-  Lease Boundary
-  Project Infrastructures
- Proposed Rail Infrastructure Centrelines**
-  FSD Direct Transfer Coal Project
-  Fraser Grain Terminal Project
-  BHP Project
-  New FSD Office Location
-  Streambank Lupine Critical Habitat Area

Notes

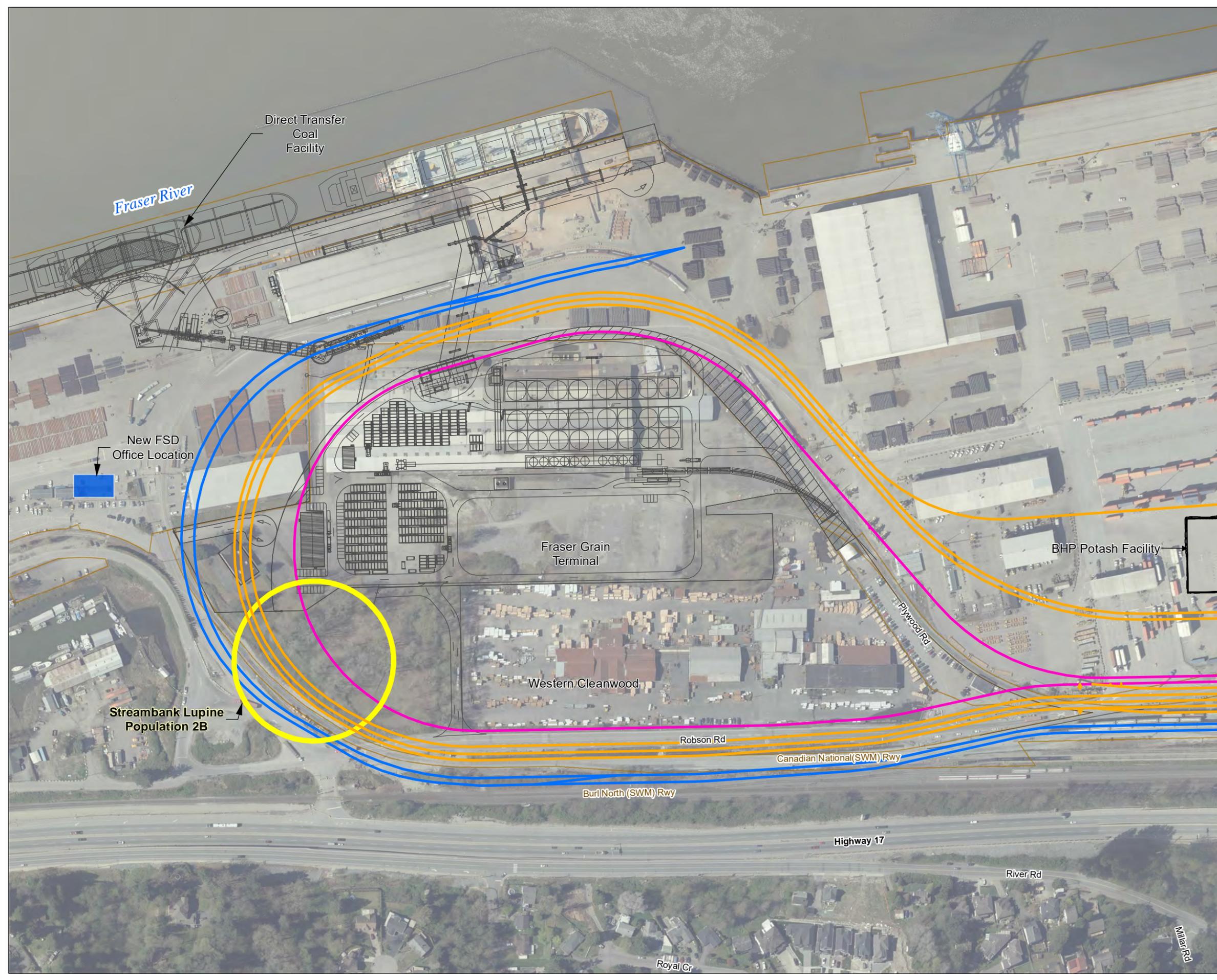
1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. All mapped features are approximate and should be used for discussion purposes only.

Sources

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- Rail infrastructure and layout: Mott McDonald (Ref: CAD 382235-MMD-00-PO-DR-RW-1000 (UTM).dwg).
- BHP Rail Infrastructure: Mott McDonald (Ref: BHP_Rails_40600_LO_DWG_0004_170808.dwg)
- Critical Habitat: Environment Canada (2017)



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**Area of Alteration within
Streambank Lupine Critical Habitat
Population 2b**

Legend

-  Lease Boundary
-  Project Infrastructures
- Proposed Rail Infrastructure Centrelines**
-  FSD Direct Transfer Coal Project
-  Fraser Grain Terminal Project
-  BHP Project
- Streambank Lupine Critical Habitat**
-  Streambank Lupine Critical Habitat Area
-  Area that does not meet Recovery Strategy requirements (i.e., area that is paved road)
-  Area altered by terminal rail loop construction
-  Area undisturbed

Notes

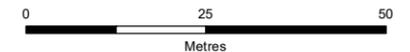
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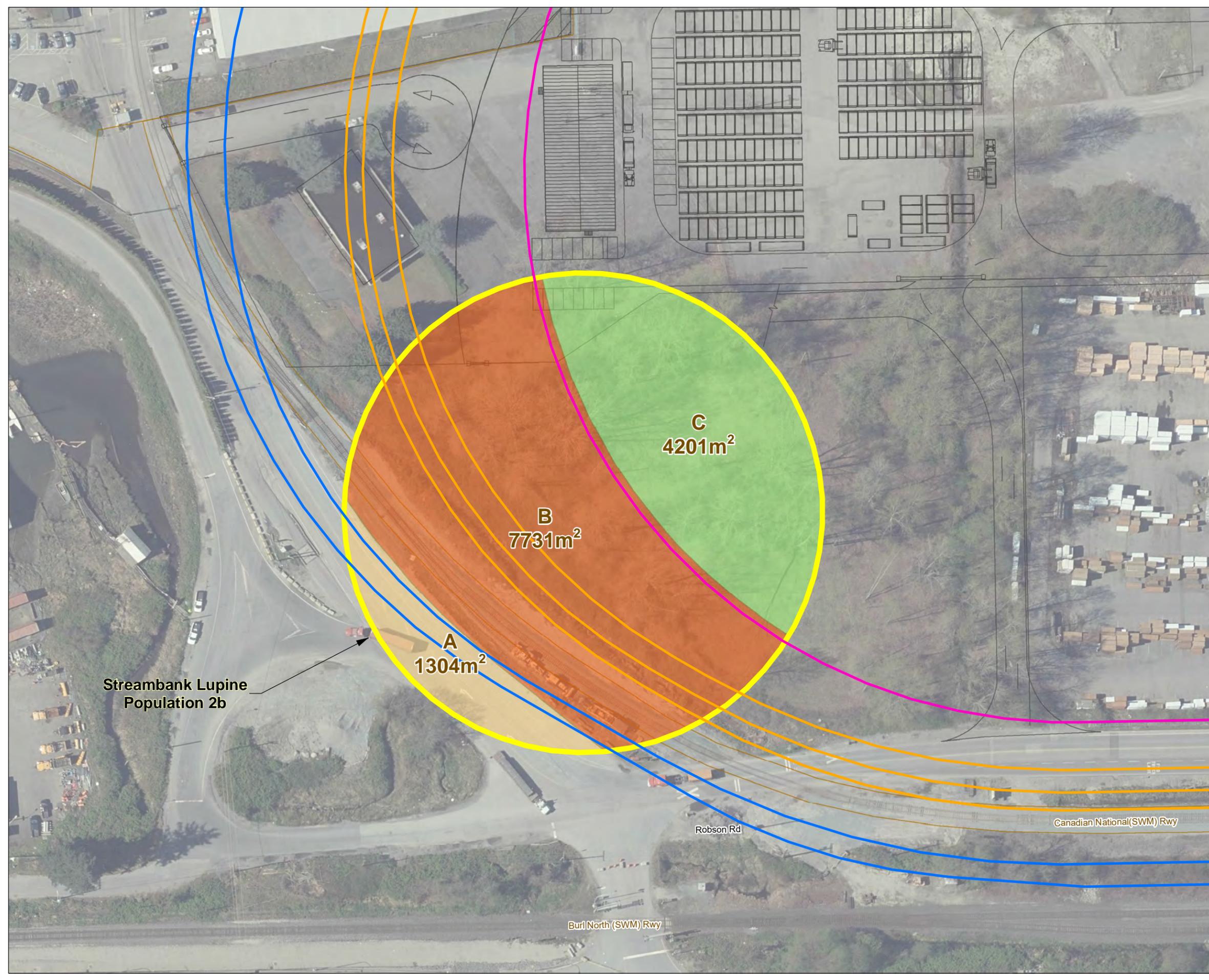


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3.0 APPLICANT INFORMATION

As the lease holder for the land required for the projects, Fraser Surrey Docks is the applicant and will be the permit holder.

Jurgen Franke, Director, Engineering & Terminal Development
jurgenf@fsd.bc.ca

Fraser Surrey Docks
11060 Elevator Rd,
Surrey, BC V3V 2R7
778-838-7581

Qualified Environmental Professional:

Charlie Palmer, B.Sc. (Botany), M.Sc. (Ecology), P.Bio, R.P.Bio, Practice Leader (EIA)
cpalmer@hemmera.com
(see **Appendix B** for CV)

4.0 BACKGROUND

4.1 OVERVIEW OF FRASER SURREY DOCKS

The FSD site is an existing 77 ha deep-sea marine terminal on the Fraser River in Surrey, BC that manages the import and export of a variety of goods including bulk, break-bulk, containers, and forestry products. The site has operated as a marine terminal since the 1930s. FSD currently handles the import and export of containers, steel, forest and agricultural products via some 400 vessels and 76,000 rail cars per year. The terminal also sees up to 300 containers and 175 steel trucks daily (FSD 2015).

FSD currently leases approximately 7,215 metres (m) of railcar storage from VFPA in the form of the VFPA Railcar Holding tracks on the southeast edge of the FSD site bordering Robson Road (referenced as the Port Authority Rail Yard or PARY). Direct connections to railways include links to Canadian National Railway (CN) and Southern Rail of BC (SRY) with inter-switching access to Canadian Pacific Railway (CP) and Burlington Northern and Santa Fe Railway (BNSF) railways.

4.2 LAND USE UNDER THE CANADA MARINE ACT

VFPA has been delegated authority to manage federal lands by the *Canada Marine Act* (CMA), which sets a clear requirement for Canadian port authorities to adopt a comprehensive land use plan to guide development of the lands and waters within their jurisdictions (VFPA 2014). Under the requirements of the CMA, the VFPA prepared a land use plan in 2014 that provides a framework for growth and development of port lands, including objectives and policies around development decisions. The plan was the result of two years of consultation with municipalities, Aboriginal groups, government agencies, environmental organizations, businesses, industries, and members of the public. The 2014 VFPA Land Use Plan guides

development of port lands and waters over the next 15 to 20 years. The VFPA's Letters Patent identifies the uses and activities that VFPA may consider approving on its lands and waters.

The entire FSD site, including the critical habitat for streambank lupine, is designated as Port Terminal under the VFPA Land Use Plan and is intended to be used as Port Terminal land. As per VFPA's Land Use Plan, "Port Terminal areas are primarily designated for deep-sea and marine terminals that handle a variety of commodities, including... primary uses that support shipping, transportation of goods and passengers, handling of goods, and other uses" (VFPA 2014). The proposed Project is consistent with VFPA's land use designation of "Port Terminal."

A key priority for VFPA, and one of their obligations under the CMA, is to ensure there is adequate land available to meet trade requirements today and in the future (VFPA 2014). VFPA responds to this demand by using the region's industrial lands more efficiently (VFPA 2014). For port lands, VFPA has suggested ways in which more intensive use can be achieved, including through better site utilization and increased transportation capacity (VFPA 2014). The proposed railway lines associated with the Project align with this key priority.

4.3 STREAMBANK LUPINE OVERVIEW

4.3.1 Streambank Lupine Establishment, Germination, and Survival

Streambank lupine is a perennial herbaceous plant (**Figure 3**). Streambank lupine matures at an average age of two years (COSEWIC 2002). Like other lupine species, streambank lupine appears to produce abundant amounts of large heavy seeds that can be dropped up to 8 m from the parent plant when the seed pods dehisce (explode) (COSEWIC 2002). Seed dispersal is generally in July (BC's Coast Region: Species and Ecosystems of Conservation Concern 2010). Seeds are sometimes further dispersed by birds and rodents and possibly by mowing activities along dykes and railway beds (COSEWIC 2002, BC's Coast Region: Species and Ecosystems of Conservation Concern 2010), though under natural conditions water-borne transportation and dispersal of seeds would have been most common. Seeds of streambank lupine readily germinate and grow in various soil types ranging from sand to commercial garden soil (ECCC 2017). In British Columbia, seeds appear to germinate throughout the year when conditions are favourable (ECCC 2017). Seeds may not germinate every year and seedling emergence from the seed bank has proven critical to species survival (ECCC 2017).

There are concerns about the long-term survival capability of the seven small and isolated populations of streambank lupine across the Fraser Lowlands (and one in Sooke, Vancouver Island) because of inbreeding (COSEWIC 2002). The COSEWIC (2002) report noted that genetic erosion in small populations can be counteracted by manually exchanging seeds from other streambank populations. Though lupine seeds are known to be viable for thousands of years, thus increasing the gene pool available (COSEWIC 2002). Maintenance of populations is a key conservation challenge because the current small and isolated

populations of streambank lupine are vulnerable to stochastic disturbances. The absence of seasonal flooding limits seed dispersal (ECCC 2017), and the natural short longevity of mature plants and populations, as evidenced from widely variable population numbers within sites, is a challenge.



Figure 3 Mature streambank lupine in bloom (ECCC 2017) and seedling

4.3.2 Streambank Lupine Habitat Preferences

Streambank lupine occur in the Coastal Douglas-fir and the Coastal Western Hemlock (CWH) biogeoclimatic zones (COSEWIC 2015). It is found only on the west coast of North America, from southwestern British Columbia to northwestern California. BC's seven populations are small, with only 1 to 100 individuals, and mainly of seedlings; the result of mowing and other disturbances (BC's Coast Region: Species and Ecosystems of Conservation Concern 2010). Mature, seed producing plants are rare.

Preferred habitat is open, nutrient-poor, sandy, or gravelly river or creek bank sites at low elevations close to coastal regions, where there is little competition from other plants (Ministry of Environment 2014, COSEWIC 2015). Streambank lupine can grow under trees, but only if sufficient light permeates the canopy and sufficient drainage is available (Zevit and Fairbarns 2010, ECCC 2017). Specific ecological requirements (e.g. specific soil chemistry needs) are not known for this species (BC's Coast Region: Species and Ecosystems of Conservation Concern 2010), but streambank lupine's proclivity for nitrogen-poor soils (lupines are nitrogen-fixers) is known, which gives them an advantage over competing plants in low nitrogen situations (USDA 2012).

Streambank lupine is not restricted to naturally occurring fluvial areas or areas near open water. The species is often found in disturbed habitats, including rights-of-way, railway tracks, and roadsides (COSEWIC 2015). Streambank lupine populations in Delta and other Fraser Lowland locations include gravel dykes and the gravel and sand beds of railway lines.

Populations in the Fraser Lowlands appear to have limited spread and recruitment in the locations where they are found. There is speculation that, similar to other lupines, streambank lupine requires highly specific

soil conditions and microorganisms (mycorrhizal bacteria) to assist in seed germination (BC's Coast Region: Species and Ecosystems of Conservation Concern 2010).

4.3.3 Critical Habitat Area, Population 2

The SARA Recovery Strategy identifies critical habitat of streambank lupine as areas occupied by streambank lupine plus a critical function zone of 50 m. Within the areas identified as containing critical habitat, critical habitat is identified wherever the following biophysical attributes occur (ECCC 2017):

- River or creek banks, composed of various substrate (including gravel, cobble, riprap, sand, or silt).
- Areas with minimal ground cover (no developed grass, tree, or shrub layer) that are natural or anthropogenic in origin (e.g., sand or silt banks along railway right of ways, dykes, roadside edges, open lots or parking areas).

Such habitats are, as noted in the Provincial Recovery Plan (part 2 of ECCC 2017), often “prone to flooding and frequently scoured and modified.” Such natural disturbance processes may be a means of avoiding competition (ECCC 2017).

Streambank lupine has seven known extant populations described in the SARA Recovery Strategy (ECCC 2017), where populations are collections of individuals separated by more than 1 km, while sub-populations are located within 1 km of each other. Population 2 has been recorded in the general vicinity of Fraser Surrey Docks since 1990, and is divided into two sub-populations (**Figure 4**); Sub-population 2a located adjacent to Alaska Way in Delta, originally recorded in 2001, and Sub-population 2b located adjacent to Elevator Road in Surrey, originally recorded in 2008 (**Figure 4**). A third sub-population, Sub-population 2c located in Surrey, was originally recorded in 1992 but was classified as extirpated in 2004 (Streambank Lupine Recovery Team 2014).

4.3.3.1 Current Conditions

Critical Habitat area 2a is a mosaic of concrete port terminal land, and railway lines and roads with associated verges, the least vegetated, dry, sandy, and mobile (i.e., unvegetated and disturbed) of which host streambank lupine. Critical habitat 2a is fully-described in **Section 9** (also see figures in **Section 9**).

Critical Habitat area 2b has a canopy of black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) and dense ground cover of native and non-native plants including Himalayan blackberry (*Rubus armeniacus*), Canada goldenrod (*Solidago canadensis*) and other species, e.g., agronomic and non-native grasses (**Figure 5**). Dense and continuing growth of these species at the site is considered inimical to the germination, growth and survival of streambank lupine (Hemmera 2016). The Streambank Lupine Recovery Team discussed the vegetation succession issue at Critical Habitat area 2b in 2012 (following site visits in 2011), noting that shade from the cottonwood trees and competition from invasive species threatened the long-term viability of the population (K Keskinen *pers. comm.*).

**Streambank Lupine
Critical Habitat Population
2a and Population 2b**

Legend

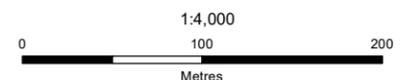
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-  Project Infrastructures
- Proposed Rail Infrastructure Centrelines**
-  FSD Direct Transfer Coal Project
-  Fraser Grain Terminal Project
-  BHP Project
-  New FSD Office Location
- Streambank Lupine Critical Habitat**
-  Streambank Lupine Critical Habitat Area

Notes

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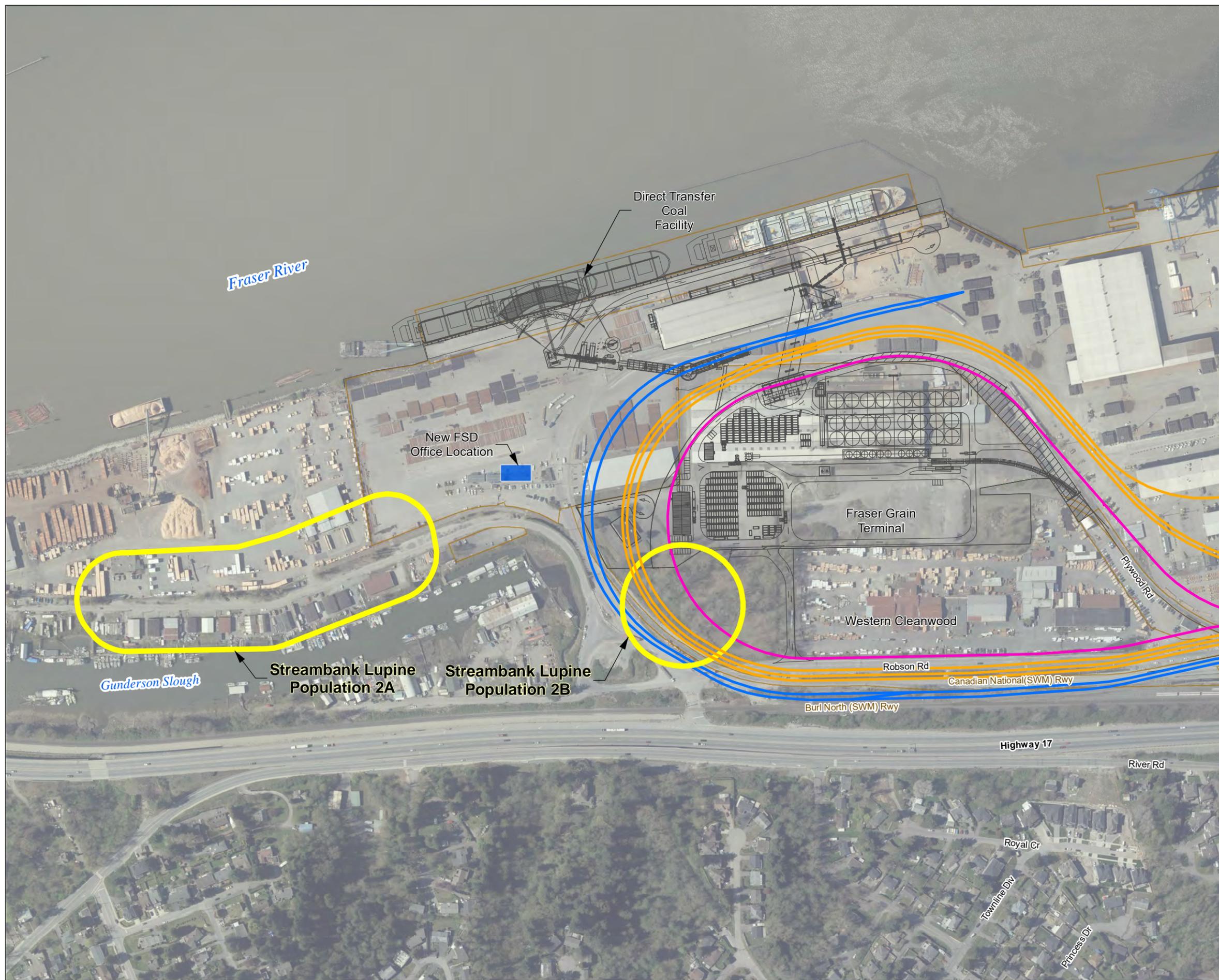
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- Critical Habitat: Environment Canada (2017)



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Figure 5 Streambank lupine Critical Habitat area 2b, summer 2016

Critical Habitat area 2b is not optimal streambank lupine habitat. There are no nutrient-poor and dry river or creek banks composed of gravel, cobble, riprap, sand or silt, or artificial surrogates, that through natural events (floods) or human activities provide the disturbances that give streambank lupine a competitive advantage over other plants (Environment Canada 2016). In disturbed areas streambank lupine can germinate and grow despite these stochastic disturbances (Envirowest 2006, Ministry of Environment 2014) because, like other lupines, it does not require nitrogen, allowing it to outcompete other plants in a post-disturbance situation. Disturbed railbeds and road verges, locations where streambank lupine is now frequently found, can offer an artificial surrogate for natural habitat with the requisite free-draining low fertility substrate that is free from vegetative competition. Critical Habitat area 2b does not have these characteristics, and dense vegetation has proliferated as a result.

4.3.3.2 Historic Context

To better understand streambank lupine Critical Habitat area 2b and its value for the species, an analysis of the site history was conducted. Historical aerial photographs of Critical Habitat area 2b and 2a, were obtained from the University of British Columbia and geotechnical studies were reviewed. Fourteen aerial photographs spanning the period from 1932 to 2016 were obtained, scanned and georeferenced. The resulting images are in **Appendix C**.

In 1932, through the 1940s (see 1947 image) to 1952, Critical Habitat area 2b was minimally developed, with only a railway spur loop (to a dock on the river edge) running past the area now identified as Critical Habitat area 2b. The railway spur is in a different location to the current road / railway. Critical Habitat area 2b was almost fully vegetated in floodplain forest, thought to be the original native vegetation at the site. Note the extensive floodplain forest vegetation in the surrounding area. Geotechnical studies near Sub-population 2b in 2014 show a high water table (between 1.5 and 2 m) and nutrient-rich peat and other organic materials at -2 to -3 m depth (MEG 2015), evidence in the substrate of the former forest cover.

Also of note from this era is that much Critical Habitat area 2a is active river channel in 1932, and a slough in 1947 and 1952.

By 1954 the forest at Critical Habitat area 2b was mostly intact, but some clearing in and around the area had occurred. To the west a pond had been dug, and clearing had occurred to the north and along paths into Critical Habitat area 2b. Critical Habitat area 2a is still a slough.

By 1963 almost the entire Critical Habitat area 2b had been filled, likely with Fraser River dredgate-sand. Except for scattered trees throughout the area, and a margin of trees along the relocated railway (same location as currently), Critical Habitat area 2b was cleared of vegetation. Critical Habitat area 2a had also been filled, and the current road / railway line had been created.

By 1969, the entire Critical Habitat area 2b was cleared of trees, except for the trees adjacent to the rail spur. But, five years later in 1974 vegetation had started to grow on the site, including either patches of shrubs (possibly blackberry) or small trees. From then through to the present day, continued growth, of trees and ground cover has been ongoing. Photographs from 1986, 1991, 1997 and 2002 show the Critical Habitat area 2b becoming increasingly more vegetated. In 2009, despite the obscured photograph, vegetation growth is very apparent, and in 2016 (a fall or winter period photograph when there are no leaves on the trees) vegetation cover is almost continuous (see also **Figure 5**).

The aerial photograph analysis was interpreted as follows.

1. The landform at Critical Habitat area 2b is not of a type that has optimal habitat characteristics for streambank lupine. A forested floodplain with no evidence of a watercourse or river banks (as shown in 1932 – 1952 images of **Appendix C**) some hundreds of metres from active river or creek areas is not consistent with the described and defined biophysical attributes of critical habitat for streambank lupine (Environment Canada 2016). Prior to 1932 and up to 1952 the aerial

photograph evidence does not suggest any presence of streambank lupine is possible. The “Ecosystem processes that occur on banks that support Streambank Lupine are integral to the production and maintenance of suitable microhabitat conditions” (Environment Canada 2016); in the absence of riverbank landforms the processes supporting streambank lupine are absent.

2. Suitably free-draining substrate conditions for streambank lupine appear to have been introduced to the site (in or before 1963). The addition of sand for converting the site to industrial land may have introduced streambank lupine, explaining how a ruderal species of riverbanks appears in an area of floodplain forest. Vegetation clearing and the introduction of a sand substrate replaced the dense floodplain forest formerly present at Critical Habitat area 2b, and seed in the sand introduced the species.
3. However, the establishment and growth of seral trees and shrubs since about mid-1970, after this part of the site was abandoned for industrial use, has prevented the maintenance of a strong streambank lupine population in what might otherwise be considered a suitable substrate. Such growth is the natural progression of an undisturbed floodplain site, but development of dense ground cover and a canopy of trees since about 1970, plus the lack of river-mediated disturbance, is not consistent with the described and defined biophysical attributes of critical habitat for streambank lupine (Environment Canada 2016).

Aside from large scale and high-intensity human-mediated disturbances, i.e., the vegetation clearing and filling in the early 1960s, Critical Habitat area 2b does not have low-intensity and frequent disturbance events to maintain a vegetation-free state for streambank lupine (Ministry of Environment 2014). No other land clearing activities have taken place within Critical Habitat area 2b since 1974, so the streambank lupine seed that was likely introduced to the site with reclamation in the 1960s is not in an optimal site for continued growth. Sub-population 2b does not, unlike other non-natural sites with streambank lupine, have artificial disturbances that mobilise the substrate allowing seed to germinate, and concurrently acting to remove the competing vegetation that then allows streambank lupine seedlings to grow to maturity.

4.3.4 Streambank Lupine Occurrence at Population 2

4.3.4.1 Critical Habitat Area 2a

Since the first 2001 record at Critical Habitat area 2a, mature flowering plants have been consistently recorded, with the exception of 2005, when >500 seedlings/juveniles were catalogued (Streambank Lupine Recovery Team 2014, also see **Figure 9**). Between 2 and 70 flowering plants have been recorded in Sub-population 2a between 2001 and 2013, in addition to between 24 and >500 seedlings/juveniles (**Figure 6**, Streambank Lupine Recovery Team 2014). Long-term survival of the seedbank has proven important to the survival for streambank lupine, but impacts on populations have resulted in the continued reduction of mature plants, which is a threat to long-term persistence of the species (Streambank Lupine Recovery Team 2014). Despite the threats, these observations demonstrate a viable persistent sub-population at Critical Habitat area 2a due to mobile sediments, limited canopy cover and ground cover in key locations, and moderate levels of disturbance. From this perspective, Sub-population 2a is a viable and persistent sub-population, despite only two flowering plants being present in 2017 (Madison 2017).

4.3.4.2 Critical Habitat Area 2b

Since records began in 2005 only 1 mature plant has been recorded at Critical Habitat area 2b (in 2008). At most 13 seedlings have been recorded. From this perspective, and given the strong vegetation competition, lack of disturbance and unsuitable substrate, Sub-population 2b is not considered a viable and persistent sub-population.

The yellow highlighted text (**Figure 6**) describes the historical streambank lupine occurrence in the Critical Habitat area 2b between 1990 to 2001.

Lupinus rivularis has been reported from the Fraser Surrey docks since 1990, and four small sub-populations were identified in 2001 during surveys for a COSEWIC status report. Three of these populations have since been extirpated by development and maintenance activities (B. Klinkenberg, pers. comm. 2004). The remaining sub-population along with two newly recorded sub-population were last observed in 2013 (T. McIntosh, pers. comm. 2013).

2013: 4 flowering plants; 28 seedlings/juveniles outside the fence near the road. Approximately 70 flowering plants; 100+ seedlings/juveniles inside the fence near rail tracks and piled lumber on Alaska Way; **1 seedling/juvenile on Elevator Road**. In coarse gravel, silt and sand (roadside); 8 flowering plants and more than 20 seedlings in sandy-gravelly soil between the sidewalk and concrete bridge edge on Grace Road (T. McIntosh, pers. comm. 2013).

2012: 5 flowering plants; 6 seedlings/juveniles outside the fence near the road. Approximately 25 flowering plants; 66+ seedlings/juveniles inside the fence near the rail tracks and piled lumber on Alaska Way (T. McIntosh, pers. comm. 2013).

2011: 2 flowering plants; 49 seedlings/juveniles across from Alaska Way (Streambank Lupine Recovery Team, 2012).

2010: 2 flowering plants and 24/juveniles seedlings across from 9560 Alaska Way (Streambank Lupine Recovery Team, 2012). **13 seedlings/juveniles on Elevator Road (T. McIntosh, pers. comm. 2013).**

2009: 10 flowering plants, 51+ seedlings across from 9560 Alaska Way (Streambank Lupine Recovery Team, 2012). **3 seedlings/juveniles on Elevator Road (T. McIntosh, pers. comm. 2013).**

2008: **1 plant on Elevator Road (T. McIntosh, pers. comm. 2013).**

2006-07-26: Approximately 50% of the area where the lupines grow behind a concrete barrier at Alaska Way was accidentally mowed. Three plants survived the mowing, 17 plants remain in the area directly east of the mowed area and approximately 17 plants were found along the railway rails (S. Alain, pers. comm. 2006).

2005: More than 500 seedlings/juveniles across from 9560 Alaska Way (Streambank Lupine Recovery Team, 2012).

2004-07: 3 remaining extant plants across from 9560 Alaska Way. Most plants at this location were covered by a pile of dirt and others were destroyed during the repair of a nearby water main (Vennesland, pers. comm. 2004).

2001-summer: Three sub-populations with a total of 32 mature plants and 30+ seedlings at the River Rd., Timberland Rd. and Robson Rd sites; 50 flowering plants and 100+ seedlings across from 9560 Alaska Way (Streambank Lupine Recov. Team, 2012).

1999-08-23: Timberland Road - single large plant in old sand dredgings mixed with railroad gravel. Some question as to whether this is a natural or introduced population since it is along railway tracks (University of British Columbia herbarium).

1990-05-17: River Road - Small patch on sand landfill (F. Lomer, pers. comm.).

Figure 6 Streambank lupine occurrence data from the Conservation Data Centre, with Elevator Road data (Sub-population 2b) highlighted.

The first record for Sub-population 2b was in 2008, one plant. Thereafter the almost-annual surveys have failed to find any mature plants, with seedlings only being observed. The highest number of seedlings seen was 13 in 2010 (Terry McIntosh). Since 2013 when one seedling was observed (Terry McIntosh), no seedlings have been observed despite almost annual surveys by qualified botanists.

The list of streambank lupine observations below is an extract from the Conservation Data Centre (CDC) record (**Figure 6**), with additions from the notes of Kim Keskinen (Vancouver Fraser Port Authority (VFPA) and former Streambank Lupine Recovery Team member) and reports held by VFPA.

- 2005, nil (Envirowest 2006, Mark Adams, R.P.Bio.)
- 2008, 1 plant (CDC: pers comm Terry McIntosh)
- 2009, 3 seedlings/juveniles (CDC: pers comm Terry McIntosh)
- 2010, 13 seedlings/juveniles (CDC: pers comm Terry McIntosh)
- 2011, no CDC record. The Alaska Way site was surveyed in 2011 by Terry McIntosh, and likely Elevator Rd was surveyed too. Kim Keskinen (VFPA) records show visits on 30 May 2011 and 5 July 2011 (with Sylvia Letay) they found 1 seedling
- 2012, nil (Triton 2013 report: Karla Graf)
- 2012, probably nil. The Alaska Way site was surveyed in 2012 by Terry McIntosh, and likely Elevator Rd was surveyed too
- 2013 1 seedling/juvenile (CDC: pers comm Terry McIntosh)
- 2013 (May), nil (Triton 2013 report: Karla Graf), also reported in the EIA for the Fraser Surrey Docks direct coal transfer facility.
- 2016 (15 June), nil (Hemmera 2016 report: Caroline Astley, R.P.Bio.)
- 2016 (30 September), nil (Hemmera 2016 report: Caroline Astley, R.P.Bio.)
- 2017 (19 May and 5 June), nil (Maddison Consulting 2017 report, Micaele Florendo, R.P.Bio.)

Compared to nearby sites with populations of streambank lupine (e.g., Sub-population 2a) regular monitoring at the Sub-population 2b Critical Habitat site since 2005 by qualified botanists shows a poor record of presence. This trend is likely due to the absence of both of the key biophysical attributes required for streambank lupine at Critical Habitat area 2b; (i) no disturbed sand, silt or cobble areas (river or creek banks or road/rail verges) and (ii) too much vegetative competition. The growth and survival of any streambank lupine seedlings that do germinate is not assured at Critical Habitat area 2b, possibly due to the combined effects of the organic peat substrate underlying the sand at about -2 m depth and the water table at between -1.5 and -2 m (MEG 2015) not being free-draining and containing too many nutrients, and the shade and competition from other plants.

5.0 CONSULTATION INFORMATION

The Proponents all require approval through the VFPA Project and Environmental Review (PER) process to construct and operate their projects. Streambank lupine information is/will be included in all the Proponents PER applications. Consultation with First Nations and the public is part of the PER process.

6.0 PROJECT DESCRIPTION AND RATIONALE FOR RAIL REQUIREMENTS

The terminal rail loop is anticipated to consist of six railway lines and will connect to the main terminal and marine berths to the PARY, the CN mainline rail, and the BNSF mainline rail (**Figure 1**). FSD first proposed the terminal rail loop track, as designed through the streambank lupine habitat area, to VFPA as part of FSD's master terminal plan in 2013.

There are four projects at various stages in the PER process that require the additional railway line capacity (**Table 2**). Additional railway capacity is critical for connecting the supply chain of these projects.

Table 2 Description of projects, project status, and rail requirements

Project	Description	Project Status in PER Process	Rationale for Rail Requirements
FSD's Direct Transfer Coal Facility Project (the "DTC Project")	FSD is approved to handle up to four million metric tonnes per year (MTPA) of coal. Coal will be received via rail and transshipped by ocean going vessel.	VFPA PER Permit issued. CEAA 2012 §67 decision received. Construction on rail in the PARY has already commenced.	Execution of the approved DTC construction permit.
Fraser Grain Terminal Ltd. Project (the "FGT Project")	Proposed a grain handling facility to receive, store and ship up to 4 MTPA of bulk grain products. Grain will be received via rail. FGT is currently using the site for existing grain exports, including rail.	In VFPA PER Application Review Phase	Rail access to the new rail car unloading facility proposed by FGT is required to accommodate the quantity of product proposed without interfering with existing rail use on the FSD site.
BHP Billiton Canada Inc. Potash Export Facility Project (the "BHP Project")	Proposed potash export facility which will receive, store and ship approximately 8 MTPA of potash produced by the proposed Jansen mine in Saskatchewan. Potash will be received via rail.	In VFPA PER Preliminary Project Inquiry Review Stage.	Rail capacity to connect Jansen's potash operations with suitable port sites is one of the key drivers of site-selection for this Project. Given the anticipated quantity of product, the Project is not feasible without the proposed new railway lines.

The terminal rail loop, including the proposed six railway tracks, is required to meet the rail transportation demands of the projects described in (Table 2). Given the projected needs, which includes train length, amount of product being transported and transhipped, frequency of train arrivals/departures, and rail length requirements (see Table 3), the proponents are unable to decrease the number of rail lines required.

Table 3 Description of projected intensity of rail use

Project	Average Train Length	Cars per Train	Average Train Frequency	Rail Length Requirements in the FSD rail yard
DTC Project	2,134 m with locomotives	125-135 cars/unit train	365 unit trains per year	Unit trains will be stored in the PARY and blocks of 25 cars will be processed through the FSD rail yard. Sufficient rail length must be available in the terminal for two 25 rail car blocks (one empty ready to be removed and one full block being unloaded) without interfering with the operations of the dry bulk agri facility, or exiting the terminal area and blocking the crossings on Robson Road (FSD 2013). Changes to the rail layout via the creation of new rail loops is necessary for efficient, continual handling of the expected length of unit trains, and seamless interactions between commodities (FSD 2015b).
FGT Project	2,187 m with locomotives	112 cars/unit train	308 unit trains per year	The new terminal rail loop will transit through an unloading building and directly connect unit trains stored in the PARY trackage with the unloading facilities, and allow for continuous unloading of railcars. Continuous unloading is more efficient mechanism of handling product from single-origin unit trains. Unit trains will be broken into strings of maximum 19 railcars each for unloading at the FGT (this is the maximum number to avoid blocking Robson road during unloading). Unloading one unit train is anticipated to take 9.5 hrs (CMC Engineering and Management Ltd 2017).
BHP Project	2,590 m with locomotives	177 cars/unit train	455 unit trains per year	Minimum track-length capacity to park or hold three 2,590 m unit trains on the FSD site is required for efficient processing of the estimated 455 trains of potash per year. Unit trains will be processed through the proposed railcar unloading system intact (without being broken into blocks of cars), on a 24 hr/day work schedule. The rail loop will conform to railway industrial track standards for rail materials, track ties, and power switch stands.

7.0 REASONABLE ALTERNATIVES

A number of alternative configurations and designs have been considered, including not building the terminal rail loop, using rail ladder track configuration, sharing rail tracks, elevating the rail loop, moving the rail loop south, and the current alignment.

7.1 NO RAILWAY CONSTRUCTION

As required in the ECCC guidelines for a SARA permit application, not advancing the Project (i.e., no rail construction) was considered as an alternative. The projects require rail to transport products to the terminal from various sources (e.g., mine sites and grain fields). Without rail access, the projects are not feasible. Given the critical importance of rail to the projects, this alternative was not selected.

7.2 RAIL LADDER (INSTEAD OF RAIL LOOP)

A railway ladder track option was considered. This option requires entire trains to be broken into rail car segments for unloading, with each segment being shunted onto its own portion of the ladder track. During this process, more road-rail traffic impacts are generated as well as increased noise and air quality emissions from multiple shunting operations required to break the trains.

Ladder tracks require more space than a rail loop as each train segment is stored on its own parallel track and would therefore have a larger footprint effect. Given the proximity of the Project to sensitive noise and air quality receptors (e.g., houses) and the limited space on the FSD site, a rail ladder layout was not selected.

7.3 SHARED RAILWAY LOOP TRACKS

The three proponents requiring the terminal rail loop considered sharing railway tracks within a loop to minimize the total number of tracks required and therefore, overall footprint. This alternative is considered unfeasible for the following reasons:

- Expected frequency of trains for each project,
- Overlap in time for deliveries to each project,
- Location of rail unload facilities within the terminal,
- Required track length to process these trains, and
- Adverse impacts on terminal access.

Sharing railway tracks would not only restrict or limit access to the PARY, where most of the unit train will be stored while blocks of rail cars are processed, but it could result in blockages to vehicle use of Robson Road. Sharing railway tracks between proponents was rejected as an alternative to the Project considering the rail requirements for each project.

7.4 ELEVATED TERMINAL RAIL LOOP

Elevating the terminal rail loop over Critical Habitat area 2b with a clear span overpass, was considered as a rail alignment alternative. The elevated terminal rail loop was not considered further for the following reasons:

- Economically unfeasible,
- Rail grade requirements (5% or less) would necessitate grade changes beginning just south of King George Boulevard (approximately 3.5 km from the Project).
- The overpass would likely shade Critical Habitat area 2b, thus affecting the growing conditions of the streambank lupine in this area.

7.5 MOVING THE TERMINAL RAIL LOOP SOUTH INTO GUNDERSON SLOUGH

Moving the terminal rail loop south to avoid the critical streambank lupine habitat area was considered as an alternative for the rail alignment. For this alternative, Elevator Road would be realigned to the south, necessitating infilling valuable fish habitat in Shadow Brook and Gunderson Slough (**Figure 7**). Further, this alternative creates unfeasible rail alignment geometry and requires the removal of two buildings on VFPA land leased to non-FSD tenants.

Shadow Brook's confluence with Gunderson Slough is characterized by the Fraser River Estuary Management Program (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. All five species of Pacific salmon may be encountered seasonally within this area. Shadow Brook also provides year-round salmonid habitat (CoD 2003, CoD 2015, COSMOS 2015). Rearing habitat value is high downstream of Elevator Road, and moderate upstream of Elevator Road.

Approximately 2,000 m² of productive fish habitat and 4,100 m² of riparian vegetation would be destroyed if this alternative was selected. A *Fisheries Act* Authorization would be required for this alternative.

In addition, this alternative would require 13^o rail curvatures on some of the tracks within the terminal rail loop, exceeding the maximum curvature specified in the CN Engineering Specifications for Industrial Tracks, and requires some alignments to utilize reverse curve geometry. These rail curvatures would create a fatal flaw preventing some of the projects proceeding.

In summary, re-aligning the terminal rail loop to the east was rejected as an alternative rail alignment option for the following reasons:

- Approximately 2,000 m² of productive fish habitat and 4,100 m² of riparian vegetation would be destroyed,
- Neighbouring tenancies would be disrupted due to removal of two of their existing buildings, and
- The tight rail curvatures create a fatal flaw preventing some of the projects proceeding.

7.6 PROPOSED ALIGNMENT AND CONCLUSION

Selection of the current proposed terminal rail loop alignment:

- Allows the Project to proceed and to deliver the proponent's targeted throughputs;
- Efficiently uses the limited-space available at FSD, both terminal and PARY;
- Allows for the rail curvature to be within tolerance of CN's Engineering Track Standards;
- Is economically feasible;
- Minimizes noise, and air quality effects to neighbouring communities and avoids physical disruption to tenants; and
- Minimizes disturbance to productive, red-coded fish habitat and important riparian areas.

Given these reasons, the current proposed terminal rail loop alignment was selected as the preferred approach.

8.0 PROJECT-RELATED EFFECTS

The 2017 surveys conducted for the SARA permit application found no streambank lupine plants (seedlings or mature plants) in Critical Habitat area 2b. Therefore, construction of a rail loop for the Project will not have direct effects on the current population. There may, however, be a reservoir of seeds in the substrate at Critical Habitat area 2b (i.e., seed bank) and there may be Project -related effects on the seed bank.

Current conditions, and possibly the underlying substrate, in Critical Habitat area 2b are not conducive to the germination and growth of streambank lupine. No plants have been observed since 2013 (see **Section 4.3.4**), and only one mature plant has been observed since records began in 1990. Critical Habitat area 2b does not have the biophysical attributes required for streambank lupine; open, nutrient-poor sand or gravel river or creek banks, i.e., mobile substrates with natural disturbance regime (ECCC 2017). Further, historical assessment of the landcover suggests the area was floodplain forest, not riverbank, and the seedbank that is present likely came from imported sand for site reclamation. As a result of the current conditions with much competing vegetation and no disturbances, and without extensive efforts to enhance and manage the critical habitat area for streambank lupine there is little potential for Critical Habitat area 2b to *in-situ* provide for the survival and recovery of the species. Enhancement costs, particularly tree and ground cover removal, would be high due to the density of existing vegetation, and the underlying peat substrate and high water table is likely unsuitable for such recovery efforts.

Critical Habitat area 2b does however have value for the survival and recovery of the species in that the soils at the site (likely imported) are a reservoir of seeds (a seed bank). Hence, mitigation for the proposed Project centres on the provision of measures to (i) maintain and salvage the seed propagules of streambank lupine at the site, and (ii) use the seed resource to augment the unaffected portions of the population where there are appropriate conditions for streambank lupine, and where there are individuals in the extant Sub-population 2a at Alaska Way (see **Section 9.0**).

9.0 MITIGATION MEASURES

The hierarchical of mitigation steps (avoid, minimise and offset (enhance)) will be used to address the critical habitat effects at Sub-population 2b. The effect that will be mitigated is the potential loss of future streambank lupine germination at Critical Habitat area 2b.

9.1 AVOIDANCE

The potential loss of future streambank lupine germination at Critical Habitat area 2b has been avoided, where possible, through Project design by:

- Reducing the area for the railway tracks to the minimum possible for achieving Project objectives.
- Limiting effects at Critical Habitat area 2b by designing the railway lines as close as possible while maintaining railway safety and design standard requirements
- Avoiding the portion of Critical Habitat area 2b that is most-suitable for streambank lupine (the moderately open area in the north of the critical habitat circle).

9.2 MINIMIZING

The potential loss of future streambank lupine germination at Critical Habitat area 2b has been minimised through Project design by:

- Informing 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.
- Avoiding the use of chemical herbicides for vegetation control because it affects streambank lupine either directly or indirectly through wind drift.
- Undertaking any maintenance activities on the railway in Critical Habitat area 2b post-growing season and seed set, such that vegetation management maintains the suitability of critical habitat.
- Avoiding storing or dumping of fill, construction materials or garbage in areas that could cover or bury streambank lupine critical habitat or otherwise degrade Critical Habitat area 2b quality.
- Removing vegetation (trees and ground cover) in a manner to avoid the mixing of soils.
- Salvaging and retaining the 0 to -6 cm organic soil layer from the non-forested parts of Critical Habitat area 2b for ex-situ use as a seedbank during streambank lupine enhancement (see **Section 9.3**). Salvaged soil will be screened to remove blackberry and horsetail propagules.

9.3 ADAPTIVE MANAGEMENT / MAINTENANCE AND ENHANCEMENT ACTIVITIES

The proposed enhancement mitigation includes activities that offset the effects of the Project by providing equivalent and additional benefits for streambank lupine in the same location / population, and prior to the effects occurring. In this context, the mitigation actions are consistent with the general principles of offsetting as per ECCC advice (EC 2012). In the absence of this proposal, the enhancement activities for survival and recovery of the species presented here would not be conducted. The current land owners and

managers, Corporation of Delta, Vancouver Fraser Port Authority and tenants Interfor, provide some physical protection for streambank lupine populations, but do not actively manage to enhance the survival of the population.

Mitigation activities to enhance the Critical Habitat area 2 population include (i) maintenance and adaptive management – those for research, monitoring and long-term population maintenance designed to understand the needs of streambank lupine and to maintain and increase the population at Population #2, specifically at Sub-population 2a where there is both a viable population and suitable habitat (see **Section 9.4**), and (ii) enhancement – designed to create more-suitable habitat conditions at Critical Habitat area 2a for the survival and recovery of streambank lupine.

9.3.1 Enhancement Area Selection

Biophysical, financial and practical considerations used for selecting streambank lupine management and enhancement areas to address project effects are as follows:

1. Proximity to an extant population (seed source)
2. Substrate suitability (well-drained, mobile sand and gravel)
3. Competing vegetation (minimal overhead shade and limited competing ground vegetation)
4. Management costs (for enhancement and long-term maintenance)
5. Ownership (potential for protective covenant or management agreement in perpetuity)
6. Future use (potential for future use and the ability to provide physical protection)

Given the above characteristics, the naturalised areas within Critical Habitat area 2a and 2b that are clearly or possibly included in the definition of critical habitat in the SARA Recovery Strategy were surveyed as candidates for potential enhancement sites. Areas that are currently paved, or with buildings were excluded as unsuitable (as per ECCC 2017). **Figure 8** shows the locations of the candidate sites described below:

- Area A: VFPA portion of the rail spur. No mature streambank lupine plants were present during the 2017 growing season, but a seedbank is possibly present. Suitable substrate is available (sand and crushed gravel), but there is some competing vegetation and shrubs (**Figure 16**). There are high enhancement costs to remove (or partially remove) the railway lines, ballast and ties are likely. There is potential for extension of enhancement in this area to the adjacent Corporation of Delta road verge currently used as informal parking (the management actions as for the Interfor staging area (Area D) would also apply here).
- Area B: Interfor portion of the rail spur. No mature streambank lupine plants were present during the 2017 growing season, but there have been plants recently recorded at this location. In 2012 there were ~25 mature plants and ~66 seedlings, and in 2013 there were ~20 mature plants and ~100 seedlings. A seed bank is likely present. Suitable substrate is available (sand and gravel) and there is little competing vegetation. Removal (or partial removal) of the railway lines, ballast and ties to create more area for streambank lupine would be expensive. Though the presence of mature plants or seedlings would preclude such an activity at this location. This is a small area, and as a

result it would not be proposed as an enhancement site without also including adjacent Area C. The land is currently unused for industrial purposes, and leased by Interfor from the VFPA. See **Figure 13**. Chain-link fences fully and partially separate this area from the public and from other areas.

- Area C: Corporation of Delta road verge 1. This area contains a small extant population of streambank lupine and a suitable substrate. There is much competing vegetation, including overhead cover, shrubs and ground cover. Streambank lupine only occurs in openings. Management costs for enhancement are modest, except for tree removal and stump grinding. Management jurisdiction is Corporation of Delta (right-of-way), no protective covenant is possible, but a Roadside Use Agreement is possible. Physical protection is already in place (Jersey barrier - **Figure 12**). There is an underlying Metro Vancouver water main right-of-way, which would require consultation during Roadside Use Agreement discussions. No current management to maintain the streambank lupine population is conducted, beyond the physical protection provided by the Corporation of Delta and one rare plant sign.
- Area D: Corporation of Delta road verge 2 (Interfor parking / staging area). While this area is close to an extant population (Area C), it has no current streambank lupine presence. This is likely because of the highly compacted substrate with no mobile sands or gravel. Competing vegetation is minimal, but there are overhanging trees. Management costs for enhancement are high because soil compaction needs to be addressed and substrate augmented. Ownership is Corporation of Delta, no protective covenant is possible, but a Roadside Use Agreement is possible. Underlying Metro Vancouver water main right-of-way and informal Interfor parking and staging use would require negotiations before use can be assumed. See **Figure 14**.
- Area E: Corporation of Delta road verge 3 (Interfor parking / staging area). No current streambank lupine presence. Highly compacted substrate with no mobile sands or gravel. Competing vegetation minimal, but overhanging trees. Management costs for enhancement are high because soil compaction needs to be addressed and substrate augmented. Ownership is Corporation of Delta, no protective covenant is possible, but a Roadside Use Agreement is possible. Underlying Metro Vancouver water main right-of-way and informal Interfor parking and staging use would require negotiation in association with the Roadside Use Agreement before use. See **Figure 15**.
- Unused portion of Sub-population 2b. (see **Figure 2**) There is no current streambank lupine presence, but there is likely a seedbank. There are limited areas with suitable substrates, but extensive tree and ground cover removal would be required to remove the current limitations to germination and growth. The underlying substrate may be unsuitable for growth, as it is probably a floodplain forest (waterlogged peat), not a free-draining gravel site typical of natural habitat.

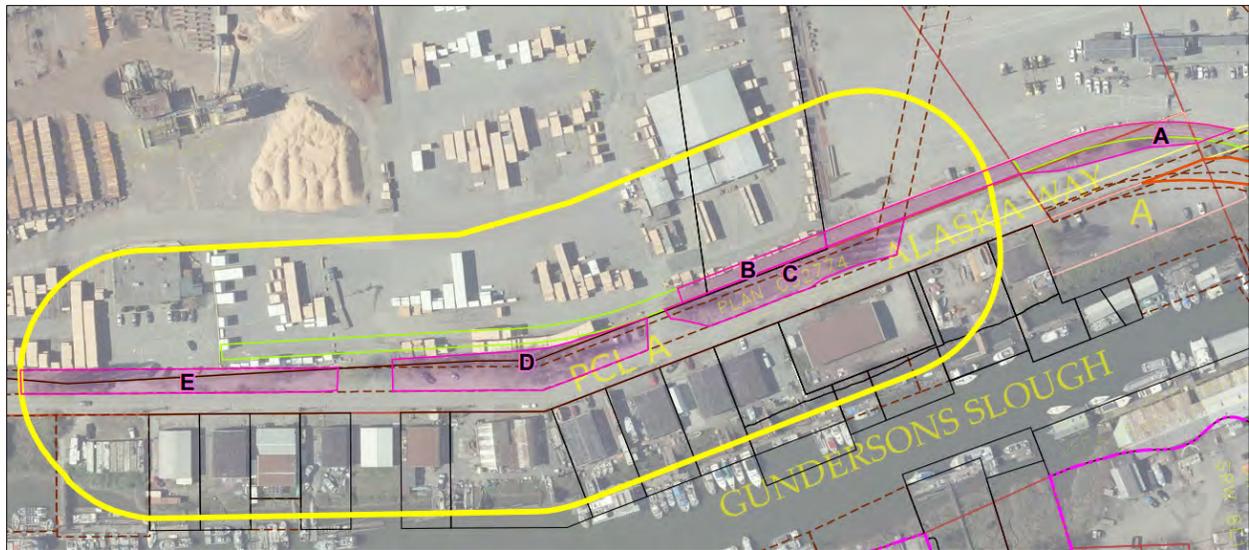


Figure 8 Naturalised portions of Critical Habitat Area 2a considered for enhancement activities

Management and enhancement activities in Areas B and C (the Interfor railway spur and the Corporation of Delta road verge) are considered to have the most potential to successfully establish a stable population. The current population (2 mature plants, 6 -8 seedlings) is down from that recorded in previous years, but in general the population varies year to year in respect of the level of disturbance and the extent of monitoring efforts. The extant population in Areas B and C is mostly physically protected, but not managed for long-term maintenance of the population. With modest efforts to remove ground cover and overhead tree cover, supported by an adaptive management approach to test the optimal management regime, success is considered likely. The presence of a strong seed bank has been proved in both areas after disturbance by Metro Vancouver in 2005 created conditions for upwards of 500 seedlings to establish (**Figure 8**). Area C is managed by the Corporation of Delta as a portion of their road right-of-way, and a portion of the area overlaps a Metro Vancouver water main. As such a legal restrictive covenant for conservation purposes in Area C is not possible, but a maintenance agreement is possible.



Figure 9 Corporation of Delta Alaska Way road verge (Area C) in 2005 after Metro Vancouver water main maintenance caused surface disturbance (CoD M. Brotherston photograph).

In Area B, managed by Interfor, there has in the past been a healthy population (140 plants in 2005, Envirowest 2006) including mature plants (**Figure 10**). None were observed in 2017. Similar management to Area C is proposed. VFPA has provided approval in principle to use Area B, but consultation will have to occur with VFPA and Interfor regarding the proposed use. A restrictive covenant (tenure) for conservation purposes between FSD and the owner (VFPA) can be arranged for long-term (perpetual) physical and legal protection.



Figure 10 Streambank lupine in the Interfor rail spur (Area B) in, left to right, 2010, 2011 and 2012 (VFPA K. Keskinen photographs)

The next most suitable area is the VFPA rail spur (Area A). This area is close to the extant population, have suitable substrates and minimal competing vegetation. Substrate augmentation, from Critical Habitat area 2b, would add a seed bank that does not appear to be present. A restrictive covenant for conservation purposes for the VFPA portion of the rail spur may be possible, based on preliminary discussions. Extension of enhancement from this area into the current Corporation of Delta right-of-way (as per Area C) appears

possible; and such efforts would expand the habitat enhancement. The landowner (VFPA) did not provide approval to use Area A and therefore Area A will not be considered further as an enhancement area.

Enhancement at the non-affected portion of Critical Habitat area 2b (**Figure 2**) is not considered suitable. The absence of a viable population (i.e., mature plants) since 2009 does not give confidence that the area can sustain a streambank lupine population, possibly due to an unsuitable substrate. Historical aerial photograph analysis (see **Section 4.3.4** and **Appendix C**) show floodplain conifer forest is the native landform. Geotechnical studies near Sub-population 2b show a high water table (between 1.5 and 2 m) and peat and other organic materials at -2 to -3 m depth with imported sand fill over the top of the peat (MEG 2015). Enhancement costs, particularly tree and ground cover removal, are high due to the density of existing vegetation. A restrictive covenant for conservation purposes for the VFPA portion of this tenure may be possible, based on preliminary discussions.

The other areas (Areas D and E) considered, either require consultation with Corporation of Delta, and/ or are less-suitable for enhancement activities because there is no seedbank. The substrate is unsuitable and compacted, and there are high costs and effort to ameliorate the conditions for better suitability for streambank lupine. Enhancement activities in these areas are not proposed for the reasons noted above. The landowner (VFPA) provided approval in principle to use Area D, but not Area E. Areas D and E will not be considered further as enhancement areas.

The enhancement activities and the population survival and recovery rationale for them, plus the evidence of efficacy, is detailed in the sections below. Given the above analysis of the possible enhancement areas, Areas B and C have been chosen as the best sites due to combinations of biological suitability and likelihood of success.

The costs to conduct the enhancement activities in areas B and C are well within the proponent's ability to fund, a cost estimate is available on request.

9.3.2 Adaptive Management / Maintenance Activities

Adaptive management and maintenance activities are proposed within Areas B and C as a means of improving the habitat conditions for streambank lupine, and increasing the chances of survival for the Sub-population at Critical Habitat area 2a. The maintenance activities are not only designed to improve the environment for streambank lupine to grow, but to learn what management techniques are required for maintenance of populations because such knowledge is lacking. The activities described below are proposed to occur over a five-year period in Areas B and C, where there are existing streambank lupine plants. The information gained from the activities would be used to inform and adapt the activities in Critical Habitat area 2a for best efficacy, and could have utility for the actions of other parties in managing streambank lupine in other populations.

The permit holder will be responsible for the management outlined, using qualified professionals where necessary in the conduct of the work.

9.3.2.1 Legal Protection

Legal protection for a conservation purpose provides an additional protective mechanism that is tied to the title for the land, and adds to the *Species at Risk Act* protections which are not tied to the title. The SARA Recovery Strategy (ECCC 2017) has examples where streambank lupine populations have been negatively affected by rail (Sub-population 2c) and road (Sub-populations 5a and 5b) expansions. Situations that may have been avoided if legal protection were in place. Legal protection also allows for conduct of the necessary enhancement and management actions to benefit the population (examples in the following sections). A legal restrictive covenant over the Corporation of Delta portion of Critical Habitat area 2a is not possible because it is a road right-of-way with a Metro Vancouver watermain that requires routine maintenance. However, a Road Use Agreement that allows streambank lupine maintenance activities to be conducted, and seeks consultation prior to road and watermain maintenance is a reasonable alternative that provides adequate protection. The Corporation of Delta has indicated that there is no impediment to such an application (M. Brotherston *pers. comm.*). On VFPA land, the land use designation of the areas can be changed from “port terminal” to “conservation”, thereby focusing the use of the area on habitat conservation, enhancement, and restoration (VFPA 2014). To obtain the change in land use designation, a formal submission would be provided to VFPA requesting a land use change with justification for such change. A secondary request in the form of a licence would be made to VFPA to maintain the area. As per the Port Land Use Plan, VFPA can update land designations as and when requested, subject to Board approval and consultation, and has indicated that there is no legal or practical impediment to such a land use designation change (Jennifer Natland, Manager Planning *pers. comm.*). Such an arrangement would likely be between Fraser Surrey Docks as tenure holder, and the VFPA.

Legal protection applications will be made to the land owner/manager prior to other enhancement activities occurring. After SARA permit application approval (anticipated late 2017) applications to the Corporation of Delta for a Roadside Use Agreement and to the Vancouver Fraser Port Authority for a change in land use designation to conservation and for permission to maintain the land will be made.

9.3.2.2 Nested Plot Study and Implementation

A key objective of the SARA Recovery Strategy (ECCC 2017), is to address knowledge gaps relating to species' biology, habitat requirements and disturbance dynamics. To be successful in increasing the population at Critical Habitat area 2a such information is also needed to guide management activities so that the most-effective are used. As part of the mitigation proposed for the Project, a statistically robust approach will be taken to determine the optimal combination of management actions required to maintain and grow streambank lupine populations to increase the number of mature plants. In year one, a nested

plot treatment design would be initiated in Areas B and C within Critical Habitat area 2a where there are extant plants, and where in 2005, earthworks by Metro Vancouver for water main maintenance created conditions for germination of >500 seedlings of streambank lupine. Various combinations and individual treatments, plus a control (all replicated) will be randomly assigned to portions of the area to test various management approaches to establish seedlings. The treatments will be: manual disturbance (raking), competing vegetation (moss) removal, watering (for germination), substrate augmentation (with soil from Critical Habitat area 2b), and a control. Trees and shrubs will be selectively removed before implementation of the trial.

9.3.2.3 Vegetation Management

Competition from other plants is considered a serious threat for streambank lupine, with the potential for a high impact on the species (ECCC 2017). Invasive weed species that are fast growing and prolific seed producers have the potential to physically overwhelm streambank lupine as well as outcompete streambank lupine seedlings for water and nutrients (ECCC 2017). Streambank lupine exhibits some of the characteristics of an invasive species, it has high seed production, rapid growth, early phenology flowering, good dispersal (Noble 1989), and in a constantly-disturbed ecosystem where perturbations remove other plants it has good competitive abilities. It does not, however, thrive in stable situations where the superior abilities of other plants out-compete streambank lupine.

Competing vegetation in the form of ground cover, shrubs and trees is inconsistent with the biophysical attributes of streambank lupine habitat (ECCC 2017), and is suggested to be a threat to some populations (ECCC 2017). Streambank lupine Critical Habitat area 6 (Watkins Creek, Coquitlam) is considered extirpated due to “heavy growth of tall vegetation since 2010 (grasses and shrubs; no open areas remain)” and Critical Habitat area 2b has had no mature streambank lupine plants since 2009 and no seedlings since 2013 and has heavy competition from ground cover and extensive shading (Hemmera 2016a, 2016b, 2017; Maddison 2017). Removal of competing vegetation in the enhancement areas is considered essential for streambank lupine maintenance in Areas B and C.

Weed removal in Areas B and C is proposed to improve streambank lupine survival. Weeds will be hand pulled or removed with a trowel, to remove the roots; such manual approaches are designed to minimise accidental affect on streambank lupine. Competing species currently present on the site include horsetail (*Equisetum* spp.), blackberry (*Rubus* sp.), English ivy (*Hedera helix*), broom (*Cytisus scoparius*), cottonwood (*Populus trichocarpa*), hardhack (*Spirea douglasii*), Canada goldenrod (*Solidago canadensis*), willow (*Salix* sp.) and various grass species. Branches of small saplings will be removed and disposed of to prevent seed spread. Weed removal activities are planned to occur in all areas over a five-year period and will involve three visits per year.

In addition, and in accordance with the SARA Recovery Strategy, a “No Spray” sign will be erected in all areas to reduce the possibility of spray from herbicides affecting streambank lupine. Temporary pin flags or a more-circumspect means of permanently marking the locations of streambank lupine will be employed to avoid trampling and accidental removal during weed removal operations.

Vegetation management in Areas B and C (see **Figure 8**) will be conducted with sensitivity to avoid effects on existing individuals of streambank lupine (2 mature plants and ~8 seedlings in Area C as at July 2017). As per the threat characterisations in ECCC (2016), hand pulling of ground cover and weeds and hand cutting of shrubs will be necessary in Areas B and C. Tree removal and stump grinding is considered necessary in Area C, and needs to be conducted without damaging individuals of streambank lupine, probably in the winter season when previously mapped mature plants can be more-easily protected.

Ground cover, shrub and tree removal and management to provide open areas without competition from other plants is an essential tool for streambank lupine management. Such actions provide the habitat requisites of streambank lupine (ECCC 2017) by mimicking the results of a natural riverbank ecosystem that through frequent flooding, scouring and modification removes competing vegetation, and uncovers new seed material from the substrate for germination.

9.3.2.4 Tree Removal

Streambank lupine prefers / requires open habitats. The SARA Recovery Strategy has identified trees such as native black cottonwood and exotic white poplar (*Populus alba*) as particular problems. At Critical Habitat area 2b, the site for the Project, a black cottonwood canopy has colonized the critical habitat site and is shading streambank lupine (ECCC 2017). Gradual tree removal over a five-year period is proposed in Areas B and C to provide the less-shaded conditions that improve streambank lupine survival (USDA 2012). Removal will be conducted in a manner that avoids major substrate disturbance; and such activities will likely involve manual felling with chainsaws, and *in-situ* stump grinding.

9.3.2.5 Garbage Removal

The SARA Recovery Strategy considers garbage and dumping of materials (sand/gravel fill) to be a threat to streambank lupine at Critical Habitat area 2a (ECCC 2017). As noted in the SARA Recovery Strategy “debris ... can alter, destroy and disturb habitat” (ECCC 2017). Garbage removal in all areas is proposed to improve streambank lupine survival. Garbage removal activities are proposed to occur four times a year over a five-year period. Garbage removal is necessary in all areas of Critical Habitat area 2a (**Figure 11**).



Figure 11 Garbage in Area C (see Figure 8) of Critical Habitat area 2a

9.3.2.6 *Watering*

Moisture levels and spring and summer temperatures play a role in lupine survival and flower persistence (COSEWIC 2002). Streambank lupine seed germination is limited by water availability as seeds appear not to germinate in very dry soils (Australian Government 2013). As such, watering is proposed in all areas over a five-year period; three times per week over the 16 driest weeks in the summer.

9.3.2.7 *Physical Protection*

Physical protection for the enhancement areas is considered necessary to prevent accidental intrusion, particularly from vehicles operating on the adjacent Alaska Way roadway. Jersey barriers have been used in a portion of Critical Habitat area 2a by the Corporation of Delta (**Figure 12**), and chain link fencing in the Interfor area is in place (**Figure 13**). The area adjacent to the roadway and in the road right-of-way is used for vehicle parking and truck (**Figure 14** and **Figure 15**). Intrusion of vehicles into the enhanced portion of Critical Habitat area 2a compacts the substrate (preventing germination and root extension) and physically damages plants that do establish. Streambank lupine in Critical Habitat area 2a is threatened by trampling by people and damage from vehicles because the area is easily accessible (ECCC 2017). While disturbance is necessary for the germination and establishment of streambank lupine, the physical damage from tires is considered too intense for streambank lupine. Continued physical protection such as Jersey barriers and fencing avoid and minimise the threats from roadway expansion cited in the SARA Recovery Strategy (ECCC 2017).



Figure 12 Barriers used by the Corporation of Delta to physically protect streambank lupine in Area C of Critical Habitat area 2a.



Figure 13 Chain link fence separating the Interfor railspur from Alaska Way (at Area B see Figure 8) of Critical Habitat area 2a

A portion of Critical Habitat area 2a is noted in the Recovery Strategy as having been affected by gravel fill (ECCC 2017), this is thought to be the areas adjacent to Alaska Way noted as Areas D and E in Figure 8, and now used for parking and semi-trailer staging prior to unloading (Figure 14 and Figure 15).



Figure 14 Area D (see Figure 8) of Critical Habitat area 2a, affected by gravel fill and now used for vehicle parking.



Figure 15 Area E (see Figure 8) of Critical Habitat area 2a, affected by gravel fill and used for semi-trailer staging

9.3.2.8 Substrate Amelioration and Augmentation

The substrate and landform in Critical Habitat area 2a is not universally suitable for streambank lupine. In some areas within Critical Habitat area 2a, the biophysical attributes of streambank lupine critical habitat (ECCC 2017) are not present as:

- There is not frequent disturbance mimicking natural river or creek bank habitat; and
- Despite the presence of sand, gravel, cobble and silt, there is compaction and infrastructure.

Road and railway verges (as per ECCC 2017) in Critical Habitat area 2a could be suitable for streambank lupine with certain enhancements.

Rails, ties and ballast in Area B (Figure 16) will be removed, if removal avoids affecting any existing streambank lupine plants. This will provide a greater area for streambank lupine establishment and removes any future potential for the rail spur to be used.



Figure 16 Rails, ties and ballast in Area B (see Figure 8) of Critical Habitat area 2a, removal of which will provide greater area for streambank lupine enhancement. Note the dry sand and gravel substrate with little vegetation cover, seemingly suitable for streambank lupine but with no plants currently growing – despite close proximity to extant plants. Area A in the background.

While removing railway infrastructure in Critical Habitat area 2a is seemingly inconsistent with the SARA Recovery Strategy (ECCC 2017), it should be noted that the SARA Recovery Strategy advice assumes the presence of plants when stating that railway line modification and maintenance could be a threat to

populations. Historically in one unfenced part of Area B (**Figure 16**), there are no streambank lupine plants growing.

To date, only two attempts at establishing new populations have been made; Deas Island and Kirkland Island. While only the Deas Island population was successfully established, details of each of these two attempts give insight into important factors that guide success in establishment of a streambank lupine population.

The Deas Island population was successfully established from 125 seeds that were variously treated with scarification, soil inoculation, burying, surface scattering (D. Hanna *pers. comm.*). Seeds have germinated and mature flowering plants have been present since 2013. The site on Deas Island was chosen because it had optimal combinations of (i) protected area, (ii) a similar location relative to the bank of the Fraser River as other populations (i.e., Alaska Way, No. 8 Rd.), (iii) substrate, (iv) site security – away from the public, (iv) no overhead cover and few grasses / herb competition. This enhancement site was a trial for translocation of seeds to a suitable site.

The Kirkland Island translocation was unsuccessful. Both plants and seeds were used in the attempt, but plants were translocated in July (not an optimal time for planting) and seeds were broadcast (likely with no treatment) into a river bank area on Kirkland Island not understood to be suitable for streambank lupine.

Because there are no plants at Sub-population 2b there is no opportunity to collect plants or seeds from pods of existing plants. As such, the approach to providing streambank lupine propagules to enhance Sub-population 2a is the seedbank in surface soil material from Sub-population 2b. Removal of railway lines, ties and ballast in part of Area B will require substrate augmentation including the seedbank removed with the organic layer from Sub-population 2b (Section 9.2).

Evidence from the enhancement activities at Deas and Kirkland islands (D. Hanna *pers. comm.*), and the literature (Australian Government 2013), suggests that burying lupine seeds enhances germination. Seeds broadcast on the surface at Kirkland Island (and untreated) did not establish. Buried seeds at Deas Island germinated better than those that were broadcast on the surface (D. Hanna *pers. comm.*), perhaps because they were scarified and/or artificially or naturally inoculated with the nitrogen-fixing rhizobia known to improve germination (USDA 2012). Sowing seeds below 4 cm reduces germination though, as such the 0 to -3 cm soil from Sub-population 2b will be used preferentially as substrate augmentation, rather than the -3 to -6 cm layer. Seeds from Sub-population 2b that are currently buried in the soil will have had some scarification and may be inoculated with rhizobia; both factors in addition to watering improve germination (USDA 2012).

Substrate amelioration and augmentation in Area B will proceed concurrent with or immediately after top soils are stripped from Sub-population 2b (Section 9.2). This will minimize the mixing and loss of substrate material including the seedbank.

9.3.2.9 Monitoring

Third-party monitoring of the effectiveness of the enhancement and management activities will be completed. Monitoring will occur twice a year, for a duration of six years, starting in 2018 while the enhancement activities are being implemented. Monitoring activities will consist of:

- Surveying the enhancement areas for streambank lupine. The distribution, relative area, and vigor of the species will be noted. Photographs and GPS waypoints will be taken.
- Noting any deficiencies in maintenance activities (e.g., presence of weeds and/or garbage, trees causing substantial shading, requirements for watering, etc.).
- Documenting the results of the survey in a memorandum, including survey methods, results, and additional recommended mitigation measures (as applicable).

Monitoring activities will likely be completed by Micaele Florendo of Maddison Consultants Ltd. Micaele is a rare plant specialist with experience with streambank lupine Sub-populations 2a and 2b. Micaele's resume is provided in **Appendix D**.

9.3.3 Timing of Maintenance and Enhancement Activities

Vegetation clearing for the construction of the terminal rail loop is anticipated to begin in late fall 2018. The enhancement activities would occur prior to this, starting with legal protection (for all enhancement areas) and adaptive management in Areas B and C. As such, and consistent with offsetting principles (EC 2012), much of the offsetting mitigation will be in place prior to the disturbances for which this permit application seeks approval. Ongoing management of Areas B and C will occur for five years (until 2022) as per the optimal combination of treatments that benefit streambank lupine in the year 1 (2018) adaptive management nested plot trial.

Monitoring as described in **Section 9.3.2.7** will occur continuously.

9.3.4 Anticipated Success and Contingency Measures

Manipulation of existing streambank lupine habitat in a low-intensity, and non-deliberate, fashion has led to successful establishment of new seedlings (see **Section 9.3** and **Figure 9**). Streambank lupine, like most members of the lupine genus, is a short-lived, early successional species that thrives in low nutrient, particularly low Nitrogen situations. It is easily out-competed by other plants as shown in many sites in the Lower Mainland, such as at the well-vegetated cottonwood forest at Sub-population 2b where there has been no germination for three years, and little for the entire monitoring record. Successful maintenance of populations using the high-volume and long-viable seedbank from existing mature plants will require frequent and ongoing disturbances similar to the action of rivers and streams in the natural habitat of streambank lupine. In the absence of natural conditions providing these requisites, the management described here provides an artificial alternative.

- Removal of competing vegetation as done in the natural environment through flooding and scouring
- Mechanical substrate turn-over to expose soil-inoculated and scarified seeds from the seedbank
- Watering to enhance germination, as provided naturally by rivers

Previous translocation of streambank lupine seeds treated in various ways has led to successful establishment of a population at Deas Island. The most-successful treatments involved soil inoculation, scarification and watering. Seeds have germinated and mature flowering plants are present in 2013 (ECCC 2017). While seed supply for population establishment using a seedbank in substrate has not been attempted the absence of success using this method will answer questions about the utility of such approaches (as noted in the SARA Recovery Strategy). Further, the success of mitigation to address the effects of the Project does not hinge on this method. As noted above, the adaptive management and treatment trial in the existing Critical Habitat area 2a will be conducted prior to or concurrent with this enhancement that has had no demonstrated success elsewhere. There is, however, no risk as substrate amelioration activities will only occur in parts of Area B that currently and historically have had no streambank lupine. Substrate amelioration activities in Area B are somewhat experimental and contribute to knowledge of streambank lupine mitigation methods, without affecting the chances of successful mitigation in Areas B and C.

9.4 CONSISTENCY OF MITIGATION WITH RECOVERY STRATEGY

The mitigation proposed is consistent with various goals and objectives of the SARA Recovery Strategy (ECCC 2017), namely:

- Securement of long-term protection for extant populations and habitats of streambank lupine – the mitigation proposed includes physical and legal protection the extant population portion of Critical Habitat area 2a. Two distinct areas for enhancement will be proposed and each requires a different approach based on tenure: (i) a road use agreement with the Corporation of Delta to positively manage a roadside verge with the only extant plants in Sub-population 2a. (ii) a tenure with the VFPA to positively manage an area in and adjacent to Critical Habitat area 2a where there are appropriate conditions for streambank lupine recovery.
- Addressing knowledge gaps relating to species' biology, habitat requirements and disturbance dynamics – proposed mitigation includes a statistically robust approach to determining the optimal combination of management actions required to maintain and grow streambank lupine populations to increase the number of mature plants. In year one, a nested plot treatment design would be initiated in the area of Critical Habitat area 2a where there are extant plants, and where in 2005, earthworks by Metro Vancouver for water main maintenance created conditions for germination of 500 seedlings of streambank lupine (**Figure 9**). Various combinations and individual treatments and a control (all replicated) will be randomly assigned to portions of the area to test management approaches to establish seedlings and maintain their growth. The treatments will be: manual disturbance (raking), competing vegetation (moss) removal, watering, and substrate augmentation (with soil from Critical Habitat area 2b). Trees and shrubs will be selectively removed before implementation of the trial.
- Clarify and mitigate threats to the species and its habitat including invasive plants and plant succession - the proposed mitigation includes a statistically robust approach to determining the optimal combination of management actions required to maintain and grow streambank lupine populations by increasing the number of mature plants (as above).

- Determining the feasibility of augmenting existing populations – the mitigation includes measures to salvage the suspected streambank lupine seed resource at the sub-optimal Critical Habitat area 2b, and use it to bolster areas adjacent to the extant individuals in Sub-population 2a. Soil stripping will be conducted to a pre-determined depth where streambank lupine seeds are thought to reside. This soil will be used immediately to augment soils at Critical Habitat area 2a, or will be stored for future augmentation use in accordance with soil recovery best management practices to avoid mixing of the soil, invasive weed establishment and erosion.
- Multi-party commitment - cooperation of many different constituencies that will be required to successfully implement this strategy including federal regulators (ECCC) and landowners (VFPA), municipal landowners (CoD), Port tenants, industrial developers, and the Streambank Lupine Recovery Team.

10.0 SURVIVAL AND SPECIES RECOVERY

The Sub-population of streambank lupine at Critical Habitat area 2b is not viable, and as such survival and recovery of the species at this location is not assured under current or future management scenarios. In reaching this conclusion following factors were considered:

1. Historical observations of individuals in the sub-population have not exceeded 13 (in 2010 and seedlings only), and only one mature plant has ever been recorded present (in 2008). Since 2013 (1 seedling only) no individuals have been recorded (survey data from 2015, 2016, and 2017).
2. The habitat conditions are unsuitable for streambank lupine establishment, germination and growth. There are no mobile substrates, vegetation competition is high, and there is much shading.
3. The landform and underlying geology is not indicative of natural streambank lupine habitat, and may be an active impediment to establishment and survival (see **Section 4.3.4**).

While streambank lupine does survive in non-natural habitats (e.g., railway line verges) it only does so where the establishment and growing conditions are suitable. At Critical Habitat area 2b the conditions required for survival are absent. So despite the assumed presence of a seedbank, the lack of disturbance and mobile substrates and the shading and competition from other plants act in concert to prevent germination (establishment) and then growth. Sub-population 2b does not, unlike other non-natural sites with streambank lupine, have artificial disturbances that mobilise the substrate allowing seed to germinate, and concurrently acting to remove the competing vegetation that then allows streambank lupine seedlings to grow to maturity.

Alteration of streambank lupine Critical Habitat 2b by the Project will not affect Population #2 (ECCC 2017) because neither individuals nor viable habitat will be affected. The value of Critical Habitat area 2b for streambank lupine survival and recovery lies in the seedbank that is assumed to be present. Mitigation in association with the Project has been designed to maintain, salvage, and use the seedbank at Sub-population 2b for use in survival and recovery of Population #2 at the only location of extant plants – in Sub-population 2a at Alaska Way. Further, active management of the extant streambank lupine Sub-population

2a in advance of the effects from the Project on Sub-population 2b will advance knowledge of the management requisites such that survival and recovery management can be effectively implemented.

Critical Habitat area 2a, the site of proposed enhancement activities, is the only viable part of Population #2. There are extant plants, the substrate is relatively mobile, and infrequent and low intensity disturbances appear to mobilise seed and allow it to germinate. Vegetation cover at ground and canopy levels is becoming dense, but is currently open enough to allow germination and growth (**Figure 9**, **Figure 11**, **Figure 12**, and **Figure 17**).

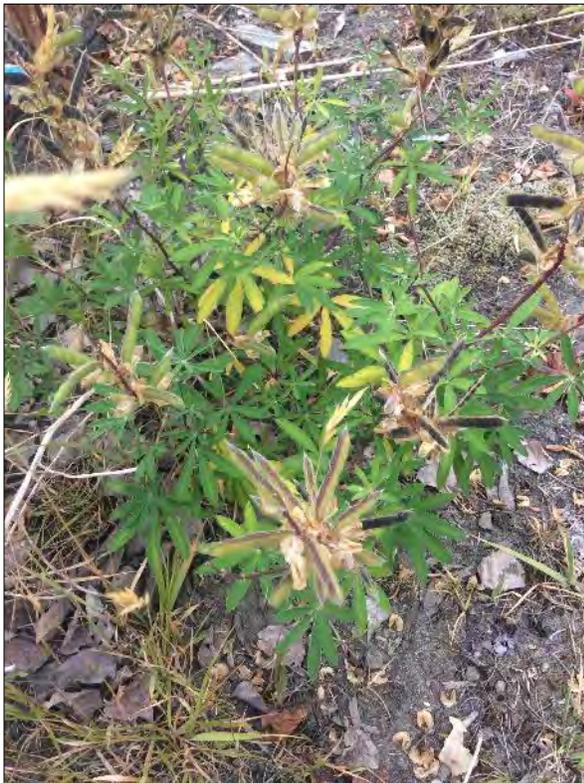


Figure 17 Streambank lupine plants (L) and seedlings (R) in Area C of Critical Habitat area 2a, July 2017

Critical Habitat at Sub-population 2a is, however, sub-optimal in respect of the ideal conditions for streambank lupine, despite the presence of extant plants. No targeted and species-specific maintenance is undertaken, and the persistence of Sub-population 2a is mostly left to chance and previously enacted barrier fencing. Because this Sub-population represents 100% of the extant individuals in Population #2, and the area is small, there is a risk to the population from any number of the threats listed in the Recovery Strategy; competing vegetation, trampling, lack of disturbance (ECCC 2017). Modest maintenance activities in the parts of Sub-population 2a with extant plants will increase the survival and recovery of Population #2. Further, proposed enhancement activities in the parts of Sub-population 2a that are suitable

but have no plants will increase the area available for streambank lupine and will utilise the seedbank salvaged from the non-viable portion of Population #2 (i.e., Critical Habitat area 2b).

Sub-population 2a at Alaska Way has at its peak had ~500 seedlings (**Figure 8**), an anomalously high count that was the result of disturbance in the water main right-of-way during 2005. Prior to this disturbance Sub-population 2a had 50 flowering plants and 100 seedlings (ECCC 2017). Since the 2005 disturbance Sub-population 2a has had at its peak in 2103 had 75 flowering plants and ~120 seedlings spread across the Corporation of Delta road verge (Area C) and Interfor railway spur (Area B) portions (ECCC 2017). Current population estimates (2017) are much lower; 2 flowering plants and ~10 seedlings (Maddison 2017 and *pers. obs.*), all in Area C within and on the edge of the Corporation of Delta Jersey barriers. The mitigation proposed in association with the Project has as its objective the provision of conditions that will result in the establishment of 50 to 75 mature plants and associated seedlings at the end of five years of operations. Legal protection in association with the maintenance and enhancement activities will provide the legal framework for similar future activities to provide for the perpetuation of Population #2.

This assessment concludes that the terminal rail loop development proposed in Critical Habitat area 2b will not jeopardise streambank lupine Population #2. In reaching this conclusion the efficacy of active and scientifically-tested management operations that are deliberately applied to the extant Sub-population at 2a have been considered. Such activities will provide better chances of survival and recovery of Population #2 because, based on the biology of lupines and evidence of streambank lupine reactions to such species-specific maintenance, the actions lead to greater production of streambank lupine than the current situation where there is no species-specific management and persistence is left to chance. Further, the threat of extirpation will be reduced because there will be more individuals, and a larger area – both factors that reduce the effects of major perturbations and accidents.

The above conclusion also considers that other than the value of Sub-population 2b as a reservoir of seeds, there is no foreseeable situation where Critical Habitat area 2b, where the Project activities are proposed, can provide any value for the survival and recovery of streambank lupine. As described above, the geological, biological, financial and practical limitations are too great for functioning habitat to develop *in situ*. However, mitigation to salvage the seedbank and using it to augment the viable Sub-population at Critical Habitat area 2a is a sensible and scientifically defensible means to ensure the survival of Population #2, as per the objectives of the Recovery Strategy (ECCC 2017).

11.0 CLOSING

This Work was performed in accordance with Contract 403B Environmental Engineering Services for Permit Applications, Contract Number 8500085638, and Professional Service Agreement between Hemmera Envirochem Inc. ("Hemmera") and Parrish & Heimbecker c/o CMC Engineering and Management, BHP, and Fraser Surrey Docks ("Clients"), dated September 9, 2015, September 11, 2015, and December 21, 2015 ("Contracts"). This Report has been prepared by Hemmera, based on fieldwork and desktop work conducted by Hemmera, for sole benefit and use by the Client. 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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Marine + Earth Geosciences Consulting Limited (MEG). 2015. Geotechnical Engineering Report for Port Authority Rail Yard at Fraser Surrey Docks, Surrey, BC.

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<http://www.portvancouver.com/wp-content/uploads/2015/06/port-metro-vancouver-land-use-plan-english.pdf>. Accessed May 2017.

Zevit, P. and M. Fairbarns. 2010. BC's Coast Region: Species & Ecosystems of Conservation Concern
Streambank Lupine (*Lupinus rivularis*)

APPENDIX A
Species at Risk Act Request for a Permit Form



REQUEST FOR A PERMIT

	Applicant*	Permit Coordinator**
Name:	<u>Jurgen Franke</u>	<u>Megan Harrison</u>
Organization:	<u>Fraser Surrey Docks</u>	<u>Canadian Wildlife Service</u>
Address:	<u>11060 Elevator Rd, Surrey, BC, V3V 2R7</u>	<u>5421 Robertson RD, RR 1, Delta, BC, V4K 3N2</u>
Phone:	<u>778-838-7581</u>	<u>604-351-1719</u>
Fax:		
E-mail:	<u>JurgenF@fsd.bc.ca</u>	<u>Megan.Harrison@ec.gc.ca</u>

Preferred Language of Correspondence: English French

* The applicant will be considered the permit holder in the event that a SARA permit is issued, and assumes responsibility for actions of any assistants involved in the permitted activity.

** Refer to page 5.

Have you received a SARA permit before: Yes No

If yes, please provide the permit number: _____

Activity title: Construction of terminal rail loop through streambank lupine critical habitat

1. What purpose describes the context of your request? Select all applicable options:

- Scientific research for the conservation of the species
- Other type of activity beneficial to the species or required for the survival of the species
- Neither of the above – affecting the species is incidental to the carrying out of the activity.

2. Please summarize qualifications of the applicant below. This individual will be undertaking the activity, or supervising the undertaking of the activity.

See attached *curriculum vitae*

Charlie Palmer (Hemmera) will be supervising the undertaking of the activity (see CV in Appendix B)

3. Assistants participating in the activity:

Caroline Astley (Hemmera - see CV in Appendix B), various field assistants

4. Other participating or affected organizations or individuals (name, contact, phone number):

Valerie Bond (BHP Billiton Canada, Inc.) 306-385-8439, Casey McCawley (Fraser Grain Terminal) 604-868-1069,

Jennifer Natland (VFPA) , Planning Manager (Corporation of Delta) contact details available upon request to the applicant

Other participating/affected organizations (to be completed by Environment Canada):



- 5. a) List species at risk affected and identify any critical habitat and/or the residences of individuals that will be affected, either directly or indirectly, by the proposed activities and the estimated number of individuals or residences.
- b) To assist us in monitoring other wildlife species, please identify any other species affected and the estimated number of individuals (Scientific and common names).

Streambank lupine (*Lupinus rivularis*), Critical Habitat 2b (Surrey-Elevator Road) will be affected. No individual lupine are anticipated to be affected since none have been observed in the area since 2003 (see Section 4.3.4 of application).

- 6. Location and description of the area of activities (this information will remain confidential): UTM coordinates of the north-west and south-east corners of the area of activities See attached map

Northwest corner - 506215 m E, 5447379 m N UTM10N NAD83

Southeast corner - 506314 m E, 5447274 m N UTM10N NAD83

Specify the province(s) where the activities will take place: BC

- 7. Date of activities: From mid-2018* To mid-2023*

*Note: see Section 2.0 of application for additional information

- 8. Summary of the activities (add a detailed description with specific reference to the purpose(s) of the activities identified in question 1):

See attached document

- 9. Method and site for disposal of biological material : N/A

- 10. Animals that will be in captivity – description of area, pen, methods, duration : See attached documents

Not applicable

MANDATORY CONDITIONS FOR PERMITS AND AGREEMENTS

73. (1) The competent minister may enter into an agreement with a person, or issue a permit to a person, authorizing the person to engage in an activity affecting a listed wildlife species, any part of its critical habitat or the residences of its individuals.

- (2) The agreement may be entered into, or the permit issued, only if the competent minister is of the opinion that
 - (a) the activity is scientific research relating to the conservation of the species and conducted by qualified persons;
 - (b) the activity benefits the species or is required to enhance its chance of survival in the wild; or
 - (c) affecting the species is incidental to the carrying out of the activity.

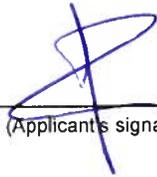
- (3) The agreement may be entered into, or the permit issued, only if the competent minister is of the opinion that
 - (a) all reasonable alternatives to the activity that would reduce the impact on the species have been considered and the best solution has been adopted;
 - (b) all feasible measures will be taken to minimize the impact of the activity on the species or its critical habitat or the residences of its individuals; and
 - (c) the activity will not jeopardize the survival or recovery of the species.

* the applicant must show that the activities meet these conditions



11. In a separate document, answer the following questions :

- a) Did you consider all reasonable alternatives to the proposed activity that would reduce the impact on the species? Elaborate.
- b) Explain why you consider that your proposal is the best solution.
- c) What measures to minimize the impact of the activity on the species, its critical habitat or the residences of its individuals will be taken? Elaborate.
- d) Why do you consider that this activity will not jeopardize the survival or recovery of the species? Elaborate.


(Applicant's signature)

Aug 25, 2017
(Date)

Comments (For internal use only)

<i>Purpose – Section 73(2)</i>		<i>EC Scientific Reviewer</i>	
<i>Date Received</i>		<i>Date Required</i>	
<i>SARA Species</i>		<i>Permit #</i>	
<i>EA Required</i>		<i>Animal Care Approval Required</i>	
<i>Previous Permit #</i>		<i>Previous Report on File</i>	



INSTRUCTIONS

- Question 1. Purpose of the activity – Check off applicable option(s).
- Question 2. State the qualifications that allow you to conduct this activity. Attach *curriculum vitae* if necessary.
- Question 3. Provide the names and addresses of all persons who will, at any time, be collaborating with, or acting under the direction of, the permit holder.
- Question 4. Provide the names and contact details of all organizations or individuals that might be affected by the activity or that participate in the activity (e.g. organization that authorizes funds or collaborates on the activity, landowner, band under the *Indian Act*, provincial or municipal agency, etc.)
- Question 5. Name the species, or any part of its critical habitat or the residences of its individuals, that are to be affected by the activity. If specimens are to be taken, indicate which materials and the quantity of material that will be taken at each site for each species. If relevant, give the dates and duration of specimen collection activities.
- Question 6. Specify the exact location(s) where the activity will be conducted. The UTM coordinates are recommended. Inclusion of maps or figures is often helpful. (NOTE: This information is kept confidential.)
- Question 7. Indicate the start and end dates of the activities.
- Question 8. Provide a summary of all proposed activities with specific reference to the purpose of the activity identified in question 1. This must include details on impacts upon the affected species, any part of its critical habitat, or the residences of its individuals. Identify measures to be taken to minimize the impact of the activity upon the affected species. Specify any supporting material.
- Question 9. Where and how will specimens be stored? Where and how will you dispose of biological material after use? This question might not be applicable to your activity (N/A).
- Question 10. Where will live animals be kept, under what conditions, and for how long? How will they be handled, and what animal care guidelines will be followed? Attach Animal Care Committee approval or an application form if requesting Animal Care approval from the Canadian Wildlife Service.
- Question 11. Provide complete answers to all four questions. You must establish that your activity meets the basic requirements of the *Species At Risk Act* for the issuance of permits as outlined in Section 73 of the Act, and relevant policy.

NOTES OF IMPORTANCE

- Do not forget to sign the form;
- Provide additional supporting documentation and attachments as appropriate (missing or incomplete information may result in a delay in the application review process);
- The issuance of a permit is discretionary;
- This permit does not negate the obligation to obtain any other permit, licence, certificate, or other authorization that may be required under any other legislation.



If you have any doubts concerning the need for a SARA permit or if you require any additional information, please contact the regional office's permit coordinator:

Atlantic Region

Permits Officer
Canadian Wildlife Service
Environmental Conservation Branch
17 Waterfowl Lane
PO Box 6227
Sackville, New-Brunswick
E4L 1G6

Tel: (506) 364-5044
Fax: (506) 364-5062
E-mail: Sarapermitting.atl@ec.gc.ca

Quebec Region

SARA permit coordinator
Division of habitats
Canadian Wildlife Service
1141, route de l'Église, 9th floor
P.O. box 10 100 - Succ. Sainte-Foy
Sainte-Foy, Québec
G1V 4H5

Tel: (418) 648-5757
Fax: (418) 648-7045
E-mail: permislep.qc@ec.gc.ca

Ontario Region

Canadian Wildlife Service
867 Lakeshore Rd
Burlington, Ontario
L7R 4A6

Tel: (905) 336-4464
Fax: (905) 336-4587

Prairie and Northern Region

(Everywhere except Nunavut)
SARA Permit Coordinator
Canadian Wildlife Service
Twin Atria Bldg.
Room 200, 4999-98th Avenue
Edmonton, Alberta
T6B 2X3

Tel: (780) 951-8695 or (780) 951-8889
Fax: (780) 495-2615

Nunavut

Habitat Biologist
Canadian Wildlife Service
Environment Canada
Box 1714
Qimugjuk Bldg (#969)
Iqaluit, Nunavut
X0A 0H0

Tel: 867-975-4633
Fax: 867-975-4645

Pacific and Yukon Region

Canadian Wildlife Service
Permit Section
5421 Robertson Rd., RR #1
Delta, BC
V4K 3N2

Tel: (604) 940-4650 or (604) 940-4700
(604) 946-7022
E-mail: SARAPERMITTING.PYR@ec.gc.ca

APPENDIX B
Curriculum Vitae of Individual Supervising Activity

EDUCATION

M.Sc. (Botany),
University of
Canterbury

B.Sc. (Ecology),
University of
Canterbury

DESIGNATIONS

Alberta Society of
Professional
Biologists

College of Applied
Biology

International
Association of
Impact Assessors -
Sustaining Member

ADDITIONAL TRAINING

Advanced Resource
Management Law,
Lincoln University

Ethics for Biologists,
2008, 2012

Charlie is a professional ecologist with 20 years of experience in management of natural values. Charlie has strengths in environmental impact assessment (EIA) under the *Canadian Environmental Assessment Act 2012*, the *BC Environmental Assessment Act* and related legislation and policies, particularly related to ecological values and species at risk.

Charlie has designed and implemented scientific studies and monitoring for assessment of effects on flora and fauna, conservation management, invasive plant management and sustainability indicators, particularly for species at risk. Mitigation design, and habitat enhancement as compensation for project-related effects, has been a recent focus, as well as monitoring to ensure the efficacy of the mitigation.

RELEVANT EXPERIENCE

Gateway Program, South Fraser Perimeter Road, 2004 – Ongoing: Charlie led the terrestrial habitat offsetting, which involved an assessment of habitat compensation requirements, regulatory engagement, input to design, and ongoing monitoring of approximately 20 ha of habitat enhancement areas. Plant species at risk management (streambank lupine and Van. Is. beggarticks) was a focus. He is currently leading the monitoring of the mitigation for six species at risk.

Port Metro Vancouver, Habitat Enhancement, 2012 – 2015: Charlie was involved in the early design of a habitat banking program – from the perspective of terrestrial wildlife. Since then he has been involved in the assessment and design of a site that restores estuarine habitat to a previously reclaimed area; specifically for avian issues. Peripheral involvement in other sites for avian issues.

Vancouver Fraser Port Authority, Species at Risk Inventory, 2015 - ongoing: Charlie designed and has implemented a species at risk inventory and management program in Port lands to address federal needs under the *Canadian Environmental Assessment Act 2012* and the *Species at Risk Act*, including streambank lupine, little brown myotis and red-legged frog.

Ministry of Transportation, Species at Risk Advisor, 2015: Charlie coordinated the regulatory engagement and ecological studies required to show effective protection for species at risk in designated *Species at Risk Act* critical habitat for Pacific water shrew.

BC Hydro, Ruskin and Strathcona, 2010: Charlie led the ecological input into an analysis of alternatives for management of two BC Hydro dam and reservoir facilities. This work included the design and conduct of GIS analyses to determine the mitigation (and compensation) needs for each alternative. The work involved much integration with fisheries, engineering, and other disciplines.

Ministry of Forest Land and Natural Resource Operations, 2011: As a qualified environmental professional, Charlie provided advice on ecological requirements for the Development Plan IR (<50MW green energy project) process.

AltaGas, McLymont Creek Hydroelectric Project, Iskut, 2010 – 2014: Charlie was responsible for the design of field programs, regulatory agency liaison, ecological impact assessment and mitigation design. His role included monitoring development, and consultation with the Tahltan Nation and regulators.

National Research Council, Herzberg Observatory, Saanich, BC, 2010 – 2012 and 2017: Charlie wrote and facilitated a Species at Risk Management Plan. He designed the framework, facilitated workshops, and liaised with Garry oak ecosystem experts. A five-year update and revision was completed in 2017.

Capital Power Corporation, Quality Creek Wind Energy Project, 2008 – 2015: Charlie was the leader for ecological impact assessment studies associated with this wind energy project in northeast BC. His responsibilities include regulatory liaison, authoring bird and bat impact assessment, and EA process management. Charlie was involved in mitigation design and is currently involved in implementation.

NaiKun Wind Development, 2009 – 2010: Charlie was the regulatory liaison coordinator for bird impact assessment studies, including bird energetics / satellite telemetry studies with Simon Fraser University.

Bear Mountain Wind Park, Dawson Creek, 2006 – Ongoing: Charlie reviewed and wrote vegetation, wildlife and monitoring sections of the EA application. He was the lead ecologist during federal and provincial EA reviews, and is monitoring birds and bats for the project's adaptive management program.

Meridian Energy, New Zealand, 2001 – 2004: Charlie assessed the effects of a major (600+ MW) run-of-river hydroelectricity project on vegetation and wetlands, soils and productive potential. Habitat restoration and enhancement on braided rivers including weed control options was a focus.

QE II National Trust, New Zealand, 1999 – 2002: Charlie assessed and prioritized ecological projects for protection and funding. His work included collation and analysis of data, landowner consultation, and report presentation. He was the ecological advisor, particularly related to weed and pest control and other habitat enhancement efforts.

SELECT PUBLICATIONS

Palmer (1999). "Lowland native ecosystems – key elements in the biodiversity jigsaw." Proc. of the New Zealand plants & their story conference. Royal New Zealand Institute of Horticulture, Wellington.

Palmer (2007). "Effectiveness of guidelines and policies to streamline EA for wind energy in BC, North American Windpower 4(8).

Palmer (2009). "Cumulative What? A practitioner's perspective [on cumulative effects]". Presentation to the [Federal] Regional Environmental Assessment Committee. Vancouver, November 2009.

Palmer and Paterson (2010). "Raptor and migratory bird and bat monitoring and follow-up report 2009 and recommendations for 2010. Report for Bear Mountain Wind Limited". February 2010.

Palmer (2011). Sandhill Crane adaptive management associated with SFPR. Presentation to the BC Association of Professional Biologists, Nanaimo, BC, May 2011.

Palmer and Hindmarch (2012). Barn Owl (*Tyto alba*) monitoring for mitigation development in the Lower Mainland, British Columbia. North American Ornithology Conference, July 2012, Vancouver.

PROFESSIONAL HISTORY

Hemmera, BC, Senior Ecologist, 2004 – Present

Boffa Miskell Limited, NZ, Senior Ecologist, 2001 – 2004

QEII National Trust, NZ, Ecologist, 1998 – 2001

Lincoln University, NZ, Ecological Researcher, 1996 – 1998

Caroline Astley, M.Sc., R.P.Bio.

TEM Specialist – Wildlife and Vegetation

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EDUCATION

M.Sc.
(Environment and
Management),
Royal Roads
University

B.Sc.
(Biology),
University of Toronto

Diploma
(Fish and Wildlife
Technician),
Sir Sandford Fleming
College

DESIGNATIONS

College of
Applied Biology /
Association of
Professional
Biologists of BC -
Registered
Professional
Biologist,
2006

ADDITIONAL TRAINING

Terrestrial
Ecosystem Mapping

Riparian Areas
Regulations
Assessment
Methodology /
Environmental
Monitoring for
Construction
Projects,
Malaspina College

Quality Management
Systems Auditor /
Lead Auditor,
Ashbrooke

CABIN Benthic
Invertebrate
Sampling

Caroline Astley is a Terrestrial Ecosystem Mapping (TEM) Specialist with 14 years of related experience. She has participated in and completed several large-scale and high profile TEM projects. She has experience mapping both urbanized and remote ecosystems. Caroline also has expertise in species-at-risk assessments and habitat requirements. She has conducted wildlife habitat assessments throughout BC and the Yukon for a variety of clients.

Working for high-profile clients, Caroline has completed a number of TEM and wildlife projects. Her TEM work on the CDFmm passed rigorous Ministry of Environment QA. Her work in the Yukon required a great deal of teamwork, flexibility, and creativity. She is knowledgeable on federal, provincial, and municipal regulations and standards.

Caroline has maintained strong and effective relationships with clients through her communication skills. She is able to easily convey complex issues, such as the presence of species-at-risk on a project site, and helps the client determine the best course of action. As a member of several multi-disciplinary teams, Caroline has functioned as team leader, as well as a participant, on several important and high-profile projects. Her contributions have helped bring to completion a number of large-scale projects. She understands that clients have a vested interest in their projects, and need to rely on their hired professionals. She has made a name for herself by proving that she can be relied upon to complete projects on time and under budget, and to complete projects at a high level of quality.

RELEVANT EXPERIENCE

SeaBreeze Power, Traditional Use Plant Survey, Merritt, BC, 2016: Caroline designed the field data collection program and lead the field assessments for traditional use plants in two proposed wind turbine areas outside of Merritt BC. The field crew consisted of two local First Nations members.

BC Hydro, Site C Dam Wetland Assessments, Fort St. John, BC, 2016: Caroline lead the field assessments to confirm and classify over 55 wetlands located along the transmission line from Fort St. John to Hudson's Hope, BC.

Fortis BC, Lower Mainland System Upgrade and Lower Mainland Intermediate System Upgrade, BC, 2015 – Ongoing: Caroline is providing senior leadership and support for the biophysical assessments and permitting activities for two gas pipeline projects in the Lower Mainland.

Fraser Surrey Docks, Delta BC, 2015 – Caroline conducted vegetation mapping for this project. She also conducted three at-risk plant surveys at two locations, specifically for streambank lupine (*Lupinus rivularis*).

Aeolis Wind Power Corp., Moose Lake and Babcock Ridge At-risk Plant Surveys, 2015 – Caroline led the at-risk plant surveys for two wind farm projects in the Tumbler Ridge area.

Caroline Astley, M.Sc., R.P.Bio.

TEM Specialist – Wildlife and Vegetation

Page 2 of 2



Kwantlen Polytechnic University/Squamish Nation Trade Centre, 2015 – 2017: Caroline assisted with the design and delivery of a seven week environmental monitoring training course delivered to Squamish Nation Trade Centre students. Students represented bands from around the Lower Mainland, and participated in classroom and field-based exercises.

Borex Inc., Red Willow Wind Project 2012 – 2015: Caroline led the TEM mapping for six wind projects in the Peace Region. She completed TEM maps for each project, including ecosystem classification, provided senior support for field crews, and performed QA/QC on field data.

Constantine Metal Resources Ltd., Palmer Project, Haines, AK, 2015: Caroline designed and led invasive plant species baseline studies for a proposed mine project in Alaska.

Ministry of Transportation, George Massey Tunnel Replacement Project, 2014 – 2016: Caroline led the Terrestrial Ecosystem Mapping project for the GMT project, including identifying rare ecosystems, delineating ecosystems in the project footprint, and determining impacts. She also assisted with the rare plant surveys for the project.

Port Metro Vancouver, T2 / Deltaport Expansion Project, 2012: Caroline was lead ecosystem mapper and vegetation inventory lead. She supervised and coordinated field staff, including subcontractors to collect baseline vegetation information for the project study area.

Department of National Defence, Nanaimo, BC, 2011: Caroline lead the invasive plant species mapping and management plan creation for two DND properties on Vancouver Island. She trained and supervised field staff and wrote two technical management strategies.

BC Hydro, John Hart Redevelopment Project, 2010: Caroline was the Terrestrial Ecosystem Mapping (TEM) and inventory lead, and coordinated field studies to determine potential impacts of reservoir drawdown during redevelopment of the John Hart Dam.

Simon Fraser University/SFU Community Trust, South Neighbourhood Environmental Review, 2010: Caroline was the TEM and inventory lead, and coordinated the field studies to collect baseline data for a constraints and opportunities study prior to development of the SFU South Neighbourhood.

BC Hydro, Environmental Assessment of Alternatives, John Hart Dam, 2010: Caroline undertook background research and analysis of the environmental impact of several alternatives for redevelopment of the John Hart Dam.

Ministry of Transportation, Highway 3A Safety Upgrades at Yellow Lake, 2010: Caroline was the TEM and vegetation lead and undertook the listed ecosystem field work for the Yellow lake Highway 3A project.

Ministry of Transportation, SFPR Listed Vegetation, Delta and Surrey, 2009 – 2013: Caroline coordinates the listed vegetation surveys for the SFPR project. The project involves in-field data collection, data analysis, and reporting on the status of listed ecosystems and vegetation in the study area.

Aeolis, Thunder and Hackney Wind Farms, Peace Region, 2009: As part of the environmental assessment team for the Thunder and Hackney IPP project, Caroline reviewed and analysed TEM data for each wind farm project, and assembled the vegetation sections for the EA.

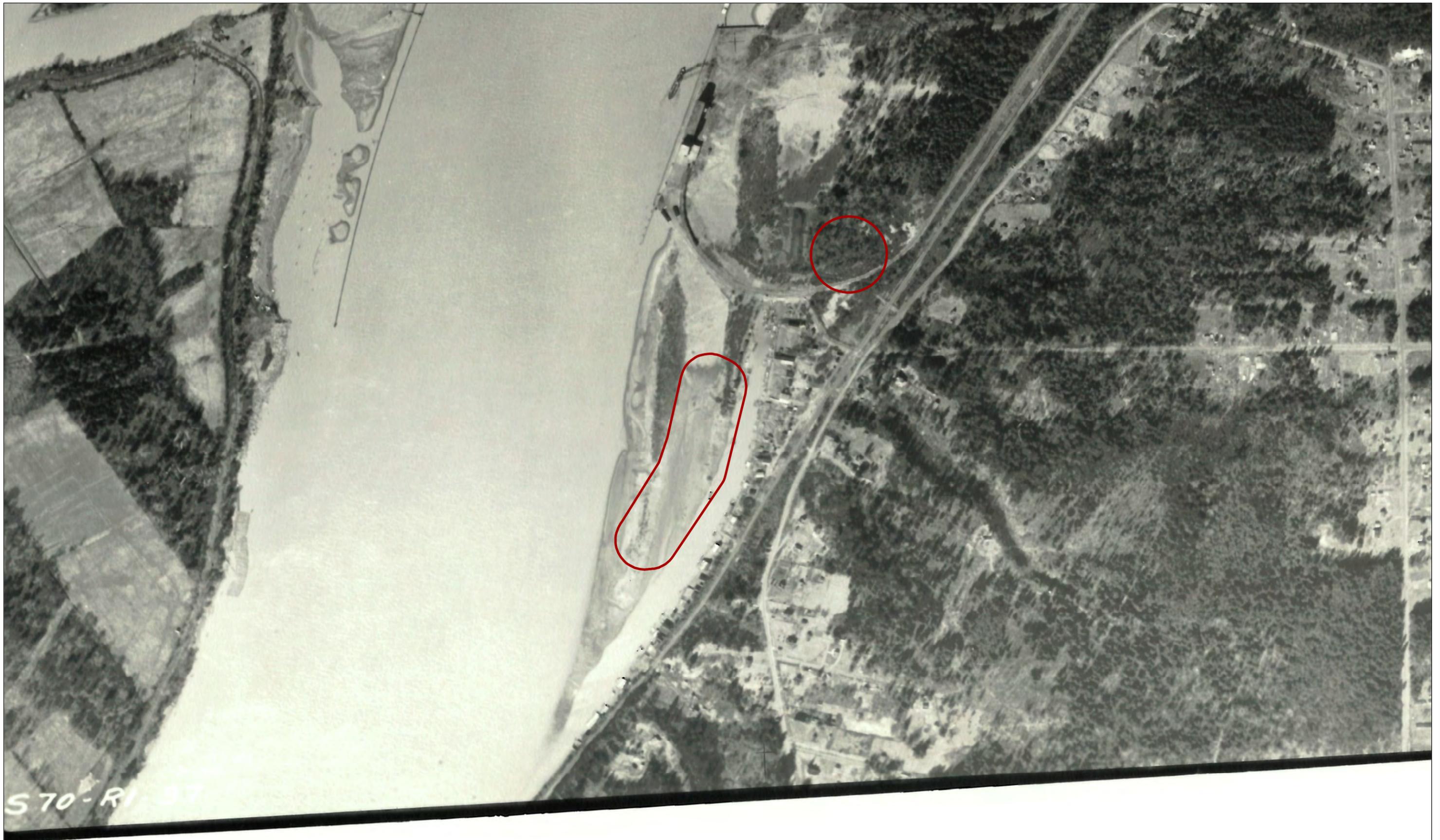
Integrated Land Management Bureau (ILMB), CDFmm TEM Mapping Project, 2006 – 2007: As one of the mappers for year two of the project, Caroline mapped the majority of Texada Island and a portion of Powell River to RISC standard. Her work passed the rigorous Ministry of Environment QA process. Caroline also participated in fieldwork and data collection.

City of Abbotsford, Rare Element Survey, McKee Peak, Abbotsford, BC, 2005 – 2006: While conducting this survey, Caroline's activities included habitat and species capability surveys, rare element counts (including vegetation and wildlife), and performing transects for selected species.

APPENDIX C
Historical Photographs of Streambank Lupine
Population #2

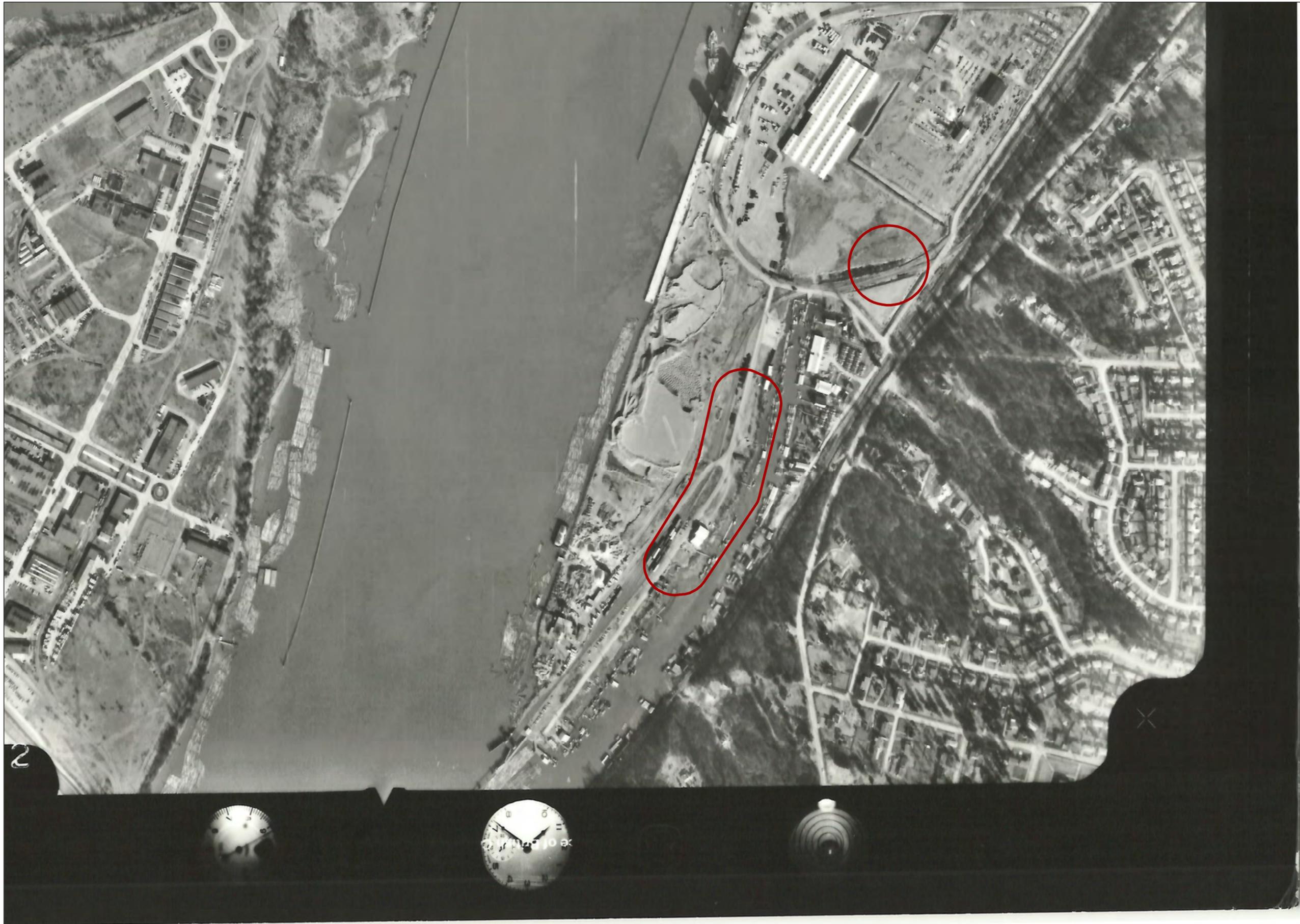






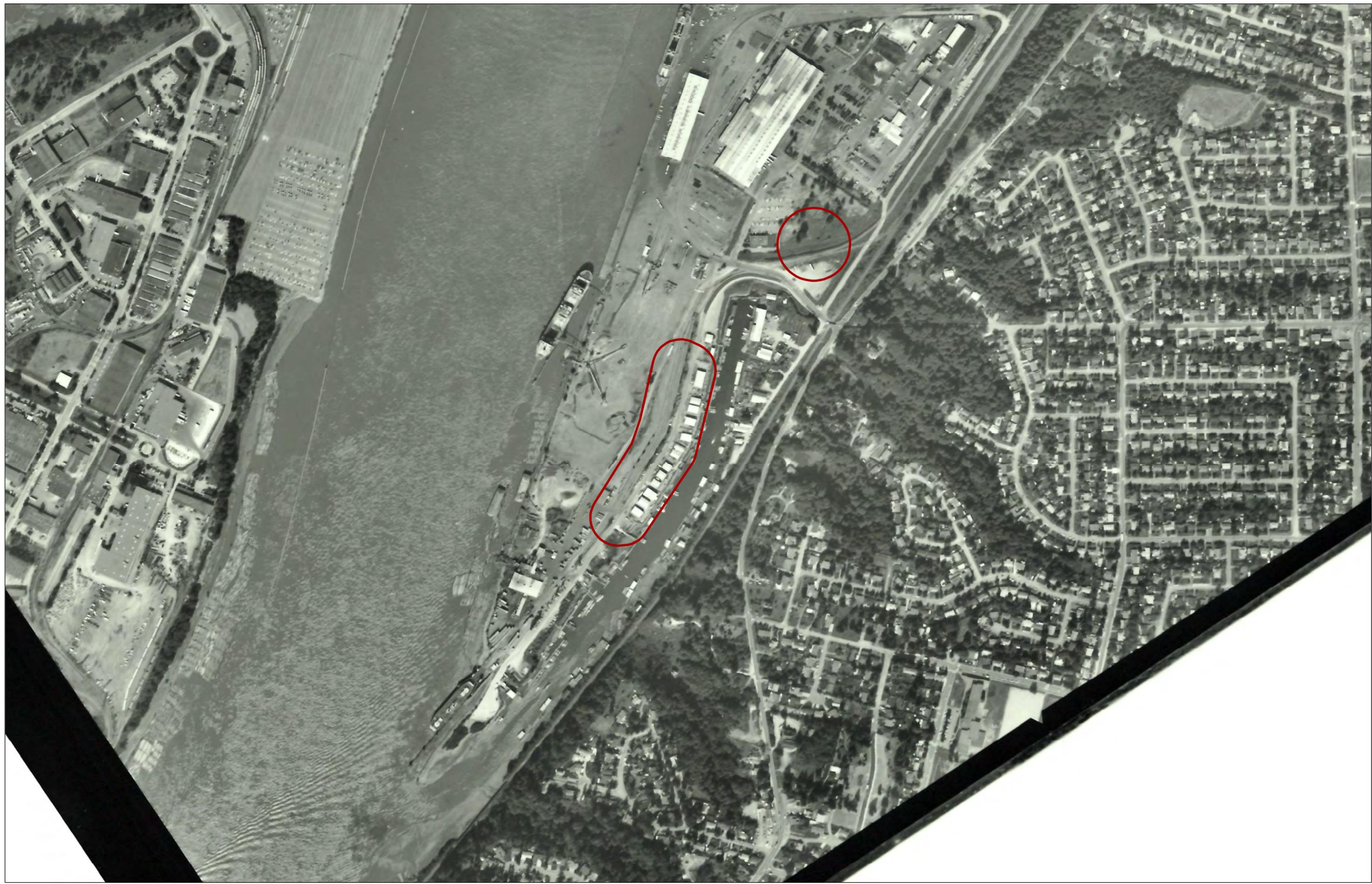






















APPENDIX D
Curriculum Vitae of Independent Monitor

MI CAELE J.W. FLORENDO, B.Sc., P.Biol., R.P.Bio.
Principal Biologist, 23 years experience

Micaele has worked both in Canada and the United States of America (U.S.A.), during the past twenty-three years on residential, commercial, industrial development projects. Her experience covers botanical inventory surveys, biological reconnaissance surveys, habitat mapping, ornithological surveys, amphibian call surveys, environmental assessments, ecological assessments, biological impacts analysis, habitat restoration, construction monitoring, design and implementation of avoidance and minimization measures, design and implementation of mitigation measures, permit applications, and watershed assessment.

Micaele's career began in British Columbia (BC) working on a variety of contracts in both fisheries and botany. Subsequently, she moved to Southern California to work as a biologist specializing in botanical resources with some experience in ornithological surveys and wetland assessments for a mid-sized environmental consulting company. In 2005, Micaele partnered with her father, David Maddison, to provide biological resource services for Maddison Consultants Ltd. Micaele has been the sole proprietor since her father's retirement in 2008. In 2009, Micaele moved to Alberta (AB) where she has completed dozens of biophysical assessments, amphibian surveys, ornithological surveys, botanical surveys and wetland classification assessments, as well as associated permit applications. Micaele is currently located on Bowen Island, BC. She continues to provide services in both BC and AB.

SELECTED PROJECTS:

Micaele conducted a habitat suitability assessment for sensitive botanical species within Dawson and Oleskiw parks along the North Saskatchewan River within the City of Edmonton. (2016).

Micaele conducted a biophysical assessments within a proposed recreational development within Medicine Hat, Alberta. This assessment included a botanical and ornithological surveys, as well as a wetland classification assessment and recommendation of avoidance and minimization measures. Sensitive botanical species identified during the assessment included *Cryptantha kelseyana* and *Phlox gracilis* ssp. *gracilis* (2015).

Micaele was retained to confirm the identification of *Lupinus* sp. in Richmond, British Columbia. (2015).

PROFESSIONAL DEVELOPMENT:

Alberta Wetland Policy: As the rubber hits the road webinar, 2014.

Demistifying Wetlands in Alberta, 2012

Botany of Calgary and Environs, 2011

Environmental and Operational Engineering Standards, 2006

Flora of the Eastern Mojave Desert, 2003

Flora of Camp San Luis Obispo, 2003

Birding By Ear, 2002 & 2003

Introductory Birding, 2002

Identification of Raptors, 2001

Fairy Shrimp – Tadpole Shrimp Identification, 2001

Flora of San Diego County, 2001

Flora of San Luis Obispo, 2000

Southwestern Willow Flycatcher (*Empidonax traillii extrimus*) workshop, 2000

Fish Habitat Assessment and Rehabilitation Prescriptions, 1996

Introduction to the Forest Practices Code, 1995

PROFESSIONAL AFFILIATIONS:

Alberta Society of Professional Biologists, number 2066

College of Applied Biology/Association of Professional Biologists of BC, number 1423

EDUCATION:

University of Victoria, Bachelors of Science (Biology), 1994

WORK HISTORY:

Maddison Consultants Ltd. 2005 – present

ECL-Envirowest Consultants Ltd. Burnaby, B.C., 2005

LSA Associates, Inc. Irvine, California, 1999 – 2005

SELECTED PROJECTS CONTINUED:

Micaele conducted a biophysical assessment of a proposed seismic program within the Manitou Sandhills Area, Saskatchewan. (2015).

Micaele conducted a rare plant assessment for a proposed water pipeline pump station north of Medicine Hat. Species considered included slender mouse-ear cress (*Halimolobos virgata*), tiny cryptantha (*Cryptantha minima*), salt marsh sand spurry (*Spergularia salina*), few-flowered aster (*Aster pauciflorus*), smooth goosefoot (*Chenopodium subglabrum*) and creeping whitlow-grass (*Draba reptans*). (2013).

Micaele completed a biophysical assessment and wetland classification assessment for several proposed road improvements in the County of Flagstaff, Alberta. These assessments include botanical, ornithological, and spring amphibian call surveys, along with recommendations for avoidance and minimization measures. In addition, Micaele obtained the environmental permitting approvals from the appropriate agencies for the proposed project including the preparation of a habitat compensation plan to offset project impacts to wetlands. (2012-2014).

Micaele completed a biophysical constraints analysis of a proposed industrial development within Alexander First Nations Reserve Number 134. This assessment included botanical and ornithological surveys, constraints analysis, and recommendation of avoidance and minimization measures. Micaele prepared the Detailed Environmental Review based on the Aboriginal Affairs and Northern Development Canada (AANDC) terms of reference. (2012-2013).

Micaele compiled a sensitive botanical species list and then conducted botanical surveys for sensitive botanical resources within the revised project boundary for the South Fraser Perimeter Road (SFPR) project of the Gateway Program, Lower Mainland, BC. Subsequently, she designed and coordinated the implementation of the mitigation plan for the rare botanical species observed within the project boundaries. (2008-2010).

Ms. Florendo was responsible for conducting focused surveys for *Trillium ovatum* within Clayton Park, Surrey, British Columbia. (2008).

WORK HISTORY CONTINUED:

BC Conservation Foundation, Surrey, B.C., 1998 – 1999

J.O. Thomas and Associates, Vancouver, B.C., 1998

EVS Environment Consultants, North Vancouver, B.C., 1997 – 1998

Andrew A. Bryant Services, Nanaimo, B.C., 1997

Malaspina University-College, Nanaimo, B.C., 1996

Coastal Geoscience Research Corporation, Victoria, B.C., 1994 – 1996

Pacific Forestry Centre, Victoria, B.C., 1992 - 1993

SELECTED PROJECT EXPERIENCE
PRIOR TO MADDISON
CONSULTANTS LTD.:

Micaele conducted focused surveys for *Lupinus rivularis* within several Fraser River Port Authority properties (2005).

Micaele conducted the background literature review, botanical surveys, general ornithological surveys, delineation of jurisdictional waters, oak tree surveys, and impact assessment for a variety of projects throughout southern and central California. In addition, Micaele designed the avoidance and minimization measures to offset impacts associated with proposed development. Furthermore, she obtained the required environmental approvals from the various regulatory agencies (2003-2005).

APPENDIX C

Summary of Wildlife Species Detected and Possibly Present, Including Provincial and Federal Listing Status, in the Wildlife Zone of Influence

Table 3 Summary of Wildlife Species Detected and Possibly Present, including Provincial and Federal Listing Status, in the Wildlife Zone of Influence

Scientific Name	Species Common Name	Listing Status		Detected
		BC List ¹	SARA Schedule 1	BHP Surveys
Birds				
<i>Fulica americana</i>	American Coot	Yellow	-	-
<i>Spinus tristis</i>	American goldfinch	Yellow	-	Yes
<i>Falco sparverius</i>	American kestrel	Yellow	-	-
<i>Turdus migratorius</i>	American robin	Yellow	-	Yes
<i>Anas americana</i>	American wigeon	Yellow	-	-
<i>Calypte anna</i>	Anna's hummingbird	Yellow	-	Yes
<i>Haliaeetus leucocephalus</i>	Bald eagle	Yellow	-	Yes
<i>Tyto alba</i>	Barn owl	Red	Special Concern	-
<i>Hirundo rustica</i>	Barn swallow	Blue	-	Yes
<i>Strix varia</i>	Barred owl	Yellow	-	-
<i>Megaceryle alcyon</i>	Belted Kingfisher	Yellow	-	Yes
<i>Thryomanes bewickii</i>	Bewick's wren	Yellow	-	-
<i>Haematopus bachmani</i>	Black oystercatcher	Yellow	-	-
<i>Cypseloides niger</i>	Black swift	Blue	-	-
<i>Poecile atricapillus</i>	Black-capped chickadee	Yellow	-	Yes
<i>Pheucticus melanocephalus</i>	Black-headed grosbeak	Yellow	-	-
<i>Setophaga nigrescens</i>	Black-throated gray warbler	Yellow	-	-
<i>Anas discors</i>	Blue-winged Teal	Yellow	-	-
<i>Euphagus cyanocephalus</i>	Brewer's blackbird	Yellow	-	-
<i>Certhia americana</i>	Brown creeper	Yellow	-	-
<i>Molothrus ater</i>	Brown-headed cowbird	Yellow	-	-
<i>Bucephala albeola</i>	Bufflehead	Yellow	-	-

Scientific Name	Species Common Name	Listing Status		Detected
		BC List ¹	SARA Schedule 1	BHP Surveys
<i>Psaltriparus minimus</i>	Bushtit	Yellow	-	-
<i>Branta canadensis</i>	Canada goose	Yellow	-	Yes
<i>Hydroprogne caspia</i>	Caspian tern	Blue	-	-
<i>Vireo cassinii</i>	Cassin's vireo	Yellow	-	-
<i>Bombycilla cedrorum</i>	Cedar waxwing	Yellow	-	-
<i>Poecile rufescens</i>	Chestnut-backed chickadee	Yellow	-	-
<i>Spizella passerina</i>	Chipping sparrow	Yellow	-	-
<i>Anas cyanoptera</i>	Cinnamon teal	Yellow	-	-
<i>Petrochelidon pyrrhonota</i>	Cliff swallow	Yellow	-	-
<i>Bucephala clangula</i>	Common goldeneye	Yellow	-	-
<i>Mergus merganser</i>	Common merganser	Yellow	-	Yes
<i>Chordeiles minor</i>	Common nighthawk	Yellow	Threatened	-
<i>Corvus corax</i>	Common raven	Yellow	-	-
<i>Geothlypis trichas</i>	Common yellowthroat	Yellow	-	Yes
<i>Accipiter cooperii</i>	Cooper's hawk	Yellow	-	-
<i>Junco hyemalis</i>	Dark-eyed junco	Yellow	-	-
<i>Phalacrocorax auritus</i>	Double-crested cormorant	Blue	-	Yes
<i>Picoides pubescens</i>	Downy woodpecker	Yellow	-	-
<i>Streptopelia decaocto</i>	Eurasian collared-dove	Exotic	-	Yes
<i>Sturnus vulgaris</i>	European starling	Exotic	-	Yes
<i>Coccothraustes vespertinus</i>	Evening grosbeak	Yellow	-	-
<i>Passerella iliaca</i>	Fox sparrow	Yellow	-	-
<i>Anas strepera</i>	Gadwall	Yellow	-	-
<i>Larus glaucescens</i>	Glaucous-winged gull	Yellow	-	Yes
<i>Regulus satrapa</i>	Golden-crowned kinglet	Yellow	-	-

Scientific Name	Species Common Name	Listing Status		Detected
		BC List ¹	SARA Schedule 1	BHP Surveys
<i>Zonotrichia atricapilla</i>	Golden-crowned sparrow	Yellow	-	-
<i>Ardea herodias fannini</i>	Great blue heron, <i>fannini</i> subspecies	Blue	Special Concern	Yes
<i>Bubo virginianus</i>	Great horned owl	Yellow	-	-
<i>Aythya marila</i>	Greater scaup	Yellow	-	-
<i>Butorides virescens</i>	Green heron	Blue	-	-
<i>Anas crecca</i>	Green-winged teal	Yellow	-	-
<i>Empidonax hammondi</i>	Hammond's flycatcher	Yellow	-	-
<i>Catharus guttatus</i>	Hermit thrush	Yellow	-	-
<i>Lophodytes cucullatus</i>	Hooded merganser	Yellow	-	-
<i>Haemorhous mexicanus</i>	House finch	Yellow	-	Yes
<i>Passer domesticus</i>	House sparrow	Exotic	-	Yes
<i>Vireo huttoni</i>	Hutton's vireo	Yellow	-	-
<i>Charadrius vociferus</i>	Killdeer	Yellow	-	-
<i>Aythya affinis</i>	Lesser scaup	Yellow	-	-
<i>Geothlypis tolmiei</i>	MacGillivray's warbler	Yellow	-	-
<i>Anas platyrhynchos</i>	Mallard	Yellow	-	Yes
<i>Cistothorus palustris</i>	Marsh wren	Yellow	-	-
<i>Falco columbarius</i>	Merlin	Yellow	-	-
<i>Larus canus</i>	Mew gull	Yellow	-	-
<i>Zenaida macroura</i>	Mourning dove	Yellow	-	-
<i>Cygnus olor</i>	Mute swan	Exotic	-	-
<i>Colaptes auratus</i>	Northern flicker	Yellow	-	-
<i>Accipiter gentilis</i>	Northern goshawk	Yellow	-	-
<i>Circus cyaneus</i>	Northern harrier	Yellow	-	-
<i>Anas acuta</i>	Northern pintail	Yellow	-	-

Scientific Name	Species Common Name	Listing Status		Detected
		BC List ¹	SARA Schedule 1	BHP Surveys
<i>Stelgidopteryx serripennis</i>	Northern rough-winged swallow	Yellow	-	-
<i>Anas clypeata</i>	Northern shoveler	Yellow	-	-
<i>Corvus caurinus</i>	Northwestern crow	Yellow	-	Yes
<i>Contopus cooperi</i>	Olive-sided flycatcher	Blue	Threatened	-
<i>Oreothlypis celata</i>	Orange-crowned warbler	Yellow	-	-
<i>Pandion haliaetus</i>	Osprey	Yellow	-	Yes
<i>Troglodytes pacificus</i>	Pacific wren	Yellow	-	-
<i>Empidonax difficilis</i>	Pacific-slope flycatcher	Yellow	-	-
<i>Phalacrocorax pelagicus</i>	Pelagic cormorant	Yellow	-	-
<i>Falco peregrinus anatum</i>	Peregrine falcon, <i>anatum</i> subspecies	Red	Threatened	-
<i>Podilymbus podiceps</i>	Pied-billed grebe	Yellow	-	Yes
<i>Cephus columba</i>	Pigeon guillemot	Yellow	-	-
<i>Dryocopus pileatus</i>	Pileated woodpecker	Yellow	-	-
<i>Spinus pinus</i>	Pine siskin	Yellow	-	-
<i>Haemorhous purpureus</i>	Purple finch	Yellow	-	-
<i>Progne subis</i>	Purple martin	Blue	-	-
<i>Loxia curvirostra</i>	Red crossbill	Yellow	-	-
<i>Mergus serrator</i>	Red-breasted merganser	Yellow	-	Yes
<i>Sitta canadensis</i>	Red-breasted nuthatch	Yellow	-	-
<i>Sphyrapicus ruber</i>	Red-breasted sapsucker	Yellow	-	-
<i>Vireo olivaceus</i>	Red-eyed vireo	Yellow	-	-
<i>Buteo jamaicensis</i>	Red-tailed hawk	Yellow	-	Yes
<i>Agelaius phoeniceus</i>	Red-winged blackbird	Yellow	-	Yes
<i>Larus delawarensis</i>	Ring-billed gull	Yellow	-	-
<i>Columba livia</i>	Rock pigeon	Exotic	-	Yes

Scientific Name	Species Common Name	Listing Status		Detected
		BC List ¹	SARA Schedule 1	BHP Surveys
<i>Regulus calendula</i>	Ruby-crowned kinglet	Yellow	-	-
<i>Selasphorus rufus</i>	Rufous hummingbird	Yellow	-	-
<i>Passerculus sandwichensis</i>	Savannah sparrow	Yellow	-	-
<i>Accipiter striatus</i>	Sharp-shinned hawk	Yellow	-	-
<i>Melospiza melodia</i>	Song sparrow	Yellow	-	Yes
<i>Porzana carolina</i>	Sora	Yellow	-	-
<i>Actitis macularius</i>	Spotted sandpiper	Yellow	-	-
<i>Pipilo maculatus</i>	Spotted towhee	Yellow	-	Yes
<i>Cyanocitta stelleri</i>	Steller's jay	Yellow	-	-
<i>Catharus ustulatus</i>	Swainson's thrush	Yellow	-	-
<i>Larus thayeri</i>	Thayer's gull	Yellow	-	-
<i>Setophaga townsendi</i>	Townsend's warbler	Yellow	-	-
<i>Tachycineta bicolor</i>	Tree swallow	Yellow	-	-
<i>Cathartes aura</i>	Turkey vulture	Yellow	-	-
<i>Ixoreus naevius</i>	Varied thrush	Yellow	-	-
<i>Chaetura vauxi</i>	Vaux's swift	Yellow	-	-
<i>Tachycineta thalassina</i>	Violet-green swallow	Yellow	-	Yes
<i>Rallus limicola</i>	Virginia rail	Yellow	-	-
<i>Vireo gilvus</i>	Warbling vireo	Yellow	-	-
<i>Aechmophorus occidentalis</i>	Western grebe	Red	-	-
<i>Piranga ludoviciana</i>	Western tanager	Yellow	-	-
<i>Contopus sordidulus</i>	Western wood-pewee	Yellow	-	-
<i>Zonotrichia leucophrys</i>	White-crowned sparrow	Yellow	-	Yes
<i>Empidonax traillii</i>	Willow flycatcher	Yellow	-	Yes
<i>Gallinago delicata</i>	Wilson's snipe	Yellow	-	-

Scientific Name	Species Common Name	Listing Status		Detected
		BC List ¹	SARA Schedule 1	BHP Surveys
<i>Cardellina pusilla</i>	Wilson's warbler	Yellow	-	-
<i>Aix sponsa</i>	Wood duck	Yellow	-	-
<i>Setophaga petechia</i>	Yellow warbler	Yellow	-	Yes
<i>Setophaga coronata</i>	Yellow-rumped warbler	Yellow	-	-
Terrestrial Mammals				
<i>Castor canadensis</i>	American beaver	Yellow	-	-
<i>Neovison vison</i>	American mink	Yellow	-	-
<i>Eptesicus fuscus</i>	Big brown bat	Yellow	-	-
<i>Rattus norvegicus</i>	Brown rat	Yellow	-	-
<i>Myotis californicus</i>	Californian myotis	Yellow	-	-
<i>Sorex cinereus</i>	Cinereus shrew	Yellow	-	-
<i>Canis latrans</i>	Coyote	Yellow	-	Yes ²
<i>Sorex monticolus</i>	Dusky shrew	Yellow	-	-
<i>Sylvilagus floridanus</i>	Eastern cottontail	Exotic	-	Yes ²
<i>Sciurus carolinensis</i>	Eastern grey squirrel	Exotic	-	-
<i>Mus musculus</i>	House mouse	Exotic	-	-
<i>Myotis lucifugus</i>	Little brown myotis	Yellow	Endangered	-
<i>Peromyscus maniculatus</i>	North American deer mouse	Yellow	-	-
<i>Lontra canadensis</i>	North American river otter	Yellow	-	Yes
<i>Peromyscus keeni</i>	Northwestern deer mouse	Yellow	-	-
<i>Sorex bendirii</i>	Pacific water shrew	Red	Endangered	-
<i>Procyon lotor</i>	Raccoon	Yellow	-	-
<i>Rattus rattus</i>	Roof rat	Exotic	-	-
<i>Myodes gapperi occidentalis</i>	Southern red-backed vole	Red	-	-
<i>Mephitis mephitis</i>	Striped skunk	Yellow	-	-
<i>Microtus townsendii</i>	Townsend's vole	Yellow	-	Yes ²

Scientific Name	Species Common Name	Listing Status		Detected
		BC List ¹	SARA Schedule 1	BHP Surveys
<i>Marmota flaviventris</i>	Yellow-bellied marmot	Yellow	-	Yes
<i>Myotis yumanensis</i>	Yuma myotis	Yellow	-	-
Amphibians and Reptiles				
<i>Lithobates catesbeianus</i>	Bull frog	Exotic	-	-
<i>Thamnophis sirtalis</i>	Common gartersnake	Yellow	-	-
<i>Lithobates clamitans</i>	Green frog	Exotic	-	Yes
<i>Rana aurora</i>	Northern red-legged frog	Blue	Special Concern	-
<i>Thamnophis ordinoides</i>	Northwestern gartersnake	Yellow	-	-
<i>Ambystoma gracile</i>	Northwestern salamander	Yellow	-	Yes
<i>Thamnophis elegans</i>	Terrestrial gartersnake	Yellow	-	-

Notes: ¹ BC List – CDC ranking: Red = Extirpated, Endangered or Threatened, Blue = Special Concern, Yellow = Secure, Exotic = non-native

² Species was not directly observed but sign of the species was documented (e.g., scat)

APPENDIX D
**Project Interaction with Potential Environmental
Components**

Project Interaction with Potential Environmental Components

Project Activity	Component					
	Vegetation		Wildlife			
	Plant Communities	Conservation Concern	Birds	Mammals	Amphibians	Conservation Concern
Construction						
Demolition of existing infrastructure (including hazardous materials management)	0	0	2	2	0	2
Vegetation removal	2	2	2	2	2	2
Installation of temporary construction trailers and infrastructure (including lighting, petroleum product storage, and materials laydown)	0	0	1	1	0	1
Ground improvements (pre-loading and upland stone columns/piles)	0	0	2	1	0	1
Installation of marine piles	0	0	2	2	0	2
Seismic upgrades for the shiploader (i.e., densification and upland piling)	0	0	2	1	0	1
Excavation	0	0	1	2	0	1
Construction of product unloading facility, storage shed, material handling, and transfer system	0	0	2	1	0	1
Installation of the shiploader	0	0	2	1	0	1
Construction of terminal rail loop	2	2	2	2	2	1
Installation of utilities and stormwater management facilities	0	0	1	1	0	1
Disposal of construction waste (i.e., materials and water)	0	0	0	0	0	0
Transport of people and materials to and from the site	0	0	0	0	0	0
Operation						
Rail traffic	0	0	2	2	0	2
Maintenance of rail rights of way	0	2	0	0	0	0
Transfer and storage of product at the site	0	0	0	0	0	0
Vessel mooring and loading	0	0	1	1	0	1
Marine vessels traffic	0	0	1	1	0	1
Transport of people and materials to and from the site	0	0	0	0	0	0
Disposal of operation waste and off-spec material	0	0	0	0	0	0
Site lighting	0	0	0	0	0	0
Storage of fuels or petroleum products for equipment	0	0	0	0	0	0
Stormwater management	0	0	0	0	1	0

APPENDIX E
Vegetation Management Plan Outline

1.0 VEGETATION MANAGEMENT PLAN OUTLINE

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, enhancement of habitat for wildlife species, and prevention of spread of noxious plant species.

General guidelines for vegetation removal and replanting are as provided below.

1.1 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*).

1.2 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.

1.3 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 (**Table 1**).
- 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 1 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