ANNEX C
Environmental Mitigation Strategy

R.087575.004 Reay Creek Remediation – Victoria Airport Lands
1640 Electra Boulevard, Sidney, BC
SLR Project No.: 205.03892.00004

global environmental solutions

Public Services and Procurement Canada
Reay Creek Remediation Project
Sidney, BC

Environmental Mitigation Strategy – Reay Creek Remediation

March 2019
SLR Project No.: 205.03892.00003

ENVIRONMENTAL MITIGATION STRATEGY – REAY CREEK

REAY CREEK REMEDIATION PROJECT

SIDNEY, BC

SLR Project No.: 205.03892.00003

Prepared by
SLR Consulting (Canada) Ltd.
303 – 3960 Quadra Street
Victoria, BC V8V 1M8

for

PUBLIC SERVICES AND PROCUREMENT CANADA
219-800 BURRARD STREET
VANCOUVER, BC V6Z 0B9

31 March 2019

Prepared by:

COLLEGE OF APPLIED BIOLOGY
Hailey O'Neill
31/03/2019
R.P. Bio
3123

Hailey O'Neill, M.Sc., R.P.Bio
Terrestrial Ecologist

Megan Charlton, B.Sc.
Environmental Scientist

Reviewed by:

David McKeown, B.Sc., R.P.Bio
Senior Scientist

Distribution: 1 copy – PSPC
1 copy – SLR Consulting (Canada) Ltd.

EXECUTIVE SUMMARY

SLR Consulting (Canada) Ltd. (SLR) was retained by Public Services and Procurement Canada (PSPC), on behalf of Transport Canada, to conduct an Environmental Mitigation Strategy (EMS) for the Reay Creek Remediation Project (the Project).

The Reay Creek Remediation Project involves the removal of contaminated sediment in the upper portions of Reay Creek that is located on Airport Lands (Reaches 1 to 4) as well as the Reay Creek Pond (Reach 5). Remediation would consist of removal of all soft sediments from Reaches 1 to 5 to native clay layers.

Historical activities at the Victoria Airport have contributed to the contamination of Reay Creek and Reay Creek Pond sediments. The remediation plan for Reaches 1 to 4 will include full removal of creek sediments to depths ranging from 0.15 to 1.0 m within all areas of the creek upstream of Canora Road with the exception of Reach 3, where only partial removal along the eastern extent is planned, and Reach 2, where creek sediments have already been removed as part of the Victoria Airport Authority (VAA) Detention Pond Project. Excavation of sediments from Reach 5 will range from 0.5 to 2.0 m deep.

The Project involves five stages: (1) Planning and Design Activities, (2) Site Preparation, (3) Site Remediation, (4) Site Restoration, and (5) Long-Term Monitoring. Stages 2 through 4 have the potential to interact with the surrounding environment and have effects on Valued Ecosystem Components (VECs).

Potential environmental effects of the Project were assessed and mitigation measures have been identified to minimize or eliminate impacts on physical, biological and social VECs. Physical components included atmosphere, ambient noise, surface water, sediment, and soils. Biological components included terrestrial habitat, vegetation, terrestrial animals, aquatic habitat and aquatic animals (including fish, reptiles, amphibians and benthic communities). Cultural components included heritage and historical resources, recreation, services and aesthetics, and people and public health.

Mitigation measures were identified and will be incorporated into Project design and implementation. Potential environmental effects associated with the Project are expected to be minimal and short-term in duration. With appropriate mitigation, adequate project planning, and compliance with applicable legislative and regulatory requirements, there is little likelihood that significant adverse environmental impacts will result from remedial activities within Reay Creek. Furthermore, several VECs are anticipated to benefit from removal of contaminated sediment from the upper reaches of Reay Creek creating a net positive environmental effect from the Project.

Potential cumulative effects associated with this Project in conjunction with past and potential future projects were assessed. The cumulative effects of past sediment and surface water enhancement programs, future potential habitat enhancement programs and the current sediment remediation and habitat enhancement program will provide a net benefit to the surrounding environment and VECs.

Based on the information presented in this EMS report, the proposed Reay Creek Remediation Project is not expected to cause significant residual adverse environmental effects. This expectation is based on the implementation of mitigation measures developed for this Project, and application and approval of associated permits and approvals. Long-term benefits to aquatic habitat, fish and wildlife resources, and public enjoyment of Reay Creek Pond are anticipated to result from the Project.

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PHOTOGRAPHS

ACRONYMS

AFW	Freshwater Aquatic Life
AOA	Archaeological Overview Assessment
BC CDC	BC Conservation Data Centre
bgs	Below Ground Surface
BMP	Best Management Practices
CDF	Coastal Douglas fir
CEPA	Canadian Environmental Protection Act
CEQGS	Canadian Environmental Quality Guidelines
CCME	Canadian Council of Ministers of the Environment
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSR	Contaminated Sites Regulation
CRD	Capital Regional District
DBH	Diameter at Breast Height
DFO	Fisheries and Oceans Canada
DO	Dissolved Oxygen
DR	Departmental Representative
EA	Environmental Assessment
ENV	BC Ministry of the Environment and Climate Change Strategy
EMA	Environmental Management Act
EMS	Environmental Mitigation Strategy
EPP	Environmental Protection Plan
ESA	Environmental Site Assessment
FCSAP	Federal Contaminated Sites Action Plan
FISS	Fisheries Information Summary System
FN	First Nations
HWR	Hazardous Waste Regulation
ISQG	Interim Sediment Quality Guidelines
LWD	Large Woody Debris
MBCA	Migratory Birds Convention Act
MFLNRORD	Ministry of Forests, Lands, Natural Resource Operations and Rural Development
PSPC	Public Services and Procurement Canada
PEL	Probable Effect Level
PEP	Provincial Emergency Program

QEP	Qualified Environmental Professional
QP	Qualified Professional
RAP	Remedial Action Plan
RAR	Riparian Areas Regulation
SAR	Species at Risk
SARA	Species at Risk Act
SedFS	Sediment Quality Standards for Freshwater Sensitive Sites
SLR	SLR Consulting (Canada) Ltd.
TSS	Total Suspended Solids
VAA	Victoria Airport Authority
VEC	Valued Ecosystem Components
VIA	Victoria International Airport
WSA	Water Sustainability Act

1.0 INTRODUCTION

SLR Consulting (Canada) Ltd. (SLR) was retained by Public Services and Procurement Canada (PSPC), on behalf of Transport Canada, to complete an Environmental Mitigation Strategy (EMS) for the upstream reaches of Reay Creek located within the boundaries of the Victoria International Airport (VIA) in North Saanich, BC (Reaches 1 to 4) and for Reay Creek Pond (Reach 5) located in Sidney, BC (collectively known as the "Site"). The EMS was created to support applicable environmental permit applications, be used as part of the tendering package, and identify mitigation measures for the implementation of the Remedial Action Plan (RAP; SLR, 2019).

The EMS was completed under PSPC Contract No. EZ897-161534/001/VAN (Task Authorization Order No. 700429175).

1.1 Location of Proposed Project

Reay Creek originates at the VIA in North Saanich BC. It runs through the Town of Sidney and terminates in Bazan Bay in North Saanich BC. The upper portion of Reay Creek is located on VIA property and extends from the headwaters located south of the East Camp area and flows in a southeast direction for approximately 450 m to 500 m to a culvert under Canora Road. Downstream of the culvert, Reay Creek has been historically modified by a dam structure to create Reay Creek Pond within the Town of Sidney. The Pond extends for approximately 210 m through a park in a residential area. Reay Creek continues downstream beyond the dam in a southeast direction through Town of Sidney lands and eventually empties into Bazan Bay within the District of North Saanich.

The property is generally located at:

Easting: 469196.22 m E
Northing: 5387548.92 m N
Zone 10 U

1.2 Project Summary

This EMS focuses on the portion of Reay Creek that is located on Airport Lands (Reaches 1 to 4) as well as the Reay Creek Pond (Reach 5). Construction design drawings showing the designated reaches of Reay Creek can be found within Appendix A.

Historical activities at the Victoria Airport have contributed to the contamination of Reay Creek and Reay Creek Pond sediments. Historically, sediment contamination in the upper section of Reay Creek (i.e., on Airport Lands) contained various contaminants of concern, including and predominantly metals. The contamination of the creek sediment and water are presumed to be the result of past industrial activities and inputs to the creek via storm water outfalls.

The remediation plan for Reaches 1 to 4 will include removal of creek sediments to depths ranging from 0.15 to 1.0 m within all areas of the creek upstream of Canora Road with the exception of Reach 3, where only partial removal along the eastern extent is planned, and Reach 2, where creek sediments have already been removed as part of the Victoria Airport Authority (VAA) Detention Pond Project. The remediation of Reaches 1 to 4 is planned to occur in the summer of 2019.

In subsequent years beyond 2019, excavation of sediments from Reach 5 will range from 0.5 to 2.0 m deep. It is SLRs understanding that the Pond dam will be retained by the Town of Sidney and upgraded in the future if/as necessary. Future dam upgrades are not included in the current scope of work.

The objectives of the planned remedial activities are to reduce potential environmental effects associated with historic contamination resulting from past practices at the Victoria Airport and to reduce liabilities associated with this historic contamination.

This EMS contains information pertaining to remediation of Reaches 1 to 4 (2019) as well as remediation of Reach 5 (subsequent years). Reaches 1 to 4 occur on Airport Lands, while Reach 5 occurs on Town of Sidney lands.

2.0 REGULATORY FRAMEWORK

The following sections outline key environmental legislation and applicability to the Project. The Airport Lands are federally owned, and therefore fall under federal regulatory jurisdiction.

Generally, provincial and territorial laws and municipal by-laws do not apply on federal lands and to federal undertakings. Environmental standards, guidelines and objectives established by provincial, territorial or municipal departments, ministries, and agencies will be considered for the purposes of establishing investigation and remediation/risk management environmental quality criteria. Also, material removed from federal jurisdiction may become subject to provincial and territorial laws and municipal by-laws.

Accordingly, the BC Contaminated Sites Regulation (CSR) are used for remedial targets. The applicable standards for contaminated sediments within the Project area will be screened against the BC CSR Freshwater Sediment Standards for Sensitive Use (SedFS). More information on applicable standards can be referenced below in Section 2.2.3.2.

2.1 Key Federal Legislation

2.1.1 Fisheries Act (R.S.C., 1985, c. F-14)

In Canada, the legislation for the conservation and management of fisheries and fish habitat is the Fisheries Act. Section 35 (1) of the Federal Fisheries Act states that:

- '…No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery'.
- Serious harm is defined as the death of fish or permanent alteration to or destruction of fish habitat.

Subsection 35(2) of the Fisheries Act, outlines conditions under which proponents may carry on any work, undertaking or activity without contravening subsection (1). Current amendments are proposed to restore lost protections and incorporate modern safeguards into the Fisheries Act. Moving forward, the bill will be subject to the parliamentary process; however, a timeline for passing the bill into a law is currently unknown.

2.1.2 Migratory Birds Convention Act, 1994 (MBCA) (S.C. 1994, c. 22)

This Act protects all migratory birds and their nests regardless of where they are located. According to Section 6 of the Migratory Birds Regulations, no person shall 'disturb, destroy or take a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird'. In practice, adherence to this section of the Regulations involves avoiding activities that disturb migratory birds during sensitive breeding and nesting periods through a combination of temporal and spatial avoidance of nesting areas for these species.

2.1.3 Species at Risk Act (SARA) (S.C. 2002, c. 29)

The Species at Risk Act (SARA) was proclaimed in June 2003 and is one part of a three part Government of Canada strategy for the protection of wildlife species at risk (SAR). The Act recognizes that the protection of wildlife species is a joint responsibility among federal and provincial jurisdictions and that all Canadians play a role in the protection of wildlife. It applies to all federal lands in Canada; all wildlife species listed as being at risk; and their critical habitat.

Species designated extirpated, endangered, threatened and of special concern are listed in Schedule 1 of the SARA. General prohibitions for species in this schedule, with the exception of special concern, specify that: "No person shall damage or destroy the residence of one or more individuals of a wildlife species that is listed as an endangered species or a threatened species, or that is listed as an extirpated species if a recovery strategy has recommended the reintroduction of the species into the wild in Canada." Species listed in Schedules 2 and 3 of the SARA are designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and are reassessed before addition to Schedule 1.

2.1.4 Canadian Environmental Protection Act (CEPA), 1999 (S.C. 1999, c. 33)

The Canadian Environmental Protection Act (CEPA) 1999 aims to contribute to sustainable development through pollution prevention and to protect the environment, human life and health from the risks associated with toxic substances. It covers a diversity of activities that can affect human health and the environment and acts to address any pollution issues not covered by other federal laws. As such, CEPA 1999 is a "catch all" piece of legislation that ensures potentially toxic substances are not inadvertently exempt from federal oversight as a result of unforeseen legislative loopholes.

2.1.5 Canadian Council of Ministers for the Environment (CCME), 1999

As identified above, the Airport Lands fall under federal regulatory jurisdiction. Federal contaminated sites are generally evaluated using the Canadian Environmental Quality Guidelines (CEQGs) developed by the Canadian Council of Ministers for the Environment (CCME; 1999), including subsequent updates for individual substances (up to and including 2018). The CEQGs are primarily risk-based numerical guidelines set at levels for which it is believed that unacceptable adverse effects on environmental or human health are unlikely to occur. These were developed for various media including water, soil, and sediments.

The CCME Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life are applicable to be used as the federal guidelines for sediment. Both the PEL (Probable Effect Level) and the ISQG (Interim Sediment Quality Guidelines) apply on Airport Lands. The PELs are concentrations above which adverse effects to organisms are believed to occur frequently. The ISQGs are considered to be analogous to Threshold Effect Levels, contaminant

concentrations, below which adverse effects to organisms are believed to rarely occur. Remedial targets have been set which are based on provincial standards (see Section 2.2.3.2, below).

2.2 Key Provincial Legislation

2.2.1 Water Sustainability Act [RSBC 2014] c. 15

At the provincial level, the Water Sustainability Act (WSA) and the Water Sustainability Regulation (2016) provide important and powerful rules and guidance for issuing water licenses and approvals and directing the allocation of surface water and groundwater within the province (Ministry of Forests, Lands and Natural Resources, 2016). Under Section 11 of the WSA, Notifications or Approvals are required to make “changes in and about a stream”.

Notifications are typically used for project works that do not involve any diversion of water, may be completed within a short period of time and will have minimal impact on the environment or third parties. The information specified in the Notification Form must be submitted to the Habitat Officer at least 45 days prior to commencing the work.

A Change Approval *(Section 11, WSA*) is a written authorization for changes in and about a stream that are of a complex nature. For example, work requiring an approval include, but are not limited to:

- Watercourse or channel realignment;
- Retaining wall or bank protection installation;
- Dredging;
- Construction of a sediment sump; and
- Other significant works.

A Water Use Approval (*Section 10, WSA*) allows the diversion and use of water from a stream or an aquifer, and the temporary construction of works on the stream or aquifer, for a period of up to 24 months. Section 10 Use Approvals are related to dewatering operations, when water infiltrates excavation limits and requires active pumping to divert water from the area.

To receive an Approval, an application including all information on habitat assessment (fish and wildlife values), project designs and plan, channel stability and flood levels and application fee must be submitted. A Change Approval and Water Use Approval will be required for the proposed Project.

2.2.2 Riparian Areas Protection Act [RSBC 1997] c. 21

The Riparian Areas Regulation (RAR) was enacted in 2004 under Section 12 of the Fish Protection Act – re-titled the Riparian Areas Protection Act in February 2016. The RAR require those local governments that adopt the regulations to protect riparian areas during residential, commercial, and industrial development projects through the application of a science-based assessment of proposed activities as completed by a Qualified Environmental Professional (QEP). The primary purpose of the RAR is to protect the varied features, functions and conditions that are vital for maintaining stream health and productivity (Province of British Columbia 2018b).

2.2.3 Environment Management Act [RSBC 2003] c. 53

The Environmental Management Act (EMA) regulates industrial and municipal waste discharge, pollution, hazardous waste and contaminated site remediation. EMA provides the authority for introducing wastes into the environment, while protecting public health and the environment. The Act enables the use of permits, regulations and codes of practice to authorize discharges to the environment and enforcement options, such as administrative penalties, orders and fines to encourage compliance. Guidelines and objectives for water quality are developed under the EMA.

2.2.3.1 *Hazardous Waste Regulation*

Hazardous wastes are wastes that could harm human health or the environment if not properly handled and disposed. The Hazardous Waste Regulation (HWR) addresses the proper handling and disposal of hazardous wastes, under the EMA.

2.2.3.2 *Contaminated Sites Regulation*

The CSR under the EMA is the principal regulatory document defining requirements for contaminated sites management in British Columbia. The regulation outlines the procedures for site assessment, remediation and application for environmental closure for a property. The CSR is relevant to the characterization, transportation and disposal of contaminated materials.

The CSR was updated by the BC Ministry of Environment and Climate Change Strategy (ENV). The Stage 10 amendments to the CSR were enacted October 27, 2016 and came into effect November 1, 2017. Analytical data have been compared Stage 10 amended standards as reference.

CSR Schedule 3.4 Generic Numerical Sediment Standards for aquatic life use are intended to protect sediment-dwelling species from unacceptable effects that may be associated with exposure to contaminated sediments at typical and sensitive sites. Concentration standards for substances of potential concern are provided for freshwater sediments. In this report, these standards are abbreviated as SedFS for sensitive freshwater sediments. “Sensitive sediment use” is defined in ENV Procedure 8.

It should be noted that once contaminated sediments are removed from the creek, they will be considered “soil” under the CSR. If the soil meets industrial land use standards, deposition on industrial lands would not require a soil relocation agreement or BC ENV notification under the current procedures. However, if industrial land-use soil standards cannot be met, or the receiving site would have a more stringent land use standard than the soils to be deposited on can meet, additional requirements may be posed by BC ENV.

For the purposes of this report, SLR will continue to refer to contaminated sediments once they have been removed from Reay Creek and Reay Creek Pond.

2.2.3.3 *Spill Reporting Regulation*

The regulation defines a “spill” as an unauthorized release or discharge of a listed substance into the environment in an amount exceeding the listed quantity and specifies requirements for reporting to the Provincial Emergency Program (PEP). The requirements of the Spill Reporting

Regulation are to be considered in the development of a Spill Response Plan (see Section 3.2.1).

2.2.4 Transportation of Dangerous Goods Act [RSBC 1996] c. 458

Transportation of dangerous goods in vehicles is regulated under both the federal and provincial jurisdiction. The framework harmonizes both federal and provincial requirements under the British Columbia Act.

2.2.5 Wildlife Act [RSBC 1996] c. 488

The BC Wildlife Act regulates the management of wildlife in the province. It restricts the harvest of individuals and prohibits the killing, capture, and harassment of wildlife, except by permit or regulation. The BC Wildlife Act also provides protection for active bird nests, including specific measures for raptors and their habitats. Section 34 of the Wildlife Act specifically prohibits the disturbance or destruction of any bird, its active nest, or its eggs. It also protects the nest of any eagle, peregrine falcon, gyrfalcon, osprey, heron, or burrowing owl, regardless of whether it is actively used.

Should Project activities have the potential to interact with species identified under the BC Wildlife Act, a permit application will need to be submitted to FrontCounter BC for each activity type. These permit applications should be prepared and submitted well in advance of Project activities, as they can take up to 90-days for approval. A Scientific Fish Collection Permit will be required to complete fish salvage work within Reay Creek and Reay Creek Pond prior to in-water works. A General Wildlife Permit (including animal care form) will be required for the collection and relocation of amphibians, reptiles and other wildlife that may be incidentally encountered.

2.2.6 Endangered Species Legislation

Legislation for two Acts aimed at identifying and protecting SAR in BC were tabled in 2017: Endangered Species Act and the Species at Risk Protection Act. While these Bills are not currently enacted it is important to understand there may be potential implications to project proponents to consider once this legislation is put in force (Norton Rose Fulbright, 2018).

2.3 Municipal Bylaws, Policies and Requirements

2.3.1 District of North Saanich Noise Bylaw No. 1383 (2015)

The Noise Bylaw states that no person shall carry out "…excavating or other operation, or operate any kind of machine or engine…except between the following hours: Monday to Friday between 7:00 am and 7:00pm and Saturdays between 8:00 am to 4:00 pm." However, exemptions may be issued by the district under extenuating circumstances.

2.3.2 Town of Sidney Noise Bylaw No. 1689 (2001)

The noise bylaw states that "No person in the municipality shall on any day from Monday to Friday before 7:00 a.m. or after 8:00 p.m., nor on Saturday before 8:00 a.m. or after 8:00 p.m., construct, erect, reconstruct, alter, repair or demolish any building, structure or thing or excavate or fill in land in any manner which disturbs the quiet, peace, rest, enjoyment, comfort or convenience of the neighbourhood or of persons in the vicinity."

Exemptions may be approved by the Town of Sidney if deemed necessary.

2.3.3 Town of Sidney Tree Preservation Bylaw No. 2138 (2017)

Prior to cutting down or removing a tree, applications must be made to the Town of Sidney. Every person who cuts, removes, or damages a Protected Tree shall at that person's expense plant two (2) replacement trees of a type and in a location specified by the Director.

2.3.4 Capital Regional District (CRD) Sewer Use Bylaw No. 2922 (2016)

If discharging water into the sanitary sewer lines, a Waste Discharge Permit shall be obtained. This permit is required if discharging greater than 10 cubic meters per day of non-domestic wastewater, or wastewater containing high loads of specified chemical contaminants into the sanitary sewer. Permittees are required to sample and test their wastes, record flows and report to the program on a regular basis. Suspected or known contaminants must be indicated on the permit application.

2.3.5 Capital Regional District (CRD) Saanich Peninsula Stormwater Source Control Bylaw No. 4168 (2018)

This bylaw applies to the District of Central Saanich, the District of North Saanich and the Town of Sidney. The bylaws set out the requirements for discharges to the municipal drainage system with the goal to prevent the release of contamination through education, maintenance of catch basins, appropriate business practices, and the proper disposal of waste. The bylaw was finalized in December 2018 and CRD staff are currently working with municipalities, stakeholders and dischargers to implement the bylaw.

3.0 DESCRIPTION OF PROPOSED PROJECT AND SCOPE

3.1 Project Objectives

The objectives of the planned remedial activities are to reduce potential environmental effects associated with historic contamination resulting from past practices at the Victoria Airport and to reduce liabilities associated with this historic contamination.

The objective of the EMS is to provide information on historic and existing environmental site conditions immediately adjacent to Reay Creek and identify physical, biological, and social components that may be affected by Project activities. Mitigation measures and strategies are provided to reduce disturbance or negative impacts to those physical, biological, or social components.

The EMS was created to support applicable environmental permit applications, be used as part of the tendering package, and identify mitigation measures for the implementation of the RAP.

3.2 General Description of Proposed Project

Reaches 1 to 4 are planned for remediation during 2019. Reach 5 will be remediated in a subsequent year. All information regarding details of the remediation project in its entirety (i.e., Reaches 1 to 5) has been provided below.

Excavation is the preferred method to permanently remove impacted soil or sediments from a property to a secured disposal facility. Areas of anticipated sediment removal are provided in the attached 70% Construction Design Drawings and currently include all of Reaches 1A, 1B, 1C, 4 and 5 as well as the eastern-most portion of Reach 3 (Appendix A). The excavation shall begin at the high water mark and extend to the creek bottom until a stable surface (i.e., native clays) is encountered. Excavation depths will vary depending on depth of accumulated sediments and typically range from 0.15 to 1.0 m within all remedial areas of the creek upstream of Canora Road, and between 0.5 to 2.0 m for Reach 5 (Appendix A).

The remediation plan involves excavation, removal and off-site disposal of approximately 3,975 m^3 of contaminated sediment from the site that exceed the CSR sediment quality standards for freshwater sensitive sites (SedFS). Table 1 following provides details of the sediment removal activities anticipated within each of the identified reaches. It should be noted that no changes to existing area (m^2) of aquatic habitat are anticipated to result from the project.

Table 1:
Sediment Remediation Areas and Estimated Volumes per Reach

Reach	Estimated Remedial Area (m^2)	Estimated Excavation Depth (m)	Estimated Volume (m^3)
Reach 1A	377	0.60	226
Reach 1B	338	0.25	85
Reach 1C	216	1.0	102
Reach 3	178	0.15	27
Reach 4	184	0.50	37
Reach 5	3,621	1.0	3,498

Following removal of contaminated sediments, remediation will be verified by collecting confirmatory samples at the base of excavations at predetermined frequencies. Samples will be sent for laboratory analytical testing to confirm removal of contaminated material and will be a condition of completing the sediment removal program.

3.3 Project Components, Scope and Timeframe

The remediation is anticipated to be split over multiple years, with the remediation of the Airport Lands occurring in 2019, followed by the remediation of Reay Creek Pond occurring in a subsequent year. The remediation of each yearly component consists of five general stages:

- **Stage 1 – Planning and Design Activities:** refinement of remedial areas, detailed design, and logistical support for the remediation Project must be considered prior to the development of a remediation specification. Stage 1 is anticipated to be completed by early spring 2019.
- **Stage 2 – Site Preparation:** preparing the site for the remediation including channel isolation, fish salvage, site clearing and grubbing, installation of sediment and erosion control measures, and Contractor set up of laydown areas and utility clearance. Select Stage 2 activities such as mobilization, clearing and grubbing may be completed prior to in-water works but could continue as the Project progresses, depending on overall Project sequencing. Other activities such as channel isolation and fish salvage will be

conducted within the reduced risk window (June 15th to September 15th). Stage 2 is anticipated to begin following contract award in late spring 2019 and will be completed prior to Stage 3.

- **Stage 3 – Site Remediation:** removal of contaminated material and transportation to a permitted facility for disposal. Stage 3 must be completed within the general reduced risk timing windows for instream works on Vancouver Island (June 15th to September 15th).
- **Stage 4 – Site Restoration:** includes backfilling and grading of the site and re-planting of disturbed areas to support fish and wildlife habitat. Stage 4 will be split into two restoration activities: instream restoration and upland restoration. Instream restoration will commence immediately following completion of in-water works (i.e., within the reduced risk timing window for instream works). Upland restoration and vegetation planting will be completed following remedial activities and in periods of favourable environmental conditions from increased precipitation events (i.e., fall 2019).
- **Stage 5 – Long-Term Monitoring:** includes assessment of riparian plantings and restoration areas in accordance with warranty periods (typically for a period of one year). Long-term monitoring may also include qualitative monitoring of riparian area establishment, fish habitat enhancement features, water flow and water quality monitoring. Additional monitoring based on conditions set out by approval and permitting agencies may also be included. Stage 5 is anticipated to be conducted for up to two years post-construction but may depend on specific conditions set out in approvals stipulated by the relevant permitting agencies.

These five stages are described in detail in the following sections.

3.3.1 Planning and Design Activities

The following additional work will need to be completed in tandem with the finalization of the detailed design and prior to the development of tender specifications:

- Completion of detailed remedial design by the design engineer;
- Once the detailed design has been sufficiently advanced, submissions to permitting agencies will need to be completed. The following permit submissions are anticipated to be required:
  - DFO online submission of a Request for Project Review form;
  - Application for BC WSA Water Use Approval and Change Approval (*Section 10* and *Section 11, WSA*) (i.e., dewatering construction works and approval for changes in and about a stream); and
  - Application for BC Wildlife Act Permit for fish salvage work (Scientific Fish Collection Permit) and General Wildlife Permit (including animal care form) for the collection and relocation of amphibians, reptiles, and other wildlife that may be incidentally encountered (managed through FrontCounter BC).

Once the above investigations and permitting submissions have been completed, contract specifications can be completed. Completed design drawings and specifications will then be tendered in order to select and engage the remediation Contractor.

Once the remediation Contractor has been selected through the tendering process, the Contractor will be required to complete the following prior to remedial works:

- Health and safety program;
- Environmental Protection Plan (EPP) including:

  - environmental protection measures and methods;
  - Sediment and Erosion Control Plan; and
  - Spill Response Plan.
- Soil and Contaminated Materials Management Plan;
- Construction Work Plan;
- Water Management Plan;
- Transportation Management Plan;
- Disposal facility details;
- Backfill source and quality information;
- Site Restoration Plan; and
- Applicable security clearances and documents if/as appropriate for the site (i.e., working within airside portions of the Airport).

3.3.2 Site Preparation

The site preparation stage is anticipated to include the following:

- Nesting bird surveys within and adjacent to areas identified for vegetation removal will be required prior to any vegetation removal activities;
- Site clearing and grubbing in all Reaches. In many areas, access to the creek can be limited to a number of locations in order to reduce disturbance and retain vegetation, where possible. The Contractor shall attempt to limit the amount of disturbance along each Reach by accessing the remedial areas from only one bank slope and moving up the main channel of the Reach as needed:
  - There will be shrub and small tree clearing required within Reach 1A. Some invasive species (i.e., reed canarygrass (*Phalaris arundinacea*)) removal may be required from the main channel as well as Himalayan blackberry (*Rubus armeniacus*) removal from the creek banks in order to gain access in some areas;
  - Reach 1B will require small tree and shrub clearing in select areas. There is a large Garry oak tree (*Quercus garryana*) adjacent to Reach 1B that will need to be protected from remedial activities. Larger planted trees may be able to be retained where possible along this reach.
  - Reach 1C will involve clearing of some trees and shrubs. Remedial extents have been set to protect larger red alders (*Alnus rubra)* that are growing downstream of the culvert that runs below the gravel access road.
  - Reaches 3 and 4 will involve clearing of some trees and shrubs. Native tree and shrub species that currently exist in these reaches are red alder, black cottonwood (*Populus trichocarpa*), willows (*salix spp.),* Indian plum (*Oemleria cerasiformis*), salmonberry (*Rubus spectabilis*), red osier dogwood (*Cornus stolonifera*) and oceanspray (*Holodiscus discolor*). A number of larger red alder and Douglas fir (*Pseudotsuga menziesii*) trees exist in Reach 4 and the downstream end of Reach 3. To the extent possible, these trees shall be retained.
  - Reach 5 will involve clearing shrubs, small trees, some invasive species, and large trees that may be deemed as a danger or hazard during remediation. To the extent possible, large trees should be limbed in order to gain access, with the majority of the tree being retained. Where root stability following remediation may become compromised, tree removal may be required. A danger tree assessment shall be completed by the Contractor prior to clearing activities. Within Reach 5, decisions on whether to retain or remove a tree may need to be completed on an individual basis and should be completed during the danger tree assessment. Site

access shall be limited to the northern and eastern sides of the Pond, through Town of Sidney lands.
    - Significant trees have been identified within the Project area (see Appendix A). To the extent possible, the significant trees shall be protected during the remediation Project. Significant trees have been defined as trees > 10 cm diameter at breast height (DBH) in Reach 1A and 1B, trees > 30 cm DBH in Reaches 1C, 3, 4 and 5, and select species > 15 cm DBH adjacent in Reach 5 (Garry oak, Arbutus (*Arbutus menziesii*), or Western flowering dogwood (*Cornus nuttallii*));
    - A Certified Arborist will be retained by the Contractor to determine extents of tree clearing in order to keep disturbance to a minimum; and
    - In select areas where there is potential risk to roots of significant trees, hand tools shall be used by the Contractor to obtain remedial extents.
- Installation of sediment and erosion control measures;
- Contractor site set-up which may include Contractor facilities water management and treatment equipment as required, etc.;
- Mobilization of equipment and materials to site;
- Set up of laydown areas and temporary sediment stockpile locations (ground liners, sump pumps, etc.);
- Identification and protection of underground and overhead utilities prior to initiating work (Contractor);
- Fish and aquatic species salvage (including amphibians and reptiles); and
- Channel isolation, dewatering and diversion equipment and supplies to allow work in the dry.

3.3.3 Site Remediation

Preliminary remedial excavation limits will include all areas below the high water mark within Reaches 1A, 1B, 1C, 4 and 5 as well as the eastern-most portion of Reach 3. Table 1 outlines the estimated excavation depths and anticipated excavation volumes.

Site clearing and grubbing within remedial access locations will be done in the Site Preparation phase. A number of remedial access locations may be required for remediation within Reach 5. The location of the remedial access locations will be determined by the Contractor; however, these locations must be approved by the PSPC Departmental Representative (DR) prior to initiation of clearing and grubbing.

Prior to excavation, channel isolation and dewatering will occur. In the upstream Reaches of Reay Creek that are on Airport Lands, it is anticipated that a standard channel isolation and passive flow diversion around the remedial areas will be completed by the Contractor.

Within Reach 5, dewatering is anticipated to be comprised of three phases following channel isolation: (1) passive dewatering of surface water to the lowest elevation of the Pond dam spillway; (2) active pumping of water below the spillway and above the sediment layer; and (3) active dewatering of sediments during remediation. For phases 2 and 3, the Contractor may be required to pump the water into holding tanks, allow the water to decant, conduct treatment (if necessary), complete testing and finally release the water either into downstream creek areas or into sanitary sewer lines. If water is to be released back into the downstream creek areas, water must meet BC water quality guidelines for the protection of freshwater aquatic life (BC ENV, 2018). If discharging water into the sanitary sewer lines, the Contractor shall obtain a waste discharge permit (see Section 2.3.4). The Contractor shall be required to sample the water for analytical testing, record flows and report to the Capital Regional District (CRD) on a regular basis when discharging occurs.

Excavation activities are anticipated to involve smaller equipment in select areas in order to minimize disturbance as much as possible. Equipment to be used may include small track excavators, spider hoe excavators, small tracked dump trucks (e.g., marookas) and standard dump trucks for material transport.

Within Reach 5, it is likely that multiple excavators will be working in the isolated channel. Swamp pads, temporary access routes, or similar devices may be used in the Pond areas to reduce movement of contaminated sediments and to provide a stable base for the equipment. A temporary access road may also be created to allow access to interior sections of the Pond. It is anticipated that one or more excavators may work in tandem to move material within the Pond area and maximize dewatering operations prior to movement of the sediments into dump trucks or other material transport vehicles (e.g., marookas). The Contractor will not be permitted to excavate onto private property.

The Contractor may also temporarily stockpile the removed sediment material prior to transport off-site to the disposal location. Sealed dump trucks will move the contaminated sediments from the remedial areas and truck it to a dedicated stockpile area. The sediments will be windrowed in the stockpile area which will allow for further dewatering and drying of sediments prior to transportation off-site. All dewatering operations and facilities, whether within the Pond area or in the temporary stockpile area, will allow for the collection, treatment, testing and appropriate discharge or disposal of generated water.

The Contractor will be responsible for identifying and protecting all utilities within and immediately adjacent to the excavation areas. The Contractor will be responsible for surveying excavation limits and adhering to finalized detailed design drawings. Confirmatory sediment samples will be collected during remedial works to verify remedial objectives are met (see Section 3.2.3.2 for more detail).

A commissionaire escort for all work within air-side areas of Airport Lands will be required. It will be the responsibility of the Contractor to coordinate with VAA for the provision of appropriate commissionaire supervision of the works.

The specific remediation methods, means, and sequencing is up to the Contractor performing the work. It is the responsibility of the Contractor's Qualified Professional (QP) that the work is performed in general conformance with this EMS and associated permits or approvals. If not, it is the responsibility of the Contractor to obtain regulatory approvals based on modified methods.

3.3.3.1 *Environmental Monitoring*

Environmental monitoring will be conducted during the remediation program to verify compliance with the terms of the remedial program, the Contractor's EPP, this EMS, and any permitting obligations and requirements.

The Contractor will be responsible for implementation of all necessary environmental controls prior to, and during, the remedial activities for the protection of environmental features and resources at, and immediately adjacent to, the site.

Details of environmental protection measures including sediment and erosion control measures, spill contingency and response planning and equipment, dewatering and water bypass activities and other mitigation measures will be inspected and documented as required. If any corrections, modifications or additional measures are required, the environmental monitor will provide recommendations to the PSPC DR for their implementation by the Contractor.

The environmental monitor will have the authority to halt construction activities in the event of imminent risk to the environment or significant non-compliance issues. PSPC will be notified immediately of any such actions by the environmental monitor. Corrective actions will be the responsibility of the Contractor in order to regain compliance with Project requirements and permit conditions.

3.3.3.2 *Excavation Monitoring*

On-site excavation monitoring will also be conducted for the duration of the remediation program to monitor, observe and document the remedial excavation works. This includes the creation of a soil/sediment tracking manifest and the collection of the soil/sediment disposal certificates in accordance with standard practices for the off-site removal of contaminated materials. The excavation works for both years of the Project are expected to be undertaken during summer months within the reduced risk fisheries window between June 15 and September 15.

Following excavation works, and prior to backfilling activities, the excavation monitor will collect confirmatory samples to determine the residual sediment quality within the excavated channels. The confirmatory samples will be collected at a frequency consistent with the requirements outlined in BC ENV Technical Guidance Document 1: Site Characterization and Confirmation Testing (BC ENV, 2009).

When excavating the creek areas on Airport Lands, confirmatory samples will be collected from the floor and sidewalls of the excavation approximately 20 m apart. In Reach 5, confirmatory samples will be collected within a 10 m x 10 m grid. This will consist of collecting sidewall samples along each side of the Pond, and one floor sample, every 10 m. All confirmatory samples will be collected to a depth of approximately 5 to 10 cm.

The confirmatory samples will be discrete samples; no composite samples are to be collected in the field or to be composited in the laboratory. Table 2 below details the expected number of confirmatory samples to be collected during the remediation.

Table 2:
Expected Number of Confirmatory Samples

Reach	Number of Confirmatory Floor Samples	Number of Confirmatory Sidewall Samples	Number of BFDs	Total Number of Confirmatory Samples
Reach 1A	6	12	2	20
Reach 1B	8	16	2	26
Reach 1C	4	8	1	13
Reach 3	2	4	1	7
Reach 4	2	4	1	7
Reach 5	21	42	6	69
Total Number of Samples			**142**	

Should any confirmatory sample exceed the CSR SedFS standards, additional excavation and subsequent confirmatory sampling may be required.

The analytical results will provide valuable information on the post-remediation site conditions prior to installation of backfill material and/or reinstatement of the Reay Creek channel and Pond areas. In some areas adjacent to private property lines adjacent to Reay Creek Pond, slot cuts

or other construction methods to maintain slope stability followed by immediate backfilling may be required for structural and slope stability purposes. In these instances, collection of confirmatory sediment samples may not be possible and it is understood that some residual contamination may remain in place in these areas.

Additional monitoring will be required by a qualified engineer to verify that the Contractor is adhering to the remedial design and that excavation limits are achieved in accordance with the contract. The qualified engineer will be on site periodically as necessary during the remediation.

3.3.4 Site Restoration

Select excavated areas within the creek and Pond will be backfilled using clean sub-rounded to rounded sands, gravels and small cobble. Side slopes along the creek segments will be graded to an approximate 2 Horizontal to 1 Vertical (2:1) slope using clean fill material. Clean sand and gravel material will be used in select locations along the channel bottoms to provide substrates suitable for fish and aquatic organisms. Material is to be clean, sub-rounded to rounded, well graded granular material from naturally formed deposits of sand, gravel and cobbles, free of any recycled material.

Short term sediment and erosion controls shall be implemented by the Contractor immediately following slope disturbance in order to access creek and Pond remedial areas. These measures may include placing topsoil along the bank, followed by covering with an erosion control blanket (e.g., coconut matting, straw matting etc.).

Following placement of backfill material and regrading, disturbed slopes of the creek are to be reseeded with native seed mix and plantings of native shrubs and live stakes of native shrubs or willows shall be installed to provide additional vegetative cover along the creek banks and in disturbed areas along the riparian zones.

The Contractor shall develop a Site Restoration Plan that follows BC Landscape Standards and prioritizes the restoration of native riparian vegetation. The Site Restoration Plan shall be submitted to, and approved by, the PSPC DR prior to conducting restoration activities.

Re-planted shrub species may include salmonberry, thimbleberry (*R. parviflorus*), hardhack (*Spiraea douglasii*), red osier dogwood, oceanspray, and Nootka rose (*Rosa nutkana*). Graminoids that could provide bank stability and enhance instream fish habitat may include slough sedge (*Carex Obnupta*), small-flowered bulrush (*Scirpus microcarpus*) and soft-stemmed bulrush (*S. lacustris*).

Tree planting with appropriate native species such as red alder and black cottonwood shall be installed within the disturbed riparian areas. Species selection should consider full mature height to ensure height restrictions in accordance with Airport operations are not exceeded. The frequency and number of tree plantings should be linked to removal activities such that no net loss of trees results from the Project. If trees are required to be removed in order to access remedial areas, they should be replaced with two species of the same tree (if native) or a suitable native tree species (if exotic).

Aquatic habitat enhancement features shall be maintained or installed, where appropriate. Existing riffles within the bypass channel (Reach 1B) shall be retained in order to provide flow diversity within the channel. Following remediation in the Pond (Reach 5), aquatic habitat enhancement features shall be installed at access locations to increase structural diversity and

habitat complexity. Root balls, anchored logs, and large woody debris (LWD) should be placed at these disturbed areas (see Appendix A). No instream aquatic vegetation will be planted as it is anticipated that species shall recolonize naturally from upstream sources.

The manicured areas adjacent to Northbrook and Westbrook Drive shall be restored to their original state. The Contractor shall demobilize from the site and restore any disturbed areas to pre-construction conditions including remedial access locations and laydown areas as required.

3.3.5 Long Term Monitoring

Periodic inspection of the constructed works is likely to be required as a condition of approval from regulatory agencies such as DFO and the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD; administers the BC Water Sustainability Act). Environmental monitoring will be completed during remedial activities (see Section 3.2.3.1).

A confirmatory sampling program will be implemented to confirm and verify results of the sediment remediation program prior to reinstating creek and Pond areas.

For up to two years following remediation, a QEP will conduct qualitative monitoring of the riparian plantings, fish habitat enhancement efforts and water flow rate and create a follow-up post-remediation report describing the findings and recommendations of the monitoring effort. It is anticipated that regular water quality and flow monitoring will continue to be conducted by VAA which will likely satisfy any water volume and quality monitoring requirements.

4.0 EXISTING ENVIRONMENTAL CONDITIONS

4.1 Previous Reports and Assessments

A review of available literature and web-based information was conducted to identify existing and potential terrestrial and aquatic resources at the Project site. Several reports, assessments and investigations have been undertaken throughout the Reay Creek system over the past several years. The following studies were reviewed to provide context and information regarding current conditions within Reay Creek:

- Victoria International Airport Environmental Baseline Study - M.M. Dillon Ltd., 1994.
- Subsurface Soils Investigation - Environmental Design Solutions Ltd. (EDSL), 2003.
- Reay Creek Watershed – Proper Functioning Condition Assessment - Aqua-Tex, 2004.
- Assessment of Metal Contamination and Fish Kills in Reay Creek at Victoria International Airport - Environmental Solutions Partnership, Royal Roads University (undated, approximately 2005).
- Investigation of Recent Fish Kills (March 2003 and November 2004) in Reay Creek - Global Environmental Management Systems Ltd, 2005.
- Reay Creek Assessment Study - MB Laboratories, September 2005.
- Site Inspection, Navair Lease Property, Victoria International Airport, BC - Franz Environmental Inc., 2006.
- Detailed Site Investigation (DSI), Hangar 17-39, Victoria Airport, Sydney, BC - Franz Environmental Inc., 2006.
- Airfield Tributary Storm Drain Remediation Program Summary - Bethell Associates Ltd., 2007.
- Lower Airfield Ditch Remediation - Bethell Associates Ltd., 2008.
- Upper Airfield Ditch Remediation - Bethell Associates Ltd., 2008.

- Reay Creek Pond Remediation Study - Justin Robinson and Rachelle Sarrazin, 2010.
- Reay Creek Channel Rehabilitation - SLR, 2012.
- Reay Creek Remediation Project Summary - SLR, 2012.
- Sediment and Water Sampling Results, Reay Creek Hydraulic Oil Spill - SLR, 2012.
- Reay Creek Dam, Sidney, BC Geotechnical Inspection and Assessment - Thurber Engineering Ltd., 2013.
- Underground Services Condition Survey at Victoria International Airport - Kerr Wood Leidal, 2014.
- Environmental Consulting Services - Viking Air Spill Support - SLR, 2015.
- Plating Shop Spill Response, Viking Air Facility, Victoria International Airport, Sidney, BC - Arcadis, 2015.
- Reay Creek Sediment Sampling Results - Viking Air Spill Support – SLR, 2015.
- Sampling and Analysis of Reay Creek Pond Sediments - SLR, 2015.
- Reay Creek Side Channel Sediment Removal – SLR, 2015.
- An Investigation of Reay Creek Pond - Macdonald and Bruce, 2015.
- Technical memorandum - Reay Creek Preliminary Stormwater Impact Assessment - Kerr Wood Leidal, 2015.
- Data Gap Analyses Reay Creek Pond – SLR, 2016.
- Reay Creek Sediment and Soil Investigation - 2016 Stormwater Management Plan Design – SLR, 2016.
- Phase II Environmental Site Assessment - Reay Creek (on Victoria Airport Lands) – SLR, 2019.
- Reay Creek Remediation – Preliminary Remedial Action Plan Reaches 1 to 4 (Draft) – SLR, 2018.
- Reay Creek Remediation – Archaeological Overview Assessment. Millennia Research Limited. 2018.
- Reay Creek Fish and Fish Habitat Assessment. LGL Limited Environmental Research Associates. 2018.
- Reay Creek Supplemental Sediment Sampling and Probing on Airport Lands (Final) – SLR, 2019.

Detailed summaries of each of the above reports are provided in the updated RAP (SLR, 2019).

4.2 Site Visits

SLR biologists have conducted numerous site visits of the remedial areas of Reay Creek in tandem with design engineers. During these visits, observations were made along Reaches 1 through 5 regarding the description of the riparian habitat and possible Contractor remedial access locations. The riparian habitat was observed to consist mainly of deciduous trees, shrubs and riparian forbs that provide shade to the creek and foraging and nesting habitat potential for birds. Preliminary observations were made to identify trees that could be retained during construction. These trees were identified as significant trees and are provided on construction design drawings (see Section 3.2.2). Additional assessments have been completed including supplemental sediment sampling programs, site visits to assess remedial strategies and options, sediment probing programs, and geotechnical assessments of the Project area.

A fish and fish habitat assessment was also completed by LGL Limited Environmental Research Associates (LGL, 2018). The results of the assessment have been described in Section 5.2.3.

4.3 External Resources

In addition to the site visits and site-specific reports, the following sources were examined as part of the EMS:

- BC Conservation Data Centre iMap: http://www.env.gov.bc.ca/cdc/
- BC Species and Ecosystems Explorer: http://a100.gov.bc.ca/pub/eswp/
- BC Water Resource Atlas: http://maps.gov.bc.ca/ess/sv/wrbc/
- Environment Canada – Climate: http://climate.weather.gc.ca/
- Fisheries and Oceans Canada - New Salmon Escapement Database System: https://open.canada.ca/data/en/dataset/c48669a3-045b-400d-b730-48aafe8c5ee6
- Environment Canada. *National Air Pollution Surveillance Program*: https://www.canada.ca/en/environment-climate-change/services/air-pollution/
- Environment Canada. General Nesting Periods of Migratory Birds: https://www.canada.ca/en/environment-climate-change/services/avoiding-harmmigratory-birds/general-nesting-periods/

4.4 Project Boundaries

4.4.1 Spatial Boundaries

Reay Creek is a sinuous linear channel that originates at the VIA in North Saanich, BC. It runs through the Town of Sidney and terminates in Bazan Bay in North Saanich, BC. Reaches 1 to 4 are located within VIA property. Reay Creek flows in a southeast direction and below Canora Road through a culvert. Downstream of the culvert, Reay Creek turns into Reay Creek Pond (Reach 5) on the Town of Sidney lands. Reay Creek Pond is bounded by seven residential lots along its southwest bank edge. Along its northeast bank edge, the Pond is bounded by two residential lots (only the east-most lot has a dwelling) and Reay Creek Park. The park is comprised mainly of a grassed boulevard that is lined with trees and is further bound by Wesbrook Drive along its northeast edge. A dam, owned and maintained by the Town of Sidney, is located at the downstream end of Reay Creek Pond. Construction drawings in Appendix A show the spatial boundaries of the Project area.

4.4.2 Temporal Boundaries

For Reaches 1 to 4, site preparation works are anticipated to commence in the spring of 2019 following contract award. Instream Project works are anticipated to be completed in the summer of 2019, and upland site restoration work will extend into the fall of 2019.

Reach 5 will be remediated in a subsequent year. The anticipated preliminary schedule for various Project components can be referenced in Section 3.2.

The yearly Project components will take place within multiple timing windows (e.g., general nesting windows, reduced risk fisheries windows). Additional mitigation measures must be considered when Project activities occur outside these windows (see Section 6.0).

Site preparation works will be completed within the general nesting period for migratory birds (mid-March to mid-August; Environment Canada, 2019). Mitigation measures have been outlined for site clearing activities occurring within the general nesting period and can be referenced below in Section 6.2.2.

Instream work shall be conducted within the general reduced risk timing (instream work) windows for Vancouver Island (from June 15th to September 15th). Relevant data (DFO, 2018) indicate that cutthroat trout *(Oncorhynchus clarkia)* and coho salmon *(O. kisutch)* have been observed within Reach 5 and further downstream. Despite the presence of these salmonids within the Reay Creek system, average aquatic habitat for salmonids within Reaches 1A – 1C is considered poor. Reaches 2 – 4 have classified the average aquatic habitat for salmonids as fair, while Reach 5 has been considered to have good aquatic habitat for salmonids (LGL, 2018; see Section 5.2.3). Fish capture efforts have determined that the majority of fish species present within the Reay Creek system are threespine stickleback (*Gasterosteus aculeatus*) (LGL, 2018). Therefore, the likelihood of the presence of cutthroat trout and coho salmon occurring within the upper reaches of Reay Creek on VAA lands, particularly during summer months, is low. If mitigation measures are implemented (see Section 6.2.4.1), construction activities can proceed using the general reduced risk timing window for instream work.

4.5 General Description

Reay Creek is a permanent coolwater urban stream within the Reay Creek watershed. Reay Creek headwaters daylight at the upstream end of Reach 1B and originate from airside runway and other Airport Lands drainage routes. On Airport Lands, Reay Creek consists of narrow, linear channels that are lined with riparian vegetation (see Drawings in Appendix A). Further downstream of Canora Road, Reay Creek becomes a linear Pond due to a historic dam that is owned and maintained by the Town of Sidney. Further downstream of the dam and outside of the Project Area, Reay Creek again becomes a sinuous creek within a forested park area. For detailed information on specific environmental components, refer to Section 5.0, below.

5.0 VALUED ECOSYSTEM COMPONENTS

Valued Ecosystem Components (VECs) are described below. VECs have been broken down amongst physical, biological and social components consistent with established EMS practices.

5.1 Physical Components

5.1.1 Atmosphere

Atmosphere is selected as a VEC as it has been identified as an important aspect of the environment by provincial and federal regulators and because emissions from the Project activities have the potential to alter the existing air quality.

Environment Canada works with provincial and territorial governments to implement the National Air Pollution Surveillance program, which provides long-term air quality data from across Canada (Environment Canada, 2013). There are numerous data collection stations within Western Canada. Although not directly specific to the Project area, the station in Victoria (Victoria Topaz, station ID# 231886) has the most complete data for the region.

Based on the 2016 ambient air quality data from the Victoria monitoring station, the ambient air quality in the area is good most of the time, with no averages exceeding the applicable limits for the measured pollutants (Environment Canada, 2013).

5.1.2 Ambient Noise

Acoustic environment is selected as a VEC as it has been identified as an important aspect of the environment by public, provincial and federal regulators and because noise, defined as an unwanted sound, from the Project activities has the potential to alter the existing outdoor acoustic environment. Noise conditions in the Project area are dominated by flight traffic at the VAA as well as local traffic along Canora Road and various other urban noise sources.

5.1.3 Surface Water

Water Quality is a critical component in the maintenance of healthy aquatic ecosystems. It is a valued component in its own right, as well as being crucial to the functioning and maintenance of other biological VECs such as fish, amphibians and benthic communities and linkages with other biological, social and aboriginal VECs.

Reay Creek is a low-gradient stream with the upstream portion draining Airport Lands including runways, open fields and meadow. The downstream sections of Reay Creek meander through urban forested areas (AquaTex, 2004; LGL, 2018). Stormwater inputs and outfalls occur throughout the length of Reay Creek including from the East Industrial Area on Airport Lands and municipal outfalls adjacent to Reay Creek Pond and further downstream.

Relevant data indicate the presence of cutthroat trout and coho salmon within Reach 5 and further downstream (see Section 5.2.4.1). Robinson and Sarrazin (2010) noted that based on the optimum temperature ranges for specific life history stages of salmonids, the temperatures at several locations in Reay Creek Pond exceeded temperature requirements for many of the coho and cutthroat trout life stages (BC ENV, 2001). The temperature in the middle of Reay Creek Pond exceeded all optimum temperatures for incubation, rearing, migration and spawning life stages for coho and cutthroat trout.

In the same study by Robinson and Sarrazin (2010), dissolved oxygen (DO) levels were suitable to sustain aquatic wildlife but were too low to accommodate spawning activities and healthy populations of food sources for salmonids.

Large fluctuations in pH were identified throughout Reay Creek Pond (Robinson and Sarrazin, 2010), which is an important non-chemical parameter that can have adverse impacts on fish and fish habitat. Available data (Robertson & Bryan, 2004) suggest that Reay Creek Pond would not be suitable to support or sustain a population of coho salmon and cutthroat trout in its current state. Recent fish capture activities have been completed within the Pond and have determined that the majority of fish occurring within the pond are threespine stickleback (LGL, 2018).

In addition to these parameters, contamination has also been documented to affect the aquatic community in Reay Creek. In 2003 and 2004, approximately 600 coho fry and 80 cutthroat trout were found dead in Reay Creek. Fish tissue chemical analysis identified lethal doses of cadmium in these fish (Robinson and Sarrazin, 2010), which is suspected to be the result of an upstream release.

The VAA maintains two fixed water monitoring stations on Airport Lands, one at TenTen Creek and one at Reay Creek. Weekly water samples are taken to monitor water quality leaving Airport property. In addition to the fixed stations, the Airport uses portable testing stations when analyzing various inputs to the creeks (VAA, 2016).

Table 3 following, summarizes metals concentrations in surface water collected by VAA from the Reay Creek sampling station between 2012 and 2017. Results are compared against Canadian Council of Ministers of the Environment (CCME) water quality guidelines for protection of freshwater aquatic life (AFW). As Reay Creek Pond is located on Town of Sidney lands, BC Water Quality Guidelines for the protection of freshwater aquatic life have been presented in the following table. With the exception of past episodic and periodic spill events, trends in recent years have indicated water quality improvement due to upstream activities and controls such as stormwater pipe cleanouts, environmental procedural controls within the East Camp, and Glycol Recovery and Monitoring programs (VAA, 2016). Removal of sediment contamination in the upper Reaches of Reay Creek through the current remediation Project is anticipated to continue to improve water quality.

Table 3:
Summary of Metals Concentrations in Surface Water Collected by VAA within the Upper Reaches of Reay Creek (on Airport Lands)

Parameter	CCME AFW Guideline (µg/L)	BC AFW Standard (µg/L)	Concentration (µg/L)	
Total Hardness (CaCO3)	n/a[1]	n/a[1]	Minimum	33.1
			Maximum	374
			Average	171
Total Mercury (Hg)	0.026	0.00125[3]	Minimum	0.0051
			Maximum	0.022
			Average	0.01
Total Arsenic (As)	5.0	5.0[4]	Minimum	0.28
			Maximum	**13.3**
			Average	0.70
Total Boron (B)	1500	1200[3]	Minimum	51
			Maximum	318
			Average	84.2
Total Cadmium (Cd)	Hardness Dependent[2]	Hardness Dependent[2*]	Minimum	0.01
			Maximum	0.46
			Average	0.12
Total Chromium (Cr)	1.0[5,6]	1.0[6,7]	Minimum	1.0
			Maximum	29.8
			Average	2.27
Total Copper (Cu)	Hardness Dependent[2]	Hardness Dependent[2]	Minimum	1.03
			Maximum	**70.6**
			Average	**6.55**
Total Iron (Fe)	300	1000[4]	Minimum	174
			Maximum	**9560**
			Average	**792**
Total Lead (Pb)	Hardness Dependent[2]	Hardness Dependent[2]	Minimum	0.2
			Maximum	6.05
			Average	0.81

Parameter	CCME AFW Guideline (µg/L)	BC AFW Standard (µg/L)	Concentration (µg/L)	
Total Molybdenum (Mo)	73	1000[3]	Minimum	1
			Maximum	12.8
			Average	2.40
Total Selenium (Se)	1.0	1.0[3]	Minimum	0.1
			Maximum	0.55
			Average	0.15
Total Silver (Ag)	0.25	Hardness Dependent[2]	Minimum	0.02
			Maximum	**0.42**
			Average	0.05
Total Thallium (Tl)	0.8	0.8[7]	Minimum	0.282
			Maximum	0.282
			Average	0.282
Total Uranium (U)	15	8.5[7]	Minimum	0.1
			Maximum	1.49
			Average	0.52
Total Zinc (Zn)	30	Hardness Dependent[2]	Minimum	5.9
			Maximum	**240**
			Average	27.4

Bold – Exceeds CCME AFW Guideline and/or BC WQG AFW
[1] No CCME AFW Guideline or BC AFW Guideline exists for parameter
[2] Guideline is dependent on waterbody hardness
[2*]Standard is dependent on waterbody hardness. Standard is based on dissolved cadmium. No standards exist for total values.
[3] BC WQG (Approved), AFW, Long-term (30 day)
[4] BC WQG (Approved), AFW, Short-term
[5] CCME WQG, AFW, Long-term guideline
[6] Chromium VI guideline used for conservative purposes
[7] BC WQG, AFW (Working), Long-term (30 day)

One water license exists within Reay Creek. Water licenses allow licensees to divert, store and use specific quantities of water for one or more water use purposes. A water license may also authorize works related to the diversion and use of the water (BC ENV, 2019b). The license is held by Town of Sidney for the purpose of construction works (License Number C064092). Under the license the Town of Sidney is permitted to use 3,700 m^3 of water per year from Reay Creek, although it should be noted that the specific use and intention of this water use is unknown.

5.1.4 Sediment

Numerous environmental investigations of Reay Creek have been completed since 2003. During the Phase II Environmental Site Assessment (ESA; SLR, 2018), sediment stratigraphy in areas surrounding Reaches 1 to 4 consisted of silt and silty clay overlying clay. The sediments encountered from samples collected were composed of mainly gray clay and sand with organics with some brown/orange mottling. Sediments within Reach 5 have been investigated and have been deemed to be contaminated with metals throughout this Reach (SLR, 2015).

Historic sediment quality data were compiled from various sources including SLR, CRD, and VAA including investigations up to December 2018. The primary contaminants of concern at the site include select metals parameters in sediment including arsenic, cadmium, chromium (total), copper, lead, mercury and zinc. A summary of select metals results in sediment within each designated reach of Reay Creek are provided below in Table 4 with comparison to the remedial objective for the site (CSR SedFS standards). The following data was compiled from previous SLR sampling programs, CRD, and VAA.

Table 4:
Summary of Metals Concentrations in Sediment within Reay Creek

Parameter	CSR SedFS Standard (mg/kg)		Concentration (mg/kg)					
			Reach 1A	Reach 1B	Reach 1C	Reach 3	Reach 4	Reach 5
pH	n/a[1]	Minimum	7.10	6.38	7.35	6.72	6.67	6.17
		Maximum	7.75	7.94	7.77	7.93	6.67	7.21
		Average	7.46	7.16	7.58	7.14	6.67	6.7
Arsenic	11	Minimum	6.60	3.13	5.48	5.33	2.0	4.51
		Maximum	**12.5**	10.3	9.50	8.62	**21.3**	**11.2**
		Average	8.34	5.98	7.18	7.38	5.24	5.9
Cadmium	2.2	Minimum	0.266	0.276	1.01	0.326	0.40	0.448
		Maximum	**18.9**	**3.94**	**4.72**	0.397	**12.6**	**42.1**
		Average	**6.59**	0.87	**2.97**	0.357	**4.29**	**22**
Chromium (total)	56	Minimum	48.4	25.4	30.7	31.9	16.3	31.2
		Maximum	**271**	**59.6**	**73.7**	**59.3**	**152**	**153**
		Average	**129**	42.3	54.3	46.1	47.6	**123**
Copper	120	Minimum	53.1	22.1	26.2	41.6	18.0	22.5
		Maximum	**192**	**168**	**137**	67.5	**132**	99.8
		Average	**124**	62.0	73.2	58.8	43.4	59
Lead	57	Minimum	6.54	4.84	8.477	7.64	6.0	13.9
		Maximum	**140**	**57.3**	45.4	9.29	44.0	**68.2**
		Average	**61.3**	17.2	23.8	8.21	17.2	42
Mercury	0.3	Minimum	0.058	<0.05	<0.05	<0.05	<0.05	<0.05
		Maximum	0.216	0.16	0.141	0.065	**4.80**	0.129
		Average	0.123	0.067	0.080	0.059	0.261	0.087
Zinc	200	Minimum	77.0	62.9	115	102	77.7	90.7
		Maximum	**1390**	**1300**	**1710**	**320**	**614**	**700**
		Average	**576**	**247**	**680**	175	**295**	**366**

Bold – Exceeds BC CSR Sed FS standard.
[1] No CSR SedFS Standard exists for parameter
Note: Reach 2 has recently been remediated as part of the VAA Detention Pond Project. Confirmatory sediment sampling results have confirmed successful removal of contaminated sediment in this area. Reach 2 has not been included in the above table or remedial areas.

5.1.5 Soils and Groundwater

The geology of the Reay Creek area is dominated by deposits of Victoria clay overlying bedrock (Blyth & Rutter, 1993). In an aquifer located approximately 0.5 km south of Reay Creek, and falling partially within the Reay Creek watershed, the clay layer was found to be between 0.91 and 12 m thick (AquaTex, 2004).

During the Phase II ESA conducted by SLR (SLR, 2018), while installing groundwater monitoring wells adjacent to Reaches 1 A-C, depth to groundwater ranged from 1.91 m below ground surface (bgs) to 3.65 m bgs. Groundwater concentrations exceeded federal interim groundwater guidelines for cadmium, iron and selenium at select monitoring well locations. Provincial groundwater standards for drinking water check values were also exceeded for iron, lithium and manganese. However, since groundwater is not used as a supply of drinking water at or immediately near the site, these standards are unlikely to apply. All other parameters tested in groundwater were below federal and provincial guidelines and standards

Existing water well infrastructure was determined using an electronic search of the on-line BC Water Resource Atlas. The search indicated 40 water wells occurring within a 1,000 m buffer of the proposed Project area (BC ENV, 2019b). Of these, 6 were designated as other use, 4 were designated as private domestic use, and 30 were designated as unknown use (Appendix B). The nearest water well is located 415 m southwest of the Project area and is designated as unknown use.

5.2 Biological Components

5.2.1 Terrestrial Habitat

Terrestrial habitat has been selected as a VEC because of the intrinsic value of wildlife and wildlife habitat, specifically within riparian areas.

Riparian areas are unique ecosystems that surround the banks of waterways. The individuals in a riparian community have specific adaptations for living in repeatedly flooded environments. Riparian forests provide critical wildlife habitat for migratory songbirds, waterfowl, fish and a host of other species. The vegetation within riparian areas provides predator protection, shade that cools water temperatures, breeding and nesting areas, and food sources.

5.2.1.1 *Vegetation*

The riparian vegetation on Airport Lands has height restrictions due to the proximity of Reay Creek to Airport runways. From Reach 1A to 1C, the riparian habitat consists mainly of woody shrub species and some shorter trees such as willows and red alder. Adjacent to Reaches 3 and 4, the riparian habitat is comprised of mainly taller alders, black cottonwoods and Douglas fir trees. Beyond the riparian vegetation, the surrounding area has been cleared of natural vegetation in order to maintain sight lines for the Airport. Large areas of land consist of parking lots, runways and fields that are maintained by Airport staff. Invasive species such as Himalayan blackberry occur throughout many areas surrounding the upstream creek sections.

Surrounding Reach 5, the riparian habitat is made up of a number of woody shrub species lining the steep banks as well as large deciduous trees such as big leaf maple (*Acer macrophyllum*), red alder, black cottonwood, western redcedar and ornamental weeping willow (*S. babylonica*). A large proportion of invasive species including Himalayan blackberry and English ivy as well as

other native woody shrub species and herbs are present along the banks of Reach 5. Manicured lawns associated with adjacent private properties also occur along much of the southwestern pond perimeter.

5.2.1.2 *Plant Species at Risk*

The BC Species and Ecosystem Explorer online database was reviewed for potential occurrences of plant SAR that may be found within the Project area. The search was refined by filtering through spatial categories. SLR narrowed results to Vancouver Island, CRD, Coastal Douglas Fir (CDF) biogeoclimatic zone, and riparian habitat. The results of the advanced search indicated that three plant SAR potentially occur within the Project area (Appendix B). Following a literature review of each species record, SLR concluded that one plant SAR (Columbian water-meal) has the potential to occur within or near the Project area; this species is shown in Table 5 and discussed below.

The BC Conservation Data Centre (CDC) database was reviewed for records of plant and ecosystem SAR. This search revealed one plant or fungi SAR occurrence and five ecosystem occurrences that have been mapped on site or within 1.5 km from the center of the site (Table 5). One masked occurrence was found to potentially occur within 1.5 km the site; however, further discussions with the BC CDC indicated that the details of this occurrence are not required for the planning of site activities (i.e., Project activities are unlikely to impact this masked species occurrence).

The ecological community, *Populus trichocarpa - Alnus rubra / Rubus spectabilis* (black cottonwood - red alder / salmonberry) exists within the floodplain of Reay Creek, along Reach 5 as well as areas further downstream. This ecological community is designated as Blue Listed under Provincial status but is not designated under the SARA. Based on previous site visit observations, this ecological community primarily occurs further downstream of the dam within Reay Creek Park and is unlikely to be affected by Project activities.

Downstream of the dam within Reay Creek Park, three additional provincially red-listed terrestrial communities were observed by Sherwood, Franke, and Fitzpatrick (2018). These included (1) the ecological community (red alder and skunk cabbage *(Lysichiton americanus*)), (2) the ecological community of Western redcedar, Douglas fir, and Oregon beaked-moss (*Eurhynchium oreganum*), and (3) the ecological community (Doulgas fir and/or grandifir (*Abies grandis*) with an understory cover of dull Oregon-grape (*Mahonia nervosa*). None of these communities are protected under SARA and all were observed downstream of the dam. Therefore, these ecological communities are not anticipated to be affected by Project activities.

Columbian water-meal, an aquatic plant species was identified using the BC Species and Ecosystem Explorer as having the potential to occur within the Project area. Known mapped occurrences indicate that the nearest population of this plant is found in Beaver Lake, approximately 15 km south of the site. Therefore, it is unlikely that this plant will occur, or be affected by, Project activities. The remainder of the potentially occurring ecological communities and plant SAR have been mapped by the CDC and are unlikely to occur or be affected by Project activities.

More detailed descriptions of terrestrial habitat community and SAR records are provided in Table 5 below.

Table 5:
Terrestrial Plant and Ecological Community SAR Potentially Occurring within the Project Area

Scientific Name	English Name	Classification	BC List	SARA Schedule	Location
Within Reay Creek Project Area					
Populus trichocarpa - Alnus rubra / Rubus spectabilis[1]	black cottonwood - red alder / salmonberry	Ecological Community	Blue	---	On the floodplain of Reay Creek between Victoria Airport and the highway
Within 1.5 km of Reay Creek Project Area					
Thuja plicata / Achlys triphylla[1]	western redcedar / vanilla leaf	Ecological Community	Red	---	Near small stream east of present Dunsmuir Lodge
Thuja plicata / Oemleria cerasiformis[1]	western redcedar / Indian-plum	Ecological Community	Red	---	Near small stream east of present Dunsmuir Lodge
Abies grandis / Mahonia nervosa[1]	grand fir / dull Oregon-grape	Ecological Community	Red	---	Northeast side of Mt. Newton, northeast of present Dunsmuir Lodge
Pseudotsuga menziesii / Berberis nervosa[1]	Douglas-fir / dull Oregon-grape	Ecological Community	Red	---	Mount Newton, Saanich Penninsula
Abies grandis / Tiarella trifoliate[1]	grand fir / three-leaved foamflower	Ecological Community	Red	---	Piece of Airport south of Airport access road
Epilobium torreyi[1]	Brook spike-primrose	Vascular Plant	Blue	1, Endangered	West of Bazan Bay, near McTavish Road
Wolffia columbiana[2]	Columbian water-meal	Vascular Plant (aquatic)	Blue	---	---

[1] CDC generated results
[2] BC Species and Ecosystem Explorer generated result

5.2.2 Terrestrial Animals

Terrestrial animals, including migratory and nesting birds, are selected as a VEC as they have been identified as an important aspect of the environment and have intrinsic value within the greater terrestrial ecosystem.

The areas surrounding Reay Creek on Airport Lands are surrounded by grass fields that are maintained by the VAA for aircraft approach. Residential urban propertied surround Reay Creek Pond, while further downstream of the Pond, an urban park trail which is maintained by the Town of Sidney, follows the creek for approximately 650 m before terminating adjacent to the Patricia Bay Highway.

Terrestrial species occurring within the general area of the Project are those typical of an urban environment and likely include urban deer, squirrels, bats, raccoons, mice, voles, passerine birds, and some larger birds of prey.

Airport Lands are actively managed to discourage or prevent specific wildlife from potentially coming into contact with aircraft. Although this is primarily focused on birds, all mammals that could pose a risk to aviation safety are encompassed in the program.

The Airport works to discourage birds from feeding in high-risk zones using a variety of non-lethal techniques in habitat management and deterrents. A continued focus on drainage helps to reduce the potential for flooding in airside fields, which can attract waterfowl and gulls.

There is a potential for nesting birds to occur within the Project area during remedial works. Mitigation measures detailing methods to avoid adverse impacts to nesting birds can be found below in Section 6.2.2.

5.2.2.1 *Terrestrial Species at Risk*

The BC Species and Ecosystem Explorer online database was reviewed for potential occurrences of animal SAR that may be found within the Project area. The search was refined by filtering through spatial categories as indicated above in Section 5.2.1.2. The results of the advanced search indicated that 32 animal species potentially occur within the Project area (Appendix B). SLR conducted a literature review of each potential occurrence and refined the potential to 8 terrestrial animal SAR that could occur in the Project area. These species can be found in Table 6 below.

One Provincially red-listed species (warty jumping slug) was among one of the potential occurrences within the Project area. Following a literature review, it was determined that this species is unlikely to occur within the Project area, as the habitat and biological needs associated with the warty jumping slug do not occur within the Project boundary. The warty jumping slug is associated with rich mesic mature and old growth coniferous temperate forests dominated by western hemlock (*Tsuga heterophylla*) and western redcedar (BC Invertebrate Recovery Team, 2008), none of which occur within, or adjacent to, the Project area.

The BC CDC database was reviewed for records of terrestrial SAR. This search revealed one animal SAR species occurrence (Brant) has been mapped on the site or within 1.5 km from the center of the site. Additionally, one masked occurrence was found to potentially occur within the Project area; however, further discussions with the BC CDC indicated that the details of this occurrence are not needed to plan activities at the site and therefore Project activities are unlikely to impact this masked species occurrence. More detailed descriptions of animal SAR records are provided in Table 6 below.

Table 6:
Terrestrial Animal SAR Potentially Occurring within the Project Area

Scientific Name	English Name	Classification	BC List	SARA Schedule
		Bats		
Corynorhinus townsendii[2]	Townsend's Big-Eared Bat	Vertebrate Animal (Bat)	Blue	---
Myotis lucifugus[2]	Little Brown Myotis	Vertebrate Animal (Bat)	Yellow	1, Endangered
		Birds		
Ardea Herodias fannini[2]	Great Blue Heron, *fannini* subspecies	Vertebrate Animal (Bird)	Blue	1, Special Concern
Butorides virescens[2]	Green Heron	Vertebrate Animal (Bird)	Blue	---
Megascops kennicottii kennicottii[2]	Western Screech-Owl, *kennicottii* subspecies	Vertebrate Animal (Bird)	Blue	1, Threatened
Branta bernicla[1]	Brant	Vertebrate Animal (bird)	Red	---
		Invertebrates		
Sympetrum vicinum[2]	Autumn Meadowhawk	Invertebrate Animal (Dragonfly)	Blue	---
Tramea lacerata[2]	Black Saddlebags	Invertebrate Animal (Dragonfly)	Red	---
Hemphillia glandulosa[2]	Warty Jumping-slug	Invertebrate Animal (Slug)	Red	1, Special Concern

[1] CDC generated results
[2] BC Species and Ecosystem Explorer generated result

Many of the SAR listed above are transient in nature and are not likely to occur within the land or waters in and around Reay Creek. The CDC occurrence of the Brant is unlikely to occur within the Project area due to its affinity for coastal habitats. Furthermore, the last date that this species was observed in the CDC database was in 1993.

5.2.3 Aquatic Habitat

Aquatic habitat is selected as a VEC because of Reay Creek's potential for fish spawning, rearing and feeding. The aquatic habitat can be an indicator for the productive capacity of a waterbody and the associated riparian vegetation, which is important to both people and wildlife.

Aquatic habitat is often defined by numerous biophysical parameters including hydrology, channel and flow characteristics, substrate, cover, water and sediment quality, and benthic invertebrate communities. Furthermore, water quality parameters help to define aquatic habitat including temperature, DO, total suspended solids (TSS), turbidity and pH. Overhanging riparian vegetation is present in all reaches of the Project area, while emergent and submergent aquatic vegetation are present primarily in Reaches 1A, 1B and 5. This habitat feature provides structural complexity as well as potential spawning and rearing opportunities to the fish within the Reay Creek system.

The upper portion of Reay Creek is located on VIA property and extends from the headwaters located south of the East Camp area and flows in a southeast direction for approximately 450 m to 500 m to a culvert under Canora Road. In 2012, a new 190 m (approximate) channel was constructed to bypass a 130 m portion of the old channel that received potentially contaminated stormwater from the East Camp area. Upper Reay Creek, which includes a tributary channel, has been segregated into six sub-reaches to allow for proper assessment and determination of appropriate remedial actions (Appendix A). Lower Reay Creek consists of Reay Creek Pond, which flows over a constructed dam and becomes a sinuous channel further downstream. The Project area consists of Reaches 1 to 5 and the aquatic habitat within these Reaches is described in the following sections.

5.2.3.1 *Reach 1A*

Reach 1A is a segregated, 130 m section of the historic channel that is presently known as the "former channel". Reach 1A is connected to the main channel via two gates / dam structures with flow-controllers and is currently used to receive stormwater through several outfalls that drain surface water from the nearby East Camp (Photo 1). Reach 1A also provides emergency control and storage capacity in the event of spill events as the channel can be isolated by closing the flow control gates at both the upstream and downstream ends of the reach. Currently, this channel is used as a water quality improvement linear wetland/retention Pond with instream vegetation consisting primarily of reed canarygrass (Photo 2). Fish habitat surveys completed by LGL (2018) indicate that Reach 1A is rated "good" for holding pools and percent overhead cover, and "poor" for percent of pools, pool frequency, percent of wood in pools, spawning gravel quantity, and gravel quality.

The riparian vegetation in Reach 1A consists of numerous groves of mature native shrubs and deciduous trees (Photo 3). A number of large patches of Himalayan blackberry exist along the north bank of Reach 1A (Photo 4), as well as on the vegetated berm that separates Reach 1A from Reach 1B.

5.2.3.2 *Reach 1B*

Reach 1B is a 190 m stretch known as the "bypass channel" and was constructed in 2012 to allow Reay Creek headwaters to bypass Reach 1A – former channel. Reay Creek headwaters daylight at the upstream end of Reach 1B and originate from airside runway and other Airport Lands drainage routes (Photo 5). Rip rap armouring was placed along the stream channel at the headwaters and along the outer edges of the creek meanders to limit erosion during higher flows anticipated in fall and spring seasons. Coconut and straw matting was placed, stapled and staked along the length of the new channel side-slopes to reduce erosion and sedimentation potential and to facilitate establishment of vegetative cover. Three riffle structures were installed within the new channel to diversify flow patterns and to reduce the potential for channel erosion while also providing habitat diversity and potential support for spawning areas in the future. Fish habitat surveys completed by LGL (2018) indicate that Reach 1B is rated "good" for holding pools and percent overhead cover, and "poor" for percent of pools, pool frequency, percent of wood in pools, spawning gravel quantity, and gravel quality.

Instream aquatic vegetation consisting mainly of duckweed (*Lemnaceae* sp.), sedges and rushes exists in areas of lower flow within Reach 1B (Photo 6). Riparian vegetation has matured since its installation in 2012 and consists mainly of red alders and willow shrubs that were planted along the south bank edge (Photo 7).

5.2.3.3 *Reach 1C*

Reach 1C, also known as the “connector channel” begins at the terminus of the bypass channel and flows approximately 95 m to the southeast towards a new detention pond. This portion of Reay Creek was previously described as a sinuous channel with a steeper gradient and is separated into two halves by a culvert underneath a gravel access road. Fish habitat surveys completed by LGL (2018) indicate that Reach 1C is rated “good” for holding pools and percent overhead cover, and “poor” for percent of pools, pool frequency, percent of wood in pools, spawning gravel quantity, and gravel quality.

To the east of the access road, a number of larger red alder and Western redcedar trees as well as native shrubs line the channel (Photo 8).

5.2.3.4 *Reach 2*

Reach 2 (also referred to as the “detention pond”) is situated along the north-eastern edge of a newly constructed detention pond located ground-side within Airport Lands. A 5,000 m^3 detention pond was constructed in 2017/2018 along this Reach to help control stormwater flows within the Reay Creek drainage system. At the downstream end of the detention pond, an outlet structure has been constructed that provides a controlled rate of water discharge aimed at reducing peak flows in downstream areas in an effort to mitigate flooding and soil erosion and improve aquatic habitat. The previous channel along the detention pond was excavated of all potentially contaminated sediments and the new channel has been lined with rounded gravels and cobbles. During low flows, the creek channel maintains flow to downstream areas. Higher flow events back up at the outlet weir and inundate the pond area which slowly draws down and alleviate large pulses in flow during storm events. Fish habitat surveys completed by LGL (2018) indicate that Reach 2 is rated “good” for holding pools and spawning gravel quantity, “fair” for percent overhead cover and gravel quality, and “poor” for percent of pools, pool frequency, and percent of wood in pools.

Riparian vegetation was retained along the northern bank of the creek, while the southern bank is reserved for the detention pond, therefore limiting larger shrubs and trees that could provide shade to this Reach (Photo 9).

5.2.3.5 *Reach 3*

Reach 3 is described as the “tributary channel” that flows adjacent to the BC Aviation Museum and confluences with Reay Creek channel south of Norseman Road at the upstream portion of Reach 4. Aqua-Tex (2004) suggested that Reach 3 may be the original upper channel of Reay Creek.

Much of this section of creek is currently a channelized ditch and the upstream sections are devoid of riparian vegetation (likely due to its proximity to Airport runways and associated limitations to the acceptable height of vegetation) leading from the Airport terminal building toward the museum. Fish habitat surveys completed by LGL (2018) indicate that Reach 3 is rated “good” for holding pools and spawning gravel quantity, “fair” for percent overhead cover and gravel quality, and “poor” for percent of pools, pool frequency, and percent of wood in pools.

Some shrub and taller deciduous trees occur toward the eastern section of Reach 3 beyond the BC Aviation Museum and toward its confluence with Reach 4. These trees provide shade and leaf litter input into this Reach of Reay Creek (Photo 10).

5.2.3.6 *Reach 4*

Reach 4 is the “connector channel” that connects Reaches 2 and 3 and then flows toward the Canora Road culvert. Fish habitat surveys completed by LGL (2018) indicate that Reach 4 is rated “good” for holding pools and spawning gravel quantity, “fair” for percent overhead cover and gravel quality, and “poor” for percent of pools, pool frequency, and percent of wood in pools.

Tall riparian vegetation surrounds this section of the creek, including a number of red alder, black cottonwood, and Douglas fir trees (Photo 11).

5.2.3.7 *Reach 5 (Reay Creek Pond)*

Downstream of Canora Road, Reay Creek Pond (Reach 5) extends for approximately 210 m through a park in a residential area. The Pond is approximately 18 m wide (range = 10 to 22 m) with a water depth ranging from <0.5 to 2.25 m (Robinson and Sarrazin, 2010). Historically, agricultural land use surrounded Reay Creek. A property owner installed a mud dam in the 1950’s to raise the water level in Reay Creek and develop a pond to support a duck farm. In 1998, the municipality of Sidney reconstructed the dam with stronger materials (Photo 12). The dam was not constructed to permit fish passage (Robinson and Sarrazin, 2010); however, recent site visits conducted by SLR indicated that at higher flows fish may be able to pass up the spillway to the southwest of the dam (Photo 13).

Overtime, the Pond has acted as a reservoir for accumulation and settlement of sediments and associated contaminants. The sediment depth in Reay Creek Pond ranges from 0.5 m to 2.0 m with an average sediment depth of 1.0 m (KWL, 2019). The Pond has undergone periods of eutrophication, massive algal blooms, resulting in reduced DO levels (Robinson and Sarrazin, 2010). SLR completed a sediment investigation of Reay Creek Pond in January 2015 and a data gap analysis in May 2016 for the Town of Sidney. In the data gap analysis, the analytical results for metals were found to be relatively uniform throughout the sediments, and it was concluded that all samples were from one population and that the entire accumulated sediment mass is contaminated.

The aquatic environment within the Reay Creek Pond has been rated as overall “good” habitat for salmonids. However, the instream water quality is marginal due to high temperatures and low DO levels that occur in the summer months and is highly degraded. Instream aquatic vegetation has been observed in summer site visits and is mostly absent in the winter months (Photo 14). Fish habitat surveys completed by LGL (2018) indicate that Reach 5 is rated “good” for holding pools, percent of pools, pool frequency, and percent overhead cover, rated “fair” for percent of wood in pools, and “poor” for spawning gravel quantity, and gravel quality.

The riparian habitat is made up of a number of woody shrub species lining the steep banks as well as large deciduous trees such as big leaf maple, red alder, black cottonwood, western redcedar and ornamental weeping willow (Photo 15). A large proportion of invasive species including Himalayan blackberry and English ivy (Photo 16) as well as other native woody shrub species and herbs are present along the banks of Reach 5. Along the southwestern edge of the Pond, some private homeowners have manicured lawns and gardens that reach to the Pond

edge. Through conversations with landowners during site visits, many have noted erosion of the Pond banks over time. At the top of the Pond banks along the northeastern edge and adjacent to a grassed area within the residential area, larger ornamental and deciduous trees line the street (Photo 17).

5.2.4 Aquatic Animals

5.2.4.1 *Fish*

Fish are valued for their ecological services as a renewable resource base, and have economic, cultural, spiritual and ceremonial benefits.

Within the Fisheries Information Summary System (FISS) Database, fish observations were recorded in Reay Creek from 1977 to 1995. These data indicate the presence of cutthroat trout and coho salmon within Reach 5 and further downstream over the 28 years of record.

Recent fish collections in Reach 5 resulted in the capture of threespine stickleback, cutthroat trout, coho salmon, and prickly sculpin (*Cottus asper*) (LGL, 2018). The majority of fish caught were sticklebacks (102 observations). Threespine stickleback is highly tolerant of disturbance associated with urbanization and degraded conditions. Based on the information available at the time of this report, no aquatic federally listed SAR have been identified in Reay Creek. Provincially listed fish SAR are referenced below in Section 5.2.4.4.

Aqua-Tex (2004) reported that coho and cutthroat trout utilize Reay Creek for spawning and rearing functions. In addition, DFO regularly stocks Reay Creek. Records back to 2006 show that 500 to 900 coho and/or chum salmon fry have been released annually, although the exact location is unknown. Peninsula Stream Society (2016) set up smolt traps within Reay Creek and counted over 600 healthy coho salmon on their way to sea in 2014. Sampling from LGL (2018) indicated that cutthroat trout and coho salmon were caught in the upstream reaches of Reay Creek (Reaches 1 – 4) as well as Reach 5 and lower in the system.

Coho returns (3 year averages) have been reported to increase from 8 individuals during 1987-1989 to 35 individuals during 1999 – 2001 (Peninsula Streams Society, 2004). Further to this, government records indicate that the 10 year mean coho return was 18 individuals, with a maximum return of 41 individuals in 2001, where data was collected from 1953-2016 (DFO; NuSEDS, 2018).

The salmonid species observed in Reay Creek are not permanent resident species. Coho and cutthroat trout migrate from marine to freshwater environments for spawning. Eggs will incubate in Reay Creek for a few months and fry may spend up to a year in freshwater before migrating back to Bazan Bay (Table 7).

Table 7:
Typical Habitat Preferences and Life History Strategies for Fish in Reay Creek

Common Name	Scientific Name	Habitat Preferences and Life History Strategies*
Cutthroat Trout	*Oncorhynchus clarkia*	• gravelly lowland coastal streams and lakes, inland alpine lakes and small rivers, and estuaries or the sea near shore • spawn in gravel streams • stay close to the shore and the estuaries they came from • time spend in ocean is variable, couple weeks to half a year • can live up to 10 years
Coho Salmon	*Oncorhynchus kisutch*	• spawning occurs in swifter water of shallow, gravelly areas of river tributaries • the emergent fry occupy shallow stream margins, and, as they grow, establish territories which they defend from other salmonids • Coho fry live in ponds, lakes, and pools within streams and rivers, usually among submerged, woody debris- in quiet areas free of current • most migrate to the open ocean after one year of growth in freshwater
Threespine Stickleback	*Gasterosteus aculeatus*	• usually inhabits coastal waters or freshwater bodies well connected (or once well connected) to the coasts • prefers slow-flowing water with areas of emerging vegetation • can be found in ditches, ponds, lakes, backwaters, quiet rivers, sheltered bays, marshes, and harbours

*Adapted from Scott and Crossman, 1973; Lamb and Edgell, 2010; Froese and Pauly, 2016.

Typically, adult coho migrate from the ocean to freshwater tributaries in the summer and spawn from August to November. In contrast, cutthroat trout spawn in the spring (February to May) and adults typically migrate from marine environments to freshwater tributaries in February (Table 8).

Table 8:
Timing of Migratory Salmonid Species in Reay Creek

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Coho Salmon												
Adult Migration												
Spawning												
Egg Incubation												
Emergence												
Rearing												
Overwintering (Juvenile and Adult)												
Cutthroat												
Adult Migration												
Spawning												
Egg Incubation												
Emergence												
Rearing												
Overwintering (Juvenile and Adult)												

Table adapted from DFO, 2001

5.2.4.2 *Reptiles and Amphibians*

No reptile or amphibian surveys have been completed within Reay Creek. There are thirteen species of frogs and toads, nine species of salamanders and newts, and two species of turtles in British Columbia. The following table displays the reptiles and amphibians whose distributions overlap the Project area and could potentially be found on site.

Table 9:
Potential Reptiles and Amphibians Occurring within the Project Area

Common Name	Scientific Name	Status (BC)	Status (SARA)
AMPHIBIANS			
Frogs and Toads			
Bullfrog	*Lithobates catesbeiana*	Exotic	Exotic
Green Frog	*Lithobates clamitans*	Exotic	Exotic
Northern Red-Legged Frog	*Rana aurora*	Blue	Special Concern
Pacific Tree Frog	*Hyla regilla*	Yellow	---
Tailed Frog	*Ascaphus truei*	Blue	Special Concern
Western Toad	*Anaxyrus boreas*	Yellow	---
Salamanders and Newts			
Rough-skinned Newt	*Taricha granulosa*	Yellow	---
Northwestern Salamander	*Ambystoma gracile*	Yellow	---
Long-Toed Salamander	*Ambystoma macrodactylum*	Yellow	---
Rough-skinned newt	*Taricha granulos*	Yellow	---
REPTILES			
Turtles			
Red-eared Slider	*Trachemys scripta*	Exotic	Exotic
Western Painted Turtle	*Chrysemys picta bellii*	Red	Endangered

From conversations with surrounding landowners, it is possible that turtles have been observed in Reay Creek Pond. If present, these turtles are most likely red-eared sliders (*Trachemys scripta*), an introduced species of turtle that are known to occur in Southern Vancouver Island (BC ENV, 2019a). Red-eared sliders are commonly confused with Western painted turtles (*Chrysemys picta bellii*) and are more widely distributed on Southern Vancouver Island.

The riparian and aquatic habitat of Reay Creek Pond does not meet the obligate requirement type of Western painted turtles for successful nesting or rearing. Females nest in loose, warm, well-drained soils devoid of riparian vegetation. The majority of populations in BC occur in the Okanagan Valley, with the closest known population of Western painted turtles occurring in Beaver Lake, approximately 15 km south of Reay Creek. Furthermore, threats to this species include water pollution, habitat fragmentation, drainage of wetlands, and increased predation of eggs and juveniles particularly by higher populations of raccoons (COSEWIC, 2006). For these reasons, it's unlikely that Western painted turtles will occur within Reay Creek Pond.

Rough-skinned newts (*Taricha granulos*) were observed during fish surveys in 2018 within the Reay Creek system (LGL, 2018).

5.2.4.3 *Benthic Communities*

Benthic communities were selected as a VEC because of their functional importance to both terrestrial and aquatic ecosystems. Benthic macroinvertebrates burrow deeply into layered sediments and accelerate nutrient cycling. Burrowing benthic organisms and insect larvae mix the sediments, aerate deeper layers of sediments, and increase rates of recycling of macronutrients (nitrogen, phosphorus, and organic carbon) and micronutrients (trace elements) by bioturbation and fecal production. Epibenthic organisms enhance microbial growth and nutrient cycling through their mixing of surface sediments and breakdown of organic detritus.

No benthic invertebrate studies or community analyses have been completed within Reay Creek or Reay Creek Pond. Some studies have shown that contaminated sediments can lead to effects in the benthic community structure as well as changes to life history alterations including acute toxicity, morphological and genetic changes (Rawson *et al.,* 2010). LGL (2018) observed several signal crayfish (*Pacifastacus leniusculus*) when conducting fish and fish habitat surveys of Reay Creek.

5.2.4.4 *Aquatic Species at Risk*

The BC CDC database and BC Species and Ecosystem Explorer were reviewed for records of aquatic SAR (Table 10). This search revealed two fish species occurrence within Reay Creek that are provincially designated as yellow and blue (coho salmon and cutthroat trout, respectively). While both of these species are provincially designated, neither are considered at risk of imminent extinction or extirpation, nor are they federally listed under the SARA.

DFO's Distribution of Fish Species at Risk mapping (2013) shows approximately 37 SAR that occur within the Pacific Ocean, where Reay Creek eventually discharges. These records are marine species and do not occur within Reay Creek. More detailed descriptions of SAR records are provided in Appendix B.

Table 10:
Provincially Listed Fish Species Occurring Within Reay Creek

Scientific Name	English Name	Classification	BC List	SARA Schedule	Location	Description
Oncorhynchus kisuth	Coho Salmon	Vertebrate Animal – Fish	Yellow	---	This occurrence is located within the waters of Reay Creek	Species of anadromous fish that spawn in fall/winter months and spend between a few weeks and 2 years in freshwater streams before migrating to sea.
Oncorhynchus clarkii clarkii	Cutthroat Trout	Vertebrate Animal – Fish	Blue	---	This occurrence is located within the waters of Reay Creek	Species of semi-anadromous fish that spawns in late winter / early spring months and spend upwards of 2-3 years in freshwater streams before migrating to sea (time at sea depends on geographical area and population).

The BC Species and Ecosystem Explorer online database was reviewed for potential occurrences of aquatic animal SAR that may be found within the Project area. The results of the advanced search indicated 6 aquatic animal species that could potentially occur within the

Project area (Appendix A). SLR conducted a literature review of each potential occurrence and refined the potential to 3 aquatic animals SAR that could potentially occur in the Project area. These species can be found in Table 11 below.

Table 11:
Aquatic Animal SAR Potentially Occurring within the Project Area

Scientific Name	English Name	Classification	BC List	SARA Schedule
Reptiles and Amphibians				
Chrysemys picta	Western Painted Turtle	Vertebrate Animal (Reptile)	Red	1, Endangered/Special Concern
*Anaxyrus boreas (*previously *Bufo boreas*	Western Toad	Vertebrate Animal (Amphibian)	Yellow	1, Special Concern
Rana aurora	Northern Red-Legged Frog	Vertebrate Animal (Amphibian)	Blue	1, Special Concern

Based on the life history and habitat preferences for the Western painted turtle, this species is unlikely to occur within the Project area (see Section 5.2.4.2). The two above amphibian species could potentially occur within the Project area.

5.3 Social Components

5.3.1 Heritage and Historical Resources

An Archaeological Overview Assessment (AOA) has been completed for the Project by Millennia Research Ltd. (Millennia; 2018). Known archaeological sites adjacent to the Project area include DdRu-4, an ethnographic village located at Bazan Bay. This site spans 1.2 km along the shoreline adjacent to Lochside Drive and is considered to have high archaeological significance.

Millennia found that the archaeological potential associated with the land immediately surrounding Reay Creek Pond is considered minimal.

Millennia concluded that upper Reay Creek areas (i.e., on Airport Lands) are deemed to have some archaeological potential as there is some possibility of old, habitable landforms to be present that are obscured by industrial developments and agricultural practices.

Several of the reaches of Reay Creek that exist on Airport Lands are located near the BC Aviation Museum. This museum preserves aircraft and aviation artifacts that relate to the history of aviation in Canada, and particularly in British Columbia. The museum is host to many tourists and visitors; it also serves as an educational resource for local schools and organizations.

5.3.2 Recreation, Services and Aesthetics

The Reay Creek area is used throughout the year for a wide range of recreational activities by tourists and local residents alike. The Reay Creek Park, located on Town of Sidney lands, features forested walking trails and park benches. Reay Creek provides ecosystem services to residents and other public users who enjoy being close to nature. The public area is commonly used by dog walkers and bird watchers. The public park and watershed contribute aesthetic value to the neighbourhood, which is highly valued by its residents.

5.3.3 People and Public Health

The Reay Creek area has been classified under Transport Canada's list of contaminated sites; the site is considered to be high priority for action under the Federal Contaminated Sites Action Plan (FCSAP). Signage has been erected within Reay Creek Park regarding the elevated levels of metals contamination within the Pond sediments of Reay Creek Pond. This signage advises park users to avoid contact with bottom sediments. There has been a consistent public demand for cleanup of the area to alleviate the public health advisory, which the Project intends to address.

Spawning of trout and salmon species are monitored by several organizations including Sidney Anglers Association and Saanich Peninsula Stream Society. These organizations have engaged in spawning habitat enhancement activities in downstream areas of Reay Creek in the past. There is potential for future fish habitat restoration in upstream reaches of Reay Creek (Reach 3); however, further communication with VAA is needed to confirm long term restoration and habitat enhancement plans.

5.4 Consultation

Throughout the planning phase of the Project, Transport Canada has engaged in a number of consultative activities which are summarized in the sections below.

5.4.1 Consultation with Federal Departments

Transport Canada has engaged Health Canada, DFO, and Environment and Climate Change Canada as expert support in obtaining funding for the Project through the FCSAP. The site has been classified as high priority for action through the FCSAP program.

5.4.2 Consultation with the Public

Throughout the planning stages of this Project, the Town of Sidney has consulted with the general public. The Town of Sidney attends the Reay Creek Neighbourhood Association meetings and provides updates on information generated from the Technical Working Group. Transport Canada is engaged with the Technical Working Group (see Section 5.4.4).

5.4.3 Consultation with First Nations

Transport Canada has completed an AOA and has distributed it to the following four surrounding First Nations (FN) groups in summer 2018:

- Pauquachin
- Tsartlip
- Tsawout
- Tseycum

In November 2018, Transport Canada requested/offered to meet the above FN to discuss and solicit any interest in the Project. In December 2018, Transport Canada met with both the Tsawout and the Tsartlip FN groups to discuss the Project. Transport Canada will continue to request/offer to meet FN groups as the Project progresses.

5.4.4 Consultation with Other Departments, Agencies or Jurisdictions

In 2015, the Town of Sidney created the Reay Creek Technical Working Group. Throughout the planning phase of the Project, Transport Canada has been engaged with the Reay Creek Technical Working Group, which includes representatives from the following agencies/departments:

- Transport Canada
- VAA
- DFO
- BC ENV
- CRD
- Town of Sidney
- District of North Saanich

The Reay Creek Technical Working Group meets approximately bi-annually to discuss details of the Reay Creek Remediation Project and associated business.

6.0 ASSESSMENT OF ENVIRONMENTAL EFFECTS, MITIGATION MEASURES, AND RESIDUAL EFFECTS

The effects assessment consisted of a qualitative analysis of potential changes induced by the proposed Project, and a rating of the effects of those changes.

Potential direct and indirect Project effects were identified by assessing the potential interactions between the Project activities associated with creek remediation and the environmental components described in Section 5.0. Potential effects are detailed in the Environmental Effects Matrix seen below in Table 12.

Once the potential effects were identified, specific response measures to address each identified effect were considered. These responses include physical measures, methods, or management strategies which are implemented to mitigate potential Project impacts. Potential effects which could not be eliminated through the implementation of mitigation measures were treated as residual effects.

Table 12:
Environmental Effects Matrix

	VALUED ECOSYSTEM COMPONENTS												
	PHYSICAL						BIOLOGICAL				SOCIAL		
PROJECT COMPONENT	Atmosphere	Ambient Noise	Surface Water	Sediment	Soils	Groundwater	Terrestrial Habitat	Terrestrial Animals	Aquatic Habitat	Aquatic Animals	Heritage and Historical Resources	Recreation, Services, and Aesthetics	People and Public Health
Site Preparation	X	X	X		X		X	X	X	X	X	X	X
Instream Remediation	X	X	X	X*	X			X	X	X	X	X	X
Site Restoration			X*	X*	X*		X*	X*	X*	X*		X*	X*

X – Potential Effect
X* - Potential Positive Effect

6.1 Effect on Physical Components

6.1.1 Atmosphere

Site Preparation, Instream Remediation

Potential Effects

The operation of heavy equipment such as the excavators, dump trucks and other small construction equipment may result in decreased ambient air quality during site preparations and remediation activities (i.e. from increased emissions and concentrations of chemical pollutants, dust and other particulate matter) in the immediate vicinity for the duration of remedial activities. Air emissions from vehicles and equipment, including sulphur oxides, nitrogen oxides, particulate matter, volatile organic compounds, and carbon monoxide, are expected to represent only a small change to ambient conditions. Dust may also be generated during site preparation and remediation components of the Project. Sources of dust may include exposure of loose soils during clearing and grubbing, operation of vehicles over dirt or gravel roadways or remedial access locations, and wind-blown dust from stockpiled or transported materials.

Mitigation Measures

The following mitigation measures are recommended to eliminate, reduce or otherwise control the adverse environmental effects of the Project on the atmosphere:

- Vehicles and equipment will be kept in good working condition, use low sulphur fuels when possible, and limit idling to a minimum;

- Vehicles/machinery/equipment are to be in good repair, equipped with emission controls as applicable and operated within regulatory requirements;
- The Contractor will employ dust control measures such as water misting and covering of stockpiles and transported material as necessary; and
- Burning of waste material is not permitted.

Residual Effects

Potential effects during remediation are anticipated; however, residual effects are expected to be low after the above mitigation measures are implemented.

6.1.2 Ambient Noise

Site Preparation, Instream Remediation

Potential Effects

The operation of heavy equipment such as excavators, dump trucks, and hand machinery / equipment is likely to result in increased ambient noise levels in the immediate vicinity of remedial activities and for the duration of the Project. Noise generating activities will be temporary and have the potential to affect wildlife and adjacent residents near the Project site during approved work hours.

Mitigation Measures

The following mitigation measures are recommended to eliminate, reduce or otherwise control the adverse environmental effects of noise and vibration generation of the Project:

- The operation of heavy equipment shall be limited to specified excavation locations;
- Vehicles/machinery/equipment are to be in good repair, equipped with noise emission controls as applicable and operated within regulatory requirements;
- Vehicles and machinery shall not be left idling while not in use;
- Activities that could create excessive noise will be restricted to daylight hours and adhere to both the District of North Saanich and Town of Sidney Noise Bylaws;
- Noise monitoring will be completed by the Contractor, and will be triggered on a complaint-driven basis; and
- The Contractor's foreman or designate shall be on site for the duration of the remedial activities and shall direct public complaints to the PSPC DR, as appropriate.

Residual Effects

Potential effects exist; however, the residual effects are expected to be low due to adherence to Noise Bylaws and the above mitigation measures.

6.1.3 Surface Water

Site Preparation, Instream Remediation, Site Restoration

Potential Effects

During the site preparation phase, surface water quality could be affected as heavy equipment is mobilized to the site. Clearing and grubbing activities could negatively impact surface water if exposed soils on site following clearing activities encounter unseasonal precipitation events. Machinery and equipment used during construction may result in the introduction of contaminants to surface waters such as oil and grease, lubricants and fuel.

During in-water works, impacts to water quality may occur from the suspension of particles in local watercourses during Project activities. Stream diversion techniques may alter flow downstream for a short period of time.

Water from dewatering activities could be discharged into the sanitary sewer system. Dewatering of Pond sediments may generate contaminated water that could enter downstream environments if not properly collected and disposed.

Potential effects to surface water quality associated with construction activities include:

- Increase in TSS levels;
- Increase in contaminant concentrations due to dewatering of sediments; and
- Introduction of other contaminants (e.g. oil and grease).

The potential surface water quality effects outlined above could, in turn, affect fish and wildlife.

Mitigation Measures

Mitigation measures for protection of water quality during construction activities are well documented and include standard engineering and construction practices as well as best management practices (BMPs). These practices are to be outlined in the Contractor's EPP, specifically the Sediment Erosion and Control Plan as well as the Water Management Plan, which will provide details on the procedures that the Contractor will employ to dewater the work area and manage turbid water.

Dewatering of the Pond may require the Contractor to collect, treat, test and discharge/dispose of water. The Contractor shall identify the ultimate discharge location in the Water Management Plan. Water discharge to sanitary sewer during dewatering shall be in accordance with the CRD Sewer Use Bylaw and Saanich Peninsula Stormwater Source Control Bylaw (CRD Bylaws No. 2922 and 4168, respectively). The Contractor shall be responsible for obtaining and adhering to a Waste Discharge Permit prior to discharging any volume of water to the sanitary sewer. Water discharge into downstream reaches of Reay Creek must meet applicable provincial standards (i.e., BC Water Quality Guidelines for the protection of freshwater aquatic life).

Creek isolation and fish salvage activities (including minnow trapping, electrofishing, or other methods within appropriate areas of the creek and Pond) will be conducted under supervision of qualified fisheries biologists prior to sediment removal. See Section 6.2.4.1 for more details on fish salvage.

Water will be diverted around the temporary work sites during Project activities. A Change Approval (Section 11, WSA) and Water Use Approval (Section 10, WSA) for changes in and about a stream will be obtained prior to instream works.

In addition to the above, mitigation measures to minimize potential effects to surface water quality will include, but not necessarily be limited to:

- Full time environmental monitoring by a QEP will be implemented for instream works;
- Instream remedial works will be completed during the reduced risk timing window (June 15th – September 15th) to reduce potential impacts to fish;
- Sediment control measures, such as silt fences, must be placed in areas where there is potential for runoff to intercept downstream surface waters. The Contractor will be required to meet federal and provincial water quality guidelines for turbidity at locations downstream of Project activities;
- A Spill Response Plan will be developed as part of the Project specific EPP. The Spill Response Plan will outline procedures to prevent spills and procedures to be followed in the event of an accidental spill, including a list of all spill response equipment to be maintained on site;
- All equipment must be in proper working condition before arriving on site and must be maintained throughout the Project;
- Equipment and machinery left in the Project area during shut-down hours will have properly placed drip pans;
- The QEP shall provide environmental awareness training with the Contractor's staff and discuss environmental components of the Project with all new staff;
- Place fill/ stockpiles away from watercourses and ditches and minimize stockpiles by coordinating construction and disposal activities;
- Clean equipment in areas designated for vehicle maintenance and cleaning prior to leaving the construction site;
- Washing, refueling and servicing of land-based equipment will be conducted away from the water (i.e., no closer than 30 m from the Pond or creek edge or other surface water conveyance structures);
- Any hydraulic machinery used in isolated channels will use environmentally-friendly hydraulic fluids (i.e., nontoxic to aquatic life, and biodegradable);
- Ensure work proceeds rapidly to ensure that disruptions are minimized;
- Backfill materials will be free of potential contaminants; and
- The QEP must be present during all instream works and shall conduct periodic post-construction inspections of Reay Creek at remedial locations and locations downstream of remedial activities to ensure that the system is functioning as planned during both low precipitation and high precipitation periods during the first year following Project activities. All observations shall be promptly conveyed to the PSPC DR.

Residual Effects

Potential effects exist however the residual effects are expected to be low. Taking into account the implementation of the mitigation measures, the residual effects of the Project is:

- Temporary increase in turbidity and decreased water quality in the immediate Project site.

The permanent removal of contaminated sediment within Reay Creek and Reay Creek Pond is considered to be a beneficial effect of the Project on surface water quality. The remediation will also result in increased water depths within Reach 5. Increased depth will provide a net benefit to cutthroat trout and coho by lowering the average surface water temperature and result in improved salmon rearing and potential spawning conditions.

6.1.4 Sediment

Instream Remediation, Site Restoration

Potential Effects

Disturbed sediments from remedial activities have the potential to migrate and distribute contamination further downstream. Removal of sediment may result in the re-suspension of some contaminated sediments and local redistribution in the creek system if not properly contained.

Settlement of suspended sediments can disrupt benthic communities through siltation and smothering of aquatic vegetative communities and substrates, which are important for supporting fish and invertebrate food and habitat. Potential effects to the aquatic habitat include stress to fish due to abrasion and clogging of gills from increased TSS, as well as the smothering of sessile organisms. Temporary increased water turbidity can disrupt feeding behaviours in fish and reduce photosynthesis in algae and aquatic vegetation. More details on these effects can be found within Section 6.2.

The permanent removal of contaminated sediment within Reay Creek and Reay Creek Pond is considered to be a net positive effect to the entire Reay Creek system.

Mitigation Measures

The Project includes measures to reduce sedimentation and loading from the remediation where exposed sediments have the potential to become mobilized within the creek.

Mitigation measures for prevention of contaminated sediment migration during remedial activities are to be outlined in the Contractor's EPP, Sediment Erosion and Control Plan as well as the Soil and Contaminated Materials Management Plan. Within these Plans, the Contractor shall detail contaminated sediment material handling and segregation, stockpiling and transportation to disposal facilities.

The Project will take place during the reduced risk fisheries window from June 15 to September 15 and work areas will be hydraulically isolated to allow work in the dry. Summer months coincide with when flows within the creek are typically at their lowest, thus reducing sediment migration.

In addition to the above, mitigation measures to minimize the effects of sediment removal will include, but not necessarily be limited to:

- The Contractor shall prevent the release of silt, sediment, sediment-laden water into all downstream watercourses or storm sewer systems; The Contractor shall install effective erosion and sediment control measures, such as silt fences, sand bags, flow diversion measures, and other features, prior to site disturbance;

- Erosion and sediment control measures shall be inspected regularly and maintained as needed;
- Creek base flows will be diverted around the temporary work sites during Project activities to allow work in the dry;
- The Contractor shall segregate and track contaminated sediments removed during remedial works and dispose of contaminated material at an appropriate licensed facility; and
- All stockpiled materials will be underlined and covered with 6 mm polyethylene sheeting or plastic liner to prevent contamination of underlying soils and minimize interaction with wind and precipitation.

Removal of contaminated sediments conducted as part of this Project will provide a beneficial effect on the environment.

Residual Effects

The permanent removal of contaminated sediments within the remedial areas will provide considerable benefit to the local environment as a result of this Project.

6.1.5 Soils

Site Preparation, Instream Remediation, Site Restoration

Potential Effects

Equipment storage or vehicle movement during remediation may result in surface soil compaction and rutting. Environmental effects of remedial activities on soils include erosion impacts, and potential for soil quality impacts via improper waste disposal and/or contamination from accidental release of contaminants such as fuels.

Mitigation Measures

The following mitigation measures are recommended to eliminate, reduce or otherwise control the adverse environmental effects of the Project on soils:

- Excavation activities shall involve smaller equipment wherever possible in order to minimize disturbance in sensitive areas;
- Equipment to be used may include small track excavators, spider hoe excavators, small tracked dump trucks (e.g., marooka) and standard dump trucks for material transport;
- The Contractor shall restore areas of exposed soils where compaction or rutting from vehicle movement has occurred;
- The Contractor shall operate construction vehicles on existing and established routes to minimize disturbance and compaction;
- All imported materials will be stockpiled away from sensitive receptors such as drainages or surface water features and will be underlined and covered with 6 mm polyethylene sheeting or plastic liner to minimize interaction with wind and precipitation;
- Imported material for use as backfill shall be tested and verified to meet appropriate provincial and/or federal standards prior to being brought to site;
- No soils or fill brought to the property shall be stockpiled within 30 m of a waterbody;
- Fueling must be conducted in a designated area, at least 30 m away from drainage ditches, catch basins, or waterbodies and must have secondary containment in place;
- Equipment and machinery left in the Project area during shut-down hours will have properly placed drip pans;

- A Spill Response Plan will be developed as part of the Project specific EPP. The Spill Response Plan will outline procedures to prevent spills and procedures to be followed in the event of an accidental spill, including a list of all spill response equipment to be maintained on site; and
- Construction vehicles and equipment will be checked every morning for leaks and shall be maintained in good working order.

Residual Effects

Residual environmental effects to soil quality are not anticipated provided the mitigation measures are implemented during all Project phases.

6.2 Effect on Biological Components

6.2.1 Terrestrial Habitat

Site Preparation, Site Restoration

Potential Effects

Site preparation will require the removal of riparian vegetation including trees and shrubs to establish remedial access locations along Reay Creek and Reay Creek Pond. Riparian areas serve as important habitat for terrestrial species, and are used as travel corridors, feeding grounds and nesting areas for wildlife. The removal of shrubs and trees will reduce the available habitat for local bird species and will reduce a minor quantity of habitat present in the area.

Disturbed and exposed soils are susceptible to colonization by invasive plants, which - once established - are capable of out competing native plants in the area and reducing native habitat for local species.

Mitigation Measures

The following mitigation measures are recommended to eliminate, reduce or otherwise control the adverse environmental effects of the Project on terrestrial habitat:

- Wherever possible, trees and vegetation shall be retained in order to minimize disturbance to the riparian area;
- Significant trees that are removed shall be replanted at a 2:1 ratio of the same tree species (or suitable native species as directed by the PSPC DR);
- Replacement of shrubs and other vegetation will also be completed with use of native species;
- Invasive plants and impacted soils are to be completely removed from soils within the bounds of the Project area, and disposed of off-site; and
- Disturbed soils must be promptly revegetated to prevent invasive plant colonization.

Residual Effects

Residual effects include the loss of trees and shrubs for nesting of local bird species and the loss of a small area of riparian habitat within the Project area. However, impacts to terrestrial habitat are not believed to be significant, as Site Restoration activities shall replace any removed terrestrial vegetation with native varieties of plants.

6.2.1.1 *Vegetation*

Potential Effects

Vegetation will be removed or impacted in the process of accessing the Project areas by heavy machinery and equipment. A number of large native trees may be removed within the Project area in order to gain access to the remedial areas or as deemed necessary by geotechnical and/or certified arborist review. Disturbed and exposed soils are susceptible to colonization by invasive plants which, once established, are capable of out competing native plants in the area.

Site access through private lands adjacent to the Pond is not anticipated; therefore, removal of lawns or other landscaped vegetation occurring on private lands is not anticipated.

Mitigation Measures

Removal of vegetation shall be limited to various remedial access locations and replanting will occur following remedial activities. The removal of invasive plant species will be completed in select areas which will be replanted with native plant species according to Contractor's Site Restoration Plan. This will result in a net benefit to the surrounding native plant community.

The Contractor shall employ a certified arborist to complete a danger tree assessment and remove any trees that have been identified to pose a safety hazard.

The following mitigation measures are recommended to eliminate, reduce or otherwise control the adverse environmental effects of the Project on vegetation:

- Care will be taken to minimize trampling by using appropriate equipment (e.g., track-mounted excavators) and using protective matting if applicable;
- Remedial access shall be limited to a select number of locations and care shall be taken by the Contractor to limit vegetation removal at all times. Access areas will be subject to approval by the PSPC DR;
- Equipment movement shall follow existing and established routes when possible;
- The laydown area should be limited to existing gravel or paved areas wherever possible;
- Significant trees that are removed shall be replanted at a 2:1 ratio of the same tree species (or suitable native species);
- If a non-native tree is removed, two trees of appropriate native species shall be re-planted in its place;
- Hand tools shall be used by the Contractor when working within the root zones of significant trees;
- Patches of invasive species shall be removed as indicated on Project drawings (Appendix A) and re-vegetated with native plant species;
- Removed invasive plants shall be placed directly into covered bins and immediately disposed of at an appropriate disposal facility;
- To reduce the movement and establishment of non-native species, equipment shall be cleaned when moving between areas;
- The Contractor's Site Restoration Plan will include a list of possible native plant species that can be installed during site restoration activities;
- Upon completion of construction activities, all areas must be restored to their pre-existing conditions, which will include planting native shrubs and hydro-seeding with a native seed-mix;

- If an incidental SAR plant observation occurs, work should stop and an appropriate QEP is to be consulted. During pre-work tailgate meetings, all Contractors on the site should be briefed on SAR plants potentially in the area, and encouraged to notify the PSPC DR regarding all suspected SAR observations; and
- If disturbance is made to the public park areas adjacent to the Pond, these areas shall be returned to their pre-construction state immediately following remedial activities.

The tree removal is anticipated to occur prior to Project works in early June, which is within the general nesting period for migratory birds for Vancouver Island (late march - mid august). Further discussion is presented in Section 6.2.2.

Residual Effects

Remediation activities will result in a temporary net loss in vegetation. Significant trees removed during the Project will be replaced at a 2:1 ratio; however, plantings will take several years to reach maturity.

Taking into account the implementation of the mitigation measures, the residual effects of the Project are:

- Temporary loss of large trees, native shrubs, herbs and graminoids.

As replacement trees will be planted and all areas will be restored to their pre-existing condition, the effect is considered reversible. The removal of invasive plant species followed by replanting of native plants will contribute to a gain in the native plant population, resulting in a net positive effect.

6.2.2 Terrestrial Animals

Site Preparation, Instream Remediation, Site Restoration

Potential Effects

Site preparation, remediation and restoration activities, including the operation of equipment and machinery, and clearing and grubbing, may cause a disturbance to terrestrial animals. In addition to stress from noise, terrestrial wildlife could be impacted by the loss of habitat.

The presence of construction equipment and noise emissions may disrupt some migratory birds and resident species (i.e. waterfowl) utilizing the Pond and creek during the remediation timeframe. It is likely that these birds will seek other areas in the vicinity that are less disturbing to their activities.

Mitigation Measures

The following mitigation measures are recommended to eliminate, reduce or otherwise control the adverse environmental effects of the Project on terrestrial animals:

- Wildlife handling procedures shall be clearly detailed in the EPP, and procedures shall adhere to the conditions outlined in the General Wildlife Permit and accompanying Animal Care Form;

- During the felling of all large trees, a QEP shall be on hand to ensure that wildlife is cleared from the area;
- Removal of riparian vegetation must be overseen by a QEP to ensure small mammals and amphibians have cleared the area. The QEP must be present for all vegetation removal operations;
- Vegetation removal will occur within the key breeding and nesting bird period identified by Environment Canada (mid-March to mid-August) (Environment Canada, 2019);
- A pre-construction breeding bird nest survey will be conducted by a QEP in the areas where tree and vegetation removal is necessary. The surveys will be completed by a qualified professional and will follow a scientifically sound approach as recommended by Environment and Climate Change Canada. Nest surveys are generally valid for a 7-day period. If tree removal occurs outside of the 7-days following nest surveys, additional surveys shall be conducted;
- If nests are present, the QEP will develop a nest management plan identifying protective measures specific to the species present. The nest management plan should be developed in accordance with Federal and Provincial guidelines;
- A QEP, who is provided with authority to modify or halt Project activities if it is deemed necessary to do so for the protection of bird species or habitat, will monitor the nest management plan through Project implementation;
- If an incidental observation of a migratory bird nest or terrestrial animal SAR occurs in the vicinity of the Project Area, project activities near the sighting must stop and an appropriate QEP must be consulted; and
- During pre-work tailgate meetings, all Contractors on the site shall be briefed on terrestrial animal SAR potentially in the area and directed to notify the PSPC DR for all wildlife sightings.

Residual Effects

Residual effects include the loss of mature trees for local nesting bird species. As replacement trees will be planted in the area at a 2:1 ratio, and no SAR are expected to be impacted, the effect is considered minimal and reversible.

6.2.3 Aquatic Habitat

Site Preparation, Instream Remediation, Site Restoration

Potential Effects

The Project has the potential to interact with the aquatic environment by altering water depths, aquatic habitats and/or changing populations of wildlife that are important in an environmental context, including SAR.

Removing aquatic vegetation may lead to temporary changes in light penetration resulting in changes in water temperature, DO, primary productivity and food supply. This may also lead to changes in habitat structure and cover as well as lead to changes in resuspension and entrainment of sediments which may affect downstream watercourses. These short duration works may involve the introduction of sediment and other deleterious substances into the aquatic environment, and / or riparian vegetation disturbance. Instream works will result in the short-term disruption of instream habitat during remedial activities. Suspended sediments can smother and alter aquatic habitat substrate.

The clearing of vegetation along the banks at remedial access locations reduces riparian function, which affects instream habitat quality. Riparian areas contribute food to the aquatic system in the form of organic detritus and insects shed from vegetation, improve habitat quality by creating cover from predators and moderate temperatures along streambanks and within waterways.

Accidental fuel or chemical spills during refueling and operation of equipment have the potential to pollute aquatic habitat.

The long-term effects of the Project are anticipated to benefit the aquatic habitat following contaminated sediment removal. Increased water depths in the Pond area will benefit fish habitat, aquatic vegetative growth, and thermal properties of the watercourse. Post construction restoration presents opportunities to enhance riparian areas and instream fish habitat. Therefore, aquatic habitat will be improved as a result of remedial activities, thus enhancing the habitat complexity for fish and other aquatic animals.

Mitigation Measures

The risk to aquatic habitat from these and other potential impacts is often controlled or eliminated through the use of timing windows for in-water works, restricting remedial access locations, site controls and operational constraints, and construction monitoring and inspection.

The following mitigation measures will be followed to reduce effects of the Project on the surrounding aquatic habitat:

- The Contractor's Water Management Plan shall provide details on the procedures that the Contractor will employ to dewater the work area and manage turbid water;
- Existing vegetation will be preserved where possible. Removed vegetation will be compensated with new native plantings (see Section 3.2.4);
- Sediment and erosion controls shall be employed by the Contractor;
- Work will be completed in-the-dry during the reduced risk fisheries window for instream works on Vancouver Island (June 15th to September 15th);
- A fish salvage program will be completed prior to stream isolation works (see Section 6.2.4.1 for more details);
- During in-water works, flow will be isolated in remedial areas and diverted around the Project site to downstream areas, thus maintaining downstream flow;
- Instream aquatic vegetation shall be allowed to recolonize from upstream seed sources naturally;
- Instream habitat enhancement features shall be installed at remedial access locations along the Pond as per design drawings (Appendix A). These may include buried emergent logs, anchored root balls, and LWD;
- Aquatic habitat features in Reaches that exist within Airport Lands shall be retained. These include riffle structures in Reach 1B; and
- A DFO Request for Project Review will be submitted prior to remedial activities and recommendations will be incorporated into future planning of the Project.

Residual Effects

Taking into account the implementation of the mitigation measures, the residual effect of the Project on Aquatic Habitat is:

- Temporary loss in instream aquatic vegetation; and
- Temporary loss in riparian vegetation at remedial access locations.

A negative residual effect of short duration is associated with the loss of riparian area function where riparian vegetation will be removed. The residual effect will be maintained until planted riparian vegetation reaches the pre-construction age class. It is anticipated that a net positive effect will occur at remedial access locations, as riparian vegetation matures.

A loss in instream aquatic vegetation is not anticipated to be significant, as recolonization from upstream seed sources will naturally infill available spaces during the instream aquatic habitat growing season.

Long-term improvements to aquatic habitat will result through the removal of contaminated sediments, an increase in Pond water depths, in which is anticipated to lower Pond water temperatures.

6.2.4 Aquatic Animals

Site Preparation, Instream Remediation, Site Restoration

6.2.4.1 *Fish*

Potential Effects

During site preparation and instream remediation activities, the following potential effects on fish could occur:

- Potential to impact fish movements during remediation;
- Potential to obstruct flows during remediation;
- Removal of riparian and instream vegetation during remediation;
- Entrainment in pumps/machinery may lead to direct mortality of fish;
- Creek isolation may lead to impacts on downstream and upstream fish passage resulting in alterations of migration patterns, change in access to habitat, incidental entrainment, or mortality of resident species;
- Change in water chemistry and temperature may lead to alteration of migration patterns and access to habitats as well as changes in thermal cues or temperature barriers;
- Flow alterations may lead to changes in thermal cues and attraction;
- Increased water depths in the Pond area to allow for improved aquatic habitat benefitting aquatic vegetative growth as well as thermal properties of the watercourse; and
- Potential post construction restoration opportunities to enhance riparian areas and instream fish habitat.

These short duration works may involve the introduction of sediment and other deleterious substances into the aquatic environment, and / or riparian vegetation disturbance. However, the long-term effects of the Project are anticipated to benefit fish and fish habitat following contaminated sediment removal.

Mitigation Measures

A creek isolation and fish salvage will be conducted by qualified fisheries biologists prior to any waterway diversion. In the larger remedial areas (i.e., Reay Creek Pond), the fish salvage program may take upwards of 1 week to complete. A Scientific Fish Collection Permit will be obtained in order to complete fish salvage work within Reay Creek prior to in-water works.

The following mitigation measures will be followed to reduce potential effects of the Project on fish:

- Sediment and erosion controls shall be employed by the Contractor;
- Work will be completed in-the-dry during the reduced risk fisheries window for instream works on Vancouver Island (June 15th to September 15th);
- A fish salvage program will be completed prior to stream isolation works;
- In the Pond, the fish salvage program will be completed through the use of several techniques including isolation nets, minnow traps, fyke nets, and pole seines. The salvage program may take up to seven days to complete, or until no more fish are caught using the above techniques;
- For reaches that exist on Airport Lands, where the creek channel is more defined, and the substrate bottom is more consolidated, electrofishing may be utilized to capture and salvage fish;
- During in-water works, flow will be isolated in remedial areas and diverted around the Project site to downstream areas, thus maintaining downstream flow;
- All pumps will utilize appropriate fish screens and/or anti-entrainment measures to avoid physical impact to fish or other wildlife and measures will be taken to avoid siltation near pump intakes;
- Following remediation, instream aquatic vegetation shall be allowed to recolonize from upstream seed sources naturally;
- Instream habitat enhancement features shall be installed at remedial access locations along the Pond following instream remediation. These may include buried emergent logs, anchored root balls, and LWD;
- Aquatic habitat features in reaches that exist within Airport Lands shall be retained. These include riffle structures in Reach 1B;
- All remedial works will be monitored by a QEP, who will be equipped to rescue any stranded or isolated fish; and
- A DFO Request for Project Review will be submitted prior to remedial activities and recommendations will be incorporated into future planning of the Project.

Residual Effects

Taking into account the implementation of the mitigation measures, no residual effects are anticipated.

6.2.4.2 *Reptiles and Amphibians*

Potential Effects

Reptiles and amphibians may be present in the remedial areas of Reay Creek and could be directly affected by the remedial activities. The reduced risk timing windows for instream Project work (June 15 – September 15) may affect reptiles and amphibians, when they typically move from wetland breeding habitats to adjacent upland features off site.

Potential effects of remedial activities on reptiles and amphibians include alteration or removal of riparian vegetation and upland creek banks and disruption of aquatic habitat. Reptile or amphibian SAR have the potential to be affected by remedial activities.

Mitigation Measures

The following mitigation measures are recommended to eliminate, reduce or otherwise control the adverse environmental effects of the Project on reptiles and amphibians:

- Full time environmental monitoring by a QEP will be implemented for removal of riparian vegetation and instream remedial works. The QEP will be equipped to rescue any stranded or isolated reptiles or amphibians;
- QEPs shall visually search for evidence of turtle nests on the side slopes of the Pond; however, due to the vegetated nature of the Pond slopes, turtle nests are not anticipated;
- Minimize removal of riparian vegetation where possible;
- Obtain a General Wildlife Permit (including preparation of the animal care form);
- If an incidental SAR reptile or amphibian occurs, work should stop and an appropriate QEP is to be consulted. During pre-work tailgate meetings, all Contractors on the site should be briefed on SAR reptile and amphibian species potentially in the area, and directed to notify the PSPC DR regarding all suspected SAR observations; and
- Install instream habitat enhancement features such as emergent buried logs, large root balls, and LWD in accordance with the Project design drawings (Appendix A); and
- Stabilize disturbed areas as soon as possible after remedial activities are complete.

Residual Effects

Removing impacted sediments will likely improve water quality and overall aquatic habitat value. Improved water quality is likely to contribute positively to amphibian and reptile health, as well as to other wildlife species which rely on this food source. Once mitigation measures are implemented, no residual effects are anticipated.

6.2.4.3 *Benthic Communities*

Potential Effects

The Project has the potential to interact with benthic communities through siltation and smothering of aquatic vegetative communities and substrates, which are important for supporting fish and invertebrate food and habitat. Smothering can cause direct mortality to benthic invertebrates and reduce the photosynthetic capacity of aquatic vegetation.

The benthic communities within the remedial areas will be directly affected by the Project, which will result in the temporary loss of benthic, epibenthic and infaunal organisms as a result of sediment removal activities within the Project area.

Accidental fuel or chemical spills during refueling and operation of equipment have the potential to pollute aquatic habitat and negatively impact downstream benthic communities.

The permanent removal of contaminated sediment within Reay Creek and Reay Creek Pond is considered to be a beneficial effect of the Project on benthic communities. The remediation will result in increased water depths within Reach 5 which will increase the wetted depth of the Pond and lower the average surface water temperature. Remedial work is also likely to create higher benthic community diversity by enhancing opportunities for less pollution-tolerant species to become established.

Mitigation Measures

Downstream benthic communities can be protected by the following mitigation measures:

- A Spill Response Plan will be developed as part of the Project specific EPP. The Spill Response Plan will outline procedures to prevent spills and procedures to be followed in the event of an accidental spill, including a list of all spill response equipment to be maintained on site;
- Imported fill material will provide more diverse substrate types for future colonization;
- During in-water works, flow will be isolated in remedial areas and will be maintained in downstream areas, thus maintaining downstream flow; and
- Sediment and erosion controls shall be employed by the Contractor.

Residual Effects

A negative residual effect of short duration is associated with the loss of benthic, epibenthic and infaunal organisms as a result of sediment removal activities. The residual effect will be maintained until benthic community recolonization occurs, which is likely to happen rapidly following contaminated sediment removal. It is anticipated that a net positive effect will occur following removal of contaminated sediments, which is considered to provide beneficial effects on benthic communities.

Furthermore, increases in wetted depths, lowering of water temperatures and improving water quality and diversity of substrate conditions will have a net benefit on benthic communities.

6.3 Effect on Social Components

6.3.1 Heritage and Historical Resources

Site Preparation, Instream Remediation

Potential Effects

Based on the aforementioned AOA (Millennia, 2018), the archaeological potential for select areas within Reay Creek is considered moderate to high. Therefore, archaeological sites and/or artifacts could potentially be uncovered during the Project works.

The BC Aviation Museum may be impacted by the Project area surrounding the museum on Airport Lands. The main access to the museum parking lot is on Norseman Road, which lies directly adjacent to the tributary channel (Reach 3) of Reay Creek. This narrow road may be subject to increased construction traffic.

Mitigation Measures

The following mitigation measures are recommended to eliminate, reduce or otherwise control the adverse environmental effects of the Project on heritage and historical resources:

- Employ full time archaeological monitors during construction activities that involve ground disturbance;
- In the event that archaeological artifacts are uncovered, Project activities within the vicinity will be halted and the PSPC DR and archaeological monitor will be notified to determine appropriate actions prior to resuming work.

- Limit construction vehicles to established trucking routes;
- Establish a route and/or alternate parking area for museum visitors during Project work affecting Norseman Road (if applicable);
- Consult with BC Aviation Museum staff throughout the duration of the Project; and
- Reduce idling when vehicles and equipment are adjacent to the museum.

Residual Effects

Given the information provided and the mitigation measures listed above, no residual adverse effects of the Project are anticipated.

6.3.2 Recreation, Services and Aesthetics

Site Preparation, Instream Remediation, Site Restoration

Potential Effects

The presence of remediation equipment and other associated Project vehicles may result in a temporary negative impact on the general aesthetics of the immediate Project area. The greatest potential for people to view Project activities is from publicly accessible locations along adjacent roadways such as Norseman Road, Canora Road and Westbrook Drive. Adjacent private properties will also have a high potential for observing Project activities.

Use of the park and the public area for recreation and other ecosystem services will be restricted during the Project period. However, the main portion of the park and trails, which are downstream from the dam, will not be affected by the Project. Downstream flows in the creek shall be maintained during stream isolation and remediation.

Mitigation Measures

The following mitigation measures are recommended to eliminate, reduce or otherwise control the adverse environmental effects of the Project:

- Minimize the duration of Project activities to the extent practical;
- All non-hazardous and hazardous construction wastes generated by the Project shall be collected, stored in secure / approved containers, and transported to a provincially-approved facility for disposal on a regular basis. Long-term storage of waste materials on site shall be avoided;
- Stockpiling of materials and staging equipment shall be undertaken in designated locations only and as far away from residences as possible;
- Site maintenance and housekeeping shall be completed on a regular basis; and
- Clean-up all sites and repair all damages to lands utilized for Project activities.

Residual Effects

Given the information provided and the mitigation measures listed above, no residual adverse effects of the Project are anticipated.

6.3.3 People and Public Health

Site Preparation, Instream Remediation, Site Restoration

Potential Effects

Disturbance to people's use and enjoyment of their properties (especially those directly adjacent to Reach 5) may be affected during the Project. However, due to consistent public demand for cleanup of the area, the temporary disturbance is considered acceptable.

Public safety may be affected from Project activities from the use of large machinery, trucking movement, and potential exposure to contaminated sediments. Private properties adjacent to Reach 5 may be affected by the remediation if remedial extents impede on private properties.

The previous habitat enhancement performed by fisheries-focused organizations downstream of the dam will not be impacted. The Project will be completed within the reduced risk timing (instream work) windows for Vancouver Island from June 15th to September 15th. In addition, fisheries resources will benefit from the reduction of contaminated sediments from the creek that have the potential to migrate further downstream. The removal of contaminated sediment will also have a net benefit on fisheries resources available upstream of the dam.

Mitigation Measures

The following mitigation measures are recommended to eliminate, reduce or otherwise control the adverse environmental effects of the Project on people and public health:

- The Contractor shall maintain communication with private land owners when working adjacent to private lands;
- The Contractor shall direct complaints made by adjacent private land owners to the PSPC DR;
- The Contractor shall maintain setbacks as described on Construction Drawings and not impede on private property;
- The Contractor shall secure the work areas to prevent public access;
- Site maintenance and housekeeping shall be completed on a regular basis; and
- Limit construction activities to approved working hours that adhere to the intent of both North Saanich and Town of Sidney Noise Bylaws.

Residual Effects

Any removal of contaminated sediments is considered to be a beneficial effect of the Project on both people and public health. Given the information provided and the mitigation measures listed above, no residual adverse effects of the Project are anticipated.

7.0 SEVERITY ASSESSMENT

The severity of residual environmental effects was evaluated using the general criteria outlined in Table 13 and the rating matrix presented in Table 14.

Table 13:
General criteria used to guide interpretation of the severity of adverse effects

Criteria	Definition	Rating
Magnitude	Severity of the adverse effect	**High** – the effect causes a ≥ 25% change in VECs abundance/function/process/value **Low** – the effect causes a ≤ 25% change in VECs abundance/function/process/value
Spatial extent	A description of over how large an area the adverse effect occur.	**High** – the effect occurs in an area ≥ 25% of the study area. **Low** – the effect occurs in an area ≤ 25% of the subject property
Duration	The duration of the effects.	**High** – the effect is long-lasting, and/or occurs frequently **Low** – the effect is short term and does not occur frequently.
Likelihood	The chance that a particular effect may occur.	The rating uses probability data, where available, or if not available, professional judgment is applied based on an understanding of past scenarios that are similar to those predicted here.

Table 14:
Effect Severity Rating Matrix

Spatial Extent	Duration	Magnitude	Description of potential effect	Is the effect significant?
H	H	H	A strong effect that is long lasting and/or frequent and covers a large area.	Yes
H	H	L	A weak effect that is long lasting and/or frequent and covers a large area.	Yes
H	L	H	A strong effect that covers a large area but does not last long or occur frequently.	Yes
L	H	H	A strong effect that is long lasting and/or frequent but does not cover a large area.	Yes
H	L	L	A weak effect that covers a large area but does not last long or occur frequently.	No
L	H	L	A weak effect that is long lasting and/or frequent but does not cover a large area.	No
L	L	H	A strong effect that is not long lasting and/or frequent and does not cover a large area.	No
L	L	L	A weak effect that is not long lasting and/or frequent and that does not cover a large area.	No

Adverse effects that are severe and likely will be subject to mitigation measures to reduce the effects to insignificant levels. The proposed mitigation measures must be directly related to the predicted effects, or they will not have the desired goal of eliminating or reducing the effect significance. The effectiveness of the mitigation measures is evaluated by re-assessing the residual effect assuming the implementation of the mitigation measures. Residual effects after mitigation have been assigned “Levels of Residual Effects” as summarized below (Table 15). Residual effects ranked as high or moderate (i.e. which cannot be mitigated to an adequate level) need to be compensated.

Table 15:
Summary of Levels of Residual Effects

Level of Residual Effect	Definition
High	Potential effect results in a decline/change in the environmental resource considered and cannot be offset by the implementation of BMPs.
Moderate	Potential effect results in a decline/change in the environmental resource considered and mitigation measures result in partial mitigation only.
Low	Potential effect may results in a slight decline/change in resource in study area but the effect can be fully mitigated and the resource should return to levels similar (or better) to those observed as part of the existing conditions.

Table 16 summarizes the potential impacts of the Project, proposed mitigation measures, and residual effects. The severity of residual effects (both negative and positive) is ranked as either not significant or significant.

Table 16:
Summary of Project Effects, Mitigation and Overall Residual Effects Severity

Factor	Potential Effect	Severity of Effect Without Mitigation				Mitigation	Residual Effects Ranking	Overall Residual Effects Significance
		Spatial Extent	Duration	Magnitude	Overall Significance			
Atmosphere	• Decreased ambient air quality due to emissions and dust.	L	L	L	Low Negative Effect	• Vehicles / equipment kept in good working condition • Use of low sulphur fuels and emission controls when possible • Limit idling to a minimum; • Implement dust control measures as required • Cover stockpiles and transport trucks • No burning of waste material	Low	Not Significant
Ambient Noise	• Increased ambient noise in immediate vicinity of remedial activities • Disturb wildlife and adjacent residences near the Project site	L	L	L	Low Negative Effect	• Limit operation of equipment to specified locations and approved work hours • Equip vehicles, machinery, equipment with noise emission controls as applicable • Implement idle reduction strategy • Noise monitoring completed on a complaint-driven basis	Low	Not Significant
Surface Water	• Exposed soils leading to sedimentation and erosion into waterways • Suspension of particles in on site watercourses during Project activities • Stream diversion techniques may alter flow downstream • Increase in TSS levels • Increase in contaminant concentrations • Introduction of other contaminants through spills or leaks	H	L	H	High Negative Effect	• Full time monitoring by a QEP • Install and maintain erosion and sediment control structures • Contractor to complete Spill Response Plan • Obtain a BC WSA Water Use Approval and Change Approval (*Section 10* and *Section 11, WSA*) authorizations (i.e., dewatering construction works and approval for changes in and about a stream) • Work in dry summer months during reduced risk timing windows (June 15 to Sept 15) • Divert water around remedial areas and maintain downstream flow. • Contractor to meet federal and provincial water quality guidelines for TSS / turbidity downstream of Project • Dewatering to be done according to Water Management Plan. Contractor to collect, treat, test and discharge/dispose of site waste water. • Place fill/ stockpiles away from watercourses and ditches • Minimize stockpiles by coordinating construction and disposal activities • Dispose of sediment, water or waste generated during construction appropriately • Clean equipment in designated areas only • Washing, refueling and servicing equipment will be conducted > 30 m from waterbodies and conveyance structures (e.g., storm drains, ditches, etc.) • Use environmentally-friendly hydraulic fluids • Minimize vehicle activity on disturbed site surfaces during and after wet weather • Minimize disturbance to riparian vegetation along channel banks • Ensure work proceeds rapidly, to ensure that disruptions are minimized • Stabilize and re-vegetate the site as soon as construction is complete.	Low Permanent removal of contaminated sediments has net benefit on surface water quality	Significant Positive Effect
Sediment	• Disturbed sediments have the potential to migrate downstream. • Settlement of suspended sediments can disrupt benthic communities • Potential effects to the aquatic habitat (stress to fish, disrupt fish feeding behaviours, smothering of sessile organisms, and reduction in photosynthesis) • Potential for spread of contamination due to improper handling, transport, storage or disposal of contaminated sediments	H	L	H	High Negative Effect	• Full time monitoring by a QEP • Install and maintain erosion and sediment control structures • Divert water around remedial areas and maintain downstream flow • Use proper contaminated material handling, transport and disposal methods in accordance with Contractor's Soil and Contaminated Materials Management Plan • Track and dispose of contaminated sediments at an appropriate licensed facility.	Low Permanent removal of contaminated sediments has net benefit on surrounding system	Significant Positive Effect

Factor	Potential Effect	Severity of Effect Without Mitigation				Mitigation	Residual Effects Ranking	Overall Residual Effects Significance
		Spatial Extent	Duration	Magnitude	Overall Significance			
Soils	• Soil erosion, compaction and rutting from equipment • Soil contamination from accidental release of contaminants	L	L	L	Low Negative Effect	• Use of smaller track equipment during excavation where possible • Restore areas of compaction or rutting. • Use established construction routes and equipment storage areas. • Stockpile material on 6 mm poly sheeting or plastic liner and cover • Do not stockpile soils within 30 m of a waterbody. • A Spill Response Plan will be developed as part of the Project specific EPP • Re-fueling completed in designated area and must have secondary containment in place. • Place drip pans under equipment and machinery left on site overnight • Provide proof of testing of imported material	Low	Not Significant
Terrestrial Habitat	• Removal of riparian vegetation • Reduction of available habitat for local wildlife and bird species • Disturbed and exposed soils are susceptible to colonization by invasive plants	L	H	L	Low Negative Effect	• Wherever possible, trees shall be retained • Removed significant trees shall be replanted at a 2:1 ratio • Replace vegetation with native species • Remove invasive plants and dispose off-site • Revegetate disturbed soils to prevent invasive plant colonization	Low Site Restoration activities shall replace removed terrestrial vegetation with native varieties of plants.	Significant Positive Effect
Vegetation	• Vegetation will be removed in remedial access locations • Large native trees may be removed • Danger trees may be removed if they pose a hazard. • Disturbed and exposed soils are susceptible to colonization by invasive plants	L	H	L	Low Negative Effect	• Use of small track equipment and protective matting where possible • Limited remedial access locations in order to reduce vegetation removal • Follow approved construction routes • Use hand tools when working within root zones of significant trees • Contractor to complete Site Restoration Plan for approval by the PSPC DR • Remove invasive species in identified areas and re-plant with native plant species • Clean equipment between areas to limit spread of invasive plant species • Reinstate public park spaces to pre-construction state • Replant significant trees at 2:1 ratio using native species • Stop work and consult QEP if incidental SAR plant observation occurs	Low Temporary loss in vegetation at remedial access locations, followed by replanting. Removal of invasive plant species followed by replanting of native plants will contribute to a gain in the native plant population.	Significant Positive Effect
Terrestrial Animals	• Construction equipment may disrupt terrestrial animals, migratory birds and resident species • Loss of habitat from Site Preparation activities • Removal of vegetation could result in harm to nesting birds	L	L	L	Low Negative Effect	• Pre-construction breeding bird nest surveys to be completed within 7 days prior to vegetation removal • Nest management plan to be created by a QEP if nests are observed. • The Contractor shall obtain a qualified arborist to complete any necessary tree removal. • Wildlife handling procedures shall be clearly detailed in the EPP, and procedures shall adhere to the conditions outlined in the General Wildlife Permit and accompanying Animal Care Form • QEP will oversee removal of vegetation to monitor for small mammals and amphibians • If an incidental observation of a migratory bird nest or terrestrial animal SAR occurs in the vicinity of the Project Area, project activities near the sighting must stop and an appropriate QEP must be consulted	Low Temporary loss of mature trees for local nesting bird species. Replacement trees planted at 2:1 ratio, therefore effect is considered minimal and reversible.	Not Significant

Factor	Potential Effect	Severity of Effect Without Mitigation				Mitigation	Residual Effects Ranking	Overall Residual Effects Significance
		Spatial Extent	Duration	Magnitude	Overall Significance			
Aquatic Habitat	• Water depths will be altered • Potential to alter aquatic habitats and/or change population dynamics of wildlife • Temporary changes in light penetration resulting in changes in water temperature, DO, primary productivity and food supply. • Temporary changes in habitat structure and cover • Potential to impact fish movements, obstruct flows • Erosion and sedimentation. Suspended sediments can smother and alter aquatic habitat substrate. • Removal of riparian vegetation, instream vegetation and habitat • Accidental fuel or chemical spills can pollute aquatic habitat.	H	H	H	High Negative Effect	• Contractor's Water Management Plan shall provide details on dewatering and management of turbid water • Preserve existing vegetation where possible. • Replace removed vegetation with native plantings • Install and maintain erosion and sediment control structures • Complete work during the reduced risk timing window (June 15th to September 15th) • Complete fish salvage program by a QEP • Isolate flow and pump around construction to maintain flow in downstream areas • Install instream habitat enhancement features following remediation • Retain existing instream habitat features on Airport Lands • Increased water depth will improve aquatic habitat and reduce average water temperatures • Full time monitoring by a QEP - will be equipped to rescue stranded or isolated fish • Submit DFO Request for Review prior to remedial activities. Incorporate recommendations into future planning of the Project.	Low Temporary Disturbance; Ultimate Net Benefit to Aquatic Habitat	Significant Positive Effect
Fish	• Removal of aquatic vegetation can alter water temperature, DO, primary productivity, habitat structure and food supply. • Suspension of contaminated sediments could migrate downstream. • Increase in turbidity can disrupt feeding behaviours in fish and smother gills, leading to asphyxiation. • Fish can become entrained in pumps/machinery • Alteration of water depths will improve Pond habitat conditions to support fish	H	H	L	High Negative Effect	• Install erosion and sediment control structures • Complete work during the reduced risk timing window (June 15th to September 15th) • Obtain Scientific Fish Collection Permit • Complete fish salvage program by a QEP • Isolate flow and pump around construction to maintain flow in downstream areas • Allow instream aquatic vegetation to recolonize from upstream sources • Install instream habitat enhancement features following remediation • Retain existing instream habitat features on Airport Lands • Increased water depth will improve aquatic habitat and reduce average water temperatures • Full time monitoring by a QEP - will be equipped to rescue stranded or isolated fish • Submit DFO Request for Review prior to remedial activities. Incorporate recommendations into future planning of the Project.	Low Temporary dislocation and removal of fish from remedial areas. Positive impact in Pond for fish	Significant Positive Effect
Reptiles and Amphibians	• Project timing may affect species overland migration • Removal of riparian vegetation may disrupt breeding sites • Removal of sediments will directly affect animals living in remedial extents	L	H	L	Low Negative Effect	• Preserve existing vegetation where possible. • Replace removed vegetation • Obtain General Wildlife Permit and accompanying Animal Care Form • Full time monitoring by a QEP to monitor for stranded reptiles or amphibians during creek and Pond dewatering, sediment piling and sediment dewatering; • Transfer collected amphibians and reptiles to suitable downstream habitat • Maintain water flow in downstream areas • Install instream habitat enhancement features following remediation • If an incidental observation of reptile or amphibian SAR occurs in the vicinity of the Project Area, project activities near the sighting must stop and an appropriate QEP must be consulted	Low	Not Significant
Benthic Communities	• Removal of existing benthic community through sediment excavation • Siltation and smothering can cause direct mortality to benthic communities • Siltation and smothering can reduce the photosynthetic capacity of aquatic vegetation. • Accidental fuel or chemical spills can pollute aquatic habitat and negatively impact downstream benthic communities.	H	H	H	High Negative Effect	• Imported fill material and clean sediment surfaces to provide diversity of substrates that are uncontaminated for future colonization • Maintain water flow in downstream areas; • Install erosion and sediment control structures • A Spill Response Plan will be developed as part of the Project specific EPP	Low Temporary Disturbance from Sediment Removal Ultimate Long-Term Net Benefit to Benthic Communities	Significant Positive Effect

Factor	Potential Effect	Severity of Effect Without Mitigation				Mitigation	Residual Effects Ranking	Overall Residual Effects Significance
		Spatial Extent	Duration	Magnitude	Overall Significance			
Heritage and Historical Resources	• Archaeological sites / artifacts may be uncovered during the Project works. • Potential impacts to visitors and staff of the BC Aviation Museum from increased construction traffic.	L	L	L	Low Negative Effect	• Employ full time archaeological monitors during construction activities; • Limit construction vehicles to established trucking routes; • Establish a route and/or alternate parking area for museum visitors during Project work affecting Norseman Road; • Consult with BC Aviation Museum staff throughout the duration of the Project; and • Reduce idling when vehicles and equipment are adjacent to the museum.	Low	Not Significant
Recreation, Services, and Aesthetics	• Temporary negative impact on the general aesthetics of Reay Creek • Use of the Reay Creek Park adjacent to the Pond will be restricted during the Project period.	L	L	H	Low Negative Effect	• Minimize the duration of Project activities to the extent practical; • Store and secure construction wastes generated from the Project; • Dispose of wastes at approved off-site facility regularly • Maintain general housekeeping of the Project area at all times • Stockpile materials in designated stockpile area • Stage equipment in designated staging area • Conduct site clean-up and restoration immediately following remediation activities.	Low	Not Significant
People and Public Health	• Temporary disturbance to private landowners adjacent to remedial areas • Public safety may be affected by Project activities • Private properties potentially affected by Project activities • Removal of contaminated sediment will have net benefit for people, public health and ecosystem resources (i.e., fish)	H	L	L	Low Negative Effect	• Contractor to maintain lines of communication with private land owners • The Contractor shall direct complaints made by adjacent private land owners to the PSPC DR • Complete site maintenance and housekeeping at all times • Limit construction activities to approved working hours • The Contractor shall maintain setbacks and not impede on private property • The Contractor shall secure the work areas to prevent public access	Low	Not Significant

8.0 CUMULATIVE EFFECTS

Cumulative effects represent the incremental effects of an action on the environment when the effects are combined with those from other past, existing or future actions. The assessment of cumulative environmental effects presented in this section considered residual effects resulting from the proposed Project combined with those of other past, existing and known imminent projects and activities.

8.1 Historic and Future Projects

The following section details known projects that have been undertaken in the recent past as well as future potential projects within the Reay Creek Remediation Project area. The VAA are engaged in a number of construction and environmental enhancement projects in different areas of the Airport; however, only those projects that directly impact Reay Creek were considered in the cumulative effects assessment.

8.1.1 Historic Projects

The following historic projects were considered:

Reay Creek Channel Diversion and Restoration Project. 2012.

In an effort to reduce potential for new contaminant inputs into downstream areas of Reay Creek, a 200 m long diversion channel was built (Reach 1B) to isolate the most contaminated areas of the creek (Reach 1A). The diversion channel incorporated aquatic habitat features such as rocks, riffle structures and riparian vegetation plantings to provide habitat for a variety of aquatic species.

The diversion channel was designed to allow for clean storm water to bypass the historically contaminated areas while enhancing riparian plantings to help remediate the existing creek. The old creek channel (Reach 1A) was converted into a bio-remediation linear wetland and was used as a catch basin for stormwater inputs. Creation of the bypass channel involved installing isolation berms with spill gates to help reduce the risk of any event or spill in the future that may impact the lower creek reaches that run through Town of Sidney and North Saanich.

Reay Creek Detention Pond Project. 2017 – 2018

In spring 2018, the newly construction detention pond within Reach 2 was created ground-side within VIA property. A 5,000 m^3 detention pond was constructed to help control stormwater flows from impermeable surfaces located on Airport Lands. At the downstream end of the detention pond, an outlet structure was constructed that provides a controlled rate of water discharge aimed at reducing peak flows in downstream areas in an effort to mitigate flooding and soil erosion.

The previous channel along the detention pond was excavated of all potentially contaminated sediments and the new channel was lined with gravel and cobble substrates. During low flows, the creek channel maintains flow to downstream areas. Higher flow events back up at the outlet weir and inundate the pond area which slowly draws down to alleviate large pulses in flow during storm events. A sediment trap was also constructed to reduce future sedimentation leaving Airport Lands.

8.1.2 Future Projects

The following projects have the potential to occur within the Reay Creek system, although have not been confirmed:

- Potential aquatic habitat enhancement projects within Reach 3 (Tributary Channel) may be completed by VAA;
- Potential further remediation of Reay Creek downstream of the Pond dam may be completed to address historical sediment contamination in this area;
- Potential upgrades to the Reay Creek Dam may be conducted by the Town of Sidney following Pond remediation activities; and
- Potential ongoing salmon enhancement within Reay Creek from local Streamkeepers Associations (i.e., Sidney Anglers Association, Peninsula Streams Society).

8.2 Cumulative Effects Assessment

The historic projects as well as the future potential projects listed above all provide benefits to VECs, either through habitat enhancement, reduction in contaminated sediment migration, or reduction in storm surge flows.

The proposed Reay Creek Remediation Project will provide an ultimate net benefit to the surrounding environment. The cumulative effects of past sediment and surface water enhancement programs, future potential habitat enhancement programs and the current sediment remediation and habitat enhancement program will provide a net benefit to the surrounding environment and VECs listed in Section 5.0.

9.0 ACCIDENTS AND MALFUNCTIONS

Section 6.0 described the proposed mitigation measures to avoid and minimize environmental effects as a result of the remediation Project. Infrequent and unplanned accidents and malfunctions can, however, occur during the implementation of the Project, and these potentially can affect the environment. This section describes the potential for malfunction and accidents and contingency measures that will be implemented to minimize their occurrence and consequence.

9.1 Spills of Toxic or Hazardous Materials

Accidental spills of toxic or hazardous materials to water bodies or storm sewers can cause acute or chronic effects to aquatic life (including plants) and aquatic dependent birds and mammals a well as their food source. Accidental spills can involve gasoline, diesel, propane, hydraulic oil, lubricating oils and greases, and may occur during construction activities or operation. To prevent and minimize the potential effects of accidental spills, the Contractor shall create and submit an EPP prior to the construction works. A Spill Response Plan shall be included within the EPP and mitigation measures outlined within the plan shall be in place during the construction phases of the Project and should outline spill prevention, detection and response measures.

Details regarding mitigation measures to limit the potential for contamination to soils, groundwater and surface water from accidental spills can be referenced in Section 6.1.5. The implementation of the Spill Response Plan including the mitigation measures outlined in Section 6.1.5 will reduce the likelihood of occurrence of many accidents and malfunctions and confirm

that, should they occur, adverse environmental effects will be prevented or minimized. Therefore, accidental spills associated with the proposed Project are not expected to occur with any regularity or result in any measurable long-term effects on the receiving environment.

9.2 Damage to Utilities

Damage to utilities (e.g. buried natural gas pipes, water conveyance structures, and telecommunication cables), can be a safety hazard during construction and cause disruption to commercial services during construction. All applicable rights of way will be identified prior to construction to minimize accidental damage to utilities. Therefore, damages to utilities are expected to be unlikely. Generally, potential damage to utilities has low consequences to the environment, but may be harmful to human health or safety and public services.

The Contractor will be responsible to complete a utility locate using a certified utility locate sub-Contractor prior to site preparation activities. The Contractor shall develop a Health and Safety Plan that shall contain contingency and mitigation measures to minimize damage to utilities.

9.3 Sediment and Erosion Control Failure

Sediment and erosion mitigation measures will be implemented to prevent sediment discharge to water bodies during construction activities. The procedures outlined in the EPP and Sediment and Erosion Control Plan will be in place before the site preparation and construction activities start to minimize sediment transport to nearby water bodies. The sediment control measures for the Project will be inspected by an appropriately qualified environmental monitor and maintained by the Contractor to verify they are installed and functioning correctly. The Contractor will also be responsible for meeting federal and provincial water quality guidelines for TSS and turbidity in areas downstream of Project activities.

With the implementation of the Water Management Plan and Sediment and Erosion Control Plan, the likelihood of failures in the mitigation measures is considered to be low. Should a failure in erosion and sediment control measure occur, it will likely be of short-duration and reversible. The Contractor shall maintain enough adequate additional sediment and erosion control material (e.g. filter fabric, silt fencing, hay bales, etc.) on site to deal with an emergency.

10.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Environmental conditions potentially affecting the Project adversely during construction are described briefly and assessed for risk in the following subsection. Such effects may include erosion and flooding hazards and implication of climate change (including extreme weather events). SLR outlines proposed mitigation measures below that may be incorporated into the Project design to reduce environmental effects on the Project and assesses the extent that potential effects can be either eliminated or minimized to acceptable levels.

10.1 Erosion and Flooding Hazards

Erosion and flooding protection are not anticipated to cause a large impact on the Project.

There is a low flooding risk downstream of Reach 2 where a detention pond has been constructed to control stormwater flows from impermeable surfaces located on Airport Lands. At the downstream end of the detention pond, an outlet structure has been constructed that

provides a controlled rate of water discharge aimed at reducing peak flows in downstream areas in an effort to mitigate flooding and soil erosion.

A low erosion risk is associated within the Airport Lands catchment area because they are routinely maintained to limit flooding and ponding to control for waterfowl. Removal of riparian vegetation will be necessary along remedial access locations to Reay Creek and Reay Creek Pond. Implementation of sediment and erosion controls, and re-vegetation activities will contribute to long-term bank stability and help minimize erosion (see Section 3.2.4).

10.2 Climate Change

Over the last six decades, Canada has become warmer, with average temperatures over land increasing by 1.5°C between 1950 and 2010 (Werner & Lemmen, 2014). A general increase in temperature has the potential to affect the Project area through an increase in extreme weather events, particularly increases in average annual precipitation.

10.2.1 Extreme Weather Events

Many researchers point to an increase in severe weather events as a likely outcome of global climate change. In Canada, the frequency of warm days (when the daily maximum temperature is above the daily 90th percentile) during the summer has increased nationally since 1950, while the frequency of cold nights (when the daily minimum temperature is below the daily 10th percentile) during the winter has decreased nationally since 1950 (Werner & Lemmen, 2014).

An increase in extreme weather events is expected to generate a greater frequency of large storms as well as an overall increase in the magnitude of storm intensity (Werner & Lemmen, 2014). Climate change is also predicted to influence the rainfall distribution pattern. These changes would likely be associated with less precipitation falling as snow; more frequent, high intensity precipitation events (especially in December and January); and more drought conditions (Werner & Lemmen, 2014). Large rain events are predicted to occur less frequently in summer months.

10.2.2 Greenhouse Gas Emissions and Air Contaminants

The emissions of greenhouse gases such as carbon dioxide, methane, nitrous oxide and chlorofluorocarbons have increased along with rapid industrialization, resulting in an increase in the average surface temperature of the Earth over time. Strategies for the reduction in greenhouse gas releases will be employed to the extent practicable during the execution of the remediation project. Idle reduction policies will be followed and machinery that is in proper working condition will be used to limit emissions. Sediments provide long-term sinks for carbon and provide a global carbon sink of about 10 million tonnes each year (Lim *et al.*, 2010). The removal of contaminated sediments from Reay Creek may remove the current carbon sink from the Reay Creek system; however, the deeper channel and pond will provide future opportunities to accumulate sediments and further the benefit of having a carbon sink within the pond and creek substrates.

Terrestrial vegetation improves air quality by removing carbon dioxide and releasing oxygen. The temporary removal of riparian vegetation at remedial access locations will reduce air quality in the immediate area for a short time. Terrestrial habitat restoration activities and replanting of native plant species will improve long-term air quality. Furthermore, replanting trees at a 2:1 ratio will provide net benefits to improving air quality and reducing air contaminants.

11.0 FOLLOW-UP PROGRAM

A DFO Request for Review shall be submitted for approval during the Project planning and preparation phase. Based on the mitigation measures outlined within this EMS and the significance assessment of residual effects, SLR has concluded that a *Fisheries Act* authorization is likely not required given that serious harm to fish can be avoided by following the mitigation measures as outlined in this EMS.

Follow-up monitoring is not required under the *Fisheries Act* but may be recommended by DFO or provided as conditions of approval or authorization. However, environmental monitoring of the implementation of mitigation measures identified in this EMS and the Contractor's compliance with all Terms and Conditions of contracts, permits and approvals issued for the Reay Creek Remediation Project will be conducted by PSPC's independent QEP.

A confirmatory sampling program will also be implemented to confirm and verify results of the sediment remediation program prior to reinstating creek and Pond areas. Furthermore, installed riparian vegetation will also be monitored for survival and establishment for the warranty period of one year post-planting.

In addition, it is anticipated that for up to two years following remediation, a qualified professional will conduct qualitative monitoring of the riparian plantings, fish habitat enhancement efforts and water flow rate and create a follow-up post-remediation report describing the findings and recommendations of the monitoring effort. It is anticipated that regular water quality and flow monitoring will continue to be conducted by VAA which will likely satisfy any water volume and quality monitoring requirements.

12.0 CONCLUSIONS AND RECOMMENDATIONS

Reay Creek is a sinuous linear channel that originates at the VIA in North Saanich, BC. It runs through the Town of Sidney and terminates in Bazan Bay in North Saanich, BC. Reaches 1 to 4 are confined on all sides by VIA property. Reay Creek flows in a southeast direction below Canora Road through a culvert toward Reay Creek Pond on the Town of Sidney lands. Reay Creek Pond (Reach 5) is bounded by approximately seven residential dwellings located along the southwest and north bank edges. A grassed park boulevard and vegetated riparian fringe is maintained to the north and east bounds of Reay Creek Pond that is further bound by Wesbrook Drive. A dam, owned and operated by the Town of Sidney, is located at the downstream end of Reay Creek Pond.

The proposed Project is located on Airport Lands and Town of Sidney lands and consists of removal and off-site disposal of contaminated sediment that exceed the CSR SedFS Standards from Reaches 1A to 1C and Reaches 3 to 4 in the summer of 2019. Remediation of Reach 5 is planned to occur during subsequent years. Remediation of contaminated sediments for all aspects of the Project will be in accordance with the construction design drawings (Appendix A).

Surface water quality within Reay Creek (i.e., on Airport Lands) and Reay Creek Pond is generally considered poor (in terms of supporting aquatic life) based on low oxygen levels, high summer temperatures, and fluctuating pH levels. The temperature in the middle of Reay Creek Pond exceeded all optimum temperatures for incubation, rearing, migration and spawning life stages for coho and cutthroat trout. Dissolved oxygen levels were suitable to sustain aquatic wildlife, but were too low to accommodate spawning activities and healthy populations of food sources for salmonids. Large fluctuations in pH were identified throughout Reay Creek. These factors combined suggest that Reay Creek Pond is not suitable to support or sustain population of coho salmon and cutthroat trout.

The sediments encountered within Reay Creek are composed of mainly gray clay and sand with organics and some brown/orange mottling. Historic sediment quality data shows that the sediments within the Project area are contaminated with the following primary contaminants of concern: arsenic, cadmium, chromium (total), copper, lead, mercury and zinc. Removal of the contaminated sediments will provide a net benefit to the Project areas of Reay Creek, as well as downstream of the remedial extents.

Most of the riparian vegetation surrounding the upper reaches of Reay Creek within Airport Lands consists of woody shrub species and some shorter trees such as willows, alders and black cottonwoods. Select areas contain considerable concentrations of invasive species such as Himalayan blackberry. Adjacent to Reaches 3 and 4, the riparian habitat is comprised of mainly taller alders and Douglas fir trees. Surrounding Reach 5, the riparian habitat is made up of a number of woody shrub species lining the banks as well as large deciduous trees such as big leaf maple, red alder, black cottonwood, western redcedar and ornamental weeping willow. A large proportion of invasive species including Himalayan blackberry and/or English ivy as well as other native woody shrub species and herbs are present along the banks of Reach 5. The Provincially Blue-listed ecological community, black cottonwood - red alder / salmonberry, exists within the floodplain of Reay Creek, along Reaches 5 and further downstream; the listed ecological community is not designated under the SARA.

The riparian vegetation in the Project area offer spring/summer forage and nesting habitat for birds, and breeding and feeding habitat for small mammals. Potential effects on birds and wildlife include habitat alteration (e.g. loss, fragmentation and change in quality), sensory disturbance and mortality. Mitigation measures have been identified to reduce harm to nesting birds during the Project timeframe. Many of the terrestrial animal SAR that were identified as potentially occurring within the Project area are transient and are not likely to occur within the land or waters in and around Reay Creek during remedial works.

The aquatic habitat potential of the upper Reaches of Reay Creek (Reaches 1 to 4) have been described as functioning properly, although not at their potential condition due to channel modification (i.e., ditching), removal of taller trees, and the prevalence of invasive species. Reach 5 is of marginal aquatic habitat due to high temperatures and low DO levels that occur in the summer months. Cutthroat trout and coho salmon have been known to spawn and occur within Reay Creek; both of these species are provincially listed (blue and yellow, respectively) but are not designated under SARA and are not federally protected. Aquatic habitat, including fish, reptiles and amphibians, and benthic communities represent the ecosystem components that will be affected the most by the Project.

Potential effects on aquatic habitat include the temporary loss of wetted area resulting from channel isolation and sediment remediation, changes in the physical structure and habitat of Reay Creek Pond (i.e., greater wetted depths, decreased water temperatures), removal of instream aquatic vegetation, and removal of riparian vegetation at remedial access locations. Mitigation measures will offset these effects and the remedial program will ultimately lead to a long-term net benefit in aquatic habitat and ecosystem function of the remedial areas and entire Reay Creek system.

Measures including fish salvage operations and construction timing windows to avoid disturbing fish and wildlife during sensitive periods can mitigate most direct effects of construction activities on fish and wildlife. Other measures including sediment and erosion control, and storm water best management practices can protect fish and wildlife habitat if installed and maintained adequately. These and other mitigation measures have been described above and will be implemented as the Project proceeds.

Potential effects on social components, including heritage resources, recreation services, and people and public health have been deemed to be not significant given the provided mitigation measures are followed.

Potential cumulative effects associated with this Project in conjunction with past and future potential projects were assessed. The cumulative effects of past sediment and surface water enhancement programs, future potential habitat enhancement programs and the current sediment remediation and habitat enhancement program will provide a net benefit to the surrounding environment and VECs.

Based on the information presented in this EMS report, the proposed Reay Creek Remediation Project is not expected to cause significant residual adverse environmental effects. This expectation is based on the implementation of mitigation measures developed for this Project, and application and approval of associated permits and authorizations. Long-term benefits to aquatic habitat, fish and wildlife resources, and public enjoyment of Reay Creek Pond are anticipated to result from the Project.

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14.0STATEMENT OF LIMITATIONS

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HO/MC/DM/cn

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PHOTOGRAPHS

Environmental Mitigation Strategy – Reay Creek
Reay Creek Remediation Project, Sidney BC
SLR Project No.: 205.03892.00003

Photo 1: Flow controller at upstream end of Reach 1A, looking south.

Photo 2: Instream vegetation consisting primarily of reed canarygrass in Reach 1A, looking west.

Photo 3: Typical riparian vegetation present along north bank of Reach 1A, looking east.

Photo 4: Large patch of Himalayan blackberry along north bank of Reach 1A, looking west.

Photo 5: Headwaters of Reay Creek daylight from culvert at upstream end of Reach 1B, looking west.

Photo 6: Instream aquatic vegetation (duckweed, sedges and rushes) in low flow areas of Reach 1B, looking east.

Photo 7: Typical riparian vegetation present along south bank of Reach 1B, looking east.

Photo 8: Typical riparian vegetation present along north and south banks of Reach 1C to the east of the access road, looking west.

Photo 9: Typical riparian vegetation present along north bank of Reach 2, looking east.

Photo 10: Typical riparian vegetation present along north and south banks of Reach 3, looking west.

Photo 11: Typical riparian vegetation present along north and south banks of Reach 4, looking west.

Photo 12: Reay Creek Pond Dam, looking west.

Photo 13: Spillway to the southwest of Reay Creek Pond Dam, looking west.

Photo 14: Instream aquatic vegetation in Reay Creek Pond during summer months, looking north.

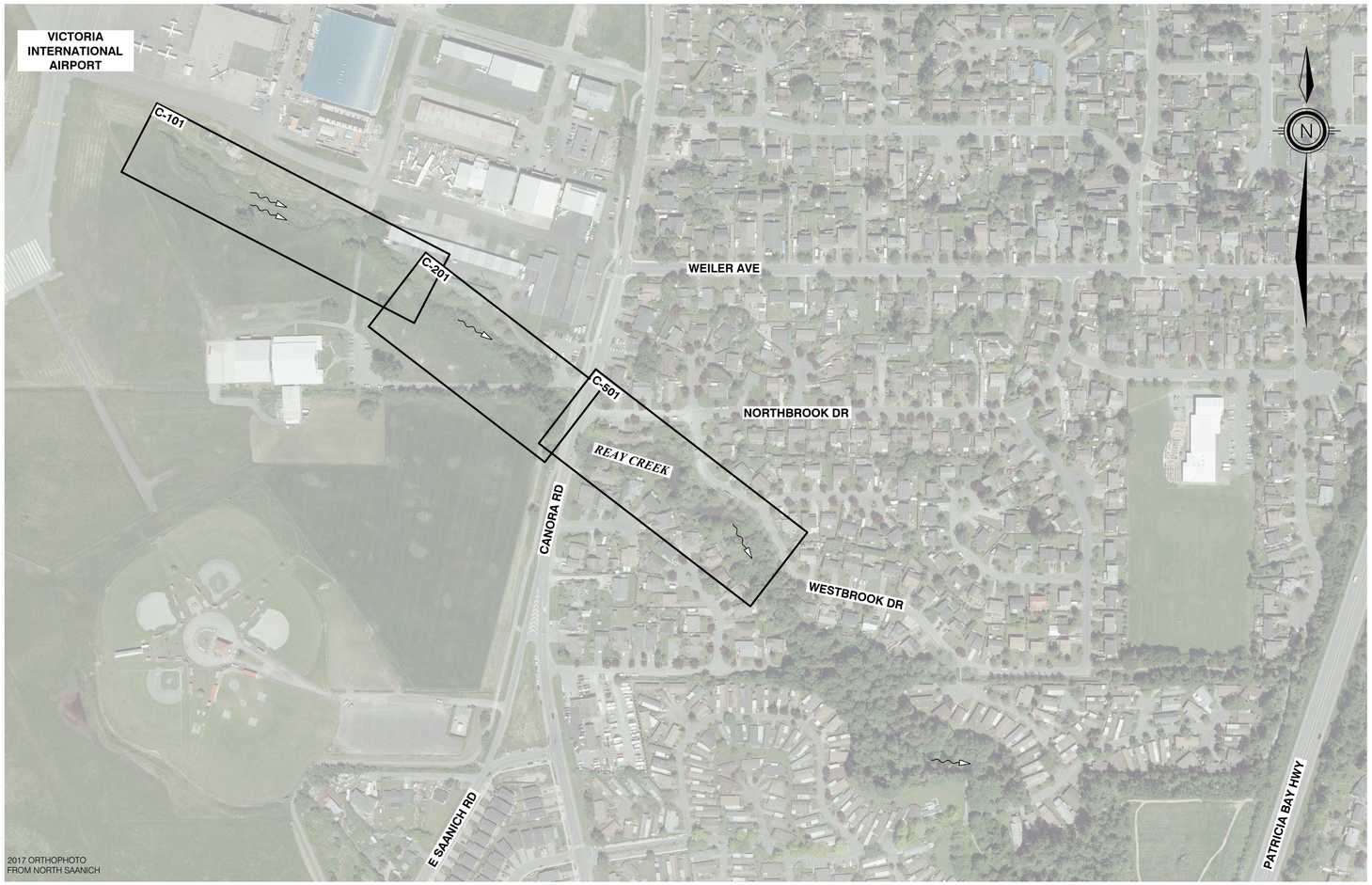
Photo 15: Typical riparian vegetation present along north bank of Reay Creek Pond, looking east.

Photo 16: Patches of invasive species (Himalayan blackberry, English ivy) present along banks of Reay Creek Pond, looking south.

Photo 17: Reay Creek Park lined with ornamental trees and grassed areas adjacent to Westbrook Drive, looking north.

APPENDIX A
Construction Design Drawings

Environmental Mitigation Strategy – Reay Creek
Reay Creek Remediation Project, Sidney BC
SLR Project No.: 205.03892.00003



SITE PLAN
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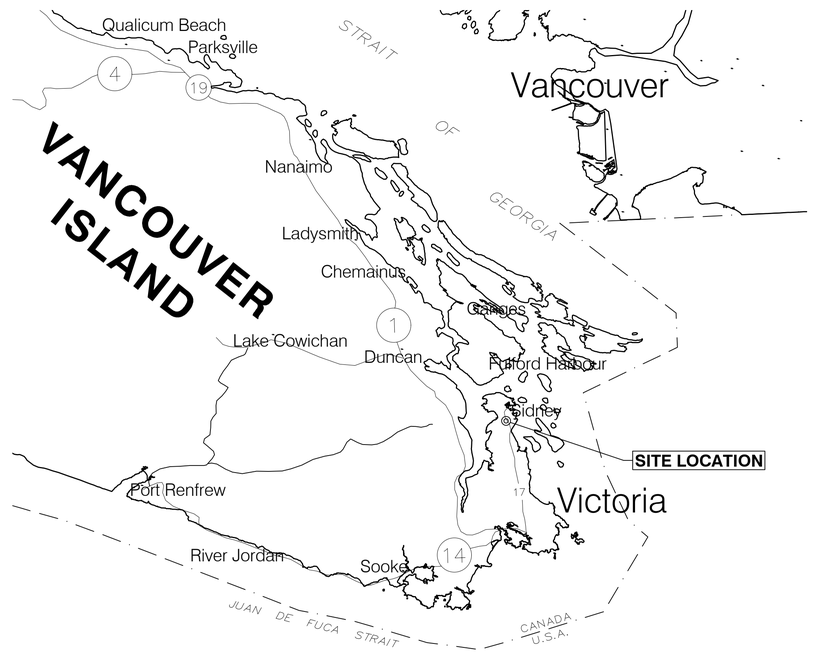

KEY PLAN
N.T.S.

TRANSPORT CANADA
2019 REAY CREEK REMEDIATION

DRAWING LIST	
Sheet Number	**Sheet Title**
G-001	SITE PLAN, KEY PLAN, & DRAWING LIST
G-002	TOWN OF SIDNEY / POND AREA - CONSTRUCTION SITE BOUNDARY
G-003	VICTORIA AIRPORT AUTHORITY LANDS - CONSTRUCTION SITE BOUNDARY & ACCESS AREAS
C-100	REACH 1A, 1B, & 1C - EXISTING CONDITIONS
C-101	REACH 1A, 1B, & 1C - EXCAVATION PLAN & SECTIONS
C-200	REACH 2, 3, & 4 - EXISTING CONDITIONS
C-201	REACH 2, 3, & 4 - EXCAVATION PLAN & SECTIONS
C-500	REACH 5 - EXISTING CONDITIONS
C-501	REACH 5 - EXCAVATION PLAN, PROFILE, & TYP. SECTIONS
C-502	REACH 5 - SECTIONS

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Issued for Review
2019-03-29

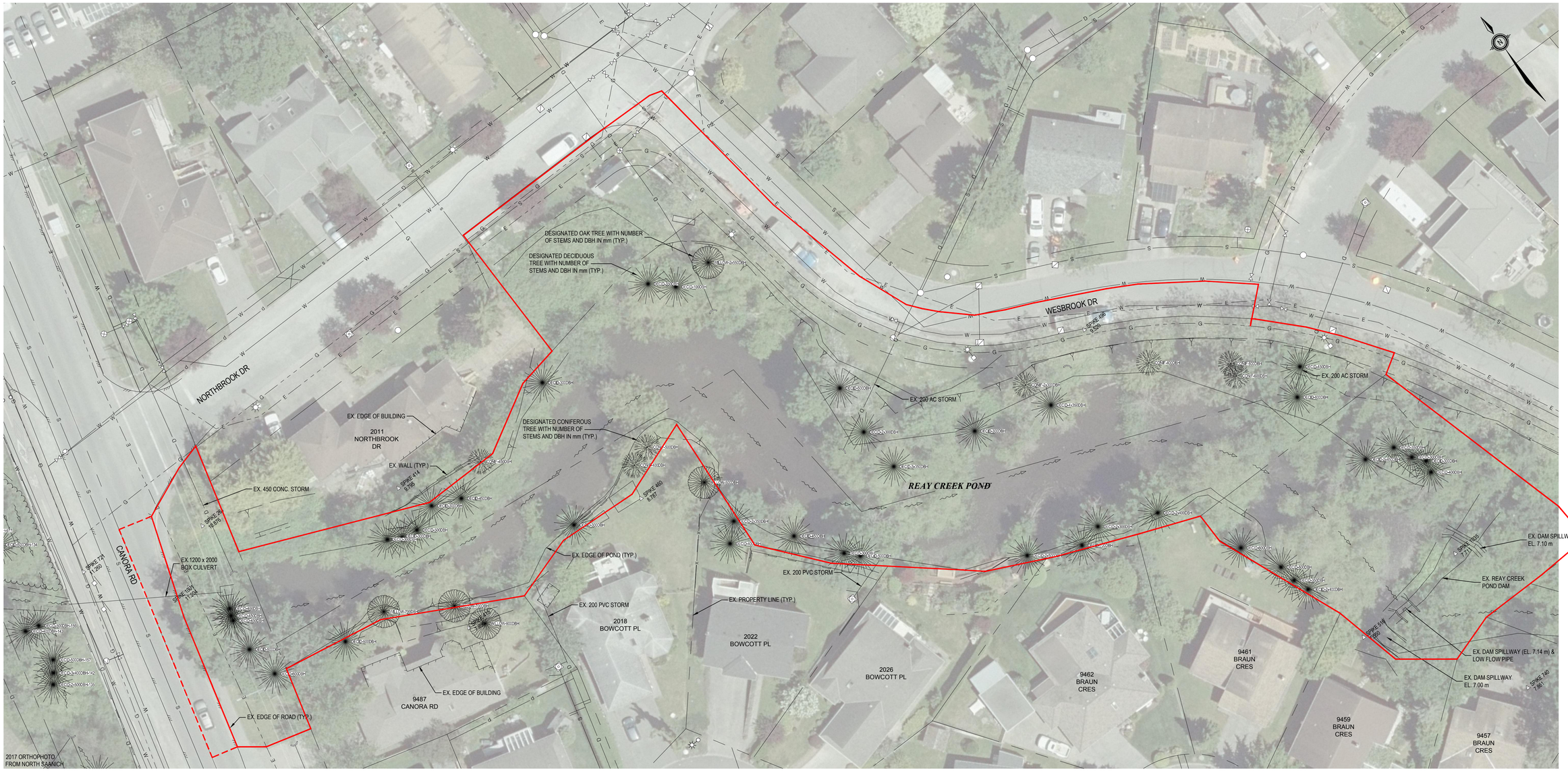
Seal:

Rev	Date	Des	Dwn	Chk	Description of Revision
A	2018-03-02	DNM	PAC	DNM	30% CONCEPT DESIGN
B	2019-03-12	CS	PAC	DNM	ISSUED FOR 70% DESIGN
C	2019-03-29	CS	PAC	DNM	ISSUED FOR 90% DESIGN

Rev	Date	Des	Dwn	Chk	Description of Revision

TRANSPORT CANADA
REAY CREEK REMEDIATION
REAY CREEK
SITE PLAN, KEY PLAN,& DRAWING LIST

Project No.	Drawing No.	Rev.
2396-009	G-001	C
Group: GENERAL		



NOTE: WORKSITE IS BOUNDED BY PRIVATE PROPERTY BOUNDARIES AROUND THE POND UNLESS OTHERWISE NOTED ON THE PLAN.

CONSTRUCTION ACCESS AREA - CONTRACTOR MAY USE DEFINED AREA FOR ACCESS/EGRESS TO THE CONSTRUCTION SITE. HOWEVER, AT ALL OTHER TIMES THE AREA MUST BE KEPT CLEAR OF ALL EQUIPMENT AND MATERIALS TO MAINTAIN ACCESS FOR PUBLIC. TRAFFIC MANAGEMENT WILL BE REQUIRED DURING PERIODS WHEN CONSTRUCTION ACCESS AREAS ARE BEING OCCUPIED BY CONTRACTOR AS OUTLINED IN TRAFFIC MANAGEMENT PLAN TO BE PREPARED BY THE CONTRACTOR.

CONSTRUCTION SITE - THE AREA CONTAINED WITHIN THE SOLID LINES ON THE PLAN DEFINED AS THE CONSTRUCTION SITE FOR THE PURPOSE OF CONTRACT.

PLAN
Scale 1:300

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Issued for
Review
2019-03-29

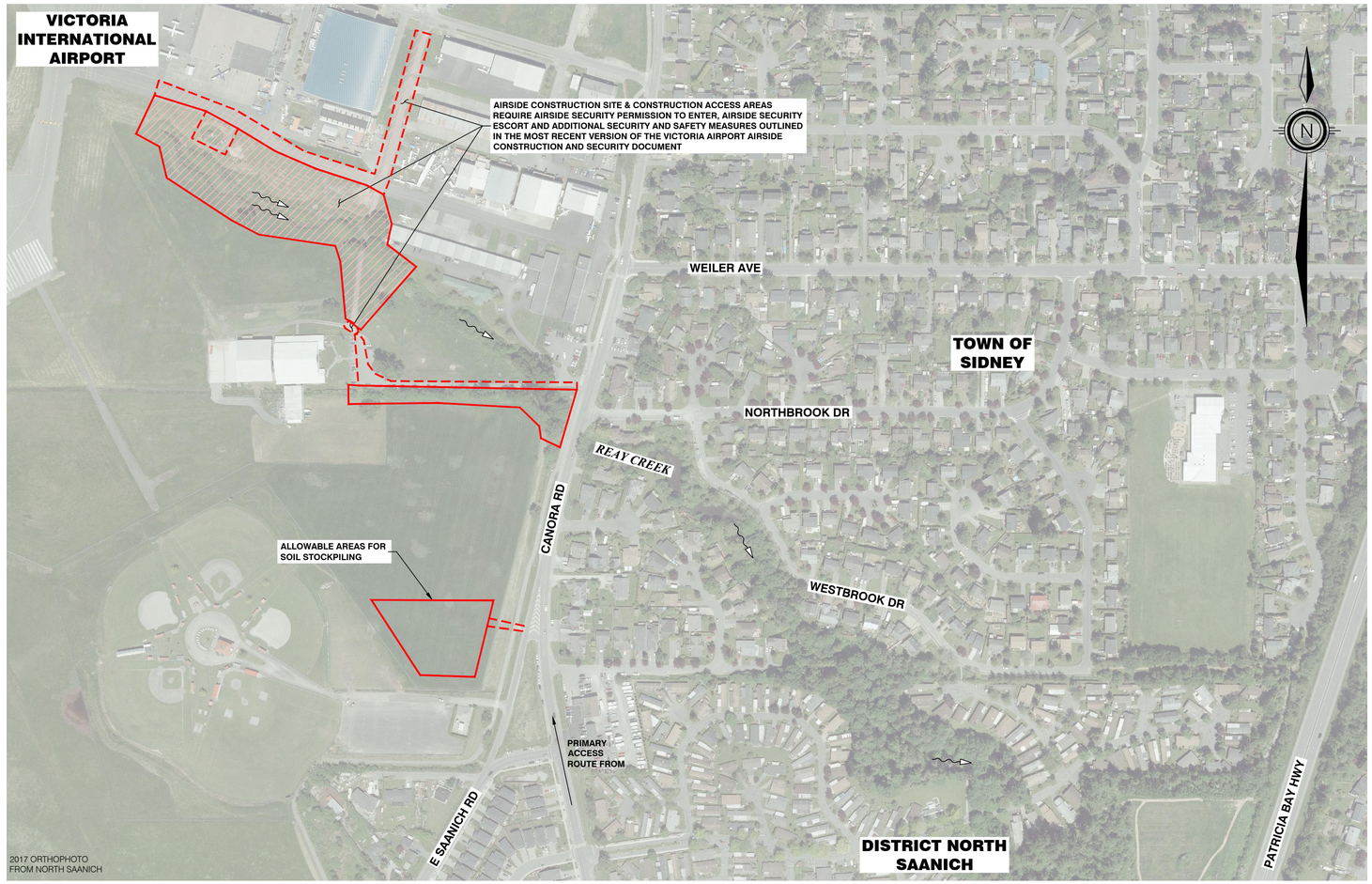
Seal:

Rev	Date	Des	Dwn	Chk	Description of Revision
A	2019-03-29	CS	JKK	DNM	ISSUED FOR 90% DESIGN

Rev	Date	Des	Dwn	Chk	Description of Revision

TRANSPORT CANADA
REAY CREEK REMEDIATION
REAY CREEK
TOWN OF SIDNEY / POND AREA
CONSTRUCTION SITE BOUNDARY

Project No. 2396-009
Group CIVIL
Drawing No. G-002
Rev. A



ACCESS PLAN

Scale 1:2,500

CONSTRUCTION ACCESS AREA - CONTRACTOR MAY USE DEFINED AREA FOR ACCESS/EGRESS TO THE CONSTRUCTION SITE. HOWEVER, AT ALL OTHER TIMES THE AREA MUST BE KEPT CLEAR OF ALL EQUIPMENT AND MATERIALS TO MAINTAIN ACCESS FOR PUBLIC. TRAFFIC MANAGEMENT WILL BE REQUIRED DURING PERIODS WHEN CONSTRUCTION ACCESS AREAS ARE BEING OCCUPIED BY CONTRACTOR AS OUTLINED IN TRAFFIC MANAGEMENT PLAN TO BE PREPARED BY THE CONTRACTOR.

CONSTRUCTION SITE - THE AREA CONTAINED WITHIN THE SOLID LINES ON THE PLAN DEFINED AS THE CONSTRUCTION SITE FOR THE PURPOSE OF CONTRACT.

KERR WOOD LEIDAL
consulting engineers

Issued for
Review
2019-03-29

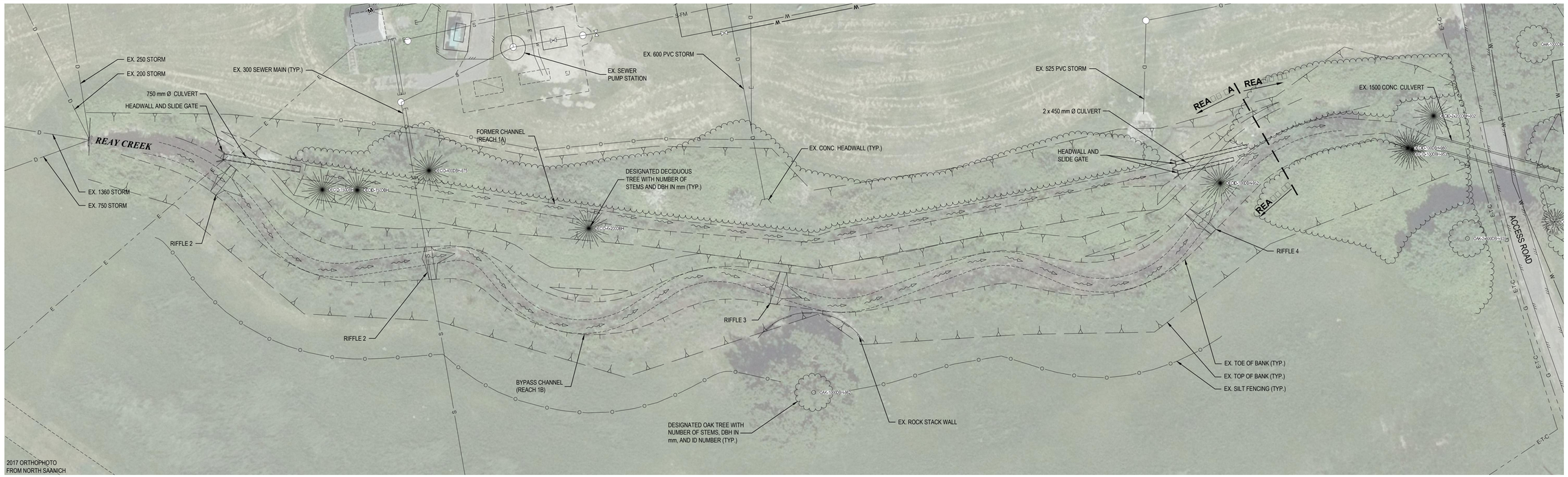
Seal:

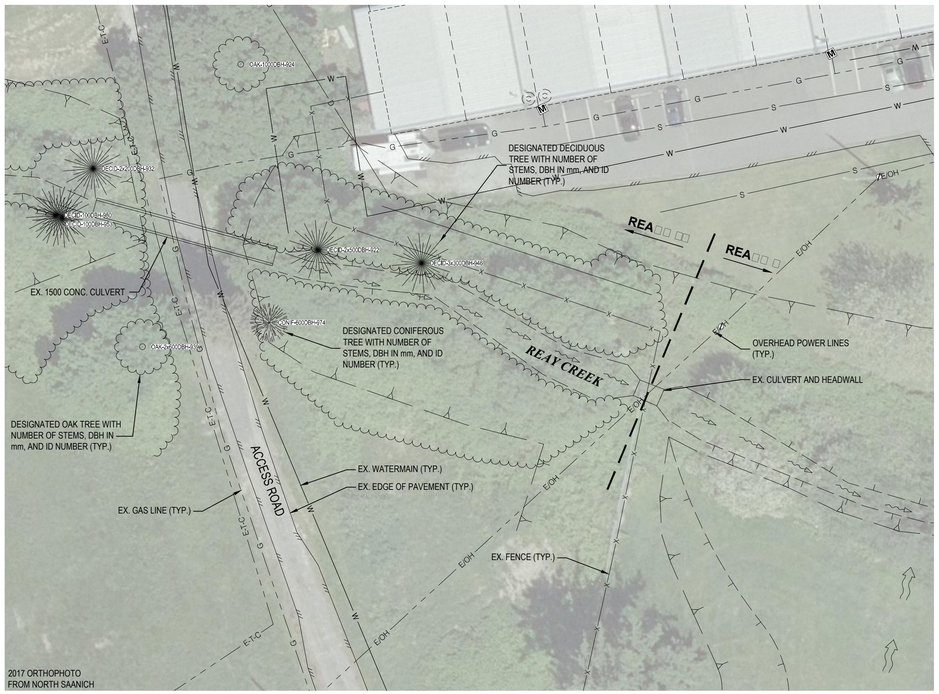
Rev	Date	Des	Dwn	Chk	Description of Revision
A	2019-03-29	CS	JKK	DNM	ISSUED FOR 90% DESIGN

TRANSPORT CANADA
REAY CREEK REMEDIATION

VICTORIA AIRPORT AUTHORITY LANDS
CONSTRUCTION SITE BOUNDARY & ACCESS AREAS

Project No. 2396-009 | Drawing No. G-003 | Rev. A
Group GENERAL





KERR WOOD LEIDAL
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Issued for
Review
2019-03-29

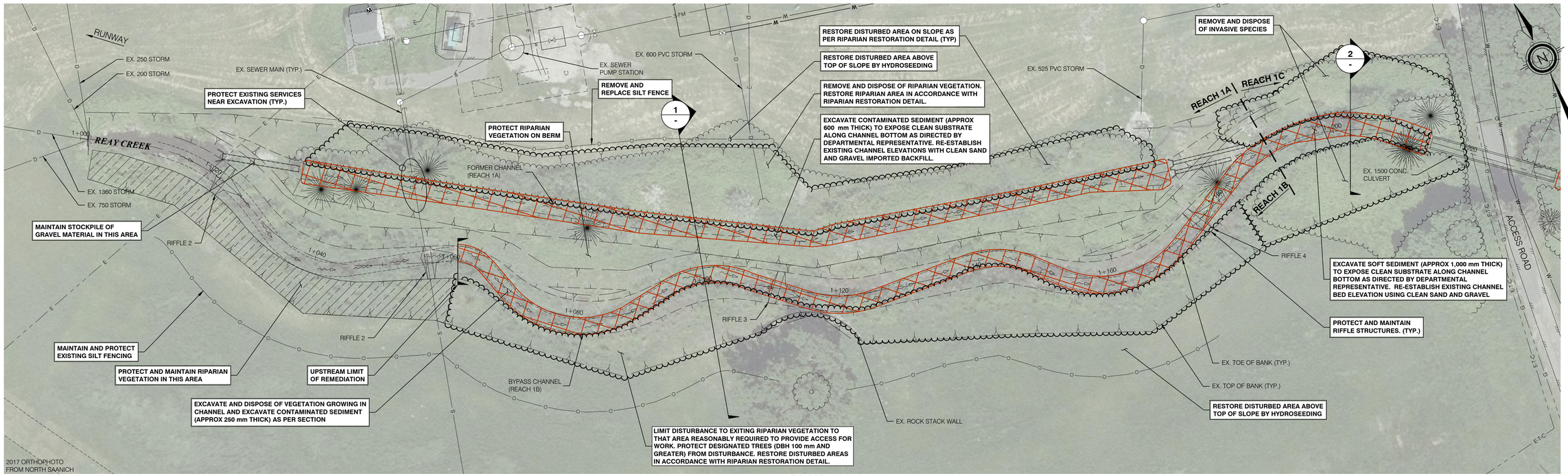
Seal:

Re□	D□te	Des	D□n	□□□	Descri□tion o□ Re□ision	Re□	D□te	Des	D□n	□□□	Descri□tion o□ Re□ision
A	2019-03-12	CS	PAC	DNM	ISSUED FOR 70% DESIGN						
B	2019-03-29	CS	PAC	DNM	ISSUED FOR 90% DESIGN						

TRANSPORT CANADA
REAY CREEK REMEDIATION

REAY CREEK
REAC□ □A□□B□□ □C
E□SITING CONDITIONS □ SER□ICES

Project No. □□□□□□□□
Group □□IL
Drawing No. **C-□00**
Rev. **B**

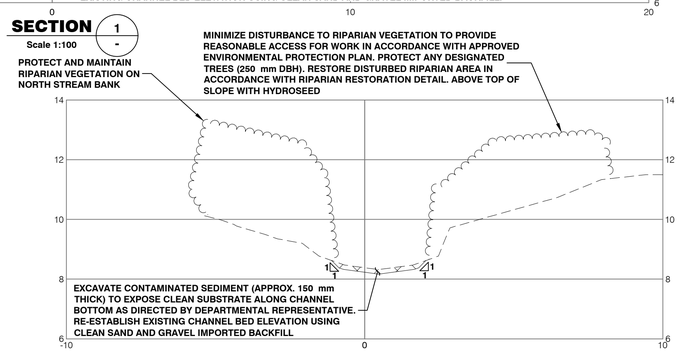


PLAN

Scale 1:300

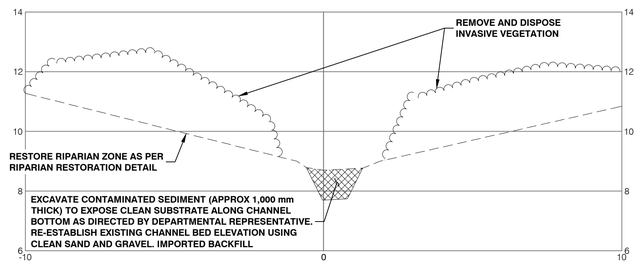
SECTION 1

Scale 1:100



SECTION 2

Scale 1:100



SECTION 3

Scale 1:100

NOTE: SECTIONS LOOKING DOWNSTREAM

0 2.5 (1:300) 15m

0 1 (1:100) 5m

KERR WOOD LEIDAL
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Issued for
Review
2019-03-29

Seal:

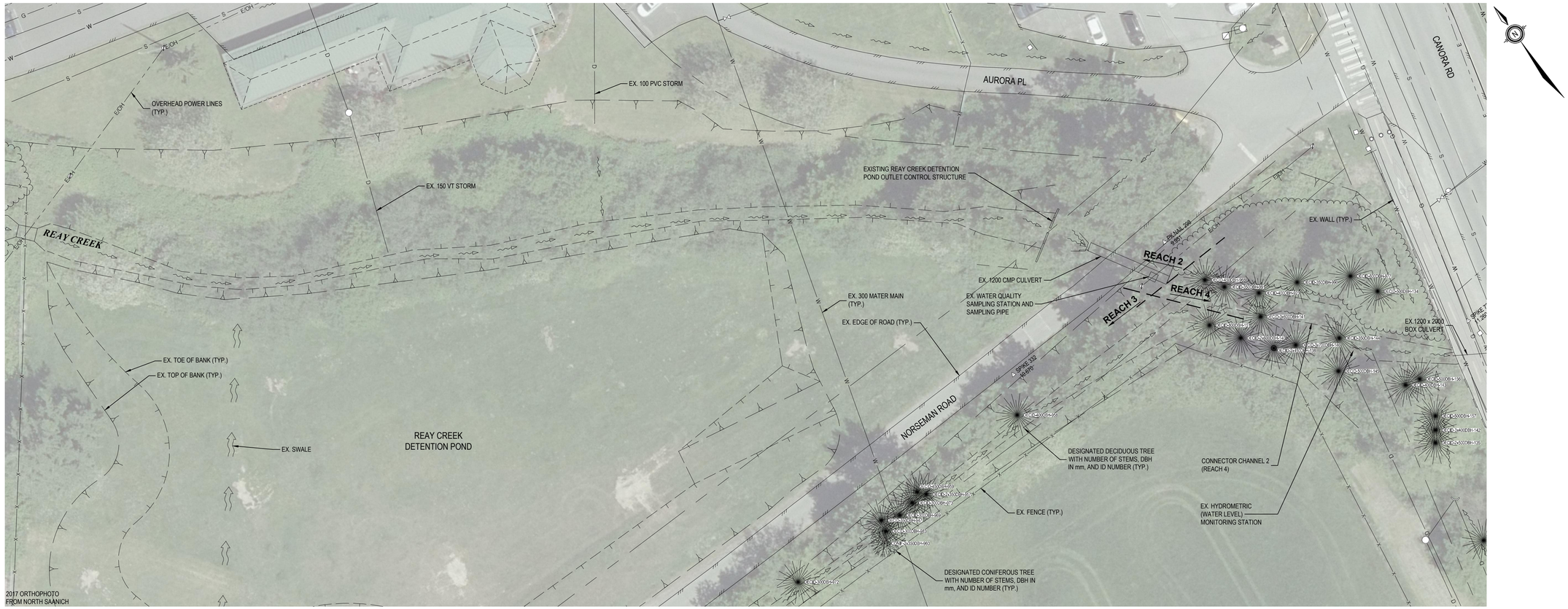
Rev	Date	Des	Dwn	Chk	Description of Revision
A	2018-03-02	DNM	PAC	DNM	30% CONCEPT DESIGN
B	2019-03-12	CS	PAC	DNM	ISSUED FOR 70% DESIGN
C	2019-03-29	CS	PAC	DNM	ISSUED FOR 90% DESIGN

TRANSPORT CANADA
REAY CREEK REMEDIATION

REAY CREEK
REACH 1A, 1B, & 1C
EXCAVATION PLAN & SECTIONS

Project No. 2396-009
Drawing No. C-101
Rev. C
Group CIVIL

SAVED 2019/03/29, 10:04 AM
Paper Size = ANSI D
At Full Size, this border measures 320 mm x 800 mm
Q:\2300-2399\2396-009\501-Drawings\a_Production_Dwgs\C-101_PlanPro.dwg



PLAN
Scale 1:300

KERR WOOD LEIDAL
consulting engineers

Issued for
Review
2019-03-29

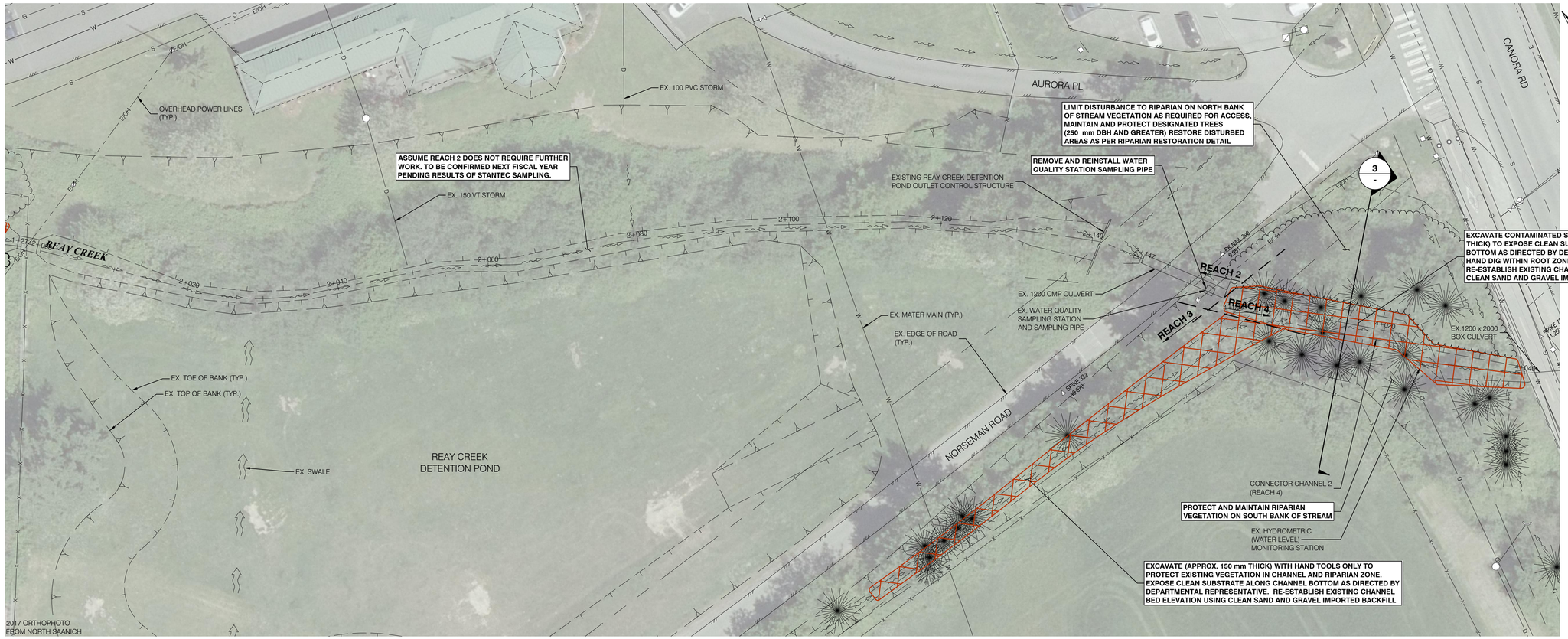
Seal:

Rev	Date	Des	Dwn	Chk	Description of Revision
A	2019-03-12	CS	PAC	DNM	ISSUED FOR 70% DESIGN
B	2019-03-29	CS	PAC	DNM	ISSUED FOR 90% DESIGN

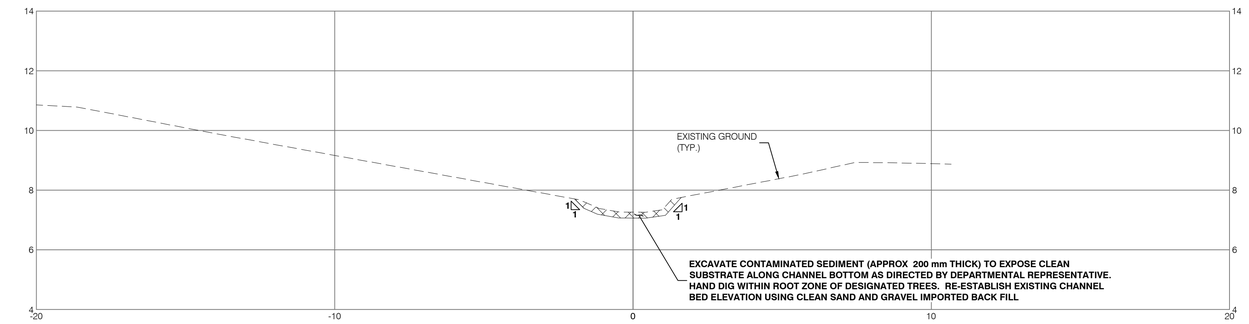
Rev	Date	Des	Dwn	Chk	Description of Revision

TRANSPORT CANADA
REAY CREEK REMEDIATION
REAY CREEK
REACH 2, 3, & 4
EXISTING CONDITIONS & SERVICES

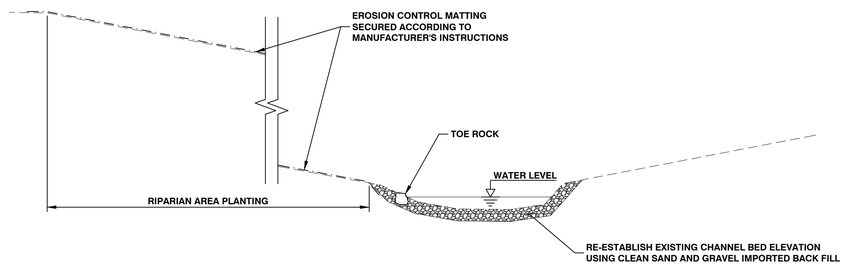
Project No.	Drawing No.	Rev.
2396-009	C-200	B
Group: CIVIL		



PLAN
Scale 1:300



SECTION 3 / -
Scale: 1:100



CHANNEL RIPARIAN RESTORATION DETAIL
Scale: 1:50

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Seal:

Issued for
Review
2019-03-29

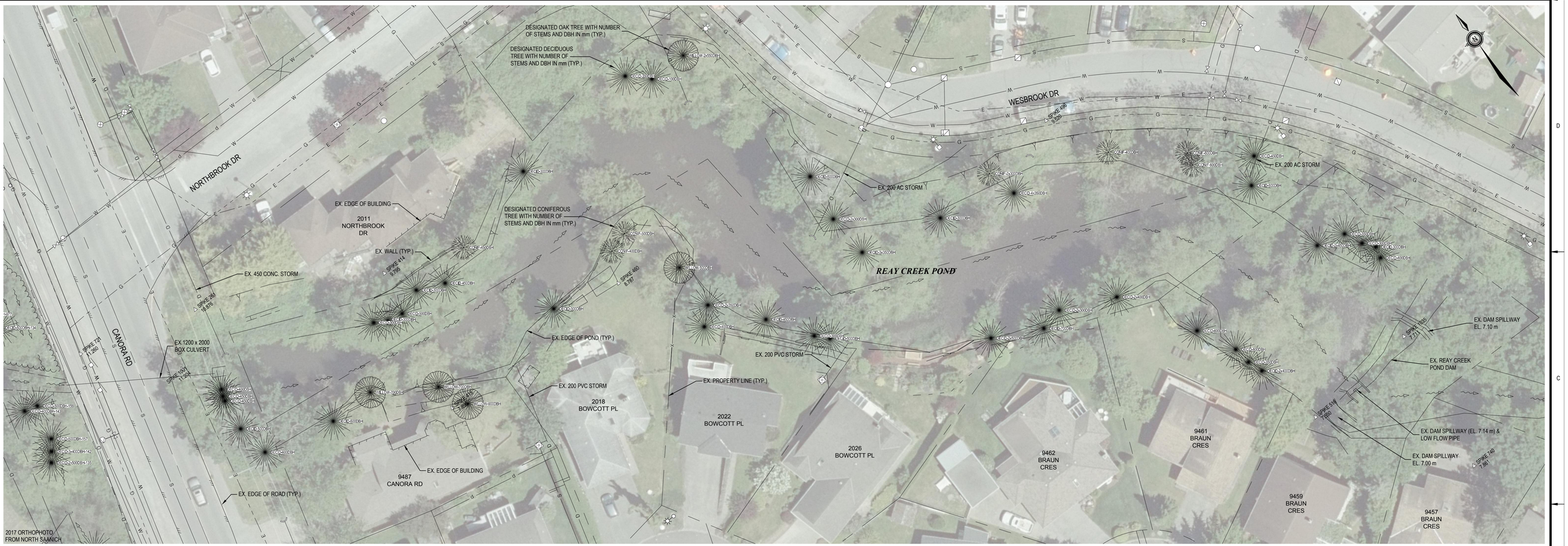
Rev	Date	Des	Dwn	Chk	Description of Revision
A	2018-03-02	CS	PAC	DNM	30% CONCEPT DESIGN
B	2019-03-12	CS	PAC	DNM	ISSUED FOR 70% DESIGN
C	2019-03-29	CS	PAC	DNM	ISSUED FOR 90% DESIGN

Rev	Date	Des	Dwn	Chk	Description of Revision

TRANSPORT CANADA
REAY CREEK REMEDIATION

REAY CREEK REACH 2, 3, & 4 EXCAVATION PLAN & SECTIONS

Project No.	Drawing No.	Rev.
2396-009	C-201	C
Group: CIVIL		



PLAN
Scale 1:300

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consulting engineers

Issued for
Review
2019-03-29

Seal:

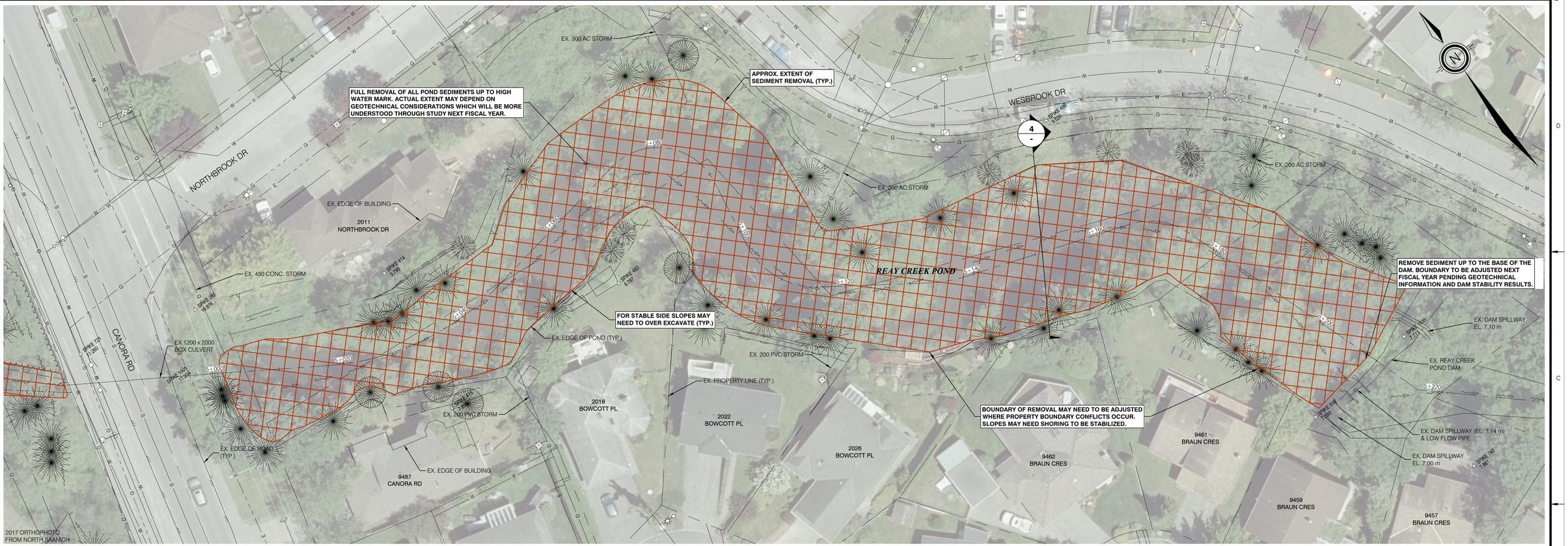
Rev	Date	Des	Dwn	Chk	Description of Revision
A	2019-03-12	CS	PAC	CS	ISSUED FOR 70% DESIGN
B	2019-03-29	CS	PAC	DNM	ISSUED FOR 90% DESIGN

Rev	Date	Des	Dwn	Chk	Description of Revision

TRANSPORT CANADA
REAY CREEK REMEDIATION

REAY CREEK POND
REACH 5
EXISTING CONDITIONS

Project No.	Drawing No.	Rev.
2396-009	C-500	B
Group: CIVIL		



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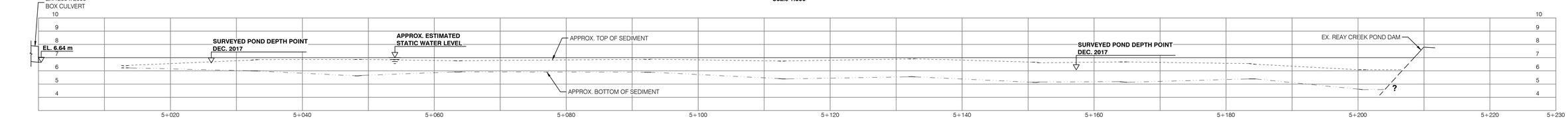
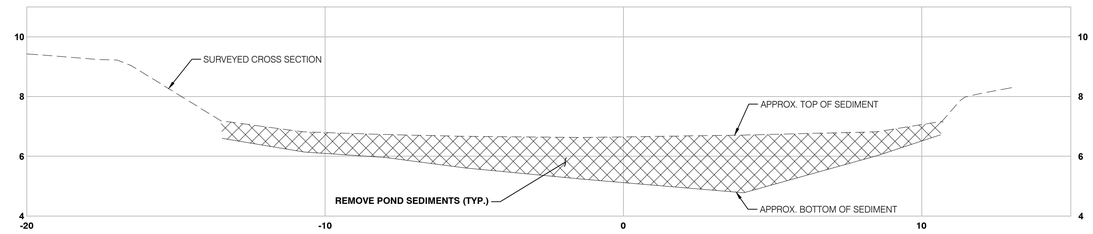
PLAN
Scale 1:300



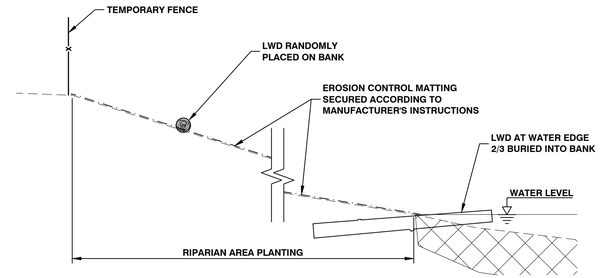
PROFILE
Scale H 1:300, V 1:150



0 1 (1:100) 5m

SECTION 4 -
Scale: 1:100

NOTES:
1. ACTUAL STATIC WATER LEVEL IS UNKNOWN AND SHOULD BE INVESTIGATED IN THE NEXT FISCAL YEAR.
2. DEPTH OF REMOVAL FOR DESIGN CONCEPT IS BASED ON BATHYMETRY AND SEDIMENT DEPTHS PROVIDED BY J.E. ANDERSON (DECEMBER 2018).



POND RIPARIAN RESTORATION DETAIL
Scale: 1:50

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Seal:

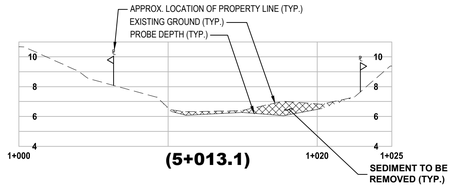
Issued for Review
2019-03-29

Rev	Date	Des	Dwn	Chk	Description of Revision
A	2018-03-02	DNM	PAC	CS	30% CONCEPT DESIGN
B	2019-03-12	CS	PAC	DNM	ISSUED FOR 70% DESIGN
C	2019-03-29	CS	PAC	DNM	ISSUED FOR 90% DESIGN

Rev	Date	Des	Dwn	Chk	Description of Revision

TRANSPORT CANADA
REAY CREEK REMEDIATION
REAY CREEK POND
REACH 5
EXCAVATION PLAN, PROFILE, & TYP. SECTIONS

Project No.	Drawing No.	Rev.
2396-009	C-501	C
Group: CIVIL		



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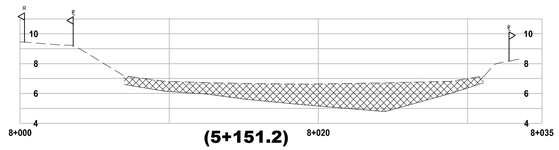

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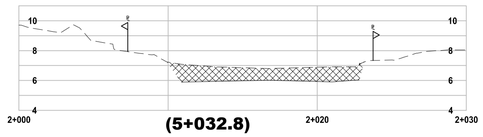

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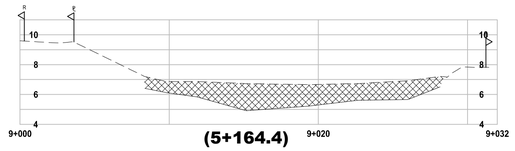

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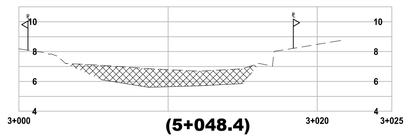

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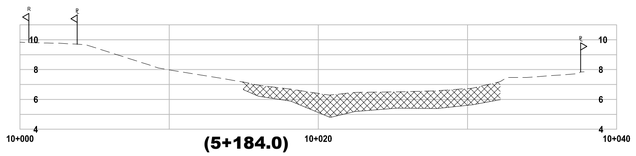

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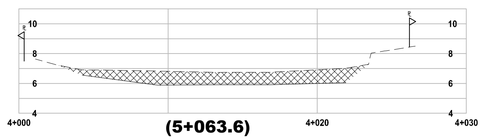
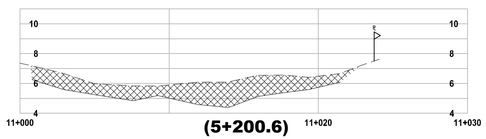


(5+063.6)



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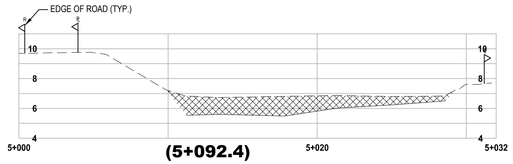

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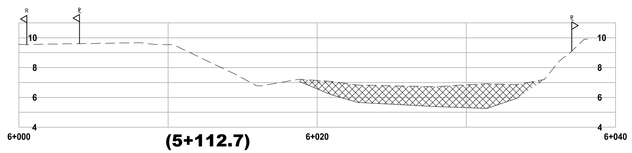

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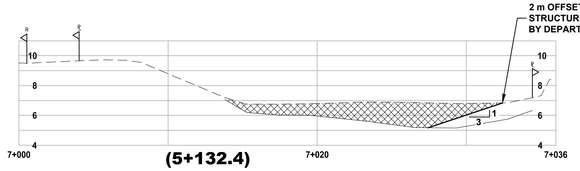

(5+132.4)

0 2 (H 1:200) 8m
0 2 (V 1:200) 8m

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Issued for
Review
2019-03-29

Seal:

Rev	Date	Des	Dwn	Chk	Description of Revision
A	2019-03-12	CS	PAC	CS	ISSUED FOR 70% DESIGN
B	2019-03-29	CS	PAC	DNM	ISSUED FOR 90% DESIGN

Rev	Date	Des	Dwn	Chk	Description of Revision

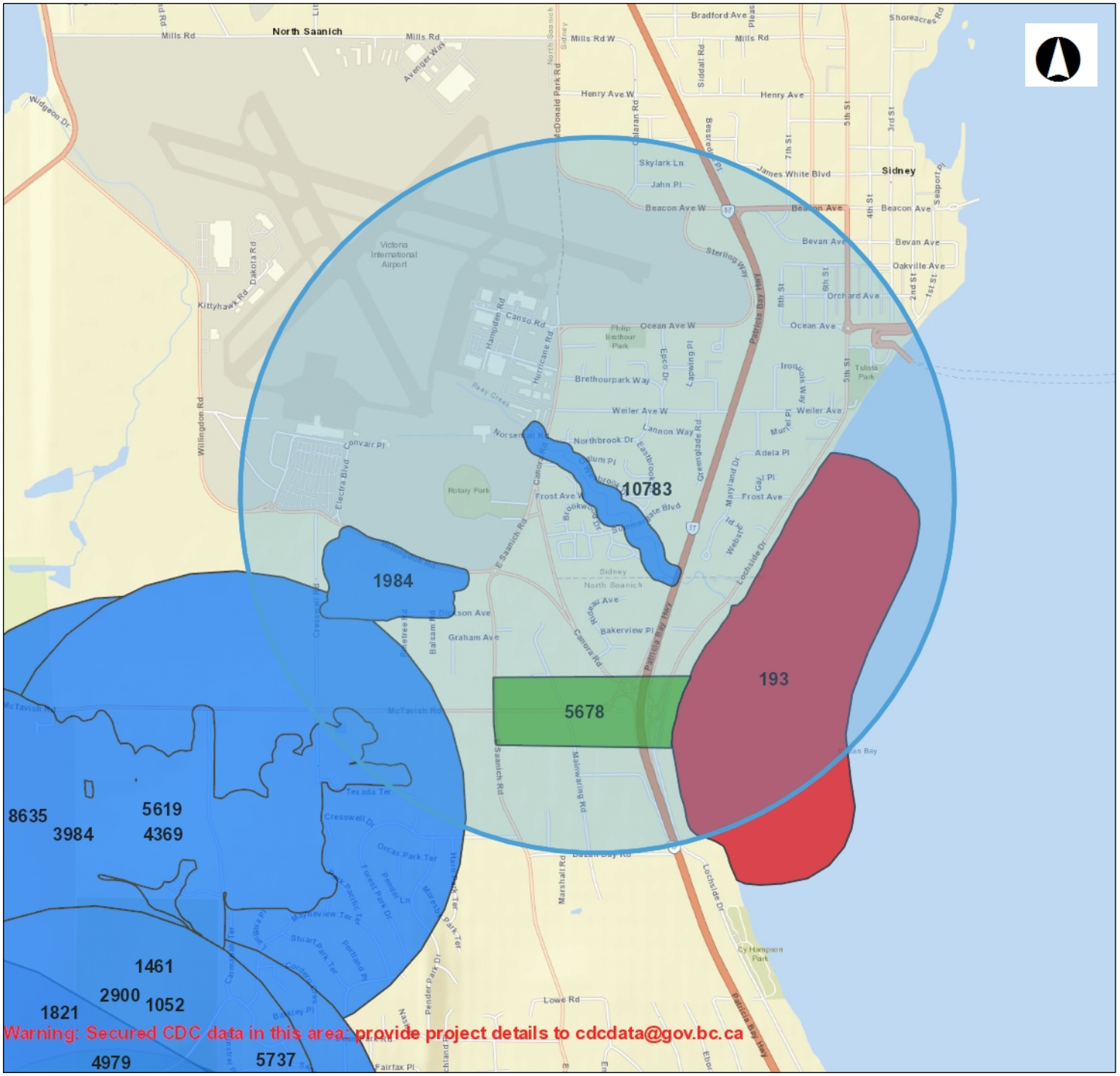
TRANSPORT CANADA
REAY CREEK REMEDIATION

REAY CREEK POND REACH 5 SECTIONS

Project No. 2396-009
Group CIVIL
Drawing No. C-502
Rev. B

APPENDIX B
Search Information and Resources

Environmental Mitigation Strategy – Reay Creek
Reay Creek Remediation Project, Sidney BC
SLR Project No.: 205.03892.00003



BRITISH COLUMBIA

CDC Occurrence Map

Legend

Species and Ecosystems at Available Occurrences - CD

FEATURE_CODE

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

Species and Ecosystems at Secured) Publicly Available

Species and Ecosystems at and Historical) Publicly Avail CDC

FEATURE_CODE

- Animal - Vertebrate

0 0.73 1.47 km

1: 36,112

Copyright/Disclaimer

CAUTION: Maps obtained using this site are not designed to assist in navigation. These maps may be generalized and may not reflect current conditions. Uncharted hazards may exist. DO NOT USE THESE MAPS FOR NAVIGATIONAL PURPOSES.

Datum: NAD83

Projection: WGS_1984_Web_Mercator_Auxiliary_Sphere

Key Map of British Columbia

BC Conservation Data Centre: Ecosystem Occurrence Report
Shape ID: 1588

Scientific Name: *Thuja plicata / Achlys triphylla*

English Name: western redcedar / vanilla-leaf

Identifiers

Occurrence ID: 3984

Shape ID: 1588

Element Group: Ecological Community

Status

Provincial Rank: S1

BC List: Red

Global Rank: G1

Locators

Survey Site: MOUNT NEWTON, DUNSMUIR LODGE

Directions: "near small stream east of present Dunsmuir Lodge" - no small stream on map, put dot east of lodge

Biogeoclimatic Unit: CDF mm

Ecosection: SGI

Occurrence Information

First Observation Date: 1968 **Last Observation Date:** 1968

Occurrence Data:

VTAB Plot No. RO 188

General Description:

Stand occurs near small stream, stand occurs on north-facing mid to lower slopes.

Environmental Summary:

Occurrence Rank and Occurrence Rank Factors

Rank*:

Note: in the case of Ecological Communities, "viability" should read as "ecological integrity".

Rank Date:

Rank Comments:

Condition of Occurrence:

Size of Occurrence:

Landscape Context:

Version

Version Date: 1993-06-22

Version Author: RAMSAY, L.

Mapping Information

Estimated Representation Accuracy:

Estimated Representation Accuracy Comments:

Confident that full extent is represented by Occurrence:

Confidence extent Definition:

Additional Inventory Needed: N

Inventory Comments:

Documentation

References:

Roemer, H.L. 1972. Forest vegetation and environments on the Saanich Peninsula, Vancouver Island. Ph.D. Thesis., Univ. Victoria, Victoria, BC.

University of British Columbia Department of Forest Sciences. 1991. Vegetation and Site Classification for Coastal British Columbia. Vegetation and Environment Summaries. Univ. B.C., Vancouver, BC.

VTAB data files. 1991. Vegetation and environment data for the biogeoclimatic ecosystem classification. B.C. Minist. For. Res. Branch, Victoria.

Please visit the website http://www.env.gov.bc.ca/cdc/gis/eo_data_fields_06.htm for definitions of the data fields used in this occurrence report.

Suggested Citation:

B.C. Conservation Data Centre. 2014. Occurrence Report Summary, Shape ID: 1588, western redcedar / vanilla-leaf. B.C. Ministry of Environment. Available: http://maps.gov.bc.ca/ess/hm/cdc, (accessed Jan 22, 2019).

BC Conservation Data Centre: Ecosystem Occurrence Report
Shape ID: 4072

Scientific Name: *Thuja plicata / Oemleria cerasiformis*

English Name: western redcedar / Indian-plum

Identifiers

Occurrence ID: 4369

Shape ID: 4072

Element Group: Ecological Community

Status

Provincial Rank: S1

BC List: Red

Global Rank: G1

Locators

Survey Site: MOUNT NEWTON, DUNSMUIR LODGE

Directions: "near small stream east of present Dunsmuir Lodge" - (no small stream on map), mapped east of lodge

Biogeoclimatic Unit: CDF mm

Ecosection: SGI

Occurrence Information

First Observation Date: 1968 **Last Observation Date:** 1968

Occurrence Data:

VTAB Plot No. RO 189

General Description:

Stand occurs near small stream on north-facing mid to lower slope.

Environmental Summary:

Occurrence Rank and Occurrence Rank Factors

Rank*:

Note: in the case of Ecological Communities, "viability" should read as "ecological integrity".

Rank Date:

Rank Comments:

Condition of Occurrence:

Size of Occurrence:

Landscape Context:

Version

Version Date: 1992-02-04

Version Author: RAMSAY, L.

Mapping Information

Estimated Representation Accuracy:

Estimated Representation Accuracy Comments:

Confident that full extent is represented by Occurrence:

Confidence extent Definition:

Additional Inventory Needed: N

Inventory Comments:

Documentation

References:

Roemer, H.L. 1972. Forest vegetation and environments on the Saanich Peninsula, Vancouver Island. Ph.D. Thesis., Univ. Victoria, Victoria, BC.

University of British Columbia Department of Forest Sciences. 1991. Vegetation and Site Classification for Coastal British Columbia. Vegetation and Environment Summaries. Univ. B.C., Vancouver, BC.

VTAB data files. 1991. Vegetation and environment data for the biogeoclimatic ecosystem classification. B.C. Minist. For. Res. Branch, Victoria.

Please visit the website http://www.env.gov.bc.ca/cdc/gis/eo_data_fields_06.htm for definitions of the data fields used in this occurrence report.

Suggested Citation:

B.C. Conservation Data Centre. 2014. Occurrence Report Summary, Shape ID: 4072, western redcedar / Indian-plum. B.C. Ministry of Environment. Available: http://maps.gov.bc.ca/ess/hm/cdc, (accessed Jan 22, 2019).

BC Conservation Data Centre: Ecosystem Occurrence Report
Shape ID: 1532

Scientific Name: *Abies grandis / Berberis nervosa*

English Name: grand fir / dull Oregon-grape

Identifiers

Occurrence ID: 5619

Shape ID: 1532

Element Group: Ecological Community

Status

Provincial Rank: S1

BC List: Red

Global Rank: G1

Locators

Survey Site: MOUNT NEWTON, DUNSMUIR LODGE

Directions: "Northeast side of Mt. Newton, northeast of present Dunsmuir Lodge."

Biogeoclimatic Unit: CDF mm

Ecosection: SGI

Occurrence Information

First Observation Date: 1968 **Last Observation Date:** 1968

Occurrence Data:

VTAB Plot No. RO 183, RO 182.

General Description:

Environmental Summary:

Occurrence Rank and Occurrence Rank Factors

Rank*:

Note: in the case of Ecological Communities, "viability" should read as "ecological integrity".

Rank Date:

Rank Comments:

Condition of Occurrence:

Size of Occurrence:

Landscape Context:

Version

Version Date:

Version Author:

Mapping Information

Estimated Representation Accuracy:

Estimated Representation Accuracy Comments:

Confident that full extent is represented by Occurrence:

Confidence extent Definition:

Additional Inventory Needed: N

Inventory Comments:

Documentation

References:

Roemer, H.L. 1972. Forest vegetation and environments on the Saanich Peninsula, Vancouver Island. Ph.D. Thesis., Univ. Victoria, Victoria, BC.

University of British Columbia Department of Forest Sciences. 1991. Vegetation and Site Classification for Coastal British Columbia. Vegetation and Environment Summaries. Univ. B.C., Vancouver, BC.

VTAB data files. 1991. Vegetation and environment data for the biogeoclimatic ecosystem classification. B.C. Minist. For. Res. Branch, Victoria.

Please visit the website http://www.env.gov.bc.ca/cdc/gis/eo_data_fields_06.htm for definitions of the data fields used in this occurrence report.

Suggested Citation:

B.C. Conservation Data Centre. 2014. Occurrence Report Summary, Shape ID: 1532, grand fir / dull Oregon-grape. B.C. Ministry of Environment. Available: http://maps.gov.bc.ca/ess/hm/cdc, (accessed Jan 22, 2019).

BC Conservation Data Centre: Ecosystem Occurrence Report
Shape ID: 80021

Scientific Name: *Populus trichocarpa - Alnus rubra / Rubus spectabilis*

English Name: black cottonwood - red alder / salmonberry

Identifiers

Occurrence ID: 10783

Shape ID: 80021

Element Group: Ecological Community

Status

Provincial Rank: S3

BC List: Blue

Global Rank: GNR

Locators

Survey Site: REAY CREEK, SIDNEY

Directions:

Biogeoclimatic Unit: CDF mm

Ecosection: SGI

Occurrence Information

First Observation Date: 2007 **Last Observation Date:** 2015-10-06

Occurrence Data:

This middle bench floodplain forest occurrence is based on Terrestrial Ecosystem Mapping (TEM) and has been verified by a field visit. It is comprised of a young forest. This ecological community occupies approximately 4.0 ha or 44 % of the area shown.

General Description:

This occurrence is located on the floodplain of Reay Creek between Victoria Airport and the highway. The surrounding area is mostly urban, with the occurrence being a narrow strip between urban housing.

Environmental Summary:

Field data indicates the occurrence is on level, fluvial materials.

Occurrence Rank and Occurrence Rank Factors

Rank*: E : Verified extant (viability not assessed)

Note: in the case of Ecological Communities, "viability" should read as "ecological integrity".

Rank Date:

Rank Comments:

Condition of Occurrence:

Size of Occurrence:

4.02 ha

Landscape Context:

Version

Version Date: 2013-01-29

Version Author: de Groot, A.

Mapping Information

Estimated Representation Accuracy: Medium

Estimated Representation Accuracy Comments: The ecological community occupies 44.4% (4.02 ha) of the mapped occurrence.

Confident that full extent is represented by Occurrence: ?

Confidence extent Definition: Uncertain whether full extent of EO is known

Additional Inventory Needed: Y

Inventory Comments: The field data is from a visit to verify the element occurrence.

This element occurrence is based on available ecosystem mapping. Many factors influence the reliability of an ecosystem map. Depending on the scale of aerial images used to capture the ecosystems, very small ecosystems and some types of disturbance may not be visible and will not be mapped. If the air photos are not current, new disturbance may have occurred since the time of mapping and the inventory may not accurately represent the current state of the landscape. Other factors, such as the skill and experience of the mapper within the study area, and the field survey intensity level will also influence the reliability of the map.

Documentation

References:

Madrone Environmental Services Ltd. 2008. Terrestrial Ecosystem Mapping of the Coastal Douglas-Fir Biogeoclimatic Zone. Unpublished report prepared for Integrated Land Management Bureau (ILMB), Duncan, B.C. 123pp.

Terrestrial Ecosystem Mapping [TEM] of the Coastal Douglas-fir Biogeoclimatic Zone. 2008. Prepared for B. Zinovich, Integrated Land Management Bureau, B.C. Minist. of Agric. and Lands, Nanaimo B.C. by Madrone Environmental Services, Duncan B.C. 1:20,000 spatial data.

de Groot, A., and C.M. Cadrin. 2013. Element occurrence and element occurrence rank specifications for riparian deciduous forests and shrublands of coastal British Columbia. Unpublished document. Version January, 2013. B.C. Minist. Environ., Conservation Data Centre, Victoria, B.C. 5 pp.

Please visit the website http://www.env.gov.bc.ca/cdc/gis/eo_data_fields_06.htm for definitions of the data fields used in this occurrence report.

Suggested Citation:

B.C. Conservation Data Centre. 2014. Occurrence Report Summary, Shape ID: 80021, black cottonwood - red alder / salmonberry. B.C. Ministry of Environment. Available: http://maps.gov.bc.ca/ess/hm/cdc, (accessed Jan 22, 2019).

BC Conservation Data Centre: Ecosystem Occurrence Report
Shape ID: 55764

Scientific Name: *Pseudotsuga menziesii / Berberis nervosa*

English Name: Douglas-fir / dull Oregon-grape

Identifiers

Occurrence ID: 8635

Shape ID: 55764

Element Group: Ecological Community

Status

Provincial Rank: S1

BC List: Red

Global Rank: G2

Locators

Survey Site: MOUNT NEWTON, SAANICH PENNINSULA

Directions:

Biogeoclimatic Unit: CDF mm

Ecosection: SGI

Occurrence Information

First Observation Date: 1968 **Last Observation Date:** 2008

Occurrence Data:

The occurrence (based on Terrestrial Ecosystem Mapping) is predominantly of mature (68%) forest and also has one of the few old forest stands (3%) remaining for this ecosystem. Stands of young forest (26%) and inclusions of shrub and early regenerating forest are also present. Field samples indicate the stands can be mixed, and may contain in addition to Douglas-fir, western redcedar, arbutus, bigleaf maple and western yew, varying by soil-moisture availability at different sites.

General Description:

The occurrence occupies a substantial portion of Mt. Newton, including much of John Dean Park, located on Saanich Peninsula, B.C.

Environmental Summary:

Much of the terrain is covered in morainal veneers or blankets, or glaciomarine thin veneers, veneers or blankets, with some areas of colluvial venners or undulating bedrock.

Occurrence Rank and Occurrence Rank Factors

Rank*: BC : Good or fair estimated viability

Note: in the case of Ecological Communities, "viability" should read as "ecological integrity".

Rank Date: 13-01-18

Rank Comments:

This large sized occurrence is located within an area of fairly poor landscape context but is in relative good condition (mature and old forest with large area of contiguous vegetation). The Ecological Integrity is assessed as Good to Fair.

Condition of Occurrence:

Mature forests are dominant (68%) including small patches of very old trees. Young forest (26%) is also present with minor area of early seral forest. Vertical stand structure is well developed, contributing to wildlife habitat values. The forest patches are mostly contiguous in this occurrence, but there is moderate fragmentation (more than 25%) due to roads, rural development and recreational trails and infrastructure. Condition is assessed as Good to Fair.

Size of Occurrence:

The size of this occurrence is near the lower threshold of large size within this fragmented landscape (564.46 ha).

Landscape Context:

This occurrence is surrounded to the north, east and south in a modified landcape of agricultural areas, airport infrastructure, urban and rural residential areas. To the west is the coastline of the Saanich Inlet. Connectivity to other occurrences is compromised by areas of developed and agricultural land. Landscape Context is assessed as Fair to Poor.

Version

Version Date: 2013-01-18

Version Author: de Groot, A. and C.M. Cadrin

Mapping Information

Estimated Representation Accuracy: Medium

Estimated Representation Accuracy Comments: The ecological community occupies 67.09% (564.46 ha) of the mapped occurrence.

Confident that full extent is represented by Occurrence: ?

Confidence extent Definition: Uncertain whether full extent of EO is known

Additional Inventory Needed: Y

Inventory Comments: In addition to TEM field plots from the Terrestrial Ecosystem Mapping [TEM] of the Coastal Douglas-fir Biogeoclimatic Zone, this element was confirmed by field survey (VTAB Plot RO 355) for Roemer (1972).

This element occurrence is based on available ecosystem mapping. Many factors influence the reliability of an ecosystem map. Depending on the scale of aerial images used to capture the ecosystems, very small ecosystems and some types of disturbance may not be visible and will not be mapped. If the air photos are not current, new disturbance may have occurred since the time of mapping and the inventory may not accurately represent the current state of the landscape. Other factors, such as the skill and experience of the mapper within the study area, and the field survey intensity level will also influence the reliability of the map.

Documentation

References:

Canadian Wildlife Service, Ministry of Environment, Lands and Parks Vancouver Island Region, and B.C. Conservation Data Centre. 1993-1996. Sensitive Ecosystems Inventory groundtruthing forms. Unpub. field forms.

Canadian Wildlife Service, Ministry of Environment, Lands and Parks Vancouver Island Region, and B.C. Conservation Data Centre. 1993-1996b. Sensitive Ecosystems Inventory site photographs. Unpub. slides and prints.

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.

Madrone Environmental Services Ltd. 2008. Terrestrial Ecosystem Mapping of the Coastal Douglas-Fir Biogeoclimatic Zone. Unpublished report prepared for Integrated Land Management Bureau (ILMB), Duncan, B.C. 123pp.

Roemer, H.L. 1972. Forest vegetation and environments on the Saanich Peninsula, Vancouver Island. Ph.D. Thesis., Univ. Victoria, Victoria, BC.

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.

Terrestrial Ecosystem Mapping [TEM] of the Coastal Douglas-fir Biogeoclimatic Zone. 2008. Prepared for B. Zinovich, Integrated Land Management Bureau, B.C. Minist. of Agric. and Lands, Nanaimo B.C. by Madrone Environmental Services, Duncan B.C. 1:20,000 spatial data.

University of British Columbia Department of Forest Sciences. 1991. Vegetation and Site Classification for Coastal British Columbia. Vegetation and Environment Summaries. Univ. B.C., Vancouver, BC.

VTAB data files. 1991. Vegetation and environment data for the biogeoclimatic ecosystem classification. B.C. Minist. For. Res. Branch, Victoria.

Please visit the website http://www.env.gov.bc.ca/cdc/gis/eo_data_fields_06.htm for definitions of the data fields used in this occurrence report.

Suggested Citation:

B.C. Conservation Data Centre. 2014. Occurrence Report Summary, Shape ID: 55764, Douglas-fir / dull Oregon-grape. B.C. Ministry of Environment. Available: http://maps.gov.bc.ca/ess/hm/cdc, (accessed Jan 22, 2019).

BC Conservation Data Centre: Ecosystem Occurrence Report
Shape ID: 1536

Scientific Name: *Abies grandis / Tiarella trifoliata*

English Name: grand fir / three-leaved foamflower

Identifiers

Occurrence ID: 1984

Shape ID: 1536

Element Group: Ecological Community

Status

Provincial Rank: S1

BC List: Red

Global Rank: G1

Locators

Survey Site: VICTORIA INTERNATIONAL AIRPORT

Directions: Piece of airport south of airport access road.

Biogeoclimatic Unit: CDF mm

Ecosection: SGI

Occurrence Information

First Observation Date: 1968 **Last Observation Date:** 2015-10-06

Occurrence Data:

This coniferous forest element occurrence is based on terrestrial ecosystem mapping and field inventory data. It has been verified by by two plots from 1968 and confirmed by notation in a 2015 field plot in an adjacent ecological community. The occurrence is dominated by grand fir, western redcedar, and Douglas-fir in the overstory, with some western hemlock and big leaf maple. There is a limited shrub cover, mostly of regenerating trees, minor salal and dull Oregon-grape, and minor English holly. The herb layer is dominated by English ivy. Native species composition in the herb layer is still high, swordfern, three-leaved foamflower, vanilla-leaf. There is a very low cover of mosses, Oregon beaked moss, step moss and one sighting of palm tree moss, where the ground surface is free of ivy. The element occupies 30% (5.0 ha) of the mapped occurrence.

General Description:

This occurrence is located on a level area on the Saanich Peninsula. It is surrounded by rural, agricultural and industrial development.

Environmental Summary:

The occurrence is on a gentle slope with medium-textured soils. The site is rich and mesic.

Occurrence Rank and Occurrence Rank Factors

Rank*: E : Verified extant (viability not assessed)

Note: in the case of Ecological Communities, "viability" should read as "ecological integrity".

Rank Date: August 30, 2016.

Rank Comments:

Final EO rank cannot be assigned until the element occurrence specifications represent the full range of this ecological community (depending if if the Ecological community is designated as a large patch or small patch type, the Size factor is poor and fair, respectively. Condition could be improved by active restoration (control and removal of English ivy). Much of the forest structure is that of mature forest. However, occurring within a highly developed landscape and the lack of connectivity to natural vegetation reduces the overall ecological integrity.

Condition of Occurrence:

Size of Occurrence:

5.05 ha

Landscape Context:

Version

Version Date: 2016-03-26

Version Author: Iverson, K. A. Haney, and C. Cadrin

Mapping Information

Estimated Representation Accuracy: Medium

Estimated Representation Accuracy Comments: The element occupies 29.8% (5.05 ha) of the mapped occurrence.

Confident that full extent is represented by Occurrence: ?

Confidence extent Definition: Uncertain whether full extent of EO is known

Additional Inventory Needed: Y

Inventory Comments: The two RO plots (1968) are from Hans Roemer's (1972) thesis> Plot 02-3011 is an ecosystem plot completed by CDC while sampling the forest south of Willingdon Rd. near the VIctoria Airport. The plot is mmediately adjacent to the occurrence of Abies grandis / Tiarella trifoliata. Plot 02-3011 represents the Abies grandis / Mahonia nervosa and the comments for this plot confirm the occurrence of the Abies grandis / Tiarella trifoliata sampled by Roemer (RO plots) in 1968.

Documentation

References:

Roemer, H.L. 1972. Forest vegetation and environments on the Saanich Peninsula, Vancouver Island. Ph.D. Thesis., Univ. Victoria, Victoria, BC.

Terrestrial Ecosystem Mapping [TEM] of the Coastal Douglas-fir Biogeoclimatic Zone. 2008. Prepared for B. Zinovich, Integrated Land Management Bureau, B.C. Minist. of Agric. and Lands, Nanaimo B.C. by Madrone Environmental Services, Duncan B.C. 1:20,000 spatial data.

University of British Columbia Department of Forest Sciences. 1991. Vegetation and Site Classification for Coastal British Columbia. Vegetation and Environment Summaries. Univ. B.C., Vancouver, BC.

VTAB data files. 1991. Vegetation and environment data for the biogeoclimatic ecosystem classification. B.C. Minist. For. Res. Branch, Victoria.

Please visit the website http://www.env.gov.bc.ca/cdc/gis/eo_data_fields_06.htm for definitions of the data fields used in this occurrence report.

Suggested Citation:

B.C. Conservation Data Centre. 2014. Occurrence Report Summary, Shape ID: 1536, grand fir / three-leaved foamflower. B.C. Ministry of Environment. Available: http://maps.gov.bc.ca/ess/hm/cdc, (accessed Jan 22, 2019).

BC Conservation Data Centre: Species Occurrence Report

Shape ID: 2164

Scientific Name: Epilobium torreyi

English Name: brook spike-primrose

Identifiers

Occurrence ID: 5678

Shape ID: 2164

Taxonomic Class: dicots

Element Group: Vascular Plant

Status

Provincial Rank: SH

BC List: Red

Global Rank: G5

COSEWIC: E (DEC 2018)

SARA Schedule: 1

Locators

Survey Site: BAZAN BAY, WEST OF

Directions: Near McTavish Road.

Biogeoclimatic Zone:

Ecosection: SGI

Area Description

General Description:

Vegetation Zone: Lowland

Min. Elevation (m): 50 **Max. Elevation (m):** 50

Habitat: TERRESTRIAL: Grassland/Herbaceous

Occurrence Information

First Observation Date: 1966-08-01 **Last Observation Date:** 1966-08-01

Occurrence Data:

2004: Last observed in 1966, this population occurred in an open, grassy meadow along the eastern end of McTavish Road. Much of this stretch has been converted to residential use and the remainder is either forested, used for intensive agriculture or has suffered from ditching and invasion by highly competitive non-native grasses like Agrostis capillaris and shrubs such as Rubus armeniacus (COSEWIC 2006d). 1966-08-01: With grasses, rushes, slope 0 (University of Victoria herbarium).

Occurrence Rank and Occurrence Rank Factors

Rank: X : Extirpated

Rank Date: 2004

Rank Comments:

All suitable habitat for Epilobium torreyi appears to ahve been converted and the population is considered extirpated.

Condition of Occurrence:

All suitable habitat for Epilobium torreyi appears to have been converted (COSEWIC, 2006d) and the population is considered Extirpated.

Size of Occurrence:

[No data provided].

Landscape Context:

The surrounding landscape is not likely to support additional populations of this species since much of the remainder is either forested, agricultural land or ditched and dominated by highly competitive non-native grasses like Agrostis capillaris and shrubs such as Rubus armeniacus (COSEWIC 2006d).

Version

Version Date: 2006-11-07

Version Author: Donovan, M.

Mapping Information

Estimated Representation Accuracy: Medium

Estimated Representation Accuracy Comments:

Confident that full extent is represented by Occurrence: ?

Confidence Extent Definition: Uncertain whether full extent of EO is known

Additional Inventory Needed: Y

Inventory Comments: Although no plants have been seen at the site after intensive directed surveys, there is a possibility that some seeds may remain in the soil seed bank or that previously overlooked populations may be found (COSEWIC, 2006d). However, this possibility is remote since the habitat is so altered (M. Fairbarns, pers. comm. 2004).

Documentation

References:

COSEWIC. 2006d. COSEWIC assessment and status report on the brook spike-primrose Epilobium torreyi in Canada. Comm. on the Status of Endangered Wildl. in Can. Ottawa. vi + 17 pp.

Ceska, A. Personal Communication. Ceska Geobotanical Consulting. Victoria, BC.

University of Victoria Herbarium. Biol. Dep., Univ. of Victoria, P.O. Box 3020, Victoria, BC, V8W 3N5.

Specimen: Turner, B. (1334). 1966. UVIC.

Suggested Citation:

B.C. Conservation Data Centre. 2014. Occurrence Report Summary, Shape ID: 2164, brook spike-primrose. B.C. Ministry of Environment. Available: http://maps.gov.bc.ca/ess/hm/cdc, (accessed Jan 22, 2019).

BC Conservation Data Centre: Species Occurrence Report

Shape ID: 1026

Scientific Name: Branta bernicla

English Name: Brant

Identifiers

Occurrence ID: 193

Shape ID: 1026

Taxonomic Class: birds

Element Group: Vertebrate Animal

Status

Provincial Rank: S3M

BC List: Blue

Global Rank: G5

COSEWIC:

SARA Schedule:

Locators

Survey Site: BAZAN BAY

Directions:

Biogeoclimatic Zone:

Ecosection: SGI;SOG

Area Description

General Description:

Vegetation Zone:

Min. Elevation (m):

Max. Elevation (m):

Habitat: MARINE; NEARSHORE; BAY

Occurrence Information

First Observation Date: 1988 **Last Observation Date:** 1993-04-27

Occurrence Data:

1988, 1990, 1993: seen April 8-27 in numbers up to 500+ (B.C. Vertebrate Record File 1991).

Occurrence Rank and Occurrence Rank Factors

Rank:

Rank Date:

Rank Comments:

Condition of Occurrence:

Size of Occurrence:

Landscape Context:

Version

Version Date: 1993-08-29

Version Author: RAMSAY, L.R.

Mapping Information

Estimated Representation Accuracy:

Estimated Representation Accuracy Comments:

Confident that full extent is represented by Occurrence:

Confidence Extent Definition:

Additional Inventory Needed: N

Inventory Comments:

Documentation

References:

British Columbia Vertebrate Record File. 2001. Royal B.C. Mus., Victoria, BC. V8V 1X4.

Specimen: Begg, B. 19?? Obs.

Suggested Citation:

B.C. Conservation Data Centre. 2014. Occurrence Report Summary, Shape ID: 1026, Brant. B.C. Ministry of Environment. Available: http://maps.gov.bc.ca/ess/hm/cdc, (accessed Jan 22, 2019).

BC Species and Ecosystems Explorer Search Results

Scientific Name	English Name	Biogeoclimatic Units	Status					Provincial FRPA	Land Use Objectives
			Provincial	BC List	Global	COSEWIC	SARA		
Accipiter gentilis laingi	Northern Goshawk, *laingi* subspecies	CDF CWH	S2 (2010)	Red	G5T2 (2008)	T (2013)	1-T (2003)	Y	
Anaxyrus boreas	Western Toad	BG BWBS CDF CWH ESSF ICH IDF PP SBS SWB	S4 (2016)	Yellow	G4 (2008)	SC (2012)	1-SC (2018)		
Aneides vagrans	Wandering Salamander	CDF CWH	S3 (2016)	Blue	G4 (2005)	SC (2014)	1-SC (2018)		
Ardea herodias fannini	Great Blue Heron, *fannini* subspecies	CDF CWH	S2S3B,S4N (2018)	Blue	G5T4 (1997)	SC (2008)	1-SC (2010)	Y	
Asio flammeus	Short-eared Owl	BG BWBS CDF CWH ICH IDF MS PP SBPS SBS SWB	S3B,S2N (2015)	Blue	G5 (2014)	SC (2008)	1-SC (2012)	Y	
Botaurus lentiginosus	American Bittern	BG BWBS CDF CWH ICH IDF MS PP SBPS SBS	S3B, SNRN (2015)	Blue	G5 (2016)				
Brachyramphus marmoratus	Marbled Murrelet	CDF CWH MH	S3B,S3N (2015)	Blue	G3 (2013)	T (2012)	1-T (2003)	Y	
Butorides virescens	Green Heron	BG CDF CWH ICH IDF PP SBS	S3S4B (2015)	Blue	G5 (2014)				
Chordeiles minor	Common Nighthawk	BG BWBS CDF CWH ESSF ICH IDF MH MS PP SBPS SBS SWB	S4B (2015)	Yellow	G5 (2014)	SC (2018)	1-T (2010)		
Chrysemys picta	Painted Turtle	BG CDF CWH ICH IDF MH PP SBS	S3 (2018)	No Status	G5 (2016)	E/SC (2006)	1-E/SC (2007)		
Chrysemys picta pop. 1	Painted Turtle - Pacific Coast Population	CDF CWH MH	S1S2 (2018)	Red	G5T2 (2007)	T (2016)	1-E (2007)		
Coccothraustes vespertinus	Evening Grosbeak	BG BWBS CDF CWH ESSF ICH	S5 (2015)	Yellow	G5 (1996)	SC (2016)			

		IDF MH MS PP SBPS SBS SWB						
Contopus cooperi	Olive-sided Flycatcher	BWBS CDF CWH ESSF ICH IDF MH MS PP SBPS SBS SWB	S3S4B (2015)	Blue	G4 (2008)	SC (2018)	1-T (2010)	
Corynorhinus townsendii	Townsend's Big-eared Bat	BG CDF CWH ICH IDF PP	S3S4 (2015)	Blue	G4 (2015)			
Cryptomastix devia	Puget Oregonian	CDF CWH	SX (2015)	Red	G3 (2005)	XT (2013)	1-XX (2005)	
Falco peregrinus anatum	Peregrine Falcon, *anatum* subspecies	BG BWBS CDF CWH IDF MS PP SBS	S2? (2011)	Red	G4T4 (2006)	NAR (2017)	1-SC (2012)	
Glaucidium gnoma swarthi	Northern Pygmy-owl, *swarthi* subspecies	CDF CWH MH	S3S4 (2018)	Blue	G4G5T3Q (2016)			Y
Hemphillia glandulosa	Warty Jumping-slug	CDF CWH	S2? (2015)	Red	G3G4 (2005)	SC (2013)	1-SC (2005)	
Hirundo rustica	Barn Swallow	BAFA BG BWBS CDF CWH ESSF ICH IDF IMA MH MS PP SBPS SBS SWB	S3S4B (2015)	Blue	G5 (2014)	T (2011)	1-T (2017)	
Hydroprogne caspia	Caspian Tern	BG BWBS CDF CWH ICH IDF PP SBS	S3B (2015)	Blue	G5 (1996)	NAR (1999)		
Megascops kennicottii kennicottii	Western Screech-Owl, *kennicottii* subspecies	CDF CWH MH	S2S3 (2017)	Blue	G5T4 (2003)	T (2012)	1-T	
Mustela erminea anguinae	Ermine, *anguinae* subspecies	CDF CWH MH	S3 (2010)	Blue	G5T3 (2015)			
Myotis keenii	Keen's Myotis	BWBS CDF CWH MH	S3? (2015)	Blue	G3 (2014)	DD (2003)	3 (2005)	Y
Myotis lucifugus	Little Brown Myotis	BG BWBS CDF CWH ESSF ICH IDF MH MS PP	S4 (2015)	Yellow	G3 (2015)	E (2013)	1-E (2014)	

		SBPS SBS SWB						
Patagioenas fasciata	Band-tailed Pigeon	CDF CWH ICH IDF MS SBS	S3S4 (2015)	Blue	G4 (2000)	SC (2008)	1-SC (2011)	
Plebejus saepiolus insulanus	Greenish Blue, *insulanus* subspecies	CDF CWH	SH (2013)	Red	G5TH (2003)	E (2012)	1-E (2003)	
Progne subis	Purple Martin	BWBS CDF CWH ICH	S3B (2015)	Blue	G5 (2014)			
Rana aurora	Northern Red-legged Frog	CDF CWH MH	S3 (2016)	Blue	G4 (2015)	SC (2015)	1-SC (2005)	Y
Sorex navigator brooksi	American Water Shrew, *brooksi* subspecies	CDF CWH	S2S3 (2018)	Blue	G5T2 (2016)			Y
Sympetrum vicinum	Autumn Meadowhawk	CDF CWH	S3S4 (2015)	Blue	G5 (2015)			
Tramea lacerata	Black Saddlebags	CDF	S2 (2015)	Red	G5 (1985)			
Tyto alba	Barn Owl	BG BWBS CDF CWH ICH IDF PP	S2? (2015)	Red	G5 (1996)	T (2010)	1-T (2018)	

Search Summary

Time Performed Tue Jan 22 14:47:57 PST 2019

Results 32 records.

Search Criteria Animals
AND MOE Regions:1- Vancouver Island (Restricted to Red, Blue, and Legally designated species)
AND Regional Districts: Capital (CRD)
AND Habitat Types: Riparian (Restricted to Red, Blue, and Legally designated species)
AND BGC Zone:
Sort Order:Scientific Name Ascending

Notes

1. Citation: B.C. Conservation Data Centre. 2019. BC Species and Ecosystems Explorer. B.C. Minist. of Environ. Victoria, B.C. Available: http://a100.gov.bc.ca/pub/eswp/ (accessed Jan 22, 2019).

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).

3. The data contained in the Results Export in BCSEE are provided under the Open Government License - BC.

Modify Search | New Search | Results

BC Species and Ecosystems Explorer Search Results

Scientific Name	English Name	Biogeoclimatic Units	Status						
			Provincial	BC List	Global	COSEWIC	SARA	Provincial FRPA	Land Use Objectives
Ophioglossum pusillum	northern adder's-tongue	CDFmm CWHvm CWHxm ICHmw IDFxh	S3? (2015)	Blue	G5 (2011)				
Trifolium cyathiferum	cup clover	BGxh CDFmm CWHmm CWHxm ICHdw ICHmw IDFdm IDFxh PPdh	S3 (2017)	Blue	G4 (1990)				
Wolffia columbiana	Columbian water-meal	CDFmm	S3 (2017)	Blue	G5 (2015)				

Search Summary

Time Performed Tue Jan 22 14:52:10 PST 2019

Results 3 records.

Search Criteria Plants
AND MOE Regions:1- Vancouver Island (Restricted to Red, Blue, and Legally designated species)
AND Regional Districts: Capital (CRD)
AND Habitat Types: Riparian (Restricted to Red, Blue, and Legally designated species)
AND BGC Zone:
Sort Order:Scientific Name Ascending

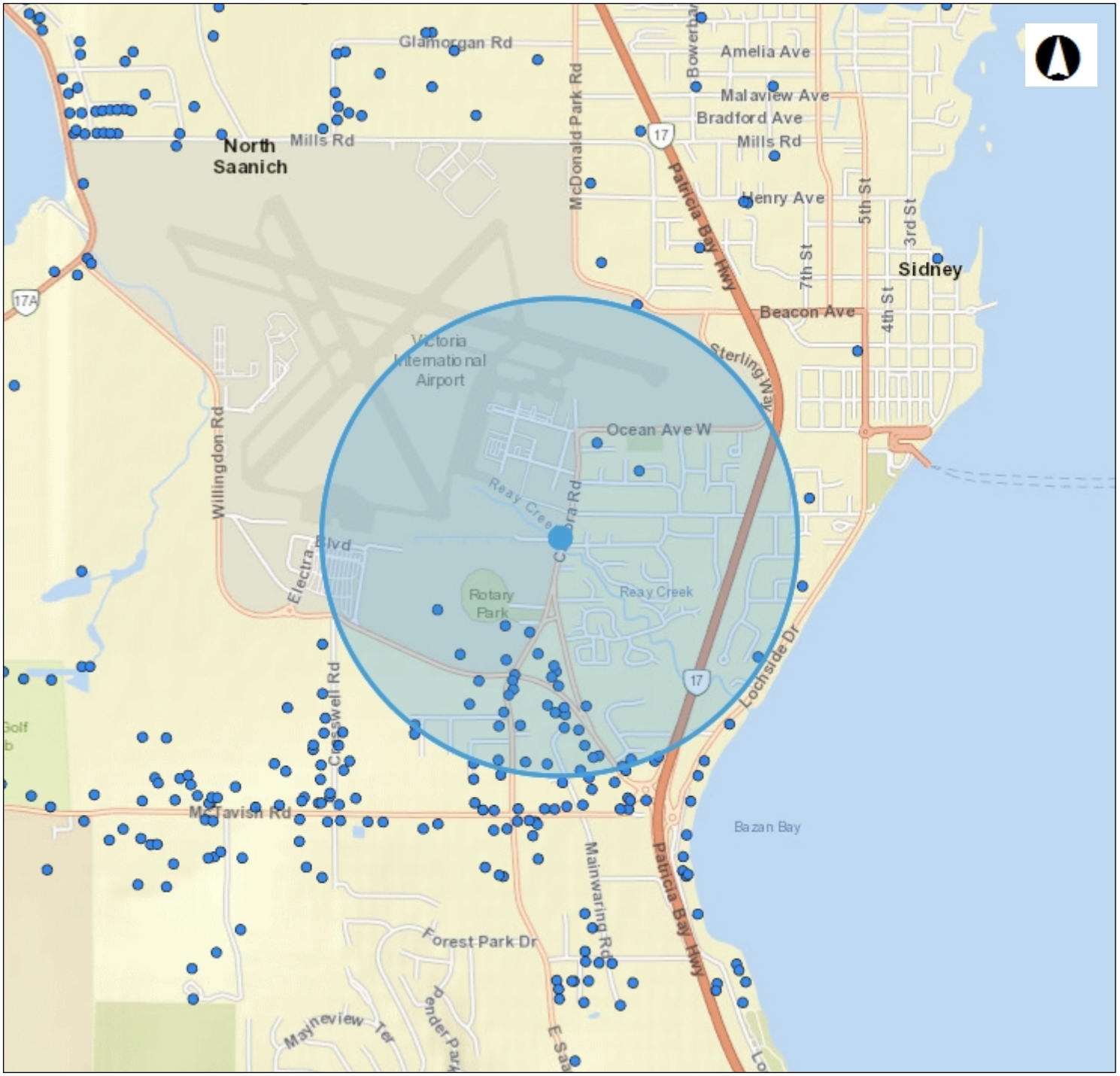
Notes

1. Citation: B.C. Conservation Data Centre. 2019. BC Species and Ecosystems Explorer. B.C. Minist. of Environ. Victoria, B.C. Available: http://a100.gov.bc.ca/pub/eswp/ (accessed Jan 22, 2019).

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).

3. The data contained in the Results Export in BCSEE are provided under the Open Government License - BC.

Modify Search | New Search | Results



BRITISH COLUMBIA

Water Wells within 1,000 m of Reay Creek

Legend

- Water Wells - All

0 0.73 1.47 km

1: 36,112

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CAUTION: Maps obtained using this site are not designed to assist in navigation. These maps may be generalized and may not reflect current conditions. Uncharted hazards may exist. DO NOT USE THESE MAPS FOR NAVIGATIONAL PURPOSES.

Datum: NAD83
Projection: BC Albers

Key Map of British Columbia

Well Tag Number	Licence Status	Well Use	Street Name
14185	UNLICENSED	Private Domestic	
23202	UNLICENSED	Unknown Well Use	
36919	UNLICENSED	Unknown Well Use	CANORA RD
13834	UNLICENSED	Other	
18329	UNLICENSED	Unknown Well Use	
20141	UNLICENSED	Unknown Well Use	VICTORIA INTERNATIOI
19829	UNLICENSED	Unknown Well Use	
23796	UNLICENSED	Unknown Well Use	
23520	UNLICENSED	Unknown Well Use	
29994	UNLICENSED	Unknown Well Use	
33085	UNLICENSED	Unknown Well Use	CANORA RD & NEW AIF
33068	UNLICENSED	Unknown Well Use	CANORA RD & NEW AIF
1989	UNLICENSED	Unknown Well Use	
15101	UNLICENSED	Private Domestic	
8999	UNLICENSED	Other	
14481	UNLICENSED	Private Domestic	
30171	UNLICENSED	Unknown Well Use	
31043	UNLICENSED	Unknown Well Use	
30156	UNLICENSED	Unknown Well Use	
38004	UNLICENSED	Unknown Well Use	DICKSON AVE
39809	UNLICENSED	Unknown Well Use	DICKSON AVE
1279	UNLICENSED	Unknown Well Use	
1345	UNLICENSED	Unknown Well Use	
1281	UNLICENSED	Unknown Well Use	
1313	UNLICENSED	Unknown Well Use	
1280	UNLICENSED	Unknown Well Use	
15425	UNLICENSED	Unknown Well Use	
2174	UNLICENSED	Unknown Well Use	
71928	UNLICENSED		9585 PAT BAY HIGHWA
34960	UNLICENSED	Unknown Well Use	LOCHSIDE DR
19869	UNLICENSED	Unknown Well Use	
33054	UNLICENSED	Unknown Well Use	CANORA RD & NEW AIF
8948	UNLICENSED	Other	
37761	UNLICENSED	Unknown Well Use	CANORA RD
32341	UNLICENSED	Unknown Well Use	
32475	UNLICENSED	Unknown Well Use	
20144	UNLICENSED	Other	VICTORIA INTERNATIOI
34539	UNLICENSED	Unknown Well Use	
1613	UNLICENSED	Other	
8974	UNLICENSED	Private Domestic	

Finished Well Depth (ft	Diameter (in)	Depth to Water (ft)	Depth to Bedrock (ft)
14	0.0	9	
22	0.0	6	
367	0.0		43
23	0.0	9	
40	6.0	26	
35	6.0	7	
130	12.0	29	51
275	0.0		54
317	0.0	11	53
500	8.0		54
298	6.5		56
200	6.5		57
70	0.0		16
14	0.0	1	
10	0.0		
14	0.0		
285	0.0		67
250	0.0		57
400	0.0		73
280	6.5		88
184	6.3		64
21	10.0	4	
26	30.0	0	
21	7.0		
187	6.0		21
21	17.0		
38	7.0		
65	0.0		46
70		43	
295	0.0		40
36	12.0	23	
173	6.5		60
18	0.0	1	
450	6.5		65
225	6.5		60
640	8.0	45	41
35	6.0		35
200	0.0		50
18	0.0	7	
22	0.0	3	

Reported Well Yield	Yield Units
0	
0	
10	Gallons per Minute (U.S./Imperial)
0	
5	Gallons per Minute (U.S./Imperial)
0	
35	Gallons per Minute (U.S./Imperial)
8	Gallons per Minute (U.S./Imperial)
150	U.S. Gallons per Minute
100	Gallons per Minute (U.S./Imperial)
2.5	Gallons per Minute (U.S./Imperial)
7	Gallons per Minute (U.S./Imperial)
1.5	Gallons per Minute (U.S./Imperial)
0	
0	
0	
5	Gallons per Minute (U.S./Imperial)
3	Gallons per Minute (U.S./Imperial)
6	Gallons per Minute (U.S./Imperial)
4	Gallons per Minute (U.S./Imperial)
30	Gallons per Minute (U.S./Imperial)
42	Gallons per Minute (U.S./Imperial)
20.8	Gallons per Minute (U.S./Imperial)
17	Gallons per Minute (U.S./Imperial)
7	Gallons per Minute (U.S./Imperial)
24	Gallons per Minute (U.S./Imperial)
0	
0.3	Gallons per Minute (U.S./Imperial)
5	Gallons per Minute (U.S./Imperial)
15	Gallons per Minute (U.S./Imperial)
10	Gallons per Minute (U.S./Imperial)
0	
50	Gallons per Minute (U.S./Imperial)
8	Gallons per Minute (U.S./Imperial)
30	Gallons per Minute (U.S./Imperial)
	DRY HOLE
12	Gallons per Minute (U.S./Imperial)
0	
0	

SLR

global environmental solutions

Calgary, AB
1185-10201 Southport Rd SW
Calgary, AB T2W 4X9
Canada
Tel: (403) 266-2030
Fax: (403) 263-7906

Edmonton, AB
6940 Roper Road
Edmonton, AB T6B 3H9
Canada
Tel: (780) 490-7893
Fax: (780) 490-7819

Grande Prairie, AB
10015 102 Street
Grande Prairie, AB T8V 2V5
Canada
Tel: (780) 513-6819
Fax: (780) 513-6821

Kamloops, BC
8 West St. Paul Street
Kamloops, BC V2C 1G1
Canada
Tel: (250) 374-8749
Fax: (250) 374-8656

Kelowna, BC
200-1475 Ellis Street
Kelowna, BC V1Y 2A3
Canada
Tel: (250) 762-7202
Fax: (250) 763-7303

Markham, ON
200 - 300 Town Centre Blvd
Markham, ON L3R 5Z6
Canada
Tel: (905) 415-7248
Fax: (905) 415-1019

Nanaimo, BC
9-6421 Applecross Road
Nanaimo, BC V9V 1N1
Canada
Tel: (250) 390-5050
Fax: (250) 390-5042

Ottawa, ON
43 Auriga Drive, Suite 203
Ottawa, ON K2E 7Y8
Canada
Tel: (613) 725-1777
Fax: (905) 415-1019

Prince George, BC
1586 Ogilvie Street
Prince George, BC V2N 1W9
Canada
Tel: (250) 562-4452
Fax: (250) 562-4458

Regina, SK
1048 Winnipeg Street
Regina, SK S4R 8P8
Canada
Tel: (306) 525-4690
Fax (306) 525-4691

Saskatoon, SK
620-3530 Millar Avenue
Saskatoon, SK S7P 0B6
Canada
Tel: (306) 374-6800
Fax: (306) 374-6077

Toronto, ON
36 King Street East, 4th Floor
Toronto, ON M5C 3B2
Canada
Tel: (905) 415-7248
Fax: (905) 415-1019

Vancouver, BC (Head Office)
200-1620 West 8th Avenue
Vancouver, BC V6J 1V4
Canada
Tel: (604) 738-2500
Fax: (604) 738-2508

Victoria, BC
303 - 3960 Quadra Street
Victoria, BC V8X 4A3
Canada
Tel: (250) 475-9595
Fax: (250) 475-9596

Winnipeg, MB
1353 Kenaston Boulevard
Winnipeg, MB R3P 2P2
Canada
Tel: (204) 477-1848
Fax: (204) 475-1649

Whitehorse, YT
6131 6th Avenue
Whitehorse, YT Y1A 1N2
Canada
Tel: (867) 689-2021

Yellowknife, NT
Unit 44, 5022 49 Street
Yellowknife, NT X1A 3R8
Canada
Tel: (867) 765-5695