

BASIC ENVIRONMENTAL IMPACT ANALYSIS GREENBURN LAKE DAM SOUTH PENDER ISLAND, BC



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Parks Canada Agency

MARCH 2015
ISSUED FOR REVIEW
FILE: K13103348-01

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LIMITATIONS OF REPORT

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1.0 INTRODUCTION

Tetra Tech EBA Inc. (Tetra Tech EBA) has been retained by the Parks Canada Agency (PCA) to complete an Environmental Impact Analysis (EIA) for the proposed rehabilitation of the Greenburn Lake Dam on South Pender Island in Gulf Islands National Park Reserve (GINPR), herein referred to as “the Project”.

1. Project Title	Greenburn Lake Dam Rehabilitation – Gulf Islands National Park Reserve	
2. Project Location	Gulf Islands National Park Reserve (South Pender Island), BC E 484515, N 5398870 (Zone 10)	
3. Project Site(s)	The dam is located at Greenburn Lake in the Gulf Islands National Park Reserve on South Pender Island, approximately 17.4 km to the north east of Sidney, BC. See Attached Figures.	
4. Proponent	Alex (Sandy) Cummings, P. Eng. PMP – Civil Engineer, Strategic Asset Management Western and Northern Region	
5. Proponent Contact Information	1300, 635 - 8th Avenue S.W., Calgary T2P 3M3 Sandy.Cummings@pc.gc.ca Telephone: 403-292-4355 Cellular Telephone: 403-808-4453	
6. Project Dates	Commencement: 2015-06-01	Completion: 2015-10-31
7. Internal Project File #	5P420-14-5097/A	

2.0 PROJECT DESCRIPTION

The Project is proposed to address several issues that were identified in the 2012 Dam Safety Review (DSR) and generally includes:

- Dam removal and reconstruction (including temporary coffer dam installation for work area isolation);
- Spillway rehabilitation (includes cast-in-place concrete works);
- Access road upgrades (gravelling surface, minor brushing to control encroaching vegetation); and
- Backfilling pond at South Pender Fire Hall and constructing bypass channel.

Section 2.3 includes additional details.

2.1 Project Location

The attached Figure 1 illustrates regional location of the Project. The Project is located on South Pender Island within the Greenburn Lake property of GINPR, approximately 17.4 km to the northeast of Sidney, BC at (NAD83) co-ordinates E 484515, N 5398870 (Zone 10).

The Greenburn Lake property of GINPR occupies approximately 118 ha. Figures 2a and 2b illustrate the localized work areas where the Project will occur on the property (herein referred to as “Project Work Areas”). The following table summarizes each Project Work Area, its location and approximate footprint:

Table 2-1: Project Work Areas

Work Area	Location	Approximate Footprint*
South Pender Fire Hall Outlet Pond and Bypass Channel	E 483833 N 5399115	0.0596 ha Pond = 560 m ² (approximately 32 m x 17.5 m) Channel = 36 m ² (approximately 36 m x 1 m)
Existing Access Road Upgrades	Start: E 483783 N 5399134 End: E 484568 N 5398914	5 ha (approximately 1 km x 50m)
Temporary Access Road	Start: E 484348 N 5398972 End: E 484485 N 5398888	1.25 ha (1 ha on 200 m x 50 m portion to NW and 0.25 on 50 m x 50 m portion to N)
Dam Rehabilitation Works	E 484515, N 5398870	0.8 ha (50 m radius from centre of dam)
*Approximate footprint is an estimate of the total work area, not necessarily an area of "new disturbance"		

2.2 Project Rationale

The Greenburn Lake Dam was subject to a Dam Safety Review (DSR) in accordance with the requirements of the PCA Directive for Dam Safety Program (DDSP) 2009 and the Canadian Dam Association (CDA) Dam Safety Guidelines (DSG) 2007. The Greenburn Lake Dam DSR, completed July 24, 2012 by Tetra Tech EBA, identified several issues with the dam and associated infrastructure:

- Considerable tree growth on both slopes of the dam may have compromised its structural integrity. Investigation to the extent of root penetration, a plan to remove the trees and remediate any damage was recommended.
- Seepage was noted around the spillway, which showed signs of deterioration. An investigation into the source of the seepage and the appropriate corrective measures required to fix the seepage issues and to repair/replace the spillway was recommended.
- The freeboard available at the dam was deemed to be insufficient.
- The road access into the dam should be redesigned to improve vehicle access into the dam during times of emergency.
- The downstream pond near the South Pender Fire Station should be filled-in with a channel and berm constructed adjacent to the building to deflect any water flow coming from the dam in the case of a breach or dam failure.

2.3 Project Details

The Project generally includes vegetation clearing and grubbing, grading, excavation, stockpiling, backfilling, concrete works, and machinery operation. It is expected that the Project will commence in early June 2015 and be completed by end of October 2015.

Typical construction methods and equipment will likely be utilized. Likely works associated with the Project include:

Site Preparation:

- Tender and award project.
- Contractor prepares an Environmental Management Plan (EMP) (which includes, but is not limited to Pollution Management, Erosion and Sediment Control, Fire Management, Wildlife Interaction Management, Waste Management, Equipment Maintenance and Fuel Management, Relics and Antiquities, and Protection of work limits.
- Mobilize equipment to site and set-up temporary facilities (fuel storage area, port-a-potty, temporary material lay-down area).
- Set up traffic control, safety signage on Gowland Point Road.

Construction:

- Mechanical clearing and grubbing of designated areas using standard heavy equipment (e.g., faller/buncher, excavator, dozer, rock truck, grader, roller, etc.) or by hand.
- Merchantable timber will be removed from site. Clearing and grubbing debris will be loaded and hauled to an appropriate disposal site.
- Organic material/topsoil will be stripped and stockpiled for future use on-site (i.e., for decommissioning works).
- Traffic control will be implemented throughout construction. Traffic will experience delays.

Dam Reconstruction:

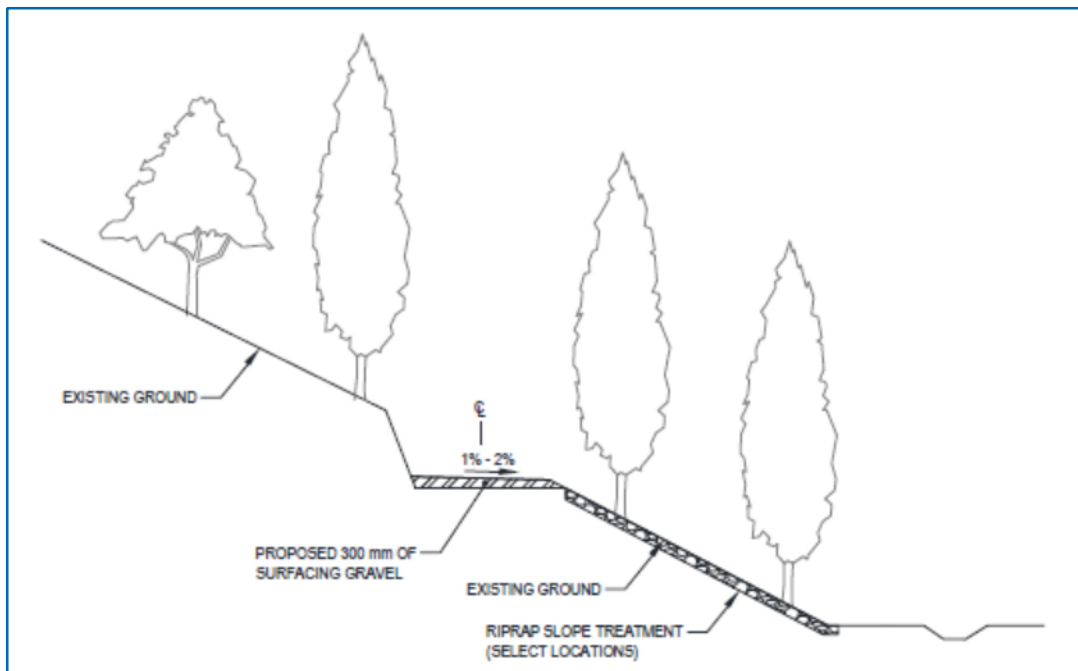
- See Figures 3a and 3b for existing conditions and proposed works, respectively.
- Install a temporary coffer dam upstream of the existing dam (approximately where the original dam was located). This may be sand bag or inflatable “aqua dam”.
- Fish and amphibian salvage will be conducted in work area between coffer dam and dam prior to de-watering.
- Isolation will be maintained throughout the Project by pumping water to the upstream side of the coffer dam. If the water is heavily laden with sediments it will be pumped to a well-vegetated upland location or temporary holding pond prior to being allowed to re-enter Greenburn Lake.
- Downstream water licence requirements will be maintained throughout the Project.
- Excavate the shell material from the downstream slope and stockpile for reuse.
- Prepare a 3 m wide base at the downstream toe of the existing core.
- Place and compact low permeability material to form a 3 m wide new ‘core’ downstream of the existing one.
- Place a filter against the downstream side of the new core.
- Place a downstream shell with a 2.5H:1V slope.
- While dewatered the upstream slope can be armoured with rip-rap.

- Place a new shut off valve on the low level outlet (LLO) upstream of the dam with a bridge to the valve stem.

Spillway Rehabilitation:

- Remove existing spillway (break concrete, remove from site).
- New spillway structure will be cast-in-place concrete. South wall of new spillway will be in the same location as existing, however the north wall will be 4 m wider. It will also be re-aligned to provide better entrance conditions.
- Install a vertical cut-off wall beneath the spillway structure in line with the cut-off wall in the dam embankment to reduce seepage.
- Current geotechnical information indicates the north side of the chute may need a small amount of mass fill concrete to meet the BC-CRD requirement that the spillway be “constructed on undisturbed ground, not on embankment fill”.
- The conveyance (chute) portion will be steepened to 3H:1V to match the reconstructed banks. The walls of the new chute will be designed to meet the freeboard requirements.

Access Road Upgrades:



- Clear encroaching shrubs and brush to improve vehicle clearance and passage. Clearing may occur mechanically or by hand.
- Place locally-sourced 300 mm gravel over existing road surface. Road will then be graded and compacted with a cross-fall to reduce erosion potential.
- Place rip-rap (approximately 150 m²) at select locations on downslope side of road to reduce erosion and sedimentation potential.

Outlet Pond & Bypass Channel:

- See Figures 4a and 4b for proposed channel design.
- Backfill “Pond 3” using locally sourced materials. Cover with topsoil. Natural re-vegetation is preferred but temporary stabilization with an approved, weed-free grass mixture may be required.
- Excavate a bypass channel. Channel will be lined with various classes of rip-rap, as per engineering design.
- Upgrade existing 600 mm culvert under Greenburn Dam Access Road to a 900 mm culvert.

Operation/Decommissioning:

- All disturbed areas will be re-contoured to match natural surroundings. These areas will be stabilized by placing topsoil (from stripping) and be seeded with an approved, weed-free grass mixture.
- Contractor will remove all temporary facilities and equipment for demobilization at end of Project.
- All temporary traffic control and road signs will be removed.
- Access road will be maintained using typical heavy equipment (e.g., snowplows, graders etc.) as required. No decommissioning of the roadway is expected.
- Dam will be maintained using typical heavy equipment (e.g., excavator) as required. No decommissioning of the dam is expected.

3.0 OPTIONS CONSIDERED

Prior to choosing the Project activities, as described in Section 2.3, several alternatives to each component was explored. Tetra Tech EBA conducted preliminary design assessments for each of the Project components in February 2015 which included developing design alternative and evaluating the advantages and disadvantages of each. The following table summarizes the options considered:

Table 3-1: Review of Greenburn Lake Dam Design Options

Design Option	General Description	Comments
Dam Rehabilitation		
Diaphragm Wall	<ul style="list-style-type: none"> Excavation of a slot or trench in the material(s) to be sealed (foundation and/or dam body) and the subsequent filling of this trench with an impervious material. 	<ul style="list-style-type: none"> Pros: <ul style="list-style-type: none"> Shortest construction schedule. Cons: <ul style="list-style-type: none"> Most Expensive Option. Could damage/rupture the water supply pipe through the dam during construction. Requires the use of a specialty contractor and mobilization of specialty equipment to the island. Dam still needs additional fill material to achieve minimum crest width and free board.
Reconstructed Dam	<ul style="list-style-type: none"> Rebuild dam: draw down lake/install coffer dam, excavate downstream slope, prepare base, place and compact fill, place filter on downstream slope, place downstream shell, armour upstream slope and place new shut off valve on low level outlet. 	<ul style="list-style-type: none"> Pros: <ul style="list-style-type: none"> Most robust long term solution. Could be built by local contractor(s). Can inspect foundation and abutment conditions during construction. Cons: <ul style="list-style-type: none"> Some existing structures need to be removed. Longest construction schedule. Construction schedule influenced by periods of inclement weather.
Upstream Liner	<ul style="list-style-type: none"> Remove existing upstream shell material and place geomembrane over clay core and extend into reservoir. Reconstruct upstream shell to provide protective layer. 	<ul style="list-style-type: none"> Pros: <ul style="list-style-type: none"> Could be built by local contractor(s). Cheapest option Cons: <ul style="list-style-type: none"> Difficult to construct water tight seals around conduits passing through the embankment Dam still needs additional fill material to achieve minimum crest width and free board.
Dam Spillway Rehabilitation (Drop Spillway)		
Chute	<ul style="list-style-type: none"> Demolish the existing chute and replace with a 4 m wide free overflow chute spillway (cast in place concrete). 	<ul style="list-style-type: none"> Most expensive option but longest design life. Equipment and materials available. Longest construction timeline.
Sheet Pile	<ul style="list-style-type: none"> Demolish existing chute and replace with a 4 m wide vertical drop structure (drop using sheet pile and rip-rap). 	<ul style="list-style-type: none"> Sheet pile must be imported. Shortest construction timeline.
Gabions	<ul style="list-style-type: none"> Demolish existing chute and replace with a 4 m wide vertical drop structure (marine quality gabion mesh baskets filled with stone). 	<ul style="list-style-type: none"> Cheapest option. Gabions must be imported. Requires the most maintenance.

Existing Access Road Upgrades		
Brush Clearing	<ul style="list-style-type: none"> Remove low-lying shrubs and brush. 	<ul style="list-style-type: none"> Would to help vehicles travel the length of the access road without having to slow down to navigate these obstacles. Relatively inexpensive option.
Add Surface Gravel And Grade / Compact Road Surface	<ul style="list-style-type: none"> Place 300 mm of surfacing gravel across the width of the roadway footprint then graded and compacted to reduce erosion. To help ensure water run-off does not create erosion issues on the downslope side of the road, riprap slope treatment (approximately 1.5 m wide by 0.3 m deep) will be installed to the bottom of the slope in select locations. 	<ul style="list-style-type: none"> Gives vehicles greater traction and eliminate flat areas with ponding water.
Bituminous Surface Treatment (Bst)	<ul style="list-style-type: none"> Cap the surface gravel placed in Gravel Option with a bituminous surface treatment (BST). 	<ul style="list-style-type: none"> BST provides a superior gripping texture and increased skid resistance compared with gravel surfaces and will resist surface erosion and damage from vehicle tires reducing maintenance costs compared to the gravel surface. Requires the completion of Gravel Option.
Widen Access And Improve Sight Lines	<ul style="list-style-type: none"> Widening/regrading of the access road at its intersection with Gowland Point Road to allow drivers of vehicles the opportunity to attain a greater vehicle entry speed before the steep grades. 	<ul style="list-style-type: none"> Requires lengthening the existing 600 mm Ø CSP culvert, widening the existing gate from 4.5 m to ~ 6.5 m and clearing existing trees on the opposite side of Gowland Point Road. This will give drivers the opportunity to see any oncoming traffic before they cross Gowland Point Road and enter the access road. Relatively small cost.
Install A MSE Retaining Wall To Provide A Consistent Road Grade	<ul style="list-style-type: none"> Install a 70 m long MSE retaining wall. 	<ul style="list-style-type: none"> 2 m high and would be constructed from SierraScape® or a similar facing product, secured with geogrid, and backfilled with structural fill. Provides more a consistent and reduced maximum road gradient (will increase gradient in some areas but reduce it in others – which may not net a benefit). High construction cost.
No Road Improvements, Use 4x4 Vehicle	<ul style="list-style-type: none"> No works required. 	<ul style="list-style-type: none"> Only 4 x 4 vehicles will be able to utilize access road. A 4 x 4 vehicle may need to be stored on the island for emergency access purposes.
Pond Outflow		
Bypass Channel	<ul style="list-style-type: none"> Decommission existing pond by filling in. Construct appropriately sized bypass channel and line with riprap. Upgrade Gowland Point Road culvert to 900 mm. 	<ul style="list-style-type: none"> 1:200 year design flow estimated to be 1.6 m³/s; proposed design Current assessment did not include the drainage ditch along Gowland Point Road. While downstream conveyance would likely be improved, a hydraulic assessment of the entire system is recommended to protect downstream properties.

4.0 METHODS

4.1 Biophysical Data Collection

An information review for the area of the proposed works was conducted as a desktop exercise. Multiple sources were reviewed to establish baseline information for species and ecosystems historically recorded on site, including:

- Parks Canada Biotics Web Explorer (Parks Canada, 2011);
- BC Conservation Data Centre (CDC) Internet Mapping Service (BC CDC 2012);
- iMapBC (DataBC, 2015);
- BC Species and Ecosystems Explorer (BC CDC 2014);
- BC MOE Fisheries Information Summary System (FISS) databases (BC MOE 2015);
- Biogeoclimatic Ecosystem Classification (BC Ministry of Forest and Range, 2011);
- Sensitive Ecosystems Inventory of East Vancouver Island and Gulf Islands (Ward et al. 1998; McPhee et al. 2000; Environment Canada et al. 2004);
- Government of Canada Species at Risk (SAR) Public Registry (Environment Canada 2012); and
- Liaison with PCA staff and review of PCA reports.

On December 3, 2014 two Tetra Tech EBA biologists (Ms. Shawneen Walker and Ms. Kristy Gabelhouse) visually assessed the Project Work Areas to identify potential sensitive biological resources (e.g., fish, wildlife or rare vegetation habitats). Mr. Todd Shannon of PCA was also present during the site visit.

Environmental features of the Project Work Areas were recorded using modified methodology of the BC Resource Information Standards Committee *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory* and the BC Ministry of Environment *Field Manual for Describing Terrestrial Ecosystems*.

Representative site photos are provided in Appendix B.

4.2 Environmental Component Interactions and Impact Determination

Following the collection of environmental information, potential environmental components (EC), including biological resources (vegetation and wildlife), cultural and historical resources and visual and aesthetic values in the Project Work Areas were reviewed to determine if they are subject to stakeholder or regulatory concern.

Selection of ECs was based on ecological importance and/or value to the existing environment, the relative sensitivity of components to potential project influences and their relative social, cultural, or economic importance. Based on these criteria and the professional judgement of the study team, Tetra Tech EBA professionals used this information to determine the final EC selection for the purposes of the environmental impact analysis for this project.

Table 4-1: Selected Environmental Components

EC	Rationale
Vegetation	<ul style="list-style-type: none"> Protected by regulation (SARA 2012). Sensitive species potentially present. Public interest. Ecological protection is part of PCA mandate.
Terrestrial Wildlife	<ul style="list-style-type: none"> Protected by regulation (SARA 2012, Migratory Birds Convention Act). Sensitive species potentially present. Public interest. Ecological protection is part of PCA mandate.
Water (Fish and Aquatic Habitat)	<ul style="list-style-type: none"> Protected by regulation (Fisheries Act 2012). Public interest. Ecological protection is part of PCA mandate.
Cultural Resources	<ul style="list-style-type: none"> Known archaeological sites present (Perry 2013).
Visitor Experience	<ul style="list-style-type: none"> Public interest. Quality visitor experience is part of PCA mandate.

Project activities that may interact with ECs were identified by investigating the various components of the Project that have potential effect pathways to the receiving environment. The potential effects pathways for this Project are related to:

- Clearing and grubbing (vegetation removal and soil disturbance);
- Earthworks (Excavating, grading and dredging);
- Stockpiling and backfilling;
- Upstream isolation at dam (coffer dam installation and lake draw-down);
- Machinery operation; and
- Concrete works.

The project pathways were compared to potential ECs and the interactions were documented for further consideration in the EIA process.

5.0 ENVIRONMENTAL COMPONENTS LIKELY TO BE AFFECTED

5.1 Vegetation

The Biogeoclimatic Ecosystem Classification (BEC) is a land classification system that groups similar ecosystems based on climate, soils and vegetation. This classification system was developed in British Columbia and is widely used as a framework for resource management as well as for scientific research. Vegetation of mature ecosystems is emphasized in the BEC as it is considered the best indicator of the combined influence of the environmental factors affecting a site.

According to BEC mapping (BC Ministry of Forest and Range, 2011), the Project Area is within the Coastal Douglas Fir moist maritime (CDF mm) zone. The CDF mm is restricted to low elevations along southeast Vancouver Island, Gulf Islands and coastal mainland, generally ranging from sea level to 150 m elevation. Forests are dominated by Douglas fir with components of Grand Fir and Western Red Cedar. These forests are typically second growth regeneration following turn of the century logging. The understory is dominated by Salal, Dull Oregon Grape and Ocean Spray. Drier sites are characterized by the presence of Gary Oak and Arbutus.

Golumbia and Mercer 2008 indicates that 38 species of vascular plants have been observed at Greenburn Lake, with approximately one-third of the species being non-native grasses and forbs. Bearded Sedge, a “rare plant of lake margin habitats” (Golumbia and Mercer 2008) was also encountered. Vegetation observed during the site visit was typical of the CDFmm however, invasive and non-native species, such as Scotch broom and Reed Canary Grass, are also present. Most of the observed areas were dominated by mature second growth coniferous forest with a fairly dense understory. Some open areas are present immediately around the dam but for the most part, coniferous forest and shrubs are present right to the shoreline around Greenburn Lake. The riparian area along Greenburn Creek, downstream of the dam, was dominated by shrub and grass species. This area may experience seasonal inundation, largely due to overland flows as the dam regulates creek flow.

No rare plant survey was specifically conducted during the site visit. A desktop review of several databases was conducted to determine plant species at risk potentially present near the Project Work Areas:

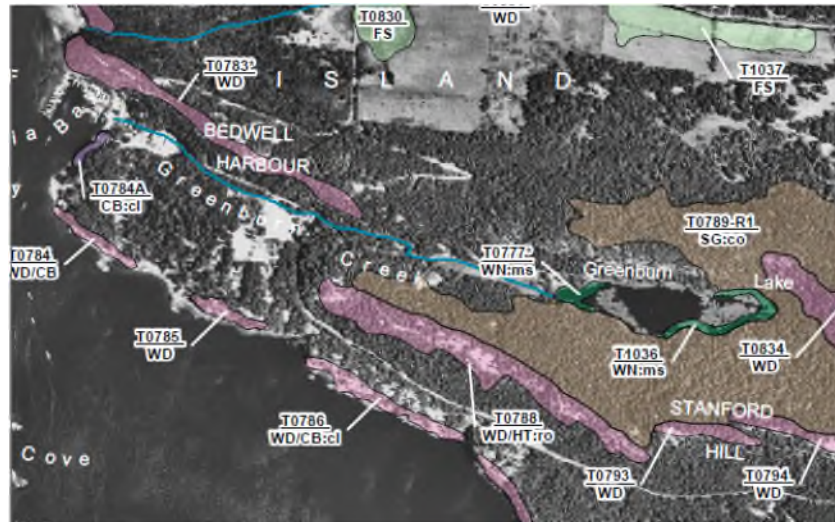
- **BC Species and Ecosystem Explorer** indicates a total of 56 plant species of management concern that have potential to occur in the regional context of the Project Area. Search results, including search criteria, are included in Appendix C. Of the species identified, 18 species are listed under the Species at Risk Act (SARA) Schedule 1 as Threatened or Endangered¹.
- **BC CDC Internet Mapping Service** indicates that two non-sensitive plant species, Spanish Clover and Batwing Vinyl, have been observed within a 1km radius of the dam. Spanish clover was last observed in 1974 3.2 km south of Mount Norman. Only the Batwing Vinyl is a SARA Schedule 1 species but the last observation date was 1974 south of Mount Norman on South Pender Island.

This mapping service also indicates that Douglas-fir/dull Oregon-grape ecological community is present over most of South Pender Island, including the Project Work Areas. This ecological community is provincially red-listed and is considered sensitive because what little remains of this type of mature, coastal forest is highly fragmented and subject to development.

Search results, including maps of Non-Sensitive and Masked Sensitive occurrences, are included in Appendix C.

- **Parks Canada Biotics Web Explorer** indicates 12 SARA Schedule 1 Threatened or Endangered plant species within GINPR with only six listed as regularly occurring. Search results are included in Appendix C.
- **Sensitive Ecosystems Inventory of East Vancouver Island and Gulf Islands** (2004) map 92B074 shows several sensitive ecosystem classes in the vicinity of the Project Work Areas:

¹ Although species listed provincially as red, yellow, or blue are considered to be a conservation priority, there is no legislation providing formal protection (with the exception of those wildlife species specifically listed under the BC Wildlife Act or listed under Schedule 1 of Species at Risk Act. SARA protects certain listed mammals, reptiles, amphibians, molluscs, lepidopterans, and plants on federal lands and certain listed birds and fish on all lands in Canada. Species that are legally protected under SARA are those listed as Endangered or Threatened and are listed in Schedule 1 of the Act. Those species listed as Special Concern and all species listed in Schedule 3, regardless of their status, are not legally protected by SARA.



- A Wetland: marsh ecosystem (green) is present immediately downstream of the dam. This ecosystem has fluctuating water levels and nutrient-rich mineral soils and is dominated by rushes, reeds, grasses and sedges.
- Older Second Growth (brown), conifer dominated forest is present to the north, east and south of Greenburn Lake but is not present within the Project Work Areas. This ecosystem is composed of >85% conifers in the 60-100 year old age class.
- Woodland ecosystems (purple) are identified north and south of Greenburn Creek but are not present within the Project Work Areas. This ecosystem is typically more open (10-25% tree cover) and often include some Garry Oak ecosystem which support a high diversity of plant species and species at risk.

The following table summarizes the habitat preferences of the SARA Schedule 1 Threatened or Endangered plant species identified to potentially occur in the Project Work Areas, as well as the likelihood of their occurrence:

Table 5-1: SARA Schedule 1 Threatened or Endangered Plant Species with Potential to Occur in Project Area

Species	Habitat Preference	Likelihood in Project Area
Deltoid Balsamroot	<ul style="list-style-type: none"> Occurs in meadows or woodlands dominated by Garry Oak and/or Douglas-fir with sparse shrub layer but well-developed herb layer. 	<p>Low</p> <p>Only 8 known populations in BC, none on Pender Island.</p>
Foothill Sedge	<ul style="list-style-type: none"> Occurs in vernal moist meadows, open woodlands and shrub thickets in Garry Oak ecosystems at elevations of less than 50 m and generally within 200 m of the coastline. 	<p>Low-moderate</p> <p>Work areas generally >200 m from coast. May occur downstream of dam. PCA Biotics Web Explorer notes regular occurrences of Garry Oak ecosystems in GINPR.</p>
Phantom Orchid	<ul style="list-style-type: none"> Occurs in association with Douglas fir, Western Red Cedar, Big Leaf Maple and Paper Birch. Understory is usually sparse and lacking large woody debris. Three-way symbiotic relationship with Big Leaf Maple and a fungus (family Thelophoraceae). 	<p>Low</p> <p>In Canada this species is known only from a total of eight existing and two historical populations in BC focused in three locales: the Victoria / Saanich Peninsula, Salt Spring Island, and the Abbotsford-Mission-Chilliwack area.</p>
Brook Spike-Primrose	<ul style="list-style-type: none"> Occurs in moist grasslands and open slopes associated with Garry oak ecosystems of the CDF zone. 	<p>Low</p> <p>Two documented populations in BC, both near Victoria.</p>
Kellogg's Rush	<ul style="list-style-type: none"> Requires seasonally wet depressions and temporary pools that are moist to wet in winter and spring and dry in summer. Suitable conditions usually occur in low spots in fields and meadows within Garry Oak habitat. 	<p>Low-moderate</p> <p>Habitat potentially downstream of dam or near outflow pond. Habitat generally not in immediate work areas.</p>
Macoun's Meadow-Foam	<ul style="list-style-type: none"> Grows in wet depressions, vernal pools and seepage sites, prefers to be close to the coastal shore in areas that are wet in the winter and dry in the summer. 	<p>Low-moderate</p> <p>Habitat potentially downstream of dam or near outflow pond. Habitat generally not in immediate work areas.</p>
Gray's Desert Parsley	<ul style="list-style-type: none"> Occurs on dry, stony sites and often of shallow, fast-draining soils. 	<p>Low</p> <p>Two known occurrences in Gulf Islands, both on very steep southwest-facing rock walls.</p>
Streambank Lupine	<ul style="list-style-type: none"> Found along riverbanks in sites with little ground cover, although it can grow under trees where sufficient light gets through. The lupine prefers sandy or gravelly soil at low elevations close to the coast, where there is little competition from other plants. It is also found along railway tracks. 	<p>Low</p> <p>Habitat generally absent from work areas (dense understory present).</p>
White Meconella	<ul style="list-style-type: none"> Occurs on open rocky or grassy areas that are wet in early spring but dry in the summer. In BC, the plants grow on south-facing hillsides below 300 m in altitude with shallow and arid soil subject to regular early-season seepage. 	<p>Low</p> <p>Known at 15 historical discreet locations in BC with only 6 populations known in 2004 (none of which were on Pender Island). PCA Biotics Web Explorer notes that as of May 2005 there were no occurrences on Park lands.</p>

Table 5-1: SARA Schedule 1 Threatened or Endangered Plant Species with Potential to Occur in Project Area

Species	Habitat Preference	Likelihood in Project Area
Dwarf Sandwort	<ul style="list-style-type: none"> Grows in a small vernal seep on the flat top of a coastal headland with about 10 cm of moraine, damp in spring and dry in summer. 	<p>Low</p> <p>Found only on Rocky Point on southern Vancouver Island.</p>
Slender Popcorn Flower	<ul style="list-style-type: none"> Associated with Garry Oak ecosystems. Occurs on coastal bluffs and other dry grassy slopes that are usually steep, open and south- or southwest-facing often in gravelly soils. 	<p>Low</p> <p>13 historical populations in BC, of which only seven are still considered likely extant. One is on southeastern Vancouver Island north of Victoria, while the remainder are on nearby Gulf Islands (Galiano, Mayne, Pender and Saturna Islands). However, only one occurrence (Saturna Island) has been recently surveyed (in 2010/11). All others were last confirmed prior to 2000. Searches conducted in 2010/11 failed to find any plants at six of the known occurrences (Parks Canada Agency).</p>
Water-Plantain Buttercup	<ul style="list-style-type: none"> Occurs in vernal pools interspersed with Garry Oak. Sites are often flooded in winter and often experience droughts in summer. 	<p>Low</p> <p>Presently found at only two locations along the east coast of Vancouver Island (Oak Bay and Ballenas Island).</p>
Purple Sanicle	<ul style="list-style-type: none"> Occurs in herb meadow openings, on eroding, sandy banks on seashore cliffs, and on shrubby, grassy knolls. It is shade-intolerant and prefers dry soils. 	<p>Low</p> <p>Habitat generally absent from work areas. No known occurrences on Pender Island.</p>
Coastal Scouler's Catchfly	<ul style="list-style-type: none"> Prefers grassy openings on gently sloping sites along the coast, (maritime meadows). It is absent from shrub thickets and from patches of introduced robust grasses. 	<p>Low</p> <p>In BC there are currently 3 known sites Trial Island, Little Trial Island and Alpha Islet, and 1 site on Salt Spring Island.</p>
Small-flowered Tonella	<ul style="list-style-type: none"> Occurs on west-facing slopes, on gravelly outcrops or stable talus. It is also found in open Big-Leaf-Maple-Arbutus forests and in open Douglas-Fir-Arbutus-Garry oak forests. 	<p>Low</p> <p>Known only on the west side of Salt Spring Island.</p>
Howell's Triteleia	<ul style="list-style-type: none"> Associated with Garry Oak ecosystems, specifically Garry Oak woodlands, and in highly disturbed sites dominated by weeds in private yards and on roadsides. 	<p>Low</p> <p>As of 2003 the BC CDC reports 12 known locations, none of which are on Pender Island.</p>
Lindley's Microseris (Lindley's False Silverpuffs)	<ul style="list-style-type: none"> Found at low elevations (0-80 m) in or near Garry oak and associated ecosystems in CDFmm on sandstone cliffs, steep grassy slopes, and xeric, open deciduous or conifer forests on rocky slopes and cliffs. 	<p>Low</p> <p>Habitat generally absent in work areas. Four known extant occurrences – (Galiano Island, Saturna Island, Ruxton Island and North Pender Island).</p>
Muhlenberg's Centaury	<ul style="list-style-type: none"> Found in moist, open habitats, ranging from vernal pools (seasonally flooded meadows) and seeps to the margins of a coastal saltmarsh. Prefers sites that are wet in spring but dry in summer. 	<p>Low</p> <p>Only 3 historic known occurrences in BC. Most recent observations include Uplands Park and Chatham Island, near Victoria.</p>

Table 5-1: SARA Schedule 1 Threatened or Endangered Plant Species with Potential to Occur in Project Area

Species	Habitat Preference	Likelihood in Project Area
Banded Cord Moss	<ul style="list-style-type: none"> Grows on soil, sometimes amongst litter and other mosses, in open to shaded habitats, usually in or near vernal moist sites, often near rock outcrops. 	<p>Low</p> <p>It has been found at twelve sites on southeastern Vancouver Island, and once on each of three nearby islands: Trial Island, Saturna Island and Hornby Island.</p>
Contorted-Pod Evening Primrose	<ul style="list-style-type: none"> Occurs in dry, open sandy habitats, sparsely vegetated grasslands and woodlands. In Canada, it is restricted to sandy flats and partially vegetated dunes (semi-stable dunes) no more than 15 m above sea level. 	<p>Low</p> <p>Habitat not present in work areas. Six of the eight known extant populations occur in the Victoria area. The other two populations occur in close proximity on Savoury Island.</p>
Batwing Vinyl	<ul style="list-style-type: none"> Occurs in open coastal forests on mossy, calcium/magnesium-rich (high pH) inclined rock outcrops with periodic seepage. 	<p>Low</p> <p>Habitat not present in work areas. Only historic known occurrence on South Pender Island was documented in 1974 south of Mount Norman.</p>
Rigid Apple Moss	<ul style="list-style-type: none"> Occurs in well-humidified, disturbed soil that is free of grasses and other vascular plants or lichens. May grow directly on rocks or on the thin soil within crevices on rock outcrops. 	<p>Low-moderate</p> <p>Habitat generally absent in work areas. However, some rock outcrops may be present along existing access road.</p>
Habitat descriptions obtained from: <ul style="list-style-type: none"> Species at Risk Public Registry Species Profiles (Available at: http://www.registrelep-sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1) BC MOE Conservation Data Centre. Conservation Status Reports (Available at: http://a100.gov.bc.ca/pub/eswp/) 		

Given the habitat preferences of these species, the probability of occurrence within the Project Work Areas would be considered low. However wetland areas, such as that present downstream of the dam, typically have an increased potential to support sensitive plant species. Garry oak ecosystems, known to support large numbers of species at risk, are reportedly present in the GINPR Greenburn Lake property (Todd Shannon, pers.comm December 3, 2014).

5.2 Terrestrial Wildlife

The mature second-growth forest and riparian areas present in and around the Project Work Areas provide food and cover elements to a wide variety of wildlife from reptiles and amphibians to both large and small mammals. Mature coniferous trees are often utilized by both song birds and raptors for feeding, nesting and staging. Mature trees also often form cavities that are used by various birds for nesting, as well as by bats for roosting and nursery colonies. The shrub dominated understory, in conjunction with woody debris, provides cover and foraging opportunities for small mammals such as rodents. Moist forests close to water are prime habitat for a variety of amphibian and reptile species. Riparian areas provide food, water and shelter for an abundance of wildlife and are

typically considered sensitive ecosystems. They also provide corridors to wildlife, which is especially important in developed or disturbed areas.

The Project Work Areas are located within the CDFmm biogeoclimatic zone where wildlife composition is influenced by the moist, mild winters and warm, dry summers. According to Stevens (1995), there are 409 wildlife species found within this zone including 11 amphibians, 9 reptiles, 67 mammals and 322 birds. Representative wildlife associated with managed second growth forest of the CDF includes:

Black tailed deer	Black bear	Raccoon	Beaver
Marten	Deer mouse	Gray Jay	Common Raven
Chestnut-backed Chickadee	Red-breasted Nuthatch	Pacific Treefrog	Western toad

According to Todd Shannon of PCA, there are occasional reports of black bear and cougars on Pender Island but it is generally absent of large predators. An amphibian and reptile survey conducted in GINPR (Ovaska et al. 2004) found two native amphibians (Rough-skinned Newt and Red-legged Frog²), introduced Bullfrog and three species of garter snakes (Common, Western Terrestrial and Northwestern) at Greenburn Lake. Beaver are also known to be present in the lake (Golumbia and Mercer 2008). During the site visit, evidence of wildlife use included: audible detection of several passerine birds, whitewash, scat and tree cavities.

A variety of wildlife may be present in the vicinity of the Project Work Areas including some species at risk or species of management concern. No survey for sensitive wildlife species was specifically conducted during the site visit. A desktop review of several databases was conducted to determine species at risk potentially present near the Project Work Areas:

- **BC Species and Ecosystem Explorer** indicates a total of 58 animal species of management concern that have potential to occur in the regional context of the Project Area. Search results, including search criteria, are included in Appendix C. Of the species identified, 9 species are listed under the Species at Risk Act (SARA) Schedule 1 as threatened or endangered and are included in Table 5-2, below.
- **BC CDC Internet Mapping Service** showed no Non-Sensitive occurrences but indicates presence of 5 Masked Sensitive Occurrences within a 5 km radius of the Greenburn Lake Dam. Masked-sensitive occurrences are observations whose exact location is not provided in the mapping service, rather, a general area is provided. Tetra Tech EBA contacted the BC CDC to obtain occurrence information. On February 12, 2015 Ms. Katrina Stipek responded that three of the occurrences were “quite close to your area of interest”. Shape files provided by the CDC indicate that these are observations of Peregrine Falcon, anatum subspecies, with the closest, occurrence located approximately 750 m northwest of the South Pender Firehall Outlet Pond Work Area, and with the last recorded observation date in 2010. The other observations are 3.5 km west and 4 km north of the Dam Work Area.

Search results, including maps, are included in Appendix C.

- **Parks Canada Biotics Web Explorer** indicates 33 SARA Schedule 1 animal species, including invertebrates, within GINPR with 17 listed as regularly occurring. Five of these species are marine-dwellers and have been excluded from consideration. Six of the regularly occurring species are listed as SARA Schedule 1 Threatened or Endangered and are included in Table 5-2, below. Search results are included in Appendix C.

² Northern Red Legged Frogs are often considered species of management concern. It is provincially blue-listed and is SARA Schedule 1 Special Concern.

The following table summarizes the habitat preferences of the SARA Schedule 1 Threatened or Endangered wildlife species identified to potentially occur in the Project Work Areas, as well as the likelihood of their occurrence:

Table 5-2: SARA Schedule 1 Threatened or Endangered Animal Species with Potential to Occur in Project Work Areas

Species	Habitat Preference	Likelihood in Project Area
Olive Sided Flycatcher	<ul style="list-style-type: none"> Associated with open areas (such as forest clearing, riparian areas, wetlands, and human disturbances) containing tall live trees or snags for perching. The forested areas typically contain large, mature trees with abundant snags. 	Moderate to high Habitat available. According to E-fauna BC mapping there are at least 3 occurrences within 1 km of the Project Work Areas.
Marbled Murrelet	<ul style="list-style-type: none"> Forage in the inshore marine environment, primarily in protected waters where both sand lance and surf smelt occur. Require old growth forest for nesting. May travel up to 75 km inland from sea location to nest sites. 	Low Nesting habitat generally absent in Project Work Areas.
Common Nighthawk	<ul style="list-style-type: none"> Nests in a wide range of open, vegetation-free habitats, including dunes, beaches, recently harvested forests, burnt-over areas, logged areas, rocky outcrops, rocky barrens, grasslands, pastures, peat bogs, marshes, lakeshores, and river banks. This species also inhabits mixed and coniferous forests. 	Moderate to high Habitat available in and immediately surrounding work areas.
Northern Goshawk, laingi subspecies	<ul style="list-style-type: none"> Prefers extensive forests with dense canopies and large trees for nesting and perching, but with open understories for hunting. On Vancouver Island and the Gulf Islands these forests are usually dominated by Douglas fir. 	Moderate Suitable forest present at or adjacent to Project Work Areas.
Western Painted Turtle, Pacific Coast pop.	<ul style="list-style-type: none"> Found in the shallow waters of ponds, lakes, marshes, and slow-moving stream reaches. Suitable wetlands have muddy substrates, an abundance of emergent vegetation, and numerous basking sites. Nest in loose substrate (sand, gravel, soil) within about 150 m of shore. 	Moderate to high Habitat present. Potential sitings at Greenburn Lake. Potential nesting sites identified immediately north of dam.
Sharp Tailed Snake	<ul style="list-style-type: none"> Favours relatively open Douglas Fir-Arbutus stands and forest edges with rock talus. Small forest openings with rocky substrate and southern exposure provides egg laying and nursery habitat. 	Moderate Potential habitat present at rocky slope on north shore of Greenburn Lake. Species detected at Greenburn Lake (Engelsoft 2008 in Golumbia and Mercer 2008). Seven known populations in BC, all on Gulf Islands.
Edwards' Beach Moth	<ul style="list-style-type: none"> Found in sparsely-vegetated sandy beaches and beach dunes, as well as sandy beaches adjacent to saltmarshes. 	Low Habitat generally absent in Project Work Areas. Known GINPR presence recorded on Sidney Island.
Dromedary Jumping Slug	<ul style="list-style-type: none"> All known sites are in old growth or forests that contain old-growth characteristics and contain abundant coarse woody debris, including large-diameter pieces. 	Low No known mapped locations in GINPR (nearest is Shawnigan Lake).

Table 5-2: SARA Schedule 1 Threatened or Endangered Animal Species with Potential to Occur in Project Work Areas

Species	Habitat Preference	Likelihood in Project Area
Greenish Blue, insalanus subspecies	<ul style="list-style-type: none"> While historically it was distributed from Campbell River to Greater Victoria, it has not been recorded since 1979. Further, its habitat preferences on Vancouver Island were often strongly associated with larval food preferences of native trifolium (clovers) that have become rare. 	<p>Low</p> <p>Food sources rare. Not typically found in the immediate coastal regions.</p>
Blue Grey Taildropper Slug	<ul style="list-style-type: none"> Found in moist coniferous or mixed-wood forests. Requires abundant coarse woody debris or other cover, a deep forest litter layer, and shaded, moist forest floor conditions. 	<p>Low</p> <p>In Canada it is known only at 5 sites on southern Vancouver Island. No known populations in Gulf Islands.</p>
<p>Habitat descriptions obtained from:</p> <ul style="list-style-type: none"> Species at Risk Public Registry Species Profiles (Available at: http://www.registrelep-sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1) BC MOE Conservation Data Centre. Conservation Status Reports (Available at: http://a100.gov.bc.ca/pub/eswp/) 		

The habitat observed at around the Project Work Areas has moderate to high potential to support several SARA Schedule 1 Threatened or Endangered wildlife species, as described in the table above. Tetra Tech EBA notes that the potential sitings of Western Painted Turtle, Pacific Coast population are unconfirmed and may be a non-sensitive subspecies. However, until the subspecies is conclusively determined, PCA will prudently assume these are of the Pacific Coast population (Michelle Paleczny and Nicole Kroeker, personal communication, February 18, 2015). Western Painted Turtle (unconfirmed subspecies) has been observed nesting along the shoreline of Greenburn Lake (Golumbia and Mercer 2008) and potential nesting areas have been identified near the dam.

Additionally, there is a high potential for Peregrine Falcon, anatum subspecies to be present as nesting sites have been documented on South Pender Island. The nearest aerie is less than 1 km from the South Pender Firehall Outlet Pond Work Area. The anatum subspecies of Peregrine Falcon is not currently SARA-listed. COSEWIC designated it as endangered in 1978 but recovery efforts have resulted in rebounding populations. However, the BC MOE maintains it as a “Masked Sensitive” species to aid in on-going recovery efforts that protect it from direct and indirect human disturbances. It is also identified as a “priority species” by PCA (PCA 2009).

5.3 Water (Fish and Aquatic Habitat)

The MOE’s Habitat Wizard database and the BC CDC iMAP database were used to identify watercourses within or adjacent to the Project Work Areas. The MOE’s Fisheries Information Summary System (FISS) was also searched for all relevant aquatic information on these waterbodies. The site visit included visual observations of Greenburn Lake and Greenburn Creek, including the area surrounding the South Pender Fire Hall Outlet Pond.

Greenburn Lake is the result of damming Greenburn Creek (watershed code: 925-257500-14900). Greenburn Creek has been described as a “non-classified drainage” with “no reasonable opportunity for fish to occur in the drainage given the lack of accessibility for anadromous fish from the ocean and lack of available habitat for resident fish” (Willmott 2010). During the site visit no flow was observed in Greenburn Creek immediately downstream of the dam and minimal standing water was observed. Water from the lake is controlled by an intake structure and supply pipe. The riparian area of the creek was open and dominated by grasses and shrubs. Based on published information and site visit observations, the poorly defined channel and organic-dominated substrates of Greenburn

Creek make it generally unsuitable for most fish species. However, the wetland characteristics of the creek and riparian zone provide good amphibian and turtle habitat.

Greenburn Lake has a narrow littoral zone with a steep drop within a metre of shore around most of its perimeter (Ovaska et al, 2004). Emergent and floating aquatic vegetation was observed in the vicinity of the dam. Common Cattail, Slough Sedge and Small-flowered Bullrush were present near the shoreline. Duckweed was observed near the shore and in deeper water. Yellow Iris is reportedly present (Golumbia and Mercer 2008).

No fish species are documented in either Greenburn Lake or Greenburn Creek other than one reference in FISS to “unidentifiable trout fry” in Greenburn Lake. According to Golumbia and Mercer 2008, the only known fish species in Greenburn Lake is Three Spine Stickleback and while local residents have indicated that trout are present in the lake, their presence is unlikely given its physical properties (including anoxic conditions).

5.4 Cultural Resources

Various cultural and historical resources have been identified in previous archaeological studies conducted in the vicinity of Greenburn Lake. Only one known resource, identified as Site 1802T in Perry 2013, is located approximately 35 m north of the Greenburn Lake Dam. This site is a large boulder that is considered to be a precontact shelter. The Perry 2013 report notes that this site “is in direct conflict with the proposed Greenburn Lake dam project” because of the proposed access road upgrade (widening) activities.

5.5 Visitor Experience

The Project Work Areas are within the Greenburn Lake Property of the GINPR. There are no facilities at this site, but there is a frequently used trail around the lake. Noise, dust, visual disturbances and potential safety impacts may be produced during construction activities and subsequent maintenance activities.

6.0 IMPORTANT EFFECTS IDENTIFIED

6.1 Potential Project Activity Interactions With Environmental Components

Interactions between the proposed Project activities and the environmental components were identified by investigating the potential effects of each of the various Project activities on the receiving environment. Table 6-1 shows the potential Project-Environmental Component interactions based on the anticipated pathways from the proposed Project activities. Knowledge of both the Project and Environmental Components are used to identify potential adverse effects of the project on the environment. The majority of impacts will result during construction and are considered temporary.

Table 6-1: Effects Identification Matrix

<p>Use the following matrix to identify if your project may have potential impacts on components of the environment</p>			Components of Environment and Mandate Elements Affected by Environmental Change									
			Natural Resources					Cultural Resources		Visitor Experience		
			Air	Soil	Water	Flora	Fauna	Historic Value	Archaeological Sites	Viewscape	Access and Use	Public Safety
	Phase	Examples of Associated Activities										
Project Components	Construction/Preparation	Mobilization of equipment & materials	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Laydown & storage of materials	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Clearing & Grubbing	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Excavation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Grading	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Backfilling	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Site Isolation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		Concrete Works	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		Use of machinery	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Operation & Maintenance	Use	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Maintenance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Vehicle Traffic	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6.2 Impact Analysis

Environmental impacts that may potentially result from the proposed works are described in the following subsections. Although the specific project details vary within each of the Project Work Areas, the general activities are similar (e.g., vegetation clearing, excavation, backfilling etc.). Impacts described apply to all Project Work Areas, unless otherwise stated.

6.2.1 Vegetation

Impacts to vegetation are expected to occur primarily as a result of clearing and grubbing activities, excavation, grading, backfilling, stockpiling and general construction disturbance. Project activities require the use of machinery, whose movement has the potential to remove or damage vegetation even in areas that are not intended to be cleared.

- Direct loss of native vegetation species or communities may occur in the Project Work Area. Project activities may include clearing vegetation to widen access road, creating temporary access to dam, establishing materials laydown areas, removing native vegetation during excavation works, covering vegetation during backfilling works.
 - Most disturbances to vegetation are expected to be temporary, however some permanent loss of vegetation will occur:
 - Vegetation in the new outlet channel will be removed (approximately 36 m² – 36 m long x 1 m wide). The existing outlet pond is proposed to be filled in and is expected to re-vegetate (approximately 560 m² – 32 m x 17.5 m).
 - The trees currently located on the dam (approximately 73 Fir, 3 Cedar and 7 Alder trees (EBA 2012)) will be permanently removed. This is necessary for safety purposes.
 - Access road upgrades will include some brushing of encroaching vegetation. It is likely that this will involve “trimming” rather than “removal”.
- Direct loss of vegetation in the Project Work Areas has the potential to reduce habitat availability for sensitive plant species and/or communities that have the potential to occur in the Project Work Areas (see Table 5-1).
- Vegetation could be impacted by an accidental release of a deleterious substance.
- Vegetation within and adjacent to the Project Work Areas could be impacted by erosion of exposed materials or sediment mobilization resulting from clearing activities/soil disturbances.
- Introduced non-native weeds could establish after vegetative clearing.
- Vegetation community composition could be altered because of potential changes in surface hydrology characteristics (water volume and/or distribution) resulting from Project activities.

It is acknowledged that some vegetation will be lost during Project activities, but the overall impacts to vegetation are not expected to be significant. It is anticipated that these effects can be mitigated assuming appropriate mitigation measures (Section 7.0) and construction best management practices are employed during the course of the Project.

6.2.2 Wildlife

Wildlife impacts are expected to occur primarily as a result of clearing and grubbing, earthworks (excavation, dredging) and general construction activities. Impacts to wildlife may also occur indirectly through vegetation impacts (i.e., reduced habitat availability).

- Wildlife, including Species at Risk, may exhibit avoidance behaviors as a result of increased noise and human presence from Project activities.
- Vegetation removal may cause habitat loss for some wildlife:
 - tree removal may cause loss of habitat (e.g., nesting or perching sites) for bird, bat and small mammal species; and
 - soil disturbance may cause loss of habitat for burrowing or ground nesting animals.

- Wildlife may be affected by an accidental spill of a deleterious substance.
- Garbage and waste generated by the construction activities could attract wildlife.
- Project activities may result in loss of individuals (e.g., road kills, excavation of occupied burrows or nests), including Species at Risk.

Overall, impacts to wildlife as a result of the Project are expected to be limited in duration and can be minimized through implementation of mitigation measures in Section 7.0.

6.2.3 Water (Fish and Aquatic Habitat)

Impacts to water are expected to occur as a result of Project activities during construction, specifically during earthworks (clearing, excavation, backfilling etc.) that occur near or below the high water mark of Greenburn Lake or Greenburn Creek. Dam rehabilitation and outlet channel construction activities are more likely to negatively impact water resources than those related to upgrading the existing access road.

- Aquatic life and habitat may be affected at and downstream of the Project Work Areas should an accidental spill of deleterious substances occur in or near Greenburn Lake or Greenburn Creek.
- Removal or disturbance of riparian vegetation may impact aquatic habitat quality (primarily by reducing shade, and nutrient inputs).
- Installing a coffer dam will cover approximately 85 m² of lake bed. Isolating the area between the coffer dam and existing dam will temporarily reduce the amount of aquatic habitat available (approximately 150 m²). Aquatic life may be temporarily displaced or killed by this activity.
- Changes to habitat availability may result from dam rehabilitation works (i.e., armouring upstream slope with rip-rap). Changes to habitat availability at Greenburn Lake Dam are expected to be equal or favourable (i.e., the amount of habitat created by the rip rap will be greater than the habitat lost on the lake bed).
- Increased erosion and/or sediment transport from disturbed areas may increase total suspended solids in water which can negatively affect aquatic life and decrease aquatic habitat quality.
- Noise and vibrations resulting from construction activities may be a temporary disturbance to aquatic life.

No permanent negative impacts to water, including fish and aquatic habitat, are expected. Fish habitat in the Project Area is considered poor and fish species that are provided protection via the Fisheries Act are not present in the watercourses proximate to the Project. The Project includes activities to rehabilitate an existing dam which currently affects downstream portions of Greenburn Creek. Construction activities will likely cause temporary impacts but current conditions are expected to return shortly following. Permanent changes to habitat availability on the upstream side of the dam are expected to be neutral or positive. By implementing appropriate mitigation measures (Section 7.0) and best management practices, impacts to water can be minimized.

6.2.4 Cultural Resources

One known archaeological site is present proximate to the dam Project Work Area. Site 1802T is a pre-contact rock shelter 35 m north of the dam. This site has the potential to be disturbed by construction activities, mostly by machinery operation, excavation or material stockpiling. By implementing best management practices and mitigation measures, the potential to impact known archaeological sites can be minimized.

There is potential for unknown archaeological sites to be encountered during the Project. Mitigation measures in Section 7.0 includes strategies to address this possibility.

6.2.5 Visitor Experience

Impacts to visitor experience are expected to occur as a result of general construction activities during all Project works. The public frequently accesses Greenburn Lake for hiking and likely expects to enjoy quiet, natural surroundings. Impacts caused by construction works required during the Project may include:

- Increased noise.
- Negative visual aesthetics of disturbed areas during construction works.
- Increased traffic in the area from equipment and materials mobilization.
- Safety hazards from construction equipment, open excavations, materials stockpiles, etc.

Effects will occur during the construction phase of the Project. No negative impacts to visitor experience are anticipated following construction completions. Overall, impacts to visitor experience are expected to be limited in duration and able to be mitigated by implementing appropriate measures and best management practices.

7.0 MITIGATION MEASURES

7.1 Environmental Procedures for Impact Mitigation Applicable to All Areas

7.1.1 General

- A qualified environmental professional should oversee construction activities to ensure Project works are conducted in accordance with all identified environmental protection measures. Parks Canada may assign an Environmental Surveillance Officer (ESO) or a third-party Environmental Monitor (EM) may fulfill this role.
- The ESO/EM should have the authority to halt any work that does not comply with regulatory requirements or that has the potential to cause adverse environmental impacts.
- All contractors shall ensure that all work is performed in accordance with the ordinances, laws, rules and regulations set out in the *Canada National Parks Act* and Regulations.

Failure to comply with or observe environmental protection procedures may result in the work being suspended pending rectification of the problems.

- All contractors should be subject to an environmental briefing regarding their individual and collective responsibilities to ensure all avoidable adverse environmental impacts do not arise as a result of their activities and personal choices. This information should be available on-site and provided to any new workers and/or subcontractors such that subsequent environmental briefings can be presented by arrangement with the ESO/EM.
- The selected contractor should prepare an Environmental Management Plan (EMP) in accordance with Parks Canada Environmental Procedures.
- PCA and the selected contractor should be prepared to change existing measures and BMPs should they fail or in the event that additional measures are required. The ESO/EM should be notified of any changes to ensure they are adequate and installed properly.

7.1.2 Spill Management

- The EMP should include a Spill Management Plan. Appropriately sized and stocked spill kits should be on site and one located on each piece of equipment. They should be capable of dealing with 110% of the largest potential spill. All staff should be aware of their location(s) on site and trained in spill response procedures.
- Any spill of a substance that is toxic, polluting, or deleterious to terrestrial or aquatic life of reportable quantities must immediately be reported to the Provincial Emergency Program 24-hour phone line at 1-800-663-3456 Parks Canada Dispatch and the ESO/EM should also be notified.
- All stationary operating equipment with fuel tanks or hydraulic systems (e.g., pumps), or stores of liquid hazardous materials (e.g., fuel) should be located within an impervious secondary containment area capable of holding 110% of the contents.

7.1.3 Machinery and Equipment

- Equipment and machinery should be in good operating condition, clean (power washed), free of leaks, excess oil and grease and non-native plant species. Equipment leaking or producing excessive exhaust should be repaired or replaced.
- Equipment should operate above the high water mark of all watercourses. Where instream work is necessary (and has been approved through appropriate regulatory processes) equipment should work from a dry location or from an area that has been isolated and dewatered where possible.
- Machinery should be situated to minimize track movement.
- Equipment servicing and maintenance should not occur on site.
- Refueling of equipment should occur on land at least 30 m from any watercourse, where possible. Where 30 m is not possible, a location as far as possible from the watercourse should be chosen. Topographic features and slope should be considered. The refueling area should have a spill containment kit immediately accessible and personnel should be knowledgeable in its use.

7.1.4 Air Quality and Noise

- Dust-generating activities should be minimized as much as possible during windy periods.
- No burning of oils, rubber, tires and any other material should take place on site.
- Stationary emission sources (e.g., portable diesel generators, compressors, etc.) should be used only as necessary. Equipment and vehicles should be turned off when not in active use to reduce noise and air pollution.
- All equipment, vehicles and stationary emission sources should be well-maintained and used at optimal loads to encourage minimal noise and air emissions.
- Construction activities should occur during reasonable daytime hours (typically 7 am to 7pm) to minimize disturbance to neighbours.

7.1.5 Erosion and Sediment Control

- Plan and schedule Project activities for dry weather whenever possible. When significant wet weather is encountered, then additional measures may be required to minimize erosion potential.

- Minimize construction and equipment travel during periods of heavy precipitation. Excavation activities should be halted during heavy rainfall events. Work may be stopped completely or works may require additional erosion and sediment control measures be implemented in order to permit work to continue.
- Minimize the area of soil exposed at any one time by: phasing construction activities; retaining vegetation as much as possible; and, once construction works are completed, stabilize the exposed soils as soon as possible using temporary measures such as mulch, erosion sediment control blankets, hydroseeding, and/or plastic sheeting or planting long-term vegetation (if during the appropriate time of year).
- Stockpile, or have readily available, supplies of erosion and sediment control materials as appropriate on-site such as (but not limited to) rock, gravel, grass seed, silt fencing, staking, polyethylene sheeting, etc.
- Erosion and sediment control measures should be routinely inspected. After a heavy rain event, it is likely that many of the controls will require repair, clean out, or reinforcement. A quick response to assess and correct damages of the controls is required, especially before subsequent precipitation events.

7.1.6 Vegetation

- Vegetation removal should be minimized as much as possible.
 - Retain large trees where possible and leave coarse woody debris (i.e., branches) on the ground to provide cover and reduce erosion potential.
 - Retain mature conifers (Douglas fir, Western red cedar etc.) where possible. Given a choice, remove deciduous trees such as big leaf maple and red alder, which tend to grow faster than conifers.
- The area to be cleared should be clearly marked with highly visible materials (i.e., flagging tape, snow fencing) to ensure equipment operators are aware of the area they are to work in. Equipment operators should work carefully to ensure they do not cause mechanical damage to trees and other vegetation outside the designated clearing area.
- Given the low likelihood of occurrence for the majority of sensitive plant species (see Table 5-1) within habitats present within the Project Work Areas, additional assessment, with respect to rare plant surveys, is not likely warranted.
 - However, should PCA decide it is necessary, early season rare plant surveys to determine the presence of species of management concern prior to construction may be conducted. Should species of management concern be identified during the course of the rare plant survey, an appropriate mitigation strategy should be developed to address any such occurrences.
 - Should incidental occurrences of species of management concern be identified during the course of Project works, an appropriate mitigation strategy should be developed to address any such occurrences.
 - Dependent on the species identified, population characteristics and location of any identified species of management concern occurrence, appropriate mitigation may include avoidance (through the establishment of buffers), the transplant of potentially affected species of management concern and/or the salvage and relocation of soils likely to contain a species of management concern seed bank.
- Measures to reduce the potential for weed establishment within the Project Work Areas should include the use of certified 'weed free' seed mixes and the cleaning of construction equipment, prior to arrival on site, to ensure equipment is free of soil and/or weed seeds.

- Maintain existing surface water flow patterns and thereby reduce potential project related effects to wetland and riparian vegetation communities.
- Vegetation removal that will affect trees used by all birds and other wildlife should be avoided while they are breeding, nesting, roosting or rearing young.
 - Environment Canada's General Regional Nesting Period for the Northern Pacific Rainforest, Zone A1 is mid-March to mid-August (Environment Canada 2014). Provincial guidelines suggests April 1 to July 31 for most species, January 15 to September 15 for herons, January to August for Bald Eagles and owls, April to August for Osprey and May to August for other raptors.
 - Tetra Tech EBA notes that the proposed schedule (early June to end of October) conflicts with both Federal and Provincial guidelines for nesting periods. Therefore an appropriately qualified environmental professional should survey vegetation to be removed to identify any breeding, nesting, roosting or rearing birds and determine species-specific BMPs.
- Vegetation in areas temporarily disturbed by heavy equipment and other construction-phase related activities (including lay-down sites, temporary work sites, and material stock pile sites) should be restored as quickly as possible. This may be accomplished by planting grass seed or hydroseeding (using certified "weed free" mixtures).
 - Riparian restoration should follow the general principles outlined in the Fisheries and Oceans Canada (DFO) Operational Statement for the Pacific Region Riparian Areas and Revegetation (2006)³, and the BC MOE Planting Criteria and Recommended Native Tree and Shrub Species for the Restoration and Enhancement of Fish and Wildlife Habitat (1998).

7.1.7 Wildlife

- All contractors and operators will be expected to comply with the following Federal legislation during all Project works:
 - The **Migratory Birds Convention Act** (1994) prohibits the taking or killing of migratory bird nests and eggs, and the deposition of harmful substances in areas frequented by migratory birds. The Wildlife Act also prohibits the possession, taking, injury, molestation or destruction of a bird or its egg, or the nest of an eagle, peregrine falcon, gyrfalcon, osprey, heron or burrowing owl.
 - The **Canada Wildlife Act** allows for the creation, management and protection of wildlife areas for wildlife research activities, or for conservation or interpretation of wildlife. The purpose of wildlife areas is to preserve habitats that are critical to migratory birds and other wildlife species, particularly those that are at risk. The Wildlife Area Regulations of the Act prohibits all activities that could be harmful to species and to their habitat, unless a permit is issued indicating the permitted activity. Section 3 of the Wildlife Area Regulations lists activities that may not be conducted in wildlife areas. This includes, but is not limited to, damaging or destroying vegetation, animals and soils. Section 4 of this regulation stipulates that permits may be issued for an activity described in Section 3 in any wildlife area where that activity will not interfere with the conservation of wildlife.

³ This guide is no longer valid as DFO no longer provides Operational Statements, however the principals and recommendations within it remain as good practice. A copy of this now-defunct Operational Statement is provided in Appendix D.

- The **Species at Risk Act** (2012) protects rare and sensitive species. Should a rare or sensitive species be identified any time during the Project, the ESO and EM should be notified immediately for further direction. The BMPs to be employed in order to mitigate the potential effects would vary greatly depending on the identified species, its sensitivity to the Project, and its proximity of habitat to the Project footprint.
- The **Fisheries Act 2012** provides protection for all fish, fish habitat, and water quality. The Act is administered federally by DFO and Environment Canada and requires that projects avoid causing serious harm to fish unless authorized by DFO. This applies to work being conducted in or near waterbodies that support fish that are part of or that support a commercial, recreational or Aboriginal fishery.
- The selected contractor should be aware of sensitive wildlife windows (e.g., bird nesting, fish migration/spawning) within GINPR. Works should be scheduled outside sensitive wildlife periods as much as possible.
 - Environment Canada's General Regional Nesting Period for the Northern Pacific Rainforest, Zone A1 is mid-March to mid-August (Environment Canada 2014). Provincial guidelines suggests April 1 to July 31 for most species, January 15 to September 15 for herons, January to August for Bald Eagles and owls, April to August for Osprey and May to August for other raptors.
 - DFO refers to provincial guidelines which suggest a reduced risk work window for all fish species June 15 to September 15 for in-stream works (BC MOE 2007).
 - *It is anticipated that the Project will occur between June and October 2015. This is generally within the reduced risk work window for fish. However, this work schedule overlaps the sensitive nesting period of many bird species and the nesting/hatching period for Western Painted Turtle.*
- All wildlife sightings and/or signs should be reported to the ESO/EM as soon as possible and during the same day as the observation. This may include dens, litters, nests, carcasses (road kills) or encounters etc.
- Maintain slow speeds when moving machinery or driving on site to reduce potential for vehicle collisions and wildlife mortality.
- Avoid or terminate activities that attract or disturb wildlife and vacate the area and stay away if wildlife displays aggressive behaviour or persistent intrusion. Allow all wildlife to pass without harassment should it be encountered on or near the Project Work Areas.
- Secure all food and garbage in crew vehicles, which must be removed from site at the end of each day.
- Respond to all spills that may attract wildlife (i.e., hydraulic fluids) immediately according to a spill response plan. Spills should be reported the ESO/EM regardless of volume.
- Minimize vegetation clearing and disturbance as much as possible. Reasonable efforts should be made to retain wildlife trees⁴ (or snags) where possible.

⁴ A standing live or dead tree with special characteristics that provide valuable habitat for wildlife. Characteristics include large diameter and height for the site, current use by wildlife, declining or dead condition, value as a species, valuable location, and relative scarcity (BC MOE 2012a).

7.1.8 Species at Risk Specific Mitigation

7.1.8.1 Olive-Sided Flycatcher, Common Nighthawk & Northern Goshawk laingi (SARA listed) and Peregrine Falcon anatum (BC MOE Masked Sensitive)

Four sensitive bird species have moderate to high potential to occur in the vicinity of the Project Work Areas.

- Individuals will likely exhibit avoidance behaviour of the Project Work Areas because of increased noise and human presence.
- Do not conduct Project activities around dusk and dawn when birds are more active.
- Conduct vegetation removal during reduced risk work windows (i.e., outside of nesting seasons) where possible. Olive-Sided Flycatcher nests April to June with fledging by end of July; Common Nighthawk nests May to June with fledging mid-June to late-August; Northern Goshawk laingi nests in May with fledging in early July; Peregrine Falcon anatum lay eggs and have chicks in nest from mid-April to mid-July.
- If vegetation removal is conducted during nesting season, nest surveys should be conducted by a qualified biologist. If nests are encountered, measures to protect them (such as, but not limited to, retaining the nest tree with a buffer) should be implemented.

7.1.8.2 Sharp Tailed Snake

Potential Sharp Tailed Snake habitat has been identified in the vicinity of the Project Work Areas, particularly on rocky ridges. These snakes spend a significant portion of time under cover, especially in winter and the warm summer months.

- Do not disturb south-facing rocky slopes where possible (i.e., limit machinery movement, avoid material laydown, do not excavate etc.).
- Potential Sharp Tailed Snake habitat areas should be visibly delineated to ensure Project activities do not encroach.

7.1.8.3 Western Painted Turtle, Pacific Coast population

Potential nesting habitat has been identified immediately north of the dam.

- Visibly and physically delineate the nesting area with a 60cm (2') tall, 2" stucco mesh fence in late March before nesting begins. This will prevent turtles from entering the nesting areas, and encouraging use of other areas less likely to be affected by Project activities. It will also allow hatchlings in current nests to exit the nesting site as they are small enough to pass through the mesh. (Nicole Kroeker, email, February 19, 2015).
- Do not conduct Project activities near dawn or dusk when most egg-laying occurs and turtles are most sensitive.
- It is anticipated that turtles will be captured and marked with telemetry devices in March/April 2015 which will allow tracking of individuals. If individuals are found in the vicinity of Project activities (e.g., laydown areas, coffer dam/site isolation etc.) they should be captured and relocated according to accepted PCA protocols.

7.1.8.4 Water (Fish and Aquatic Habitat)

- Use sediment fencing and/or other appropriate erosion control materials to prevent sediment transport to Greenburn Lake and Greenburn Creek.
- Prevent deleterious materials from entering Greenburn Lake and Greenburn Creek or associated drainages, wetlands or riparian areas that would result in damage to aquatic and riparian habitat. Hazardous or toxic products (fuels, lubricants etc.) shall be stored at least 30 m from any watercourse.
- Avoid stockpiling in riparian zones to avoid sedimentation resulting from overland flows and heavy precipitation events. Appropriate use of erosion and sediment control measures should be implemented where this is not practical or where stockpiling cannot be avoided.
- Equipment should work from above the high water mark of a watercourse whenever possible. If in-stream work is required, the equipment should be situated to minimize movement.
- Where site isolation is necessary at Greenburn Lake Dam, a fish and amphibian salvage within the isolation area should be conducted before and during water draw-down.
- Water quality monitoring (i.e., turbidity monitoring) may be implemented if sedimentation becomes a concern. A background level of turbidity should be established prior to Project start-up to determine the baseline against which Water Quality Guidelines are applied. The water quality monitoring program, if needed, will be established in the EMP.
- If pumping is required, pumps will be screened according to DFO *Freshwater Intake End of Pipe Fish Screen Guideline* (1995). Water within acceptable turbidity limits may be pumped directly downstream of the dam into Greenburn Creek. If turbidity exceeds established limits water should first be pumped to an upland location prior to re-entry into the creek. The ESO/EM should establish the location (typically either a well-vegetated area or temporary settlement pond).
- Placing rip-rap on the upstream side of Greenburn Lake Dam will result in a loss of aquatic habitat (area covered on lake bottom) as well addition of aquatic habitat (surface area and interstitial spaces provided by rip-rap). These effects are individually considered adverse and beneficial, respectively but when considered together are *neutral*. The habitat lost on the lake bottom will be compensated for by the habitat provided by the surface area and interstitial spaces within the rip rap.
- Uncured concrete has the potential to increase the pH of water which can be corrosive to tissue and increase toxicity of other substances. To minimize the potential impacts of concrete works:
 - Concrete should be mixed at least 30 m from the watercourse;
 - All concrete wash must be contained and removed from site;
 - The area concrete is to be applied to should be adequately isolated from water until the concrete sufficiently dries.

7.1.9 Cultural Resources

- Perry (2013) recommends that the access road not be widened in the vicinity of Site 1802T but rather “be constrained within the previously disturbed area by the former cabin.” All Project activities should be conducted as far as practically possible from the known archaeological site.

- If a previously unknown cultural resource is encountered during Project activities, all work should cease and the ESO or EM should be immediately contacted. Although the Project is outside of provincial jurisdiction, the Archaeology Branch of BC Ministry of Forests, Lands and Natural Resource Operations at **250-953-3334** may also be contacted for additional direction.

7.1.10 Visitor Experience

- PCA should (has) post signs to inform the public of the proposed Project, including works to occur and timelines.
- The selected contractor should have a Health and Safety Plan in place that includes measures to protect the public from construction activities (e.g., marking and providing barriers to open excavation, restricting access to active work areas etc.).
- Provide alternative access to highly used public areas (e.g., the trail around Greenburn Lake) if possible.
- Applying mitigation measures in the previous subsections will minimize the impacts to Visitor Experience.

8.0 IMPACT SIGNIFICANCE

8.1 Determination of Significance of Residual Environmental Effects

Assigning residual impact significance is required to determine if a project is “likely to cause significant adverse environmental effects, taking into account the implementation of mitigation” (CEAA, 2012, Section 20-1). When considering significance relative to a project or a project’s activities, the concepts of “adverse” and “likely” have been incorporated (Federal Environmental Assessment Review Office 1994).

Tetra Tech EBA has chosen a transparent method of significance determination and defining residual impacts, which are presented in Appendix E.

Project impacts that can be avoided or completely mitigated are not considered to have a residual impact and therefore, have not been rated or incorporated into the Residual Impact and Significance Table below.

Table 8-1: Determined Residual Impact and Significance Rating Matrix

Potential Impact	Residual Impact	Residual Impact Rating						Significance
		Direction	Frequency	Extent	Duration	Reversibility	Magnitude	
Loss and/or disturbance to vegetation during clearing (including wildlife and riparian effects).	Yes	Negative	Continuous	Local	Long-term	Non-reversible	Low	Not Significant
Permanent alteration and/or loss of wildlife habitat.	Yes	Negative	Continuous	Local	Long-term	Non-reversible	Low	Not Significant
Disruption or barriers to wildlife movement.	Yes	Negative	Intermittent	Local	Short-term	Reversible	Low	Not Significant
Wildlife and aquatic life disruption due to habitat loss, construction noise.	Yes	Negative	Intermittent	Local	Short-term	Reversible	Low	Not Significant
Change in Aquatic habitat availability due to fill/rip-rap placement on upstream side.	Yes	Neutral	Continuous	Local	Long-term	Reversible	Low	Not Significant
Mortality of individuals due to Project activities.	Yes	Negative	Infrequent	Local	Short-term	Non-reversible	Moderate	Not Significant
Any deleterious substance spills to land or water as a result of accidents or malfunctions during construction.	Yes	Negative	Once/ Infrequent	Local	Short or long-term	Reversible	Moderate	Not Significant
Increased total suspended solids in watercourses as a result sediment mobilization from earthworks or stockpiling.	Yes	Negative	Infrequent	Local	Short-term	Reversible	Low	Not Significant
Disruptive visitor experience due to noise, highway stoppages etc.	Yes	Negative	Intermittent	Local	Short-term	Reversible	Low	Not Significant

Potential residual environmental impacts of the Project were assessed, characterized and found to be negligible or of low magnitude and not significant provided the Project adheres to all contract specifications for working within a National Park, employs Best Management Practices, and specific environmental mitigation measures such as those suggested herein are used to minimize adverse impacts.

8.1.1 Cumulative Effects

Cumulative effects are changes to the environment that “are likely to result from the project in combination with other projects or activities that have been or will be carried out” (Hegmann et al, 1999). These effects may be the result of a number of developments within a geographic area or of a number of developments occurring over time. A project’s contribution to cumulative effects is assessed based on its effects on environmental components that are also affected by uses. Overall, cumulative effects are effects of all uses on an EC, including effects caused by the proposed Project.

The overall impacts that have potential to result from Project activities are not significant when considered on their own. However, while individually no significant adverse effects are anticipated, cumulative effects consider the potential additive and synergistic effects of overall residual effects, in combination with past, existing or known planned activities in the vicinity of the Project. Although the residual effects of an individual activity may be acceptable, the combined residual effects of several developments may result in unacceptable effects.

Given the limited temporal and spatial extent of the Project, the overall “conservation” mandate of PCA it is unlikely that the cumulative effects of Project will have a significant adverse effect.

9.0 SITE INSPECTION

<input type="checkbox"/>	Site inspection not required
<input checked="" type="checkbox"/>	Site inspection required
<p>Environmental monitoring is recommended to be carried out by a Qualified Environmental Professional (QEP) during the Project to ensure that prescribed mitigation measures set out in this EIA, as well as the recommendations made by PCA, are being applied. Additionally, it is expected that an EMP, which typically includes recommendations for environmental monitoring, will be prepared for the Project by the construction contractor.</p> <p>Full time monitoring may not be necessary and an appropriate schedule should be established between the QEP and PCA. With the prescribed mitigation measures and BMPs in place, monitoring can likely be conducted at a part-time level as required.</p> <p>The EM should be present during project start up to provide direction with properly implementing the described mitigation measures. Site inspection/monitoring will likely focus on:</p> <ul style="list-style-type: none"> ▪ Surveying wet areas for amphibians and turtles; ▪ Surveying for rare plants; ▪ Monitoring for wildlife activity; ▪ Inspecting erosion and sediment control measures and other impact mitigation BMPs used. 	

10.0 EXPERTS CONSULTED

Department/Agency/Institution	Parks Canada Agency
Contact Information	Tara Sharma, Acting Ecosystem Team Leader & Geomatics Coordinator, GINPR
Date of Request	2015-02-06
Expertise Requested	Requested information on SARA species occurring near Greenburn Lake.
Response	Provided an Amphibian and Reptile Survey (2004) and a Plan to identify Painted Turtles in Greenburn Lake (2015).

Department/Agency/Institution	Parks Canada Agency
Contact Information	Tara Sharma, Acting Ecosystem Team Leader & Geomatics Coordinator, GINPR
Date of Request	2015-02-16
Expertise Requested	Requested information on fish species occurring in Greenburn Lake.
Response	Provided "Resource Data Report" (Golumbia and Mercer 2008) and email response – only stickleback known from surveys, residents believe there are trout.

Department/Agency/Institution	Parks Canada Agency
Contact Information	Sandy Cummings, Strategic Asset Management Western & Northern Region Nicole Kroeker, Acting, Species at Risk, Coastal BC Field Unit
Date of Request	2015-02-18
Expertise Requested	Requested that any information for Western Painted Turtle mitigation be provided.
Response	Provided recommendations during phone call, provided additional mitigation measures in February 19 email.

Department/Agency/Institution	Parks Canada Agency
Contact Information	Todd Shannon
Date of Request	2014-12-03
Expertise Requested	Requested any information he may have regarding biophysical conditions at Greenburn Lake, including anything for sensitive species.
Response	Mr. Shannon provided verbal accounts of known and suspected species at Greenburn Lake and stated that he would put Tetra Tech EBA in contact with other PCA staff who may have more information.

Department/Agency/Institution	BC MOE, Conservation Data Centre
Contact Information	Katrina Stipec
Date of Request	2015-02-06
Expertise Requested	Species/occurrence information for Masked Sensitive Species proximate to Project Area.
Response	Ms. Stipec provided information for species occurring near project, including shape files of locations and observation dates.

Public Participation? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
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11.0 DECISION

Taking into account implementation of mitigation measures outlined in the analysis, the project is:	
<input type="checkbox"/>	Not likely to cause significant adverse environmental effects.
<input type="checkbox"/>	Likely to cause significant adverse environmental effects.

12.0 SIGNATURES AND APPROVAL

Tetra Tech EBA Author		
Name: Shawneen Walker, R.P.Bio, P.Biol., EP		Title: Aquatic Biologist
Signature		Date
Name:	Title:	
Signature		Date
Decision Approval		
Name:		Title: (Park, Site or Field Unit Superintendent, or Designate
Signature		Date (YYYY-MM-DD)

13.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech EBA Inc.

ISSUED FOR REVIEW

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FIGURES

Figure 1	Site Location
Figure 2a	Project Work Area – Outlet Pond and Existing Access Road
Figure 2b	Project Work Area – Dam
Figure 3a	Dam and Spillway Existing Conditions, Plan View
Figure 3b	Proposed Dam Rehabilitation Crossection
Figure 4a	Proposed Pond and Bypass Channel
Figure 4b	Proposed Bypass Channel Profile and Typical Sections

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LEGEND

- ★ Site Location
- Road

NOTES

Base data source:
Imagery from Google; USDA Farm
Service Agency; DigitalGlobe;
NASA (2011)
CanVec 1:50,000
ESRI Data & Maps

STATUS
ISSUED FOR REVIEW

BASIC ENVIRONMENTAL IMPACT ANALYSIS GREENBURN LAKE DAM

Project Location

PROJECTION
UTM Zone 10

DATUM
NAD83

CLIENT
 Parks Canada

Scale: 1:20,000
400 200 0 400
Metres

FILE NO.
K13103348-01_002_Figure01_SiteLocation.mxd

PROJECT NO.
K13103348-01.002

OFFICE
T1 EBA-VANC

DWN
MEZ

CKD
SL

APVD
SW

REV
0

DATE
March 3, 2015

 **TETRA TECH** EBA

Figure 1



LEGEND:

- Approximate Legal Lines
- Approximate Road Alignments

0 250
Scale: 1: 5 000 (metres)

NOTES

- Images and Base map adopted from Google Earth Professional and CRD Atlas.

CLIENT



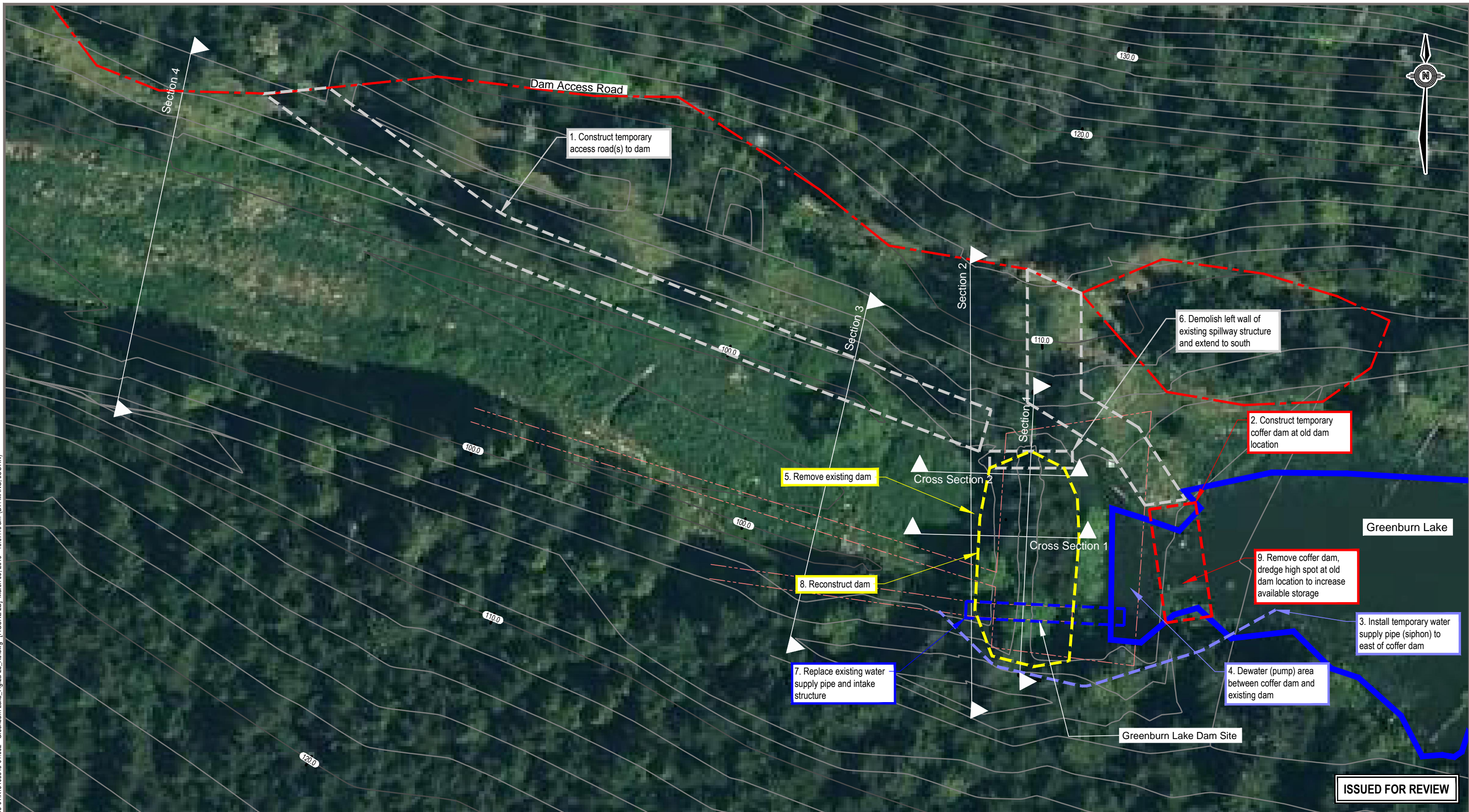
BASIC ENVIRONMENTAL IMPACT ASSESSMENT,
GREENBURN LAKE DAM

PROJECT WORK AREAS
ACCESS ROAD & POND OUTFLOW

PROJECT NO. K13103348-01.002	DWN RERH	CKD MJL	REV 0
OFFICE EBA-Kelowna	DATE March 03, 2015		

Figure 2a

Q:\Vancouver\Drafting\Engineering\K131\K13103348-01\K13103348-01.002 - Greenburn Lake_Fig 2a-2b_R0.dwg [FIGURE 2B] March 05, 2015 - 10:07:49 am (BY: MANG, JUSTIN)



LEGEND:

- Approximate Legal Lines
- Approximate Road Alignments

0 250

Scale: 1: 5 000 (metres)

NOTES

- Images and Base map adopted from Google Earth Professional and CRD Atlas.
- Construction & laydown/access areas will be delineated and marked as per PCA direction to avoid impacts to Western Painted Turtle.

CLIENT

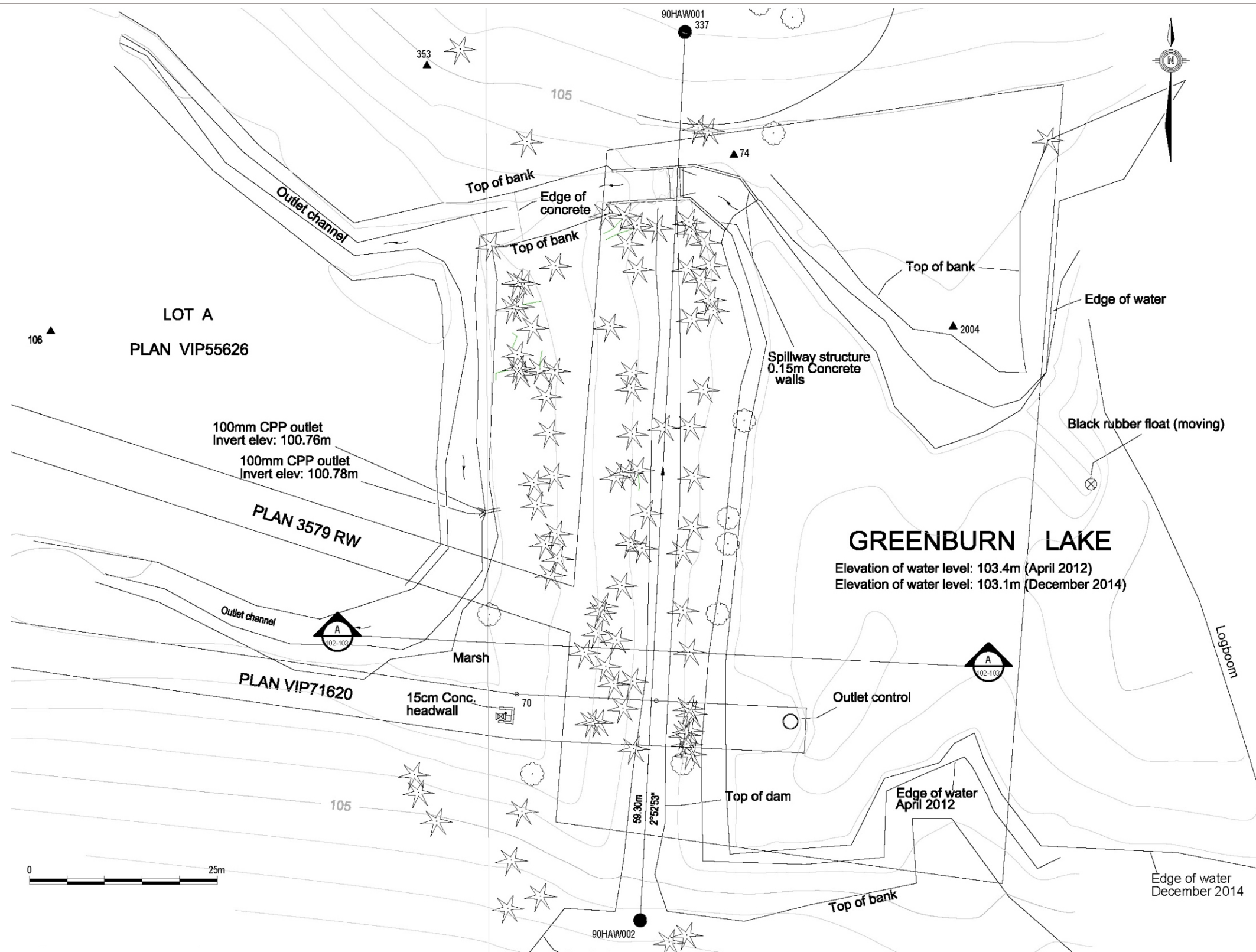


BASIC ENVIRONMENTAL IMPACT ASSESSMENT, GREENBURN LAKE DAM

PROJECT WORK AREAS DAM & TEMPORARY ACCESS

PROJECT NO. K13103348-01.002	DWN RERH	CKD MJL	REV 0
OFFICE EBA-Kelowna	DATE March 04, 2015		

Figure 2b



NOTES

STATUS
ISSUED FOR REVIEW

CLIENT

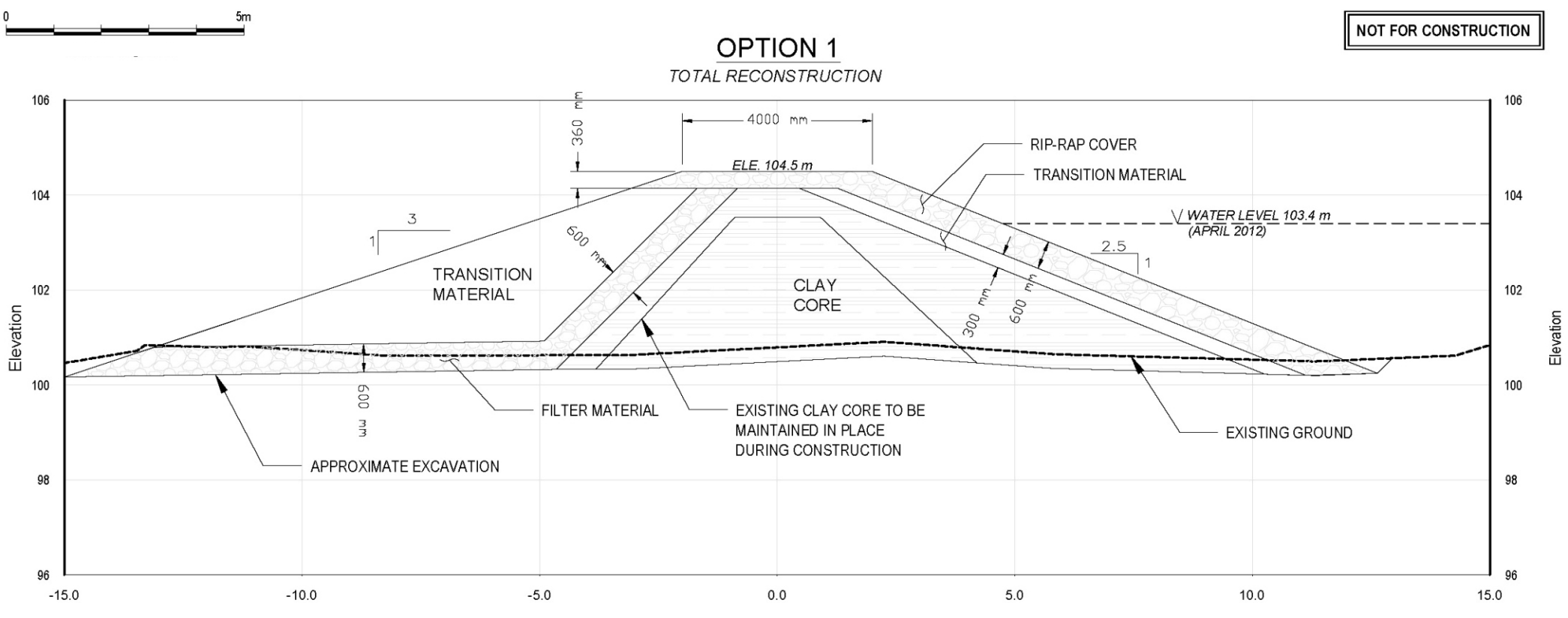
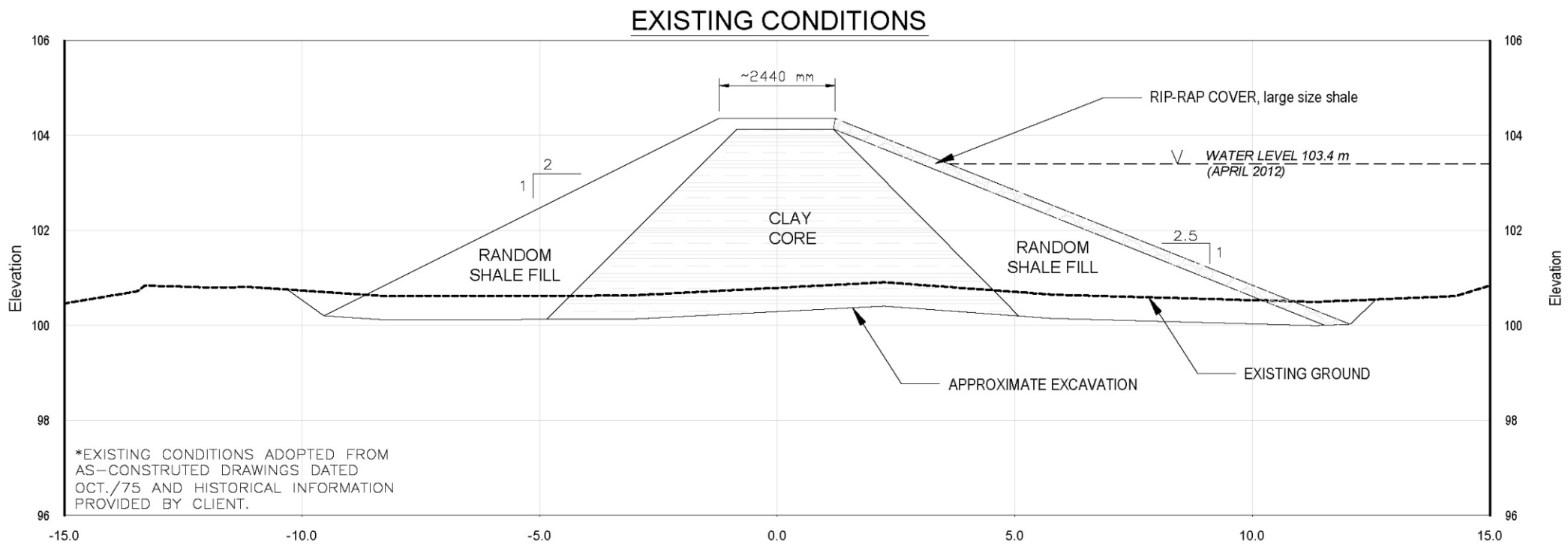


**BASIC ENVIRONMENTAL IMPACT ASSESSMENT
GREENBURN LAKE DAM**

**Dam and Spillway
Existing Conditions Plan View**

PROJECT NO. K13103348-01.002	DWN MEZ	CKD SL	APVD SW	REV 0
OFFICE Tt EBA-VANC	DATE March 3, 2015			

Figure 3a



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NOTES

STATUS
ISSUED FOR REVIEW

CLIENT



BASIC ENVIRONMENTAL IMPACT ASSESSMENT
GREENBURN LAKE DAM

Proposed Dam Rehabilitation
Cross Section

PROJECT NO. K13103348-01.002	DWN MEZ	CKD SL	APVD SW	REV 0
OFFICE Tt EBA-VANC	DATE March 3, 2015			

Figure 3b



Figure 4b

APPENDIX A

TETRA TECH'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOENVIRONMENTAL REPORT

This report incorporates and is subject to these “General Conditions”.

1.0 USE OF REPORT AND OWNERSHIP

This report pertains to a specific site, a specific development, and a specific scope of work. It is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site or proposed development would necessitate a supplementary investigation and assessment.

This report and the assessments and recommendations contained in it are intended for the sole use of Tetra Tech EBA's client. Tetra Tech EBA does not accept any responsibility for the accuracy of any of the data, the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than Tetra Tech EBA's Client unless otherwise authorized in writing by Tetra Tech EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of Tetra Tech EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where Tetra Tech EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed Tetra Tech EBA's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by Tetra Tech EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of Tetra Tech EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except Tetra Tech EBA. The Client warrants that Tetra Tech EBA's instruments of professional service will be used only and exactly as submitted by Tetra Tech EBA.

Electronic files submitted by Tetra Tech EBA have been prepared and submitted using specific software and hardware systems. Tetra Tech EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

3.0 NOTIFICATION OF AUTHORITIES

In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by Tetra Tech EBA in its reasonably exercised discretion.

4.0 INFORMATION PROVIDED TO TETRA TECH EBA BY OTHERS

During the performance of the work and the preparation of the report, Tetra Tech EBA may rely on information provided by persons other than the Client. While Tetra Tech EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, Tetra Tech EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

APPENDIX B

SITE PHOTOS



Photo 1: Pond at South Pender Fire Hall – to be backfilled.



Photo 2: Upstream side of existing dam.



Photo 3: Existing spillway.



Photo 4: Vegetation immediately downstream of existing dam.

APPENDIX C

SPECIES AT RISK DATABASE SEARCH RESULTS

BC Species and Ecosystems Explorer Search Results

Status							
Scientific Name	English Name	Provincial	BC List	COSEWIC	SARA	Global	CF Priority
<i>Accipiter gentilis laingi</i>	Northern Goshawk, <i>laingi</i> subspecies	S2B (2010)	Red	T (2013)	1-T (2003)	G5T2 (2008)	1
<i>Anaxyrus boreas</i>	Western Toad	S3S4 (2010)	Blue	SC (2012)	1-SC (2005)	G4 (2008)	2
<i>Aneides vagrans</i>	Wandering Salamander	S3S4 (2010)	Blue	SC (2014)		G4 (2005)	2
<i>Ardea herodias fannini</i>	Great Blue Heron, <i>fannini</i> subspecies	S2S3B,S4N (2009)	Blue	SC (2008)	1-SC (2010)	G5T4 (1997)	1
<i>Asio flammeus</i>	Short-eared Owl	S3B,S2N (2009)	Blue	SC (2008)	1-SC (2012)	G5 (2008)	2
<i>Botaurus lentiginosus</i>	American Bittern	S3B (2010)	Blue			G4 (1996)	2
<i>Brachyramphus marmoratus</i>	Marbled Murrelet	S3B,S3N (2010)	Blue	T (2012)	1-T (2003)	G3 (2013)	1
<i>Butorides virescens</i>	Green Heron	S3S4B (2009)	Blue			G5 (1996)	4
<i>Callophrys eryphon sheltonensis</i>	Western Pine Elfin, <i>sheltonensis</i> subspecies	S3 (2013)	Blue			G5TNR	4
<i>Callophrys johnsoni</i>	Johnson's Hairstreak	S1S2 (2013)	Red			G3G4 (2004)	2
<i>Callophrys mossii mossii</i>	Moss' Elfin, <i>mossii</i> subspecies	S2S3 (2013)	Blue			G4T4 (2001)	2
<i>Carychium occidentale</i>	Western Thorn	S2S3 (2008)	Blue			G3G4 (2002)	2
<i>Cercyonis pegala incana</i>	Common Wood-nymph, <i>incana</i> subspecies	S2 (2013)	Red			G5T4T5 (2003)	2
<i>Chordeiles minor</i>	Common Nighthawk	S4B (2010)	Yellow	T (2007)	1-T (2010)	G5 (2009)	2
<i>Chrysemys picta</i>	Painted Turtle	S3 (2012)	No Status	E/SC (2006)	1	G5 (2005)	2
<i>Chrysemys picta pop. 1</i>	Painted Turtle - Pacific Coast Population	S2 (2012)	Red	E (2006)	1-E (2007)	G5T2 (2007)	2
<i>Coenonympha tullia insulana</i>	Common Ringlet, <i>insulana</i> subspecies	S1 (2013)	Red			G5T3T4 (1998)	1
<i>Contia tenuis</i>	Sharp-tailed Snake	S1S2 (2012)	Red	E (2009)	1-E (2003)	G5 (2010)	1
<i>Contopus cooperi</i>	Olive-sided Flycatcher	S3S4B (2009)	Blue	T (2007)	1-T (2010)	G4 (2008)	2
<i>Corynorhinus townsendii</i>	Townsend's Big-eared Bat	S3 (2013)	Blue			G3G4 (2014)	2
<i>Cryptomastix devia</i>	Puget Oregonian	SX (2008)	Red	XT (2013)	1-X (2005)	G3 (2005)	1
	Sooty Grouse	S3S4 (2009)	Blue				2

<i>Dendragapus fuliginosus</i>						G5 (2007)	
<i>Epargyreus clarus</i>	Silver-spotted Skipper	S3 (2013)	Blue			G5 (2009)	4
<i>Erynnis propertius</i>	Propertius Duskywing	S2 (2013)	Red			G5 (2009)	2
<i>Erythemis collocata</i>	Western Pondhawk	S3 (2004)	Blue			G5 (2000)	2
<i>Euchloe ausonides insulanus</i>	Large Marble, <i>insulanus</i> subspecies	SX (2013)	Red	XT (2010)	1-X (2003)	G5T1 (2010)	2
<i>Falco peregrinus anatum</i>	Peregrine Falcon, <i>anatum</i> subspecies	S2?B (2010)	Red	SC (2007)	1-SC (2012)	G4T4 (2006)	2
<i>Falco peregrinus pealei</i>	Peregrine Falcon, <i>pealei</i> subspecies	S3B (2010)	Blue	SC (2007)	1-SC (2003)	G4T3 (1997)	1
<i>Fossaria vancouverensis</i>		SH (2008)	Red			GHQ (2009)	1
<i>Fratercula cirrhata</i>	Tufted Puffin	S3B,S4N (2011)	Blue			G5 (2003)	2
<i>Glaucidium gnoma swarthi</i>	Northern Pygmy-Owl, <i>swarthi</i> subspecies	S3 (2009)	Blue			G4G5T3Q (1996)	1
<i>Hemphillia dromedarius</i>	Dromedary Jumping-slug	S2 (2008)	Red	T (2014)	1-T (2005)	G3G4 (2005)	2
<i>Hemphillia glandulosa</i>	Warty Jumping-slug	S2S3 (2008)	Blue	SC (2013)	1-SC (2005)	G3G4 (2005)	2
<i>Hesperia colorado oregonia</i>	Western Branded Skipper, <i>oregonia</i> subspecies	S1 (2013)	Red	E (2013)		G5T3T4 (2000)	2
<i>Hirundo rustica</i>	Barn Swallow	S3S4B (2009)	Blue	T (2011)		G5 (1996)	2
<i>Hydroprogne caspia</i>	Caspian Tern	S3B (2011)	Blue	NAR (1999)		G5 (1996)	2
<i>Megascops kennicottii kennicottii</i>	Western Screech-Owl, <i>kennicottii</i> subspecies	S3 (2009)	Blue	T (2012)	1-SC (2005)	G5T4 (2003)	1
<i>Monadenia fidelis</i>	Pacific Sideband	S3S4 (2008)	Blue			G4G5 (2002)	2
<i>Mustela erminea anguinae</i>	Ermine, <i>anguinae</i> subspecies	S3 (2010)	Blue			G5T3 (1996)	2
<i>Myotis keenii</i>	Keen's Myotis	S2S3 (2013)	Blue	DD (2003)	3 (2005)	G2G3 (2012)	1
<i>Nearctula</i> sp. 1	Threaded Vertigo	S2 (2008)	Red	SC (2010)	1-SC (2012)	G3G5 (2006)	2
<i>Patagioenas fasciata</i>	Band-tailed Pigeon	S3S4B (2009)	Blue	SC (2008)	1-SC (2011)	G4 (2000)	2
<i>Phalacrocorax auritus</i>	Double-crested Cormorant	S3S4B (2013)	Blue	NAR (1978)		G5 (1999)	2
<i>Physa acuta</i>	Pewter Physa	S1S3 (2008)	Red			G5Q (2008)	2
<i>Plebejus saepiolus insulanus</i>		SH (2013)	Red	E (2012)	1-E (2003)	G5TH (2003)	1

	Greenish Blue, <i>insulanus</i> subspecies						
<i>Pristiloma johnsoni</i>	Broadwhorl Tightcoil	S2S3 (2008)	Blue			G3 (2013)	2
<i>Progne subis</i>	Purple Martin	S2S3B (2005)	Blue			G5 (1996)	3
<i>Promenetus umbilicatellus</i>	Umbilicate Sprite	S3S4 (2008)	Blue			G4 (2000)	2
<i>Prophyaon coeruleum</i>	Blue-grey Taidropper	S1 (2008)	Red	E (2006)	1-E (2007)	G3G4 (2010)	1
<i>Prophyaon vanattae</i>	Scarletback Taidropper	S3S4 (2008)	Blue			G4 (2002)	4
<i>Rana aurora</i>	Northern Red- legged Frog	S3S4 (2010)	Blue	SC (2004)	1-SC (2005)	G4 (2008)	1
<i>Sorex palustris brooksi</i>	American Water Shrew, <i>brooksi</i> subspecies	S2 (2010)	Red			G5T2 (1996)	1
<i>Speyeria zerene bremnerii</i>	Zerene Fritillary, <i>bremnerii</i> subspecies	S2 (2013)	Red			G5T3T4 (1998)	2
<i>Sympetrum vicinum</i>	Autumn Meadowhawk	S3S4 (2004)	Blue			G5 (1985)	4
<i>Tramea lacerata</i>	Black Saddlebags	S1 (2006)	Red			G5 (1985)	2
<i>Tyto alba</i>	Barn Owl	S3 (2009)	Blue	T (2010)	1-SC (2003)	G5 (1996)	2
<i>Vertigo andrusiana</i>	Pacific Vertigo	S2 (2008)	Red			G2G3 (2004)	1
<i>Zonitoides nitidus</i>	Black Gloss	S3S4 (2008)	Blue			G5 (2003)	2

Search Summary

Time Performed Tue Dec 09 19:00:37 PST 2014

Results 58 records.

Search Criteria Search Type: Animal
AND Forest Districts: South Island Forest District (DSI) (Restricted to Red, Blue, and Legally designated species)
AND MOE Regions: 1- Vancouver Island (Restricted to Red, Blue, and Legally designated species)
AND Regional Districts: Capital (CRD) (Restricted to Red, Blue, and Legally designated species)
AND Habitat Types: Forest, Lakes, Riparian, Springs, Stream/River, Subterranean, Wetland (Restricted to Red, Blue, and Legally designated species)
AND BGC Zone: CDF
Sort Order: Scientific Name Ascending

Notes 1. Citation: B.C. Conservation Data Centre. 2014. BC Species and Ecosystems Explorer. B.C. Minist. of Environ. Victoria, B.C. Available: <http://a100.gov.bc.ca/pub/eswp/> (accessed Dec 9, 2014).

2. Forest District, MoE Region, Regional District and habitat lists are restricted to species that breed in the Forest District, MoE Region, Regional District or habitat (i.e., species will not be placed on lists where they occur only as migrants).

[Modify Search](#) | [New Search](#) | [Results](#)

BC Species and Ecosystems Explorer Search Results

Status							
Scientific Name	English Name	Provincial	BC List	COSEWIC	SARA	Global	CF Priority
<i>Acmispon americanus</i> var. <i>americanus</i>	Spanish-clover	S3 (2007)	Blue			G5T5 (1994)	4
<i>Allium amplexens</i>	slimleaf onion	S3 (2001)	Blue			G4 (1988)	2
<i>Allium geyeri</i> var. <i>tenerum</i>	Geyer's onion	S2S3 (2005)	Blue			G4G5T3T5 (2002)	3
<i>Anagallis minima</i>	chaffweed	S3 (2008)	Blue			G5 (1984)	2
<i>Balsamorhiza deltoidea</i>	deltoid balsamroot	S1 (2009)	Red	E (2009)	1-E (2003)	G5 (1988)	1
<i>Bidens amplissima</i>	Vancouver Island beggarticks	S3 (2008)	Blue	SC (2001)	1-SC (2003)	G3 (1988)	1
<i>Callitriche heterophylla</i> var. <i>heterophylla</i>	two-edged water-starwort	S2S3 (2000)	Blue			G5T5 (1998)	3
<i>Carex feta</i>	green-sheathed sedge	S2S3 (2012)	Blue			G5 (1990)	2
<i>Carex tumulicola</i>	foothill sedge	S2 (2011)	Red	E (2008)	1-E (2010)	G4 (1985)	2
<i>Cephalanthera austini</i>	phantom orchid	S2 (2000)	Red	T (2000)	1-T (2003)	G4 (1990)	2
<i>Ceratophyllum echinatum</i>	spring hornwort	S3 (2002)	Blue			G4? (1995)	4
<i>Cuscuta campestris</i>	field dodder	S2S3 (2000)	Blue			G5 (2007)	2
<i>Cyperus squarrosus</i>	awned cyperus	S3 (2014)	Blue			G5 (1993)	2
<i>Eleocharis parvula</i>	small spike-rush	S2S3 (2000)	Blue			G5 (1984)	3
<i>Epilobium torreyi</i>	brook spike-primrose	SX (2004)	Red	E (2006)	1-E (2007)	G5 (1988)	2
<i>Eurybia radulina</i>	rough-leaved aster	S1 (2000)	Red			G4G5 (1988)	2
<i>Fraxinus latifolia</i>	Oregon ash	S1S2 (2013)	Red			G5 (1990)	1
<i>Glyceria leptostachya</i>	slender-spiked mannagrass	S2S3 (2000)	Blue			G3 (1991)	2
<i>Grindelia hirsutula</i> var. <i>hirsutula</i>	hairy gumweed	S2 (2012)	Red			G5T3T4 (2000)	2
<i>Heterocodon rariflorum</i>	heterocodon	S3 (2012)	Blue			G5 (1988)	2
<i>Hydrophyllum tenuipes</i>	Pacific waterleaf	S2 (2007)	Red			G4G5 (1988)	2
<i>Isoetes nuttallii</i>	Nuttall's quillwort	S3 (2001)	Blue			G4? (2011)	2
<i>Juncus kelloggii</i>	Kellogg's rush	S1 (2009)	Red	E (2003)	1-E (2005)	G3? (1990)	2
<i>Limnanthes macounii</i>	Macoun's meadow-foam	S2 (2007)	Red	T (2004)	1-T (2006)	G2 (2012)	1
<i>Lomatium dissectum</i> var. <i>dissectum</i>	fern-leaved desert-parsley	S1S2 (2014)	Red			G4T4 (2003)	1

<i>Lomatium grayi</i>	Gray's desert-parsley	S1 (2008)	Red	T (2008)	1-T (2011)	G5 (1987)	2
<i>Lupinus oreganus</i> var. <i>kincaidii</i>	Kincaid's lupine	SX (2000)	Red	XT (2008)	1-X (2011)	G4T2 (2000)	1
<i>Lupinus rivularis</i>	streambank lupine	S1 (2009)	Red	E (2002)	1-E (2005)	G2G4 (2009)	1
<i>Meconella oregana</i>	white meconella	S1 (2005)	Red	E (2005)	1-E (2006)	G2G3 (2013)	1
<i>Melica harfordii</i>	Harford's melic	S3 (2013)	Blue			G5 (1990)	2
<i>Minuartia pusilla</i>	dwarf sandwort	S1 (2009)	Red	E (2004)	1-E (2005)	G5 (1990)	2
<i>Ophioglossum pusillum</i>	northern adder's-tongue	S2S3 (2000)	Blue			G5 (2011)	3
<i>Packera macounii</i>	Macoun's groundsel	S3 (2001)	Blue			G5 (1993)	2
<i>Piperia candida</i>	white-lip rein orchid	S2 (2001)	Red			G3? (2012)	2
<i>Plagiobothrys tenellus</i>	slender popcornflower	S1 (2013)	Red	T (2008)	1-T (2011)	G4G5 (1988)	1
<i>Pleuropogon refractus</i>	nodding semaphoregrass	S3 (2001)	Blue			G4 (1997)	2
<i>Potamogeton oakesianus</i>	Oakes' pondweed	S2S3 (2001)	Blue			G4 (1988)	2
<i>Potentilla gracilis</i> var. <i>gracilis</i>	graceful cinquefoil	S2S3 (2006)	Blue			G5T5 (2012)	2
<i>Ranunculus alismifolius</i> var. <i>alismifolius</i>	water-plantain buttercup	S1 (2009)	Red	E (2009)	1-E (2003)	G5T5 (1995)	1
<i>Ranunculus lobbii</i>	Lobb's water-buttercup	SH (2006)	Red			G4 (1991)	2
<i>Rupertia physodes</i>	California-tea	S3 (2001)	Blue			G4 (1985)	2
<i>Sanicula bipinnatifida</i>	purple sanicle	S2 (2009)	Red	T (2001)	1-T (2003)	G5 (1990)	2
<i>Sericocarpus rigidus</i>	white-top aster	S2 (2008)	Red	SC (2009)	1-SC (2003)	G3 (2007)	1
<i>Sidalcea hendersonii</i>	Henderson's checker-mallow	S3 (2001)	Blue			G3 (2004)	2
<i>Silene scouleri</i> ssp. <i>scouleri</i>	coastal Scouler's catchfly	S1 (2000)	Red	E (2003)	1-E (2005)	G5T3T5 (2002)	4
<i>Tonella tenella</i>	small-flowered tonella	S1 (2009)	Red	E (2003)	1-E (2005)	G5 (1990)	2
<i>Toxicodendron diversilobum</i>	poison oak	S2S3 (2000)	Blue			G5 (1999)	2
<i>Trifolium cyathiferum</i>	cup clover	S1 (2000)	Red			G4 (1990)	2
<i>Triglochin concinna</i>	graceful arrow-grass	S2 (2000)	Red			G5 (1990)	3
<i>Triteleia howellii</i>	Howell's triteleia	S1 (2005)	Red	E (2003)	1-E (2005)	G4G5T3T4Q (2003)	1
<i>Uropappus lindleyi</i>	Lindley's microseris	S1 (2000)	Red	E (2008)	1-E (2010)	G5 (1990)	1
<i>Viola howellii</i>	Howell's violet	S2S3 (2000)	Blue			G4 (1988)	2

<i>Wolffia columbiana</i>	Columbian water-meal	S1 (2000)	Red			G5 (1984)	2
<i>Woodwardia fimbriata</i>	giant chain fern	S3 (2011)	Blue			G5 (1994)	2
<i>Yabea microcarpa</i>	California hedge-parsley	S3 (2014)	Blue			G5? (1990)	1
<i>Zeltnera muehlenbergii</i>	Muhlenberg's centaury	S1 (2009)	Red	E (2008)	1-E (2010)	G5? (1996)	1

Search Summary

Time Performed Tue Dec 09 18:59:04 PST 2014

Results 56 records.

Search Criteria Search Type: Plant
AND Forest Districts: South Island Forest District (DSI) (Restricted to Red, Blue, and Legally designated species)
AND MOE Regions: 1- Vancouver Island (Restricted to Red, Blue, and Legally designated species)
AND Regional Districts: Capital (CRD) (Restricted to Red, Blue, and Legally designated species)
AND Habitat Types: Forest, Lakes, Riparian, Springs, Stream/River, Subterranean, Wetland (Restricted to Red, Blue, and Legally designated species)
AND BGC Zone: CDF
Sort Order: Scientific Name Ascending

Notes 1. Citation: B.C. Conservation Data Centre. 2014. BC Species and Ecosystems Explorer. B.C. Minist. of Environ. Victoria, B.C. Available: <http://a100.gov.bc.ca/pub/eswp/> (accessed Dec 9, 2014).
2. Forest District, MoE Region, Regional District and habitat lists are restricted to species that breed in the Forest District, MoE Region, Regional District or habitat (i.e., species will not be placed on lists where they occur only as migrants).

[Modify Search](#) | [New Search](#) | [Results](#)

BC Species and Ecosystems Explorer Search Results

Scientific Name	English Name	Biogeoclimatic Units	Status			Identified Wildlife	Land Use Objectives	CF Priority
			Provincial	BC List	Global			
<i>Abies grandis</i> / <i>Mahonia nervosa</i>	grand fir / dull Oregon-grape	CDFmm/04	S1 (2005)	Red	G1			1
<i>Abies grandis</i> / <i>Tiarella trifoliata</i>	grand fir / three-leaved foamflower	CDFmm/06	S1 (2013)	Red	G1			1
<i>Alnus rubra</i> / <i>Carex obnupta</i> [<i>Populus trichocarpa</i>]	red alder / slough sedge [black cottonwood]	CDFmm/14	S1 (2006)	Red	G1			1
<i>Alnus rubra</i> / <i>Lysichiton americanus</i>	red alder / skunk cabbage	CDFmm/Ws52	S2 (2010)	Red	GNR			1
<i>Arbutus menziesii</i> / <i>Arctostaphylos columbiana</i>	arbutus / hairy manzanita	CDFmm/00 CWHxm1/00	S2 (2013)	Red	G2			2
<i>Brasenia schreberi</i> - <i>Utricularia</i> spp.	water shield - bladderworts	CDFmm CWHdm CWHmm1 CWHmm2 CWHvh1 CWHvm1 CWHvm2 CWHxm1 CWHxm2	SNR	No Status	GNR			
<i>Dulichium arundinaceum</i> Herbaceous Vegetation	three-way sedge	CDFmm/Wm51 CWHmm1/Wm51 CWHxm2/Wm51 ICHwk1/Wm51	S2 (2004)	Red	GNR			2
<i>Eleocharis palustris</i> Herbaceous Vegetation	common spike-rush Herbaceous Vegetation	BGxw2/Wm04 CDFmm/Wm04 CWH/Wm04 ESSFdv d/Wm04 ESSFdv/Wm04 IDFxm/Wm04 SBSdk/Wm04 SBSmk2/Wm04	S3 (2004)	Blue	GNR			3
<i>Populus trichocarpa</i> - <i>Alnus rubra</i> / <i>Rubus spectabilis</i>	black cottonwood - red alder / salmonberry	CDFmm/08 CWHdm/09 CWHds1/09 CWHds2/09 CWHmm1/09 CWHms1/08 CWHms2/08 CWHvm1/10 CWHwm/06 CWHws1/08 CWHws2/08 CWHxm1/09 CWHxm2/09	S3 (2010)	Blue	GNR		Central and North Coast LUO South Central Coast LUO	2
<i>Pseudotsuga menziesii</i> - <i>Arbutus menziesii</i>	Douglas-fir - arbutus	CDFmm/02	S2 (2004)	Red	GNR			1
<i>Pseudotsuga menziesii</i> / <i>Mahonia nervosa</i>	Douglas-fir / dull Oregon-grape	CDFmm/01 CWHxm1	S2 (2010)	Red	G2	Y		1
<i>Pseudotsuga menziesii</i> / <i>Melica subulata</i>	Douglas-fir / Alaska oniongrass	CDFmm/03	S1 (2006)	Red	G1	Y		1
<i>Quercus garryana</i> - <i>Arbutus menziesii</i>	Garry oak - arbutus	CDFmm/00	S1 (2004)	Red	G1			2
<i>Quercus garryana</i> / <i>Bromus carinatus</i>	Garry oak / California brome	CDFmm/00	S1 (2004)	Red	G1			2
<i>Quercus garryana</i> / <i>Holodiscus discolor</i>	Garry oak / oceanspray	CDFmm/00	S1 (2004)	Red	G1			2
<i>Salix sitchensis</i> - <i>Salix lasiandra</i> var. <i>lasiandra</i> / <i>Lysichiton americanus</i>	Sitka willow - Pacific willow / skunk cabbage	CDFmm/Ws51 CWH/Ws51 ICH/Ws51	S2 (2004)	Red	G2			1
<i>Schoenoplectus acutus</i> Deep Marsh	hard-stemmed bulrush Deep Marsh	BGxh1/Wm06 BGxh2/Wm06 BGxw1/Wm06 BGxw2/Wm06 CDFmm/Wm06 CWHxm1/Wm06 ICHwk1/Wm06 IDFdk1/Wm06 IDFdk3/Wm06 IDFdk4/Wm06 IDFdk5/Wm06	S3 (2004)	Blue	G5			4

		IDFdm2/Wm06 IDFmw1/Wm06 IDFhx1/Wm06 IDFhx2/Wm06 IDFkx/Wm06 IDFxm/Wm06 MSdk/Wm06 MSdm2/Wm06 PPxh1/Wm06 PPxh2/Wm06 PPxh3/Wm06 SBPSmk/Wm06 SBPSxc/Wm06 SBSmk2/Wm06				
<i>Spiraea douglasii</i> / <i>Carex sitchensis</i>	hardhack / Sitka sedge	CDFmm/Ws50 CWHxm1/Ws50 CWHxm2/Ws50 ICHmc1/Ws50 SBSmk1/Ws50 SBSwk1/Ws50	S4 (2004)	Yellow	G4	4
<i>Thuja plicata</i> / <i>Achlys</i> <i>triphylla</i>	western redcedar / vanilla-leaf	CDFmm/12	S1 (2013)	Red	G1	2
<i>Thuja plicata</i> / <i>Oemleria cerasiformis</i>	western redcedar / Indian-plum	CDFmm/13	S1 (2006)	Red	G1	2
<i>Thuja plicata</i> - <i>Pseudotsuga</i> <i>menziesii</i> / <i>Eurhynchium</i> <i>oreganum</i>	western redcedar - Douglas-fir / Oregon beaked- moss	CDFmm/05	S1 (2013)	Red	GNR	2
<i>Thuja plicata</i> / <i>Symphoricarpos albus</i>	western redcedar / common snowberry	CDFmm/07	S1 (2013)	Red	GNR	1
<i>Typha latifolia</i> Marsh	common cattail Marsh	BGxh1/Wm05 BGxh2/Wm05 BGxw1/Wm05 BWBSmw/Wm05 CDFmm/Wm05 CWHdm/Wm05 CWHxm1/Wm05 CWHxm2/Wm05 IDFdk1/Wm05 IDFdk2/Wm05 IDFdk3/Wm05 IDFdk5/Wm05 IDFdm1/Wm05 IDFdm2/Wm05 IDFmw1/Wm05 IDFmw2/Wm05 IDFhx1/Wm05 IDFhx2/Wm05 IDFkx/Wm05 PPdh2/Wm05 PPxh1/Wm05 PPxh2/Wm05	S3 (2004)	Blue	G5	1

Search Summary

Time Performed Tue Dec 09 19:03:34 PST 2014

Results 23 records.

Search Criteria Search Type: Ecological Communities
AND Ecosystem Realm-Groups: Terrestrial - Forest OR Wetland - Mineral
AND Forest Districts: South Island Forest District (DSI)
AND MOE Regions: 1- Vancouver Island
AND Regional Districts: Capital (CRD)
AND BGC Zone, Subzone, Variant, Phase: CDFmm
Sort Order: Scientific Name Ascending

Notes

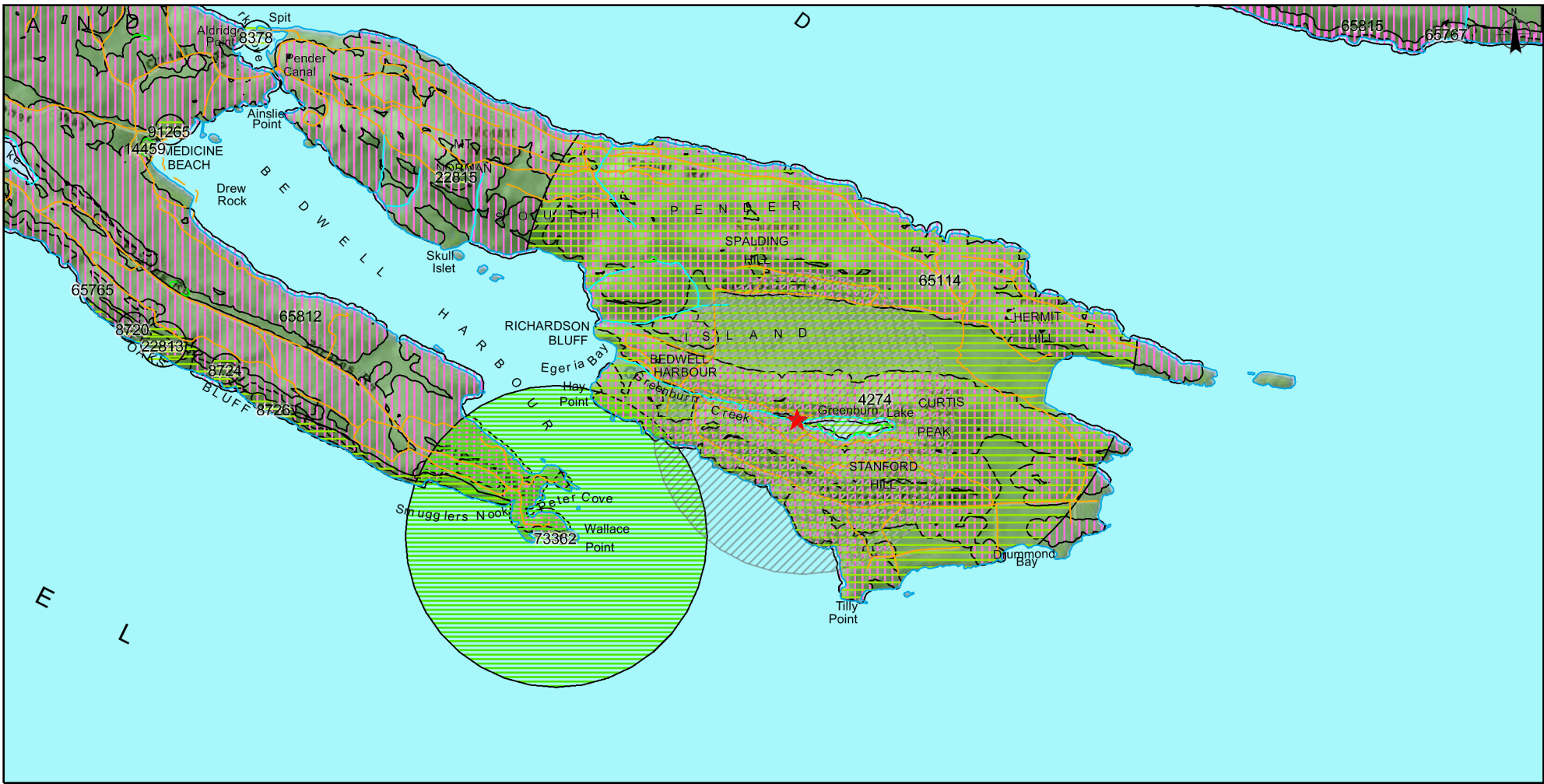
1. Citation: B.C. Conservation Data Centre. 2014. BC Species and Ecosystems Explorer. B.C. Minist. of Environ. Victoria, B.C. Available: <http://a100.gov.bc.ca/pub/eswp/> (accessed Dec 9, 2014).
2. Biogeoclimatic Site Unit(s): This column indicates the BGC unit(s) on which each ecological community is known to occur (future inventories may indicate range extensions). The two digit number following the slash (01 and up) indicates that the ecological community occurs on a site series that is part of the B.C. Ministry of Forests (MOF) site series classification (see [MOF Regional Field Guides to Site Identification and Interpretation](#) for more information). A two digit number of '00' indicates that the ecological community occurs on a site unit that is not part of the MOF site series classification but is recognized from other vegetation and site classifications, and ecosystem mapping projects.

[Modify Search](#) | [New Search](#) | [Results](#)



BC Conservation Data Centre - Occurrence Report

Non Sensitive Species Occurrences



Legend

- Non-sensitive Occurrences
- Animal - Vertebrate
 - Animal - Invertebrate
 - Plant - Vascular
 - Plant - Non-vascular
 - Ecological Community
- Masked Sensitive Occurrences
-
- Big Trees
-

Occurrence data is updated frequently.
This map should be considered out of
date 6 months after
February 6, 2015
For more information about the BC CDC
visit: <http://www.env.gov.bc.ca/cdc/>

Index Map



MAP COMPILATION
Projection: Albers Equal Area Conic
Datum: NAD 83



Map center: 48° 44' 40" N, 123° 12' 48" W

 Province of British Columbia
Ministry of Environment

Map Created February 6, 2015



BC Conservation Data Centre: Occurrence Report (4274)

February 6, 2015

Acmispon americanus var. *americanus*
Spanish-clover

Field definition document available at

<http://www.env.gov.bc.ca/atrisk/ims.htm>

This is a summary report. For a complete record contact the CDC (cdcddata@gov.bc.ca).

Identifiers

Occurrence ID:	4411	Status:	
Shape ID:	4274	Global:	G5T5
Type:	Vascular Plant	Provincial:	S3
		COSEWIC:	
Taxonomic Class:	dicots	BC List:	Blue
Data Sensitive:	N	SARA Schedule:	

Locators

Survey Site: SOUTH PENDER ISLAND, 3.2 KM. SOUTH OF MOUNT NORMAN
Directions:

Survey Information

First Obs. Date: 1974 **Last Obs. Date:** 1974-05-22
Occurrence Data: Douglas-fir hillside

Occurrence Rank and Occurrence Rank Factors

Rank: E Verified extant (viability not assessed) **Rank Date:** 1974-05-22

Rank Comments: There is insufficient data to assign a viability rank.

Condition of Occurrence

Size of Occurrence:

Landscape Context:

Description

General Description:

Vegetation Zone: Lowland
Habitat: TERRESTRIAL: Forest Needleleaf

Documentation

References: University of British Columbia. Dep. Bot., Dep. Zool., Biol. Sci. Bldg., 6270 Univ. Blvd., Vancouver, BC.

Version

Version Date:

Mapping Information

Estimated Representation
Accuracy:
Confidence Extent:



BC Conservation Data Centre: Occurrence Report (73362)

February 6, 2015

Leptogium platynum
batwing vinyl

Field definition document available at

<http://www.env.gov.bc.ca/atrisk/ims.htm>

This is a summary report. For a complete record contact the CDC (cdcdata@gov.bc.ca).

Identifiers

Occurrence ID:	9968	Status:	
Shape ID:	73362	Global:	G3G4
Type:	Fungus	Provincial:	S1S2
		COSEWIC:	E (MAY 2011)
Taxonomic Class:		BC List:	Red
		SARA Schedule:	
Data Sensitive:	N		

Locators

Survey Site:	NORTH PENDER ISLAND, WALLACE POINT
Directions:	On protected beach, near Wallace Point, Bedwell Harbour on North Pender Island.

Survey Information

First Obs. Date:	1974-05-23	Last Obs. Date:	2009-05-12
Occurrence Data:	The occurrence has been known since 1974 and was last surveyed in 2009. 2009-05-12: Surveys for the COSEWIC Status Report were conducted in the area of the original 1974 observation; no specimens were found during these surveys (COSEWIC 2011d). 1974-05-23: Observed on shale cliff among moss on a protected coastal beach (University of British Columbia Herbarium).		

Occurrence Rank and Occurrence Rank Factors

Rank:	E Verified extant (viability not assessed)	Rank Date:	2009-05-12
Rank Comments:	There is insufficient information to assign a viability rank.		
Condition of Occurrence	[No data provided.]		
Size of Occurrence:	[No data provided.]		
Landscape Context:	Climate change and increasing summer drought are thought to be threats for this population (COSEWIC 2011d).		

Description

General Description:	Located on a shale cliff among moss.
Vegetation Zone:	Lowland
Habitat:	TERRESTRIAL: Cliff; MARINE: Coastal Bluffs

Documentation

References: COSEWIC. 2011d. COSEWIC assessment and status report on the Batwing Vinyl Lichen *Leptogium platynum* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. ix + 22 pp. University of British Columbia. Dep. Bot., Dep. Zool., Biol. Sci. Bldg., 6270 Univ. Blvd., Vancouver, BC.

Version

Version Date: 02-OCT-12

Mapping Information

Estimated Representation Low

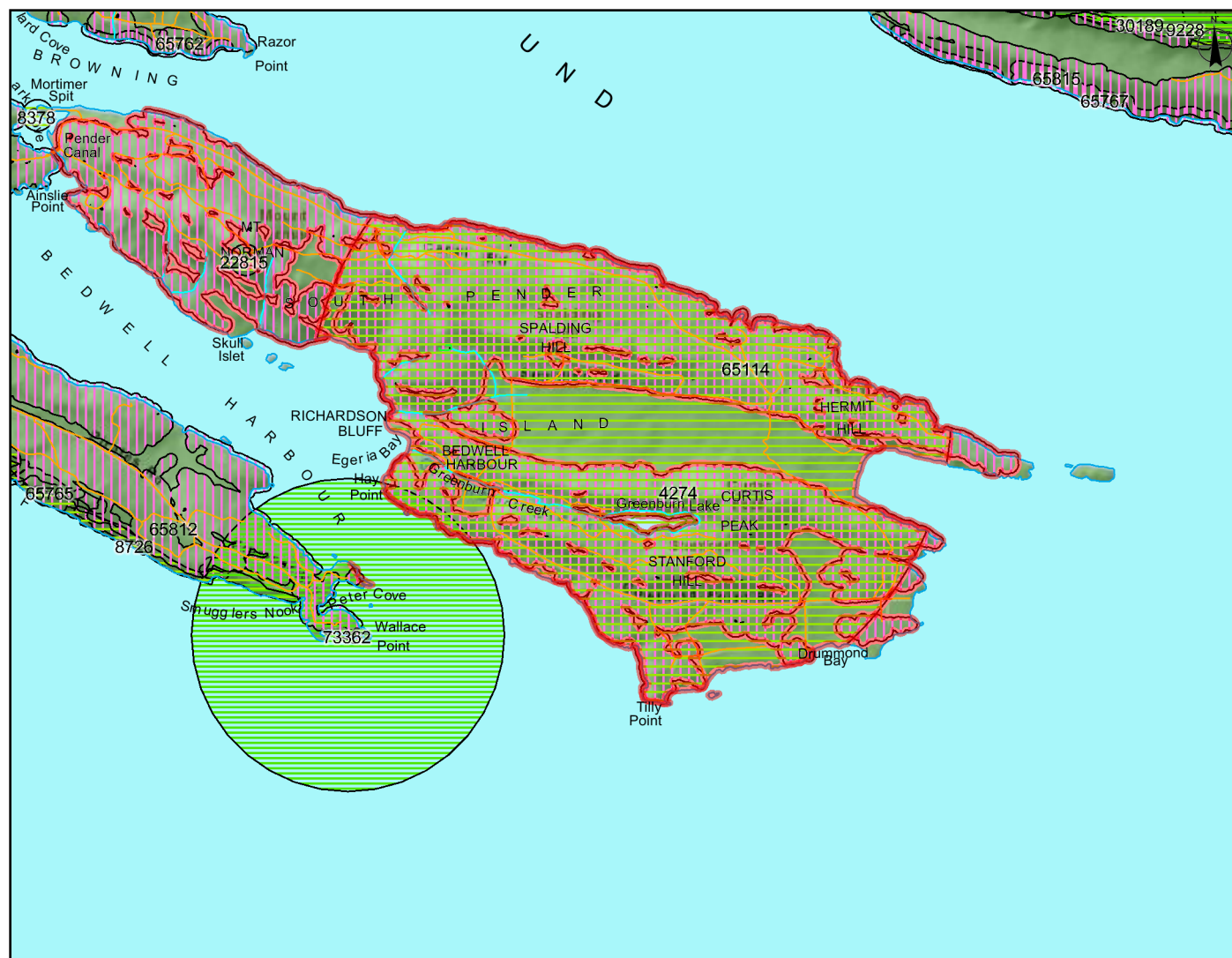
Accuracy:

Confidence Extent: N
February 6, 2015



BC Conservation Data Centre - Occurrence Report

CDC Non-Sensitive Ecosystem



Legend

Non-sensitive Occurrences

- Animal - Vertebrate
- Animal - Invertebrate
- Plant - Vascular
- Plant - Non-vascular
- Ecological Community

Masked Sensitive Occurrences

- Big Trees

Occurrence data is updated frequently.
This map should be considered out of
date 6 months after
February 13, 2015
For more information about the BC CDC
visit: <http://www.env.gov.bc.ca/cdc/>

Index Map



MAP COMPILATION
Projection: Albers Equal Area Conic
Datum: NAD 83

0 1250 2500 3750 m.
Scale: 1:42,639

Map center: 48° 44' 40" N, 123° 12' 31" W

Province of British Columbia
Ministry of Environment
Map Created February 13, 2015



BC Conservation Data Centre: Occurrence Report

(65114)

December 9, 2014

Pseudotsuga menziesii / *Mahonia nervosa*

Douglas-fir / dull Oregon-grape

Field definition document available at

<http://www.env.gov.bc.ca/atrisk/ims.htm>

This is a summary report. For a complete record contact the CDC (cdcddata@gov.bc.ca).

Identifiers

Occurrence ID:	9197	Status:	
Shape ID:	65114	Global:	G2
Type:	Ecological Community	Provincial:	S2
		BC List:	Red
Data Sensitive:	N		

Locators

Survey Site:	SOUTH PENDER ISLAND
Directions:	

Survey Information

First Obs. Date:	2004	Last Obs. Date:	2006
Occurrence Data:	<p>This coniferous forest occurrence is based on Terrestrial Ecosystem Mapping and has been confirmed by 17 ecosystem plots. It is mostly comprised of young (70%) and mature (27%) Douglas-fir dominated forests, with components of old forest (~3%) and veteran trees. These forests have mostly regenerated after selective or clear-cut harvesting, but some areas have regenerated after fire. Other co-occurring tree species include grand fir, arbutus, western redcedar, bigleaf maple and red alder, varying by localized soil-moisture conditions and time since disturbance. The terrain consists of a combination of decomposed bedrock, with morainal, and colluvial veneers with some areas containing glaciomarine deposits. This ecological community represents approximately 432 ha or 60% of the element occurrence.</p>		

Occurrence Rank and Occurrence Rank Factors

Rank:	BC Good or fair estimated viability	Rank Date:	13-01-18
Rank Comments:	<p>The Ecological Integrity of this occurrence is assessed as Good to Fair. Condition is fair, as it is influenced by the area of young forest, the roaded, residential and agricultural areas, and landscape context is considered good. Size is limited primarily by the island geography and consequently the integrity rank is weighted more heavily by the condition of the occurrence.</p>		
Condition of Occurrence:	<p>The occurrence is mostly comprised of young mixed with areas of mature forests, and small components of old forest structure (70/27/35%). Overall the stand structure is mixed with greater complexity in the areas of mature and old forest. The occurrence is somewhat internally fragmented by rural residential development and roads. Condition is assessed as Fair.</p>		
Size of Occurrence:	<p>The size of this occurrence is near the lower threshold of large size within this</p>		

fragmented landscape (432.6 ha).

Landscape Context:

South Pender Island is somewhat fragmented (more than 50%) by rural residential development and agriculture. One main road provides access to most areas of the island with smaller roads providing access to rural residential and old harvesting. Overall the level of development is relatively light, with little recent forest clearing and more than 75% of natural or semi-natural vegetation. Immediately adjacent is the more highly developed North Pender Island. Landscape Context is assessed as Good.

Description

General Description:

The occurrence is spread out over much of South Pender Island, B.C. This occurrence is distributed across the island on a variety of aspects and slopes.

Habitat:

BGC:

CDF mm

Documentation

References:

Canadian Wildlife Service, Ministry of Environment, Lands and Parks Vancouver Island Region, and B.C. Conservation Data Centre. 1997. Sensitive Ecosystems Inventory: East Vancouver Island and Gulf Islands. Clover Point Cartographics Ltd., Victoria.

Churchill, J., T. Tripp and T. Innes. 2009. Conversion of existing Southern Gulf Islands (SGI) ecosystem mapping to provincial Terrestrial Ecosystem Mapping standards. Madrone Environmental Services Ltd. Unpublished report prepared for Islands Trust, Victoria, B.C. 16pp.

Green, R.N. 2007. Terrestrial Ecosystem Mapping of the Southern Gulf islands. B.A. Blackwell and Associates. Unpublished report submitted to Parks Canada, Sidney, B.C.

Sensitive Ecosystems Inventory [SEI] of East Vancouver Island and Gulf Islands: Sensitive Ecosystems Mapping, Disturbance Mapping and Re-evaluation of Major Riparian Corridors. 2004. Prepared by Axys Environ. Consulting Ltd. for Environ. Can., Can. Wildl. Serv., B.C. Minist. Sustainable Resour. Manage., and B.C. Minist. Water, Land and Air Prot., and the Habitat Conserv. Trust Fund. 66 mapsheets, 1:20 000 scale.

Version

Version Date:

18-JAN-13

Mapping Information

Estimated Representation Medium

Accuracy:

Confidence Extent:

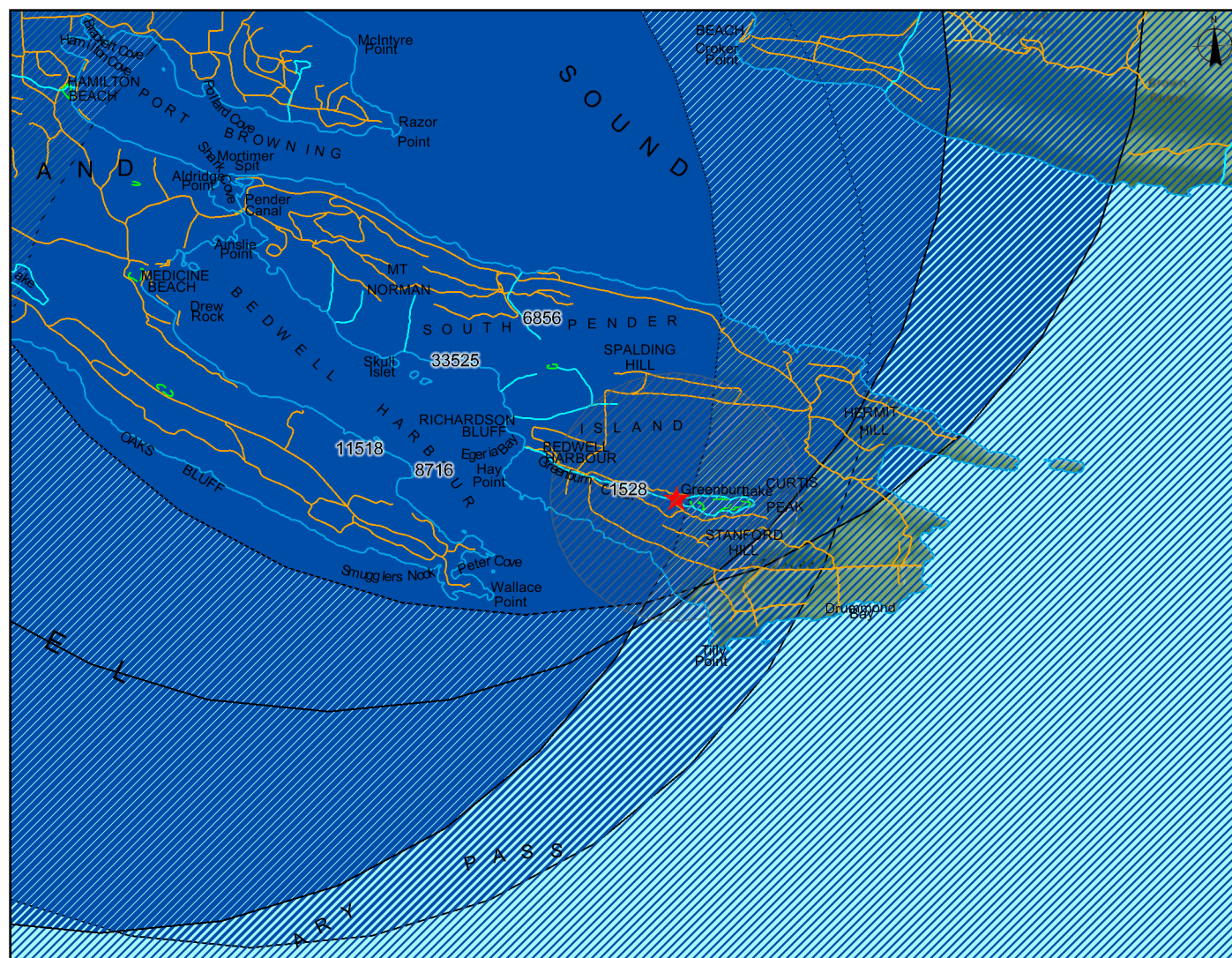
?

December 9, 2014



BC Conservation Data Centre - Occurrence Report

Masked Sensitive Occurrences



Legend

Non-sensitive Occurrences

- Animal - Vertebrate
- Animal - Invertebrate
- Plant - Vascular
- Plant - Non-vascular
- Ecological Community

Masked Sensitive Occurrences

- Big Trees

Occurrence data is updated frequently.
This map should be considered out of
date 6 months after
February 6, 2015

For more information about the BC CDC
visit: <http://www.env.gov.bc.ca/cdc/>

Index Map

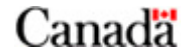
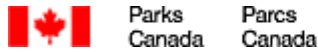


MAP COMPILATION
Projection: Albers Equal Area Conic
Datum: NAD 83

0 1.6 3.2 4.8 km.
Scale: 1:53,705

Map center: 48° 44' 38" N, 123° 12' 58" W

Province of British Columbia
Ministry of Environment
Map Created February 6, 2015



[Home](#) > [Biotics Web Explorer](#) > Biotics Web Explorer

Biotics Web Explorer

[Back](#)

Scientific Name	Common Name	SARA Schedule	Managed Area Name	Regularity	Population
<i>Accipiter gentilis laingi</i>	Northern Goshawk laingi subspecies	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	Transient
<i>Allogona townsendiana</i>	Oregon Forestsnail	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	Unknown
<i>Anarta edwardsii</i>	Edwards' Beach Moth	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Unknown
<i>Ardea herodias fannini</i>	Great Blue Heron fannini subspecies	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Breeding
<i>Balaenoptera musculus</i> pop. 2	Blue Whale - Pacific population	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	Transient
<i>Bartramia stricta</i>	Rigid Apple Moss	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	Unknown
<i>Brachyramphus marmoratus</i>	Marbled Murrelet	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Non-breeding
<i>Camissonia contorta</i>	Contorted-pod Evening-primrose	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
<i>Carex tumulicola</i>	Foothill Sedge	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
<i>Chordeiles minor</i>	Common Nighthawk	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Breeding
<i>Chrysemys picta</i> pop. 1	Western Painted Turtle - Pacific Coast population	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round

Scientific Name	Common Name	SARA Schedule	Managed Area Name	Regularity	Population
<i>Colinus virginianus</i>	Northern Bobwhite	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	Unknown
<i>Contia tenuis</i>	Sharp-tailed Snake	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
<i>Contopus cooperi</i>	Olive-sided Flycatcher	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Breeding
<i>Copablepharon fuscum</i>	Sand-verbena Moth	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	Unknown
<i>Cryptomastix devia</i>	Puget Oregonian	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	Unknown
<i>Entosthodon fascicularis</i>	Banded Cord-moss	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
<i>Euchloe ausonides insulanus</i>	Island Marble	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	Unknown
<i>Eumetopias jubatus</i>	Steller Sea Lion	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Non-breeding
<i>Euphydryas editha taylori</i>	Taylor's Checkerspot	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	Breeding
<i>Falco peregrinus pealei</i>	Peregrine Falcon pealei subspecies	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
<i>Haliotis kamtschatkana</i>	Northern Abalone	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
<i>Hemphillia dromedarius</i>	Dromedary Jumping-slug	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	Unknown
<i>Hemphillia glandulosa</i>	Warty Jumping-slug	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	Unknown

Scientific Name	Common Name	SARA Schedule	Managed Area Name	Regularity	Population
<i>Limnanthes macounii</i>	Macoun's Meadowfoam	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	Unknown
<i>Lomatium grayi</i>	Gray's Desert-parsley	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	
<i>Meconella oregana</i>	White Meconella	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
<i>Megaptera novaeangliae</i> pop. 1	Humpback Whale - North Pacific population	Schedule 1	Gulf Islands National Park Reserve of Canada		
<i>Megascops kennicottii kennicottii</i>	Western Screech-owl <i>kennicottii</i> subspecies	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Unknown
<i>Melanerpes lewis</i>	Lewis's Woodpecker	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	Transient
<i>Microseris lindleyi</i>	Lindley's False Silverpuffs	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
<i>Numenius americanus</i>	Long-billed Curlew	Schedule 1	Gulf Islands National Park Reserve of Canada	Accidental/Nonregular	Transient
<i>Orcinus orca</i> pop. 3	Killer Whale - Northeast Pacific transient population	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Unknown
<i>Orcinus orca</i> pop. 5	Killer Whale - Northeast Pacific southern resident population	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Unknown
<i>Ostrea conchaphila</i>	Olympia Oyster	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	Unknown
<i>Patagioenas fasciata</i>	Band-tailed Pigeon	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Breeding
<i>Phocoena phocoena</i> pop. 2	Harbour Porpoise - Pacific Ocean population	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Unknown

Scientific Name	Common Name	SARA Schedule	Managed Area Name	Regularity	Population
<i>Pituophis catenifer catenifer</i>	Pacific Gophersnake	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	Unknown
<i>Plagiobothrys tenellus</i>	Slender Popcornflower	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
<i>Rana aurora</i>	Red-legged Frog	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
<i>Ranunculus alismifolius</i>	Water-plantain Buttercup	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	Unknown
<i>Ranunculus californicus</i>	California Buttercup	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	
<i>Sanicula bipinnatifida</i>	Purple Sanicle	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	Unknown
<i>Synthliboramphus antiquus</i>	Ancient Murrelet	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Non-breeding
<i>Tyto alba</i> pop. 1	Barn Owl - Western population	Schedule 1	Gulf Islands National Park Reserve of Canada	Unknown/Undetermined	Unknown
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Scientific Name	Common Name	SARA Schedule	Managed Area Name	Regularity	Population
Anarta edwardsii	Edwards' Beach Moth	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Unknown
Ardea herodias fannini	Great Blue Heron fannini subspecies	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Breeding
Brachyramphus marmoratus	Marbled Murrelet	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Non-breeding
Camissonia contorta	Contorted-pod Evening-primrose	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
Carex tumulicola	Foothill Sedge	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
Chordeiles minor	Common Nighthawk	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Breeding
Chrysemys picta pop. 1	Western Painted Turtle - Pacific Coast population	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
Contia tenuis	Sharp-tailed Snake	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
Contopus cooperi	Olive-sided Flycatcher	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Breeding
Entosthodon fascicularis	Banded Cord-moss	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
Eumetopias jubatus	Steller Sea Lion	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Non-breeding
Falco peregrinus pealei	Peregrine Falcon pealei subspecies	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
Haliotis kamtschatkana	Northern Abalone	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
Meconella oregana	White Meconella	Schedule 1			Year-round

Scientific Name	Common Name	SARA Schedule	Managed Area Name	Regularity	Population
			Gulf Islands National Park Reserve of Canada	Regularly occurring	
Megascops kennicottii kennicottii	Western Screech-owl kennicottii subspecies	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Unknown
Microseris lindleyi	Lindley's False Silverpuffs	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
Orcinus orca pop. 3	Killer Whale - Northeast Pacific transient population	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Unknown
Orcinus orca pop. 5	Killer Whale - Northeast Pacific southern resident population	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Unknown
Patagioenas fasciata	Band-tailed Pigeon	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Breeding
Phocoena phocoena pop. 2	Harbour Porpoise - Pacific Ocean population	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Unknown
Plagiobothrys tenellus	Slender Popcornflower	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
Rana aurora	Red-legged Frog	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Year-round
Synthliboramphus antiquus	Ancient Murrelet	Schedule 1	Gulf Islands National Park Reserve of Canada	Regularly occurring	Non-breeding
Number Of Records Returned 23					

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APPENDIX D

DFO OPERATIONAL STATEMENT – RIPARIAN AREAS AND REVEGETATION (2006)

Riparian Areas

Riparian areas (also known as 'riparian zones') are located next to watercourses and can broadly be described as the upland areas adjacent to and nearby a watercourse. Riparian areas can include stream and river banks or lakeshores and are associated with all types of watercourses including swamps, wetlands, tributaries, side channels and intermittently wetted areas.

Riparian areas have a direct influence on aquatic habitat, and form important transition zones between the aquatic and upland environments. As such, riparian areas directly contribute to fish habitat by providing shade, cover, food and nutrients for fish, as well as help to maintain water quality and moderate flows and temperatures that are critical for healthy fish habitat.

Leave strips are identified areas of land and vegetation that should remain in an undisturbed state and are intended to protect the integrity of the riparian area. Leave strips, usually extend inland a minimum of 15 meters from the high water mark or top of bank of any watercourse.

Where encroachment into a leave strip or riparian area is required, and harm to fish habitat is unavoidable, project plans should be forwarded to your local DFO office and/or appropriate Provincial or Territorial agency, in advance, for review and to obtain any necessary approvals. Please note, DFO does not require review of your project plans, if the project falls under the governance of a Pacific Region Operational Statement or the Provincial Riparian Areas Regulation, as they have been developed to ensure your works do not result in a harmful alteration, disruption, or destruction (HADD) of fish habitat. For further guidance on working in or around riparian areas, please contact your local DFO office.

For guidance on replanting within disturbed riparian areas, please refer to the section below, Riparian Revegetation.

Please be advised, the information found on this webpage is provided as a general guide and does not constitute approval under any municipal, provincial and/or federal legislation.

Riparian Revegetation

Whether enhancing an existing riparian area on a previously disturbed site or re-establishing riparian vegetation from bare ground, it is important to observe the surrounding plant community of the disturbed area, specific to that biogeoclimatic zone, and select the appropriate species for site specific conditions.

- ▶ Revegetate with native plants in disturbed areas in riparian zones as per the criteria set below, and
- ▶ Immediately establish ground cover through seeding and/or other protective materials to control erosion and sediment, and to enhance germination of plants, and
- ▶ Conduct regular maintenance to improve the chances of survival within the first year of plant growth; which may include: routine irrigation, removal of invasive species, observation of poor growth, elevated erosion problems, and/or animal intrusion.

Riparian Planting Criteria

1. All tree and shrub species should be native to the local area and where available, of guaranteed nursery stock for successful transplanting. Prior removal of invasive plant species (e.g. Himalayan blackberry, Japanese knotweed, scotch broom) may be required to enhance the survival of transplants.
2. When nursery stock is used, the correct botanical name should be used to order planting stock and tags should be left attached for field identification.
3. Purchased plant stock should be a minimum of 2 years old, and if transplanting an entire area, planted no greater than 2.0 meters apart for all stock.
4. Salvage native plants wherever possible for replanting of the disturbed area, which can also be counted as replacement vegetation.
5. For the replacement of individual trees, such as a danger or hazard tree, please refer to the British Columbia Provincial Tree Replacement Criteria. For individual shrub replacement, two shrubs should be replanted for each shrub removed; no replacement of shrubs for trees.
6. Fruiting trees and shrubs should be planted to promote recolonization by seed and provide wildlife food sources.
7. Stock should be planted in the fall (September to October) or spring (March to April) depending on local conditions.
8. To ensure success of the transplants, at least 80% should survive within the first year of planting.
9. Additional fertilizing, dedicated watering and/or replanting may be required to establish vigorous vegetative cover throughout the first year of growth.

Suggested Planting Layout

The planting layout will depend on what is required to re-establish or enhance existing vegetation, species selected, density of plants, mature plant heights and planting system: linear, random, grid, etc. A Riparian Plant List is provided below to help with your selection of suitable plants. For site specific advice on plant selection and/or layout, please consult with a qualified professional or other knowledgeable source.

Ground Seeding

Growth of ground cover after seeding reduces surface erosion, enhances soil absorption and stability, as well as promotes establishment of newly planted trees and shrubs. For optimal germination, seeding should occur in the spring or fall. However, when used as an erosion control measure, seeding is suitable anytime within the growing season to protect disturbed soils. Whether planting is scheduled immediately or not, seed should be placed on any disturbed soils that will lie dormant for a period of time. Laying mulch will further reduce erosion as well as enhance germination by protection of the seeds and retaining moisture.

A seeding mix should be selected based on site specific conditions (e.g. soil type, soil moisture, climate) but will usually include fall rye and local grasses. Advice from a local seed supplier or professional agrologist on seed mixture selection and application rates may be required.

Riparian Plant List

The following plant list indicates those tree and shrub species native to the Pacific Region, that are recommended for planting within riparian areas next to streams, rivers, lakes and wetlands to enhance or maintain fish habitat values. This is not an exhaustive list as plant selection will vary according to site conditions and should serve only as a guide. Please consult with a qualified professional or other knowledgeable source for site specific advice.

Although some species below may be suitable for the marine environment, please refer to the Stewardship Series document, Shoreline Structures Environmental Design for further guidance on planting in and around tidal or estuarine areas.



Common Name	Latin Name	Coastal ¹	Southern interior ¹	Northern ¹
<i>Deciduous Tree Species</i>				
Vine Maple	<i>Acer circinatum</i>	X		
Douglas Maple	<i>Acer glabrum</i> var. <i>douglasii</i>	X	X	X
Broadleaf Maple	<i>Acer macrophyllum</i>	X		
Red Alder	<i>Alnus rubra</i>	X		
Sitka Alder	<i>Alnus viridis</i> ssp <i>sinuata</i>		X	X
Western Paper Birch (White Birch)	<i>Betula papyrifera</i>	X	X	
Black Hawthorn	<i>Crataegus douglasii</i> *	X	X	
Pacific Crabapple	<i>Malus fusca</i> *	X		
Balsam Poplar (Black Cottonwood)	<i>Populus balsamifera</i> *	X	X	X
Trembling Aspen	<i>Populus Tremuloides</i> *			X
Pin Cherry	<i>Prunus pensylvanica</i> *	X		
Choke Cherry	<i>Prunus virginiana</i> *	X	X	
Cascara	<i>Rhamnus purshiana</i> *	X	X	
Mountain Ash	<i>Sorbus aucuparia</i> *	X		
<i>Coniferous Tree Species</i>				
White Spruce	<i>Picea glauca</i>	X	X	X
Engelmann Spruce	<i>Picea Engelmann</i>			X
Black Spruce	<i>Picea mariana</i>	X		X
Sitka Spruce	<i>Picea sitchensis</i>	X		
Lodgepole Pine	<i>Pinus contorta</i>		X	X
Western White Pine	<i>Pinus monicola</i>	X	X	
Ponderosa Pine	<i>Pinus ponderosa</i>		X	X
Douglas Fir	<i>Pseudotsaga menziesii</i>	X	X	X
Western Red Cedar	<i>Thuja picata</i>	X	X	
Western Hemlock	<i>Tsuga heterophylla</i>	X		



Shrub Species				
Saskatoon	<i>Amelanchier alnifolia</i> *	X	X	X
Spreading Dogbane	<i>Apocynum androsaemifolium</i>		X	
Kinnickinnick	<i>Arctostaphylos uva-ursi</i> *	X	X	
Dwarf Birch	<i>Betula nana & glandulosa</i>			X
Redstem Ceanothus	<i>Ceanothus sanguineus</i>		X	
Red Osier Dogwood	<i>Cornus sericea</i> *	X	X	X
Beaked Hazelnut	<i>Corylus cornuta</i> *	X	X	X
Ocean Spray	<i>Holodiscus discolor</i>	X	X	
Black Twinberry	<i>Lonicera involucrata</i> *	X	X	X
Mock Orange	<i>Philadelphus lewisii</i>		X	
Pacific Ninebark	<i>Physocarpus capitatus</i>	X	2	
Prickly Rose	<i>Rosa acicularis</i> *		X	X
Nootka Rose	<i>Rosa nutkana</i> *	X	X	
Thimbleberry	<i>Rubus parviflorus</i> *	X	X	X
Salmonberry	<i>Rubus spectabilis</i> *	X	X	X
Willow	<i>Salix spp</i>	X	X ³	X ³
Blue Elderberry	<i>Sambucus cerulea</i> *	X	X	
Red Elderberry	<i>Sambucus racemosa</i> *	X	X	X
Soopalallie	<i>Shepherdia canadensis</i> *		X	
Sitka Mountain Ash	<i>Sorbus sitchensis</i> *	X	X	X
Hardhack	<i>Spiraea douglasii</i>	X	X	X
Snowberry	<i>Symphoricarpos alba</i> *	X	X	X
Red Huckleberry	<i>Vaccinium parviflorum</i> *	X		
Highbush Cranberry	<i>Viburnum trilobum</i> *	X	X	X
Saskatoon	<i>Amelanchier alnifolia</i> *	X	X	X

Notes:

* denotes fruit-bearing species

1 three generalized climatic regions within the Pacific Region

2 wet-belt south of Shuswap Lake only

3 live staking with spp. lasiandra and exigua are recommended if sufficient access to groundwater is available year round



APPENDIX E

SIGNIFICANCE AND RESIDUAL IMPACTS RATING CRITERIA TABLE

Significance Rating Criteria

Impact Magnitude	Geographic Extent	Duration	Significance
Negligible	Any	Any Duration	Not Significant
Low	Any	Any Duration	Not Significant
Moderate	Local	Any Duration	Not Significant
	Project Work Area	Short-term	Not Significant
		Medium-term	Not Significant
		Long-term	Significant
	Park-wide	Short-term	Not Significant
		Medium-term	Significant
		Long-term	Significant
	Regional	Short-term	Not Significant
		Medium-term	Significant
		Long-term	Significant
High	Local	Short-term	Not Significant
		Medium-term	Not Significant
		Long-term	Significant
	Project Work Area	Short-term	Not Significant
		Medium-term	Significant
		Long-term	Significant
	Park-wide	Any Duration	Significant
	Regional	Any Duration	Significant

Residual Impacts Rating Criteria

Criteria	Rating Term	Definition
Direction	Positive	Beneficial change.
	Neutral	No change.
	Negative	Adverse change.
Geographic Extent	Local	Effect is limited to the footprint of the Project Work Areas.
	Area Surrounding Project Work Areas	Effect extends to an area immediately surrounding the project footprint (50 m buffer).
	Park-wide	Effect has implications to GINPR.
	Regional	Effect extends beyond GINPR.
Duration	Short Term	Effect present during construction or less.
	Medium Term	Effect remains for remediation phase.
	Long Term	Effect last beyond decommissioning of Project.
Frequency	Once/Infrequent	Effect occurs infrequently.
	Intermittent	Effect occurs periodically.
	Continuous	Effect occurs continuously.
Reversibility	Reversible	Effect is reversed after the activity ceases.
	Partially-reversible	Effect is partially reversed after the activity ceases.
	Non-reversible	Effect will not be reversed when activity ceases.
Magnitude	Negligible	No measurable impacts.
	Low	Potential impact may result in slight decline in resource in/on the property during the life of the project. Research, monitoring, and/or recovery initiatives would not normally be required.
	Moderate	Potential impact could result in decline in resource to lower-than-baseline, but stable levels on the property after project closure. Regional management actions such as research, monitoring, and/or recovery initiatives may be required.
	High	Potential impact could threaten sustainability of the resource and should be considered a management concern. Research, monitoring, and/or recovery initiatives should be considered.