Wastewater Treatment Project
Treated for a cleaner future

Environmental Impact Study of Core Area Wastewater Treatment Program Facilities Terrestrial Environment I of III

Report Context

The CRD has been planning wastewater treatment for the Core Area for over 30 years. During this time a significant number of reports have been prepared and/or reviewed to assess options and provide information to further planning.

In May 2016 a Project Board was established to define and implement wastewater treatment for the Core Area. The Project Board heard delegations and presentations from the public, industry professionals, and a CRD Director. The Project Board Chair and Vice Chair also met with staff from the CRD, all of the Core Area municipalities, and with Esquimalt and Songhees Nations representatives. The Project Board reviewed the previous technical work and extensive public commentary and developed a methodology to review and evaluate all options. This methodology included evaluation of a large number of options to identify a short list that best addressed the Project goals.

In September 2016 the Project Board presented its recommendation for wastewater treatment and on September 14, 2016 the CRD Board approved the Wastewater Treatment Project (the Project).

A significant number of the reports that have been prepared and/or reviewed still serve as useful background information, but not all of the reports are applicable to the Project. To respond to several recent public inquiries regarding topics of interest, the CRD has prepared a synopsis of reports along with a summary of the applicability of the report to the Project. The document summary is available here: https://www.crd.bc.ca/docs/default-source/wastewater-planning-2014/2017-05-30-summary-of-documents-related-to-topics-of-interest.pdf?sfvrsn=a1a738ca_12. The document summary does not provide a comprehensive list of reports completed as part of wastewater treatment planning for the Core Area, it is a compilation of a number of reports related to key topics of interest: odour; seabed pipeline; bluffs and shoreline; geotechnical; and noise.

Purpose of this Report

This report is part of the Environmental Impact Study for the Project.

Volume 1 examines the upland facilities associated with the CRD's wastewater management program, except for the Hartland North Resource Recovery Centre, and the residual solids pipeline from McLoughlin Point to Hartland North. This updated report includes assessments of additional temporary construction workspace, staging, and material storage areas at Macaulay Point and McLoughlin Point.

This report describes the environmental effects of the construction and operation of the facilities on the following topics: geotechnical conditions; hydrology and water quality; vegetation; wildlife and wildlife habitat; fish; air quality; archaeology and heritage; land use; traffic; noise, vibration, and lighting; human health; visual aesthetics; and site contamination.

This EIS identifies potential impacts of the treatment facilities and ancillary facilities, and recommends mitigation measures as appropriate.

The EIS is based on: a review of available literature on wastewater facility construction and operation; field inspections of the sites, ancillary facility routes and surrounding areas; analysis of plans and reports prepared by municipalities and major institutions covering land use, environmental analyses and other relevant topics; discussions with staff of local governments and major land-owning institutions; and direction provided by the CALWMC.

Part of this report included a section on odour control for the McLoughlin Point Wastewater Treatment Plant.

Applicability to Project

This report is still valid with respect to the Environmental Impact Study; however, the specifics of the odour control in this report are no longer applicable because the design has subsequently been advanced. An atmospheric dispersion model has been created by Harbour Resource Partners (the Contractor for the McLoughlin Point Wastewater Treatment Plant) based on the design of the facility. The CRD has provided the output of the modelling on its website and at public meetings.

ENVIRONMENTAL IMPACT STUDY OF CORE AREA WASTEWATER TREATMENT PROGRAM FACILITIES

TERRESTRIAL ENVIRONMENT

VOLUME I OF III

UPDATED

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Prepared for:

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SUMMARY

The Capital Regional District (CRD) has prepared an Environmental Impact Study (EIS) of the proposed Core Area Wastewater Treatment Program (CAWTP) Facilities: Terrestrial Environment – Volume I of III. Volume I examines the upland facilities associated with the CRD's wastewater management program, except for the Hartland North Resource Recovery Centre, and the residual solids pipeline from McLoughlin Point to Hartland North, which is assessed in Volume II and III respectively. An analysis of environmental effects of the marine portion of the wastewater management program is presented in a separate EIS. This updated report includes assessments of additional temporary construction workspace, staging, and material storage areas at Macaulay Point and McLoughlin Point that have not been previously investigated.

In compliance with provincial directives to institute secondary treatment of wastewater, the CRD is developing plans for treatment facilities to serve the CRD's core area. The facilities will treat wastewater flows from Victoria, Esquimalt, View Royal, Oak Bay, Saanich, Colwood and Langford, British Columbia.

Following extensive engineering and planning study, in spring 2010 the Core Area Liquid Waste Management Committee (CALWMC) selected the McLoughlin Point site as the preferred location for a wastewater treatment facility and determined that the existing facilities at Macaulay and Clover points will be upgraded, a new pump station at Craigflower will be required, an attenuation tank will be needed at the Arbutus Road site, and a biosolids facility will be constructed north of the Hartland landfill site..

As part of the CAWTP, flows from the current Macaulay Point and Clover Point catchment areas will be diverted to the newly constructed McLoughlin Point facility for treatment. The CAWTP facilities will also create opportunities for potential resource recovery including biogas, phosphorous, effluent heat recovery and dried biosolids for beneficial reuse.

The proposed CAWTP facilities include:

- facilities upgraded at Macaulay Point (Township of Esquimalt) and Clover Point (City of Victoria) will screen, remove grit and pump wastewater to the McLoughlin Point treatment facility;
- a new McLoughlin Point treatment facility (Township of Esquimalt) will provide secondary treatment, discharge the liquid effluent and provide opportunities for effluent heat recovery;
- a new Arbutus Road underground attenuation tank (District of Saanich) to reduce downstream wet weather overflows;
- a new Craigflower pump station (Town of View Royal);
- ancillary facilities, primarily pipes to convey wastewater between facilities and a new outfall to be constructed at McLoughlin Point; and
- sludge conveyance to the Hartland site, where a digester and processing facility will be constructed.

The system configuration forms the basis of amendments to the CRD's Core Area Liquid Waste Management Plan. A previous amendment associated with the CAWTP was submitted to the provincial government in December 2009. The Ministry of Environment has mandated that an EIS of the selected sewage treatment facility sites be submitted. This EIS has been prepared to comply with that requirement by examining terrestrial facilities, with the exception of the proposed biosolids facility located at the Hartland site, which is subject to a separate assessment. Effects of marine facilities and effluent discharge are examined in a separate document.

This report describes the environmental effects of the construction and operation of the facilities on the following topics, as specified in terms of reference for the EIS developed jointly by the CRD and the Ministry of Environment:

- geotechnical conditions;
- hydrology and water quality;
- vegetation;
- wildlife and wildlife habitat;
- fish;
- air quality;
- archaeology and heritage;
- land use;
- traffic;
- noise, vibration, and lighting;
- human health;
- visual aesthetics; and
- site contamination.

This EIS identifies potential impacts of the treatment facilities and ancillary facilities, and recommends mitigation measures as appropriate. The methods applied in conducting the study are described in detail in Section 4.0. In general terms, the EIS is based on:

- a review of available literature on wastewater facility construction and operation;
- field inspections of the sites, ancillary facility routes and surrounding areas;
- analysis of plans and reports prepared by municipalities and major institutions covering land use, environmental analyses and other relevant topics;
- discussions with staff of local governments and major land-owning institutions; and
- direction provided by the CALWMC.

The McLoughlin Point facility will provide opportunities to recover heat from wastewater. Sludge will be pumped to a biosolids facility, where it will undergo thermophilic anaerobic digestion, dewatering and drying. This process produces methane, which can be used on-site or cleaned and injected into the natural gas distribution system, and Class A biosolids that can be used as a soil amendment or a fuel.

Construction impacts are examined separately from impacts of facility operation. Construction activities includes site clearing, grading, excavation, foundation work, building construction, equipment installation and testing, commissioning of the facility, site restoration and landscaping. Operations include day-to-day functioning of the treatment facilities and ancillary facilities, including routine maintenance. Project-related impacts identified in the EIS are described according to their:

- spatial extent (area affected);
- temporal extent (duration);
- reversibility;
- magnitude; and

- significance.

Tables 1 to 5 summarize the impact significance ratings for the various topics assessed for each facility site. Tables 6 to 9 summarize the ratings for the ancillary facility routes. Most of the project-induced effects can be reduced to less than significant levels using mitigation measures that are standard practice. In six cases, enhanced mitigation measures will be required to reduce project effects to a less than significant level. In five cases, potential effects could be beneficial as a result of the facility construction or operation mitigation measures.

TABLE 1

MACAULAY POINT – SIGNIFICANCE OF IMPACTS

	Impact Significance			
	Macaulay Point			
	Construction		Operation	
Impact On	Standard Practice	Enhanced Mitigation	Standard Practice	Enhanced Mitigation
Geotechnical hazards	L	L	L	L
Hydrology and water quality	L	L	L	L
Vegetation	L	L	L	L
Wildlife	L	L	L	L
Fish	N/A	N/A	N/A	N/A
Air quality	L	L	L	L
Archaeology and heritage	L	L	L	L
Land use	L	L	L	L
Noise, vibration, and lighting	L	L	L	L
Traffic	L	L	L	L
Human health	L	L	L	L
Visual aesthetics	L	L	L	B

TABLE 2

CLOVER POINT – SIGNIFICANCE OF IMPACTS

	Impact Significance			
	Clover Point			
	Construction		Operation	
Impact On	Standard Practice	Enhanced Mitigation	Standard Practice	Enhanced Mitigation
Geotechnical hazards	L	L	L	L
Hydrology and water quality	L	L	L	L
Vegetation	L	B	L	L
Wildlife	L	B	L	L
Fish	N/A	N/A	N/A	N/A
Air quality	L	L	L	L
Archaeology and heritage	L	L	L	L
Land use	L	L	L	L
Noise, vibration, and lighting	L	L	L	L
Traffic	L	L	L	L
Human health	L	L	L	L
Visual aesthetics	L	L	L	L

S =	Significant	The identified effect would have characteristics that render it unacceptable to the public, regulators, other interests, or it exceeds standards or contravenes legal requirements.
L =	Less than significant	Effects that are not considered significant.
B =	Beneficial	The resource or topic under study would be improved as a result of project effects.
N/A =	Not applicable	

TABLE 3

MCLOUGHLIN POINT – SIGNIFICANCE OF IMPACTS

Impact On	Impact Significance			
	McLoughlin Point			
	Construction		Operation	
	Standard Practice	Enhanced Mitigation	Standard Practice	Enhanced Mitigation
Geotechnical hazards	L	L	L	L
Hydrology and water quality	B	B	L	L
Vegetation	L	L	L	L
Wildlife	L	L	L	L
Fish	N/A	N/A	N/A	N/A
Air quality	L	L	S	L
Archaeology and heritage	L	L	L	L
Land use	L	L	L	L
Noise, vibration, and lighting	L	L	L	L
Traffic	S	L	L	L
Human health	L	L	L	L
Visual aesthetics	L	L	L	L

TABLE 4

ARBUTUS ROAD ATTENUATION TANK – SIGNIFICANCE OF IMPACTS

Impact On	Impact Significance			
	Arbutus Road Attenuation Tank			
	Construction		Operation	
	Standard Practice	Enhanced Mitigation	Standard Practice	Enhanced Mitigation
Geotechnical hazards	L	L	L	L
Hydrology and water quality	L	L	L	L
Vegetation	S	L	L	L
Wildlife	L	L	L	L
Fish	N/A	N/A	N/A	N/A
Air quality	L	L	L	L
Archaeology and heritage	L	L	L	L
Land use	L	L	L	L
Noise, vibration, and lighting	L	L	L	L
Traffic	L	L	L	L
Human health	L	L	L	L
Visual aesthetics	L	L	S	L

S =	Significant	The identified effect would have characteristics that render it unacceptable to the public, regulators, other interests, or it exceeds standards or contravenes legal requirements.
L =	Less than significant	Effects that are not considered significant.
B =	Beneficial	The resource or topic under study would be improved as a result of project effects.
N/A =	Not applicable	

TABLE 5

CRAIGFLOWER PUMP STATION – SIGNIFICANCE OF IMPACTS

Impact On	Impact Significance			
	Craigflower Pump Station			
	Construction		Operation	
	Standard Practice	Enhanced Mitigation	Standard Practice	Enhanced Mitigation
Geotechnical hazards	L	L	L	L
Hydrology and water quality	L	L	L	L
Vegetation	L	L	L	L
Wildlife	L	L	L	L
Fish	N/A	N/A	N/A	N/A
Air quality	L	L	L	L
Archaeology and heritage	L	L	L	L
Land use	L	L	L	L
Noise, vibration, and lighting	L	L	L	L
Traffic	L	L	L	L
Human health	L	L	L	L
Visual aesthetics	L	L	L	L

TABLE 6

MACAULAY POINT TO MCLOUGHLIN POINT ANCILLARY FACILITIES – SIGNIFICANCE OF IMPACTS

Impact On	Impact Significance			
	Macaulay Point To McLoughlin Point Ancillary Facilities			
	Construction		Operation	
	Standard Practice	Enhanced Mitigation	Standard Practice	Enhanced Mitigation
Geotechnical hazards	L	L	L	L
Hydrology and water quality	L	L	L	L
Vegetation	L	L	L	L
Wildlife	L	L	L	L
Fish	N/A	N/A	N/A	N/A
Air quality	L	L	L	L
Archaeology and heritage	L	L	L	L
Land use	L	L	L	L
Noise, vibration, and lighting	L	L	L	L
Traffic	L	L	L	L
Human health	L	L	L	L
Visual aesthetics	L	L	L	L

S =	Significant	The identified effect would have characteristics that render it unacceptable to the public, regulators, other interests, or it exceeds standards or contravenes legal requirements.
L =	Less than significant	Effects that are not considered significant.
B =	Beneficial	The resource or topic under study would be improved as a result of project effects.
N/A =	Not applicable	

TABLE 7

CLOVER POINT TO MCLOUGHLIN POINT ANCILLARY FACILITIES – SIGNIFICANCE OF IMPACTS

Impact On	Impact Significance			
	Clover Point To McLoughlin Point Ancillary Facilities			
	Construction		Operation	
	Standard Practice	Enhanced Mitigation	Standard Practice	Enhanced Mitigation
Geotechnical hazards	L	L	L	L
Hydrology and water quality	L	L	L	L
Vegetation	L	L	L	L
Wildlife	L	L	L	L
Fish	L	L	L	L
Air quality	L	L	L	L
Archaeology and heritage	L	L	L	L
Land use	L	L	L	L
Noise, vibration, and lighting	L	L	L	L
Traffic	S	L	L	L
Human health	L	L	L	L
Visual aesthetics	L	L	L	L

TABLE 8

ARBUTUS ROAD ATTENUATION TANK ANCILLARY FACILITIES – SIGNIFICANCE OF IMPACTS

Impact On	Impact Significance			
	Arbutus Road Attenuation Tank Ancillary Facilities			
	Construction		Operation	
	Standard Practice	Enhanced Mitigation	Standard Practice	Enhanced Mitigation
Geotechnical hazards	L	L	L	L
Hydrology and water quality	L	L	L	L
Vegetation	L	L	L	L
Wildlife	L	L	L	L
Fish	N/A	N/A	N/A	N/A
Air quality	L	L	L	L
Archaeology and heritage	L	L	L	L
Land use	L	L	L	L
Noise, vibration, and lighting	L	L	L	L
Traffic	L	L	L	L
Human health	L	L	L	L
Visual aesthetics	S	L	L	L

S =	Significant	The identified effect would have characteristics that render it unacceptable to the public, regulators, other interests, or it exceeds standards or contravenes legal requirements.
L =	Less than significant	Effects that are not considered significant.
B =	Beneficial	The resource or topic under study would be improved as a result of project effects.
N/A =	Not applicable	

TABLE 9

CRAIGFLOWER PUMP STATION ANCILLARY FACILITIES: PORTAGE INLET CROSSING AND TERRESTRIAL ROUTE – SIGNIFICANCE OF IMPACTS

Impact On	Impact Significance			
	Craigflower pump Station Ancillary Facilities			
	Construction		Operation	
	Standard Practice	Enhanced Mitigation	Standard Practice	Enhanced Mitigation
Geotechnical hazards	L	L	L	L
Hydrology and water quality	L	L	L	L
Vegetation	L	L	L	L
Wildlife	L	L	L	L
Fish	L	L	L	L
Air quality	L	L	L	L
Archaeology and heritage	L	L	L	L
Land use	L	L	L	L
Noise, vibration, and lighting	L	L	L	L
Traffic	L	L	L	L
Human health	L	L	L	L
Visual aesthetics	L	L	L	L

S =	Significant	The identified effect would have characteristics that render it unacceptable to the public, regulators, other interests, or that exceeds standards or contravenes legal requirements.
L =	Less than significant	Effects that are not considered significant.
B =	Beneficial	The resource or topic under study would be improved as a result of project effects.
N/A =	Not applicable	

The following points summarize the findings of this EIS.

- Construction of the facility at McLoughlin Point provides opportunities to complete remediation of this site by the CRD.
- For all of the treatment facility sites except Clover Point and Arbutus Road, facility construction will not adversely affect public use of adjacent lands. At Clover Point and Arbutus Road, construction effects on the adjacent park can be mitigated to less than significant levels.
- Odour effects at the facilities can be mitigated to less than significant levels through implementation of advanced odour treatment technology, frequent maintenance and use of redundant systems and backup power supplies.
- Construction of the McLoughlin Point facility will result in significant traffic effects on local roads, primarily during removal of excavated rock and delivery of concrete. Implementation of transportation management plans, including consideration of use of barges, for these activities can mitigate the traffic impacts to less than significant levels.
- High quality design, finish and landscaping of the facilities can mitigate visual aesthetic impacts to less than significant levels.
- Effects on archaeological features are expected to be less than significant at all CAWTP facility sites.
- Rezoning is required for a wastewater treatment facility at the McLoughlin Point site. The Clover Point facility will need to comply with land tenure requirements for the site. The facilities at the other sites comply with plans and bylaws. The land use effects of the facilities are less than significant.

- Few vegetation or wildlife impacts will result from facility construction or operation at the McLoughlin Point, Clover Point, Macaulay Point and Craigflower sites. The vegetation impacts at Arbutus Road can be reduced to less than significant by enhanced mitigation measures.

- Soils, hydrology and other geotechnical effects are less than significant in most cases. At the McLoughlin Point site, ground water quality may be improved with site redevelopment where water quality could be improved with site redevelopment constituting a beneficial effect.

- Installing ancillary pipes along Dallas Road is likely to result in significant traffic and land use disruptions. The Dallas Road route could encounter archaeological features. Scheduling construction to avoid peak tourist traffic periods would reduce impacts to less than significant levels.

- Operation of the facilities will generate low volumes of traffic, resulting in less than significant impacts. Construction traffic will require careful management to avoid significant traffic impacts at each of the sites.

- Potential project nuisance effects (noise, vibration and lighting) and human health effects can be mitigated to less than significant levels at the facilities.

- The proposed CAWTP facilities are mostly on land that has been previously developed for other urban uses, and less than 1 ha of “greenfield” land will be affected. The contribution of the wastewater project facilities to the cumulative effects of developments in the region on the environment, on land use and on communities is considered less than significant. However, careful planning will be needed to avoid significant cumulative effects of the projects on local traffic and roads.

The EIS commits the CRD to take a variety of actions specified in the report. These actions will mitigate the impacts identified in the EIS.

Environmental and community impacts resulting from construction and operation of treatment and ancillary facilities can be effectively mitigated. The nature of the impacts and recommended mitigation measures are described in the EIS. The impacts of building and operating wastewater treatment facilities need to be considered in the context of the substantial improvements in the quality of effluent released into the marine environment by the CRD’s wastewater facilities.

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1.0 INTRODUCTION

The Capital Regional District (CRD) has prepared an Environmental Impact Study (EIS) for the proposed Core Area Wastewater Treatment Program: Terrestrial Environment.

The purpose of the EIS is to:

- describe the locations and types of wastewater treatment facilities;
- assess the potential environmental effects of facility construction and operation;
- recommend mitigation measures to avoid or reduce project effects; and
- comply with *Municipal Wastewater Regulation* and Ministry of Environment requirements.

An EIS is required by the Ministry of Environment as part of the Liquid Waste Management Plan amendment process. The EIS is to assess the entire Core Area Wastewater Treatment Program, and needs to examine both the marine and terrestrial environments. This report presents Volume I of the EIS for the terrestrial environment for the CAWTP facilities. A separate EIS (Volume II) will be completed for the proposed biosolids facility located at the Hartland site. The CRD's EIS for the marine environment will be presented in a separate Stage II EIS.

The CAWTP facilities will include:

- the upgraded Macaulay and Clover Point facilities, which will screen, remove grit and pump the wastewater to the new McLoughlin Point facility;
- the McLoughlin Point facility, which will treat and discharge the liquid effluent, and provide opportunities for effluent heat recovery;
- the new Arbutus Road attenuation tank;
- the new Craigflower pump station;
- the ancillary facilities, primarily pipes to convey wastewater between the facilities and the new outfall to be constructed at McLoughlin Point; and
- sludge conveyance to the Hartland site, and the new biosolids treatment facility at the Hartland site.

1.1 Report Contents

A summary of the EIS findings are presented at the beginning of this report. This section, Section 1, presents a brief introduction to the report. Section 2 describes the process used to select facility sites and conveyance routes, public involvement in site selection, and resource recovery and conservation. Section 3 presents the project description for the CAWTP facilities. Section 4 describes the study methods used to assess project effects. Section 5 describes the site conditions, potential project effects, and proposes mitigation measures to reduce or avoid adverse effects. Section 6 presents the cumulative effects assessment. Section 7 confirms the CRD's commitment to implement the identified mitigation measures. Section 8 describes the expertise of the preparers of the report. Section 9 lists the references used in the study.

The study topics of this EIS have been reviewed and approved by the Ministry of Environment as compliant with the *Municipal Wastewater Regulation*.

2.0 SITE SELECTION

Since 2007, CRD consultants have conducted siting studies for wastewater treatment facilities in the core area of the CRD. *The Path Forward* report was completed in June, 2007 and identified six potential areas for wastewater treatment facilities as well as a biosolids site. In 2008, the conceptual planning phase of wastewater treatment was updated and resource recovery methods were investigated.

A study completed in March 2009 investigated land suitability in James Bay and South Esquimalt (Westland 2009a), and another study, completed in September, reviewed land near the Victoria Harbour (Westland 2009b) and involved collecting and analyzing geotechnical, ecological, archaeology, heritage and land use information. These topics were studied as they relate to the technical aspects of facility operation, cost, energy consumption, resource recovery, effluent discharge and effect on adjacent neighbourhoods.

Additional studies were completed in 2010 and investigated proposed wastewater treatment facility and ancillary facilities on the West Shore. The other study, completed in September 2010, investigated locations for underground wastewater attenuation tanks in Saanich East-North Oak Bay by analyzing land suitability. The Arbutus Road site was selected as the preferred location for the tanks.

The following criteria were applied during the identification of candidate sites for wastewater treatment facilities:

- archaeological and heritage features are avoided;
- existing and planned land uses are compatible with wastewater treatment;
- surficial material, seismic and liquefaction risk, and site drainage and stability are suitable for facility construction and operation;
- gravity rather than pumps can be used to transport effluent, thereby conserving energy and improving reliability;
- adverse effects on sensitive or important habitat are avoided;
- reclaimed water and recovered energy can be used nearby;
- parcel size is adequate for a facility to serve treatment needs to 2065;
- housing, institutional structures, and school playgrounds are avoided; and
- sites that would entail excessive capital or operating costs are avoided.

After review of alternative technologies and facility sites by the Technical and Community Advisory Committee (TCAC), a committee of municipal engineers, representatives of major institutions, and the public, and consideration by the CALWMC, the present facility configuration was confirmed.

Liquid Waste Management Plan (LWMP) amendment #8 calls for new facilities in Saanich East, Hartland North and McLoughlin Point. The existing pump stations at Macaulay Point and Clover Point will be upgraded and expanded to include removal of grit from the waste system. The aging Craigflower pump station will be replaced by a new facility nearby, and underground tanks to attenuate high wastewater flows will be installed at Arbutus Road. Solids removed at the McLoughlin facility will be pumped to digesters to be processed into biosolids. To ensure that all the sites included in the LWMP amendment receive an environmental review, this EIS examines the facilities at Clover Point, Macaulay Point, McLoughlin Point, Craigflower, Arbutus Road and their associated ancillary facilities.

2.1 Public Involvement

A comprehensive public consultation process is a requirement of the British Columbia *Municipal Wastewater Regulation* for developing liquid waste management plans. The CRD Directors also emphasized the importance of public input to the wastewater management program.

The CRD has been conducting a public involvement program specific to wastewater management since 2006. The CRD created videos, media kits, newsletters, website updates and mall displays and used paid advertising to inform the public and receive input on how the plan should move forward.

The CRD received significant input from the public on the proposed wastewater facilities' configuration and associated issues. Most notably, the CRD requested and received input from the public on the weighting that should be used for the triple-bottom-line analyses of potential facility sites. The public indicated their preference for a weighting that scored environmental, economic and social criteria equally. The Core Area Liquid Waste Management Committee endorsed this approach, and it was used during the planning phases to analyze, recommend and select the overall preferred system configuration and sites for the Core Area Wastewater Treatment Program.

A four pillar approach was developed for the public consultation program for the planning of the core area liquid waste management program. The four pillars consisted of:

1. Educational and information: distribution of education materials and hosting open houses.
2. Community dialogues: opportunities for the community to develop their triple bottom line principles through community discussions.
3. Community validations: reporting back to the community.
4. Neighbourhood based workshops: engage residents in interactive workshops, specifically focused on the facility site process and mitigation, design and fit for a facility.

The CRD received feedback throughout the various stages of the consultation process via surveys, emails and letters and through participation in workshops and meetings. The public consultation process has allowed CRD staff to gain an understanding of communities and to respond to concerns. The CRD is cognisant of the public's desire to be included in the wastewater treatment program decision process. The public consultation program has enabled public participation in the planning phase of the project and will support ongoing information sharing during the implementation phase.

The Seaterra Program is now in the implementation and construction phase of the program. The major siting decisions have been made and communication during this phase is focused on affected neighbourhoods to inform and engage local residents on the planned facilities. The opportunities for consultation during this phase of the Program will come in the form of construction and impact reduction measures around noise, safety, air quality, traffic etc. In addition, there will be an opportunity for consultation during the design phase of the major infrastructure projects as is the case with the Design Guidelines for the Treatment Plant at McLoughlin Point.

Comments and concerns about the Seaterra Program have been documented in consultation feedback forms and reports and continue to be addressed by Seaterra staff.

CRD staff will continue to correspond with municipalities regarding the planned program activities. The governance structure of the CRD allows municipal representatives to engage directly in discussions with wastewater program staff. CRD staff also meets with municipal staff and Councils on matters associated with specific facilities or sites. The Seaterra Program will continue to provide information sharing opportunities for communities impacted by the construction of Seaterra Program facilities.

The project website (https://www.crd.bc.ca/seaterra-program) will continue to provide project information. The CRD intends to maintain and revise the website to contain more specific information about procurement, design and construction. The CRD will continue to respond to requests for information received from the public.

TABLE 10

PUBLIC CONSULTATION ACTIVITIES TO-DATE

Communication Type	Description
2006	
Public, stakeholder and public consultation meetings with project director, Core Area Wastewater Treatment Program	• Saanich Council • Public sewage forums conducted in Victoria, Esquimalt and Colwood
2007	
Public, stakeholder and public consultation meetings with project director, Core Area Wastewater Treatment Program	• Telephone survey of public opinion about wastewater and wastewater treatment • Consulting Engineers of British Columbia, Vancouver Island Chapter • Radio show and wastewater information session held for residents of Saanich • Information session held in Colwood • Saanich Agricultural Commission • Cadboro Bay Residents' Association (Monthly Executive Board) • Esquimalt Council • CFAX Radio (with Alan Lowe) • Cadboro Bay Residents Association (meeting with President and small group of members) • Cadboro Bay Residents' Association (Annual General Meeting) • Willis Point Community Association • Esquimalt Council • View Royal Council • Langford Council • Rotary Club of Saanich • Oak Bay Council • Victoria A.M. Association • Victoria Men's Garden Club • Esquimalt Committee of the Whole
2008	
Open houses	• Paid advertisements promoted open houses • Information was provided to residents; questions were answered and input was received • Information on the project background and details were displayed on boards at open houses • Looped video and PowerPoint presentations were shown at open houses, describing project background and next steps • A booklet newsletter was distributed at open houses, containing information on project history, background and next steps • Feedback forms were used to gather public response onsite at open houses
Public and stakeholder meetings	• 13 meetings between October 27 to February 21
Newsletter	• Produced on a regular basis and distributed to individual households
Website	• Launched wastewater Made Clear website: http://www.wastewatermadeclear.ca/
Media communication	• Backgrounder (project details, next steps) distributed to media • DVD media kit consisting of: DVD clips, backgrounder, news release and booklet information • Op-eds in local newspapers (editorial on project status) • News releases (background on consultation process, project siting details) • Media advisories inviting media to open houses

TABLE 10 Cont'd

Communication Type	Description
Public, stakeholder and public consultation meetings with project director, Core Area Wastewater Treatment Program	• Maritime Awards Society of Canada Public Forum, University of Victoria, regarding "Victoria's Wastewater: Land-Based Treatment or Ocean-Based Treatment or Something Better" • Esquimalt Residents Association Forum • James Bay New Horizons • Engineering Institute of Canada, Victoria Chapter • Cadboro Bay Residents' Association (Annual General Meeting) • Fairfield Community Association Forum • Cadboro Bay Sewage Treatment Forum • Oak Bay Municipality presentation on Uplands Combined Sewers and CRD Sewer Capacity • Golden Rod & Reel Club • Earth Tech – Project update • BC Sustainable Energy Association • San Juan Council USA (with Esquimalt Mayor Christopher Clements) • Central Saanich Council
2009	
Public and stakeholder meetings	• 15 meetings between January 26 and May 21
Community dialog sessions	• Five sessions in April to receive input from communities on values for decision making (Westshore, Oak Bay, Esquimalt, Victoria, and Saanich)
Community validation sessions	• Three sessions in May reporting back to the public on decision making values (Victoria, Westshore, and Saanich)
Open houses	• Three sessions in June and July in Arbutus Road-North Oak Bay to discuss siting options • Two sessions in October in Esquimalt-Victoria to discuss siting options
Public education campaign	• Paid media: advertisements, newsletters, website and DVD • Earned media: op-eds, response letters, drop-in articles and media releases
Speakers symposium	• Focus on wastewater made clear (ongoing throughout 2009)
Site tours of existing facilities	• Focus on wastewater made clear (ongoing throughout 2009)
Public, stakeholder and public consultation meetings with project director, Core Area Wastewater Treatment Program	• Esquimalt Council • Cadboro Bay Residents Association • Greater Victoria Harbours Association • Water Watch Forum • Province of BC Staff Environment Committee • Greater Victoria Harbour Authority • Cadboro Bay Residents Association • Victoria High School Grade 12 Class • District of Saanich Environment Committee • Cadboro Bay Residents Association • Council Meeting, Oak Bay • Council Meeting, Esquimalt • Committee of the Whole Meeting, City of Victoria
Public consultation and engagement sessions	• Community Dialogue Sessions – West Shore – Oak Bay – Esquimalt – Victoria – Saanich • Community Validation – Triple Bottom Line – Victoria – Langford – Saanich • Six siting meetings in Saanich East/North Oak Bay • Open House to examine treatment facility configuration options – Esquimalt – Victoria

TABLE 10 Cont'd

Communication Type	Description
2010	
Public consultation and engagement sessions	• Held in January regarding the McLoughlin Point option • Procurement Open House • Special Core Area Liquid Waste Management Committee meeting for public delegations re: procurement • Saanich East/North Oak Bay Open House on proposed treatment facility • Saanich East/North Oak Bay – Neighbourhood Validation • Esquimalt Open House – McLoughlin Point Option
Neighbourhood validation sessions	• Sessions in May in Saanich East about potential site adjustment
Open houses	• Two open houses for Westshore residents in January regarding a proposed treatment plant at 3300 Wishart Road • Two open houses in February for all Core Area residents regarding procurement options for wastewater treatment • One open house in April for Saanich East residents regarding a possible site adjustment • Two open houses in July for Esquimalt residents regarding the McLoughlin Point wastewater treatment facility • Paid advertisements promoted open houses • Information on the project background and details were displayed on boards at open houses • Looped video and PowerPoint presentations were shown at open houses, describing project background and next steps • A booklet newsletter was distributed at open houses, containing information on history, background, and next steps
Community meetings	• Meetings were held in February and March, inviting the public to speak to the Core Area Liquid Waste Management Committee
Website	• Updates to Wastewater Made Clear website: http://www.wastewatermadeclear.ca/
Media communication	• Backgrounder (project details, next steps) distributed to media • DVD media kit consisting of: DVD clips, backgrounder, news release, booklet information • Op-eds (editorial on project status) • News releases (background on consultation process, project siting details) • Media advisories inviting media to open houses
2012	
Meetings with project director, Core Area Wastewater Treatment Program	• Cost Allocation update to Township of Esquimalt • Tour of McLoughlin Point site with Township of Esquimalt Planner, Chief Administrative Officer and Engineer • Core Area Wastewater Treatment Program update – Dale Gann, Conservative candidate, by-election • View Royal Chief Administrative Officer and Engineer – Craigflower Pump Station • Core Area Wastewater Treatment Program update for Green Party • Core Area Wastewater Treatment Program update for NDP MLA's • Conference call with Infrastructure Canada regarding Environmental Assessments • Meeting with federal agency representatives and Ministry of Environment staff regarding Environmental Assessment
2013	
Public community meetings	• Fairfield and Gonzales Community meeting (October) • James Bay Community meeting (October) • RRC information sheet mailed to Willis Point, Prospect Lake and Highlands residents • Willis Point information meeting (December) • Prospect Lake information meeting (December) • Highlands information meeting (December) • Clover Point Rezoning CALUC Meeting (December) • Clover Projects Information Sheet shared at CALUC meeting

TABLE 10 Cont'd

Communication Type	Description
Open houses	• Two open houses on the Arbutus Road Attenuation tank (February) • Open House on Craigflower Pump Station Upgrade (February) w/ display boards and information sheets • Open house about the design of the treatment plant at McLoughlin Point (April) in Esquimalt • Two Design Charette meetings on the Treatment Plant at McLoughlin Point (April) in Esquimalt • Open house regarding the rezoning of McLoughlin Point (May) w/display boards and information sheets • Eight open houses regarding the location of the Resource Recovery Centre across the CRD (June) w/display boards, information sheet and online/paper feedback survey
Public hearing	• Esquimalt Public Hearing re: rezoning McLoughlin Point (July) with presentation by Seaterra Program staff
Community association and stakeholder meetings	• Meeting with View Royal Committee of the Whole about the Environmental • Development Permit Application for Craigflower Pump Station (April) • Esquimalt Chamber of Commerce (May) • Lyall Street Action Committee (June) • West Bay Residents Association (June) • Prospect Lake District Community Association (October) • Highlands District Community Association (October) • Willis Point Community Association (October) • First Nations Project Blessing Ceremony (September) • Highlands Council Committee of the Whole (December)
Website	• Seaterra Program website re-launch and regular updates
Media communication	• Media advisories inviting media to RRC open houses (June/July) • Advertising inviting public to RRC open houses (June/July) • Advertising inviting public to McLoughlin rezoning open houses (April) • News releases (background on consultation process, project siting details) • Editorial meetings (introduce Commission Chair and Program Director, rename Seaterra Program) • Backgrounders (Commission backgrounder, facility information)
2014	
Open houses	• Open House for the Fairfield Gonzales and James Bay communities regarding the Clover Pump Station and Conveyance Pipe (January) w/display boards, information sheets and feedback forms • Information sheets mailed to Fairfield and James Bay residents • Two open houses regarding the rezoning of McLoughlin Point (February) w/display boards and information sheets • Information sheets on McLoughlin Point rezoning mailed to all Esquimalt residents
Public hearing	• Esquimalt Public Hearings for McLoughlin Point rezoning (February and March)
Site tours	• Boat Tour of McLoughlin Point (February)
Website	• Regular updates to Seaterra Program website
Media communication	• Op-eds (editorial on project status) • Advertising inviting public to Clover Project open house (January) • Advertising inviting public to McLoughlin Point rezoning open houses (February) • News releases (background on consultation process, project siting details) • Editorial meetings (project updates and facility information) • Backgrounders (project updates and facility information)

TABLE 10 Cont'd

Communication Type	Description
Community association and stakeholder meetings	• DND Seaterra Update (January) • Highlands Council Committee of the Whole (January) • Esquimalt Planning Committee (January) • Prospect Lake information meeting (February) • Greater Victoria Chamber of Commerce (February) • Willis Point information meeting (March) • Esquimalt/Vic West Community Associations (March) • Saanich Community Associations (March) • James Bay New Horizons Forum (March) • Victoria Matters – Wastewater Treatment (April)

2.2 First Nations Engagement

The CRD understands that although the duty to consult with First Nations lies with the Crown, certain aspects of the consultative process may be delegated to the CRD. The CRD retained the services of a senior official from the province with a strong background in Aboriginal relations to help work with First Nations on these issues. The CRD has entered into tripartite Memorandums of Understanding with the Songhees, Esquimalt and Beecher Bay First Nations and the Province. The CRD has conducted engagement with the following First Nations:

- Songhees First Nation;
- Beecher Bay First Nation;
- Esquimalt First Nation;
- Tsawout First Nation;
- Tseycum First Nation;
- Tsartlip First Nation; and
- Pauquachin First Nation.

All of the Aboriginal groups with potential interest in the Project area are signatory tribes in the Douglas treaties, which were negotiated between 1850 and 1854. Through the treaty process, signatories and their descendents retained rights for the continued use of village sites and reserve land, as well as the ability to hunt and harvest resources on unoccupied lands in their traditional territories. The approach and content of the Douglas treaties have consistently been upheld by law (Government of BC 2012).

The CRD provided project information to the aforementioned potentially affected First Nations. Provincial officials have advised that consultation is not necessary with the Tseycum, Tsartlip and Pauquachin Nations, because there is no apparent project effect on their treaty rights or other interests.

The Songhees, Esquimalt and Beecher Bay First Nations have continued to participate in preparation of the wastewater management program.

The CRD continues to communicate with the First Nations that are engaged and interested in the wastewater management program. Meetings are scheduled to provide updates at appropriate intervals as the program moves into the detailed design, procurement and construction stages. First Nation members are involved in archaeological field studies conducted as part of the program. The CRD is prepared to respond to questions or requests for information from First Nations.

2.3 Resource Recovery and Conservation

Resource recovery and conservation were two of the criteria used in the planning, sitting and design of the CAWTP facilities. The CRD is investigating opportunities to recover heat energy from the treatment facilities to achieve the following CRD goals:

- reduce greenhouse gas emissions and carbon footprint;
- minimize use of electric power;
- recover biomethane for use in the region's natural gas system to improve the CRD's carbon footprint; and
- integrate the project with other programs, such as combining solid waste and fats, oils, and grease into the anaerobic digestion process.

Several resource recovery studies have been conducted to identify locations where opportunities exist to recover heat from the CAWTP facilities (Stantec 2010a,b, Associated Engineering *et al.* 2008). Projected energy demands for 2020 and 2065 for the core municipalities have been used to provide a better understanding of the energy reuse opportunities that may exists in the CRD (Westland 2008a). An environmental analysis has also been conducted to identify Energy Recovery Opportunity Areas (EROAs) which could be used for a potential site location for a heat recovery facility (Westland 2008b). The potential EROAs have been analysed based on surrounding high energy demand, ecology, geology, heritage, land use and the existence of water heating systems.

Energy recovery and other beneficial uses of biosolids have been extensively documented in the CRD's Biosolids Management Plan (Brown and Caldwell, Stantec 2009b). A triple-bottom-line analysis was used to determine the feasibility of implementing the identified technologies in the CRD.

3.0 PROJECT DESCRIPTION

3.1 Overview

In June 2010, the CALWMC chose the McLoughlin Option as the desired system configuration for wastewater treatment in the core area of the Capital Region. In 2010, the CALWMC also approved installing an underground attenuation tank at the Arbutus Road site to attenuate wet weather flows of wastewater.

For the purpose of this report, the McLoughlin Option facilities that will be studied include:

- Macaulay Point and Clover Point pump stations upgrade and grit removal facilities;
- McLoughlin Point liquids wastewater treatment facility (new);
- Arbutus Road attenuation tank (new);
- Craigflower pump station (new); and
- Ancillary (conveyance piping) facilities.

The locations of these facilities are shown in Figure 1. The facilities being studied in this report are key components of the regional system and necessary to meet the objectives of the CRD's Core Area Liquid Waste Management Plan.

The Craigflower pump station is required for pumping wastewater from the western communities to the Macaulay Point facility via the Lang Cove pump station in Esquimalt. Existing Macaulay Point and Clover Point pump stations will continue to provide initial screening of wastewater. Facilities to remove grit removal from the influent will be installed at these pump stations. After the wastewater is screened and the grit is removed at Clover and Macaulay Points, wastewater will be pumped to the McLoughlin Point wastewater treatment facility for secondary treatment.

At Clover Point, flows less than three times the Average Dry Weather Flow (ADWF) will be pumped to McLoughlin Point for treatment. The rare flows exceeding three times ADWF will be screened and discharged via the existing long outfall at Clover Point. Secondary treated effluent from McLoughlin Point will be discharged to the Strait of Juan de Fuca through a new outfall constructed from the McLoughlin Point site to a discharge location near the existing Macaulay Point outfall. Sludge produced during the treatment process will be pumped via pipeline from McLoughlin Point to a biosolids management facility at Hartland North. Table 11 provides a summary of the CAWTP facilities. A schematic diagram of the wastewater treatment process for the CAWTP system is presented in Figure 2.

TABLE 11

SUMMARY OF THE CORE AREA WASTEWATER TREATMENT PROGRAM FACILITIES

Type of Facility	Locations	Facility configurations
Liquids processing	McLoughlin Point	New facility to provide primary and secondary treatment of wastewater.
Pumping, screening and grit removal	Clover Point	New structure including screening, grit removal and pumping. Existing pump station to be maintained for overflow pumping.
	Macaulay Point	New structure including screening, grit removal and pumping. Existing pump station to be maintained for overflow pumping.
Pumping	Craigflower	New pump station facility
Attenuation Tank	Arbutus Road	5,000 m3 underground tank
Conveyance pipes installed in trenches	Currie Road to Clover Point	600 mm to 900 mm forcemain 750 mm and 900 mm gravity sewer 900 mm siphon pipe
	Clover Point to Ogden Point	1,200 mm forcemain
	Macaulay Point to McLoughlin Point	1,500 mm forcemain

TABLE 11 Cont'd

Type of Facility	Locations	Facility configurations
Conveyance pipe installed by horizontal directional drill (HDD) or trenchless methodology	McLoughlin Point outfall	1,800 mm to 2,000 mm outfall into Juan de Fuca Strait (installed beneath seabed to a point below intertidal zone, surface lay thereafter)
	Ogden Point to McLoughlin Point	1,200 mm forcemain
	Craigflower	750 mm gravity sewer 750 mm forcemain

Figure 1 Overview of Core Facilities

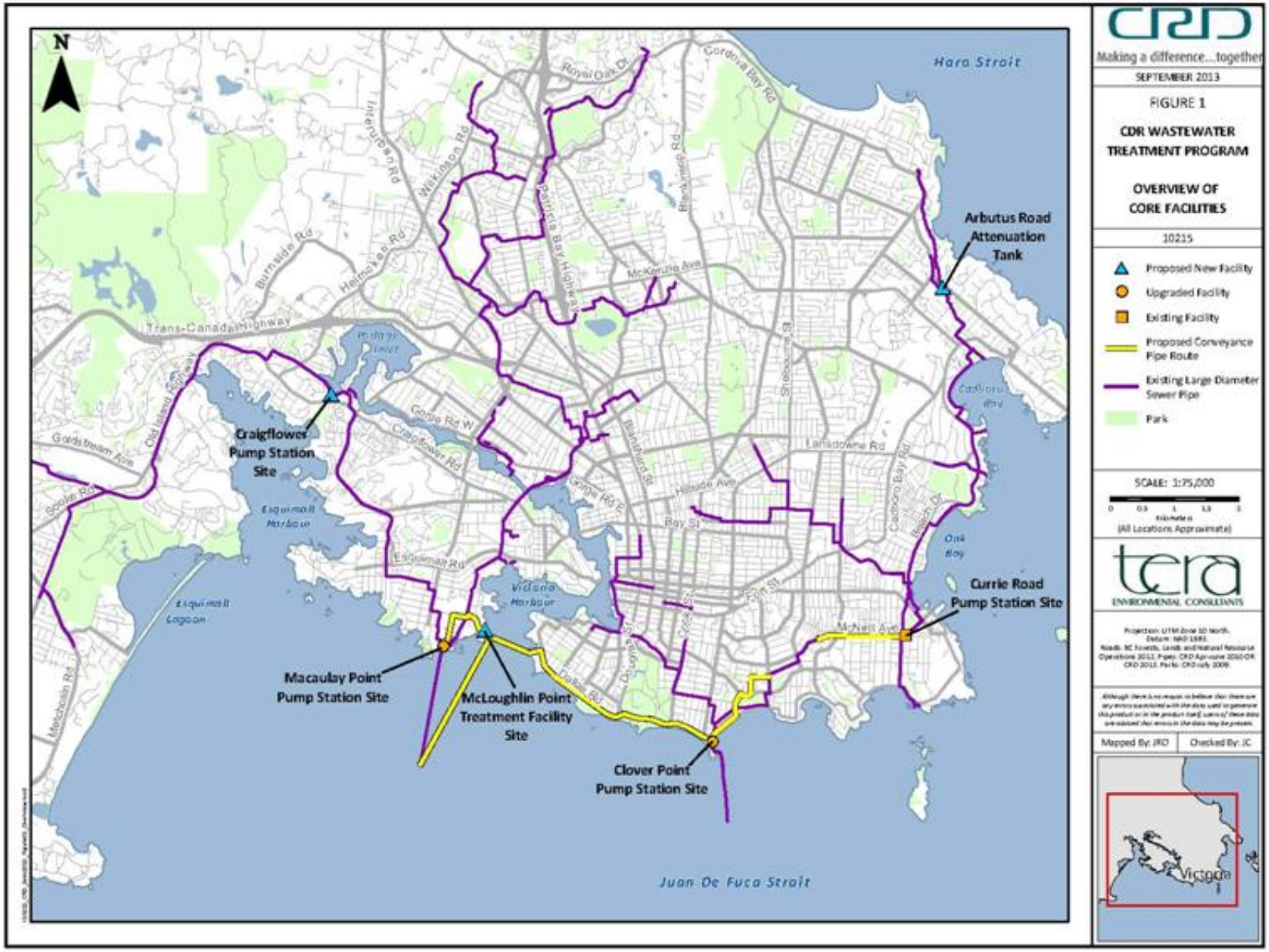
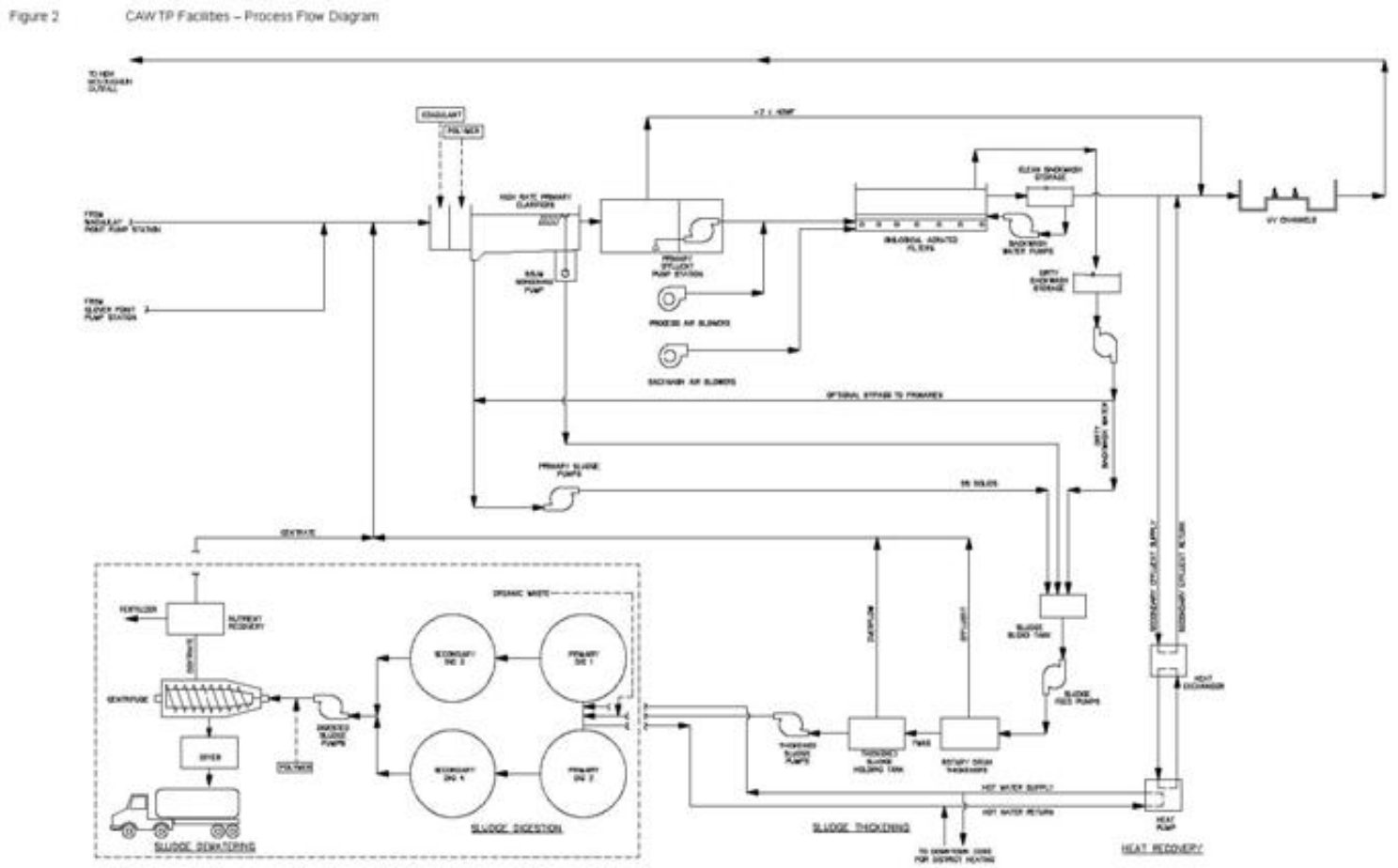


Figure 2 Core Area Wastewater Treatment Program Facilities – Process Flow Diagram



Source: Stantec 2009b

3.2 Core Area Wastewater Treatment Program System Components

3.2.1 Macaulay Point and Clover Point Facilities

3.2.1.1 Facility Site Plan

As part of the Capital Region's Core Area Liquid Waste Management Plan, wastewater from the existing Macaulay Point and Clover Point pump stations will be pumped to a treatment facility at McLoughlin Point (Figure 1). Screens at the Macaulay Point and Clover Point facilities currently remove material larger than 6 mm from the wastewater. Both facilities will continue to perform this function using new 6 mm screens before grit is removed. New grit removal facilities will be added to Clover and Macaulay locations. The screenings and grit will be transported by enclosed truck to Hartland Landfill, which is approximately 17 km northwest of the pump stations. The wastewater will then be pumped to the McLoughlin Point liquids wastewater treatment facility.

An expanded pump station will be constructed at Macaulay Point (Figure 3) to convey the wastewater to the McLoughlin Point liquids wastewater treatment facility. A standby generator also will be added to the Macaulay Point facility. The Clover Point pump station (Figure 4) will be upgraded to include new pumps to convey flows less than three times ADWF to the McLoughlin Point facility. Flows to Clover Point exceeding three times ADWF will be screened before being discharged via the Clover Point outfall.

The existing screening equipment will be maintained for overflows above three times ADWF. However, the screens may require replacement by the time construction of the pump station upgrades is underway. The odour control system at Clover Point has recently been upgraded. Because there will be no change in volume of wastewater being pumped, the current Clover Point odour control system is considered adequate for the foreseeable future.

3.2.2 McLoughlin Point Liquids Wastewater Treatment Facility

3.2.2.1 Facility Site Plan

The proposed McLoughlin Point facility site is located at the southern end of Victoria View Road in Esquimalt, British Columbia (Figure 5). The lands adjacent to the site are federally owned, and controlled by the Department of National Defence (DND). The McLoughlin Point site is currently a decommissioned Imperial Oil tank farm on 1.37 ha (3.46 acres) of freehold property. The facility formerly accommodated 17 fuel tanks that had a maximum storage capacity of 2.5 million litres.

Wastewater received from the Macaulay Point and Clover Point pump stations will undergo secondary treatment at the McLoughlin Point facility. Several buildings will be constructed at the site; including several that will be located partially below ground and some that will extend 5 m to 10 m above grade. The facility will be designed to be attractive, and not to detract from the appearance of the area. The following treatment facilities will be constructed at McLoughlin Point:

- primary clarifiers;
- biological aerated filters (BAF);
- a blower building and an administration building;
- odour control;
- heat recovery facilities;
- sludge pumping;
- standby generators; and
- vehicle access and parking.

Figure 3 Macaulay Point Pump Station Site

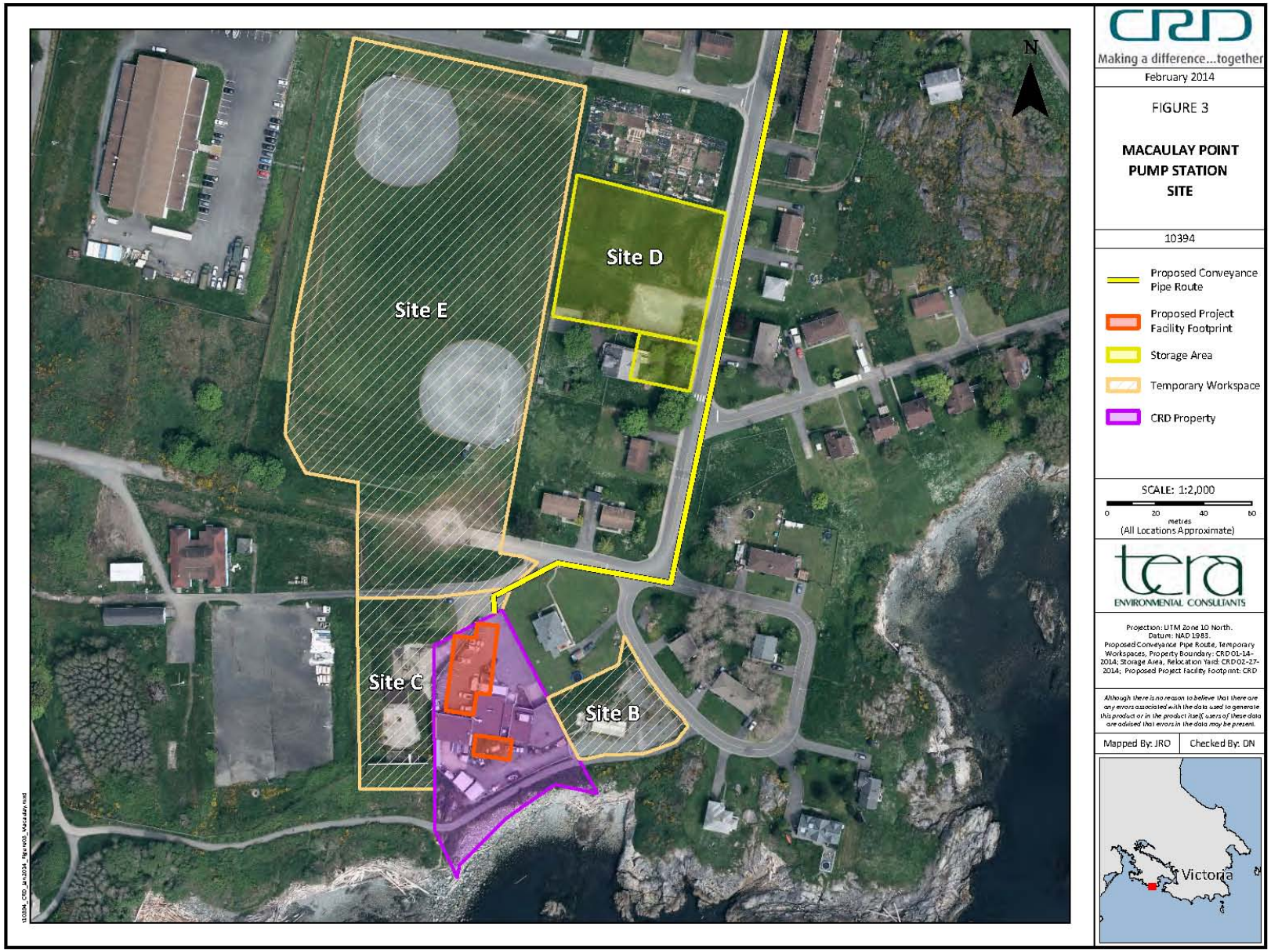
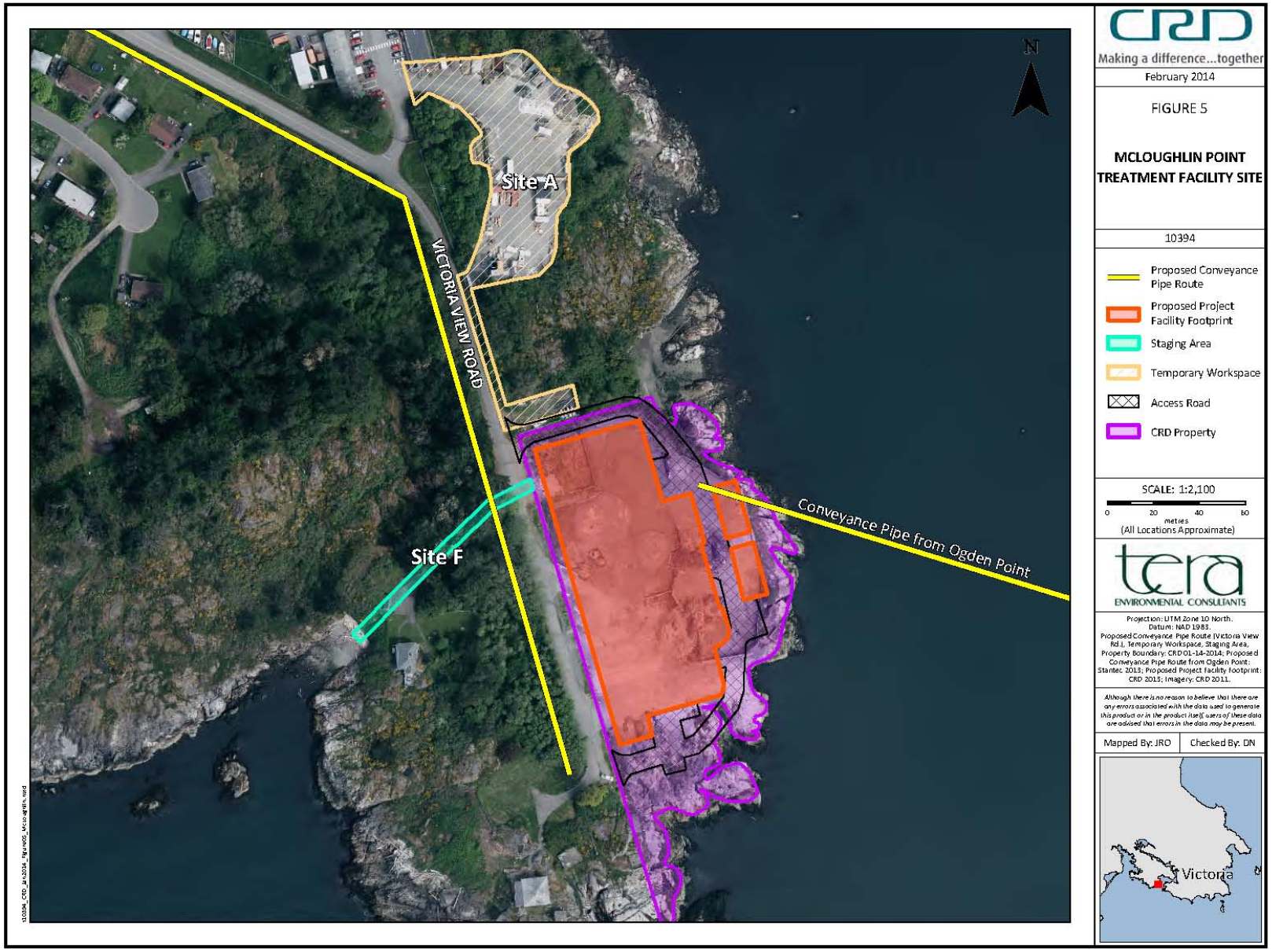


Figure 4 Clover Point Pump Station Site

Figure 5 McLoughlin Point Treatment Facility Site



The equipment and treatment units that will be installed in the McLoughlin Point facility must comply with the process reliability standards set out in the British Columbia *Municipal Wastewater Regulation BC Regulation 87/2012*.

Sludge that is produced during the primary and secondary treatment process will be conveyed to the biosolids management facility. The treated water will be discharged through a new 1,800 mm diameter outfall constructed at McLoughlin Point that will extend 2.1 km into the marine waters of Juan de Fuca Strait.

3.2.2.2 Treatment Characteristics and Design Wastewater Flows

By engineering convention, the McLoughlin Point facility is described by its ADWF capacity of 108 ML/d. In reality, the McLoughlin Point facility is designed to provide secondary treatment for two times ADWF of 216 ML/d and primary treatment for maximum wet weather flows of 380 ML/d. Design wastewater flows for the McLoughlin Point facility are derived from residences, industry, commercial developments, and institutional sources, as well as infiltration and inflow of surface water and ground water into the sanitary sewer systems. Details about hydraulic wastewater flows and the treatment standards for effluent from the McLoughlin Point facility are available in Table 4.5 of the Capital Regional District Core Area Liquid Waste Management Plan - Amendment No. 8 (June 2010).

Wastewater discharge quality must meet the BC *Municipal Wastewater Regulation* and shall not exceed the following concentrations:

- 5-day Biochemical Oxygen Demand: 45 mg/L
- Total Suspended Solids: 45 mg/L

For the portion of average daily flow exceeding two times ADWF, the following standards apply:

- 5-day Biochemical Oxygen Demand: 130 mg/L
- Total Suspended Solids: 130 mg/L

For all flows, pH shall be in the range of 6 to 9 pH units.

The McLoughlin Point facility will be designed to produce effluent that meets the proposed Federal National standards of Carbonaceous Biochemical Oxygen Demand (cBOD) of 25 mg/L and total suspended solids of 25 mg/L based on a monthly average.

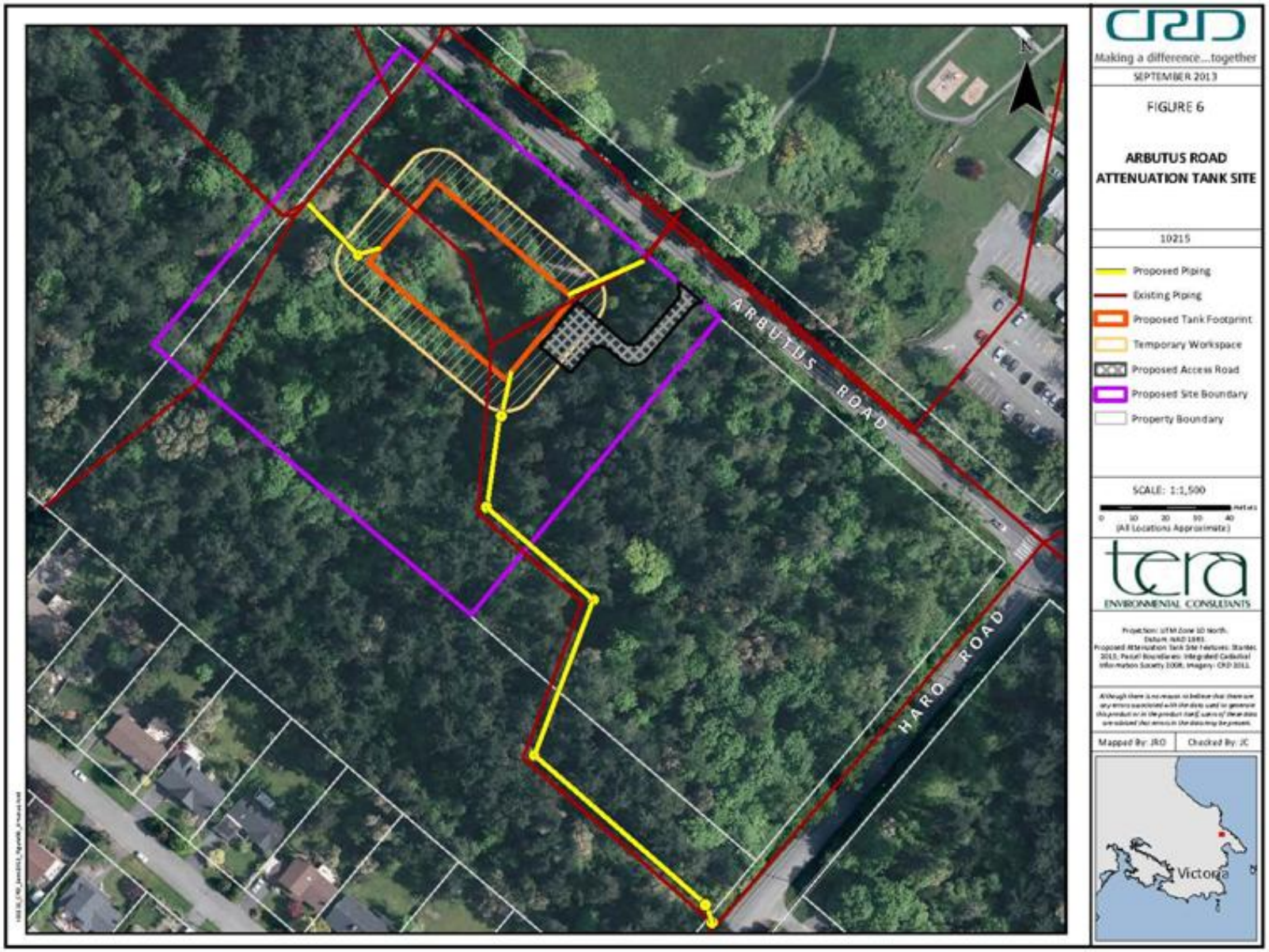
3.2.3 Arbutus Road Attenuation Tank Facility

An underground attenuation tank will be built at Arbutus Road (Figure 6) to temporarily store wastewater flows to prevent downstream overflows for the 1:5 year storm event.

The proposed current design includes the construction a single tank with a volumetric capacity of 5,000 m^3. An area of approximately 35 m by 56 m (1,960 m^2) will be needed to accommodate the proposed tank. The tank will be entirely underground and relatively shallow to take advantage of existing sewer pipe infrastructure to allow the tank to fill and drain without the use of large pumps, thereby minimising energy use and improving reliability of the system.

No above-ground permanent structure will be built on the property. Only surface access hatches, to allow entry into the tank for periodic inspections, and vents will be located on the surface. The vents will extend out of the ground to a maximum of 1.4 m and will be designed to blend with the natural surroundings. The tank will be covered with approximately 1 m of soil and will be replanted with native vegetation. An air treatment system will be installed to mitigate odours. A driveway off of Arbutus Road leading to a small parking area will be required for CRD service vehicles to access the site.

Figure 6 Arbutus Road Attenuation Tank Site



An area directly adjacent to the attenuation tank will be set aside in case there is need for a second tank to be installed in the future. If needed, the future tank would be approximately 56 m by 46 m and have a capacity of 7,000 m^3.

When in operation, stored wastewater will be released when there is adequate capacity in the East Coast Interceptor sewer trunk. After being released into the East Coast Interceptor, wastewater will be pumped through the trunk to Clover Point and then to the McLoughlin Point treatment facility.

3.2.4 Craigflower Pump Station Facility

A new Craigflower pump station is required to replace the existing facility that is aging and under capacity. The proposed Craigflower pump station will be located near the shore of Portage Inlet in the Town of View Royal, north of the Old Island Highway and directly east of the E&N Railway corridor (Figure 7).

The proposed pump station will be constructed on a 0.19 ha parcel of land located approximately 250 m southwest of the existing facility. The new pump station will consist of a building with an above ground height of 7 m and an extensive below grade structure extending 6.5 m below ground level. The underground structure will include a wet well and pump room.

The wet well will consist of a compact self-cleaning trench-style layout. The structure will have the capability to divide into two compartments to allow safe entry by the operator when maintenance is required. Access to the wet well will be through an exterior door (Associated Engineering 2008).

The pump room will house four 250 hp variable speed pumps, pump suction and discharge piping, a discharge header, associated valves, sump pumps and an air compressor (Associated Engineering 2008).

The pump station will be designed to meet current and medium term flow requirements. Provisions for upgrades will allow the pump station to meet long term design flow requirements to 2045. The design flows are:

- Initial, Stage 1: 730 L/s
- Initial, Stage 2: 897 L/s
- Ultimate: 1,991 L/s

The main floor above the wet well and pump will consist of rooms for electrical supply, motors, standby diesel generator, control equipment, a washroom and the activated carbon odour control system.

A double-walled Bioxide^{TM} tank for odour control and double-walled diesel fuel storage tank for a standby diesel generator will be installed outdoors.

3.2.5 Ancillary Facilities

Ancillary facilities are primarily pipes that are used to convey wastewater between pump stations, grit removal facilities and the proposed treatment facility at McLoughlin Point. This section describes the major ancillary facilities and the associated routes between the CAWTP facilities.

3.2.5.1 Clover Point

Installation of conveyance pipes from Currie Road pump station to Clover Point pump station (Figure 8) will occur in two sections. The first section is located in Oak Bay and constitutes a new 650 mm forcemain that will be installed in a trench along McNeill Avenue from the Currie Road pump station west to Foul Bay Road. A 750 mm forcemain will be installed along McNeill from Foul Bay Road to Lawndale Avenue.

Figure 7 Craigflower Pump Station Site

The second section is located in Victoria's Fairfield neighbourhood and involves installation of a 750 mm gravity pipe and a 900 mm siphon pipe that will be installed in a common trench starting at the intersection of St. Charles Street and Chandler Avenue. The pipe route proceeds south along St. Charles for approximately 30 m and then west along Brooke Street to Arnold Avenue. The pipes will then follow Arnold Avenue, Fairfield Road, Memorial Crescent, and Dallas Road to the Clover Point pump station. The depth of the gravity sewer will vary from 2 m to 9 m as the ground elevation rises and falls. The siphon pipe will be buried to a relatively shallow 1 m depth.

Wastewater from the Clover Point pump station will be pumped to the McLoughlin Point facility (Figure 9). The 1,200 mm diameter forcemain from Clover Point to the McLoughlin Point facility will be approximately 5 km long. The pipe will be installed in a trench along Dallas Road or along the south side of the boulevard from Clover Point to Ogden Point. For about 2.8 km, the route will follow a proposed two-way bike path planned by the City of Victoria along the Dallas Road waterfront. Combining the alignments of the conveyance pipes and the proposed bike path provides the opportunity to reduce potential impacts for both projects. The pathway alignment will be finalized by engineering and parks staff following public consultation. From Ogden Point, the forcemain will cross under the entrance of Victoria Harbour to McLoughlin Point (Figure 9) using HDD technology. The 850 m long pipe will be installed at a depth of up to 35 m beneath the sea bed.

3.2.5.2 Macaulay Point to McLoughlin Point

Wastewater from the Macaulay Point pump station will be pumped to the McLoughlin Point facility via a 1,500 mm diameter forcemain installed in a trench along Vaughan Street, Anson Street, Bewdley Avenue, Peters Street and Victoria View Road (Figure 10) for a total length of 1,160 m.

Underground utilities (water, electrical, natural gas) will be installed in a trench from Lyall Street along Peters Street and Victoria View Road to the McLoughlin facility. Above ground BC Hydro powerlines will be required along Peters Street and Victoria View Road to service the McLoughlin Point facility.

3.2.5.3 McLoughlin Point Outfall

A new 1,800 mm to 2,000 mm diameter outfall into the Juan de Fuca Strait will be built from the McLoughlin Point facility. The new outfall and multi-port diffuser will extend 2.1 km to a depth of 60 m below mean low water, near the terminus of the existing Macaulay Point outfall. The initial section of the outfall will be installed by boring or HDD technology to avoid impacts to the intertidal zone. The outfall pipe will be laid on the seabed surface thereafter. Treated wastewater will be discharged uniformly through the diffuser.

Disinfection of the discharged effluent is not required at this time. Provisions will be made to include UV disinfection facilities if disinfection of the discharged secondary treated effluent is required in the future.

3.2.5.4 Arbutus Road

The ancillary conveyance pipes at Arbutus Road will be installed parallel to existing pipes (Figure 6). The new pipes will be installed to update existing wastewater infrastructure, which includes trunks, mains and a metering station. The proposed outlet pipe from the attenuation tank will cross the eastern portion of the property and connect to the existing East Coast Interceptor sewage trunk on Haro Rd.

3.2.5.5 Craigflower

The proposed ancillary facilities for this project include a 750 mm gravity sewer from the existing pump station to the new facility and a 750 mm forcemain that will convey wastewater to the Macaulay Point pump station (Figure 7). The pipes will be aligned adjacent to an existing sewer right-of-way (ROW) along the shoreline of Portage Inlet and will then cross the tidal flats located at the southern extent of Portage Inlet and connect to the new pump station. The pipes will be installed using conventional trench excavation for the terrestrial portion and a trenchless method (pipe jacking) beneath the seabed for the marine crossing of Portage Inlet.

Figure 8 Currie Road to Clover Point Conveyance Pipe Route

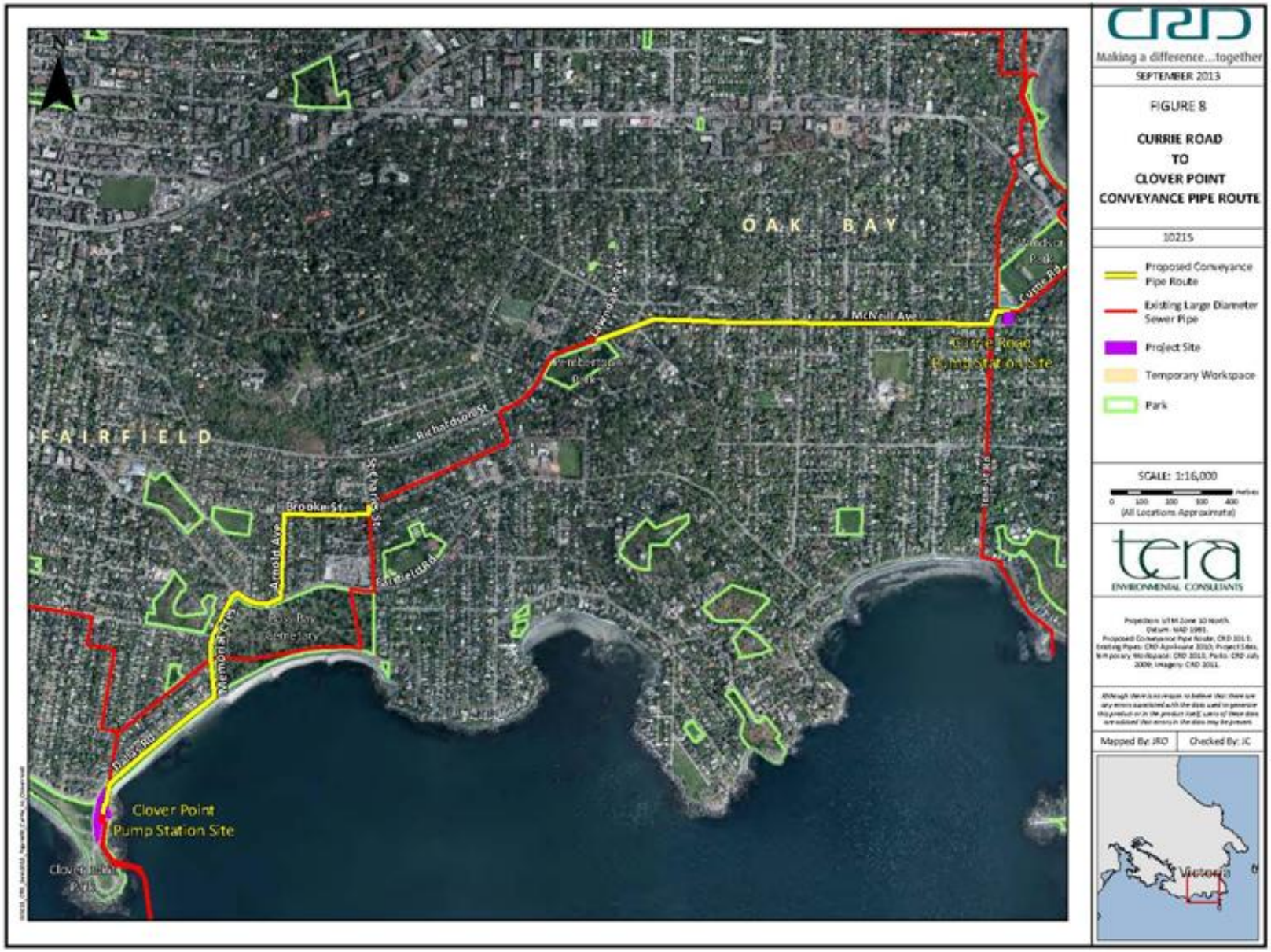


Figure 9 Clover Point to McLoughlin Point Conveyance Pipe Route

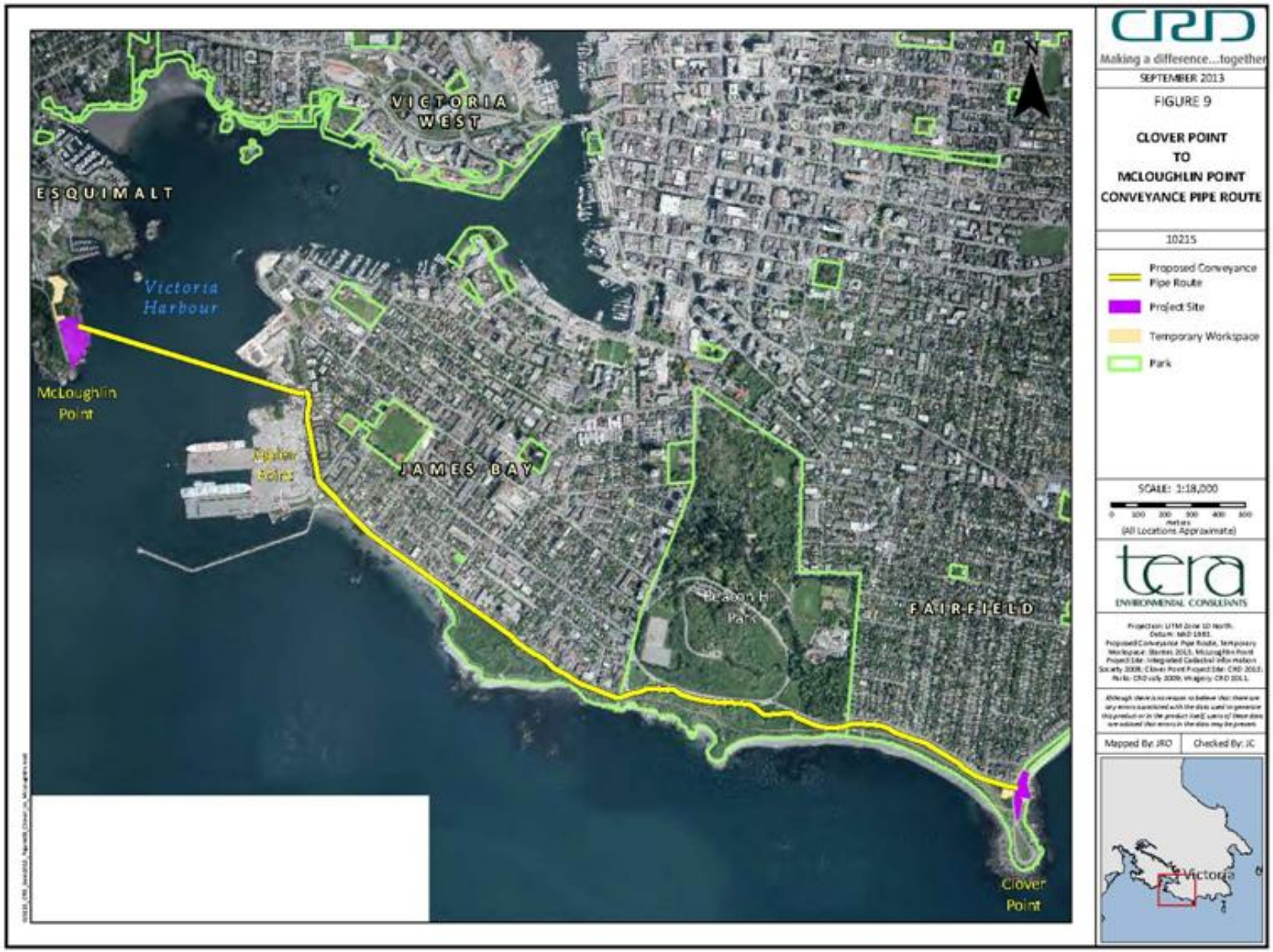
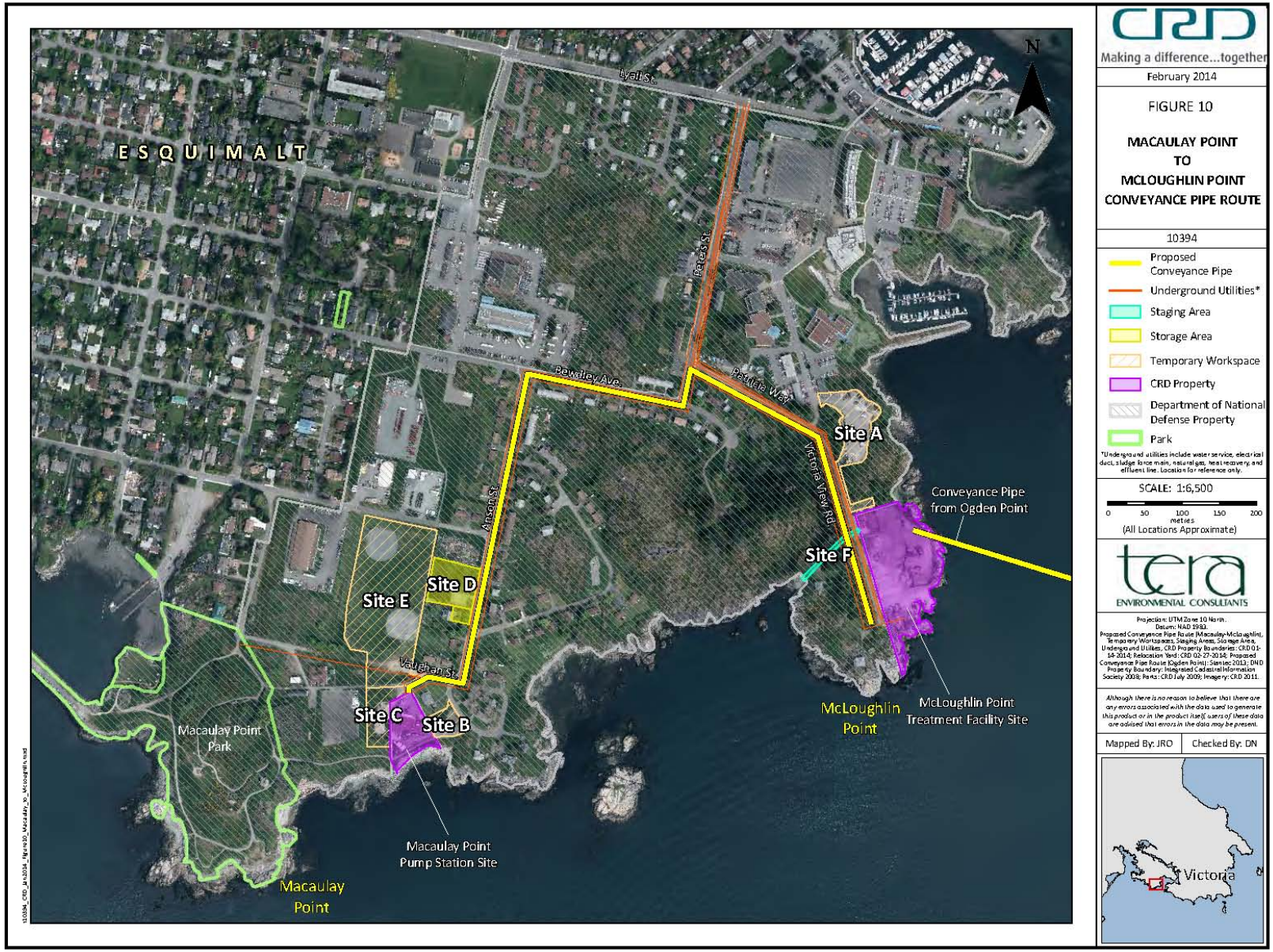


Figure 10 Macaulay Point to McLoughlin Point Conveyance Pipe Route



3.3 Combined Sewer and Sanitary Sewer Overflows

The CRD, in partnership with core area municipalities, will implement an inflow and infiltration (I&I) reduction program as described in Section 5 of Amendment No. 8 of the Core Area Liquid Waste Management Plan. The reduction program will include combined system separation, a private property I&I reduction program, and an overflow reduction plan.

3.4 Implementation of Buffer Zones

Assessment of buffer zones is required under the *Municipal Wastewater Regulation*. The following section presents a discussion of available buffer zones for each facility.

3.4.1 Macaulay Point Facility

The upgrade to the Macaulay Point pump station will extend the facility into the paved parking area at the north of the facility and include new structures within the existing property boundaries. All components in the Macaulay Point upgrades will be enclosed in buildings and include sufficient noise and odour controls to reduce or avoid nuisance effects at the property line. A public walkway and the Strait of Juan de Fuca border the site to the south. No change in adjacent DND land uses will occur and no buffer zones are considered necessary.

3.4.2 Clover Point Facility

The Clover Point facility will be expanded to the north of the existing pump station on a grassy slope in Clover Point Park. Ross Bay borders the site to the east. No changes in adjacent land uses (park, road, and residential) area anticipated. The new structures will be entirely underground, and no additional buffer zone will be required.

3.4.3 McLoughlin Point Facility

The McLoughlin Point facility is located on private property adjacent to DND land approximately 70 m east of the nearest residence on Victoria Road. No change in adjacent land uses will occur. Victoria Harbour borders the site to the east and south. The treatment facilities will be designed to be suitable in a waterfront urban setting. The treatment processing equipment will be enclosed in buildings and the facility will be fenced and landscaped. Controls will be installed to ensure acceptable odour and noise levels at the property line. With these measures in place, no additional buffer zones will be required.

3.4.4 Arbutus Road Facility

The Arbutus Road attenuation tank facility is located in the District of Saanich on forested property in a residential and institutional area. The site is bordered by three wooded areas that are being rezoned from residential to park (see Section 5.9.1.4.) To the south of the CRD site is a wooded area owned by the University of Victoria. To the east and west, the property is owned by the District of Saanich. To the north of the site is property owned by the Queen Alexandra Foundation for Children, which includes the G. R. Pearkes Child Care Centre building, approximately 80 m from the facility's property boundary. Except for entry hatches and vents, the entire attenuation tank will be located underground. Controls will be used to minimize noise and odours. With these measures in place, no additional buffer zone will be required.

3.4.5 Craigflower Facility

The pump station will be designed to be compatible with a suburban residential neighbourhood. Much of the facility will be constructed in a building or underground. The site is bordered by the Old Island Highway, the E&N Railway and Portage Inlet. Controls will be installed to ensure acceptable odour and noise levels at the boundary line. With these measures in place, no buffer zones will be required.

3.4.6 Ancillary Facilities

Most of the conveyance pipelines will be installed in a trench along roadways or beneath the bed of Victoria Harbour or Portage Inlet. As all these ancillary facilities are located underground, no additional buffer zone will be required.

3.5 Provisions for Controlling Adjacent Development

The CAWTP facilities will be designed to minimize adverse effects on nearby properties. The development of adjacent properties is managed by zoning, subdivision, and other development controls available to the Township of Esquimalt and the DND for the McLoughlin Point facility and Macaulay Point facility. The City of Victoria controls development activities surrounding the Clover Point facility, the District of Saanich controls the zoning surround the Arbutus Road site, and the District of View Royal controls development near the Craigflower Pump Station. A rigorous technical review and public involvement process accompanies applications for rezoning or Official Community Plan (OCP) amendments. With these land use management processes in place, no additional provisions for controlling adjacent development are considered necessary.

3.6 Operation of the Wastewater Processing System

Operational activities include routine maintenance of the wastewater processing system. This section describes the facilities' operational activities and associated transportation and traffic, noise and odour generation, and electricity consumption.

3.6.1 Operational Traffic

3.6.1.1 Screenings and Grit Removal

Less than 1.5 m^3 per day of grit and other screenings will be removed from each of the two upgraded pump station facilities (Clover Point and Macaulay Point). One truck will be required every five to six days for each pump station to transport screenings and grit to the Hartland Landfill.

3.6.1.2 Chemicals

Chemicals used in the wastewater treatment process at the McLoughlin Point facility will be largely inorganic materials such as polymers, caustics, coagulant chemical agents (alum, polymer), or compounds (mild acids and caustics) for cleaning treatment media. These chemicals will be delivered once per month in small to medium sized shipments (10 to 20 m^3) and stored at the McLoughlin Point facility in secured tanks with containment features.

An estimated 70 to 80 mg/L of alum (aluminum sulfate) will be needed for chemically assisted primary treatment, requiring approximately 10 trucks per year (22,000 L per truck). Alum will be stored in bulk storage tanks with suitable containment sumps. Alum will only be used during wet weather flow conditions (anticipated to occur during five months of the year).

Odour control at the Craigflower pump station will involve the use of bioxide for removal of hydrogen sulphide from the waste stream. The facilities at Clover Point and Macaulay Point may use odour control chemicals. These chemicals will be delivered as needed and will not be stored on-site.

Disinfection of the discharged effluent is not required at this time; however there is provision for UV disinfection in the future. Chlorine will only be used to disinfect treated effluent that will be reused for rinsing and cleaning tanks. The rinse water will be treated again to remove the chlorine and other materials before it is discharged through the outfall.

3.6.1.3 Maintenance of facility equipment

Maintaining and servicing the core wastewater treatment facilities equipment will include daily site visits and annual cleaning. CRD staff will visit the Macaulay Point, Clover Point and Craigflower facilities to complete regular maintenance. Table 12 summarizes the estimated operational traffic for each facility. Table 13 presents the starting and destination points for operational truck traffic.

TABLE 12

OPERATIONAL TRAFFIC ESTIMATES

Material	Macaulay Point	Clover Point	McLoughlin Point	Arbutus Road	Craigflower
Screenings and grits transferred to the Hartland North site	1 per 5 to 6 days	1 per 5 to 6 days	0	0	0
Alum delivery	0	0	2 per month	0	0
Bioxide delivery	0	0	0	0	3 - 4 per year
Polymer delivery	0	0	1 per month	0	0
Staff and maintenance traffic	2 per day	2 per day	12 per day	1 per month	2 - 3 per week

Note: At Clover Point and Macaulay Point pump stations, grit will be removed from influent by vortex chambers in the headworks, and screenings removed by the 6 mm screens before pumping to McLoughlin Point for treatment. The frequency of chemical delivery is based on one-month storage capacity being provided on-site. Smaller storage capacity will result in more truck traffic.

TABLE 13

OPERATIONAL TRUCK TRAFFIC STARTING POINTS AND DESTINATIONS

Material Transported	Starting Points	Destinations
Chemicals	Swartz Bay ferry terminal	All sites
Screenings	Macaulay Point site, Clover Point site	Hartland Landfill

3.6.2 Energy Use for Sewer and Outfall Connections

This section provides estimates of energy use for the specified treatment functions.

3.6.2.1 Inflow Connection to Wastewater Treatment Facility

Pumping wastewater from the western communities to McLoughlin Point will require the Craigflower pump station to use 400,000 kWhr of electricity per year. Wastewater from the Macaulay Point facility will be pumped to the McLoughlin Point facility through a 1,500 mm diameter forcemain, using 1,679,000 kWhr per year. The Arbutus Road tank can be filled and emptied using the force of gravity, so the amount of energy required to pump wastewater from the attenuation tank into the East Coast Interceptor will be negligible. Wastewater from the Clover Point pump station will be pumped to the McLoughlin Point facility through a 1,200 mm forcemain requiring 1,121,470 kWhr per year.

3.6.2.2 Discharge from Site

Treated effluent will flow by gravity from the McLoughlin Point facility through the 1,800 mm to 2,000 mm outfall. Pumping will be required only for high wet weather flows.

3.6.2.3 Energy Use Summary

The estimated electrical energy requirement to operate all facilities is approximately 34 million kWhr/year. Energy requirements for the facilities at McLoughlin Point will be supplied mainly by electricity. Heat will be recovered from the effluent and supplemented with natural gas. Table 9 lists the electrical energy requirements of each facility. Table 14 summarizes the estimated electrical energy use for the CAWTP facilities.

TABLE 14

ESTIMATED ELECTRICAL ENERGY REQUIREMENTS FOR THE CAWTP FACILITIES

Facility	kWhr/year
Clover Point pump station	1,121,470
Macaulay Point pump station	1,679,000
Craigflower pump station	400,000
Arbutus Road attenuation tanks	Negligible

TABLE 14 Cont'd

Facility	kWhr/year
McLoughlin Point treatment facility power required for headworks, primary treatment, secondary treatment and UV disinfection	17,213,766
Sludge pumping from McLoughlin Point to Hartland North	290,000
Hartland North Resource Recovery Centre	29,600,000
Total power requirement	50,304,236

Source: Cote pers. comm. McKelvey pers. comm

Based on the total power requirement for the CAWTP facilities, the total annual electrical energy cost (using today's rate of $0.08 per kWhr) is estimated to be approximately $4,024,338.

3.6.3 Operational Health and Safety, and Nuisance Effects

3.6.3.1 Health and Safety

Facility operations will comply with safety criteria established by Occupational Safety and Health Administration (OSHA), Workers Compensation Board (WCB) of British Columbia, and the National Fire Protection Association (NFPA). Operations staff will be trained to meet relevant health and safety regulations.

3.6.3.2 Noise

Operation of the CAWTP facilities will generate noise from the following equipment on-site:

- pumps;
- biosolids facility;
- compressors;
- standby diesel power generators;
- mixers;
- process blowers; and
- fans and blowers associated with ventilation systems.

Noise at the property line of all facilities will not exceed the levels permitted under applicable municipal Noise Control Bylaws. Sound attenuation will be installed in the buildings that house noise-generating equipment and on the exhausts of diesel engines to ensure that decibel levels remain below the required level to meet WCB and OSHA criteria for worker safety. Noise-generating equipment will be installed in soundproof rooms to meet these requirements.

3.6.3.3 Vibration

Equipment that has the potential to vibrate will be installed on pads and vibration isolation devices to minimize transmission of vibration to adjacent buildings or roadways. Vibration will be kept within acceptable operating limits for protection of the equipment and operational staff.

The CRD, as an employer for the treatment facility, will meet the requirements of OSHA and WCB.

3.6.3.4 Lighting

The lighting plan for the wastewater processing facilities will include normal post-top sodium vapour lighting standards similar to those on residential streets. If night work is required, higher intensity spot lighting lamps may be needed. Lighting will be directed downward and will have shields installed to prevent lighting of the night sky.

In accordance with corporate activities for environmental sustainability, facility planning and design will incorporate energy efficiency, BC Hydro "Power Smart" initiatives and the applicable Leadership in Energy and Environmental Design (LEED™) standards for green buildings. Low energy fixtures will be used on fixtures and motion activation sensors will turn off or reduce lighting when rooms are unoccupied. It is anticipated the facility designs will incorporate natural lighting in buildings to reduce reliance on artificial light.

3.6.4 Sources of Odour and Odour Control

3.6.4.1 Odour Sources

The sources and characteristics of odour at the CAWTP facilities are described in Table 15.

TABLE 15

ODOUR SOURCES OF THE CAWTP FACILITIES

Source	Potential Level Before Odour Treatment
Untreated wastewater recovery area	
Headworks with Odour control (Clover and Macaulay Points)	Nil to Light
Chemically Enhanced Primary Treatment (CEPT)	Light to Moderate
Primary Clarifier	Light to Moderate
Treated effluent area	
Pipe Chase Gallery	Nil to Light
Biological Aerated Filter (BAF)	Moderate (musty)
Lift Station and Sludge Pumping Station	Strong
UV Disinfection (Future) and Effluent Pumping	Nil to Very Light
Odour Control	Light to Moderate
Blowers Building	Nil to Very Light
Attenuation tank	
Attenuation tank	Light to Moderate
Pump Station(s)	
Wet well areas	Moderate
Treated air discharged from station	Nil to Very Light

3.6.4.2 Odour Control

The design of the wastewater treatment and pump station facilities will include best management practices for minimizing release of odour, especially from untreated wastewater and sludge. With proper attention to design details and adherence to operating procedures, routine release of odours from the treatment facility processes can be minimized by:

- the use of submerged inlets and weirs;
- eliminating turbulence in influent piping and channels;
- the elimination of physical conditions leading to the formation of turbulence;
- containment of odour sources;
- off-gas treatment;
- good housekeeping; and
- keeping access doors and buildings closed.

The CAWTP facilities will be specifically designed for the anticipated concentrations of odorous compounds. The odour control systems could include a combination of biofilters, wet chemical scrubbing systems and dry scrubbing systems, such as activated carbon. The heights of air exhaust stacks are 6 m

above ground level for the liquids treatment facilities and 10 m for biosolids management facilities. Air vents at the Arbutus Road facility will be 1.4 m above ground level.

3.6.4.3 Odour Discharges

Odour discharges are expressed in terms of Odour Units (OU) per hour. An OU is a measure of odour concentration and is defined as the amount of dilution with clean air required to reduce odours to non-detectable levels. The OUs are calculated by multiplying the odour concentration in the ventilation air times the ventilation airflow rate (m^3 per hour). Airflow rates for exhaust stacks of the McLoughlin treatment facility are approximately 12 m^3/s.

Table 16 defines the OUs and compares various odour magnitudes. For the CAWTP facilities, the ambient odour guideline is 5 OU, not to be exceeded at the property line under the worst-case meteorological conditions. Poor meteorological conditions are characterized by calm winds and inversions that limit mixing, dispersion and dilution of exhaust air.

The odour emission from all sources will be reduced by odour control systems before discharge to the atmosphere through exhaust stacks. Odours that can be detected at the facility fence lines are estimated to be 5 OU or less. Scrubbing of the facilities ventilation air will ensure that the 5 OU limit is not exceeded during normal operation and all meteorological conditions. It is expected that there will be infrequent short periods of time during maintenance of the scrubbers when odour emissions will exceed their design values. If objectionable odours attributable to the operation of the facilities occur beyond the boundary of the sites, measures or additional works will be implemented to reduce odour to acceptable levels.

TABLE 16

ODOUR INTENSITY VERSUS AMBIENT ODOUR CONCENTRATION

Category Scale	Field Qualitative Odour Intensity Scale	Estimated Odour Concentration (OU) (Detection Threshold)	Typical Description of Odour
Little or no odour	If the odour activates the sense of smell, the characteristics may not be distinguishable. Usual limit of public acceptability.	≤ 5	None
Very Light	Odour activates the sense of smell but is not objectionable to most people.	> 5 to 15	Earthy, stale, musty, chemical
Light	Odour is distinctive and may be objectionable to some people.	> 15 to 50	Earthy, garbage, soil, chemical
Moderate	Odour is very distinct and clearly distinguishable and may tend to be objectionable and/or irritating.	> 50 to 150	Sewer, sour, solvent, chemical
Strong	Odour is objectionable, would cause a person to attempt to avoid it and could produce physiological effects during prolonged exposure.	> 150 to 1,500	Offensive, sewer, garbage
Very strong	Odour is so strong it is overpowering and intolerable for any length of time and could easily produce physiological effects.	> 1,500	Offensive, chemical, putrid, rotten, sewer, urine, septic

Source: Adopted from Manual of Practice No. 25, Control of Odours and Emissions From Wastewater Treatment Plants, Water Environment Federation, 2004, and fit to real data from wastewater treatment facility examples.

3.6.4.4 Security

After the treatment facilities are constructed, operations staff will work daily at most sites. Access to McLoughlin will be controlled at all times. The building doors and main gates will be remotely alarmed by the CRD's supervisory control and data acquisition (SCADA) monitoring system. A combination of sturdy, but attractive, materials for fencing, lighting and landscaping will be incorporated into facility site design to discourage vandalism.

3.6.5 Drainage Management

Current principles for low impact development and stormwater management will be applied to facility site planning. Storm runoff from roofs of structures will be directed to infiltration facilities where site conditions

allow. Parking areas and other on-grade surfaces will be constructed using permeable pavers, or the runoff from these areas will be directed to biofiltration swales or similar facilities. If site conditions do not allow use of infiltration techniques, oil and grease separators and sediment traps will be installed to prevent contaminants from leaving the sites. Changes in offsite hydrology caused by development of the facilities will be minimized. Landscaping will incorporate pervious soils and vegetation to minimize increases in runoff caused by the facilities. Native vegetation will be used in landscaping to reduce irrigation demand.

A credit for stormwater management towards LEED™ Gold Standard will be sought by minimising disruption of natural water flows, limiting stormwater runoff, increasing on-site infiltration and reducing water contaminants.

3.6.6 Accidents and Malfunctions

Design of the new treatment facilities will include redundant features to comply with the *Municipal Wastewater Regulation*, and to reduce the chance of accidents and malfunctions. During the design phase, a Hazard and Operability (HAZOP) study will be completed to identify hazardous and malfunction conditions and appropriate design consideration will be given to these conditions. The redundancy anticipated in the design includes:

- building multiple treatment trains to enable maintenance and repairs;
- installing redundant critical equipment, including pumps, blowers, and other identified critical process equipment;
- oversight of the treatment plant processes by an automated SCADA system that will include monitoring of the critical treatment process parameters, such as dissolved oxygen and effluent turbidity (alarm conditions will be indicated so that operators may take immediate corrective actions);
- development of regular maintenance programs to minimize equipment downtime; and
- provision of standby generators to maintain the treatment processes during power outages.

The CRD will develop Standard Operating Procedures for the facilities. The procedures will have emergency contingency plans for abnormal operating circumstances caused by malfunctions.

The CRD will consider preparing a Conditional Management Plan (CMP) to minimize the risk of releases of effluent that could affect marine resources, particularly shellfish. A CMP will need to be approved by the CRD, Canadian Food Inspection Agency, Fisheries and Oceans Canada, Environment Canada, and the British Columbia Ministry of Environment.

Details regarding offshore impacts of accidents and malfunctions will be provided in the marine EIS for the wastewater program.

3.7 Construction of the CAWTP Facilities

3.7.1 Construction Activities

3.7.1.1 Macaulay Point Pump Station and Grit Removal Facility

The construction associated with the Macaulay Point facility involves changes in existing buildings and expansion of the pump station at the front (north side) of the facility and the addition of a standby generator at the back (south side). A new grit removal structure and new screens also will be installed. The new buildings will be approximately the same height as the existing facility. The CRD has negotiated with DND to use temporary workspace and material storage areas to the east (Site B), west (Site C) and north (Site D and Site E) of the Macaulay Point facility (Figure 3 and Figure 10).

3.7.1.2 Clover Point Pumping and Grit Removal Facility

A new grit removal facility will be constructed in an underground structure directly adjacent to the existing pump station. Construction associated with the upgrades, including two sets of new pumps and controllers, and replacement of the screens, will occur in the new underground facility, and will require excavation and concrete form work.

3.7.1.3 McLoughlin Point Facility

Imperial Oil has been remediating the McLoughlin Point facility site for several years. This site was previously used by Imperial Oil as a bulk oil and fuel storage facility. Oil and fuel was stored in tanks. The tanks and associated contaminated soils were removed when the site was decommissioned.

The McLoughlin Point site is comprised primarily of bedrock in the east and clay in the west. Blasting will be necessary to construct the wastewater treatment facility. The CRD has negotiated with DND for permission to use temporary construction workspace areas on federal land north (Site A) and west (Site F) of the McLoughlin Point treatment facility site (Figure 5 and Figure 10). The workspace area west of the site will likely be used for four to six weeks during construction of the HDD crossing of Victoria Harbour.

The McLoughlin Point facility requires the construction of deep concrete tanks, which will be located at various elevations on the facility site. These tanks will be constructed partially above grade to reduce rock excavation quantities and to achieve gravity discharge through the outfall. The depth of building foundations and concrete tanks varies from 0.3 m to 6 m. Other structures on the site include covered buildings to house major process equipment, an operations building, roadways, parking facilities and fencing.

3.7.1.4 Arbutus Road Attenuation Tank

The construction of the Arbutus Road attenuation tank will include clearing and grubbing of the site, and excavation and installation of an underground attenuation tank. No above ground structures will be built, except for surface access hatches needed for servicing, an access road leading to a parking area and four air vents.

3.7.1.5 Craigflower Pump Station

The new Craigflower pumping station will consist of a 7 m high building. Underground facilities extend 6.5 m below ground level. The underground structure will contain the wet well and pump room, housing four new pumps and controllers. The site will require clearing and grubbing, excavation and concrete form work. A double-walled Bioxide™ tank and double-walled diesel fuel storage tank will be installed outdoors.

3.7.1.6 Ancillary Facilities

Most of the pipes required to convey wastewater will be installed using conventional trench excavation. Excavation is usually 1 m to 2 m deep for forcemains and is variable for gravity mains. The area disturbed during installation of conveyance pipes is usually less than 5 m^2 per linear metre of pipe. The pipe from Macaulay Point to McLoughlin Point, and from Clover Point to Ogden Point, will similarly be installed in road-ways. No effects on streams or other water bodies are anticipated.

From Clover Point to Ogden Point, a conveyance pipe will be installed in a trench beneath Dallas Road, or along the grassed area south of the boulevard following the alignment of a two-way bike path proposed by the City of Victoria. The conveyance pipe from Ogden Point to McLoughlin Point will be installed by HDD beneath the entrance of the Victoria Harbour. The HDD crossing will extend from the McLoughlin Point site to the James Bay Anglers' boat launch ramp on Dallas Road (south of the Coast Guard facilities). The James Bay Angler's clubhouse will be relocated to the northern side of the property. No seabed disturbances will result from the HDD crossing of Victoria Harbour from Ogden Point to McLoughlin Point.

A new 1,800 mm diameter outfall to Juan de Fuca Strait will be built from the McLoughlin Point facility. The new outfall and multi-port diffuser will extend 1,700 m to a depth of 60 m below mean low water, near the terminus of the existing Macaulay Point outfall. Installation will be trenchless from the McLoughlin Point treatment facility to below the intertidal zone. Installation below the seabed in this zone will avoid potential effects on waterfowl and intertidal ecosystems. After the pipe emerges (below the intertidal zone) it will be laid on the seabed. The pipe will be weighted during the float and sink installation procedure (Stantec 2009b). Although trenching is not anticipated, if conditions require such installation, excavated materials will be replaced on top of the outfall.

New conveyance pipes will be needed to connect the proposed attenuation tank at Arbutus Road to existing wastewater infrastructure. Existing pipes will need to be regraded to allow the tank to fill and drain by gravity, thereby avoiding the need to install large pumps. A new outlet pipe will be connected to the existing East Coast Interceptor on Haro Road. This new piping will parallel existing conveyance pipes in order to minimize disturbance to the vegetation.

At the proposed new Craigflower pump station, conveyance pipes will be installed to transport sewage to the new pump station (via gravity sewer) and back to the existing northwest trunk (via forcemain). The pipes will be aligned adjacent to an existing sewer right-of-way along the shoreline of Portage Inlet and will then cross the tidal flats located at the southern extent of Portage Inlet and connect to the new pump station. The pipes will be installed using conventional trench excavation for the terrestrial portion and a trenchless method beneath the seabed for the marine crossing of Portage Inlet. No effects on streams or other water bodies are anticipated.

3.7.2 Construction Traffic

Construction traffic will be associated with delivery of equipment and supplies, workforce deployment, and transport of rock and soil. Material and equipment deliveries include 12 m^3 concrete trucks, trucks delivering reinforcing steel, excavation and other equipment, haul trucks, and vehicles transporting other materials. Vehicle types will include flatbed trucks, tandems, small to large delivery vehicles, cranes, excavators and related equipment. The estimated truck traffic for concrete, steel, excavated material, and soil and fill transport during construction of the facilities are shown in Table 17.

TABLE 17

CONSTRUCTION TRUCK TRAFFIC ESTIMATES

Facility location		Macaulay Point	Clover Point	McLoughlin Point	Arbutus Road	Craigflower
Estimated time to completion		1 year	1 year	3.5 years	1 year	1 year
Clearing or grubbing and aggregate	Total No. of trucks required*	20	20	63	75	20
Excavation	Total No. of trucks required*	233	233	2884	900	100
	Peak activity per day	13	13	60	20	10
Concrete	Total No. of trucks required*	80	80	1106	275	60
	Peak activity per day	7	7	20	10	6
Reinforcing steel	Total No. of trucks required*	3	3	23	10	2
	Peak activity per day	1	1	1	1	1
Other Deliveries	Peak activity per day	2	2	2	2	2

Source: Stantec 2009a, Cowley pers. comm.

Note: Truck volumes are calculated assuming a 9 m^3 truck.

3.7.3 Labour Force during Construction

Table 18 presents the estimated labour force during construction. Some construction activities will occur simultaneously to reduce the overall construction timeline and increase efficiency. At certain times during facility construction, several work crews may be on-site concurrently. The contractors and the CRD will minimize adverse effects by informing the public of construction schedules and traffic routing.

TABLE 18

SUMMARY OF ESTIMATED CONSTRUCTION LABOUR FORCE NEEDED TO BUILD THE SPECIFIED WASTEWATER FACILITIES

Facility	Estimated Time to Completion	Construction Labour Force
Macaulay Point pump station, grit removal, and screening	1 year	Average 22 workers per day for 1 year with a peak of 44 workers per day.
Clover Point pump station, grit removal, and screening	1 year	Average 14 workers per day for 1 year with a peak of 29 workers per day.
McLoughlin Point liquids wastewater treatment	3.5 years	Approximately 38,800 worker-days per year of site labour or an average of 155 workers per day and a peak of 308 workers per day during the concrete work.
Arbutus Road	1 year	Average 15 workers per day for 1 year with a peak of 20 workers per day
Craigflower	1 year	Average 12 workers per day for 1 year with a peak of 20 workers per day
Ancillary facilities (conveyance pipes and tunnels)	1.5 years	Each conveyance construction crew could be composed of approximately 10 workers per day and a peak 15 workers per day. An average of 84 workers per day would be dispersed at the conveyance route construction sites with a peak of 169 workers per day.
	2 years for Ogden Point to McLoughlin Point tunnel	Tunnel construction crew could be composed of 25 workers per day with a peak of 50 workers per day.

Source: Stantec 2009a, Cowley pers. comm.

3.7.4 Construction Schedule

During the design stage, different options for building the facilities may be considered. These methods are intended to improve the cost, time and reliability performance of construction. The construction schedule and project milestones based on an in-service date of the second quarter of 2018 are presented in Table 19 (note this schedule is subject to revision as the project proceeds).

Rock outcrops encountered at McLoughlin will be removed to level the site and the rock will be crushed for reuse as fill, providing the rock is not contaminated. Peak activity will be about 13 trucks per day for Macaulay and Clover Points, 60 trucks per day at the McLoughlin Point site, 20 trucks per day at the Arbutus Road site and 10 trucks per day at the Craigflower site.

Concrete volume estimates are based on an average building height of 4 m. A 300 mm slab is assumed for all buildings. Peak activity will be approximately 7 trucks per day during concrete-pouring activities at Clover Point and Macaulay Point, 20 trucks per day at McLoughlin Point, 10 at Arbutus Road and 6 trucks per day at Craigflower. It is assumed that the concrete will not be prepared on-site. Trucks transporting materials needed for construction of the facilities, such as concrete, structural and reinforcing steel and aggregates will be coming from the Upper Victoria Harbour industrial area. Pipes and equipment could be transported by truck to the facility site from the Swartz Bay ferry terminal or by barge to McLoughlin Point.

TABLE 19

TENTATIVE CONSTRUCTION SCHEDULE FOR THE CAWTP FACILITIES

Task	2012 Quarters				2013 Quarters				2014 Quarters				2015 Quarters				2016 Quarters				2017 Quarters				2018 Quarters			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
McLoughlin Point site remediation																												
McLoughlin Point facility indicative design																												
Arbutus Road attenuation tank design																												
Arbutus Road conveyance and pumping design																												
McLoughlin outfall and Ogden to McLoughlin HDD indicative design																												
Craigflower pump station design																												
Craigflower pump station construction																												
Craigflower conveyance construction																												
Arbutus Road attenuation tank construction																												
McLoughlin Point facility and outfall construction																												
Currie Road to Clover Point conveyance construction																												
Clover Point to Ogden Point conveyance construction																												
Ogden to McLoughlin HDD crossing																												
Clover Point pump station upgrade construction																												
Macaulay Point pump station upgrade construction																												
Commissioning of facilities																												

3.7.5 Construction Health, Safety, and Nuisance Effects

3.7.5.1 Health and Safety

The construction activities will comply with safety criteria established by the *Occupational Health and Safety Act*, and the Workers' Compensation Board. Workers will be trained in health and safety requirements. Temporary safety fencing and warning signs will be installed around the construction site.

A traffic management plan will address safety, road closures, work zone speed limits, traffic disruptions, truck traffic and access maintenance to nearby institutions and residences during construction. Flag persons will direct vehicles and pedestrians around the construction site. Construction drivers will observe speed limits and exercise caution.

3.7.5.2 Noise

Proper safety procedures will be observed to ensure the noise exposure to construction workers during construction is within permitted levels. If necessary, the contractor and the CRD will install temporary safety fencing and warning signs around the construction site to inform the public of noise levels at the construction sites.

Construction activities must comply with the relevant municipal noise bylaws for hours of work and noise levels. Work is allowed to occur Monday to Saturday from 7 am to 5 pm, with no work on Sundays or holidays (except in an emergency).

Construction activities such as running excavation vehicles, truck deliveries, and using chainsaws, compressors, water pumps, concrete pouring pumps, rock breakers, and blasting and blasting signals will be sources of noise potentially heard by nearby residents. Generally, potential noise sources can be controlled to meet noise standards at the site property lines.

3.7.5.3 Vibration

Potential sources of vibration during construction include heavy equipment movement, excavator operation, blasting and use of compactors and paving equipment.

People nearby may be affected by vibration (from construction activity such as blasting), even when vibration is only slightly in excess of perception levels. Activities causing vibration will occur only between 7 am and 5 pm Monday to Saturday. Nearby residents and businesses will be informed and advised about work periods that may cause abnormal vibration.

The Contractor must ensure that workers are not exposed to vibration in excess of the limits specified in the *Occupational Health and Safety* (OHS) *Regulations*.

3.7.5.4 Dust and Mud

Construction may generate short-term localized dust with associated air quality impacts. Air emissions generated by construction include fugitive dust and equipment exhaust. Trucks will have box covers when hauling soil or other granular materials that could create dust nuisances.

During wet weather, trucks may deposit mud from excavated areas on roads off site. On-site wheel washing facilities will be provided and street cleaning will be done if mud tracking becomes a problem.

The CRD Code of Practice for *Construction and Development Activities* will be used to minimize dust and mud impacts. Erosion and sediment control plans will be prepared and implemented during construction.

4.0 METHODS

This section of the EIS report outlines the data collection and assessment methods used by the study team.

4.1 Effects Assessment Criteria

The criteria applied in this study are based on industry standards for impact assessment, adapted for use in the assessment of the CRD's wastewater program. The rating of impacts under these headings focuses on mitigated impacts. The ratings assume that standard construction and operating procedures present in the project description (Section 3) will be implemented. Significance is assessed for these mitigated project effects. If additional mitigation is developed by the CRD (over and above that described in the project description), those "enhanced mitigation" measures are described in the text of the EIS. These additional measures are intended to further reduce identified project impacts.

Table 20 presents and explains the assessment criteria applied in the EIS. The criteria include the spatial context of project impacts, temporal context, reversibility, magnitude and significance of potential effects of project construction and operation.

TABLE 20

CRITERIA USED IN ASSESSING PROJECT EFFECTS

Assessment Criteria		Definition
SPATIAL CONTEXT location of effect		
Treatment Facility Footprint		Land area permanently occupied by the treatment facility including buildings, parking and access.
Ancillary Facility Footprint		Land area temporarily or permanently occupied by wastewater trunks, gravity mains, forcemains, pump stations, and other associated facilities.
Workspace		Areas temporarily used during construction, including equipment and material storage or vehicle access.
Local Area		Lands within 250 m of the site.
Regional Area		The Regional Study Area is the area in the Core Area municipalities.
TEMPORAL CONTEXT of effect		
Duration (Length of time a residual effect will last)	Short-term	Event duration is less than or equal to one year.
	Medium-term	Event duration is longer than one year, but less than or equal to five years.
	Long-term	Event duration extends longer than five years.
Frequency (How often event causing the residual effect will occur)	Occasional	Event occurs intermittently.
	Periodic	Event occurs intermittently, but repeatedly over the construction and operations period.
	Continuous	Event occurs continually over the assessment period.
Reversibility (Will identified effects cease to be a concern?)	Yes	The potential effect can be reversed.
	No	The potential effect cannot be reversed, despite efforts to mitigate.
MAGNITUDE of the effect		
Negligible		Potential effect is barely detectable.
Low		Potential effect is below established or derived environmental standards or thresholds.
Moderate		Potential effect is detectable but meets established or derived environmental or regulatory standards or thresholds.
High		Potential effect exceeds established or derived environmental standards or thresholds.
BENEFICIAL or ADVERSE effect		
Beneficial		The resource or topic under study would be improved as a result of project effects.
Adverse		The resource or topic under study would be worsened as a result of project effects.
SIGNIFICANCE of the effect		
Significant		The identified effect would have a combination of characteristics that render it unacceptable to the public, regulators, other interests, or that exceed standards or contravenes legal requirements.
Less than significant		All other effects that are not considered significant.

4.2 Data Collection and Analysis

This section describes the methods used to collect and analyse data for each EIS topic.

4.2.1 Geotechnical Conditions

Investigation of the geotechnical conditions at the sites consisted of collection and review of available information for the study area, including the BC Ministry of Energy and Mines *Quaternary Geology mapping of Greater Victoria* (Monahan & Levson 2000), as well as seismic hazard maps (Monahan *et al.* 2000a, Monahan *et al.* 2000b, McQuarrie & Bean 2000). Maps detailing regional terrain and bedrock geology (Muller 1980) were also reviewed. Published information was supplemented by interpretation of current and historical Provincial and Federal Government aerial photographs based on knowledge of local conditions, their engineering properties, and construction implications provided by C.N. Ryzuk & Associates. Additionally, geotechnical investigation reports conducted by Levelton Engineering Solutions were consulted for the Craigflower site, and a geotechnical data report prepared by Stantec was reviewed for the McLoughlin, Ogden Point and the Victoria Harbour crossing sites.

4.2.2 Hydrology and Water Quality

The assessment of hydrologic and water quality conditions in the study area were based on:

- review of topographic maps and orthophotos;
- review of relevant reports; and
- on-site field inspections.

Field inspections included observation of slopes and drainage on the sites. Evidence of slope instability was sought. The potential relationship between drainage courses and adjacent trails was examined, as was the effect of vegetation on surface soil conditions and water quality. The locations of storm drains discharging into natural drainage courses were noted, as were the effects of these discharges on flows and erosion features.

4.2.3 Vegetation

The assessment of the potential effects of project construction on vegetation was considered the Project sites, buffer areas and regional area. The Project sites include areas directly disturbed by Project construction and clean-up activities associated with building the proposed facilities and associated pipelines. Buffer areas (adjacent areas) include a 30 m wide area surrounding the Project sites. The regional area specified in this assessment is the Capital Regional District.

A review of publicly available data, existing information, literature and other data was completed before initiating fieldwork. This office-based review included the examination of orthophotos to determine the extent of natural vegetation on the sites and the variability in vegetation composition. The review also included previously completed reports on the vegetation of the study areas and sensitive ecosystem inventory mapping of the sites. Weeds of management concern identified in the BC *Weed Control Regulation* and the Coastal Invasive Species Committee (Coastal ISC) Priority Invasive Plants (http://www.coastalisc.com/priority-invasive) were reviewed prior to the commencement of the vegetation survey.

Information about rare and endangered plant species and plant communities was obtained from the Conservation Data Centre (CDC) online database. This information and any Element Occurrence Reports (EOR) for each site were reviewed to determine whether rare plants or rare plant communities have been recorded on the sites or their ancillary facilities. Information provided through interviews with knowledgeable people from the CRD and the DND was incorporated into the baseline data.

Field visits were conducted in the spring of 2009, 2013 and 2014 to confirm vegetation composition and distribution of the existing vegetation features of the sites, the workspace areas and the associated ancillary facilities. Vegetation specialists walked each site and adjacent area, noted the dominant plant communities, recorded identified species and searched for rare plants and uncommon habitat. A

"purposeful meander" technique was used to survey the areas. At locations where potentially important micro-habitats were observed, more detailed searches were performed. Surveys were conducted during early April, which is appropriate timing for identifying herbaceous plants in the region and for observing most of the species being surveyed.

Vegetation specialists noted dominant community types on aerial photographs of the study area. UTM coordinates were recorded and photographs were taken of special features. Descriptions of the facility sites and vegetation were documented.

The following information was collected at the site:

- canopy cover (dominant tree species);
- shrub cover (dominant tall and low shrubs); and
- groundcover (dominant herbaceous species).

A Site Inventory and Conservation Evaluation was completed for each site and associated ancillary facilities using standard BC Ministry of the Environment "Develop with Care" checklists (BC Ministry of Environment 2012). During site visits, all categories outlined in the protocol were assessed, but only topics relevant to the study sites are presented in this EIS.

4.2.4 Wildlife and Wildlife Habitat

The assessment of the potential effects of project construction on wildlife considered wildlife use, habitat and habitat features. Assessments were completed for each facility site and associated ancillary facilities. A review of publicly available data, existing reports and literature was completed before initiating field work. The sites were also characterized using aerial photography, topographic data, and SEI mapping. Information collected during the office-based review was used to identify potential habitat for rare and at-risk wildlife. The following publicly available data sources were consulted:

- CDC element occurrences;
- Sensitive Ecosystem Inventory (SEI); and
- Victoria Natural History Society database of important wildlife habitats.

Wildlife survey methods were based on the approach outlined in *Environmental Best Management Practices for Urban and Rural Land Development in British Columbia* (BC Ministry of Environment 2012). Field surveys were conducted at each Project site, ancillary facility routes and temporary workspace areas. Wildlife specialists walked each site and adjacent area and documented topography and forest cover, observed wildlife, noted wildlife habitat and habitat features (*e.g.*, wildlife trees, stick nests, and perch trees), and searched for signs of use by rare or at-risk wildlife. A "purposeful meander" technique was used to survey the areas and more detailed searches were performed at locations where potentially important habitat or habitat features were observed. A Site Inventory and Conservation Evaluation was completed for each site and their respective ancillary facilities using standard "Develop with Care" checklists (BC Ministry of Environment 2012).

Wildlife specialists noted dominant habitat types and habitat features on aerial photographs of the study area. UTM coordinates were recorded and photographs taken of special features. Descriptions of the facility sites and vegetation were documented and partial species lists were recorded. Surveys were conducted in April, which is appropriate timing for identifying use by at-risk wildlife, including resident and migratory birds.

4.2.5 Fish

Most of the CRD's wastewater treatment facilities are located in terrestrial areas, so few fish-bearing watercourses are in or adjacent to the treatment facility sites. Potentially-affected aquatic features examined by this EIS are the conveyance pipe crossing Portage Inlet at the Craigflower site and the HDD crossing of the Victoria Harbour from Ogden Point to McLoughlin Point.

Information relating to these two crossings was compiled by conducting a literature review of available studies including a detailed *Aquatic Effects Assessment* conducted by Archipelago Marine Research Ltd., which analyzed potential marine impacts at the Portage Inlet crossing and the HDD crossing of Victoria Harbour, as well an *Environmental Impact Screening Assessment* conducted by the CRD for the Craigflower pump station site.

A marine *Environmental Impact Study* was conducted by WorleyParsons in 2012 to assess potential impacts of the proposed McLoughlin Point outfall on the marine environment.

4.2.6 Air Quality

4.2.6.1 Macaulay Point, Clover Point, and Craigflower

Meteorological conditions were not assessed for the pump stations at Clover Point, Macaulay Point and Craigflower. The project only requires upgrades to the existing pump stations at Clover Point and Macaulay Point, and a new pump station at Craigflower with the latest odour control technology, so no change to existing air quality is anticipated.

4.2.6.2 McLoughlin Point

For the McLoughlin Point site, University of Victoria climatologist Dr. Stanton Tuller combined hourly wind and temperature data from the Esquimalt Harbour with cloud cover and cloud ceiling height from the Victoria International Airport for the five years 2004 and 2008. These data provided inputs for the U.S. Environmental Protection Agency's (EPA's) RAMMET atmospheric dispersion model.

Atmospheric stability was estimated indirectly from the time of day and local measurements of wind speed, cloud cover and cloud ceiling height using meteorological pre-processors (special software that processes meteorological data and converts it into a form used in atmospheric dispersion models) such as the RAMMET package.

Odour modeling was conducted using the EPA ISC-PRIME atmospheric dispersion model to estimate the maximum off-site odour concentrations that may result from adverse meteorological conditions. The five years of meteorological data (discussed above) and the ISC-PRIME complex terrain option were used to estimate plume elevated-terrain interactions. The output from the ISC-PRIME model was processed in a graphical post-processor to create an overlay of odour isopleths onto a Google Earth map of the site and the surrounding communities. The odour isopleths show the maximum 10-minute odour concentrations that may occur during the 5-year period represented by the meteorological data file.

4.2.6.3 Arbutus Road Site

Meteorological conditions were not assessed for the attenuation tank at Arbutus Road. The tank will be installed underground to temporarily store wastewater to prevent downstream overflows during 1:5 year storm events. The attenuation tank facility will include odour control systems that are intended to reduce odour to levels lower than are released by the existing sewage meter station on the site. No adverse effect on air quality is expected.

4.2.7 Archaeology and Heritage

4.2.7.1 Macaulay Point, Clover Point and McLoughlin Point,

In 2008 and 2009, Archaeological Overview Assessment (AOA) studies were conducted for the Victoria Harbour, South Esquimalt and James Bay areas by Bastion Group Heritage Consultants. The results of the studies were published in James Bay-South Esquimalt Siting Investigations for Wastewater Treatment Facilities (Westland 2009a) and Land Suitability for Anaerobic Digesters in Victoria Harbour (Westland 2009b). The James Bay-South Esquimalt study reviewed archaeological and heritage reports and databases, maps and aerial photographs, and archaeological potential mapping produced by the BC Archaeology Branch. The Victoria Harbour study was conducted using the same methods as the James Bay-South Esquimalt study. Results of these studies were used to assess potential archaeological and heritage impact of construction near McLoughlin Point and Macaulay Point as well as impacts of

construction of the ancillary facilities from Clover Point to McLoughlin Point, and Macaulay Point to McLoughlin Point.

Under permit from the Heritage Conservation Branch, Millennia Research Ltd. (Millennia), a Victoria based professional archaeology company, conducted an Archaeological Impact Assessment (AIA) of the McLoughlin Point facility site. The study reviewed archaeological and heritage reports and databases, maps and aerial photographs, and archaeological potential mapping produced by the BC Archaeology Branch. Field inspections were completed as part of the AIA and AOA to verify the location of known or potential sites or features and, in the case of the AIA, to conduct an impact assessment of their condition. Members of the Songhees and Esquimalt First Nations assisted in some field reconnaissance components of the study.

A series of hand excavated subsurface tests (shovel tests) were conducted on January 4, 2010 in Clover Point Park. No tests were conducted directly north of the project site as the current City of Victoria permit limited testing 1.2 m below surface and the slope indicated that considerable fill was present, suggesting it was unlikely that hand tests would reach original ground. Although it was considered unlikely that hand testing would identify an aboriginal trench feature known to exist in the area, the testing was intended to identify any other cultural materials or features, if present.

In August 2013, Stantec Consulting Ltd. conducted a preliminary field reconnaissance (PFR) of the Clover Point site to determine whether the proposed development would occur entirely in imported fill, reducing the risk that archaeological materials would be affected. The PFR involved surface inspection of the area and inspection of sediment cores.

In 2014 Millennia Research was asked to review ancillary development Areas D and E for the Macaulay Point development and Area F at McLoughlin Point. This review included additional literature review and a site inspection.

4.2.7.2 Arbutus Road Site

TERRA Archaeology conducted a Preliminary Field Reconnaissance (PFR) of the Arbutus Road site on July 30, 2013. A literature review was conducted prior to the field survey. The review researched existing archaeological and environmental reports in addition to archaeological site data obtained through the Archaeology Branch' Remote Access to Archaeological Data application.

Songhees and Esquimalt First Nations, who assert an interest in the area, were provided project information and invited to participate in the assessment.

A crew consisting of Ewan Anderson, a qualified field director from TERRA, and William (Bill) Schroeder from the Songhees First Nation conducted the survey, which consisted of examining the proposed site and the surrounding area in judgmental traverses that followed existing trails. Transects were conducted through overgrown areas. Crew members were spaced at approximately 5 m intervals and all ground exposures were inspected for cultural materials. Additionally, all trees standing or fallen, including stumps, were examined along transects for indications of cultural modification.

Archaeological potential was assessed, based on proximity to water, food resources, slope, drainage, forest cover, local knowledge and presence of topographic landforms commonly associated with known archaeological sites.

4.2.7.3 Craigflower Site

Golder Associates Ltd. conducted an AOA and an AIA of the Craigflower pump station site and ancillary pipeline route in 2007 (CRD 2012). The AOA involved a review of background materials, including archaeological site records and reports prior to conducting field work. The AIA was conducted under the *Heritage Conservation Act* Permit 2007-312 (Golder 2007). The fieldwork was conducted by Shauna Huculak, M.A. (Golder), Ron Sam (Songhees Nation Archaeological Officer), Steve Thomas (Esquimalt Nation), Dwayne Mackie (Golder) and a crew from Drillwell Enterprises Ltd (Golder 2007). Field procedures included survey traverses at 2-3 m intervals followed by auger and shovel testing of subsurface materials (Golder 2007). Field methods used were in accordance with the BC *Archaeological Impact Assessment Guidelines* and are described in the Golder report (2007).

4.2.8 Land Use

The Land Use Section of this EIS builds on information collected for the siting analyses, which included a review of existing planning documents, site visits, and discussions with representatives of the Township of Esquimalt, City of Victoria, Capital Regional District, District of Saanich, the Town of View Royal and DND to understand existing and planned land uses and potential impacts of the wastewater treatment facilities.

The preparation of this EIS involved a review of the latest versions of relevant land use plans, including:

- City of Victoria Official Community Plan;
- Township of Esquimalt Official Community Plan;
- Macaulay Point Natural Areas Management Plan;
- Beacon Hill Park Heritage Landscape Management Plan;
- Victoria Harbour Plan;
- Town of View Royal Official Community Plan;
- District of Saanich Official Community Plan; and
- Municipal zoning bylaws.

News articles, media releases, letters to the editor, and information on other community initiatives were also reviewed to understand the regional and local context.

Discussions were held with municipal planners, engineers, park managers and representatives from CFB Esquimalt, to understand development plans, concerns, potential impacts and appropriate mitigation measures.

Colour ortho-photography was reviewed and visits to the sites were conducted by the report authors to confirm the use of the sites and adjacent land by property owners, local residents, and other users. These visits were conducted numerous times and during various seasons. The proposed routing for the ancillary facilities was reviewed with ortho-photographs and with site visits in accessible areas.

4.2.9 Traffic

The following tasks were completed as part of the traffic impact assessment.

- Determine the existing vehicular volumes on preferred routes for the facility sites, including accident history where available and bus service.
- Identify an order of magnitude of current pedestrian and bicycle traffic in the transportation corridors of the preferred routes.
- Forecast the type and amount of traffic that would be generated by the project for both the construction and operation time frames and identify any relevant transportation and traffic related issues.
- Determine the impact of installing the ancillary conveyance pipes under the road surface for the various options.
- Review current and future roadway cross-section data on preferred access routes.
- Assess the level of impact on affected neighbourhoods and road users.
- Identify potential mitigation measures to reduce or avoid traffic impacts.

To conduct the aforementioned tasks, data were obtained using the following methods.

- Reviewed relevant traffic flow data, plans, and reports from the CRD, the affected municipalities, and other sources, including transportation sections of OCPs (street functional classification, traffic flow maps, and truck route bylaw maps) and a Traffic Considerations report prepared by Bunt & Associates which emphasized traffic considerations for the McLoughlin Point site.

- Inspected the relevant routings and road system, and affected neighbourhoods during several site visits.

- Acquired additional vehicular data, as required.

- Used an assumed growth rate of 1% per annum to forecast traffic volumes to 2009 (if necessary) and Horizon Year 2016 when most of the facilities will be under construction.

- Calculated PM peak hour volumes as either a percentage of the forecasted historical daily volumes or the results from surveys that were conducted in 2009. Where there were variations in traffic volumes varied along a road, the highest volumes were used for the analysis.

4.2.10 Noise, Vibration and Lighting

The Noise, Vibration and Lighting section was prepared based on facility design information and adjacent land uses. Noise, vibration and lighting effects during facility construction are assumed to be the same as a typical construction project and to follow all applicable municipal bylaws. All facilities will be designed to adhere to municipal bylaws during facility operation. Based on the foregoing assumptions, potential effects of noise, vibration and lighting on surrounding areas were identified.

4.2.11 Human Health

The Human Health section was prepared based on facility design information and adjacent land uses. Potential effects to human health during facility construction and operation are assumed to be the same as a typical construction project. All facilities will be designed to adhere to safety criteria established by OSHA, WCB and NFPA during facility operation. Based on the foregoing assumptions, potential effects to human health were identified.

4.2.12 Visual Aesthetics

The visual aesthetics assessment provides a subjective comparison of changes in the attractiveness of locations resulting from development or other changes to the landscape. The assessment considers the degree of landscape modification and the compatibility of new structures with surrounding landscape features. Modifications may include the removal of existing trees and shrubs, changes to slopes, and the addition of roads, buildings, lighting and other utility structures. These visual elements are considered in the assessment in comparison with present conditions.

Visual aesthetics assessment is a subjective exercise. Aesthetic sensibilities and tastes are unique to each individual, though there are several common aesthetic preferences:

- natural landscapes tend to be favoured over built landscapes;

- complex natural landscapes are generally preferred over simple landscapes, for example, trees and mountains versus a prairie; and

- residential and similar urban landscapes are generally preferred over industrial landscapes.

These general aesthetic preferences have been used in this study to support the assessment of positive and adverse visual impacts of development on a site.

Sites for wastewater facilities were visited in person and were viewed using online map tools, specifically Google Streetview and Bing Maps “Birds Eye View”. These tools and field visits were used to identify key

viewpoints. Photographs of the sites were used as a base to refine and better identify key viewing areas. Photographs were also taken of the sites from key viewpoints for detailed visual analysis.

Digital perspective models were developed of the proposed facilities for Macaulay Point, Clover Point and McLoughlin Point, to help to assess the visual impact of the treatment facilities and the potential effectiveness of mitigation. The models were superimposed on digital photographs taken from key viewpoints by the study team. The rendered images are a graphic representation of how the proposed facilities might look from different viewpoints. Site inspections, oblique images and facility design were used to assess visual impact and potential mitigation measures for the Arbutus Road site. Artist renderings were used to assess the visual impacts and potential mitigation measures for the Craigflower pump station site.

4.2.13 Site Contaminants

The Site Contaminants Section is based on information describing previous land use of facility sites. Information was compiled by conducting a literature review of available studies, accessing provincial and federal contaminated site databases, conducting site investigations and through discussions with CRD personnel.

5.0 SITE CONDITIONS AND IMPACT ASSESSMENT

This section presents the results of an assessment of the relevant environmental and social effects associated with the construction and operation of the CAWTP wastewater treatment facilities. Project effects on the following topics are assessed:

- geotechnical conditions;
- hydrology and water quality;
- vegetation;
- wildlife and wildlife habitat;
- fish;
- air quality;
- archaeology and heritage;
- land use;
- traffic;
- noise, vibration, and lighting;
- human health;
- visual aesthetics; and
- site contamination.

Each topic is assessed for potential effects associated with the construction and operation of the treatment facilities and associated ancillary facilities. Mitigation measures are recommended to reduce or avoid adverse effects, and the magnitude, temporal extent, spatial extent, reversibility and significance are described. Table 20 in Section 4.1 provides definitions of the assessment criteria.

5.1 General Site Descriptions

5.1.1 Macaulay Point

The Macaulay Point property is located on a 0.34 ha (0.83 acre) site at the southwest corner of Anson Street and Vaughan Street in Esquimalt, British Columbia (Figure 11). Land owned and utilized by the DND surrounds the site to the west, north and east. Macaulay Point Park, approximately 50 m to the west, is a public park situated on federal lands leased to the Township of Esquimalt. The waters of the Juan de Fuca Strait, which abut Victoria Harbour, are several metres to the south of the site. The property is owned by the Capital Regional District and zoned “Industrial” by the Township of Esquimalt. As seen in Figure 3 and Figure 10, temporary workspace areas will be used by the contractors during the construction phase of the upgrades. The areas are located directly adjacent to the site on the west (Site C = 0.29 ha), east (Site B = 0.16 ha) and northern (Site E = 1.86 ha). An agreement with DND has allows the CRD to temporarily use these small parcels of land during construction. A storage area (Site D = 0.33 ha) currently consisting of a grassed field between the northern workspace area (Site E) and Anson Street will be used to store DND relocated equipment and boats from the DND storage area north of the McLoughlin facility site. This storage area will remain following construction activities.

Figure 11 Oblique View of Macaulay Point Pump Station Looking North

Source: Bing Maps

5.1.2 Clover Point

The Clover Point property is located on a prominent point of land that extends south of Dallas Road between Moss Street and Bushby Street in the City of Victoria (Figures 12 and 13). The adjacent land to the west of the site is Clover Point Park. The residential neighbourhood of Fairfield is north of the site across Dallas Road and the shoreline of the Juan de Fuca Strait is to the east and south of the site. The existing wastewater facility property is owned by the City of Victoria and leased to the CRD. A protective covenant restricts use of the site. As seen in Figure 4, a workspace area will be used during construction. The temporary workspace area is located west of the pump station site in a grassed area south of Dallas Road and west of the access road to the Clover Point parking area.

Clover Point Park is extensively used by the public for walking, running and dog walking. A paved multi-use waterfront walkway parallels Dallas Road. The park is a popular scenic viewpoint for the public and visitors, as well as a staging area for kite flying and a key access point to the rocky beach and shoreline.

Figure 12 Oblique View of Clover Point Pump Station Looking North

Source: Bing Maps

Figure 13 Oblique View of Clover Point Pump Station Looking West

Source: Bing Maps

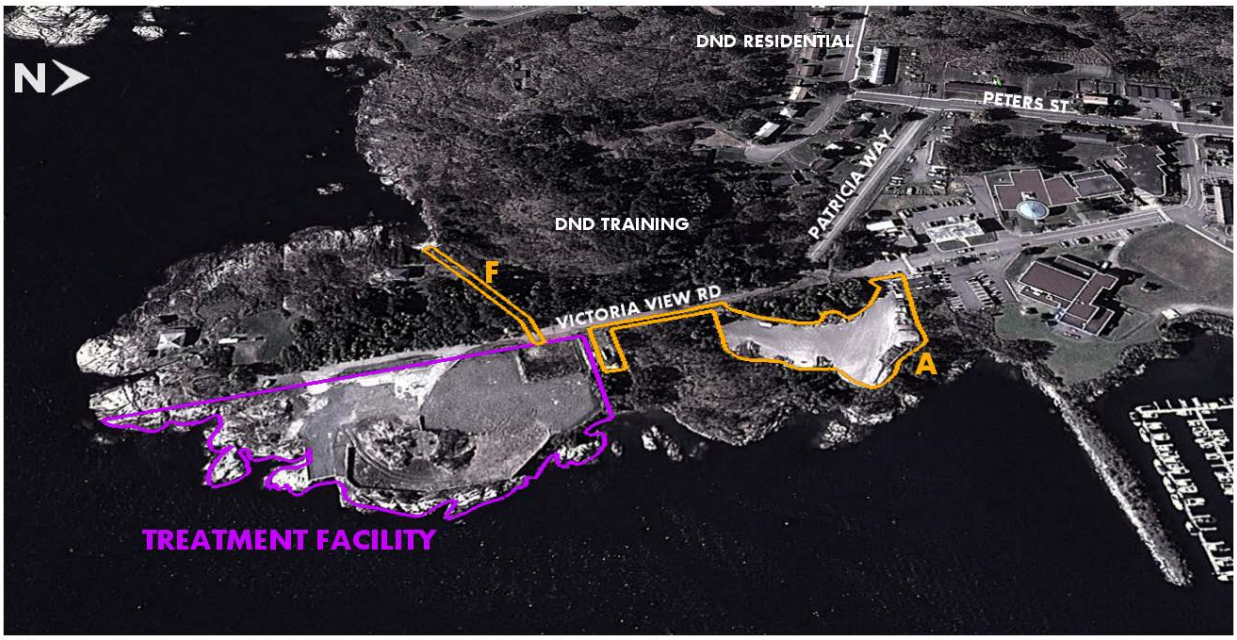
5.1.3 McLoughlin Point

The McLoughlin Point site is approximately 700 m northeast of the Macaulay Point pump station in Esquimalt, British Columbia (Figure 14). The McLoughlin Point site is a decommissioned Imperial Oil tank farm on 1.4 ha (3.46 acres) of freehold property bounded on the north and west by DND land, and on the east and south by Victoria Harbour. The facility formerly accommodated 17 oil tanks with maximum storage capacity of 2.5 million litres. The land is zoned “Industrial” by the Township of Esquimalt.

Victoria View Road runs north-south, immediately west of the McLoughlin Point site. The federal DND property extends north and west from Victoria View Road towards Macaulay Point. Victoria Harbour bounds the site to the east and south.

The workspace area (Site A) to be used during construction is located the north of the site. The workspace area has an approximate footprint of 3650 m^2 (CRD 2013a). This area will be used during the construction period. Additionally, a small (site F = 0.05 ha) narrow strip of land approximately 5 m wide will be used by the contractor as a staging area during construction of the HDD crossing of Victoria Harbour for a limited duration of four to six weeks.

Figure 14 Oblique View of McLoughlin Point Site Looking West



Source: Google Earth

5.1.4 Arbutus Road

The Arbutus Road attenuation tank site is on a forested parcel located on Arbutus Road between Finnerty Road and Haro Road (Figure 15). The parcel presently houses a sewage meter station. Underground sewer pipes of 450 mm and 600 mm diameter cross the Arbutus Road property.

The Arbutus Road property is routinely used by the public for recreation. The main uses are walking, running, orienteering, environmental study and BMX biking. A network of informal trails supports these recreational activities, both on the site and on adjoining forested lands. These lands are considered community green space by many nearby residents.

Institutional and residential are the primary land uses near the Arbutus Road site. Across Arbutus Road to the northeast is the Queen Alexandra Hospital for Children (operated by the Children’s Health Foundation of Vancouver Island) and other related facilities. The nearest homes are on Sutton Road, 150 m to the

southwest of the proposed attenuation tank location. Wooded areas surround the site to the west, east and south.

Figure 15 Arbutus Road Site Viewed From the East

Source: Bing Maps

5.1.5 Craigflower

The proposed 0.18 ha Craigflower pump station site is located 40 m north of the Old Island Highway, abutting the E&N Railway right-of-way to the west (Figure 16). Portage Inlet borders the site to the east and north. The Town of View Royal has zoned the area west of the Portage Inlet border as single-family residential. Approximately 50 m east, across Portage Inlet, land is zoned community institutional and used for buildings and playfields of the Shoreline Community Middle School. The site footprint has no corresponding land use designation and is an untitled portion of Provincial Crown foreshore (Town of View Royal 2013).

Figure 16 Craigflower Site Viewed From the North

Source: Bing Maps

5.1.6 Ancillary Facilities Site Description

5.1.6.1 Clover Point

Wastewater will be pumped from the Currie Road pump station to Clover Point in 650 mm and 750 mm forcemains and a 750 mm to 900 mm gravity sewer along the East Coast Interceptor (Figure 8). The ancillary facilities will be installed in a common trench for approximately 3,100 m of the 4,200 m route. The ancillary facilities between the intersections of Lawndale Avenue and McNeill Avenue, and St. Charles Street and Chandler Avenue do not require upgrading.

Screened wastewater from the Clover Point pump station and grit removal facility will be pumped to the McLoughlin Point facility intake (Figure 9). The 1,200 mm forcemain from Clover Point to the McLoughlin Point facility will be approximately 4,150 m long. The pipe will be installed in a trench along Dallas Road and the south side of the boulevard from Clover Point to Ogden Point at the James Bay Anglers boat ramp (~ 3,300 m) and in a HDD crossing (~ 850 m) beneath the entrance to the Victoria Harbour from Ogden Point to McLoughlin Point.

5.1.6.2 Macaulay Point to McLoughlin Point

Screened wastewater from the Macaulay Point pump station and grit removal facility will be pumped 1,100 m to the McLoughlin Point facility (Figure 10) via a 1,500 mm forcemain below road rights-of-way under Vaughan Street, Anson Street, Bewdley Avenue, Peters Street and Victoria View Road.

Underground utilities (natural gas, water, electrical and communications) will be brought to the McLoughlin Point facility from Lyall Street in a 680 m trench along the rights-of-way of Peters Street and Victoria View Road. BC Hydro power lines will also be installed above ground along the same corridor.

5.1.6.3 McLoughlin Point Outfall

A new 1,800 mm to 2,000 mm diameter outfall will be built from the McLoughlin Point facility into the Juan de Fuca Strait. The new a multi-port diffuser will extend 2,100 m to a depth of 60 m below mean low water, near the end of the existing Macaulay Point outfall. Treated wastewater will be discharged uniformly through each of 28 ports located along the 150 m long diffuser. The existing 1,600 m outfall at Macaulay Point will used as an overflow if the station capacity is exceeded during wet weather flows.

5.1.6.4 Arbutus Road

The ancillary conveyance pipes at Arbutus Road will be installed parallel to existing pipes (Figure 6). New pipes will be installed to convey wastewater infrastructure to and from the tank, which includes trunks, mains and overflow outfall. The proposed outlet pipe from the attenuation tank will cross the eastern portion of the property and connect to the existing East Coast Interceptor sewage trunk on Haro Rd.

5.1.6.5 Craigflower

The proposed ancillary facilities for the Craigflower site (Figure 7) include a gravity sewer from the existing pump station to the new facility. The pipe route will parallel an existing sewer right-of-way along the northern edge of the school playfield. The forcemain and gravity sewer will convey wastewater to the Macaulay Point pump station and cross the tidal flats in the same location at the southern extent of Portage Inlet.

5.2 Geotechnical Conditions

5.2.1 Earthquake and Tsunami Risk in Greater Victoria

Vancouver Island is in the Cascadia Subduction Zone and is susceptible to major earthquakes of magnitude 9.0 or greater. In response, current building codes require that facilities be designed to withstand at least 1 in 2,000 year earthquake events.

Earthquakes in the Cascadia Subduction Zone are the main tsunami threat to Greater Victoria. This type of tsunami would most likely affect coastal areas up to 4 m above the highest tide. Because of the bathymetry and shoreline configuration of the Strait of Juan de Fuca, tsunamis created elsewhere in the Pacific Basin would be likely to affect low-lying coastal areas in ways similar to severe winter storms (City of Victoria 2012).

A Greater Victoria Tsunami Planning Map produced for the CRD delineates areas of tsunami risk (AECOM 2013). According to this mapping, the Macaulay Point and Clover Point sites, as well as the Craigflower and Arbutus Road sites are outside the tsunami risk area. The McLoughlin Point site could potentially be affected by a tsunami, though the risk is low. Facility designs will need to consider tsunami risk.

5.2.2 Treatment Facility Site Conditions

5.2.2.1 Macaulay Point

The ground surface at the Macaulay Point site is uniform and nearly level at an elevation of 7 m to 8 m above sea level. Available information indicates that the site previously sloped gently to the southeast and south, and has been levelled by excavation in the northwestern portion and by possible fill placement along the southern margin.

The subsurface stratigraphy is expected to consist of relatively small amounts of surficial fill or topsoil over a veneer (possibly intermittent) of marine silts and clays, and then bedrock. Variations to this generalized stratigraphy may include anticipated localized zones of fill (backfill material) alongside the partially buried or underground pump station facilities. The groundwater table is expected to be within 2 m to 3 m of the present ground surface. Perched water table conditions may be present because of the anticipated relatively impermeable nature of the bedrock and near-surface native soils, which can result in locally high groundwater conditions and even surface water ponding, particularly during periods of heavy or prolonged precipitation.

Given the generally shallow bedrock depths anticipated at the site, soil conditions are relatively favourable concerning the seismic design parameters for structural elements.

5.2.2.2 Clover Point

The ground surface at the Clover Point site slopes to the south and east. Available information indicates that the site may have been previously depressed, and current development has resulted in some excavation (to accommodate the existing facilities) and fill placement to cover the facilities and raise the grade to its current level.

The subsurface conditions are expected to be comprised of surface fill materials (associated with backfilling and cover for the existing facility) atop a morainal deposit of hard gravelly sand silt and/or very dense silty sand till and then bedrock. The groundwater table is expected to be within 4 m to 5 m of the existing grade, with possible perched water table conditions from place to place. It is anticipated that soil conditions are generally favourable concerning the seismic design parameters for structural elements. Subsurface investigation will be required to determine the extent of fill placement in the area of the proposed new development to the north of the existing facility.

5.2.2.3 McLoughlin Point

The ground surface at the McLoughlin Point site is presently uniform and near level at an elevation of about 5 m above sea level. The site is asphalt or gravel surfaced, except for occasional rock outcrops. Available information indicates that the site was once irregular and rocky at a similar average grade to the adjoining sites, and was levelled to its present configuration by excavation (likely by blasting) and fill placement.

The subsurface conditions at this site are comprised of varying compositions and amounts of fill materials (up to 4 m below the ground surface) which are then underlain by bedrock. Throughout much of the eastern portion of the site, the subsurface conditions are comprised of fill, which is directly underlain by bedrock. At two locations on the eastern portion, bedrock outcrops are present. The subsurface geology of the western and northern portions of the site generally consist of fill overlaying native silt and clay soils of varying thickness, which are then underlain by granodiorite bedrock. In some places the native soils are underlain by granular soils and then bedrock (Stantec 2013a).

Some material was excavated during the remediation work conducted in 2011 and 2012. The remediated areas were then backfilled with an assortment of fill materials which included imported silty material, fine sand, 75 mm and 19 mm crushed gravel, excavated sand and gravel, and 75 mm to 150 mm clear stone (Stantec 2013a).

The general groundwater table is likely within 2m to 3 m of the present ground surface. Due to the proximity of the site to the ocean, the groundwater table may be influenced by tidal fluctuations. Perched water table conditions may be experienced from place to place resulting in locally high groundwater conditions and surface water ponding, particularly during periods of heavy or prolonged precipitation.

It is anticipated that soil conditions in the proposed development area will be favourable concerning the seismic design parameters, because bedrock is anticipated to be at relatively shallow depths.

5.2.2.4 Arbutus Road

The ground surface of the site slopes gently downward from the west to east. Maximum elevation change on the site is approximately 4 m. Site observations corroborate historical photographs, and indicate the ground surface has not been modified significantly by excavation or fill placement. Ground disturbing activities related to creating BMX bike jumps and drainage ditches were observed. The site appears to be reasonably well-drained.

The geology of the site is comprised of thick (greater than 10 m) Pleistocene deposits that are exposed at the surface. These deposits are commonly thicker than 30 m and can reach depths of 60 m. These deposits occur typically as drumlinoid (elongated hills) ridges several kilometres in length. This area has a thin veneer of topsoil overlaying surficial deposits of Vashon till or the Quadra sands (Monahan, P. and V. Levson 2000). However, it is also probable that the ridge at this particular site was eroded during the

Holocene erosion and older deposits are exposed (Monahan, P. and V. Levson 2000). The site has been rated by the BC Geological Survey Branch as having a very low liquefaction hazard rating and a low amplification hazard rating (Monahan, P. and V. Levson 2000). No borehole testing has been done on the subsurface to identify stratigraphy of the site.

5.2.2.5 Craigflower

The ground surface of the pump station site is relatively level at approximately 3.5 m elevation and slopes down sharply from west to east at the shoreline of the mudflats. The bank facing the tidal flats has approximate slope of 45 degrees (Cowley pers. comm.; INDESCO 2007). The surface of the pump station footprint is a mix of vegetation and exposed fill. Construction of the pump station will require excavation to a maximum of approximately 9.0 m depth.

Borehole testing showed the subsurface stratigraphy to consist of miscellaneous fill over compact material. The fill ranges in depth from 2.1 m to 3.6 m and includes firm topsoil and/or clay. Under this is a layer of firm to stiff, blue/grey, sandy, silty clay overlying firm to soft, blue/grey, silty clay with some sand. The clays are typical of Victoria Clay and are stiff immediately below the fill layer and become softer with depth. Below 6.0 m the clay is generally soft but normally consolidated at depth. The groundwater table was 3.6 m below the present ground surface at the time of measurement (September 2006) (Levelton Engineering Solutions 2007).

The site is geotechnically suitable but with challenges due to soil stratigraphy and water table features. These soil conditions include the extent of fill material and the presence of low strength native clays. Special construction measures will need to be followed to control excavation sideslopes, groundwater and sensitive foundation subgrade (Levelton Engineering Solutions 2005, 2007).

5.2.3 Ancillary Facility Site Conditions

5.2.3.1 Macaulay Point to McLoughlin Point

The route of the proposed 1,500 mm diameter force main from Macaulay Point to McLoughlin Point (via Bewdley Avenue, Macaulay Street and Victoria View Road) and the underground utilities (via Peters Street and Victoria View Road) pass through an area of shallow bedrock with an intermittent veneer or blanket of overburden marine silts and clays, with localized surficial fill (associated with existing roadways and infrastructure). The groundwater table is expected to be variable and may be perched atop the bedrock in many areas.

5.2.3.2 Clover Point

The route from the Currie Road pump station to Clover point is comprised mostly of Capilano deposits from the latest glaciation at or near the surface. The stratigraphy is comprised of grey Victoria clay facies greater than 3 m thick over relatively thin (less than 10 m) Pleistocene deposits. The beachfront along Dallas Road fronting the Ross Bay cemetery is composed of Holocene beach sands up to several metres thick. These sands cause the area to receive a high liquefaction hazard rating from the BC Geological Survey Branch (Monahan, P. and V. Levson 2000)

Along the route of the proposed 1,200 mm diameter forcemain from Clover Point to Ogden Point (via Dallas Road), the anticipated subsurface conditions (considering minimal burial for the main) range from morainal deposits of dense gravelly silty sand and/or hard gravelly sandy silt till (from Clover Point to Cook Street) and marine deposits of very stiff to hard silts and clays over shallow bedrock (west of Cook Street). Noted exceptions include near surface weathered materials, shallow fill (associated primarily with existing roadway pavement structure and backfill for existing infrastructure), possible near surface zones of colluvial sands and gravels, and thicker fill in the Ogden Point area (likely increasing in thickness westward). The groundwater table is expected to be variable, but generally within 2 m to 3 m of the present ground surface, with possible perched conditions in existing fill and areas of near surface colluvial materials.

The subsurface materials at the James Bay Anglers boat launch are comprised of existing fill (containing granular soils), with an approximate thickness of 4.8 m, underlain by silt and clay. The silt and clay

deposits extend to a depth of approximately 15 m below the surface and are then underlain by sand and then bedrock.

The opening of the Victoria Harbour consists of a layer of loose sediments of silty sand, overlaying compact sand, silt and clay which are layered over underlying bedrock. The sediment layer ranges from a few meters thick near the shoreline to approximately 20 m thick near the middle of the harbour opening.

5.2.3.3 Arbutus Road

The subsurface conditions along the anticipated 4 m to 5 m depth of the new gravity main from the attenuation tank to the connection to the East Coast Interceptor trunk on Haro Rd are expected to comprise glacial deposits of till or sand, with possible areas of shallow bedrock.

5.2.3.4 Craigflower Site

Terrestrial Route

The terrestrial portion of the conveyance pipe route will cross a relatively flat grass sports field to a depth of 7 m below the existing grade. The playing field is approximately 5 m above sea-level and has a relatively uniform topography that slopes down from east to west at the shoreline of portage Inlet mudflats (INDESCO 2007). The subsurface stratigraphy consists of fill that is comprised of a layer of topsoil overlaying native silty sand and gravel. The native soil varies in thickness from approximately 0.5 m depth to a maximum of 7.6 m in depth (end of augerhole) and consists of varying thicknesses of dense, stiff blue/grey/brown silty sand, organic silt and clayey silt. At two locations during the borehole investigation, the auger could not bore any deeper than 3.2 m and 5.9 m respectively; indicating likely depth to bedrock (Golder Associates Ltd. 2007).

Portage Inlet crossing

The conveyance pipes will be installed using a trenchless method (pipe jacking) no more than 2 m below the surface of the tidal estuary of Portage Inlet. The crossing location is approximately 30 m wide (INDESCO Consulting Ltd. 2007). The estuary is comprised of approximately 0.9 m of relatively soft, silty sediment overlying stiff clay (Brimmell 2007a). This soft sediment is relatively weak in shear and once disturbed becomes very soft (INDESCO Consulting Ltd. 2007).

5.2.4 Impact Assessment and Mitigation Measures

5.2.4.1 Macaulay Point

Construction

Potential Impact: Geotechnical hazards may be encountered during construction.

Excavation will be required for the new pump station at Macaulay Point. No excavation is necessary at the workspace areas. Excavation instability is not expected aside from possible localized zones of fill or backfill materials. There is a possibility of moderate to substantial seepage into deeper excavations via discontinuities or possible shattered zones in the bedrock, particularly if the excavation extends below adjacent tide levels. More seepage from possible pockets of water in permeable zones of existing fill material (resulting from long-term infiltration of surface water) may be experienced. The suitability of existing fill materials, if they exist in areas of the proposed new facilities, is uncertain.

Seismically, the conditions at this site are typical of those in the Greater Victoria area that have bedrock or shallow bedrock. The seismic conditions of such sites are usually preferable from a design perspective.

The extent and characteristics of existing fill or backfill materials, relative to the new facilities can have a substantial influence on development costs, and should be investigated further.

Mitigation Measures: A geotechnical investigation and review of the treatment facility designs will be conducted. Careful consideration will be given to ground-water levels on excavations deeper than 3 m to 4 m below existing grades and any excavations below sea level.

Appropriate measures will be implemented to avoid or control seepage from fill or rock cuts, to ensure use of suitable fill materials, and to respond to potential buoyancy concerns where structures are below the water table.

Earthquake and tsunami risks will be factored into facility designs.

Potential impacts associated with geotechnical hazards during construction at Macaulay Point are expected to be local, short-term, irreversible, low magnitude and less than significant.

Operation

Potential Impact: Treatment facility operation could be affected by geotechnical conditions.

After construction is completed and operation of the treatment facility begins at Macaulay Point, no additional geotechnical impacts are anticipated, so impacts of the treatment facility operation are considered **less than significant**.

5.2.4.2 Clover Point

Construction

Potential Impact: Geotechnical hazards may be encountered during construction.

Excavation and facility expansion are proposed to the north of the existing Clover Point facility. The extent and composition of fill material on the site is unknown, but likely related to backfilling of the existing structure and associated infilling of the surrounding landscape areas. Further geotechnical review will be required after the specific design details are known. Specific design consideration will be required where excavations are deeper than 5 m to 6 m below existing grades because of the anticipated groundwater conditions. In the existing facility, and where new loading from the upgraded components will not be substantially altered, no geotechnical concern is anticipated.

Seismically, the conditions beneath the Clover Point site are expected to be typical of those in the Greater Victoria area wherever shallow bedrock is present. Such conditions are usually preferable from a design perspective. Review of the subsurface conditions at this site, in conjunction with the foundation loading conditions of the new (reconfigured) components combined with the existing facility should be conducted prior to final design.

Mitigation Measures: A geotechnical investigation and review of the facility designs will be conducted. Careful consideration will be given to ground-water levels in excavations deeper than 3 to 4 m below existing grades and any excavations below sea level.

Appropriate measures will be implemented to avoid or control seepage from fill or rock cuts, to ensure use of suitable fill materials, and to respond to potential buoyancy concerns where structures are below the water table.

Earthquake and tsunami risks will be factored into facility designs.

If mitigation measures are implemented, potential impacts associated with geotechnical hazards during construction of the pump station upgrades at Clover Point are expected to be local, short-term, irreversible, low magnitude and **less than significant**.

Operation

Potential Impact: Treatment facility operation could be affected by geotechnical conditions.

After construction of the upgrades is completed and operation of the treatment facility begins at Clover Point, no additional geotechnical impacts are anticipated, so impacts of the treatment facility operation are considered **less than significant**.

5.2.4.3 McLoughlin Point

Construction

Potential Impact: Geotechnical hazards during construction.

The native bedrock anticipated at a relatively shallow depth at McLoughlin Point will provide competent long-term support for the proposed new facilities. The suitability of possible existing fill materials for stable foundation support for the new facilities is uncertain. Some excavation will be required during construction, most notably for the pump station and underground storage tanks. No excavation is necessary at the proposed workspace areas. Unusual concerns relating to excavation stability are not expected aside from stability considerations associated with localized zones of existing fill materials. There is a possibility of substantial seepage into deeper excavations via discontinuities or possible shattered zones in the bedrock, particularly for excavations that might extend below adjacent tide levels. Moderate seepage from pockets of water trapped in existing fill material (resulting from long-term accumulation of surface water) may be experienced.

Seismically, the conditions at this site are typical of those in the Greater Victoria area where shallow bedrock exists. Such conditions are usually desired from a design perspective.

Mitigation Measures: A geotechnical investigation and review of the treatment facility designs will be conducted. Careful consideration will be given to ground-water levels in excavations deeper than 3-4 m below existing grades and any excavations below sea level.

Appropriate measures will be implemented to avoid or control seepage from fill or rock cuts, to ensure use of suitable fill materials, and to respond to potential buoyancy concerns where structures are below the water table.

Earthquake and tsunami risks will be factored into facility designs.

Potential impacts associated with geotechnical hazards during construction at McLoughlin Point are expected to be local, medium-term, irreversible, low magnitude and **less than significant**.

Operation

Potential Impact: Treatment facility operation could be affected by geotechnical conditions.

After construction is completed and operation of the treatment facility begins at McLoughlin Point, no additional geotechnical impacts are anticipated, so impacts of the treatment facility operation are considered **less than significant**.

5.2.4.4 Arbutus Road

Construction

Potential Impact: Geotechnical hazards during construction.

Excavation will be required to install the attenuation tank. The precise depth of the excavation depends on the depth of existing wastewater infrastructure but is anticipated to be greater than 3 m. The design will accommodate existing sewer pipe depths to allow the tank to fill and drain by gravity. The excavated native soil will be used to backfill the surface of the attenuation tank following construction. Further geotechnical review will be required after the details are known. Due to the stable geology of the area, no geotechnical concerns are anticipated during the construction of the attenuation tank.

Mitigation Measures: A geotechnical investigation and review of the tank designs will be conducted. Careful consideration will be given to ground-water levels in excavations deeper than 3 m to 4 m below existing grades.

Earthquake risks will be factored into facility designs.

Potential impacts associated with geotechnical hazards during construction of the Arbutus Road attenuation tank are expected to be local, short term, low magnitude and **less than significant**.

Operation

Potential Impact: Treatment facility operation could be affected by geotechnical conditions.

After construction is completed and operation of the attenuation tank begins at the Arbutus Road site, no additional geotechnical impacts are anticipated, so impacts of the treatment facility operation are considered **less than significant**.

5.2.4.5 Craigflower

Construction

Potential Impact: Geotechnical hazards may be encountered during construction.

The subsurface stratigraphy of the Craigflower site consists of miscellaneous fill ranging from 2.1 m to 3.6 m over compact sandy, silty clay layers that become less dense with depth. The ground water table was located 3.6 m below the ground surface during the borehole testing. Construction of the new pump station will involve excavation to a maximum depth of 9 m. The substructure floor of the pump station will be 6.5 m below ground level. As such, groundwater is anticipated to be encountered and subsequent seepage to occur.

Mitigation Measures: A geotechnical investigation and review of the treatment facility designs will be conducted. Careful consideration will be given to groundwater levels in excavations deeper than 3 to 4 m below existing grades or below sea level.

Appropriate measures will be implemented to avoid or control seepage from fill or rock cuts, ensure use of suitable fill materials, and respond to potential buoyancy concerns where structures are below the water table.

Earthquake risks will be factored into facility designs.

Potential impacts associated with geotechnical hazards during construction of the pump station at the Craigflower site are expected to be local, short-term, low magnitude and **less than significant.**

Operation

Potential Impact: Pump station operation could be affected by geotechnical conditions.

No additional geotechnical impacts are anticipated after construction is complete and the pump station begins operation. Therefore, impacts of pump station operations are considered **less than significant**.

5.2.5 Ancillary Facilities

Construction

Potential Impact: Geotechnical hazards could be associated with ancillary facility construction.

Excavation for installation of the conveyance pipelines is expected to be less than 2 m to 3 m, so no unusual construction conditions are anticipated. Rock blasting will likely be necessary in some areas. Due care will be necessary when blasting occurs close to existing utilities and structures. The level of the groundwater table is not expected to pose long-term seepage concerns, although seepage from trapped pockets of water in existing granular fill and near-surface alluvial materials (from long-term infiltration of surface water) may affect work during the initial stages of excavation.

A trenchless crossing method (pipe jacking) will be used to install the conveyance pipes under Portage Inlet at the Craigflower site. This process will require the excavation of two jacking pits (one on each side of the inlet). No rock blasting is anticipated with this process. This method was chosen to avoid disturbances of the mud flats, tidal marsh and tidal meadow vegetation.

The HDD crossing beneath Victoria Harbour involves the point of entry at the McLoughlin Point site and a receiving pit at the James Bay Anglers boat launch site. This trenchless technology does not require access pits, so no excavation will be required in the harbour for this crossing.

Mitigation Measures: Blasting and potential conflicts with existing underground utilities can be reduced in some instances by considering alternatives to the presently proposed alignment.

In areas where substantial blasting will be required, care will be necessary to limit the size of charge detonated per delay, to avoid or minimize the vibration effects of the blasting on adjacent facilities and structures. Shoring will be necessary for deeper excavations in soil materials, unless there is sufficient area on each side of the installation to permit sloped excavations as per WorkSafe BC standards.

Seepage from trapped pockets of water in permeable fill and native soils can be minimized by excavating during the drier periods of the year. Such seepage can be readily mitigated by staging excavation to allow sufficient time to drain the water using a conventional sump and pump arrangement. Often a delay of only a few hours or overnight is sufficient to permit sufficient drainage and avoid associated instability.

Potential impacts associated with geotechnical hazards during construction of the ancillary facilities are expected to be local, short-term, of low magnitude and **less than significant**.

Operation

Potential Impact: Operation of ancillary facilities could be affected by geotechnical conditions.

After construction is completed and operation of the ancillary facilities begins, no additional geotechnical impacts on the site are anticipated, so the impacts of ancillary facility operation are considered **less than significant.**

5.3 Hydrology and Water Quality

5.3.1 Treatment Facility Site Conditions

5.3.1.1 Macaulay Point

The Macaulay Point site slopes gently from north to south and southeast, ranging in elevation from 7 m to 8 m above sea level. The southern shoreline on the Strait of Juan de Fuca is relatively steep. The current Macaulay Pump Station has been operating at the site since 1971 (CRD 2013b). The site is almost entirely covered in buildings and pavement, resulting in substantial alteration of natural drainage. No drainage courses are present on the site.

The quality of groundwater on the site is unknown. No water quality sampling was conducted as part of this study.

5.3.1.2 Clover Point

The CRD has operated a pump station at Clover Point since 1980 (CRD 2013b). The Clover Point site slopes down from the northwest to the southeast. The elevation changes from 10 m to 4 m above sea level across the site. The natural slope conditions were modified during park development, likely in 1956, when the loop road was constructed (Ringuette 2005). Adjacent to the southeastern edge of the pump station site is a steep concrete-edged shoreline. The natural drainage on the site has been substantially altered by the addition of the existing structure and surrounding concrete walls, roadways, fill and the re-sloping of the hillside. No drainage courses are present on the site.

The quality of groundwater on the site is unknown. No water quality sampling was conducted as part of this study.

5.3.1.3 McLoughlin Point

The McLoughlin Point site is generally flat, at an elevation of 5 m above sea level. The seaward margins of the site (east and south) feature exposed rock outcrops. The natural drainage on the site has been substantially altered with the removal of rock outcrops, site re-grading, asphalt and concrete paving, and the addition of fill. Stormwater tends to drain to the lowest elevation point on the northern portion of the site. During a site visit in November 2009, ponding was noted in this area.

No visible drainage courses are present on the site, though north of the treatment facility site a small vernal pool is located in the coastal bluff and Garry oak rock outcrop.

The quality of water on the site was tested as part of a Detailed Site Investigation (DSI) prepared by Imperial Oil. The site was an oil tank farm for several decades until it was decommissioned in 2008. Water draining from the site passes through an oil and grease separator before it is discharged into the ocean.

The proposed workspace area for equipment and supplies during the construction phase is located north of the proposed treatment facility site. The workspace area is relatively flat, gently slopes toward the northeast and is at an elevation of 9 m above sea level. The workspace area has been previously developed and is entirely paved. No drainage course is present at the workspace site.

5.3.1.4 Arbutus Road

The Arbutus Road site slopes from west to east, with gentle slopes of 5% or less. There is no drainage or watercourses found on the site. There is a defined drainage course known as “Finnerty Creek” on the adjacent Saanich-owned woodland to the northwest of the proposed site, which crosses the centre of the property from the southwest to the northeast. The drainage is dry throughout most of the year, carrying runoff only after heavy rainfall events. This depression has become an erosion feature in recent years as a result of development of the area near Finnerty and Sinclair. The source of water is an area called “Lam Circle Ravine” in the University of Victoria’s *Integrated Stormwater Management Plan*. Development of University of Victoria housing and the daycare centre on the margins of the “ravine” likely increased the rates of runoff in this area. Storm drains discharge water from the housing complex and the daycare to the drainage at the boundary of the CRD-owned property.

The drainage follows a walking path along most of its length. This path appears to have provided water with a preferential path across the property. Throughout most of its length, the drainage has downcut only a few centimetres, suggesting that it is of recent origin. In the central portion of the adjacent site, the defined channel disappears, and the drainage water percolates into the soil. Several small depressions carry runoff to the storm water ditch along Arbutus Road. One depression discharges near a bus stop, and another near the eastern edge of the wooded property. This latter drainage follows the course of a walking path and a wastewater main.

As part of its Draft Terms of Reference for the Cadboro Bay Institutional Property Action Plan, the District of Saanich has included a map of the “Haro Woods” property. The map shows a feature called “Finnerty Creek” that crosses the site. A thorough site inspection has revealed mapping inaccuracies. The defined channel crosses only the southeastern portion of the adjacent site; it is not continuous. The feature is not a creek, but a result of recent runoff channelization from upslope development.

Many paths used by walkers and mountain bikers crisscross the site. These paths and the rights-of-way for sewer pipes intercept surface flow and channelize runoff during rainfall events. Where these routes reach Arbutus Road, they discharge runoff into the roadside ditch.

The sandy and loamy character of soil on the Arbutus Road property, combined with the extensive tree cover and understory vegetation, indicate that most rainfall infiltrates into the soil of the site. Only where foot paths interrupt this subsurface flow, or where storm drains concentrate runoff from upslope, is there a surface expression of water.

The quality of the water on the site is suspect, as it flows from urban areas and roadways to the south and west. No water quality sampling was conducted as part of this study.

5.3.1.5 Craigflower

Topography of the Craigflower site is relatively uniform and has an elevation of 4 m above sea level (CRD 2013a). The natural drainage of the site has been altered from its original state by the addition of fill prior to 1948 (Golder Associates 2006). The site is a mix of bare ground, gravel, and areas of vegetation. To the north and east are gradual slopes of bare and vegetated ground, respectively, that lead to the inlet. A storm runoff drainage course at the southeastern end of the site flows from a culvert that crosses beneath the Island Highway.

The quality of groundwater on the site is unknown. No water quality sampling was conducted as part of this study.

5.3.2 Ancillary Facility Site Conditions

Most of the ancillary conveyance pipes will be located beneath roadways or underground, except for the conveyance pipeline between Ogden Point and McLoughlin Point, which will be drilled beneath the entrance to the Victoria Harbour. Drainage of roadways is managed by the City of Victoria, Township of Esquimalt, District of Saanich, District of Oak Bay and DND (on military lands). Runoff from roadways is conveyed to the stormwater system and is discharged into streams, the harbour or the Strait of Juan de Fuca.

The conveyance pipeline routes between the Currie Road pump station and Clover Point, the Clover Point facility and the McLoughlin Point facility, and the Macaulay Point facility and the McLoughlin Point facility, will not cross any streams.

The proposed inlet and outlet pipes from the Arbutus Road attenuation tank will be installed underground to connect to existing wastewater infrastructure and will not cross any watercourses.

The connecting pipes between the old and the new Craigflower pump stations involve terrestrial and marine components. The terrestrial portion of the conveyance pipes will parallel the northern edge of Shoreline School's grass sports field, and an existing sewer trunk right-of-way. There are no water-courses along the route. Any natural drainage patterns on the site would have been altered by the development of the sports field. A new forcemain will be installed parallel the access road right-of-way from the new pump station south to a point near the Old Island Highway. The marine portion involves conveyance pipes that will be installed beneath the tidal flats by using a trenchless method (pipe jacking). At the head of the Portage Inlet tidal flats, a culvert discharges urban drainage into portage Inlet. This is a marine inlet and is therefore subject to tidal influence.

5.3.3 Impact Assessment and Mitigation Measures

5.3.3.1 Macaulay Point

Construction

Potential Impact: Subsurface flows of groundwater or tidal water may be intercepted by excavation.

The new structures at Macaulay Point will be constructed in areas that are currently impermeable asphalt and concrete surfaces. The backup generator will likely be located on the south side of the site, in an area of paving and grass. Seepage from excavations may occur during construction; the amount and quality dependent on the water table conditions and whether excavation occurs below sea level. Small subsurface flows of groundwater or tidal water may be intercepted by excavation. This water will need to be infiltrated elsewhere on the site or conveyed to a storm drain or the ocean.

Mitigation Measures: During the construction period, excavations will need to be dewatered to maintain safe working conditions. This pumped water will be discharged to ground, a storm drain, or directly into the Strait of Juan de Fuca.

The potential effect of the interception of groundwater or tidal water during excavation is local, short-term, reversible, of low magnitude and **less than significant**.

Potential Impact: Sedimentation and erosion may affect water quality.

Because the Macaulay Point site is nearly flat and has little erodible soil, excavation associated with construction of the new structures is unlikely to measurably increase erosion and sediment risk on the site. Uncovered soil stockpiles may be at risk of erosion during precipitation events. Site runoff and water pumped from excavated areas may contain sediment that could affect water quality in the. Without proper drainage management, sediment-laden water could affect the water quality of the receiving waters in the Strait of Juan de Fuca.

Mitigation Measures: Prepare and implement a sediment and erosion control plan for site construction. The plan should include measures such as covering stockpiles of excavated soil to prevent erosion, settling, or filtering site runoff and water from excavations.

Effects of sediment and erosion on water quality are local, short-term, reversible, of low magnitude, and **less than significant**.

Potential Impact: Rinse water from concrete pouring activities could affect water quality.

Rinse water from concrete trucks and from freshly-poured concrete has the potential to affect water quality in the Strait of Juan de Fuca. Rinse water from concrete pouring activities will not be discharged on the site, and no measurable effect on surface or ground water quality is expected.

Mitigation Measures: Concrete truck rinse water should be removed from site for treatment. Other water used in concrete pouring should be managed to prevent entry into storm drains or the ocean. The CRD will prepare an Environmental Protection Plan that will include a contingency plan that outlines procedures in case of accidental spills.

Effects of concrete rinse water on water quality are local, short-term, reversible, of low magnitude and **less than significant**.

Operation

Potential Impact: Runoff may increase during facility operation.

The new structures will be built on impermeable surfaces. During facility operation, runoff will be handled through an on-site management and infiltration system, resulting in no net increases of runoff leaving the site.

Mitigation Measures: A drainage management plan should be prepared. On-site infiltration of runoff will be included in project design.

Effects of increased runoff during facility operation are local, long-term, irreversible, of low magnitude, and **less than significant**.

5.3.3.2 Clover Point

Construction

Potential Impact: Subsurface flows of groundwater or tidal water may be intercepted by excavation.

Seepage may occur during excavation. The volumes and quality will be dependent on water table conditions and the depth of excavation relative to sea level. Small subsurface flows of groundwater or tidal water may be intercepted by excavation. This water would need to be infiltrated elsewhere on the site, or conveyed to a storm drain or the ocean.

Mitigation Measures: During the construction period, excavations will need to be dewatered to maintain safe working conditions. This pumped water may need to be settled of filtered before being discharged either to ground, a storm drain or directly into the Strait of Juan de Fuca.

The potential effect of the interception of groundwater or tidal water during excavation is local, short-term, reversible, of low magnitude and **less than significant**.

Potential Impact: Sedimentation and erosion may affect water quality.

Because the construction of the new Clover Point facilities will be on a slope, excavation is likely to increase erosion and sediment risk. Site runoff and water pumped from excavated areas may contain sediment that could affect water quality in the Strait of Juan de Fuca. Without proper drainage management, sediment-laden water could affect the water quality of the strait directly adjacent to the site

or near the stormwater outfall, if water is conveyed to a storm drain. Uncovered soil stockpiles may be at risk of erosion during precipitation events.

Mitigation Measures: Prepare and implement a sediment and erosion control plan for site construction. The plan would include measures such as covering stockpiles of excavated soil to prevent erosion, and settling or filtering site runoff and water from excavations.

Runoff from the slope should be managed to reduce erosion. Site runoff should be monitored during precipitation events.

Potential effects of sediment and erosion on water quality are local, short-term, reversible, of low magnitude and **less than significant**.

Potential Impact: Rinse water from concrete pouring activities could affect water quality.

Rinse water from concrete trucks and from freshly-poured concrete has the potential to affect water quality in the Strait of Juan de Fuca. Rinse water from concrete pouring activities will not be discharged on the site, and no measurable effect on surface or ground water quality is expected.

Mitigation Measures: Concrete truck rinse water should be removed from site for treatment. Other water used in concrete pouring should be managed to prevent entry into storm drains or the ocean. The CRD will prepare an Environmental Protection Plan that will include a contingency plan that outlines procedures in case of accidental spills.

Potential effects of concrete rinse water on water quality are local, short-term, reversible, of low magnitude and **less than significant**.

Operation

Potential Impact: Pump station operation may affect site hydrology.

Because the expanded facility will be constructed entirely underground, the site hydrology will not be different from the current site conditions. There are no expected adverse effects to the hydrology of the site during operation of the Clover Point facility and impacts will be **less than significant**.

5.3.3.3 McLoughlin Point

Construction

Potential Impact: Subsurface flows of groundwater or tidal water may be intercepted by excavation.

Seepage may occur during excavation, however, this will depend on water table conditions and if excavation occurs below adjacent tide levels. Small subsurface flows of groundwater or tidal water may be intercepted by excavation. This water will need to be conveyed to the ocean. No excavation will be required at the workspace area, so no seepage is anticipated.

Mitigation Measures: During the construction period, excavations will need to be dewatered to maintain safe working conditions. This pumped water is likely to be discharged to the ocean because other alternatives are limited.

The potential effect of intercepting groundwater or tidal water during excavation is local, short-term, reversible, of low magnitude and **less than significant**.

Potential Impact: Sedimentation and erosion may affect on water quality.

Because McLoughlin Point is nearly flat and mostly rock, excavation associated with construction of the facility is unlikely to measurably increase erosion and sediment risk on the site. Uncovered soil stockpiles may be at risk of erosion during precipitation events. Site runoff and water pumped from excavated areas may contain sediment that could affect water quality in the Strait of Juan de Fuca. Without proper

drainage management, sediment-laden water could affect the water quality in the strait directly adjacent to the site.

Mitigation Measures: Prepare and implement a sediment and erosion control plan for site construction. The plan would include measures such as covering stockpiles of excavated soil to prevent erosion, using the existing oil and grit interceptor, settling or filtering site runoff and water from excavations. No mitigation measures relating to sedimentation or erosion control will be necessary for the workspace area.

Effects of sediment and erosion on water quality are local, short-term, reversible, of low magnitude and **less than significant**.

Potential Impact: Rinse water from concrete pouring activities may affect water quality.

Rinse water from concrete trucks and from freshly-poured concrete has the potential to affect water quality. Rinse water from concrete pouring activities will not be discharged on the site, and no measurable effect on surface or ground water quality is expected.

Mitigation Measures: Concrete truck rinse water should be removed from site for treatment. Other water used in concrete pouring should be managed to prevent entry into the ocean. The CRD will prepare an Environmental Protection Plan that will include a contingency plan that outlines procedures in case of accidental spills.

Effects of concrete rinse water on water quality are local, short-term, reversible, of low magnitude and **less than significant**.

Potential Impact: Quality of runoff water could improve after site remediation.

For decades, Imperial Oil operated an oil tank farm at McLoughlin Point. The site has received significant environmental remediation. Runoff water quality is expected to improve after construction of the facility.

Mitigation Measures: No mitigation is necessary.

The effect of increased water quality of runoff is local, long-term, **less than significant** and **beneficial**.

Operation

Potential Impact: Volumes of runoff may increase during facility operation.

The McLoughlin Point site has very low infiltration potential, as it is a paved and rocky site. A treatment facility will not increase the rate of runoff compared to existing conditions.

Mitigation Measures: Opportunities exist to provide modest infiltration on the site in landscaped areas. Runoff water should pass through oil, grease and sediment traps before being released to the ocean or storm drains. Project design should include measures to reduce offsite runoff and to improve its quality.

Effects of runoff during facility operation are local, long-term, irreversible, of low magnitude and **less than significant.**

5.3.3.4 Arbutus Road

Construction

Potential Impact: Construction may cause changes to drainage patterns, infiltration rates and stormwater runoff.

Excavation associated with construction of an attenuation tank facility on the property may result in changes to the site's hydrology. Depending on the depth of excavation and the water table, shallow subsurface flow of groundwater could be intercepted by excavation. This water will need to be infiltrated elsewhere on the site, or conveyed to the roadside ditch along Arbutus Road. Although there are no surface drainages located on the proposed attenuation tank site, opportunities exist for installing infiltration basins or similar structures.

During the construction period, excavations will need to be dewatered to allow construction and to maintain safe working conditions. This pumped water will be discharged to ground or to the roadside ditch. Runoff water from construction excavations often contains suspended sediment. There are no sensitive downstream receiving waters or lands that would be affected by short-term increases in sediment loads. Nonetheless, sediment discharges should be minimized.

Mitigation Measures: Minimize disturbance of natural hydrology of the site to the extent warranted. Implement a drainage management plan prior to construction that identifies potential problem areas and strategies for managing them.

Prepare and implement an erosion control plan for site construction. The plan would include measures such as covering stockpiles of excavated soil to prevent erosion, settling or filtering site runoff and water from excavations.

A water management plan should be prepared to minimize on-site and off-site effects of groundwater and surface water changes associated with the project. On-site infiltration of runoff should be included in project design.

Construction-related changes to hydrology will begin with site grading and continue throughout construction. Potential changes to water quality would be greatest during grading and would improve following site restoration. Drainage effects will be local and confined to the facility footprint. If on-site infiltration is successful, then no downslope effects of increased runoff are expected. Impacts on water quality are reversible following construction. The construction impacts on water quality and hydrology is of considered low magnitude, short term, reversible, and less **than significant.**

Operation

Potential Impact: Changes in drainage patterns, infiltration rates and stormwater runoff.

The entire surface of the attenuation tank will be covered with approximately 1 m of native soil and revegetated. Hard surfaces on the site will be limited to an access road and small parking area, which will be surfaced with gravel or permeable pavement. It is anticipated that, following revegetation of the site, the operation of the facility will not increase stormwater runoff or change drainage patterns.

Currently, there are numerous unvegetated compact paths on the proposed site. After the site restoration is complete and vegetation becomes re-established, infiltration rates could potentially increase, minimising runoff.

Mitigation Measures: No mitigation is necessary aside from appropriate design and active implementation of site restoration.

The magnitude of operational effects on hydrology will be low, and the impact is considered **less than significant.**

5.3.3.5 Craigflower

Construction

Potential Impact: Subsurface flows of groundwater may be intercepted by excavation

During construction, seepage may occur into the excavations needed for the pump station. The volume of inflow water will depend on the groundwater table, depth of the excavation and height of the tides. To ensure a safe work environment, this drainage water will need to be pumped from excavated areas

Mitigation Measures: During construction, excavations will be dewatered to maintain safe conditions. The water could be released to the ground, such as the adjacent playing field, which is fairly level and covered with grass, or settled in a temporary pond before being released into Portage inlet.

The potential effect on water quality of intercepting groundwater during excavation is local, short-term, reversible, of low magnitude and **less than significant**.

Potential Impact: Sedimentation and erosion may affect water quality.

Vegetation clearing and excavation have the potential to increase erosion and sediment transport. Uncovered soil stockpiles may be at risk of erosion during precipitation events. Site runoff may contain sediment that could affect water quality in Portage Inlet. Without proper drainage management, sediment-laden water could affect the water quality in the inlet adjacent to the site.

Mitigation Measures: Prepare and implement a sediment and erosion control plan for site construction. The plan would include measures such as covering stockpiles of excavated soil to prevent erosion, and settling or filtering site runoff and water from excavations. Construction can be carried out during the dry season to minimize the potential of sediment-laden runoff from the site and from soil stockpiles.

Effects of erosion and sedimentation on water quality are considered local, short-term, reversible, of low magnitude and **less than significant**.

Potential Impact: Rinse water from concrete pouring activities could affect water quality.

Rinse water from concrete trucks and from freshly-poured concrete has the potential to affect water quality in Portage Inlet. Rinse water from concrete pouring activities will not be discharged on-site and no measurable effect on surface or ground water quality is expected.

Mitigation Measures: Concrete truck rinse water will be removed from the site for treatment elsewhere. Other water used in concrete pouring should be managed to prevent entry into Portage Inlet. The CRD will prepare an Environmental Protection Plan that will include a contingency plan that outlines procedures in case of accidental spills.

Effects of concrete rinse water on water quality are considered local, short-term, reversible, of low magnitude and **less than significant**.

Operation

Potential Impact: The pump station facility will increase impervious cover and associated runoff.

The impermeable footprint of the pump station could result in an increase in runoff at the pump station location. Impacts would occur during heavy rain events, be confined to the facility footprint post-construction. The runoff is not expected to cause adverse downstream effects or to contribute a substantial amount of runoff to Portage Inlet.

Mitigation Measures: Design and implement a drainage management plan to include on-site infiltration of runoff.

Design features for the pump station might include the use of rainwater runoff control on-site by means of “green” design elements, such as the use of a bioswale or rain garden.

Effects of increased runoff during facility operation are local, long-term, irreversible, of low magnitude, and **less than significant**.

5.3.4 Ancillary Facilities

Construction

Terrestrial routes

Potential Impact: Sedimentation and erosion may affect water quality.

Site runoff and water pumped from excavated trenches may contain sediment that could affect water quality. Uncovered soil stockpiles may create a source of sediment during precipitation events. Without proper drainage management, sediment-laden water could affect the water quality in adjacent waterbodies or stormwater discharge areas.

Mitigation Measures: Prepare and implement a sediment and erosion control plan for site construction. The plan would include measures such as covering stockpiles of excavated soil to prevent erosion,

minimising clearing of vegetated areas, and settling or filtering site runoff and water from excavations before discharge.

Effects of sediment and erosion on water quality are local, short-term, reversible, of low magnitude and **less than significant**.

Marine routes

The potential impacts and mitigation measures apply to both the trenchless method to be used at the Craigflower site and the HDD crossing of the Victoria Harbour.

Potential Impacts: release of drilling fluid could cause smothering of marine organisms, or turbidity at "frac-out" or at drilling exit locations.

Water quality can be affected by drilling mud escaping into the environment as the result of a spill, in the event of a "frac-out" which results in mud being brought to the surface by excess drilling pressure, or by the tunnel collapsing. Drill cuttings can also be released at exit points.

Mitigation Measures: Develop and implement a contingency plan to contain drill fluids in case of a "frac-out" or release from drilling operations. Monitor HDD exit locations during construction and post-construction to ensure no fluid escapes into the marine environment.

Effects from releases of drilling fluid or turbidity caused by "frac-out" on water quality are local, short-term, reversible, of low magnitude and **less than significant**.

Potential Impacts: Contamination by oil or chemicals released by accidental spills in upland areas.

Use of oil or chemicals is required for the drilling equipment needed to construct the ancillary facilities. Though unlikely, accidental spills of oil and chemicals have the potential to seep into adjacent water causing contamination.

Mitigation Measures: Prepare and implement a spill containment plan for ancillary facility construction, which would include having appropriate clean up equipment on-site in the event of a spill.

Effects of accidental contamination by upland spills on water quality are local, short-term, reversible, of low magnitude and **less than significant**.

Operation

The conveyance pipes will be installed under roadways, in trenches, and beneath Victoria Harbour and Portage Inlet. After the routes are restored following construction, no impacts to hydrology or water quality are anticipated. Therefore, effects on the hydrology and water quality during ancillary facility operation are considered **less than significant**.

5.4 Vegetation

5.4.1 Regional Overview

The project area is located in the Coastal Douglas Fir moist maritime (CDFmm) Biogeoclimatic Zone. The CDFmm zone is characterized by warm, dry summers and wet, mild winters and is located between sea level and 150 m elevation. The Vancouver Island and Olympic Mountain ranges create a "rainshadow" effect and influence weather patterns in the CDFmm (Nuszdorfer *et al.* 1991).

Plant communities in the CDFmm are primarily tree dominated. Common tree species include Douglas-fir (*Pseudotsuga menziesii*), western redcedar (*Thuja plicata*), Garry oak (*Quercus garryana*), arbutus (*Arbutus menziesii*), and red alder (*Alnus rubra*). Dominant tree species and natural understory vegetation vary between areas depending on soil composition and topographic features.

All natural plant ecosystems located in the CDFmm are red- or blue-listed by the British Columbia Conservation Data Centre (CDC). A total of 36 plant species in the CDFmm are listed as endangered or

threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and 153 plant species are red- and blue-listed by the CDC. Many of the rare plants found in the CDFmm occur in Garry oak ecosystems, coastal plant communities, rock out-crops or riparian wetland habitats (TERA 2013).

In the past century, native vegetation of the CDFmm and southern Vancouver Island has been altered by urban, agricultural and industrial development. Less than 1% of Garry oak associated plant communities and mature or old forests remain in their natural state (Pojar *et al.* 2004).

5.4.2 Treatment Facility Site Conditions

5.4.2.1 Macaulay Point

The Macaulay treatment facility site is located in a developed area. A long history of use by the DND, the CRD and recreational use by the local population has altered the habitat of the surrounding area. There is no natural vegetation in the footprint of the Macaulay treatment facility expansion site or in the workspace areas. A paved parking lot is located north of the existing facility and encompasses the north end of the proposed facility site. Figure 17 shows the outline of the proposed pump station expansion and the workspace areas in relation to the surrounding vegetation features. The Project site is disturbed and it is unlikely that rare or at-risk vegetation occurs in the immediate area or in the workspace areas to the north of the site, which consists of the playing fields and a previously disturbed grassed area.

A small area of native plants is located near the project footprint. Lands to the east and west of the facility appear to be historically Garry oak rock-outcrop and parkland plant communities. The integrity of these habitats has been affected by non-native invasive plant species, such as Scotch broom (*Cytisis scorpa*), English ivy (*Hedera helix*), Himalayan blackberry (*Rubus armeniacus*), and non-native grasses. A patch of invasive poison hemlock (*Conium maculatum*) was recorded adjacent to the Macaulay Point site.

Remnants of a native coastal bluff plant community are located approximately 20 m to 50 m southwest and southeast of the site. Small patches of dense-flowered lupine (*Lupinus densiflorus*) and purple sanicle (*Sanicula bipinnatifida*), both provincially red-listed, have been documented 20 m from the project footprint. Dense flowered Lupine is known from only three sites in Canada, including the Macaulay Point site (COSEWIC 2005), where a single patch was recorded at the CRD property boundary. Purple sanicle is currently known from 18 sites on the east coast of Vancouver Island and can be found in areas adjacent to the Macaulay Point site. Both plant species are specialized to coastal benches and banks above the ocean splash zone (TERA 2013).

5.4.2.2 Clover Point

The CRD Clover Point pump station site is located in Clover Point Park, which experiences heavy recreational use. The vegetation growing atop the existing Clover Point facility, and the temporary workspace area, is highly disturbed and dominated by non-native, agronomic grasses. Clover Point is listed by the CDC as potential habitat for Kincaid's lupine (*Lupinus oreganus* var. *kincaidii*), which is red-listed by the CDC and presumed extirpated by COSEWIC. No native plant communities or rare plant species have been documented in the pump station footprint (CRD 2013a).

Rare plant species found in neighbouring parks and nearby bordering Dallas Road include dense flowered lupin, purple sanicle, golden paintbrush (*Castilleja levisecta*), and yellow montane violet (*Viola praemorsa*) (CRD 2013a).

Areas adjacent to the Clover Point site include road rights-of-way and disturbed meadows seeded with agronomic grasses. Patches of native vegetation, including thrift (*Armeria maritima*) and coastal gumweed (*Grindelia stricta)* grow on the steep slopes to the north and south of the existing underground pump station (Figure 18). Though unlikely, these areas of native vegetation could provide habitat for rare dense-flowered lupine and bear's-foot sanicle (*Sanicula arctopoides*). Scentless chamomile (*Tripleurospermum inodorum*) and patches of carpet burweed (*Soliva sessilis*), both invasive species, are located along a trail to the south of the site.

Figure 17 Vegetation Features at Macaulay Point

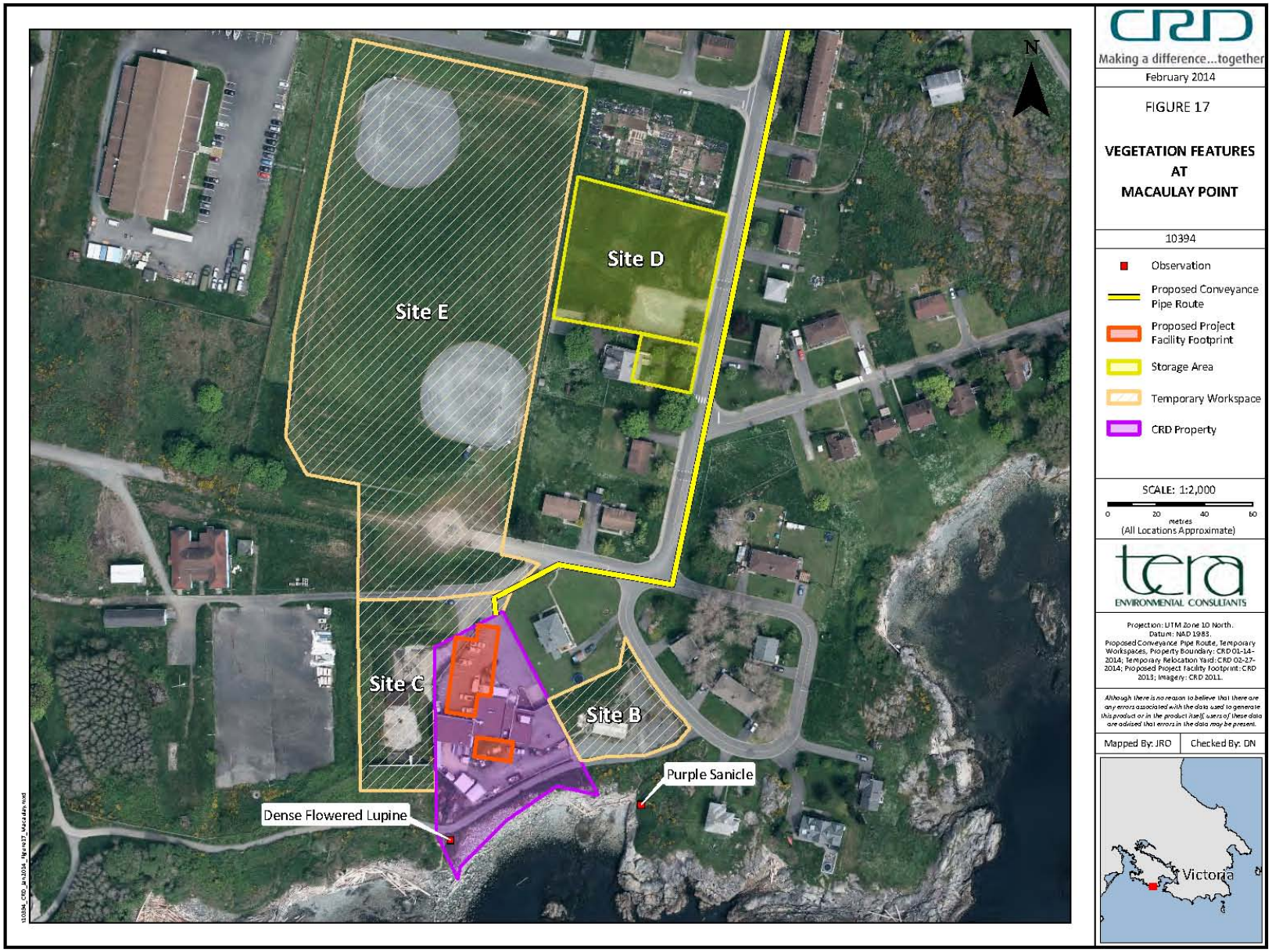


Figure 18 Vegetation Features at Clover Point

5.4.2.3 McLoughlin Point

The McLoughlin Point site is a previous industrial site located on the eastern half of McLoughlin Point, facing Victoria Harbour. The area is susceptible to strong winds and high energy waves. Topographic features include bedrock covered by a thin soil layer (CRD 2013a).

The footprint of the proposed wastewater treatment facility occurs in the former Imperial Oil tank farm. The topography has been altered by blasting and the site has been stripped of plant cover. The few plants remaining on the site are mostly invasive and include Himalayan blackberry and English ivy. There are no sensitive ecosystems on the property, but some native vegetation does occur west and north of the site. Plant species found in adjacent areas include Douglas-fir, Himalayan blackberry, English ivy, scotch broom, willow (*Salix spp*.), domestic apple (*Malus domestica*), black cottonwood (*Populus balsamifera*), and Garry oak.

Coastal bluff ecosystems line the shoreline of McLoughlin Point (Figure 19). Populations of red-listed purple sanicle and blue-listed Spanish clover (*Lotus unifoliolatus*) have been documented on the west side of the point by the CDC. These populations are outside the project site, and are located approximately 25 m west of the property boundary. The narrow staging area to the west of the proposed McLoughlin Point facility site is located along a paved driveway. The driveway is bordered on either side by Douglas fir and arbutus dominated forest with a thick understory of English ivy. A coastal bluff ecosystem is located to the northwest of the staging area. There are no sensitive habitats or plant species along the staging area.

Areas adjacent to the proposed McLoughlin Point facility site include disturbed coastal bluff to the south and east, Garry oak rock outcrop ecosystem to the north and young mixed forest to the west. The coastal bluff areas are dominated by agronomic grasses, clovers (*Trifolium* sp.) and invasive plants, including Scotch broom, Himalayan blackberry, English ivy, bur chervil (*Anthriscus caucalis*), scentless chamomile, bull thistle (*Cirsium vulgare*), orchard grass (*Dactylis glomerata*), curled dock (*Rumex crispus*), hairy cat's-ear (*Hypochaeris radicata*) and common stork's-bill (*Erodium cicutarium*). However, the coastal bluff ecological communities also contain native vegetation, such as Garry oak, saskatoon (*Amelanchier alnifolia*), California oatgrass (*Danthonia californica*), common camas (*Camassia quamash*), great camas (*Camassia leichtlinii*), white stonecrop (*Sedum album*), white fawn-lily (*Erythronium oreganum*), small-flowered woodland star (*Lithophragma parviflorum*), and coastal gumweed (TERA 2013).

A natural vernal pool exists in the coastal bluff and Garry oak rock outcrop habitat to the north of the site (Figure 20). The Garry oak habitat is degraded and the vernal pool is dominated by great camas and surrounded by Scotch broom. Vernal pools can be high value habitat for rare plants when disturbance levels are low.

Figure 19 Vegetation Features at McLoughlin Point

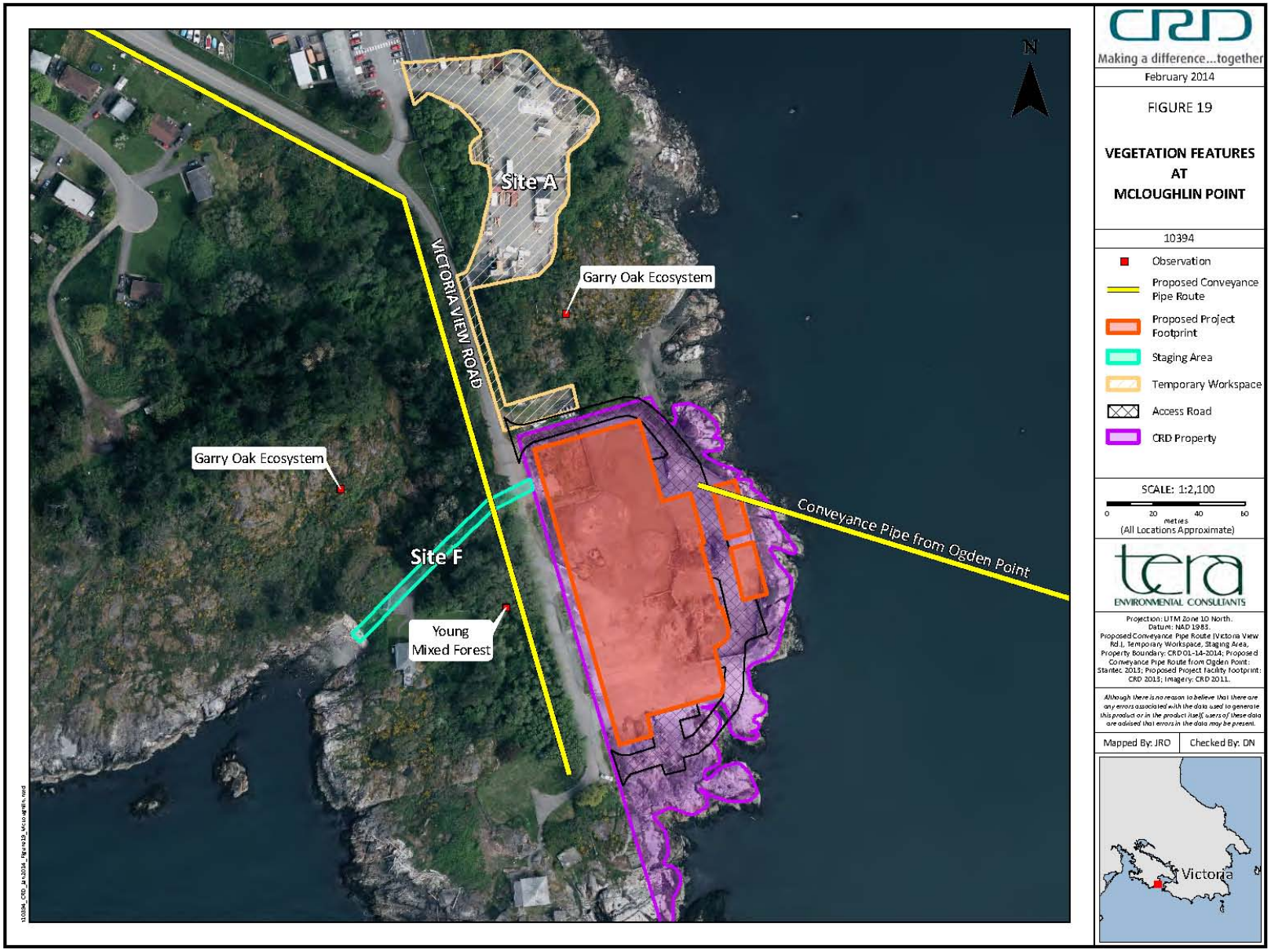


Figure 20 Vernal Pool in Coastal Bluff Area between the McLoughlin Point Treatment Facility and Workspace Site (Looking East)

5.4.2.4 Arbutus Road

The Arbutus Road attenuation tank site is situated in a stand of young and mature second growth Douglas-fir forest. The two dominant plant communities are Douglas-fir/dull Oregon grape (CDFmm/01) and Douglas-fir/arbutus (CDFmm/02). These plant communities (or natural ecosystems) are red-listed by the BC CDC.

The proposed Arbutus Road site is located in a disturbed meadow bordered by young mixed forest (Figures 21). Much of the vegetation on the site has been disturbed to varying degrees. Agronomic grasses including orchard grass and red fescue (*Festuca rubra*), and invasive vegetation such as Himalayan blackberry, Scotch broom and curled dock dominate the disturbed meadow.

Trails in the project site contain bare soils, agronomic grasses and invasive vegetation. The western border of the site is dominated by bigleaf maple (*Acer macrophyllum*) and red alder with an understory of Indian plum (*Oemleria cerasiformis*), bare soils, leaf litter and an escaped garden variety of bluebell

(*Hyacinthoides* sp.). Invasive plant species, including English ivy, Scotch broom, spurge daphne (*Daphne laureola*), Himalayan blackberry and English holly (*Ilex aquifolium*) also occur in the understory. These invasive species out-compete many of the native plant species on the project site.

Three relatively distinct sensitivity values have been assigned to the site (Figure 22). The sensitivity of the proposed attenuation tank site is considered to have a relatively low value compared to the surrounding woodland.

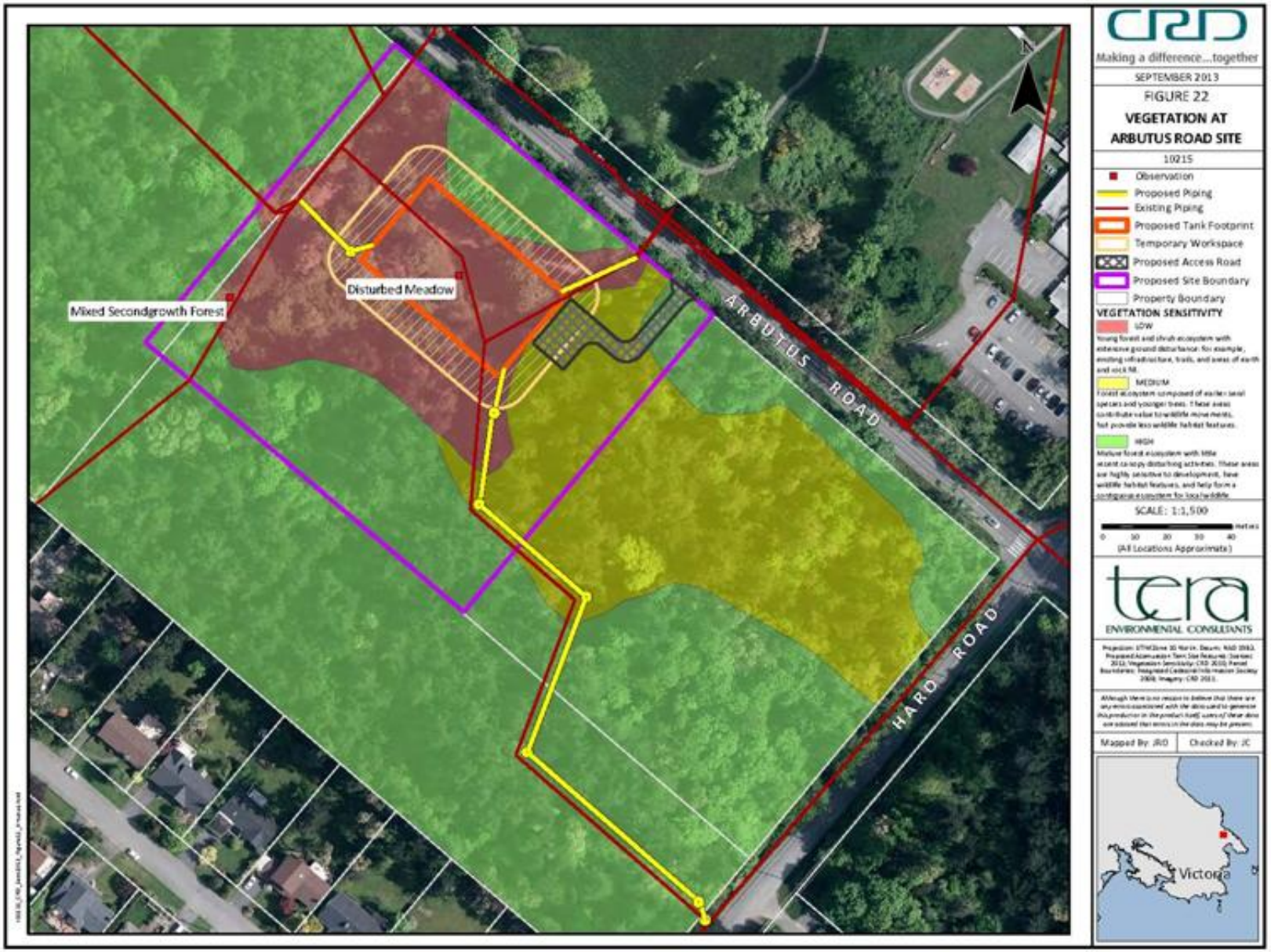
Two trails provide access to the site off of Arbutus Road. One access follows a sewer right-of-way at the northwestern corner of the site, and a second access is an old entrance road located at the northeastern corner. Some small standing dead trees and coarse woody debris exist on the site. Much of the native ground cover has been affected by ground disturbance associated with walking trails, BMX bike trails and jumps.

Walkers and bikers use the forested areas adjacent to the site and a myriad of trails and bare soil patches bordered by invasive plants are present throughout the adjacent areas. However, forested habitats to the northwest are less disturbed. Areas to the southwest are composed of relatively dry, open, young mixed forest of Douglas-fir, grand fir (*Abies grandis*) and Arbutus with an understory dominated by common snowberry (*Symphoricarpos albus*) and dull Oregon grape (*Mahonia nervosa*).

Despite the presence of red-listed plant communities adjacent to the site, the CDC has no records of red or blue listed, or COSEWIC listed plant species on the Arbutus Road site. No rare plant species were noted during the site investigation.

Figure 21 Disturbed Meadow at the Proposed Arbutus Road Site (Looking Northwest)

Figure 22 Vegetation at Arbutus Road Site



5.4.2.5 Craigflower

The Craigflower pump station site is bordered by a gravel road, rail line and a small estuary at the head of Portage Inlet. The site is disturbed and comprised of fill deposited prior to 1948 (INDESCO Consulting Ltd. 2007) that has been seeded with agronomic clovers. Existing vegetation is dominated by non-native plant species and noxious weeds including orchard grass, Scotch broom, Himalayan blackberry, spurge daphne, oxeye daisy (*Leucanthemum vulgare*), scentless chamomile, curled dock, wild carrot (*Daucus carota*), common stork's bill and common chicory (*Cichorium intybus*). Native coastal gumweed has established at the site. There is also the presence of Douglas fir, maple, alder (*Betulaceae* sp.), willow (*Salix* sp.) and common yarrow (*Achillea millefolium*) in the mixed forest south of the pump station site (Figure 23).

No rare plant communities have been identified on the site or in adjacent areas. However, the shoreline of Portage Inlet has been identified as potential habitat for Geyer's onion (*Allium geyeri*), a provincially blue listed plant. Geyer's onion had not been observed on the shores of Portage Inlet since 1959 (CDC 2012a).The red listed Deltoid Balsamroot (*Balsamorhiza deltoidea*) also has been documented near Portage Inlet (CDC 2012b).

Table 21 represents a summary of the ecological features associated with the various CRD wastewater treatment facility footprints.

TABLE 21

PRESENCE OF SPECIFIED ECOLOGICAL FEATURES OF THE TREATMENT FACILITY SITES

	Macaulay Point	Clover Point	McLoughlin Point	Arbutus Road	Craigflower
Terrestrial ecosystems in relatively unmodified state:					
Old growth forest or mature forest	No	No	No	No	No
Second growth forests	No	No	No	Yes	No
Native meadow/herb communities	No	No	No	No	No
Garry Oak woodland community	No	No	No	No	No
Coastal bluffs	No	No	Yes	No	No
Presence of ecosystems at risk:					
Ecological communities on Conservation Data Centre red or blue lists	No	No	No	Yes	No
Ecosystem types identified by the sensitive ecosystems inventory	No	No	No	No	No
Areas identified as environmentally sensitive by local governments	No	No	No	Yes	Yes
Presence of aquatic or riparian ecosystems:					
Seasonal or permanent watercourses (streams, creeks, rivers, ditches)	No	No	No	Yes	Yes
Seasonal or permanent wetlands, seepage areas or vernal pools.	No	No	Yes	No	No
Tidal mudflats	No	No	No	No	Yes
Riparian ecosystems beside these aquatic features and vegetated gullies	No	No	No	No	Yes
Presence of vegetation species at risk and their habitats:					
Species at risk identified by COSEWIC	No	No	No	No	No
Species on provincial Red and Blue lists	No	No	No	No	No

Figure 23 Vegetation at Craigflower Pump Station Site

5.4.3 Ancillary Facility Site Conditions

Most of ancillary facilities associated with the wastewater treatment facilities follow existing road systems and construction would require little or no disturbance of natural areas. The settings of the conveyance facilities are discussed in the following sections.

5.4.3.1 Macaulay Point to McLoughlin Point

The pipe connection between the Macaulay Point and McLoughlin Point sites and the underground utilities will be installed beneath existing paved roads and will not affect any sensitive ecosystems.

Exiting the Macaulay site, the pipe route crosses a gravel parking area at the corner of Vaughan Street and View Point Street. Agronomic grasses, invasive plants and some native vegetation, including great camas, harvest brodiaea and a lance-leaved stonecrop (*Sedum lanceolatum*) plant established in the gravel parking area to the south east of the site. From the Victoria View Road - Bewdley Avenue junction the pipe route enters a residential area with urban landscaping. A small rock outcrop is located on the west side of Bewdley Avenue. The outcrop is a children's play area and few native plants remain.

The Macaulay Point pump station and conveyance pipe route to McLoughlin Point is disturbed and rare vegetation is unlikely to occur in the area affected by the project. There are no records of plant species or plant communities at risk adjacent to proposed route.

Species of trees along BC Hydro alignment along Peters Street and Victoria View Road include apple (*Malus* sp.), chestnut (*Aesculus* sp.), Garry oak, Scouler's willow (*Salix scouleriana*), Douglas-fir, aspen (*Populus tremuloides*), and some ornamental cedars (*Thuja* sp.). Shrubs include Ocean spray and salal (Stantec 2013).

5.4.3.2 Clover Point

The conveyance pipes between Currie Road pump station and Clover Point will be installed in a trench along existing roadways. Hence, effects to sensitive ecosystems or vegetation are not anticipated.

The proposed forcemain connecting Clover Point and McLoughlin Point facilities will be installed beneath Dallas Road, along the edge of the boulevard, or on the alignment of a proposed bicycle path. The portion of this forcemain crossing beneath the entrance to Victoria Harbour will disturb no vegetation.

Dallas Road crosses the following sensitive ecosystem types.

- Coastal bluff ecosystems, which occur in the ocean spray splash zone, and consist of rocky shorelines, islets or cliffs dominated by moss and grasses.
- Terrestrial herbaceous ecosystems, which are natural grasslands, rock out-crops and bryophyte dominated vegetation.
- Mixed broadleaf forest, which is dominated by trees greater than 100 years old and have a broadleaf component greater than 15%.

Areas adjacent to the conveyance pipe route between Clover Point and Ogden Point include disturbed meadows, urban landscaping, young forest and coastal bluffs (Figure 24). Historically, Garry oak meadows dominated the Dallas Road area. All meadow, young forest and coastal bluff habitats have been altered and continue to be disturbed by heavy use by pedestrians, joggers, dogs and other recreationists. Meadows adjacent to the conveyance pipe route are mowed regularly, though areas with showy displays of flowering native herbs are not mowed until summer, after the vegetation has flowered and set seed. Some Garry oak associated rare and regionally important plant species are still present, such as harvest brodiaea (*Brodiaea elegans*), spring gold (*Lomatium utriculatum*) and great camas are found adjacent to the road.

Informal trails adjacent to the conveyance pipe route support invasive species, including carpet burweed, common tansy (*Tanacetum vulgare*), poison hemlock, English ivy and Himalayan blackberry. Poison hemlock and the native cow parsnip (*Heracleum maximum*) are a human health concern and are

scattered along the roadside trails adjacent to the south end of the conveyance pipe route. Native species, such as California brome (Bromus carinatus), coastal gumweed, thrift, great camas, spring gold and harvest brodiaea can also be found adjacent to the route.

Figure 24 Vegetation Features between Clover Point and Ogden Point

The new sections of sewage conveyance pipeline will be bored beneath the Portage Inlet tidal flat using a trenchless method (pipe jacking). This method was chosen to avoid disturbance to Portage Inlet. No vegetation or ecological communities at-risk are known or expected to occur in or adjacent to the ancillary route (TERA 2013).

5.4.4 Impact Assessment and Mitigation Measures

5.4.4.1 Macaulay Point

Construction

Potential Impact: Native plants or rare plant species may be affected during construction.

Construction of new structures at Macaulay Point site will occur entirely on previously disturbed areas of the CRD property. A CDC record search revealed no red-listed plant species or threatened plant communities on the site of the proposed facility expansion or in the workspace areas adjacent to the site. No loss or damage to native plants or rare plant species due to construction of the facility expansion is expected.

Mitigation Measures: Identify native vegetation pre-construction that might be feasible to protect through the installation of protective barriers. Implement a restoration plan incorporating native plant species for landscaping post-construction.

Effects of facility construction are short-term, reversible, negligible and **less than significant**.

Operation

Potential Impact: Native plants or rare plant species may be affected by facility operation.

No additional plant removal or disturbance of vegetated ground is expected during facility operation.

Effects of facility operation are short-term, reversible, negligible and **less than significant**.

5.4.4.2 Clover Point

Construction

Potential Impact: Native or rare plants may be affected during construction.

No native plant communities or rare plant species are present in the project footprint or workspace area. Historical presence of rare plants and plant communities at the Clover Point site suggests some potential for ecological restoration following facility construction.

Mitigation Measures: Implement a native plant restoration program at the site following construction, if practical.

Effects of facility construction are short-term, irreversible, of low magnitude and **less than significant**. If mitigation measures are implemented, effects of facility construction could be **beneficial**.

Operation

Potential Impact: Native plants or rare plant species may be affected by facility operation.

No additional plant removal or disturbance of vegetated ground is expected during facility operation.

Effects of facility operation are short-term, reversible, negligible and **less than significant**.

5.4.4.3 McLoughlin Point

Construction

Potential Impact: Native plants or rare plant species may be affected by facility construction.

Construction at the McLoughlin Point site will occur mostly on the footprint of the former Imperial Oil tank farm and on the edge of a coastal bluff ecosystem on the south end of McLoughlin Point. The temporary workspace and workspace area will be located on previously developed areas north (Site A) and west (Site F) of the proposed site. Between the proposed site and the workspace area to the north, there is a degraded Garry oak rocky outcrop. The proposed access road to the site, at the north end of the project footprint, will abut native vegetation including Garry oak and black cottonwood on the adjacent DND property. However, no removal of native plant communities is anticipated. Pruning will be required in some areas along the private driveway to the west of the site to provide the necessary clearances during the HDD crossing of Victoria Harbour. Removal of invasive blackberry shrubs will be required in the most southwestern portion of the staging area to allow access to the inlet during the HDD installation. However, no removal of native plant communities is anticipated.

Mitigation Measures: Avoid native vegetation and plant communities located outside of the currently disturbed areas on McLoughlin Point. Install barriers at the perimeter of the footprint to protect mature vegetation.

Effects of McLoughlin Point facility construction on native and rare plant species are local, medium-term, reversible, low magnitude and **less than significant**.

Operation

Potential Impact: Native plants or rare plant species may be affected by facility operation.

No additional plant removal or disturbance of vegetated ground is expected during facility operation.

Effects of facility operation are short-term, reversible, negligible and **less than significant**.

5.4.4.4 Arbutus Road

Construction

Potential Impact: Native plants or rare plant species may be affected by facility construction.

Construction of the attenuation tank will require a clearing of approximately 4,180 m^2. This area accounts for the land required for tank installation and a 10 m buffer area required for safety, machinery and workspace during construction. The design and location of the tank will be finalized by the design team after a complete site analysis is conducted.

Most of the current proposed site is located on a disturbed meadow. Additional forest clearing may be required to meet construction workspace needs and Work Safe BC “danger tree” requirements. Forest clearing will involve removal of mature trees, which might include Douglas fir, western red cedar, grand fir, arbutus, bigleaf maple and Garry oak. Tree removal will be overseen by Saanich Parks Staff and will follow the standard review and permitting process. No recorded sensitive ecosystems or at-risk plant communities will be affected by the construction of the attenuation tank.

Several improvements are proposed for the Arbutus Road site to address cycling, walking and safety concerns along District of Saanich and CRD property frontages. Improvements are planned for Finnerty Rd., Arbutus Rd. and Haro Rd. and will be completed by the CRD and the District of Saanich (see Section 5.9.1.4). The improvements will include a separated 2 m wide sidewalk on all frontages, as well as a 1.5 m bike lane on Arbutus and Finnerty roads. The construction of the improved sidewalks might require tree clearing. Efforts will be made to minimize tree removal by designing a meandering walkway where feasible.

Mitigation Measures: Reconfigure the site layout to avoid unnecessary disturbance to native plant communities. Implement an invasive plant species management plan for the site. Use native plants for site landscaping, and if practical, utilize plant material salvaged from the site. Install barriers at the perimeter of the footprint to protect mature vegetation. Retain a registered arborist to conduct a pre-construction assessment of site vegetation.

The current design involves the tank being situated approximately in the centre of the property boundaries, with the access to Arbutus Road and parking area located of the eastern side of the tank

(Figure 22). The present access road and parking area was relocated from its original position (on the western side of the tank) in order to provide a 30 m buffer to Finnerty Creek as required under *Streamside Protection Development Permit Guidelines* (District of Saanich 2013). Constructing the access road and parking area in its currently proposed location will require clearing a portion of mature forest that has higher sensitivity values than the vegetation affected under the original design.

As described previously in this report (Section 5.3.1.4), Finnerty Creek has been wrongly designated as a fisheries sensitive stream. The feature is not a creek, but simply a result of recent runoff channelization from upslope development that represents a drainage problem needing to be addressed. Correcting the "stream" designation would remove the need for a buffer and allow the site design to be reconfigured to minimize impacts on sensitive areas.

Based on the present design location of the attenuation tank and the area disturbed by sidewalk construction, potential exists to retain a relatively narrow (10 m to 15 m) vegetated area to act as a buffer between the attenuation tank site and Arbutus Road (Figure 22). This vegetated buffer could be susceptible to increase risk of wind throw during winter storms. The wind throw risk would be increased by root damage occurring during excavation, and removal of wind-protecting trees resulting from clearing of the attenuation tank site and the 10 m workspace. If wind throw causes a loss of mature trees between the attenuation tank and Arbutus Road, replacement planting of large-caliper coniferous trees will be conducted. The replacement trees will be tended until they are established.

Considering the sensitivity of the site as a natural area and recreational amenity for local residents, impacts associated with the removal of vegetation are local, long term, reversible, high magnitude and **significant**. If the recommended mitigation measures are implemented, the adverse effects of constructing the Arbutus Road facility on maturing forest ecosystems and native plants are considered to be local, long-term, reversible, of moderate magnitude and assessed to be **less than significant**.

Operation

Potential Impact: Native plants or rare plant species may be affected by facility operation.

Operation of the attenuation tank does not require additional removal of native vegetation. No effects on vegetation are anticipated during facility operation and therefore impacts are considered **less than significant**.

5.4.4.5 Craigflower

Construction

Potential Impact: Facility construction may affect native or rare plant species.

Construction of the proposed pump station will occur on a previously disturbed site that was created by placement of fill and has been revegetated with a mixture of non-native and native plant species. Clearing of the project footprint will involve removal of these plants.

Mitigation Measures: Before construction, identify native plants and outside the facility footprint and install protective barriers. Avoid unnecessary removal of native plants during construction. Implement a restoration plan incorporating native plant species for landscaping and, if practical, utilize salvaged plant material from the site.

Effects of the Craigflower facility construction on native and rare plant species are local, medium-term, irreversible, low magnitude and **less than significant**.

Operation

Potential Impact: Facility operation may affect native or rare plant species.

No additional plant removal or disturbance of vegetated ground is expected during facility operation.

Effects of facility operation are medium-term, reversible, negligible and **less than significant**.

5.4.5 Ancillary Facilities

5.4.5.1 Macaulay Point to McLoughlin Point

Construction

Potential Impact: Native plants or rare plant species adjacent to roads may be affected by ancillary facilities construction and underground utilities construction.

The ancillary facility route and the underground utilities will be installed beneath existing roads and will not affect any sensitive native plants or rare plant species.

Mitigation Measures: Locate temporary workspace and workspace areas in areas that will not affect native or rare plant communities. Confine construction activities to the paved rights-of-way. Minimize disturbances around critical root zones during construction of the underground utilities.

If mitigation measures are implemented, the effects of Macaulay to McLoughlin Point ancillary facility and underground utilities construction are local, short-term, reversible, of low magnitude and **less than significant**.

Potential Impact: Native plants or rare plant species adjacent to the BC Hydro power lines may be affected by construction.

Some trees will need to be removed and other trees will require pruning to provide the necessary clearance during construction of the BC Hydro power lines. It is anticipated that a total of nine trees will need to be removed: one apple tree, one ornamental cedar, one Douglas-fir and six aspen (Stantec 2013). Tree removal will comply with all DND policies and all trees removed having diameters greater than 25 cm will be replaced at a 2:1 ratio. No disturbances to arbutus, Garry oaks, heritage or protected trees, or wildlife trees are anticipated.

Mitigation Measures: Retain a registered arborist during the construction stages to determine further measures to avoid or mitigate potential damage to the street trees.

If mitigation measures are implemented, the effects of the BC Hydro power lines are local, short-term, reversible, of low magnitude and **less than significant**.

Operation

Potential Impact: Native plants or rare plant species may be affected by facility operation.

No adverse effects on native plants or rare plant species are expected during operation of conveyance pipes. Impacts will be **less than significant**.

5.4.5.2 Clover Point

Construction

Potential Impact: Native plants, rare plant species or trees may be affected by ancillary facility construction.

Conveyance pipelines connecting the Currie Road pump station to Clover Point will be installed in a trench along existing road rights-of-way and is not expected to affect sensitive vegetation.

Conveyance pipelines connecting Clover Point to McLoughlin Point along Dallas Road are adjacent to known sensitive ecosystems and mature street trees.

The installation of the conveyance pipeline from Clover Point to McLoughlin Point requires excavating a trench along Dallas Road, along the edge of the boulevard, or in the alignment of a proposed two-way bicycle path. There is a risk of damaging tree roots during pipe installation along Dallas Road, resulting in potential tree health effects. Construction of the proposed bicycle path has the potential to effect native plants, rare plant species and trees, depending on the City of Victoria's finalized route. The final alignment of the bike path will be determined by engineering and parks staff following public input.

Mitigation Measures: Retain a registered arborist during the conveyance pipeline route refinement and design stages to determine further measures to avoid or mitigate potential damage to the street trees.

Avoid sensitive ecosystems near Dallas Road during construction of ancillary facilities. Locate temporary workspace and workspace areas in areas that will not affect native or rare plant communities. Align the proposed bike path to reduce impacts to native plants, rare plants species and trees.

With mitigation measures implemented, it is expected that loss or damage to native plants, rare plant species or street trees during construction of the ancillary facilities between Clover Point and McLoughlin Point will be short-term, reversible, of low magnitude and **less than significant**.

Operation

Potential Impact: Native plants or rare plant species may be affected by ancillary facility operation.

No adverse effects on native plants or rare plant species are expected along the pipeline route during operation of the wastewater treatment facilities.

Effects are limited to the ancillary facility footprint, short-term, negligible and **less than significant**.

5.4.5.3 Arbutus Road

Construction

Potential Impact: Native plants or rare plant species may be affected by ancillary construction.

Installation of the ancillary facilities at Arbutus Road will be parallel to previously disturbed sewer rights-of-way. Most of the vegetation has previously been disturbed and the ancillary route is bordered by invasive species, shrubs and mature trees. Clearing of the ancillary footprint will involve removal of vegetation and trees.

Vegetation clearing will be kept to a minimum during the installation of the ancillary pipes. The route will be revegetated post-construction.

Mitigation Measures: Retain a registered arborist during the conveyance pipeline route construction and design measures to avoid or mitigate potential damage to trees.

Potential effects on vegetation from ancillary facility construction are considered medium-term, reversible, medium magnitude and **less than significant**.

Operation

Potential Impact: Native plants or rare plant species may be affected by ancillary facility operation.

Operation of the ancillary facilities does not require additional removal of native vegetation. Some post-construction decline in health of trees near the footprint may occur. If so, a professional arborist should be retained to develop a suitable response program. No effects of ancillary facility operation on vegetation are anticipated and therefore the effects are considered local, medium term, potentially reversible and **less than significant**.

5.4.5.4 Craigflower

Construction

Terrestrial Route

Potential Impact: Native plants or rare plant species may be affected by ancillary facility construction.

The proposed new sewage pipes will be installed beneath an existing grass sports field that is highly disturbed. Excavation will involve clearing patches of vegetation that may include native species. Any workspace areas are expected to be in turf-grass areas already cleared of other vegetation.

Mitigation Measures: Before construction, identify native plants and plants bordering Portage Inlet and install protective barriers. Implement a restoration plan for the excavated area that replants turf grass in the sports field and section of cleared vegetation. Incorporate native plant species for landscaping if practical.

Effects of pipeline installation on native and rare plant species are local, medium-term, reversible, low magnitude and **less than significant**.

Portage Inlet Crossing

Potential Impact: Sedimentation from excavation activities may inhibit growth of eelgrass in the inlet.

The proposed new sewage lines will be bored beneath Portage Inlet. No excavation in the inlet itself or the banks of the inlet will occur during construction. Possible sources of sedimentation include a potential cave-in of the horizontal bore-hole and runoff from stockpiled soil excavated on land.

Mitigation Measures: Ensure that the construction schedule leaves enough time to safely drill the bore-hole and take measures to prevent collapse of the hole. Pile excavated materials away from the bank and shore, cover soil piles, install runoff retention and settlement ponds as needed and ensure bell-hole dewatering activities release only clean water into Portage Inlet.

Effects of ancillary facility construction on eelgrass are local, medium-term, reversible, low magnitude, and **less than significant**.

Potential Impact: Diversion of groundwater by pipe trenches may affect riparian vegetation.

Excavation for the pipe trenches may cause changes in the movement of groundwater into the inlet. This diversion could change habitat conditions and could affect health of riparian vegetation.

Mitigation Measures: Use native excavated material to backfill trenches and compact to same density as pre-construction soils. Install ditch plugs if necessary.

Effects of ancillary facility construction on riparian vegetation are local, medium-term, reversible, low magnitude and **less than significant**.

Operation

Terrestrial Route

Potential Impact: Native plants or rare plant species may be affected by ancillary facility operation.

No additional plant removal or disturbance of vegetated ground is expected during facility operation.

Effects of facility operation are long-term, reversible, negligible and **less than significant**.

Portage Inlet crossing

Potential Impact: Sedimentation from excavation activities may inhibit growth of eelgrass in the inlet.

No disturbance of the mudflats or the inlet is expected to occur during facility operation.

Effects of facility operation are short-term, reversible, negligible and **less than significant**.

5.5 Wildlife and Wildlife Habitat

5.5.1 Regional Overview

The wastewater treatment facility project area is located in the Coastal Douglas Fir Biogeoclimatic (CDF) Zone on the southern tip of Vancouver Island. Wildlife communities are representative of an isolated island setting and a mild climate (MacArthur and Wilson, 1967).

Black-tailed deer are the most abundant large mammal on southern Vancouver Island and are widely distributed throughout the area. Other common mammal species include racoon, river otter and northern harbour seal.

Southern Vancouver Island possesses breeding and stop-over habitat for migratory and resident bird populations. Shorelines and small off-shore islands are vital breeding grounds for a variety of seabirds such as Double-crested Cormorant, Black Oystercatcher, Pelagic Cormorant, Pigeon Guillemot, Rock Sandpiper, Glaucous-winged Gull and Surfbird (Meidinger and Pojar 1991).

Garry oak ecosystems host a variety of bird species including Western Meadowlark, Coastal Vesper Sparrow, Bushtit, warblers, Spotted Towhee, nuthatches, swallows and hummingbirds. The open canopy and sparse understory of these woodlands attracts raptorial predators such as soaring hawks, falcons and owls, and creates foraging habitat for mammals such as deer, mice, moles and shrews (Flynn 1999).

Douglas-fir forests and their abundance of seeds, insects and fruiting plants are an excellent source of nutrients for wildlife. Species reliant on mature Douglas-fir stands include owls, Bald Eagle, Downy Woodpecker, Red-breasted Sapsucker, Chestnut-backed Chickadee, Brown Creeper, Winter Wren and Varied Thrush (Meidinger and Pojar 1991).

Mature and older second-growth forest habitats are uncommon on southern Vancouver Island, because most of the region was logged during the early to mid 1900s. Much of the land in the greater Victoria area has been developed for urban and suburban land uses.

The urbanization of southern Vancouver Island led to the establishment of non-native wildlife species, including European cottontail, house mouse, eastern grey squirrel, Norway rat, Rock Pigeon, European Starling and House Sparrow. Many of these introduced species compete with or prey upon native wildlife.

5.5.2 Treatment Facility Site Conditions

5.5.2.1 Macaulay Point

The pump station at Macaulay Point is bordered by DND development to the north, east and west, and ocean to the south. No wildlife habitat features were noted during site visits, and there are no records of use by provincially-listed or regionally significant wildlife species. No suitable habitat exists in the footprint of the proposed facility or in the workspace areas. However, areas adjacent to the Macaulay Point site have habitat potentially suitable for provincially blue listed ermine and red listed Vesper Sparrow.

The adjacent public area, Macaulay Point Park, is an off-leash dog walking area. Recreational activity in the area limits use by wildlife. Coastal shores, coastal bluff, beach and backshore habitat adjacent to the Macaulay Point site are likely used by seabirds, seals and river otters. However, these adjacent habitats are highly altered and continuously disturbed by human activities such as dog walking. Minimal habitat exists for rare or at-risk wildlife adjacent to the site.

Shrubs surrounding the Macaulay Point site may provide foraging and nesting habitat for local songbirds such as Song Sparrow and Dark-eyed Junco (Meidinger and Pojar 1991).

5.5.2.2 Clover Point

The Clover Point site is located in Clover Point Park, a highly disturbed active recreation park. The shoreline at the south end of Clover Point remains in a near natural state. River otter latrines have been documented at the tip of the point approximately 200 m from the existing pump station (CRD 2013a).

Clover Point Park and adjacent foreshore and marine habitats are a common stop-over for migratory birds. Species such as Bald Eagle, Black Oystercatcher, Black Turnstone, Killdeer, Surfbird, Dunlin, Sanderling, plovers, ducks and geese can be seen regularly at Clover Point. Migrating sandpipers, Whimbrel, Marbled Godwit, Red Knot, Ruddy Turnstone, Red-listed Horned Lark and Western Meadowlark have been documented in and near the park.

Migratory birds use adjacent areas primarily during spring and fall migration. No impacts on rare or at-risk wildlife are expected from project activities.

No wildlife habitat features are known or expected to occur on the site footprint or workspace areas (BC CDC 2010a).

5.5.2.3 McLoughlin Point

The McLoughlin Point site is located on what was previously an oil tank farm owned by Imperial Oil. The workspace areas located north and west of the site have been previously developed and paved. No wildlife use or wildlife habitat features were recorded for the site or workspace areas. No at-risk wildlife or important wildlife habitat features are known or expected to occur on the site or workspace area (BC CDC 2010a).

Adjacent areas include Garry oak rock-outcrop, coastal bluff habitat and mature Douglas-fir forest. These areas contain such wildlife habitat features as decomposing logs and wildlife trees. Garry oak habitat to the north of the property contains river otter latrine sites as described in the Regional Community Atlas (CRD 2013a).

SARA and BC CDC-listed Great Blue Heron and BC CDC-listed Purple Martin may use the shoreline for foraging. Fencing limits wildlife access between the backshore and coastal habitats. Due to its disturbed state and limited connectivity with other natural areas, the Garry oak rock outcrop area to the north of the site provides minimal potential habitat for rare or at-risk species.

Provincially listed species such as blue-listed Purple Martin and red-listed Western Meadowlark (Georgia Depression population) have been sighted in the area but are unlikely to use the project site because of a lack of suitable habitat.

Eastern grey squirrel and eastern cotton tail, both non-native wildlife species, occupy the adjacent vegetated areas and are occasional visitors to the property.

5.5.2.4 Arbutus

With exception of the disturbed meadow where much of the attenuation tank will be located, most of the Arbutus Road site is composed of young and mature, second growth forest. The value of the understory wildlife habitat of the site has been diminished by invasive weeds and ground disturbances. The forest canopy, however, still provides important habitat for wildlife. Forested habitats to the northwest are less disturbed but contain little to no habitat for rare or at-risk wildlife (TERA 2013).

Wildlife habitat features recorded on the Arbutus Road site include several wildlife trees, mature, large limbed trees, rotten logs and other woody debris. Wildlife trees provide potential nesting habitat for woodpeckers, Northern Saw-whet Owls and Western Screech Owls (blue listed). There are also habitat features of importance to raptorial birds such as Coopers Hawks, including potential nest sites and prospective prey. The downed rotten logs and other woody debris support a variety of invertebrates and small mammals, which are important foods for the birds breeding in the area.

Several wildlife trails occur on the site, and black-tailed deer use the forested area for security and thermal cover, as well as for feeding.

The forest provides breeding habitat for several common bird species, such as American Robin, Chestnut-backed Chickadee, Pine Siskin, Winter Wren, House Finch, Dark-eyed Junco, Golden-crowned Kinglet, Spotted Towhee, and Red-breasted Nuthatch (Hocking 2000). During an April 2009 site visit, a Barred Owl was heard vocalising nearby and other species noted on the candidate site included Orange-crowned Warbler and Swainson's thrush.

5.5.2.5 Craigflower

The proposed pump station is located in an urbanized portion of View Royal. The site is bordered by Portage Inlet to the north and to the east. The E&N Railway and a residential driveway are located to the west of the site and the Old Island Highway and Shoreline Public School are located to the south. The site has been previously filled and is currently vegetated with shrub and tree species that provide foraging and nesting habitat for local songbirds such as Song Sparrow and Dark-eyed Junco (Meidinger and Pojar 1991). The site provides minimal habitat for mammals but likely hosts a variety of invertebrate species.

The adjacent areas provide wildlife habitat in the form of a narrow band of shrubs and trees and adjacent marine environments. Great Blue Heron (provincially blue listed and federally listed under SARA) and other bird species forage regularly in the adjacent mud flats at low tide. Two wildlife trees were identified along the shoreline. Heavy public use of the site, including the adjacent Shoreline Public School grounds and the neighbouring roadway, limits site use by wildlife and minimizes corridor use by large mammals such as cougar, bear and deer. Provincially and federally listed Olympia oyster resides in Portage Inlet. These oysters inhabit the sub-tidal zone located below the lowest tide levels and will not be affected by pump station construction or operation activities.

5.5.3 Ancillary Facility Site Conditions

5.5.3.1 Macaulay Point to McLoughlin Point, Currie Road to Clover Point and Clover Point to McLoughlin Point

The ancillary facilities will be installed beneath existing paved roads and under Victoria Harbour for the conveyance pipes from Ogden Point to McLoughlin Point. Though adjacent areas may contain sensitive ecosystems, few wildlife habitats or habitat features are adjacent to the proposed ancillary pipe routes. The Douglas fir forest and Garry oak rock outcrops west and north of the McLoughlin Point site contain foraging, security and reproductive habitat for several bird and wildlife species. Additionally, the large street trees lining Dallas Road near Ogden Point provide potential nesting and security habitat for urban wildlife species.

5.5.3.2 Arbutus Road

The ancillary facilities associated with the Arbutus Road site will connect to existing sewer infrastructure in roads and established rights-of-way. Existing pipe routes will be realigned from the existing East Coast Interceptor into the tank. A new outlet pipe will connect the attenuation tank to the existing wastewater infrastructure on Haro Road. The new piping will parallel existing infrastructure which disturbed the soil and vegetation when initially installed. These rights-of-way have now become part of the trail system and have little to no vegetation. These areas do not contain important wildlife habitat or habitat features. Adjacent areas include mature trees and shrub habitats.

5.5.3.3 Craigflower

On the east side of Portage Inlet, the proposed ancillary facilities will be installed beneath the sports field located next to Shoreline Public School. Mixed vegetation, tree patches, shrub cover and two wildlife trees provide foraging and nesting habitat for native songbirds (Meidinger and Pojar 1991). No sensitive ecosystems have been identified in this area. Public use and the adjacent roadways reduce site use by medium and large mammals. Bird species such as raptors and provincially listed cormorants make sporadic use of nesting trees found in the project footprint.

One gravity sewer and two new forcemains are proposed for underground installation as part of the project. The pipe routes were previously cleared and have since been re-vegetated with tree and shrub species that provide food and nesting habitat for local songbirds during the breeding bird season (Meidinger and Pojar 1991). No sensitive ecosystems have been identified in this area. Public activity and adjacent roadways reduce site use by medium and large mammals. Bird species, such as raptors and provincially listed cormorants, make sporadic use of trees found in the project footprint.

Portage Inlet provides habitat for bird species, marine mammals and invertebrates. Portage Inlet is part of the federally classified Migratory Bird Sanctuary and migratory and resident bird sightings have been described in the Regional Community Atlas for this site (CRD 2013a). Regular use of the foreshore by mammals, such as river otter, mink and seal, has not been observed. Marine invertebrates including barnicle (*Balanus sp.*) and mussel (*Mytilus sp.*) species are present on the rocks in the intertidal zone. Great Blue Heron (provincially blue listed and federally listed under SARA) and other bird species regularly make use of the mud flats at low tide for foraging. Provincially and federally listed Olympia oysters have not been observed in the project footprint.

5.5.4 Impact Assessment and Mitigation Measures

5.5.4.1 Macaulay Point

Construction

Potential Impact: Construction activities may affect wildlife or wildlife habitat.

Construction of new structures at the Macaulay Point site will occur entirely on previously disturbed portions of the CRD property. Workspace and workspace areas also are located solely on previously-disturbed lands. No wildlife or habitat is identified on the site. No sensory disturbance effects are expected to affect wildlife in the area at any time of year.

The impacts of construction activities on wildlife or wildlife habitat will be short-term, local, reversible, negligible and **less than significant**.

Operation

Potential Impact: Operational activities may interfere with wildlife or wildlife habitat.

The new structures at Macaulay Point site will be situated entirely on previously disturbed portions of the CRD property, where very little wildlife use occurs, and no critical wildlife habitats exists. The operations of the proposed facility expansion at Macaulay Point will not be materially different from those already occurring at the site. Therefore, no adverse effects to wildlife or wildlife habitat are expected during operation of the proposed Macaulay Point facility and the impacts will be **less than significant**.

5.5.4.2 Clover Point

Construction

Potential Impact: Construction activities may affect wildlife and wildlife habitat.

Construction of the Clover Point facility will require the removal of a small area of turf grass that may be occasionally used by birds. The area is considered marginal wildlife habitat. The expanded facility will be entirely underground and the area will be restored following construction.

Construction activity may cause sensory disturbances and could alter migratory bird stop-over patterns if the construction activities take place during the spring and fall bird migratory period. Disturbance seems unlikely because the facility is in an urban setting and is subject to high volumes of vehicular traffic and active water and land recreation in and near Clover Point Park. Sensory disturbances to wildlife in the area due to construction activities are expected to be rare.

Mitigation Measures: Reintroduction of native plant species to the Clover Point site following construction would enhance wildlife habitat and may benefit some wildlife species.

Effects of Clover Point facility construction on wildlife are local, short-term, irreversible, of moderate magnitude, and **less than significant**. If mitigation measures are implemented, the effects of the facility construction could be **beneficial**.

Operation

Potential Impact: Operational activities may interfere with wildlife or wildlife habitat.

Because the operations of the proposed facility expansion at Clover Point will not be materially different from those already occurring at the site, adverse effects to wildlife or wildlife habitat are expected during operation of the Clover Point facility, and impacts will be **less than significant**.

5.5.4.3 McLoughlin Point

Construction

Potential Impact: Construction activities may affect wildlife or wildlife habitat.

Based on current facility designs, the proposed road at the north end of the project footprint will abut native trees and shrubs on the adjacent DND property but no removal of wildlife habitat or habitat features is anticipated. Native songbirds use this vegetation for feeding, security habitat and potentially for nesting. Construction activities at the workspace areas north (Site A) and west (Site F) of the site will not affect wildlife or wildlife habitat.

Existing sources of regular wildlife sensory disturbances at McLoughlin Point include sea and air traffic, construction during site remediation and urban use. River otters using the adjacent shorelines could be disturbed by construction activities.

Mitigation Measures: Wildlife habitat and native vegetation located outside of the project boundary should be avoided during construction to minimize potential disturbance.

Temporary construction workspace areas should also avoid areas of wildlife habitat and native vegetation.

The facility site and workspace should be fenced to protect adjacent areas from construction impacts.

Applying standard construction practices and recommended mitigation during the construction of the McLoughlin Point facility will result in impacts to wildlife and wildlife habitat that are local, medium-term, low magnitude and **less than significant**.

Operation

Potential Impact: Operational activities may interfere with wildlife or wildlife habitat.

Operation of the McLoughlin Point facility is not expected to cause adverse effects to wildlife or wildlife habitat, so the impacts will be **less than significant**.

5.5.4.4 Arbutus Road

Construction

Potential Impact: Construction will require removal of wildlife habitat.

Construction of the attenuation tank require the removal of approximately 4,180 m^2 of previously disturbed meadow and what is considered low sensitivity vegetation comprised of young forest, shrubs and ground disturbance. This removal will cause a loss of wildlife habitat features, such as nesting sites and might affect wildlife movement patterns through the area.

Mitigation Measures: Reintroduction of native plant species to the Arbutus Road site following construction will enhance wildlife habitat and may benefit some wildlife species.

Construction of the Arbutus Road attenuation tank will result in medium-term, reversible, moderate magnitude effects on wildlife habitat availability and wildlife movements on the project footprint. These impacts are assessed to be **less than significant**.

Potential Impact: Construction activities may disturb wildlife.

Construction activity may cause sensory disturbances to nesting birds and could affect nesting success if the construction activities take place during the spring bird breeding period.

Mitigation Measures: If construction must occur during the breeding bird nesting season (March 15 – July 31), nest searches should be performed by a qualified biologist before vegetation removal in accordance with Canadian Wildlife Service advice for compliance with the *Migratory Birds Convention Act*.

If the mitigation measures are implemented, the effects of construction of the facility at the Arbutus Road site will be reversible, medium-term, of low magnitude and **less than significant**.

Operation

Potential Impact: Operational activities may interfere with wildlife or wildlife habitat.

The facility operation will incrementally increase human presence and human-caused disturbances of wildlife in the area. This impact is assessed to be local, medium-term, reversible, of low magnitude and **less than significant**.

5.5.4.5 Craigflower

Construction

Potential Impact: Construction activities may affect wildlife or wildlife habitat.
The proposed footprint of the pump station facility requires removal of several patches of native trees and shrubs. These are used by native songbirds for foraging, security habitat and nesting during the breeding bird season. Existing sources of sensory disturbance to wildlife include the Old Island Highway and Shoreline Public School activity.

Mitigation Measures: Native vegetation should be restored to the site after construction is complete. Existing plants should be salvaged, when feasible, for this purpose.

Temporary construction areas should avoid wildlife habitat and native vegetation. The facility site and workspace should be fenced to protect adjacent areas from construction impacts.

If construction must occur during the breeding bird nesting season (March 15 to July 31), nest searches should be performed by a qualified biologist before vegetation removal in accordance with Canadian Wildlife Service advice for compliance with the *Migratory Birds Convention Act*.

Proposed construction activities will remove native vegetation, resulting in effects to wildlife and wildlife habitat. If mitigation measures are followed, construction of the pump station facility will result in impacts to wildlife and wildlife habitat that are local, medium-term, low magnitude and **less than significant**.

Operation

Potential Impact: Operational activities may interfere with wildlife or wildlife habitat.

Operation of the proposed pump station facility is not expected to cause adverse effects to wildlife or wildlife habitat in the area, so the impacts will be **less than significant**.

5.5.5 Ancillary Facilities

5.5.5.1 Macaulay Point, Clover Point and McLoughlin Point

Construction

Potential Impact: Construction activities may affect wildlife or wildlife habitat.

Conveyance pipelines will be installed in trenches along existing roads, along the south edge of Dallas Road and via a HDD crossing of Victoria Harbour. Most construction of the ancillary facilities will not require the removal of wildlife habitat or habitat features. Depending on the final alignment of the City of Victoria's proposed bike path along the south side of Dallas Road, several trees will be removed, which will affect associated wildlife habitat features. Sensory disturbances to wildlife during construction of the ancillary facilities are expected to be minor.

Mitigation Measures: Align the proposed bicycle path to minimize potential impacts to wildlife and wildlife habitat. Revegetate disturbed areas following construction.

The impact of the construction of the ancillary facilities on wildlife or wildlife habitat will be limited to the project footprint, and will be short-term, reversible, low to moderate magnitude and **less than significant**.

Operation

Potential Impact: Operational activities may interfere with wildlife or wildlife habitat.

There are no expected adverse effects to wildlife or wildlife habitat along the pipeline route during operation of the wastewater treatment facilities, so impacts will be **less than significant**.

5.5.5.2 Arbutus

Construction

Potential Impact: Construction activities may affect wildlife or wildlife habitat.

The installation of conveyance pipelines will be installed in trenches along existing pathways or directly adjacent to the underground attenuation tank. Construction of the ancillary facilities will require the removal of several trees, and associated wildlife habitat features. Bird nests may be disturbed if construction occurs during the breeding bird season. Sensory disturbances to wildlife during construction of the ancillary facilities are expected to be temporary.

Mitigation Measures: If construction must occur during the breeding bird nesting season (March 15 – July 31), nest searches should be performed by a qualified biologist before vegetation removal in accordance with Canadian Wildlife Service advice for compliance with the *Migratory Birds Convention Act*.

The impact of the construction of the Arbutus Road ancillary facilities on wildlife or wildlife habitat will be limited to the project footprint, short-term, reversible, low magnitude and **less than significant**.

Operation

Potential Impact: Operational activities may interfere with wildlife or wildlife habitat.

No adverse effects to wildlife or wildlife habitat are expected along the pipeline route during operation, so impacts will be **less than significant**.

5.5.5.3 Craigflower

Construction

Terrestrial Route

Potential Impact: Construction activities may affect wildlife or wildlife habitat.

The terrestrial section of the proposed conveyance pipelines will be installed in trenches. Sensory disturbance to wildlife during construction of the ancillary facilities is expected to be substantial in relation to existing sensory disturbance, but temporary in duration.

Mitigation Measures: Native vegetation should be restored to the site after construction is complete. Existing plants should be salvaged, when feasible, for this purpose.

Temporary construction areas should avoid areas of wildlife habitat and native vegetation. The facility site and workspace should be fenced to protect adjacent areas from construction impacts.

If construction must occur during the breeding bird nesting season (March 15 to July 31), breeding bird nest searches will be performed by a qualified biologist prior to vegetation removal in accordance with Canadian Wildlife Service recommendations for compliance with the *Migratory Birds Convention Act*.

Proposed construction activities will remove native vegetation that will impact wildlife and wildlife habitat. If mitigation measures are followed, construction of the ancillary facility will result in impacts to wildlife and wildlife habitat that are local, medium-term, low magnitude and **less than significant**.

Portage Inlet crossing

Potential Impact: Sedimentation from upland excavation may inhibit growth of intertidal invertebrates.

The proposed conveyance pipelines will be installed underneath Portage Inlet using trenchless technology. This will avoid potential disturbance of the mud flats, including potential sediment loading and turbidity.

Sediment loading in Portage Inlet could occur if excavated soil piles erode during rain events or soil is saturated during excavation. Runoff can transport soil particles from the excavated soil stockpiles into Portage Inlet, causing sediment loading and turbidity.

Mitigation Measures: Prepare and implement a sediment and erosion control plan for Portage Inlet crossing construction. The plan will include measures such as covering stockpiles of excavated soil to prevent erosion and settling, minimising clearing of vegetated areas or filtering site runoff and water from excavations, and response in case sediments are released during inlet crossing construction.

Effects of ancillary facility construction on wildlife and wildlife habitat are local, short-term, reversible, low magnitude and **less than significant**.

Operation

Terrestrial Route

Potential Impact: Operational activities may interfere with wildlife or wildlife habitat.

No adverse effects to wildlife or wildlife habitat are expected along the pipeline route during operation of the pump station ancillary facilities, so impacts will be **less than significant**.

Portage Inlet crossing

Potential Impact: Pipeline operation may affect marine wildlife.

No sedimentation is expected during facility operation and there are no expected adverse effects to wildlife or wildlife habitat along the pipeline route during operation of the pump station ancillary facilities.

Effects of ancillary facility operation are short-term, reversible, negligible and **less than significant**.

5.6 Fish

There are no fish-bearing watercourses in or adjacent to treatment facility sites. Hence, there are no potential effects on fish or fish habitat that need addressing and impacts are considered **less than significant**.

However, potential fisheries impacts could occur at two ancillary locations: The HDD crossing beneath Victoria Harbour from Ogden Point to McLoughlin Point and the trenchless crossing of Portage Inlet at the Craigflower site. Both of these locations will be addressed in the section.

The marine Environmental Impact Study assesses potential impacts to fish and fish habitat in the marine environment relating to construction and operation of the McLoughlin Point facility outfall and effluent discharge to the Juan de Fuca Strait.

5.6.1 Regional Overview

The project area is located in the Juan de Fuca Strait Marine Ecosection (BC Marine Conservation Analysis 2013). This Ecosection is characterized by semi-protected coasts and estuary-type outflow currents (Howes *et al.* 1997). The strait's oceanographic and habitat characteristics are shaped by a glacially formed deep trough, and other glacial scour features (Howes *et al.* 1997).

Marine habitat in the Juan de Fuca Strait Marine Ecosection is intermediate between the more sheltered Strait of Georgia and the more open Vancouver Island Shelf Ecosection (Howes *et al.* 1997). The strait is a migratory corridor for anadromous fish and has moderate productivity of a number of different neritic and oceanic species of plankton (Howes *et al.* 1997).

The project area is also in the Coastal Douglas Fir moist maritime (CDFmm) Biogeoclimatic Zone, which hosts a number of federally and provincially listed marine and freshwater fish. A total of 7 fish species in

the CDFmm are listed as threatened by SARA, and 9 fish species are red- or blue-listed by the CDC. Coho, Sockeye and Chinook salmon are yellow listed by the CDC.

Harvesting pressure from commercial fisheries, habitat loss due to development and pollution, and climate change have all played a role in the decline of fish populations. Fish stocking initiatives and habitat restoration projects are contributing to the re-establishment of some populations.

5.6.2 Ancillary Facility Site Conditions

5.6.2.1 HDD Crossing of Victoria Harbour

The entrance to Victoria Harbour is located between McLoughlin Point in the Township of Esquimalt and Ogden Point Breakwater in the City of Victoria. Depths at the center of the harbour entrance are approximately 10 m. The HDD crossing will extend approximately 850 m from the James Bay Anglers boat ramp to the proposed treatment facility location at McLoughlin Point and will be installed approximately 35 m below sea level in solid bedrock.

Although Victoria Harbour's coastline has been extensively developed, some areas retain their natural state and ecological integrity. In particular, with relation to the crossing location, the small islets in the outer harbour and the shoreline west of McLoughlin Point have been designated as having high to very high ecological value (Archipelago Marine Research Ltd. 2013).

Numerous listed species are found in the marine environment adjacent to McLoughlin Point. Some listed as species of special concern under COSEWIC are Steller sea lions, harbour porpoises, humpback whale and gray whales. The transient population of killer whales and northern abalone have been listed as threatened, and the southern resident population of killer whales is listed as endangered. Additionally, the entire Juan de Fuca Strait is designated as critical killer whale habitat (Archipelago 2013).

The intertidal zone near McLoughlin Point, classified as high marine influence, includes species such as upper intertidal barnacles, patches of gooseneck barnacles, limpets, whelks and anemones. The rocky shoreline at McLoughlin Point could be considered as potential habitat for the northern abalone; which is listed as threatened under SARA. Numerous other species are also found on the nearshore seabed adjacent to McLoughlin Point. These species include benthic infauna (worms and clams) and sessile epifaunal organisms such as sponges, bryozoans, tunicates, tubeworms and anemones. Sea stars, crabs and shrimp also are found in the harbour (Archipelago 2013). Few epibenthic fauna have been identified between the McLoughlin Point and the James Bay Anglers boat launch along the HDD crossing route.

Victoria Harbour is home to many species of resident fish, including, sculpin, gunnel, stickleback, rockfish and flatfish. Coho and chum salmon, as well as cutthroat trout are also present in the harbour and are known to spawn in Colquitz Creek and Craigflower Creek (Archipelago 2013).

Victoria Harbour contains eelgrass, a variety of small red and green algae, canopy kelps, and several types of benthic kelps, which provide habitat to numerous fish species. In particular, there is a section of nearshore stable substrate to the southwest of McLoughlin Point where dense epibenthic vegetation occurs, consisting of bladed kelps, foliose and filamentous red algae and bull kelp. Near the James Bay Anglers boat launch, foliose green algae, sparse bladed kelps and a small patch of eelgrass have been observed (Archipelago 2013).

5.6.2.2 Craigflower - Portage Inlet Crossing

The approximately 30 m crossing of ancillary pipelines at the Craigflower facility site occurs near the head of Portage Inlet. This area consists of tidal meadows, marshes and mudflats. The substrate at the proposed crossing consists predominantly of mud, which dictates the type of fauna occurring at the site. At low tide, the area becomes an extensive mudflat.

Portage Inlet is an estuarine ecosystem. These types of ecosystems provide important habitat to many types of terrestrial and aquatic species. As stated previously, the Colquitz River and Craigflower Creek, which support Coho and Chum salmon and cutthroat trout, drain into the inlet. Each spring a genetically unique herring run returns to the inlet through the Gorge Waterway (CRD 2012).

Although eelgrass is abundant in several areas of Portage Inlet and provides important rearing habitat, it does not occur at the proposed pipeline crossing.

One of the largest remaining coastal populations of native oyster is found in Portage Inlet and the Gorge Waterway. Native oysters are listed as a species of concern by COSEWIC. Similarly, no oysters have been documented at the proposed crossing (CRD 2012). Plumose anemones also have been documented at several locations in the inlet, but none have been documented at the crossing (CRD 2013a).

5.6.3 Impact Assessment and Mitigation Measures

HDD technology will be used to install the conveyance pipe approximately 35 m beneath the seabed at the entrance to Victoria Harbour between McLoughlin Point and the James Bay Anglers boat ramp. The crossing of Portage Inlet will be accomplished using a trenchless method involving pipe jacking. Both these technologies are used to minimize impacts to the marine environment.

5.6.3.1 HDD Crossing of Victoria Harbour

Construction

Potential impact: Fish or fish habitat will be affected by construction of the ancillary crossing.

Although unlikely, there is the potential for a loss of drilling fluid (typically comprised of bentonite, a non-toxic clay and water) and cuttings to the marine environment if “frac-out” occurs. Potential also exists for upland spills of oils and contaminants to enter the marine environment.

Mitigation Measure: Develop and implement a spill containment plan for upland areas and a contingency plan to contain drill fluid in the borehole in case of a “frac-out” event. An on-site monitoring program should be implemented that includes pre-construction briefings on environmental sensitivities, response plans and containment priorities.

Effects of ancillary construction on fish or fish habitat are short-term, reversible, low-impact and **less than significant**.

Potential impact: Acoustic disturbances will affect marine mammals during construction of the ancillary crossing.

Potential exists to disturb marine mammals during construction. The *Marine Mammal Regulations* (Section 7) of the *Fisheries Act* prohibits disturbances of marine mammals, which includes sounds associated with industrial activity.

Mitigation Measure: Schedule noisy construction activities to occur during months where killer whales are least likely to be near the entrance to Victoria Harbour (October to May) if feasible. Establish cooperation with local whale watching spotting network in order to receive current information on killer whale locations. Collaborate with federal orca specialists to minimize potential adverse effects on marine mammals

Effects of ancillary construction on marine mammals are considered short-term, reversible, low-impact and **less than significant**.

Operation

After the conveyance pipe is installed beneath Victoria Harbour, no impacts to marine mammals or fish or fish habitat are anticipated during normal operation, and impacts during operation are considered **less than significant**. Compared to present conditions, the post-project discharges of treated effluent is intended to result in a **beneficial** impact to marine mammals and fish and fish habitat.

5.6.3.2 Portage Inlet Crossing

Construction

The crossing of Portage Inlet will be accomplished using a trenchless method involving pipe jacking.

Potential Impacts: Fish or fish habitat will be affected by construction of the trenchless crossing at Portage Inlet.

Although unlikely, sedimentation causing smothering or turbidity at pipe jacking exit locations has the potential to affect fish or fish habitat. Surface disruptions involving sediment sags or humps can occur above the installation.

Mitigation Measures: Monitor pipe jacking exit locations during construction to ensure spoils do not enter the marine environment.

Potential Impacts: Fish or fish habitat can be affected by contamination by oil or lubricant resulting from accidental spills in upland areas.

Oil and lubrication (consisting of bentonite or polymers) are used during the pipe jacking. Accidental spills of oil or lubrication in upland areas have the potential of entering Portage Inlet and affecting fish or fish habitat.

Mitigation Measures: Prepare and implement a spill containment plan for use during ancillary facility construction. The plan will include measures to minimize the risk of spills and having appropriate clean up equipment on-site in the event of a spill.

With mitigation measures implemented, potential impacts to fish or fish habitat are considered short-term, reversible, of low magnitude and **less than significant**.

Operation

After the subsurface conveyance pipe is installed beneath Portage Inlet, no impacts to fish or fish habitat are anticipated during normal operation. Therefore, impacts to fish or fish habitat during operation are considered **less than significant**.

5.7 Air Quality

5.7.1 Treatment Facility Site Conditions

High wind speeds create direct dilution and mechanical air turbulence, resulting in good odour dispersion. These beneficial conditions do not occur if wind speeds are low. Periods of calm conditions and inversions, if combined with an odour release from a treatment facility, would increase the risk of adverse odour impacts.

5.7.1.1 Macaulay Point

Meteorological conditions at Macaulay Point are considered the same as at McLoughlin Point, discussed separately. The project only requires upgrades to the existing Macaulay Point pump station, and odour control equipment will be maintained or upgraded. Hence, no change to existing air quality is anticipated.

5.7.1.2 Clover Point

Meteorological conditions were not assessed for Clover Point. The project only requires upgrades to the existing Clover Point pump station, and odour control equipment has been maintained and upgraded. For these reasons, no change to existing air quality is anticipated.

5.7.1.3 McLoughlin Point

Figures 25, 26, 27 represent 2004 - 2008 annual wind speed, wind direction and atmospheric stability in the Victoria and Esquimalt Harbour areas. Air temperature, air pressure and wind data from 2004 to 2008 were obtained from the Esquimalt Harbour weather station. Cloud opacity and ceiling height were obtained from Victoria International Airport. The Esquimalt Harbour weather station is located at the end of a short jetty extending into the water between Duntze Head and Fisgard Island. The station is well exposed to winds coming off Juan de Fuca Strait from the south through southwest and from over Esquimalt Harbour and Constance Cove from the north-northwest through northeast. The only major high-friction surface is the land and buildings adjacent to the station to the east.

The Esquimalt Harbour weather station was used to model the meteorological conditions at the McLoughlin Point site. Data from this station were used because data from the Victoria Harbour station are not available for the important evening hours. The Esquimalt Harbour weather station data is considered representative because it is nearby and is subjected to similar wind patterns. This station is located 3.4 km west-northwest of the McLoughlin Point site. McLoughlin Point has more water exposure to the southeast than does Esquimalt Harbour.

The most frequent annual wind directions at the weather station are toward the southwest and south-southwest (Figure 25). These directions have a relatively high frequency of low wind speeds in the 0.5 to 2.1 m/s range. Winds blowing in the opposite direction are also common but are accompanied by generally higher wind speed, resulting in more atmospheric dispersion.

The pattern of the annual wind rose is a combination of warm and cold season prevailing winds. Winter winds primarily blow toward the southwest sector. From November through February, 54% of winds are headed between 200 and 250 degrees. This pattern would also hold at the McLoughlin Point site. However, the frequency of winter northwest trending winds that precede the passage of mid-latitude cyclonic storms would be greater and their wind speeds much higher at McLoughlin Point with its open exposure and long open-water fetch to the southeast.

Summer winds primarily blow toward the north-northeast. June through September 44% of winds are headed between 10 and 50 degrees. These winds come off Juan de Fuca Strait during the daytime and bring maritime fresh air. Summer wind speeds reach a peak during the afternoon and early evening. Lighter winds blowing toward the southwest sector account for 14% of summer observations, mainly occurring during night and early morning. This wind pattern would hold at McLoughlin Point.

Overall wind speeds in the area are moderate. The annual mean speed is 3.1 m/s and only 2.6% of the hourly observations are calm (Figures 25 and 26). However, the median is only 2.0 m/s. Less than 11% of the measured wind speeds are 5.7 m/s or greater.

Wind speeds along the shoreline are great enough to produce mechanical turbulence. This characteristic, combined with the water surfaces that limit surface heating during the day and surface cooling at night create a neutral stability (class D, neither stable nor unstable) 46% of the time. Unstable air (classes A, B and C) occurs with summer daytime solar heating of the ground. Prevailing winds during summer days blow toward the northeast and north-northeast. Most unstable conditions accompany these wind directions.

Stable air that inhibits vertical mixing and odour dilution (classes E and F) occurs most commonly with winds blowing toward the southwest and south-southwest. Light winds from this direction are most frequently associated with high pressure systems in winter and night time conditions in summer. Of most concern is class F (very stable) which occurs 18% of the time at Esquimalt Harbour. The frequency and direction of effect would be similar at McLoughlin Point.

Although infrequent in occurrence, McLoughlin Point winds blowing toward the west through north-northwest carry odour directly over land without any fetch and dilution over water. Maximum odour effects would occur in the McLoughlin Point area in these directions during the infrequent times of light winds and stable air (Figures 25 and 27).

Figure 25 Wind Rose for Esquimalt (2004 to 2008)

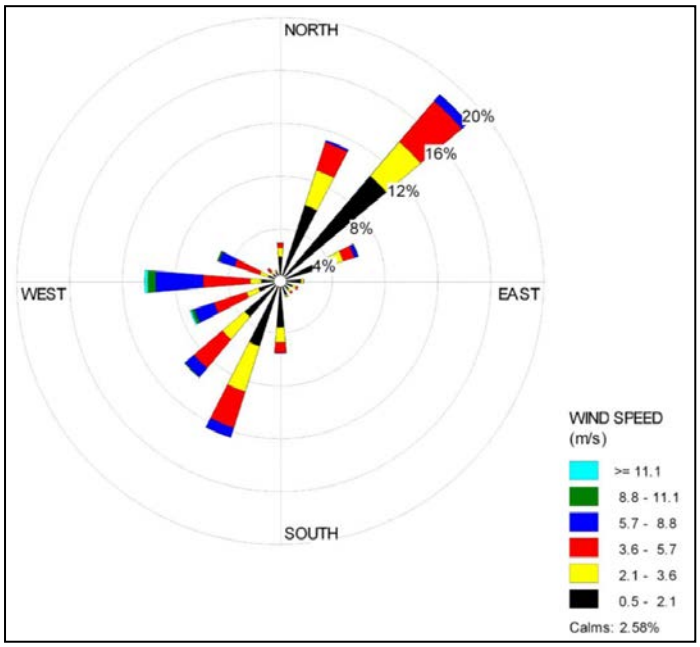


Figure 26 Atmospheric Stability Rose for Esquimalt (2004 to 2008)

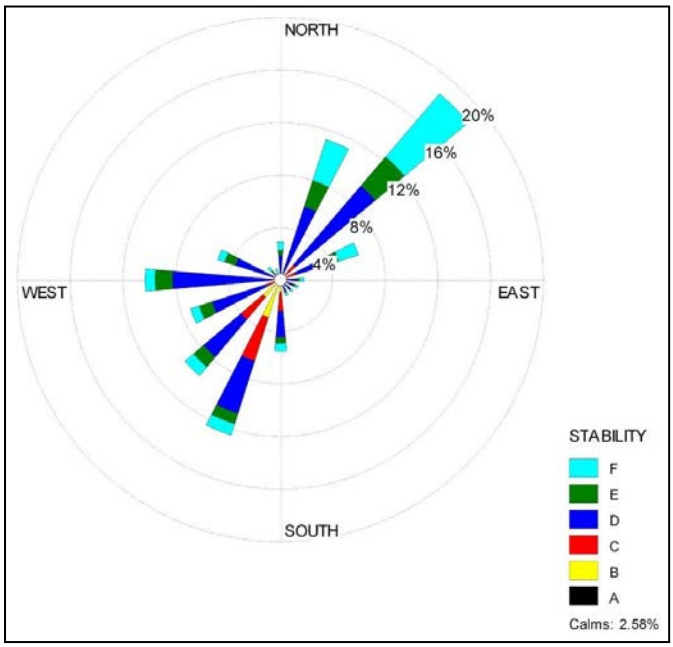
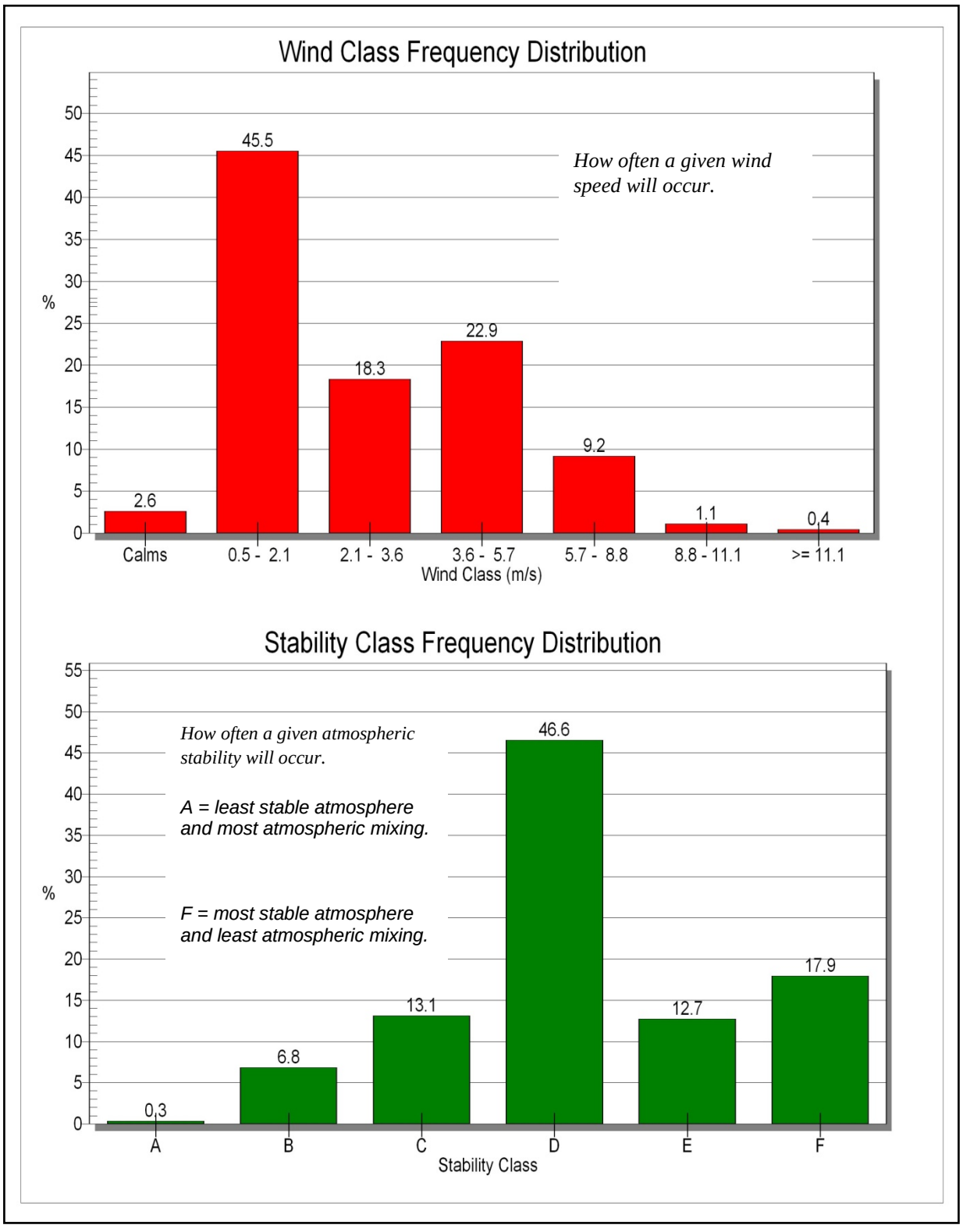


Figure 27 Frequency and Distribution of Wind and Atmospheric Stability, Esquimalt (2004 to 2008)



5.7.1.4 Arbutus Road

Meteorological studies were conducted for the Arbutus Road area in 2009, when the CRD was considering construction of a treatment facility there. Because now an attenuation tanks is being assessed, little or no odour generation is likely and it is unnecessary to analyse odour dispersion or concentration.

The attenuation tank facility will include odour control systems that are intended to reduce odour to levels lower that are released by the existing sewage meter station on the site.

5.7.1.5 Craigflower

Meteorological conditions were not assessed for the Craigflower site. Because the project involves the construction of an upgraded pump station with effective odour control technology, no adverse effect on existing air quality is expected.

5.7.2 Impact Assessment and Mitigation Measures

5.7.2.1 Macaulay Point

The Macaulay site is located next to Macaulay Point Park, a municipal park located approximately 200 m west of the treatment facility, and within 100 m of military housing. The existing pump station is a source of occasional malodours. However, Macaulay Point is usually well ventilated by local winds and, therefore, project-related odour emissions can be expected to be quickly diluted to non-detectable levels.

Because there will be no change in volume of wastewater being pumped, the proposed facility upgrades will not change air quality in the local area. The odour control system at Macaulay Point will be maintained or upgraded.

<u>Construction</u>

Potential Impact: Air quality will be reduced by dust and exhaust emissions during construction.

People may observe reduced air quality from construction dust and exhaust emissions when outdoors for extended periods. Dust can be a nuisance when it adheres to windows and vehicles or seeps into houses. No adverse health effects are anticipated. The dust and exhaust emissions would be most noticeable to those close to the facility, such as residents of the military housing, users of the Macaulay Point Park and the public walkway south of the facility, and users of the military training facilities to the west and north of the facility.

Mitigation Measures: Dust control measures, including the use of box covers on trucks, the application of the CRD codes of practice, and a dust management plan would reduce effects on residents and land users. Vehicles and equipment should be shut off when not in use to reduce exhaust emissions.

The potential effect of reduced air quality from dust and exhaust emissions during Macaulay Point facility construction is local, short-term, reversible, low in magnitude and **less than significant**.

<u>Operation</u>

Potential Impact: Air quality will be reduced by odour emissions during facility operation.

The existing Macaulay Point pump station has an odour control system. The upgrades to the existing facility include an expanded pump station and a backup generator. Because the project only requires upgrades to the existing Macaulay Point pump station, no change to existing air quality is anticipated. The potential impact on air quality is assessed to be local, long-term, irreversible, of low magnitude and **less than significant**.

5.7.2.2 Clover Point

The Clover Point site is located in Clover Point Park, a heavily-used municipal park located on the southern shore in the City of Victoria.

Clover Point is located approximately 200 m south of a residential area of detached and attached homes. The existing pump station is a source of occasional malodours. As noted previously, Clover Point is usually well ventilated by local winds and, therefore, project-related odour emissions can be expected to be quickly diluted to non-detectable levels.

Because there will be no change in volume of wastewater being pumped, the proposed facility upgrades will not change air quality in the local area. The odour control system at Clover Point has recently been upgraded and is considered adequate for the expanded pumping facility.

Construction

Potential Impact: Air quality will be reduced by dust and exhaust emissions during construction.

Nearby residents and park users may experience reduced air quality from construction dust and exhaust emissions when outdoors for extended periods. Dust can be a nuisance when it adheres to windows and vehicles or seeps into houses. No adverse health effects are anticipated. The dust and exhaust emissions would be most noticeable to those close to the facility. At the Clover Point facility, dust and exhaust emissions may affect residents to the north, northwest, and northeast, and Clover Point Park users. Air quality impacts would mainly occur during excavation and grading activities. Winds at Clover Point tend to blow offshore, which would reduce air quality impacts during construction.

Mitigation Measures: Dust control measures, including the use of box covers on trucks and implementation of a dust management plan, should be used to reduce effects on residents and park users. Vehicles and equipment should be shut off when not in use to reduce exhaust emissions.

The potential effect of reduced air quality from dust and exhaust emissions during Clover Point facility construction is local, short-term, reversible, of low magnitude and **less than significant**.

Operation

Potential Impact: Air quality may be reduced by odour emissions during facility operation.

The existing Clover Point pump station has a new and effective odour control system. Because the expanded facility will handle the same volume of wastewater as the present facility, no change to existing air quality is anticipated. The potential impact on air quality is assessed to be local, long-term, reversible, of low magnitude and **less than significant**.

5.7.2.3 McLoughlin Point

Atmospheric Dispersion Modeling

Maximum off-site odour concentrations were estimated around the McLoughlin Point site using five years (2004–2008) of wind and temperature data from the nearby Esquimalt Harbour meteorological station (described in the previous section) and cloud-cover and ceiling height data from the Victoria airport. The atmospheric dispersion modeling estimates the maximum 10-minute-averaged odour concentration, over the 5-year modeling period, at identified receptor locations. The model results are then post-processed to create odour isopleths (contours of equal odour concentration) over the potentially affected area.

The McLoughlin Point site is located near the entrance to the Victoria Harbour, where terrain elevations are modest. Clear evening skies and low winds will result in temperature inversions and stable atmospheres with low turbulence and, hence, poor odour dispersion characteristics. Under inversion conditions, the odour plume from a wastewater treatment facility at the McLoughlin Point site will tend to quickly flatten out and brush against nearby elevated surfaces, such as ridges or knolls, resulting in maximum predicted ground-level odour concentration at these locations.

For the McLoughlin Point site, the ambient odour guideline is 5 odour units (OU), which is not to be exceeded under the worst-case meteorological conditions. The effectiveness of treatment facility ventilation air scrubbing would be chosen so that this guideline is not exceeded during normal operation and all meteorological conditions. Figure 28 represents the maximum odour concentrations with sufficient odour control to reduce odour units to approximately 5 OU. Under the worst-case meteorological conditions, the model estimates odour of less than 1 OU for the property line. Outside the property line,

the model estimates odour between 0 and 5 odour units under worst-case conditions for the five years of meteorological data collected from the years 2004–2008.

Construction

Potential Impact: Air quality may be reduced by dust and exhaust emissions during construction.

People may experience reduced air quality from construction dust and exhaust emissions when outdoors for extended periods. Dust can be a nuisance when it adheres to windows and vehicles or seeps into houses. No adverse health effects are anticipated. The dust and exhaust emissions would be most noticeable to those close to the facility site. At the McLoughlin Point site, there is a substantial buffer between most of the military housing and the treatment facility site. However, two military residences are located 45 m and 70 m west of the facility site. The trees between the facility site and the residences would reduce the air quality effects during facility construction.

Mitigation Measures: Dust control measures, including the use of box covers on trucks, the application of the CRD codes of practice, and a dust management plan should be used to reduce effects on residents and land users. Vehicles and equipment should be shut off when not in use to reduce exhaust emissions.

The potential effect of reduced air quality from dust and exhaust emissions during McLoughlin Point facility construction is local, medium-term, reversible, low in magnitude and **less than significant**.

Operation

Potential Impact: Air quality may be reduced by odour emissions during facility operation.

The model predicts that the maximum ground level concentration that would occur when a gentle late night breeze of 1 m/s causes the odour plume to impinge on a 32 m above sea level knoll approximately 425 m west-northwest of the McLoughlin Point site. The predicted maximum concentration of approximately 5 OU would be expected to occur perhaps once during a 5-year period of normal operation. However, Figures 25 and 26 illustrate that wind rarely blows towards the west-northwest. A more usual evening wind would be an outflow over the open water, and not over land.

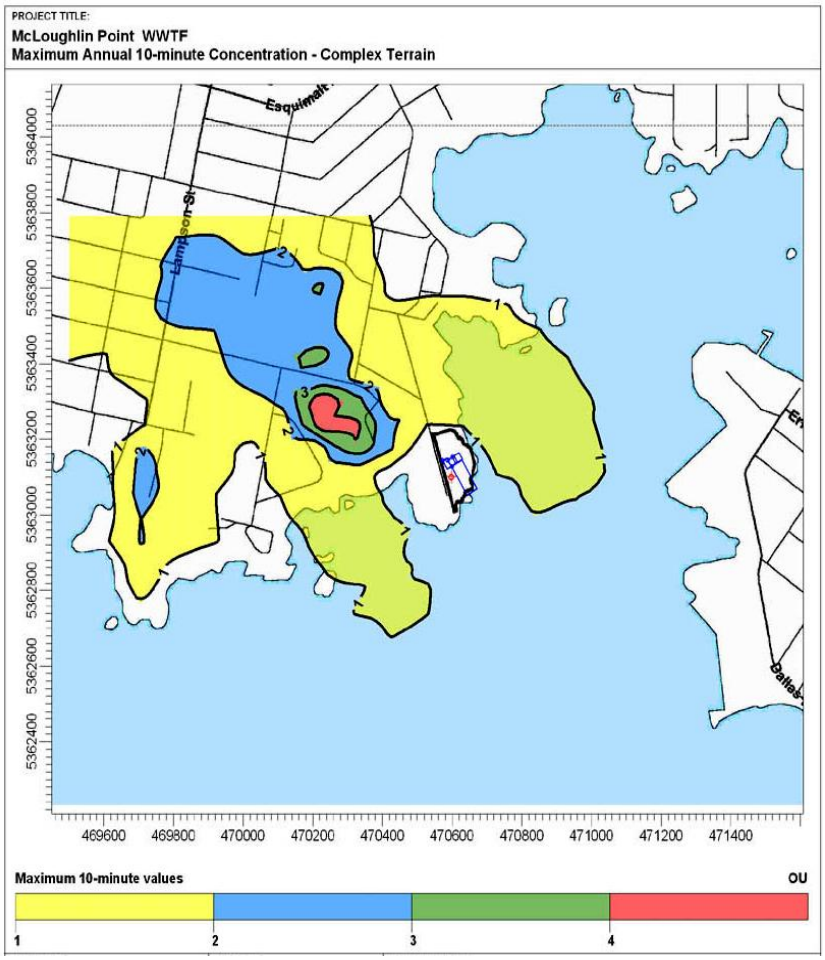
Typical operation of the facility will result in no detectable odour at the property boundary. Annual maintenance will be conducted, when possible, during breezy weather, minimising risk of adverse odour effects. However, if a redundant odour control system is not installed and running in parallel with the main system, adverse odours could be detectable during maintenance.

In rare cases of equipment malfunction, if a redundant odour control system is not installed, adverse odour effects of unknown magnitude and duration could affect the local area. The season and prevailing wind direction at the time of the malfunction would determine the location and intensity of adverse air quality effects.

Mitigation Measures: Redundant odour control systems and backup generators should be installed to reduce the risk of untreated air discharge from the facility. This mitigation also will ensure that odour impacts during maintenance, breakdowns or power failure are reduced to low magnitude.

The CRD will respond to neighbourhood concerns about odour.

Figure 28 Maximum 10-minute Duration Odour Isopleths for McLoughlin Point Site



Based on the existing treatment facility design, which does not provide a redundant odour control system, the potential impact on air quality from odour emissions during routine maintenance or mechanical failure is considered local, short-term, occasional, reversible, high magnitude and **significant**.

If a redundant odour control system is installed to operate during routine maintenance or mechanical failure, the potential impact on air quality will be reduced to low magnitude and **less than significant**.

5.7.2.4 Arbutus Road

The Arbutus Road site is located in Haro Woods, a wooded area used for recreation by local residents. The site is located in the District of Saanich.

Arbutus Road is bordered to the west and east by forested property owned by the District of Saanich, to the south by forested property owned by the University of Victoria. Queen Alexandra property is located north of the site across Arbutus Road. The closest residential areas are located 280 m northwest on Finnerty Road, 215 m northeast on Alpine Crescent and 125 m southwest on Sutton Road.

Occasional malodours are presently detectable on the site from the flow meter chamber. This occurs when the atmospheric conditions are stable, wind velocities are low and atmospheric inversions prevent mixing. These characteristics generally occur during summer months.

An odour control system will be installed at the attenuation tank facility to mitigate potential odour effects.

Construction

Potential Impact: Reduced air quality from dust and exhaust emissions during construction.

People using the adjacent trails in Haro Woods, or pedestrians on Arbutus Road, may experience reduced air quality from construction dust and exhaust emissions. The site is surrounded by wooded areas to the northwest, east and south, and the Queen Alexandra playing field to the north and northeast. The residences located 125 m southwest on Sutton Road and the G. R. Pearkes Child Care Centre located 130 m east of the site may experience minor dust accumulation on surfaces. Dust generation will be limited to the excavation and grading of the site.

Mitigation Measures: Dust control measures, including the use of box covers on trucks, the application of the CRD codes of practice, and a dust management plan should be used to reduce effects on residents and land users. Vehicles and equipment should be shut off when not in use to reduce exhaust emissions.

The potential effect of reduced air quality from dust and exhaust emissions during the attenuation tank construction is local, short-term, reversible, low in magnitude and **less than significant**.

Operation

Potential Impact: Reduced air quality from odour emissions during facility operation.

As the Arbutus Road site will only contain an attenuation tank, potential odour will be minimal. The use of activated carbon filters will avoid any potential odour issues. The potential for odour releases will only occur when the tank is in operation. The tank will operate during heavy rainfall events, primarily during Victoria's winter season, when there is usually an increase in wind velocity, turbulence and atmospheric mixing. This timing of storms would also coincide with diminished public use of the trails near the attenuation tank.

Typical operation of the attenuation tank will result in no detectable odour at the property boundary. Odorous air will be expelled mainly when the tank is filling. When the tank is draining, air will be drawn into the tank. When in operation, inflowing wastewater will be diluted, which will reduce the odour potential of the sewage. When the tank is not in use, wastewater will flow continuously through a pipe and any odours that could be generated are similar, or will be improved, to what exists presently on the site.

Mitigation Measures: The CRD will respond to public concerns in the unlikely case of reduced air quality resulting from attenuation tank operation.

The potential effects of reduced air quality during operation of the attenuation tank are local, long-term, reversible, of low magnitude and **less than significant**.

5.7.2.5 Craigflower

The proposed pump station is located approximately 200 m west of Shoreline Community Middle School and 40 m east of a residential area.

The design of the Craigflower facility will include best management practices for minimising the potential release of odour. As indicated previously, the proposed pump station will use a deep bed, activated-carbon filled scrubber, which will treat the discharge air from the wet well. Upstream of the carbon bed, a mist and grease eliminator will be used to reduce vaporized liquids. Bioxide^{TM} will also be injected into the system to control hydrogen sulphide odours downstream of the station (Associated Engineering 2008).

Construction

Potential Impact: Air quality will be reduced by dust and exhaust emissions during construction.

The dust and exhaust emissions would be most noticeable to those closest to the facility including students and teachers at Shoreline Community Middle School and residents to the west of the proposed pump station. Air quality impacts would mainly occur during site grading and excavation activities. No adverse health effects are anticipated.

Mitigation Measures: Construction during summer months while school is not in session would minimize potential air quality impacts on students and teachers. During winter, wet weather will minimize the generation of dust. Dust control measures, including the use of box covers on trucks and a dust management plan, should be used to reduce effects on nearby residents. Vehicles and equipment should be shut off when not in use to reduce exhaust emissions.

The potential effects of reduced air quality from dust and exhaust emissions during construction of the Craigflower pump station and ancillary facilities are considered local, short-term, reversible, of low magnitude and **less than significant**.

Operation

Potential Impact: Air quality may be reduced by odour emissions during facility operation.

The operation of a pump station in a developed residential and institutional area could generate odours that would be detectable to local residents and other users. The pump station will be designed to minimize odours generated during operation through the installation of an effective odour control system. The proposed pump station will include technological upgrades related to odour control to account for an increased pumping capacity. As a result, the project is not expected to have an adverse effect on air quality in the area.

The potential impact on air quality is assessed to be local, long-term, reversible, of low magnitude and **less than significant**.

5.7.3 Ancillary Facilities

Construction

Potential Impact: Air quality from dust and exhaust emissions could be affected during ancillary facility construction.

The construction of the conveyance pipelines will introduce dust impacts for residents, institutional users, industrial users and commercial users near the construction areas. Most of the conveyances pipes will be installed under roads or in tunnels, so the construction effects will be similar to other public road projects. No adverse health effects are anticipated

Dust emissions from construction of the Macaulay Point to McLoughlin Point ancillary pipes may affect military residences, users of DND military training grounds, and administration buildings.

Construction of the conveyance pipeline between Ogden Point and Clover Point will produce dust and exhaust emissions that may affect residents, commercial users and park users along Dallas Road.

Mitigation Measures: The CRD will work with the Township of Esquimalt, the City of Victoria, the Town of View Royal, the District of Saanich and DND representatives to minimize air quality impacts of ancillary facilities construction. Dust control measures, including the use of box covers on trucks, the application of the CRD codes of practice, and a dust management plan should be used to reduce effects on residents and land users. Vehicles and equipment should be shut off when not in use to reduce exhaust emissions.

The potential effect of reduced air quality from dust and exhaust emissions during ancillary facility construction is considered local, short-term, reversible, low in magnitude and **less than significant**.

Operation

No air quality effects are anticipated during ancillary facility operation, so impacts to air quality effects are considered **less than significant**.

5.8 Archaeology and Heritage

Archaeological studies involving Archaeological Overview Assessments (AOA), Archaeological Impacts Assessments (AIA) and Preliminary Field Reconnaissance (PFR) were conducted for CAWTP facility sites and ancillary routes. Sites were visited by professional archaeologists accompanied by representatives of First Nations who asserted interest in the facility site areas. All methods used in the site

assessments followed approved industry standards. Results of the assessments are presented in the following sections.

5.8.1 Treatment Facility Site Conditions

5.8.1.1 Macaulay Point

The CRD and the Hul'qumi'num Treaty Group (HTG) archaeological potential models were used to assess the area near Macaulay Point. The models indicate archaeological potential along the shoreline to the south of the pump station, including the area outside the facility fence with a rock outcropping to the south-west of the existing facility (Figure 29). Other areas of modelled potential are situated in workspace sites D and E.

Figure 29 Macaulay Point Areas of Archaeological Potential

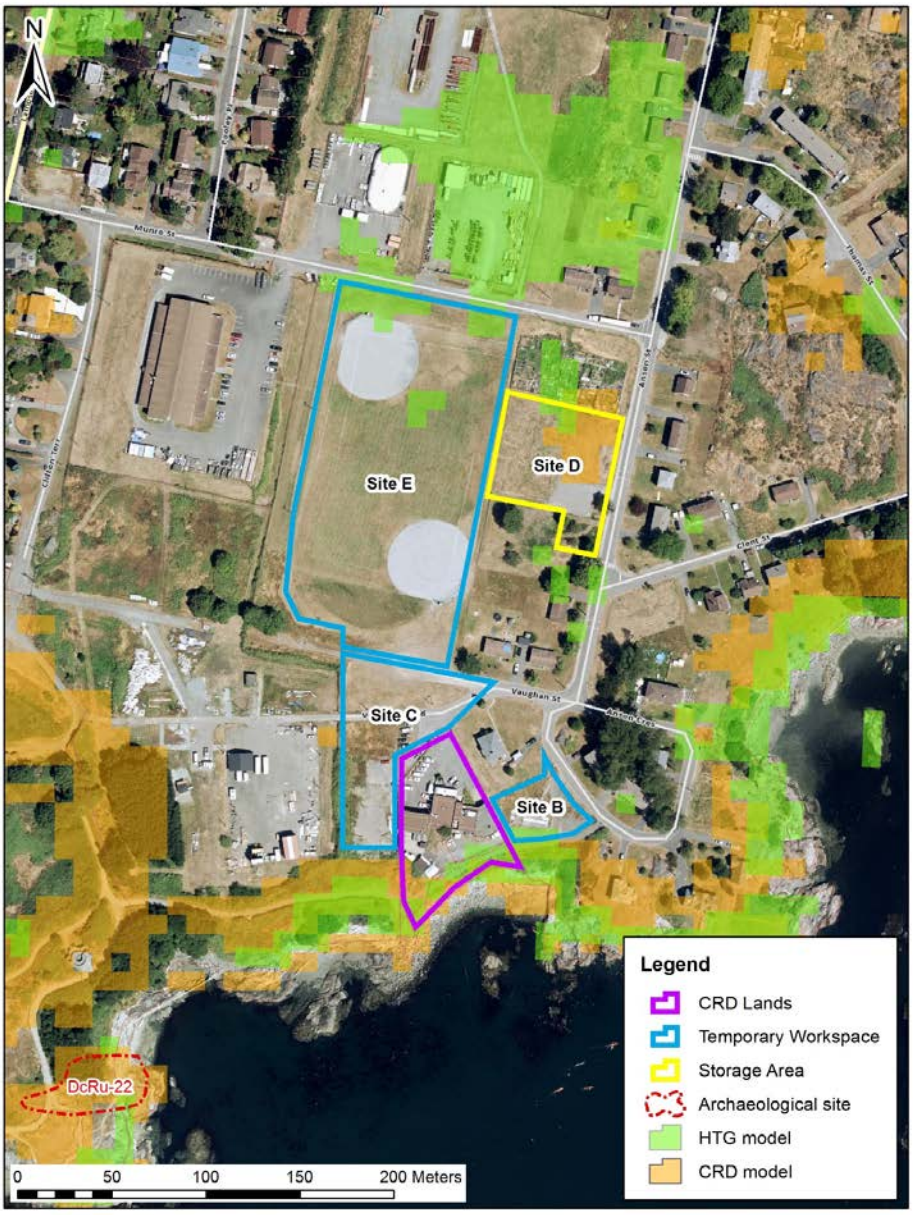


Figure 30 shows an overview of recorded archaeological and heritage features in Esquimalt and Vic West from the Provincial Archaeological Branch. No previously recorded sites are located near the CRD's Macaulay Point pump station. The closest recorded site is DcRu-22, a reported aboriginal defensive site located on Macaulay Point proper, more than 250 m west of the project site.

Both sites D and E are situated on the historic Macaulay Plains, a military camp and training ground from the late 1800s to the early 1900s, used first by the Royal Navy and subsequently by Canadian forces personnel. Photos available at the Vancouver City Archives show the 5th Regiment Canadian Garrison Artillery, the 6th Regiment The Duke of Connaught's Own Rifles (Matthews and Goodwin 1900), and members of the 18th Field Ambulance, Canadian Medical Corps camped at the site (Matthews and Goodwin 1912) (Figure 31). Later Nurse Lieutenants preparing for deployment during WWI conducted training exercises on the field (Site E) now used as a baseball field (Duffus 2009). This training area may have extended to Site D. Although Macaulay Plains was reportedly also the site of one of the earliest golf courses in the Victoria area, a photo of the course suggests the links were not situated within sites D and E (Olson 2012).

The proposed location of the pump station upgrades and immediate workspace areas were examined on December 9 and December 30, 2009. Upgrades on the south side of the existing pump station are restricted to an area located between the existing building and the walkway. This area was likely disturbed by the construction of the existing pump station. The proposed facility expansion on the north side of the existing pump station is in an excavated area, indicating that construction in this area would be unlikely to encounter archaeological deposits, if originally present. West of the existing facility, the land is characterized by a bedrock outcrop with thinly developed soil (Figure 32). No cultural sediments or features, such as burial cairns, were identified.

A field reconnaissance of workspace Site E and much of Site D was conducted by D'Ann Owens of Millennia Research in January 2014. Site E has been levelled and is currently used as a baseball field. The northwest corner of the field shows an approximately 2 m high cut into the landform behind the northern backstop, extending along the road to the north of the ball field (Figure 33). The field is largely covered with grass, with the baseball diamond covered with fine gravel. Ruts from a vehicle provided the only exposure of sediment, which showed dark brown loam. Site D is also levelled and is currently unoccupied. The field reconnaissance indicates that the area has limited potential for pre-contact archaeological deposits or features and suggests that areas of modelled potential are primarily slope-breaks associated with the artificial cut.

Figure 30 Archaeological and Heritage Features in Esquimalt and Vic West

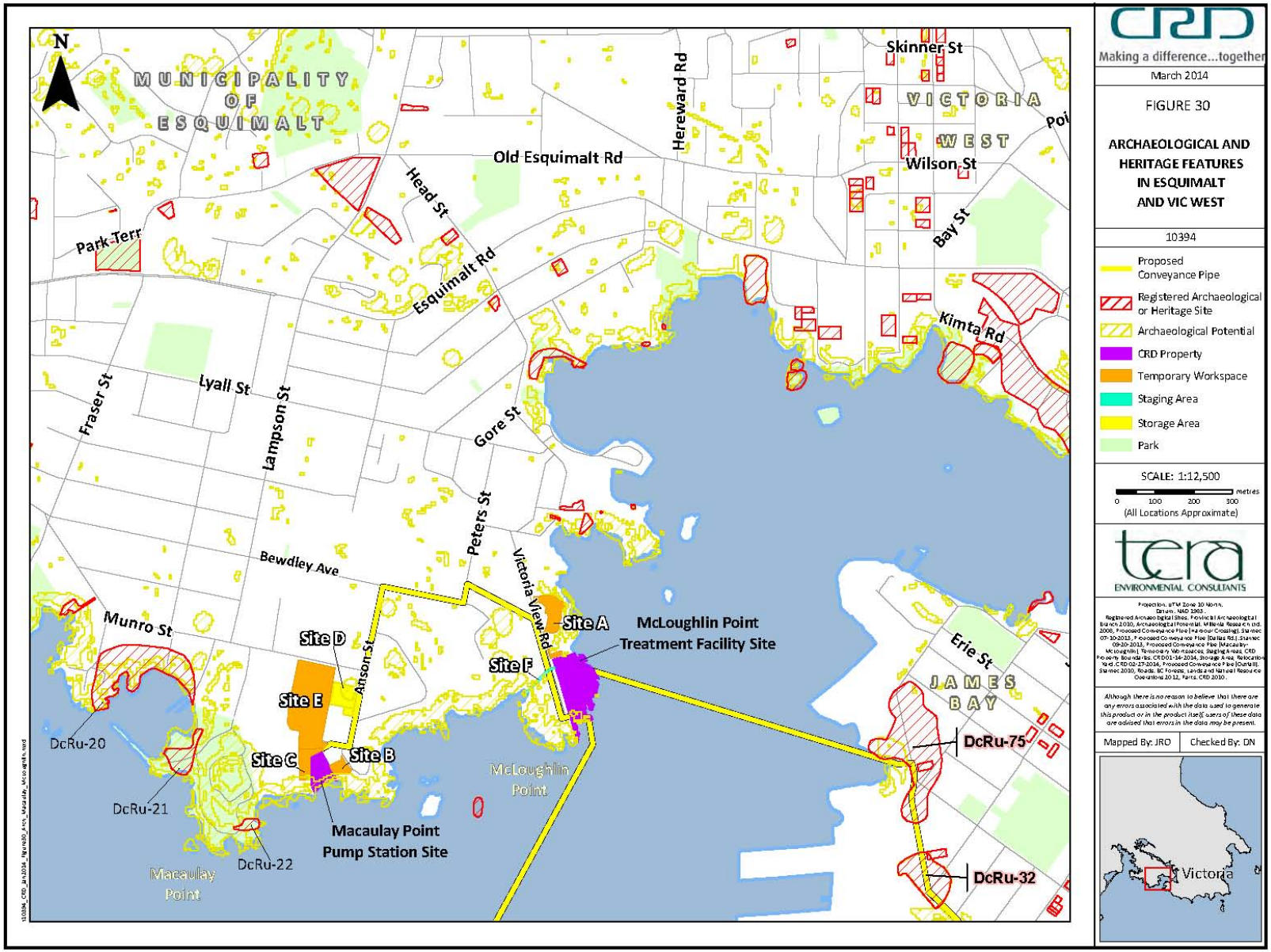
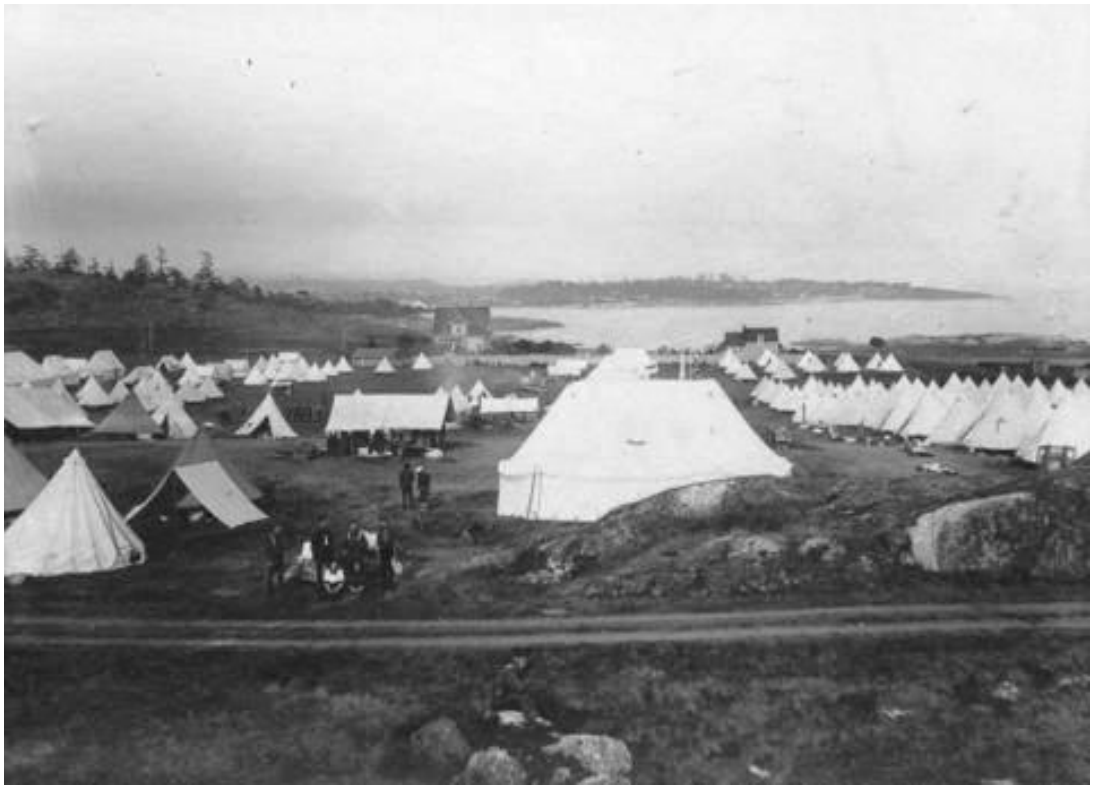


Figure 31 18th Field Ambulance, Canadian Army Medical Corps at Macaulay Plains



Source: Matthews and Goodwin 1912

Figure 32 Southwestern Edge of the Macaulay Point Pump Station Between Existing Facility and Walkway. Note Bedrock Outcrop in Foreground

Figure 33 Site D foreground and Site E background showing the cut bank behind the ball field

5.8.1.2 Clover Point

Figures 33 and 34 show an overview of the archaeological and heritage features in James Bay, Fairfield and Oak Bay.

One previously recorded archaeological site, DcRu-11, is located on Clover Point (Figures 33 and 35), approximately 50 m to the west of the existing pump station. Although there has been considerable landscape modification to area, the archaeological site consists of intact and disturbed shell midden deposits with artefacts, faunal remains and possible house floor features (Owens 2001).

Figure 33 Archaeological and Heritage Features in James Bay and Fairfield

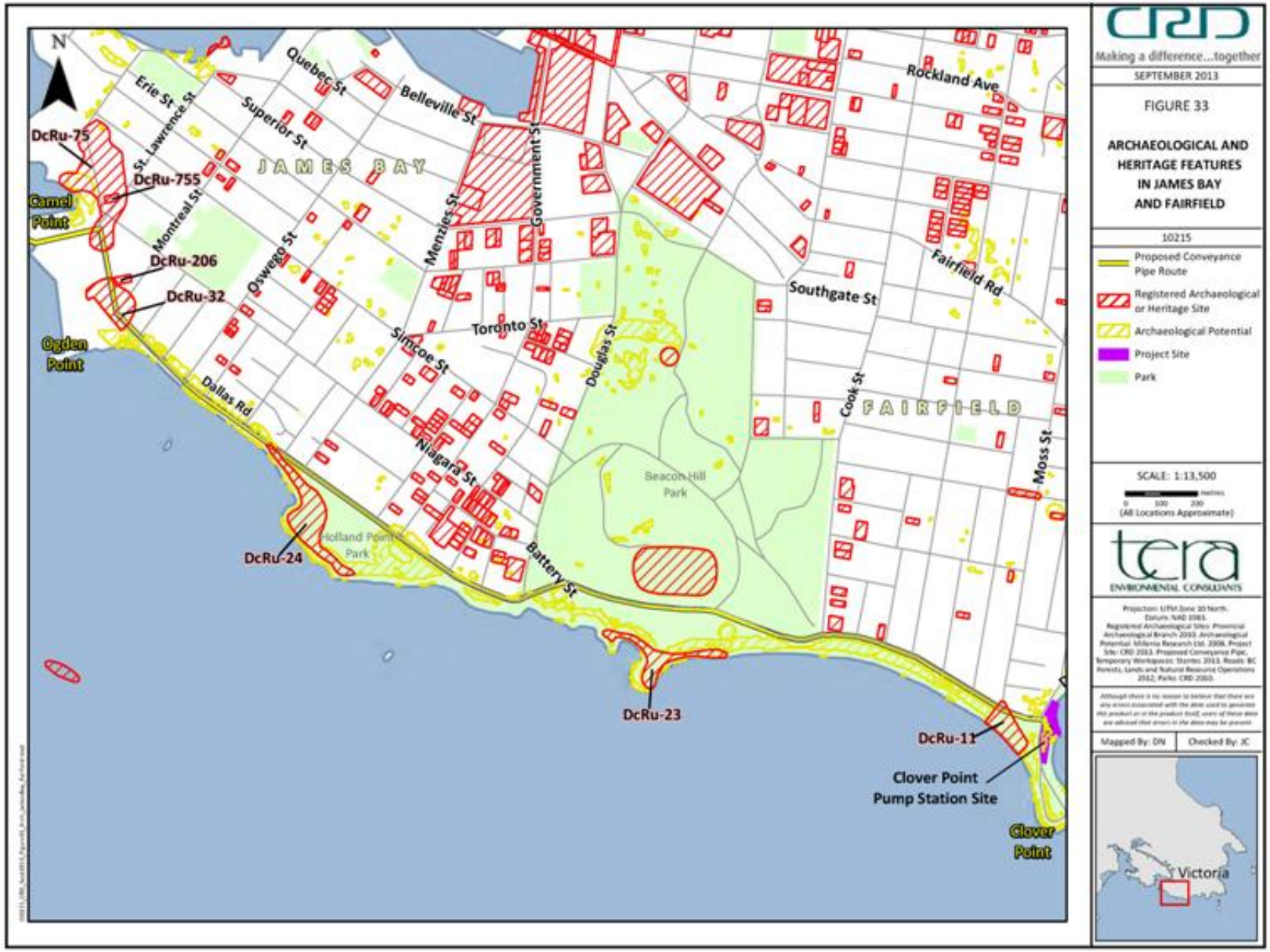
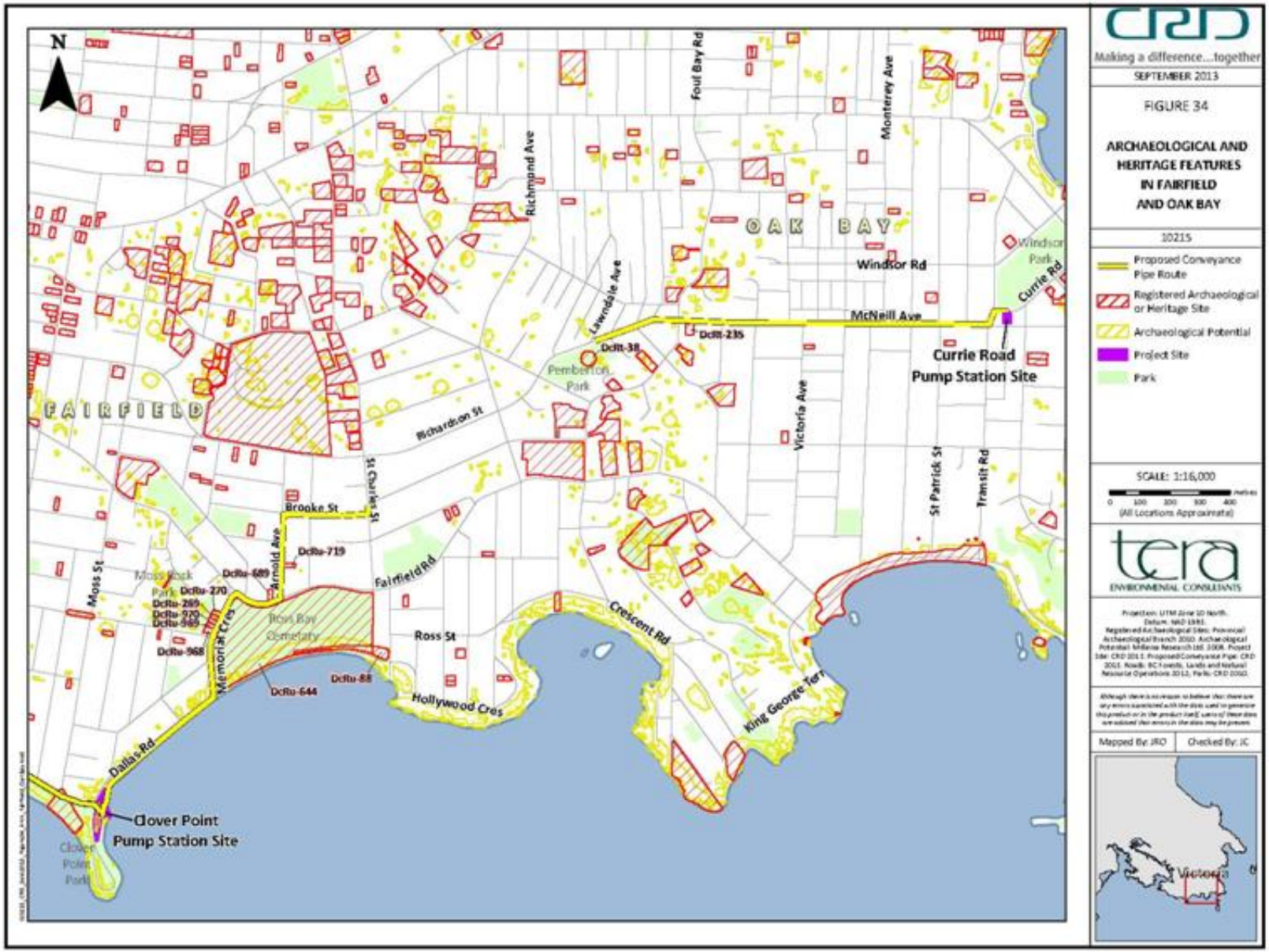


Figure 34 Archaeological and Heritage Features in Fairfield and Oak Bay



A pre-contact aboriginal trench-embankment feature is reported to be present west of the site for the area. Keddie (1997) has reviewed local historical references to these features. Two references provide an indication of their size and nature:

> *"The agger is somewhat worn down, but the fossa is clearly discernible some 12 feet in depth and 15 in breadth, extending in an oval from, round three sides, the fourth side is occupied by a steep clay cliff abutting on the sea beach" (Walter Grant 1857 in Keddie 1997).*
>
> *"I noticed a trench, cutting off a small point or rock near the shore, about six feet deep and eight wide. Governor Douglas informed me that these were not infrequent on the island; that they generally surrounded some defensible place; and that often an escarpment was constructed facing the sea" (George Gibbs 1877 in Keddie 1997).*

DcRu-11 is not known to extend to the proposed project footprint or the workspace area and no trench-embankment feature has been identified, although the site's boundary has not been defined. Clover Point was a strategic military location during the historic period as well, serving as a training area during World War I and the site of a large military searchlight during World War II. Trenches dating to the World War I were reportedly filled in the 1930s and barracks housing the men who manned the searchlight were removed in the 1950s (Ringuette 2005).

Figure 35 Clover Point Site Area of Archaeological Potential, DcRu-11 Site Boundary and Shovel Test Locations

A series of hand excavated subsurface tests (shovel tests) were conducted adjacent to the existing pump station (Figure 36) under *Heritage Conservation Act* Permit 2009-0404 and a City of Victoria Parks Research and Collection Permit. Although it was considered unlikely that hand testing would identify the aboriginal trench feature, the testing was intended to identify any other cultural materials or features, if present. Ten shovel and auger tests were excavated to apparent natural sediments. These tests generally revealed 15 cm to 40 cm of brown loam with occasional historic inclusions such as nails, asphalt, plastic, and ceramic shards. This stratum was underlain by heterogeneous culturally-sterile sediments: sand with gravel over yellow-grey clay or reddish silt over yellow-grey clay. These basal layers

are likely of late Pleistocene or early Holocene age. No pre-contact cultural deposits were identified in this stratum.

Given previous landscape modifications and filling of the area, any aboriginal trench feature is likely deeply buried and accessible only by machine testing. The aforementioned developments and modifications, in particular the WWI era trenches, and the road, parking areas, and existing outfall facilities, will have undoubtedly complicated the stratigraphy of the project footprint, making the identification of the aboriginal trench feature, if present, difficult through small scale hand tests.

The Preliminary Field Reconnaissance (PFR) of the site conducted by Stantec confirmed that the project area is situated on top of a manmade berm constructed in modern times. Examinations of core samples revealed approximately 5 m of imported fill overlaying approximately 7 m of imported clay atop undisturbed natural clay deposits. Based on the findings of the PFR, the proposed pump station site was assessed as having low archaeological potential. No further archaeological investigations are recommended as long as the project footprint remains unchanged (Stantec 2013b).

Figure 36 Facility Expansion Area, Looking North, Immediately West of the Existing Clover Point Pump Station

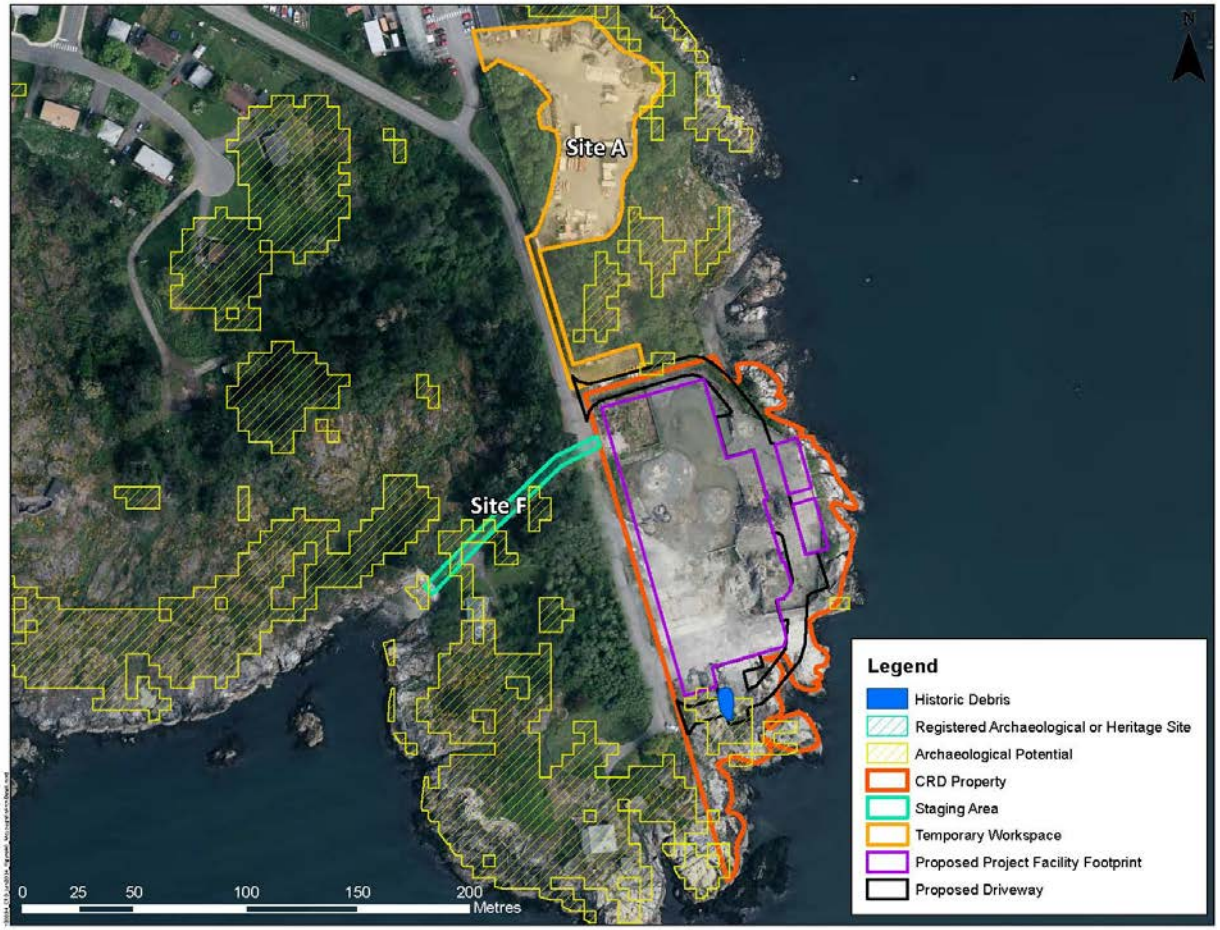
5.8.1.3 McLoughlin Point

Figure 30 shows an overview of the archaeological and heritage features in Esquimalt and Vic West.

The McLoughlin Point property contains no previously recorded archaeological sites, although the archaeological potential model maintained by the BC Archaeology Branch indicates a small area of archaeological potential along a rocky outcrop at the southern end of McLoughlin Point, and in workspace Site F (Figure 37). The closest recorded archaeological sites, shell midden recorded as DcRu-662 and a shipwreck on Harrison Island recorded as DcRu-1152, are more than 350 m from the property.

A site visit to the McLoughlin Point CRD lands on December 9, 2009 confirmed the limited archaeological potential of the area. Site F was not visited. Most of the CRD property is undergoing environmental remediation and buildings and facilities associated with previous use of the property have been removed. The central portion of the property remains capped by an asphalt pad and a concrete slab (Figure 38).

Figure 37 McLoughlin Point Study Area, Areas of Archaeological Potential and Noted Historic Debris



The area beneath these structures was not examined for archaeological potential, although sediment exposures and two cleared bedrock outcrops in the remediation area were examined. A fringe of what appears to be original shoreline outside the remediation area was not examined because access was restricted to this area at the time of the site visit.

No pre-contact archaeological deposits were identified. A small concentration of historic debris (leaded glass, bottle fragments, ceramic dishware shards, and machine cut bone) were identified in sediment in a bedrock crevice at the southern end of the remediation area (Figure 39). The material is of limited cultural significance and is not protected by the *Heritage Conservation Act* (*HCA*). Examination of the surrounding surficial exposures, including recently disturbed areas, and of excavation profiles on the western side of the property near the fence line suggests there is very limited archaeological potential in the unexamined portions of the remediation area.

The bedrock exposure south of the remediation area at the south end of McLoughlin Point was examined for cultural deposits and burial cairns. This is the area of potential as indicated by the BC Archaeology Branch's archaeological potential model. The area is a highly exposed, largely barren and it has been modified to some degree as evident from a rock wall constructed of apparent local materials, and a bunker located on adjacent DND property (Figure 40). No cultural features or sediments were located.

Figure 38 McLoughlin Point Property, Looking North. Asphalt Pad and Concrete Slab Capping in Foreground

Figure 39 McLoughlin Point Study Area from Central Bedrock Outcrop Looking South. Historic Debris was Located on Bedrock Outcrops in Background

Figure 40 Bedrock Outcrop at Southern End of McLoughlin Point Study Area

5.8.1.4 Arbutus Road

Figure 41 shows the overview of archaeological and heritage features near the Arbutus Road facility site.

No archaeological sites are known to exist on the Arbutus Road site. The closest known documented archaeological sites (DcRt-110 and DcRt-26) are located approximately 500 m to the northeast on the shore of Haro Strait. The site is adjacent to several heritage properties that are protected under the *Heritage Conservation Act,* such as the Goward House on Haro Road (TERRA Archaeology 2013).

During the Preliminary Field Reconnaissance (PFR) no archaeological material (stone tools and debitage, fire-altered rock, shell midden, *etc*.) or archaeological features (cairns or culturally modified trees) were observed. The survey concluded that the potential for undiscovered archaeological deposits that may conflict with the proposed project is considered to be low (TERRA Archaeology 2013). No further archaeological study considered necessary before construction of the attenuation tank.

5.8.1.5 Craigflower

Figure 42 shows the archaeological and heritage features in View Royal.

The proposed pump station site contains no previously recorded archaeological sites. However, 12 registered archaeological sites associated with the presence of shell middens have been recorded elsewhere on Portage Inlet. All 12 sites are located more than 200 m from the proposed sites and will not be affected by the project (Golder 2007).

Although no archaeological sites were recorded, provincial models identified the pump station site as having moderate to high potential for the presence of subsurface archaeological materials (Archaeological Overview Assessment and Preliminary Field Reconnaissance (AOA/PFR) (Golder 2007)).

Figure 41 Archaeological and Heritage Features in Saanich East

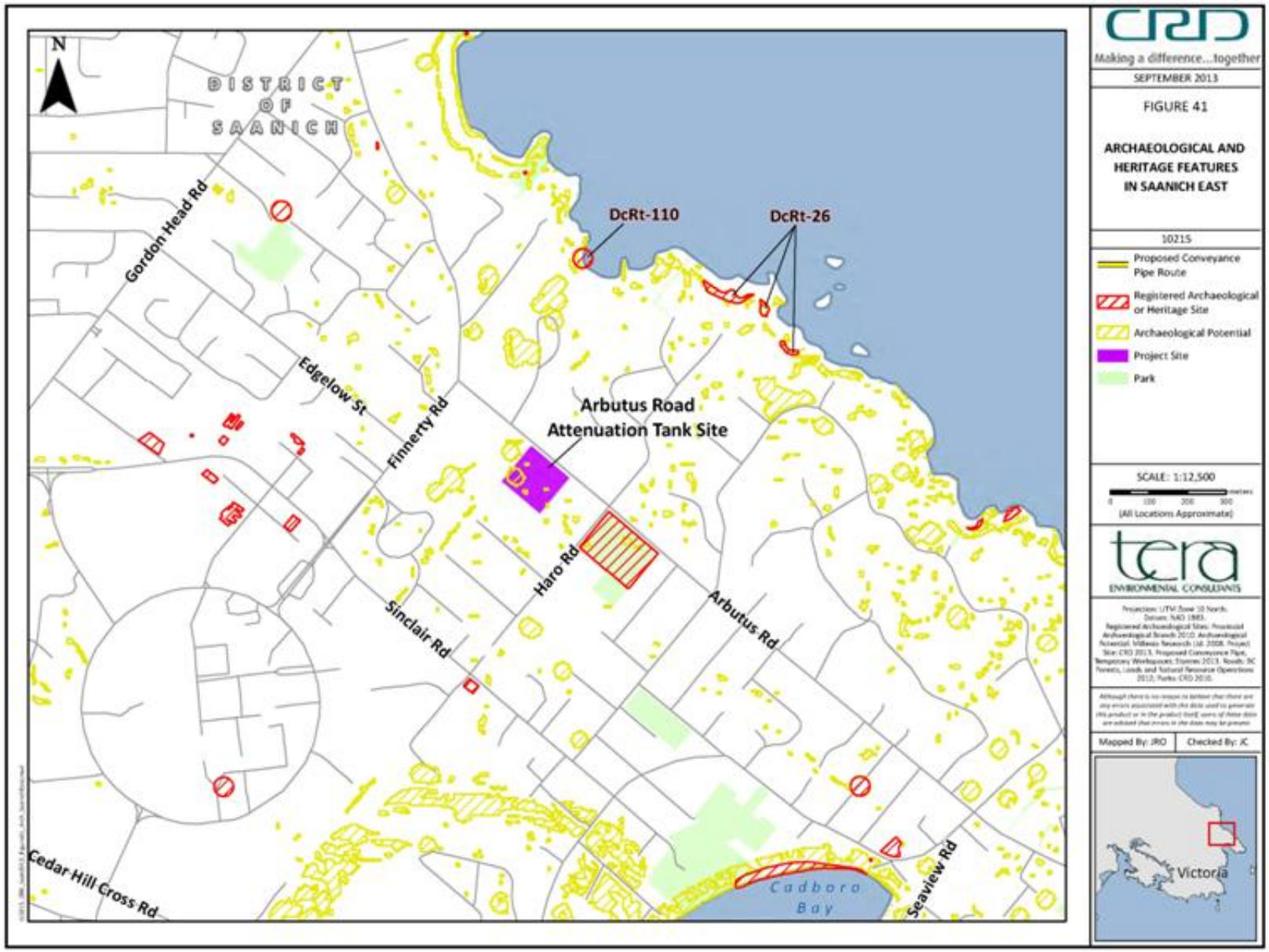


Figure 42 Archaeological and Heritage Features in View Royal

Due to the archaeological potential of the site, an Archaeological Impact Assessment (AIA) was conducted by Golder in 2007 in accordance with the BC *Archaeological Impact Assessment Guidelines* under *Heritage Conservation Act* Permit 2007-213. The AIA of the site and ancillary facility routes consisted of survey traverses, 10 machine auger tests and 2 shovel tests. No archaeological materials were identified during the field investigation. According to the findings of the AIA, impacts to archaeological sites resulting from the development of the proposed pump station and ancillary facilities are not anticipated. Golder concluded that no further archaeological work for the project area is required.

5.8.2 Ancillary Facility Site Conditions

5.8.2.1 Macaulay Point to McLoughlin Point

Conveyance pipeline connecting Macaulay Point to McLoughlin Point and the underground utilities from Lyall Street to the McLoughlin facility will be routed along existing road rights-of-way.

The shoreline between McLoughlin Point and Macaulay Point, identified as Shore Unit No. 1615.00 in the Harbours Ecological Inventory and Rating (HEIR) mapping project (VEHEAP 2000), contains no registered archaeological sites (Figure 43). However, field reconnaissance identified physiographic features associated with the potential for burial cairns, both onshore on rocky bluffs and on offshore islets. Small bays have extensive build-up of shell deposits. Inshore level areas could contain intact shell midden that has been buried by fill in the course of building detached military housing, thus covering evidence of archaeological sites. No known intensive archaeological surveys have been conducted on subsurface materials in this shoreline area, which remains relatively undisturbed by residential and industrial development. The ancillary route from Macaulay Point to McLoughlin Point pipe route will follow existing road rights-of-way and is not expected to affect cultural resources along the shoreline.

Figure 43 Shoreline between Macaulay Point and McLoughlin Point

5.8.2.2 Clover Point

The conveyance route from the Currie Road pump station to Clover Point will be installed in a trench along existing road rights-of-way (Figure 34). Ten archaeological or heritage sites are near to the proposed route, eight of which are heritage houses. Site DcRt-38 is located in the middle of Pemberton Park and site DcRu-644 is the Ross Bay Cemetery, It is anticipated that the construction of the ancillary facilities from Currie Road to Clover Point will not encounter registered archaeological or heritage sites, or areas that have archaeological potential.

The proposed 1,200 mm forcemain from Clover Point to Ogden Point will be constructed in the right-of-way of Dallas Road or along the southern edge of the boulevard to align with the proposed bicycle path. As noted previously, Clover Point contains a registered archaeological site, DcRu-11, found on the western side of the peninsula, opposite the pump station (Figures 33 and 35). The DcRu-11 site consists of shell midden that has been badly disturbed by previous land altering activities, such as walkway construction, and the site may also have intact soils containing cultural deposits. The boundaries of site DcRu-11 extend north of Clover Point and across Dallas Road (BC Archaeology Branch 2009). The proposed ancillary facility route would be constructed through a portion of this archaeological site.

Dallas Road passes between two registered archaeological sites west of Clover Point, DcRu-23 and DcRu-18 (Figure 33). The southern portion of Finlayson Point contains archaeological site DcRu-23, a trench embankment and shell midden site (Figure 44). Remains of the shell midden are evident on trails and high bluffs on Finlayson Point. North of Finlayson Point, site DcRu-18 contains the remains of what were once numerous burial cairns, many of which contained ancient funereal remains (Figure 45). Most of these cairns were excavated in the 1920s by local archaeologists, and later disturbed by City of Victoria staff in the 1980s in the course of maintaining the grass. The hillside containing the cairns is a known camas meadow, and the Songhees First Nation has records of traditional gathering of camas and other medicinal plants on the site (Te'mexw Treaty Association 2003). Other First Nations groups also probably made traditional use of this area.

To the west of Beacon Hill Park, Holland Point Park contains an extensive archaeological site, DcRu-24. The site boundaries extend from the shoreline bluff north to Dallas Road (Figure 33). The site originally contained a long trench embankment (Figure 45), and shell midden material has been recovered here during AIA investigations conducted prior to walkway development in the park. Rock clusters, which may have been the remnants of burial cairns, remain on the open grassy lawn. A midden is still present at this site.

Figure 44 Finlayson Point and Site DcRu-23, Beacon Hill Park

Figure 45 Burial Cairns at Site DcRu-18, Beacon Hill Park

Figure 46 Trench Embankment at Site DcRu-24, Holland Point

West of Holland Point Park is registered archaeological site DcRu-32, at the intersection of Dallas Road with Montreal Street (Figure 33). The site consists of shell midden currently capped by Dallas Road. A

burial was uncovered in this vicinity during street construction on Dallas Road in 1995. According to BC Archaeology Branch records, the location of shell midden near the burial, and the location of the original shoreline of Ogden Point Bay suggest that midden deposits may still be intact under the Dallas Road pavement. The remains of two aboriginal burials unearthed during construction have been reburied along the west side of Dallas Road here.

A more extensive shell midden deposit, archaeological site DcRu-75, extends from the intersection of Dallas Road and Niagara Street north to the intersection of Dallas Road and Simcoe Street near Camel Point (Figure 33). This site contained a Lekwungen winter village and defensive embankment (Keddie pers. comm.). Most of this site has been covered with fill in the course of construction at Camel Point and on Dallas Road. According to BC Archaeology Branch file records, some buried shell midden may exist under fill along the west side of Dallas Road from Camel Point to St. Lawrence Street. Two historic sites, DcRu-206, and DcRu-755, are also found within the boundaries of sites DcRu-32 and DcRu-75, respectively (BC Archaeology Branch 2009).

5.8.2.3 Arbutus Road

The ancillary route at the Arbutus Road does not contain any known documented archaeological sites. The closest known sites occur approximately 500 m to the northeast on the shore of Haro Strait. Archaeological potential for the site is considered low (TERRA Archaeology 2013).

5.8.2.4 Craigflower

The proposed pump station ancillary route contains no previously recorded archaeological sites. However, 12 registered archaeological sites associated with the presence of shell middens have been recorded elsewhere on Portage Inlet. All 12 sites are located more than 200 m from the proposed routes and will not be affected by the project (Golder 2007).

5.8.3 First Nations Lands

None of the treatment facility sites or ancillary facility routes are located on Indian Reserves, though the facilities are on the asserted traditional territories of local First Nations. The CRD has entered into an information sharing process with Songhees, Esquimalt, Tsawout and Beecher Bay Nations on project design and siting work in the core area. The Nations' interests are being recorded and submitted to MOE officials. The CRD will continue to engage the First Nations communities during the project design phase.

Through the CRD's program of active engagement of First Nations, participating aboriginal groups have expressed concerns about the potential effects of effluent discharge on marine resources. These issues will be investigated as part of the marine component of the EIS.

5.8.4 Impact Assessment and Mitigation Measures

5.8.4.1 Macaulay Point

Construction

Potential Impact: Construction activities may affect archaeological features on the Macaulay Point site.

The field reconnaissance at the Macaulay Point pump station indicates that ground disturbance associated with construction activities is unlikely to affect archaeological features near the project site. There is some limited potential for historic military artefacts to be present within workspace sites D and E.

Mitigation Measures: The CRD will take measures to identify and avoid archaeological sites and features, and to comply with requirements of the Archaeology Branch.

In order to minimize risk with respect to facility construction, tail-gate archaeological awareness training sessions should be held before the start of construction activities.

In the event that unanticipated archaeological features are identified, construction related activities in the area will be halted and the Archaeology Branch will be contacted for further direction. In the event that historical military artefacts are recovered, DND should be contacted for further direction.

If archaeological or heritage features are disturbed during facility construction, such impacts would be long-term and irreversible. However, mitigation to avoid or reduce effects, or compensation for the removal, loss, disruption, modification, or alteration of archaeological or heritage resources, would reduce project construction effects on archaeological features at the Macaulay Point site to low magnitude and **less than significant** levels.

Operation

Potential Impact: Operation of the proposed Macaulay Point facility may affect archaeological features.

No archaeological features or deposits are anticipated in the CRD lands development footprint. In the unlikely event that unanticipated archaeological features are present, the activities that may affect the features are limited to the construction phase of the project. Facility operation is not expected to affect archaeological features and, therefore, impacts are considered **less than significant**.

5.8.4.2 Clover Point

Construction

Potential Impact: Construction activities may affect archaeological features on the Clover Point site.

Archaeological testing conducted to date at the Clover Point site indicates that ground disturbance associated with construction activities is unlikely to affect shell midden or house features associated with previously recorded archaeological site DcRu-11. The Preliminary Field Reconnaissance (PFR) and core sampling of the site conducted by Stantec confirmed that the project area is situated on top of a manmade berm consisting of approximately 5 m of imported fill overlaying approximately 7 m of imported clay atop undisturbed natural clay deposits. Based on the findings, the project area was assessed as having low archaeological potential. No further archaeological investigations are recommended.

Mitigation Measures: The CRD will take measures to identify and avoid archaeological sites and features, and to comply with requirements of the Archaeology Branch.

In order to minimize risk with respect to the facility construction, an excavator with a narrow clean-up bucket will be used to excavate a north-south trending trench through the project footprint. The excavation can be conducted under *HCA* Permit 2009-0404 at the direction of an archaeologist. Archaeological monitoring will be conducted of any future environmental or geotechnical testing. Depending on the results of this monitoring, intermittent construction monitoring may be conducted by an archaeologist.

Tail-gate archaeological awareness training sessions will be held prior to initiation of construction activities.

In the event that unanticipated archaeological remains are identified, construction related activities in the area will be halted and the Archaeology Branch will be contacted for further direction.

If archaeological or heritage features, such as the aboriginal trench, are disturbed during facility construction, such impacts would be long-term and irreversible. However, mitigation to avoid or reduce effects, or compensation for the removal, loss, disruption, modification, or alteration of archaeological or heritage resources, would reduce project construction effects on archaeological features at the Clover Point site to low magnitude and **less than significant** levels.

Operation

Potential Impact: Operation of the proposed Clover Point facility may affect archaeological features.

No archaeological deposits have been identified in the project footprint, but there is potential for an unrecorded aboriginal trench feature to be encountered during construction. In the event that this feature is present, the activities that may affect it are likely limited to the construction phase of the project. Operation of the proposed Clover Point facility is not expected to affect archaeological features and, therefore, impacts are considered **less than significant**.

5.8.4.3 McLoughlin Point

Construction

Potential Impact: Construction activities may affect archaeological features on the McLoughlin Point site.

The field reconnaissance at the McLoughlin Point CRD lands site indicates that ground disturbance associated with construction activities is unlikely to affect archaeological features near the project footprint at McLoughlin Point and the associated workspace area. There is potential for archaeological deposits in workspace Site F but the anticipated activities in the area are unlikely to result in any ground disturbance and the chance of impact to archaeological deposits or features is, therefore, low.

Mitigation Measures: The CRD will take measures to identify and avoid archaeological sites and features, and to comply with requirements of the Archaeology Branch.

In order to minimize risk with respect to the proposed project, tail-gate archaeological awareness training sessions will be held before the start of construction related activities.

In the event that unanticipated archaeological features are identified, construction in the area will be halted and the Archaeology Branch will be contacted for further direction.

Based on currently available information, it is unlikely that the construction of a treatment facility at McLoughlin Point will affect archaeological or heritage features. If archaeological or heritage features are disturbed during facility construction, such impacts would be long-term and irreversible. However, mitigation to avoid or reduce effects or compensation for the removal, loss, disruption, modification, or alteration of archaeological or heritage resources at McLoughlin Point would reduce project effects to low magnitude and **less than significant** levels.

Operation

Potential Impact: Operation of the proposed McLoughlin Point facility may affect archaeological features.

No archaeological features or deposits are anticipated in the project footprint. In the unlikely event that unanticipated archaeological features are present, the activities that may affect the features are limited to the construction phase of the project. Operation of the proposed McLoughlin Point facility is not expected to affect archaeological features, so operation impacts are assessed to be **less than significant**.

5.8.4.4 Arbutus Road

Construction

Potential Impact: Construction activities may affect archaeological features on the undisturbed portion of the Arbutus Road site.

Although unlikely, tree-clearing and ground-disturbing activities associated with the construction of the attenuation tank at the Arbutus Road parcel have the potential to damage, displace or destroy buried archaeological materials and sites. Land alterations during the construction of the facility may break or displace cultural materials, such as cairns, inland shell middens or culturally modified trees.

Construction activities that may affect archaeological resources include tree cutting, tree root removal, grading to prepare building sites or excavation for installing below-ground facilities. Micro-topographic features, such as terraces, knolls and ridges, where buried archaeological sites are often located, are susceptible to logging, grading and excavation.

Mitigation Measures: Tail-gate archaeological awareness training sessions should be held with construction crews to discuss measures to be taken if archaeological features are identified during ground-disturbing activities. In the event that archaeological materials are encountered during the construction phase of the facility, operations in the locality should be suspended until the Archaeology Branch and the Esquimalt and Songhees First Nations have been contacted for direction.

Tail-gate archaeological awareness training sessions with construction personnel should be held before initiation of construction.

Impacts to archaeological and heritage resources, if any, will be limited to the construction phase of the attenuation tank. Impacts that may occur will be limited to the facility footprint and would be irreversible. If mitigation measures are implemented during construction, the impacts to archaeological and heritage resources are considered to be of low magnitude and **less than significant**.

Operation

Potential Impact: Operation of the attenuation tank at Arbutus Road may affect archaeological features.

The activities that might affect archaeological and heritage resources are likely to be limited to the construction phase of the project. It is unlikely that facility operation would affect archaeological or heritage resources, so impacts are considered **less than significant**.

5.8.4.5 Craigflower

Construction

Potential Impact: Construction activities may affect archaeological features in the area.

The AIA conducted by Golder in September 2007 indicated that ground disturbance associated with construction activities would be unlikely to affect archaeological features in the project footprint.

Mitigation Measures: Tail-gate archaeological awareness training sessions will be held with construction crews to discuss measures to be taken if archaeological features are identified during ground-disturbing activities.

In the unlikely event that archaeological features are identified, construction will be halted and the Archaeology Branch will be contacted for further direction.

If archaeological or heritage features are disturbed during construction, the impacts would be long-term and irreversible. However, the AIA conducted for the site concluded that there are no anticipated impacts to archaeological sites resulting from the proposed pump station. Furthermore, if mitigation to avoid or reduce effects, or compensate for the removal, loss, disruption, modification, or alteration of archaeological or heritage resources, project construction impacts can be **less than significant.**

Operation

Potential Impact: Operation of the pump station may affect archaeological features in the area.

According to the AIA conducted in 2007, no archaeological or heritage resources are anticipated in the project footprint. If archaeological features are encountered, the activities that may affect these resources are limited to the construction phase of the project. Therefore, pump station operation is not expected to affect archaeological features and impacts are considered **less than significant**.

5.8.5 Ancillary facilities

5.8.5.1 McLoughlin Point

Construction

Potential Impact: Construction activities may affect archaeological features near the Macaulay Point to McLoughlin Point ancillary facilities.

The pipeline connection to the Macaulay Point pump station is approximately 75 m to 100 m east of several registered archaeological sites. The approximately 680 m of underground utilities along Peters and Victoria View Road are not expected to encounter archaeological features. The archaeological potential model maintained by the Archaeology Branch indicates that unrecorded buried shell midden or cultural features may be uncovered in the course of construction of the forcemain.

Mitigation Measures: Tail-gate archaeological awareness training sessions will be held with construction crews to discuss measures to be taken if archaeological features are identified during ground-disturbing activities.

In the unlikely event that archaeological features are identified, construction will be halted and the Archaeology Branch will be contacted for further direction.

A review of available data suggests that with the application of the proposed impact avoidance and mitigation measures, effects on archaeological features and heritage resources are unlikely and impacts are expected to be **less than significant**.

Operation

Potential Impact: Operation of the Macaulay Point to McLoughlin Point ancillary facilities may affect archaeological features.

The activities that affect archaeological and heritage resources, if any, will be limited to the construction phase of the project. No impacts on archaeological or heritage resources are expected from pipeline operation, except in the unlikely event of pipeline rupture.

Mitigation Measures: No mitigation measures are proposed for routine operation of the pipeline. In the event of repair of the pipeline, the provisions of the *Heritage Conservation Act* and protection of archaeological sites and materials will govern the work.

No impacts on archaeological or heritage resources are expected, and impacts from pipeline operation are considered **less than significant**.

5.8.5.2 Clover Point

Construction

Potential Impact: Construction activities may affect archaeological features near the Clover Point to McLoughlin Point ancillary facilities or near the Currie Road to Clover Point ancillary facilities.

Pipeline construction along the proposed route from the Currie Road pump station to Clover Point does not have the potential to disturbed recorded archaeological sites.

Pipeline construction activities from Clover Point to McLoughlin Point could disturb recorded and unrecorded shell midden and cultural deposits, including deposits extending beyond the recorded site boundaries. Recorded archaeological sites on this route include:

- northern section of site DcRu-11 at Clover Point, under Dallas Road;
- northern section of site Dc-Ru-24, at Holland Point, under Dallas Road;
- southern section of site DcRu-32, at the intersection of Dallas Road and Montreal Street; and
- southern section of site DcRu-75, near the intersection of Dallas Road and Niagara Street.

Mitigation Measures: To determine whether the route would actually affect cultural resources and to assess the spatial and scientific significance of these impacts, if any, an AIA should be conducted (including archaeological sampling along the finalized pipeline routes) before construction. Registered archaeological sites are protected under the provisions of the *Heritage Conservation Act (HCA)*. Areas in

and adjacent to these sites near Dallas Road have high archaeological potential, more than 2 km of the proposed route crosses land that has been identified as having archaeological potential. The *HCA* also protects cultural resources that have not yet been identified;

East of Douglas Street, the route will be located on Dallas Road, the boulevard, or the proposed bicycle path on the south side of Dallas Road. Between Douglas and Cook Street, the archaeological potential model indicates isolated areas of potential along the roadway. Areas of archaeological potential exist east of Cook Street. Disturbance of buried shell midden and cultural deposits in sites DcRu-11 and DcRu-75 may occur.

If cultural resources are found while conducting the AIA, the CRD should consider route changes to avoid cultural resources. The AIA will provide project specific recommendations if avoidance is not possible. These recommendations may include large-scale data recovery under a *HCA* Section 14 Site Investigation permit, monitoring of construction activities, or a combination of both. Alteration to a protected site requires a Section 12 Site Alteration Permit, which may include a provision for monitoring. A qualified archaeologist should monitor ground-disturbing activities near the archaeological sites, unless AIA results indicate that there would be no impact

The AIA is intended to avoid or minimize the unanticipated discovery of cultural materials during construction, which may require suspension of construction activities and possible project delays while impacts are investigated and systematic recovery is conducted, if appropriate.

The unavoidable loss of significant archaeological resources resulting from project impacts should be compensated in cash or in-kind (BC Archaeology Branch 1989). Unmitigated impacts may require compensation for the removal, loss, disruption, modification, or alteration of archaeological and heritage resources because of the project.

A review of current data suggests that impacts would be long-term and irreversible, with the application of the proposed mitigation measures to avoid or reduce effects, or to compensate for the removal, loss, disruption, modification, or alteration of archaeological or heritage resources, potential impacts at sites DcRu-11 and DcRu-75 are likely to be limited to the ancillary facility footprint, long-term, and of moderate magnitude. These impacts are expected to be **less than significant.**

Operation

Potential Impact: Operation of the Clover Point ancillary facilities may affect archaeological features.

The activities that affect archaeological and heritage resources will be limited to the construction phase of the project. No impacts on archaeological or heritage resources are expected from pipeline operation, except in the unlikely event of pipeline rupture and emergency repair work required to fix the rupture.

Mitigation Measures: No mitigation measures are proposed for routine operation of the pipeline. If the pipeline needs to be excavated for repairs, the provisions of the *Heritage Conservation Act* and protection of archaeological sites and materials will govern ground-disturbing activities.

No operational effects on archaeological or heritage resources are anticipated, so impacts from pipeline operation are considered **less than significant**.

5.8.5.3 Arbutus

Construction

Potential Impact: Construction activities may affect archaeological features near the Arbutus Road ancillary facilities.

The PFR results indicate that the pipelines connecting the attenuation tank to existing wastewater infrastructure are unlikely to affect any archaeology features or heritage resources.

Mitigation Measures: Tail-gate archaeological awareness training sessions should be held with construction crews to discuss measures to be taken if archaeological features are identified during

ground-disturbing activities. In the unlikely event that archaeological features are identified, construction activities will be halted and the Archaeology Branch, Esquimalt and Songhees First Nations will be contacted for further direction.

If archaeological or heritage features are disturbed during construction, the impacts would be long-term and irreversible. However, the PFR conducted for the site concluded that there are no anticipated impacts to archaeological sites resulting from ancillary construction.

A review of available data suggests that with the application of the proposed impact avoidance and mitigation measures, impacts are unlikely and are expected to be **less than significant**.

Operation

Potential Impact: Operation of the Arbutus Road ancillary facilities may affect archaeological features.

The activities that may affect archaeological and heritage resources will be limited to the construction phase of the project. No impacts on archaeological or heritage resources are expected from pipeline operation.

Mitigation Measures: No mitigation measures are proposed for routine operation of the pipeline.

No impacts on archaeological or heritage resources are expected, and impacts from pipeline operation are considered **less than significant**.

5.8.5.4 Craigflower

Construction

Potential Impact: Construction activities may affect archaeological features along the ancillary route at the Craigflower location.

The pipelines connecting the old Craigflower pump station with the new pump station are not expected to disturb archaeological sites. The nearest identified archaeological sites to the Craigflower site are approximately 200 m distant.

Mitigation Measures: Tail-gate archaeological awareness training sessions will be held with construction crews to discuss measures to be taken if archaeological features are identified during ground-disturbing activities.

If archaeological or heritage features are disturbed during construction, the impacts would be long-term and irreversible. However, the AIA conducted for the site concluded that there are no anticipated impacts to archaeological sites resulting from the ancillary construction.

A review of available data suggests that with the application of the proposed impact avoidance and mitigation measures, impacts are unlikely and are expected to be **less than significant**.

5.9 Land Use

5.9.1 Treatment facility site conditions

5.9.1.1 Macaulay Point

Current Site Uses

The Macaulay Point property is located at the southwest corner of Anson Street and Vaughan Street in Esquimalt, British Columbia. The CRD-owned and -operated pump station on the site includes several structures, the pump house, screening chamber, headworks, an asphalt parking lot, and storage areas. Chain link fencing encloses the property. The Macaulay Point property is owned by the Capital Regional District and zoned “I5 – Industrial” by the Township of Esquimalt. This zone permits sewage handling facilities and related uses (Parkes pers. comm., Township of Esquimalt 2008).

Adjacent Land Uses

Land owned and used by DND borders the Macaulay Point CRD property to the west, north and east. This land is part of Canadian Forces Base Esquimalt. The DND land includes private military quarters along Anson Crescent and Vaughan Street. The nearest house is 20 m east of the CRD property line. The nearest residential dwellings outside of DND property are located on Clifton Terrace, approximately 250 m northwest of the Macaulay site.

A public paved pedestrian walkway connects Anson Crescent to walkways in Macaulay Point Park. The walkway passes to the south of the Macaulay Point site, between the pump house and the shoreline of the Juan de Fuca Strait. Two baseball diamonds are located north across Vaughan Street.

Macaulay Point Park is approximately 50 m west of the Macaulay Point facility site. The public park is situated on federal lands leased to the Township of Esquimalt. This 7.6 ha park is popular with birdwatchers, hikers and dog walkers. Park walkways provide access to the shoreline and historic military works, and offer views of the Olympic Mountains and Strait of Juan de Fuca. Former military bunkers, lookouts and defensive berms provide historical context to the park.

Planned Land Uses

With regard to the Macaulay Point pump station, the Township of Esquimalt's OCP states that a "minor expansion of the current pumping and screening facility may be considered to address effluent volume increases. However, the Township opposes the use of this site for a regional multi-stage sewage treatment plant (Township of Esquimalt 2007, p. 40).

Discussions with DND staff revealed that a Master Asset Development Plan (MADP) is currently being developed to guide future land uses on the Canadian Forces Bases (CFB) Esquimalt property that abuts the CRD-owned pump station. Based on preliminary information from the MADP, the northern portion of the base will be dedicated to military administration structures, and most of the southern portion will be used for outdoor military training (Tabbernor pers. comm.). The current draft of the MADP assumes that CRD wastewater treatment facilities will be built on the Macaulay Point and McLoughlin Point sites. The draft plan seeks to ensure compatibility between DND activities on federal property and the wastewater treatment facilities on adjacent land.

The CRD and the DND are currently negotiating an Access to Federal Lands Agreement to include construction access, use of workspace areas, operations access, and utility corridors for the Macaulay Point facility.

5.9.1.2 Clover Point

Current Site Uses

Clover Point is a prominent point of land that extends south of Dallas Road between Moss Street and Bushby Street in the Fairfield neighbourhood of the City of Victoria. Clover Point Road loops around the point of land from Dallas Road. The Clover Point pump station property is owned by the City of Victoria and zoned R1-B (Single Family Residential). Short-term parking for approximately 85 vehicles is provided along the adjacent Clover Point Road. Parking for an additional 13 vehicles is located near the intersection of Clover Point Road and Dallas Road. A paved arm of Clover Point Road on the west side of the point extends to the water to provide boat launch access.

The public uses Clover Point Park for walking, running and dog walking. A paved walkway crosses the property, parallel to Dallas Road along the shoreline in the James Bay and Fairfield communities. The site is a popular viewpoint, offering for the public and visitors panoramic views of the Olympic Mountains and Juan de Fuca Strait (Figure 47). The park is used as a staging area for numerous outdoor activities such as kite flying, kite boarding, paragliding, dog walking and gaining access to the adjacent rocky beaches.

Figure 47 Looking South Over Existing Underground CRD Clover Point Pump Station from Dallas Road and Clover Point Road Intersection

Source: Google Streetview

Adjacent Land Uses

The residential neighbourhood of Fairfield is north of the Clover Point site (Figure 48). Some nearby dwellings (Figure 49) have maintained the Arts and Crafts character and architecture that was popular during the late 19th century and early 20th century in Victoria (Segger and Franklin 1996). The rocky beaches and shoreline of the Juan de Fuca Strait surround the site on the east, south and west.

Planned Land Uses

The proposed Clover Point facility upgrades will expand the facility footprint to the north of the existing pump station. Clover Point Park is subject to a covenant requiring the land to be used for public park purposes. The expanded pump station will be an underground facility, and the land surface will still be available for park use. The facility, therefore, will not prevent the land from being used as park, which is consistent with the spirit and wording of the covenant. The CRD will meet with representatives of the City of Victoria to discuss the project design, to ensure that effects on public use of Clover Point Park are minimized.

A policy described in the City of Victoria OCP (1995) recommends that the City maintain current parks improvement programs at Clover Point Park. A neighbourhood plan does not exist for the Fairfield area. The existing CRD pump station will remain in operation.

Figure 48 Fairfield Residential Neighbourhood North of the Clover Point Site

Figure 49 Detached Dwellings in the Fairfield Neighbourhood along Dallas Road, North of the Clover Point Site

Source: Google Earth

5.9.1.3 McLoughlin Point

Current Site Uses

The McLoughlin Point site in the Township of Esquimalt is a decommissioned Imperial Oil tank farm on 1.4 ha (3.46 acres) of freehold property, previously owned by Imperial Oil Ltd. and bounded by DND land and Victoria Harbour. The oil tanks, buildings and ancillary structures have been demolished and removed from the site as part of a remediation program.

In January 2013, the CRD filed a Rezoning Application with the Township of Esquimalt to permit the construction of the wastewater treatment facility on the McLoughlin property. At the time of application, the land was zoned "I3 – Industrial" by the Township of Esquimalt, which was intended to "accommodate bulk petroleum storage facilities and related uses". The CRD concurrently submitted an application to amend the Esquimalt Official Community Plan (OCP) Bylaw No. 2804 to allow wastewater treatment at the McLoughlin Point site. The OCP amendment was needed to address requirements of Section 877 (1) (f) of the *Local Government Act*, which states that an OCP must include "statements and map designations for the area covered by the plan respecting ...(f) the approximate location and type of present and proposed public facilities including...waste treatment and disposal sites".

As part of the application process, the CRD conducted consultation meetings with the West Bay Neighbourhood Association, Lyall Street Action Group, and the Esquimalt Chamber of Commerce. A public open house was held at the Esquimalt Legion on May 23, 2013. In addition to the open house, conversations took place with representatives of the Macaulay School Parents' Advisory Council and the Esquimalt Residents Association. The Township of Esquimalt referred the application to its Advisory Planning Committee, Advisory Design Committee, and Heritage Advisory Committee, and referred it to nearly 30 external agencies.

Two Zoning bylaws were proposed to amend the Zoning Bylaw 2050. Amendment Bylaw No. 2805 provided regulations the CRD requested in its submission to allow the treatment facility to handle the core area's wastewater needs, and the amenities the CRD has offered to the Township in return for siting the wastewater facility at McLoughlin Point. Esquimalt also tabled an alternate Amendment Bylaw No. 2806, which would permit a variety of other uses intended to allow a mixed-use facility to be developed on the McLoughlin Point site. The alternate bylaw contained conditions that the CRD considered unworkable and to be outside the legislative authority of the CRD.

The Township of Esquimalt subsequently held public hearings on July 8, 9 and 10, 2013 to hear and receive public input concerning the proposed rezoning of McLoughlin Point. On July 15, the Township of Esquimalt Council voted to adopt Zoning Bylaw No. 2806. Bylaw 2805 received second reading at the same council meeting.

As of October 2013, a tentative agreement has been reached between Esquimalt and CRD staff, which will be taken to Esquimalt council and the CALWMC for consideration.

Adjacent Land Uses

The McLoughlin Point site is approximately 700 m northeast of the existing Macaulay Point sewage pump station. Victoria View Road runs north-south, immediately west of the McLoughlin Point site.

A CFB Esquimalt marina is located north of the workspace area (Figure 50) and provides 100 mooring berths for power boats less than 30 feet in length, a boat launch ramp, a storage compound, servicing bays and a clubhouse for the CFB Esquimalt Power Boat Club. The CFB Esquimalt Power Boat Club is open to all members of the Regular and Reserve Force, to DND civilian employees and to other employees of federal services. All facilities are secured by fences and protected by lockboxes, allowing exclusive access to members of the Boat Club.

Victoria Harbour bounds the McLoughlin Point site to the east and south. This portion of the harbour sees many forms of marine and air traffic, including ferries from Washington, cruise ships, floatplanes, helicopters, Canada Coast Guard, and private and commercial vessels.

DND staff refers to the DND property near the McLoughlin Point site as the Work Point area (Beach pers. comm.). Uses of the Work Point area include military training, residences (detached and attached structures) for DND staff and military personnel, a canteen, a maintenance supplies yard, CFB Esquimalt administration buildings, and heritage fortification structures (Gingras pers. comm.). The two nearest residences to the McLoughlin Point site are 45 m and 70 m west of the site.

Planned Land Uses

In discussing the McLoughlin Point site, the Town of Esquimalt's 2007 OCP states:

> *"The storage facilities are anticipated to remain on the waterfront for the near future. At the time any redevelopment plan is prepared for the surrounding DND lands, consideration should be given to alternate uses for this site that complement and support the redevelopment plan" (Town of Esquimalt 2007, p. 22).*

Figure 50 CFB Esquimalt Marina, North of the McLoughlin Point Site

Source: Bing Maps

The current draft of the Master Asset Development Plan (MADP) for future DND activities anticipates that a wastewater treatment facility will be built on the McLoughlin Point site (Gingras pers. comm.). Land uses in the MADP are intended to minimize the potential for conflict with a future wastewater treatment facility. The CRD and the DND are currently negotiating an Access to Federal Lands Agreement to include construction access, use of workspace areas, operations access and utility corridors for the McLoughlin Point facility.

5.9.1.4 Arbutus Road

Current Site Uses

The Arbutus Road site is a forested parcel in a residential and institutional area, located between the University of Victoria campus and Haro Strait.

The land is currently owned by the CRD and is zoned RS-10 (Single Family Dwelling Zone) and RS-12 (Single Family Dwelling Zone). Although the property is posted for no trespassing, the area is routinely used by the public for recreation. Existing sanitary sewer infrastructure including trunks, mains and a metering station are located at the site.

Networks of informal trails support recreational activities, both on the site and on adjoining forested lands (Figures 51 and 52). These lands are considered as community green spaces by the public.

Figure 51 Arbutus Road Property, Looking Southwest from Arbutus Road

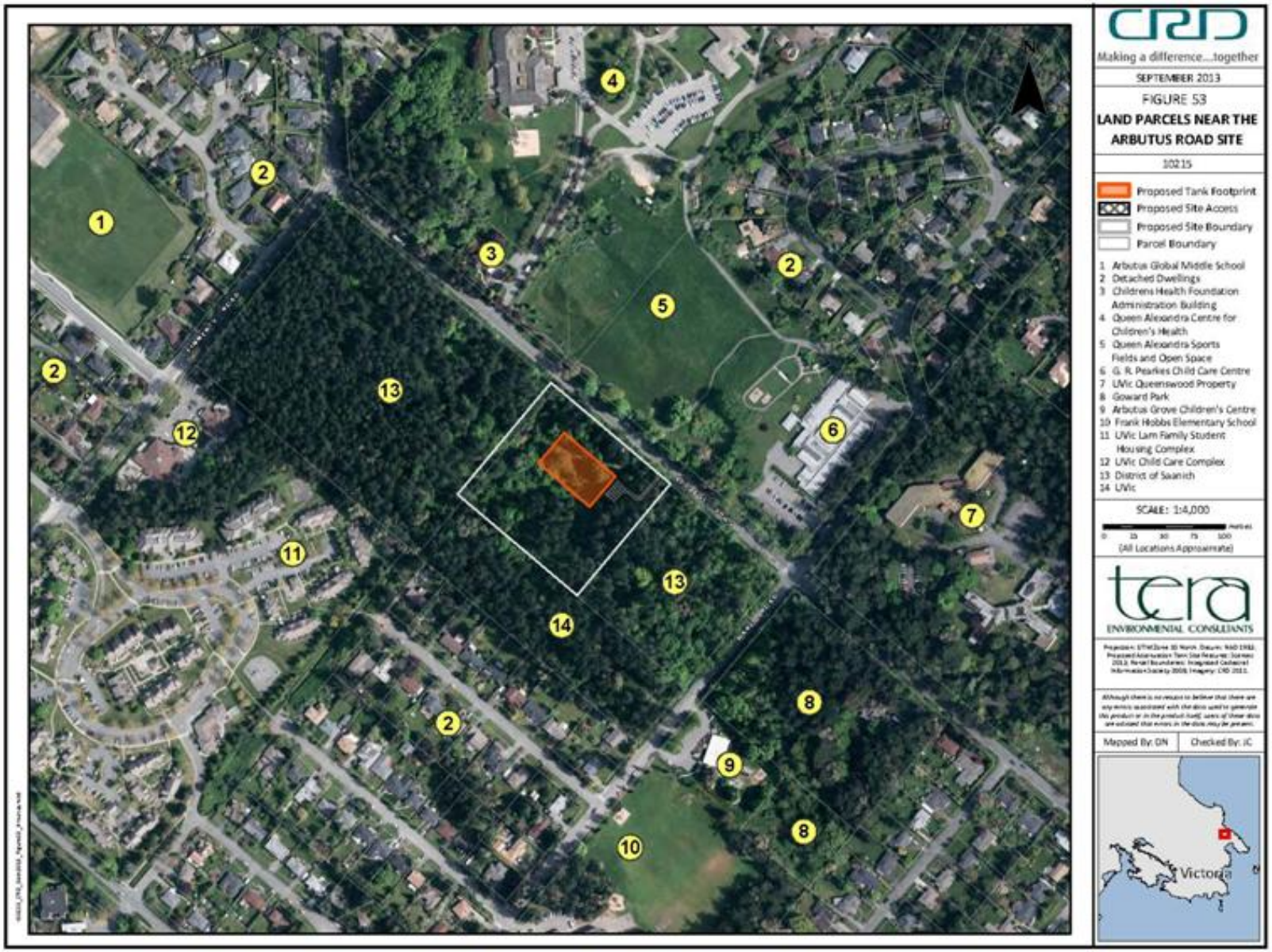
Figure 52 Trail Crossing Proposed Attenuation Tank Location (Looking Southwest)

Adjacent Land Uses

Institutions and residences are the primary land uses on lands near the Arbutus Road site (Figure 53). Specific land uses and their approximate distance from the facility footprint are:

- undeveloped wooded parcel owned by the University of Victoria (50 m south);
- undeveloped wooded parcel owned by the District of Saanich (35 m west);
- UVic Lam Family Student Housing Complex (200 m southwest);
- UVic Child Care Complex (285 m east);
- Queen Alexandra administrative building (160 m northwest);
- Queen Alexandra sports fields and open space (50 m north);
- G.R. Pearkes Child Care Center (130 m east);
- Frank Hobbs elementary school (350 m south);
- Arbutus Grove Children's Centre (215 m southeast);
- Goward Park and Goward House (170 m southeast); and
- detached residences (280 m northwest on Finnerty Road, 215 m northeast on Alpine Crescent, and 125 m southwest on Sutton Road).

Figure 53 Land Parcels near the Arbutus Road Site

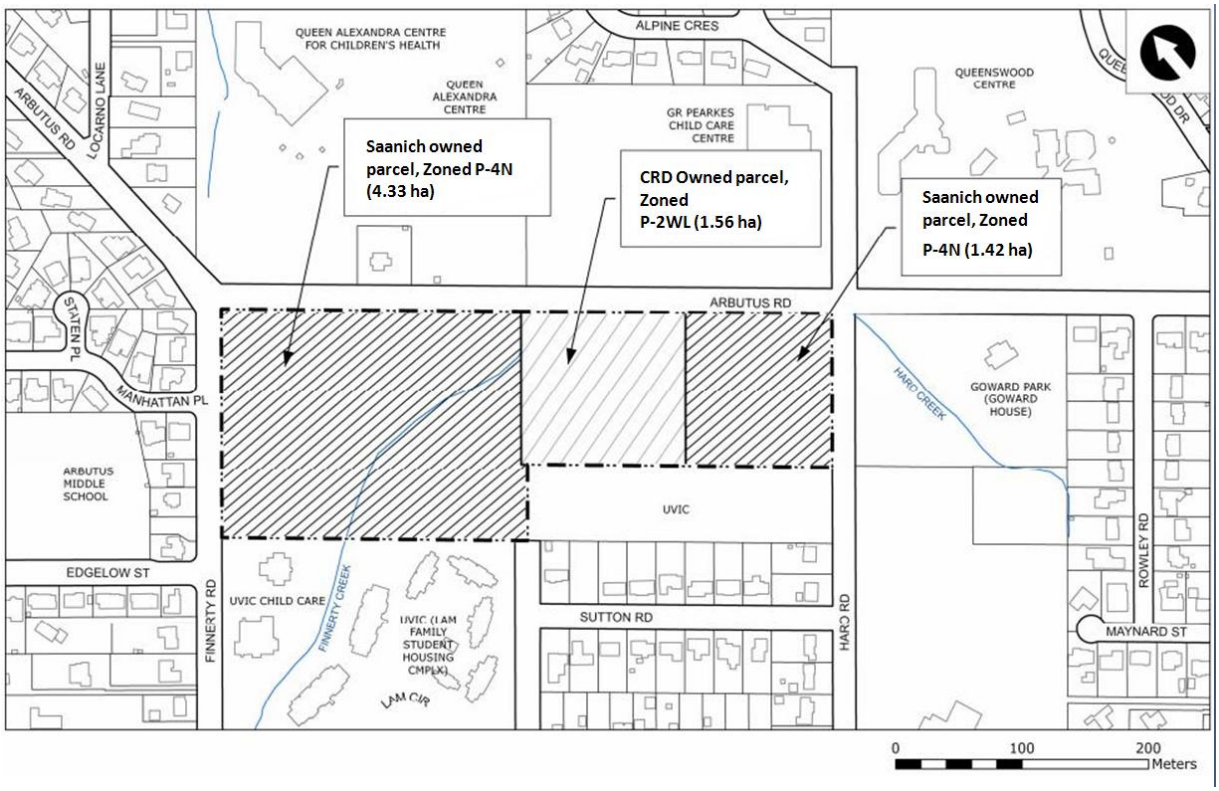


Planned Land Uses

The District of Saanich approved a rezoning application on July 23, 2013 for land parcels owned by Saanich and CRD fronting Arbutus Road. The approved zoning enables re-subdivision of lands, exchange of ownership between the two parties and construction of underground attenuation tanks by the CRD.

Figure 54 shows the land reconfiguration following rezoning. The two areas zoned P-4N (Natural Park Zone) are in the process of being conveyed to the District of Saanich and the P-2WL (Utility Wood Land) parcel will be transferred to the CRD. The attenuation tank will be constructed on the CRD parcel.

Figure 54 Zoning, Lot Configuration and Ownership of Arbutus Road Parcels



Source: Figure Adapted from District of Saanich

Several mobility improvements are proposed for the Arbutus Road site to address cycling, walking and safety concerns along District of Saanich and CRD property frontages. The improvements planned for Finnerty Rd., Arbutus Rd. and Haro Rd. will be completed by the CRD and the District of Saanich. The CRD will be responsible for improvements along Arbutus Rd. from the northernmost corner of the rezoned CRD property to the corner of Haro Road (Figure 54). The CRD also will be responsible for relocating the existing pedestrian solar beacons at the intersection of Arbutus and Haro roads. The District of Saanich will be responsible for improvements on Finnerty Rd., Haro Rd. and the remaining western portion of Arbutus Rd. Mobility improvements include a separated 2 m wide pedestrian pathway (where possible) on all frontages and 1.5 m wide bike lane on Arbutus and Finnerty roads. The Haro Rd. improvements will be extended to Sutton Rd. to improve mobility to and from the Arbutus Grove Children's Center and Frank Hobbs Elementary School.

5.9.1.5 Craigflower

Current Site Uses

The proposed pump station site is a 0.19 ha parcel located approximately 40 m north of the Old Island Highway and east of the E&N Railway right-of-way in the Town of View Royal, British Columbia. The proposed pump station will be constructed on a filled untitled Crown foreshore that does not appear on the Town of View Royal OCP and has no corresponding land use designation (Town of View Royal 2011). According to the Town of View Royal Planning Department, zoning of the area would not be required because utilities including wastewater pump stations are permitted in all land use designations (Davison pers. comm.).

Although the proposed pump station site does not appear to be heavily used by the public, site visits and aerial photographs have confirmed the presence of informal walking trails that may be used for blackberry picking or other purposes.

Adjacent Land Uses

A private gravel driveway borders the site directly to the west, and provides access to a residence along Portage Inlet to the north (Figure 55). The E&N Railway right-of-way and future E&N Rail Trail are located to the west of the driveway (Figure 56). The E&N Rail Trail is a commuter cycling and recreation trail being constructed primarily within the railway corridor connecting Victoria, Esquimalt, View Royal and Langford. The planning and design of Phase II of the E&N Rail Trail is currently underway for the section between the Old Island Highway and the Trans Canada Highway at Burnside, including the section directly west of the proposed pump station site (CRD 2012). A residential subdivision is located to the west of the railway right-of-way. The nearest residence is approximately 40 m to the west of the proposed pump station site.

A treed and grassed area to the south of the site will be used for temporary work space, which is required during construction. A sidewalk and the Old Island Highway are located south of the grassed lot. A residential subdivision is present south of the Old Island Highway.

Portage inlet is located directly east of the proposed site. A grassed sports field used by the Shoreline Community Middle School is located approximately 50 m east the proposed pump station site across Portage Inlet. The school buildings are located approximately 200 m east of the site. In September 2011, the school enrolled 282 students in grades six to nine (School District No. 61 2012). Shoreline Drive and a residential subdivision are located east of school.

A treed and grassed portion of the filled foreshore extends to the north of the proposed pump station site. Portage Inlet is located north of the filled foreshore.

The gravel driveway and the area to the west of the railway right-of-way have been designated as R-1A or One Family Residential. This designation permits predominantly detached houses and townhouses up to 2.5 storeys. The railway right-of-way, the treed and grassed area to the south (including the urban discharge outfall) and the grassed sports field to the east of Portage Inlet are designated as P-1 or Community Institutional. The designation permits the development of government buildings, publically owned facilities including schools and community centres (Town of View Royal 1990).

Planned Land Uses

Currently, the Town of View Royal has no plans to assign a land use designation to the proposed pump station site. However, if the area does undergo zoning, it is assumed that it would be designated as P-1 Community Institutional to align with existing adjacent land uses. As discussed previously, the proposed pump station does not require a land use designation because utility structures are permitted in all zones (Davison pers. comm.).

Figure 55 Private Gravel Driveway West of the Proposed Pump Station Site (Looking North)

Figure 56 Facing North Along the E&N Railway Right-of-Way towards Portage Inlet

The CRD has a License of Occupation with the Province for siting and operation of the pump station. The CRD also has statutory rights-of-way over the adjacent properties (154 Island Highway and the Shoreline School) to site and operate the Craigflower pump station.

5.9.2 Ancillary Facilities

5.9.2.1 Macaulay Point to McLoughlin Point

The conveyance pipeline that will carry screened wastewater from the Macaulay Point pump station to the McLoughlin Point facility will be installed along roads through the DND land. The DND land uses along the conveyance pipeline route include military detached housing, a community garden, a boat storage yard, CFB Esquimalt administration buildings, a maintenance supply yard and extensive space for military training activities.

5.9.2.2 Clover Point

The conveyance pipeline from Currie Road pump station to Clover Point will be installed in a trench along Currie Road and McNeill Avenue in the District of Oak Bay, and Richardson Street, St, Charles Street, Brooke Street, Arnold Avenue, Fairfield Road, Memorial Crescent and Dallas Road in the City of Victoria's Fairfield neighbourhood. Land uses bordering the roads are primarily residential. The route borders small sections of Windsor and Pemberton Parks and the Ross Bay Cemetery along Fairfield Road and Memorial Crescent.

The conveyance pipeline that will carry screened wastewater from the Clover Point pump station to McLoughlin Point facility will be installed in a trench along Dallas Road, then via HDD from Ogden Point to McLoughlin Point. The route along Dallas Road passes three City of Victoria parks, and a paved pedestrian waterfront walkway. Dallas Road constitutes part of the popular 11 km Seaside Touring Route.

Facilities at Ogden Point include commercial and industrial uses that support the on-site passenger cruise ship terminal facility and regional helicopter landing port and flight service. Ogden Point is a major entry point for tourists to Victoria, mainly passengers of docked cruise ships. A ROW will need to be obtained for the HDD crossing of Victoria Harbour. The CRD and the Greater Victoria Harbour Authority (GVHA) are currently negotiating an agreement for the ROW and construction area.

5.9.2.3 Arbutus Road

The ancillary pipes connecting the proposed attenuation tank to the existing infrastructure will be installed on the Arbutus Road site and will cross the Saanich property fronting Haro Road. The route crosses vacant forests and vegetated land. Trails have been developed over the existing wastewater rights-of-way on the CRD and Saanich properties, and a meter station exists along the ancillary route.

5.9.2.4 Craigflower

The proposed conveyance pipes that will transport sewage from the existing pump station to the proposed pump station site will parallel existing sewer line along The Shoreline School playfield margin. Currently, the proposed ancillary facilities site consists primarily of a grassed sports field used by the Shoreline Community Middle School, which is also accessible to the public. The area is zoned P1 or Community Institutional (Town of View Royal 1990). A section of the conveyance pipes will also pass beneath the tidal flats at the southern extent of Portage Inlet.

5.9.3 Impact Assessment and Mitigation Measures

5.9.3.1 Macaulay Point

<u>Construction</u>

Potential Impact: Construction could affect activities on adjacent DND land.

Considering the nearby land uses (military housing, trails, baseball diamonds, Macaulay Point Park), there may be short-term traffic effects (Section 5.10) and nuisance effects (Section 5.10) during construction of the Macaulay Point facility. However, such disturbances are unlikely to have long-term adverse impacts on those adjacent land uses.

Potential interference to adjacent activities related to construction of the Macaulay Point facility expansion is considered local, short-term, reversible, of moderate magnitude and **less than significant**.

Potential Impact: Public use of Macaulay Point Park or foreshore may be affected by construction.

The expansion of the Macaulay Point facility will occur on the CRD property and will not restrict public use of the pedestrian path to Macaulay Point Park or the adjacent foreshore during construction. For this reason, potential disruption of public use of Macaulay Point Park or the foreshore during construction is considered negligible and **less than significant**.

Potential Impact: The facility must comply with adopted plans and zoning bylaws.

The Township of Esquimalt zoned the existing Macaulay Point pump station site I5- Industrial, which permits wastewater screening and pump station facilities. The Township of Esquimalt OCP states only "minor expansion of the current pumping and screening facility" is appropriate at the Macaulay Point site. The proposed changes to the facility will occur entirely within the boundaries of the CRD property and casual observers will be unlikely to notice the change in the facility. The Macaulay Point facility expansion, therefore, is considered minor. The facility complies with Esquimalt's zoning bylaw and OCP. Because rezoning or an OCP amendment are not required, the impact of the Macaulay Point facility on adopted plans and zoning bylaws will be **less than significant**.

Operation

Potential Impact: Operation of the Macaulay Point facility may affect surrounding land uses.

Because the Macaulay Point facility includes only minor expansion of the pump station and the potential upgrading of a standby power generator located on the existing CRD property, there will not be a noticeable difference in the operation of the wastewater treatment facility compared to the existing facility. The current draft of the MADP assumes that an expansion of wastewater facilities will be built on the Macaulay Point site. Furthermore, no walkway restrictions or effects on walkway users are expected during operation of the expanded Macaulay Point facility. The Macaulay Point facility will be compatible with surrounding land uses. Effects of Macaulay Point facility on surrounding land uses during operation will be local, long-term, reversible, of low magnitude, and **less than significant.**

5.9.3.2 Clover Point

Construction

Potential Impact: Construction of the facility may affect use of Clover Point Park.

The Clover Point facility expansion will occur in Clover Point Park. Community use of the park's vehicle parking, sections of the paved pedestrian walkway to Ross Bay, and the facility footprint and workspace of the Clover Point wastewater facility will be restricted during the construction period. The quality of the recreational experience in Clover Point Park is likely to be reduced during site grading and other construction activities associated with facility expansion. The availability of alternative recreational opportunities in nearby parks will reduce the community effects during the construction phase.

Mitigation Measures: The CRD will meet with representatives of the City of Victoria to discuss the project design and construction process, to ensure that effects on public use of Clover Point Park are minimized. To reduce community impacts during facility construction, detour routes near the Clover Point site should direct users of the pedestrian waterfront walkway to the Dallas Road sidewalk on the north side of the street.

Signs and newspaper advertisements will be used to inform park users of the construction schedule and portions of the walkway, vehicle parking and park that will be temporarily closed to the public.

Provided the mitigation measures are implemented, and ensuring the availability of nearby recreational opportunities in Clover Point Park, the public access limitations during the construction phase are considered to be local, short-term, reversible, of moderate magnitude and **less than significant**.

Potential Impact: Publicly accessible land in Clover Point Park will be reduced during construction.

A portion of the park will be restricted from public use during construction activities to help ensure public safety.

Mitigation Measures: Prepare a public access management plan to minimize construction effects on public use of the park.

Access to a small area of land in Clover Point Park will be restricted during construction of the facility. If mitigation measures are implemented, the impact on public access to the park will be local, short-term, reversible, of moderate magnitude and **less than significant**.

Operation

Potential Impact: Facility operation will need to comply with restrictive covenant.

The proposed Clover Point facility upgrades will expand the facility footprint to the north of the existing pump station facility. Clover Point Park is subject to a covenant requiring the land to be used for public park purposes. The expanded pump station will be an underground facility, and the land surface will still be available for park use. The facility, therefore, will not prevent the land from being used as park, which is consistent with the spirit and wording of the covenant.

Mitigation Measures: The CRD will meet with representatives of the City of Victoria and the federal government to ensure that the facility operation complies with the restrictive covenant.

The expanded Clover Point facility will comply with the restrictive covenant, so the potential impact is considered **less than significant**.

Potential Impact: Facility operation may affect adjacent land uses.

There will be no change in facility capacity or apparent operation, so adjacent lands users (residents, drivers on Dallas Road) will notice no difference. Impacts on adjacent land uses will be **less than significant**.

5.9.3.3 McLoughlin Point

Construction

Potential Impact: Facility design must be consistent with adopted DND plans and land uses.

The draft MADP anticipates construction of a CRD wastewater treatment facility on the McLoughlin Point site.

Mitigation Measures: The CRD will continue to meet with DND staff to ensure that facility design and construction are consistent with DND plans and activities. During facility design, efforts will be made to minimize the footprint to avoid federal land to the north of the site.

The impact of the wastewater facility design and construction on adopted DND plans and land uses is considered to be **less than significant**.

Potential Impact: Public access to McLoughlin Point may be disturbed during construction.

As private land, McLoughlin Point is not readily accessible by the public. Public access also is restricted on the surrounding DND land and use of Victoria View Road is under DND control. Because public access to McLoughlin Point is already limited, restrictions on public access during construction of the wastewater treatment facility at this site is considered to be local, short-term, reversible, low magnitude, and **less than significant.**

Potential Impact: Construction activities could conflict with Victoria Harbour air traffic land use regulations.

Considering the nearby aerodrome for seaplanes and helicopters, it is necessary to ensure construction of the facilities at the McLoughlin Point site complies with federal air traffic safety policies and regulations

of Transport Canada, and with Nav Canada air navigation safety guidelines. The Transport Canada document, *TP 1247 - Aviation - Land Use in the Vicinity of Airports*, describes the operational characteristics of airports and aerodromes that may influence land uses outside the aerodrome boundary and recommends, where applicable, guidelines for nearby land uses. Transport Canada does not have regulations in place associated with structural height limitations on land adjacent to the Victoria Harbour aerodrome (Youngson pers. comm.).

Mitigation Measures: Design of the facilities and construction methods at the McLoughlin Point site should follow the Transport Canada guidelines.

Compared to other buildings near Victoria Harbour, the wastewater treatment facilities will be relatively low (three storeys or less). Cranes needed to build the treatment facility are unlikely to create a hazard to aircraft. Although this conclusion should be revisited following Nav Canada review of the construction plans, current information about the wastewater facilities and federal regulations indicate that construction will not affect air navigation in Victoria Harbour, and impacts will be local, medium-term, reversible, of low magnitude, and assessed to be **less than significant**.

Operation

Potential Impact: Facility operation must comply with adopted plans and zoning bylaws.

The draft MADP anticipates operation of a CRD wastewater treatment facility on the McLoughlin Point site.

The McLoughlin Point site has a site specific zoning precipitated by the rezoning application made by the CRD in January 2013 to permit the use of the property for a waste water treatment facility. The zoning adopted in July 2013 by the Township of Esquimalt permits a wastewater treatment system but have conditions unacceptable to and undeliverable by the CRD. The Township of Esquimalt voted against adopting amendment Bylaw No. 2805 proposed by the CRD, and instead adopted the Township's alternate amendment Bylaw No. 2806, which is unacceptable to the CRD.

Since the end of July, 2013 negotiations to seek a mutually satisfactory zoning regulation and amenity package have been underway between the CRD and the Township of Esquimalt.

The Esquimalt OCP was amended July 15, 2013 to permit the installation of the required wastewater treatment plant.

Potential Impact: Facility operation may affect existing and planned adjacent land uses.

Two houses are located 45 m and 70 m west of the site. The houses are owned by DND and leased to DND staff (Gingras pers. comm.). Approximately 20 m north of the site is a federal maintenance yard for storing building and landscaping materials. This area will be used for material storage during facility construction. Heritage fortifications are located southwest of the site. Aside from these uses, the DND land surrounding the McLoughlin Point site is mostly used as a training area for military personnel (Beach pers. comm.).

The operation of the McLoughlin Point wastewater treatment facility will not conflict with the existing and planned uses of the surrounding DND property.

The operation of the McLoughlin Point facility is deemed compatible with current and planned future uses of adjacent land. The impact of the wastewater facility operation on current and planned DND activities is assessed to be local, long-term, reversible, of low magnitude, and **less than significant**.

5.9.3.4 Arbutus Road

Construction

Potential Impact: Construction activities will disrupt adjacent land use.

Construction activities at the Arbutus Road site could affect nearby residences and institutions. There may be short term traffic (Section 5.10) and nuisance effects (Section 5.11) associated with the construction of the attenuation tank. No land uses will be displaced by the attenuation tank construction.

Mitigation Measures: The impact of construction on adjacent properties could be reduced by informing the District of Saanich, nearby residents and recreational users of the schedule and duration of potentially disturbing activities.

The impacts of construction on adjacent properties are considered to be local, reversible, medium-term, of moderate magnitude and **less than significant**.

Potential Impact: Construction activities will disrupt recreational use of the CRD-owned and Saanich-owned parcels.

During the construction of the attenuation tank, community use will be restricted in and around the active construction area. These restrictions will apply to the CRD property. Little or no restriction on use of adjacent Saanich-owned parcels is expected.

Mitigation Measures: Signage and newspaper advertisements should be used to inform community users of the construction schedule and portions of the site subject to access restrictions.

The impacts of construction on recreational use are considered to be local, reversible, medium-term, of moderate magnitude and **less than significant**.

Operation

Potential Impact: Operation of the attenuation tank will affect recreational use.

During routine operation of the attenuation tank, land use will be similar to what it is presently. The proposed site will appear to be a forest opening, vegetated with grasses and shrubs, rounded by young mixed forest and used for recreational and educational purposes.

The attenuation tank will be located completely underground, except for required vents pipes which will have a maximum high of 1.4 m above ground and be designed to blend into the natural environment. Surface access hatches will be needed to provide entry into the tank area. The entire surface of the tank will be backfilled with soil and revegetated. No fences will enclose the area and the entire site will be open for public use.

Mitigation Measures: Steps should be taken to minimize disturbance of the site and surrounding area. A rehabilitation program should be implemented to revegetate disturbed areas.

The potential impact of operation of the attenuation tank is considered local, medium-term, reversible, of low magnitude and **less than significant.**

5.9.3.5 Craigflower

Construction

Potential Impact: Community access and use of the construction area and work site will be restricted during construction.

Public use of the proposed pump station site and work space area will be restricted during the construction period. Community use of the proposed pump station site will not be allowed, resulting in a long-term, irreversible effect. Access to the work space to the south of the proposed site will be restricted during construction, which represents a local, medium-term, reversible impact.

Mitigation Measures: Signage and newspaper advertisements should be used to inform community users of the construction schedule and the areas that will have restricted access.

Opportunities for recreation activities exist on other areas along Portage Inlet outside of the proposed pump station site and work area. The facility site and workspace is private property and lacks publically

accessible recreational facilities. For these reasons, limitations to public access during construction are considered to be of low magnitude and **less than significant.**

Potential Impact: Construction could affect access to the residence along the gravel driveway.

There may be short-term effects regarding access along the gravel driveway during construction of the proposed pump station. However, such disturbances are unlikely to have long-term adverse impacts.

Mitigation Measures: Notify the residence that is accessed by the gravel driveway of the construction work schedule and potential disruptions. Minimize disruption to access along the gravel driveway during construction.

Potential interference with access along the gravel roadway related to construction of the proposed pump station is considered local, medium-term, reversible, of medium magnitude and **less than significant**.

Potential Impact: Construction could affect adjacent and nearby land uses.

Although there is some evidence of public use of the site, the construction of the proposed pump station will have limited impacts on directly adjacent land uses. Refer to Section 5.6: Air Quality and Section 5.10: Noise, Vibration and Lighting for more information related to potential nuisance effects on adjacent properties. Portage Inlet acts as a buffer area between the proposed construction site and the sports field used by Shoreline Community Middle School.

Mitigation Measures: Inform residents of construction activities and schedules. Establish a communication system that will enable CRD to respond to potential issues raised by adjacent land users.

Potential effects on the use of adjacent and nearby areas during construction of the pump station are considered local, short-term, reversible, medium magnitude, and **less than significant**.

Potential Impact: The proposed pump station must comply with plans and zoning designations.

According to the Town of View Royal Land Use Bylaw, the proposed pump station site currently has no applicable zoning designation (Town of View Royal 1990). However, as indicated previously, the construction of a public utility such as a pump station is permitted in all land use designations (Davison pers. comm.).

Mitigation Measures: No mitigation is required

Impacts to plans and zoning designation resulting from the construction of the proposed pump station are negligible and considered **less than significant**.

Operation

Potential Impact: Operation of the proposed pump station may affect surrounding land uses.

The proposed project includes the replacement of an existing pump station with an upgraded facility. The new facility will be compatible with surrounding land uses. The pump station facility is designed to be aesthetically pleasing in order to blend in with the surrounding area. Negative activity such as vandalism will be discouraged by the installation of robust and aesthetic materials including fencing, landscaping and lighting. An odour control system will be installed to suppress potential odours. A noise control system will mitigate noise generated by the pump station during operation.

Mitigation Measures: Establish ways for nearby residents to contact the CRD in case facility operation affects the use of their property.

Effects of the proposed pump station on adjacent properties during operation will be local, long-term, irreversible, of low magnitude and are deemed **less than significant.**

5.9.4 Ancillary Facilities

5.9.4.1 Macaulay Point to McLoughlin Point

Construction

Potential Impact: Construction of the Macaulay Point to McLoughlin Point conveyance pipeline and the underground utilities will affect adjacent land uses during construction.

Construction of the pipe between Macaulay Point and McLoughlin Point and the underground utilities from Lyall Street to McLoughlin Point could affect access by CFB Esquimalt administration staff and others to residences, the community garden, boat storage yard and maintenance supply yard. Traffic effects and nuisance disturbances are assessed in other sections of this report.

Mitigation Measures: Users of facilities that could be affected by pipeline construction will be notified about the work schedule and potential disruptions.

By applying standard construction procedures and the recommended mitigation measures, the adverse effects of the Macaulay Point to McLoughlin Point conveyance pipeline construction on nearby land uses during construction are considered to be local, short-term, reversible, low magnitude and **less than significant**.

Operation

Potential Impact: Facility operation may affects adjacent land uses.

Occasional, short-term road access disruptions to CFB Esquimalt administration staff, users of the community garden, boat storage yard and the maintenance supply yard may occur if pipeline repairs are needed in the future. Such effects of pipeline operation on adjacent land use are considered local, short term, reversible, low magnitude and **less than significant**.

5.9.4.2 Clover Point

Construction

Potential Impact: Construction of conveyance pipelines from Currie Road to Clover Point and Clover Point to McLoughlin Point will affect adjacent land uses.

Construction of the ancillary facilities from Currie Road to Clover Point will cause short-term road and access disturbances to residents and road users along the proposed route. Traffic effects and nuisance disturbances are assessed in other sections of this report.

Users of the Beacon Hill and Clover Point parks will be affected by ancillary pipeline installation. Similarly, travellers on Dallas Road may be affected by some construction activities. Dallas Road residents will experience short-term access restrictions and disturbances during pipeline construction.

Entry to the Ogden Point Marine facilities will be disrupted during construction of the pipe in Dallas Road. Particularly during cruise ship season (June to October) traffic volumes at Ogden Point can be high. Short-term access restrictions and disturbances also will affect the boat ramp users, Helijet Airways operations and other commercial activities where customers and suppliers use Dallas Road.

Because the right-of-way will not cross any permanent structures and the HDD harbour crossing can similarly avoid surface structures, above-ground structures will not be directly affected during construction. The James Bay Anglers hut will be relocated to the northern portion of the property.

The conveyance pipe exit point will be located directly on the CRD's McLoughlin Point property, and will not affect adjacent land use.

Mitigation Measures: City of Victoria staff, the GVHA, Dallas Road businesses, residents, and community stakeholders should be engaged to review and comment on the proposed conveyance pipeline construction program.

To avoid access restrictions and disturbances during peak periods of use by residents, visitors, and cruise ship passengers, construction of the conveyance pipes near Victoria parks and the Seaside Touring Route be scheduled to occur between late October and May, if feasible.

Standard construction procedures, a robust access management plan, and implementation of the recommended mitigation measures should ensure that adverse effects of the conveyance pipeline construction on nearby land uses are local, short-term, reversible, moderate in magnitude and **less than significant**.

Operation

Potential Impact: Adjacent land uses could be affected by conveyance facility operation.

If repairs to the conveyance pipes are required, short-term road and access disruptions could affect tourists, residents of James Bay and Fairfield, regional helicopter service operations, and commercial and industrial activities at Ogden Point. Such events are expected to be infrequent. Adverse effects on adjacent land uses during operation are considered local, short-term, reversible, of moderate magnitude and **less than significant**.

5.9.4.3 Craigflower

Construction

Potential Impact: Construction of the conveyance pipeline from the existing pump station to the proposed facility will affect adjacent land uses during construction.

Construction of the pipe along margins of the Shoreline Middle School playfield will affect recreational use of the field by students and teachers of the school and by other members of the public.

Mitigation Measures: Users of facilities that could be affected by pipeline construction should be notified about the work schedule and potential disruptions. Conducting construction during summer months while school is not in session would help to reduce potential effects on land use during the school year.

By applying standard construction procedures and the recommended mitigation measures, the adverse effects during construction of the conveyance pipeline on land use are considered to be local, medium-term, reversible, of moderate magnitude and **less than significant**.

Operation

Potential Impact: Operation of the ancillary facilities may affect adjacent land uses.

Occasional, short-term access disruptions to users of the grassed sports field may occur if pipeline repairs are needed in the future. Such effects of pipeline operation on adjacent land use are considered local, short-term, reversible, low magnitude and **less than significant**.

5.10 Traffic

5.10.1 Treatment Facility Site Conditions

This traffic impact assessment examines:

- the volumes and types of vehicular traffic;
- road classification;
- proximity to designated truck routes;
- alternative modes of transportation;
- accident history;
- transit service; and

- impact on existing traffic from construction and installation of pipes underneath existing road surfaces.

Traffic to and from the sites can use several routes. Where feasible, designated truck routes and the shortest distances to designated truck routes are assessed. A summary of the characteristics of the access roads for the five sites is presented in the following sections. Road networks near each site are shown in Figures 57 to 60.

Figure 57 Road Network near Macaulay and McLoughlin Point

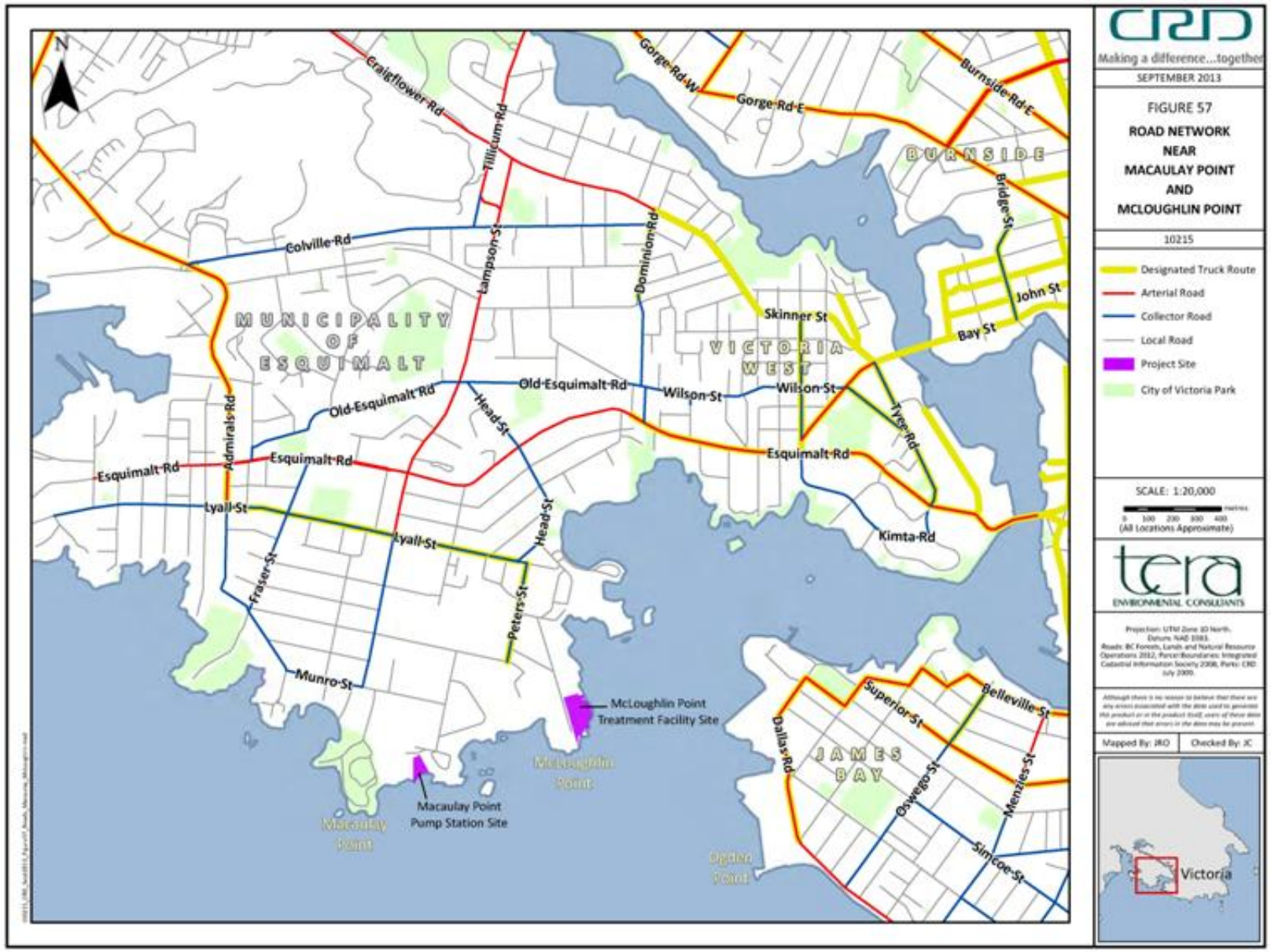


Figure 58 Road Network near Clover Point

Figure 59 Road Network near the Arbutus Road Attenuation Tank Site

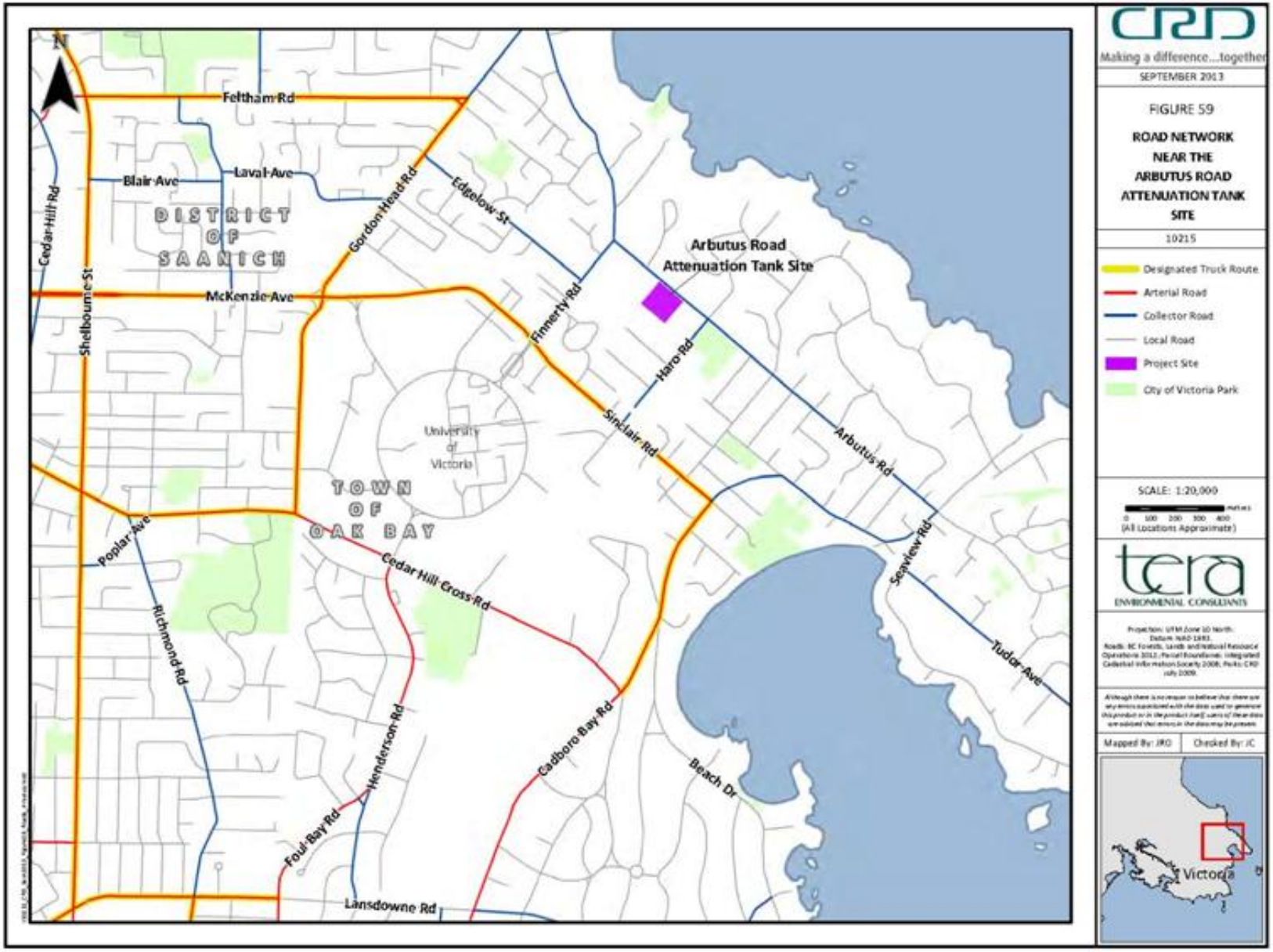
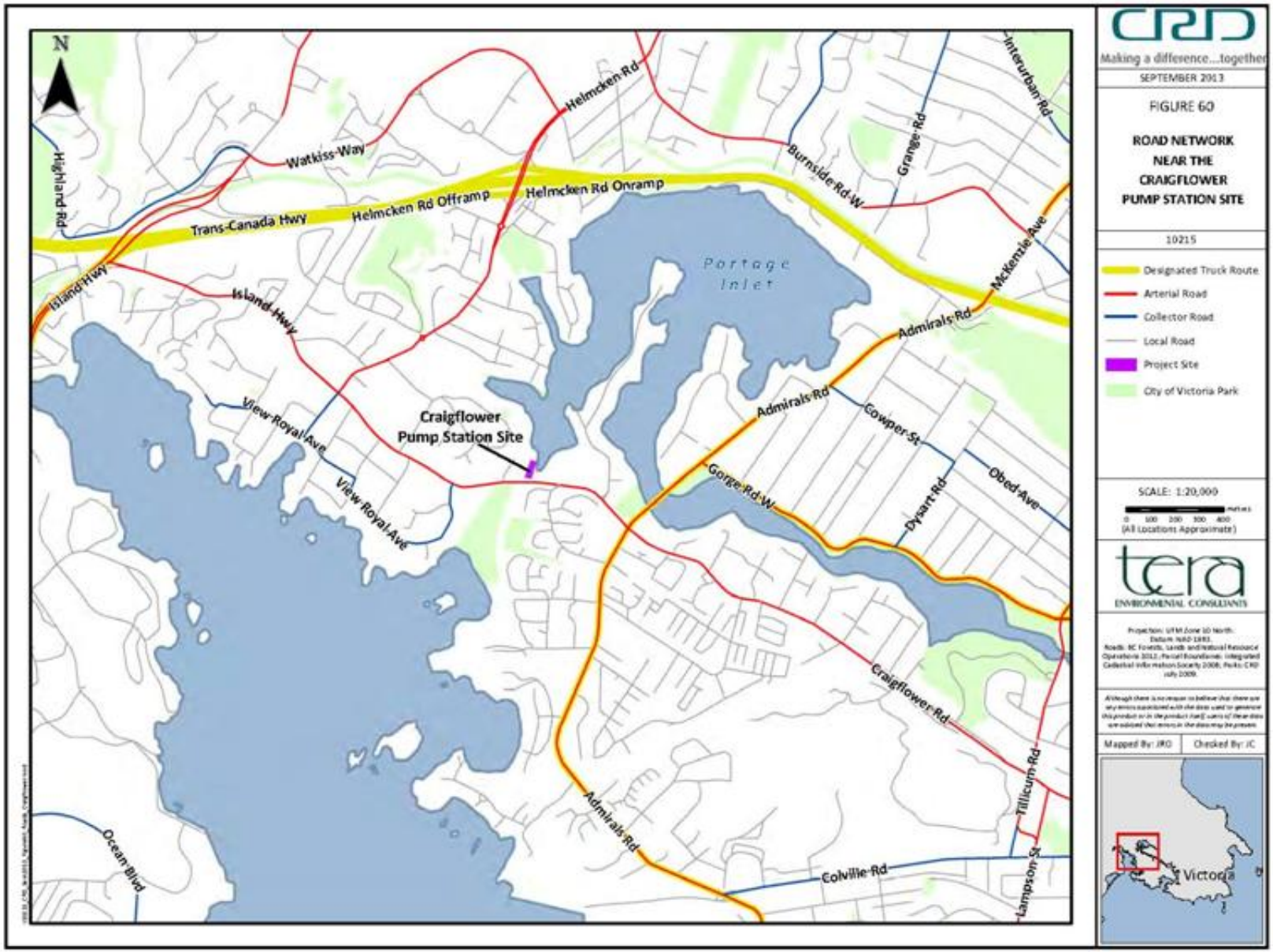


Figure 60 Road Network near the Craigflower Pump Station Site



5.10.1.1 Macaulay Point

In the Township of Esquimalt, major roads are considered to be truck routes. In 2007, Esquimalt amended their truck route bylaw to restrict truck access on roads south of Lyall Street because of concerns about a proposed expansion of sewage treatment facilities in the Macaulay Point-McLoughlin Point areas (as outlined in their letter to the Capital Regional District dated July 3, 2007). The following traffic assessment does not reflect this revision but rather examines the road network contained in the current Esquimalt Official Community Plan.

Table 22 below and Figure 57 present the characteristics of the roads that could be used to access the Macaulay site. Municipal arterial or major roads typically have two-lane or four-lane cross-sections and are expected to carry traffic volumes in the range of 10,000 to 30,000 vpd. To provide a comparison, wider arterials, such as Blanchard Street, are expected to carry more than 30,000 vpd. Municipal collector roads can have widths similar to arterials, but there is more traffic impedance from access to adjacent lands. Collector roads are expected to carry traffic volumes of 5,000 to 20,000 vpd. Admirals Road, Blanshard Street and Bay Street near Bridge Street experience congestion during peak hours.

TABLE 22

CHARACTERISTICS OF SITE ACCESS ROADS FOR MACAULAY POINT

Macaulay Point Access Roads		Designated Routes		
Roads	Class	Truck	Bus	Bicycle
Anson Street	local			
Munro Street	local			
Lampson Street	collector (1)		x	x
Lampson Street	major (2)	x	x	x
OPTIONS				
Esquimalt Road	major	x	x	x
Bay Street	arterial	x	x	x
Blanshard Street	arterial	x	x	x
OR				
Tillicum Road	major	x	x	x
Trans Canada Hwy	arterial	x	x	(3)
OR				
Esquimalt Road	major	x	x	x
Admirals Road	major	x	x	x
Trans Canada Hwy	arterial	x	x	(3)

Notes: (1) South of Lyall Street.
(2) North of Lyall Street.
(3) Except at specified interchange locations.

Pedestrian movement at the Lyall Street and Lampson Street intersection was 95 pedestrians in the morning (AM) peak hour. These counts are 65% higher than the noon and PM peak hours, because of pedestrian movements associated with Macaulay School. Pedestrian movements at the Dunsmuir Road and Head Street intersection ranged from 25 to 54 in the noon and PM peak hours respectively. There are no crossing signals at this intersection.

A vehicle classification count on Lyall Street (east of Lampson Street) found that passenger cars, pickups, vans and RVs accounted for 92% of all vehicles. Trucks with two axles and six tires accounted for another 6% and larger trucks were 0.4% of total traffic.

5.10.1.2 Clover Point

The City of Victoria and Township of Esquimalt differ in their functional classification of roads. Victoria uses ‘arterial’ as their highest category; whereas Esquimalt uses ‘major’, but the purposes of the road types are consistent. Victoria has a more robust network than Esquimalt and a more detailed

classification scheme that uses secondary arterials and secondary collectors to discriminate among road types.

Table 23 below and Figure 58 present the characteristics of the roads to Clover Point. Moss Street, as a secondary collector, has a traffic volume range less than a collector. The classification of secondary arterials, such as Cook Street, Dallas Road, the southern portion of Douglas Street and Pandora Street, their classification reflects street cross section and adjacent land uses. Their traffic volumes are appropriate for their classifications but there are areas of congestion on Cook Street and Blanshard Street during peak hours.

TABLE 23

CHARACTERISTICS OF SITE ACCESS ROADS FOR CLOVER POINT

Clover Point Access Roads		Designated Routes		
Roads	Class	Truck	Bus	Bicycle
Dallas Road	collector			x
OPTIONS				
Moss Street	secondary collector			x
Fairfield Road	collector	x	x	
Cook Street	arterial	x	x	x
Pandora Avenue	secondary arterial	x	x	x
Blanshard Street	arterial	x	x	x
OR				
Cook Street	secondary arterial		(1)	(2)
Cook Street	arterial	x	x	x
Pandora Avenue	secondary arterial	x	x	x
Blanshard Street	arterial	x	x	(4)
OR				
Dallas Road	secondary arterial			x
Douglas Street	secondary arterial		(3)	
Blanshard Street	arterial	x	x	(5)

Notes: (1) North of May Street.
(2) South of Park Boulevard.
(3) Between Niagara Street and Superior Street.
(4) North of Fort Street.
(5) Except at specified interchange locations.

Data on truck, pedestrian, and bicycle volumes were not available for all of the access roads to Clover Point, but traffic volume data were available from the City of Victoria. Additional survey data were collected for vehicular movements on Dallas Road.

Dallas Road and connecting roads are not designated trucks routes and it is noted that the data recorded for alternative modes of transportation for this analysis occurred in the winter when counts of pedestrian and bicycle traffic are lower than what normally occurs during the summer.

5.10.1.3 McLoughlin Point

Table 24 below and Figure 57 present of the characteristics of access roads leading to the McLoughlin Point site. The vehicular volumes for McLoughlin Point access routes are comparable to the Macaulay Point site. The roads with substantial congestion during peak hours of travel include Admirals Road, Tillicum Road, Blanshard Street and Bay Street. The pedestrian movements and vehicle classification percentages cited for the Macaulay Point site also apply to analysis of McLoughlin Point.

TABLE 24

CHARACTERISTICS OF SITE ACCESS ROADS FOR MCLOUGHLIN POINT

McLoughlin Point Access Roads		Designated Routes		
Roads	Class	Truck	Bus	Bicycle
Victoria View Road	local			
Patricia Way	local			
Peters Street	local			
OPTIONS				
Lyall Street	collector		x	x
Gore Street	collector		x	x
Head Street	collector		(1)	x
Esquimalt Road	major	x	x	x
Bay Street	arterial	x	x	x
Blanshard Street	arterial	x	x	x
OR				
Lyall Street	collector		x	x
Lampson Street	major	x	x	x
Tillicum Road	major	x	x	x
Trans Canada Hwy	arterial	x	x	(2)
OR				
Lyall Street	collector		x	x
Admirals Road	major	x	x	x
Trans Canada Hwy	arterial	x	x	(2)

Notes: (1) Route 25 from Gore Street to Dunsmuir Road.

(2) Except at specified interchange locations.

5.10.1.4 Arbutus Road

The Arbutus Road site is located south of Arbutus Road between Finnerty Road and Haro Road in the District of Saanich. Truck routes and other road characteristics in the vicinity of the site are outlined in Figure 59 and Table 25.

TABLE 25

CHARACTERISTICS OF SITE ACCESS ROADS FOR ARBUTUS ROAD

Arbutus Road Access Roads		Designated Routes		
Roads	Class	Truck	Bus	Bicycle
Arbutus Road	collector		x	(1)
Finnerty Road	collector		x	(1)
McKenzie Avenue	arterial	x	x	(2)
Patricia Bay Highway	highway	x	x	
Blanshard Street	arterial	x	x	(3)
OPTION				
Arbutus Road	collector		x	(1)
Finnerty Road	collector		x	(1)
Edgelow Street	collector			
Gordon Head Road	collector	x	x	(2)
McKenzie Avenue	arterial	x	x	
Shelbourne Street	major arterial	x	x	(2)
Bay Street	minor arterial			

Notes: (1) A bike route is planed as part of mobility upgrades.

(2) In some locations.

(3) Except at specified interchange locations.

In the District of Saanich, roads are typically categorized by the characteristics of road mobility and access. The Provincial facilities, such as the Trans Canada Highway and Pat Bay Highway, offer high mobility and limited access to individual land uses. Major routes in a community are also primarily for mobility with limited direct access to land parcels. Major routes in turn connect to other roads that provide more access, such as collector roads or local roads.

The most direct route to the Arbutus site from industrial areas (Upper Victoria Harbour and Keating Cross Road industrial areas) is by heading east on McKenzie Avenue, north on Finnerty and east on Arbutus. Although not as direct, the Gordon Head Road option is also presented.

5.10.1.5 Craigflower

View Royal is similar to Victoria in classifying roads. After freeways, arterial roads are the highest category and serve as major traffic routes between areas of the Municipality. Collector roads serve several local highways and act as connectors between neighbourhoods and minor roads can be considered as residential. Truck routes in View Royal are limited to Admirals Road, the Trans Canada Highway, Six Mile Road and the portion of the Old Island Highway starting at the Colwood border and running north until it reaches the Trans Canada Highway.

The proposed pump station site and ancillary facilities are located in the Town of View Royal. Table 26 and Figure 60 describe the adjacent road network and characteristics of the access roads leading to the site.

TABLE 26

CHARACTERISTICS OF SITE ACCESS ROADS FOR CRAIGFLOWER

Craigflower Access Roads		Designated Routes		
Roads	Class	Truck	Bus	Bicycle
Shoreline Drive	local			
Old Island Highway	major arterial		x	x
Craigflower	major arterial		x	(1)
Bay Street	minor arterial	x		
OPTIONS				
Old Island Highway	major arterial		x	x
Craigflower	major arterial		x	(1)
Tillicum	major collector	x	x	(1)
Gorge Road West	major collector	x		
Government Street	major collector	x	x	(1)
OR				
Old Island Highway	major arterial		x	x
Helmcken	minor arterial			x
Trans Canada Highway	freeway	x	x	
McKenzie Avenue	major arterial	x	x	(1)

Note: (1) In some locations.

Where feasible, designated truck routes and the shortest distances to designated truck routes are assessed. The proposed pump station site and the western portion of the conveyance pipe will be accessed from the private gravel driveway via the Old Island Highway. Access for construction of the ancillary facilities will be from Shoreline Drive via the Old Island Highway. Either the Trans Canada Highway #1, Helmcken Road, Admirals Road or Craigflower can be used to access the Old Island Highway. The Admirals Road option was not assessed because the Craigflower Bridge is closed until spring 2014.

5.10.2 Impact Assessment and Mitigation Measures

The forecast trips for the construction of the CAWTP facilities are shown in Table 27 as average trip rates per day (vpd) with an assumed 250 workdays per annum. For the calculation of vehicular volumes

associated with excavation and concrete activities, the peak rate was used for all facilities. Intermittent or less intense construction activities, which do not generate significant daily volumes, have their rates expressed in terms of trucks per week.

To determine the impact of construction trips on daily volumes, the trips must be doubled to account for vehicles arriving and departing from the sites. In order to determine the impact on peak hour traffic, a combination of the worker-related trips and 20% of truck trips is used. Although most of the workers can be assumed to arrive or depart during peak AM or PM hours, the truck trips would be distributed throughout the day. A worst case scenario is assumed to be all worker trips and 20% of the truck trips all occurring during the peak hour. Daily one-way, two-way and peak hour trips also are shown in Table 27 for all the sites.

The construction of the facilities between 2012 and 2017 is forecast to generate two-way daily trips ranging from 52 vpd (Craigflower) to 582 vpd (McLoughlin). The increase in afternoon peak hour trips is forecast to range from 18 vph (Clover Point) to 243 vph (McLoughlin).

TABLE 27

DAILY AND PEAK HOUR CONSTRUCTION TRAFFIC VOLUMES FOR THE CAWTP TREATMENT FACILITY SITES

Activities		Traffic impacts				
		Macaulay Point (1 year)	McLoughlin Point (3.5 Years)	Clover Point (1 year)	Arbutus Road (1 year)	Craigflower (1 year)
Clearing and grubbing	Total trucks required	20	63	20	75	20
Excavations	Total trucks required	233	2884	233	900	100
	Peak trucks per day	13	60	13	20	10
Concrete	Total trucks required	101	1106	80	275	60
	Peak trucks per day	7	20	7	10	6
Reinforcing steel	Total trucks required	4	23	3	10	2
	Peak trucks per day	1	1	1	1	1
Other deliveries	Peak trucks per day	2	2	2	2	2
Workers	Average workers per day	22	155	14	15	12
	Peak workers per day	44	308	29	20	20
Total daily one-way trips	Peak trucks per day	13	60	13	20	10
	Worker vehicles per day	33	231	22	17	16
Total peak hour one-way trips	All vehicles per peak hour	36	243	24	21	18
Total daily two-way trips	All vehicles per day	92	582	70	74	52

Source: Stantec 2010, Cowley pers. comm.

For the impact of daily and peak hour construction traffic on access roads for each site, the construction traffic for the sites is added to the forecast traffic for 2016 on the access roads to the sites. The total peak hour trips (both peak hour and daily) are the totals coming from all directions. Construction worker trips would have dispersed origins and destinations, whereas most of the construction materials and equipment would come from the Upper Harbour industrial area and the Swartz Bay ferry terminal (Table 28). The total increased trips have been added to each access road option, which overestimates the impact or percentage increase where there are multiple routings.

TABLE 28

ORIGINS AND DESTINATIONS OF CONSTRUCTION TRUCK TRAFFIC FOR ALL FACILITIES

Construction	Starting Points	Destinations
Concrete, structural steel, reinforcing steel and aggregates	Upper Victoria Harbour and Keating Cross Road industrial areas	McLoughlin Point, Clover Point, Macaulay Point, Arbutus Road and Craigflower sites
Pipes and equipment	Swartz Bay ferry terminal	McLoughlin Point, Clover Point, Macaulay Point, Arbutus Road and Craigflower sites

Data on current traffic volume and vehicle classification were obtained from the City of Victoria, Township of Esquimalt, the CRD, traffic surveys and other traffic and environmental studies.

The existing volumes and predicted traffic impacts on the roads to the facilities are presented in the following section. The table in each section shows the traffic volumes in vehicles per day (vpd) and vehicles per hour (vph) for the afternoon and evening (PM) peak hour period for each road. The percent predicted volume change, due to the added facility construction traffic, is calculated.

5.10.2.1 Macaulay Point

Construction

Potential Impact: Construction at the Macaulay Point site may increase local traffic congestion, parking concerns and safety risks.

Construction traffic increases associated with the Macaulay Point site are described in Table 29. Most of the traffic increases are less than 3%, which is considered moderate. An exception is the lower portion of Lampson Street, where present volumes are so low that the construction traffic would increase peak hour volumes by 30% and daily volumes by nearly 8%. As a designated collector, Lampson Street could accommodate the forecast volumes, because it has substantial surplus capacity. These traffic increases would be occasional during the medium term construction period. In this context, the forecast traffic impacts on Lampson Street are considered moderate in magnitude.

Although the existing traffic volumes on Anson Street and Munro Street were not available, such local roads typically can carry up to 1,000 vpd. The anticipated increase in traffic levels associated with facility construction would not exceed the roads' vehicular capacity or result in congestion.

Increased volumes of traffic are generally considered to be accompanied by commensurate increases in the potential for traffic accidents. However, with standard traffic control measures for projects of this nature, safety risk can be effectively managed during facility construction.

Mitigation Measures: Standard traffic control measures for projects of this nature will be implemented. Nearby residents will be notified in advance of disruptive construction activities. With the use of flag persons and signage, the risk to the public from vehicle movement is greatly reduced. The construction site will be fenced to prevent access by the public. In areas near travel routes to schools, flag persons will be present during school hours. If pedestrian risks are identified on other roads or intersections, flag persons will be assigned to those locations during high traffic periods.

If insufficient space is available to accommodate parking needs on-site, van-pooling, ride-sharing, and park-and-ride programs are recommended to reduce the number of trips. Additional parking should be developed if construction worker vehicles cannot be accommodated on-site, and if van-pooling, ride sharing and park-and-ride programs will not be effective in mitigating on-street parking effects.

Traffic increases will be occasional over the 10-month construction period. Parking effects, if any, can be reduced by creating parking areas elsewhere. Construction traffic impacts on Lampson Street, Munro Street and Anson Street are moderate to high in terms of percentage increase, but volumes do not exceed capacity of these streets. Construction traffic impacts are considered to be local, short-term, reversible, of moderate magnitude and **less than significant.**

TABLE 29

IMPACT OF DAILY AND PEAK HOUR CONSTRUCTION TRAFFIC ON ACCESS ROADS FOR MACAULAY POINT

Road Name	Classification	Units	Traffic Volumes		Construction Traffic 2016	
			2009	2016	Vehicle Trips	% Volume Change
Anson Street	local		N/A			
Munro Street	local		N/A			
Lampson Street	collector	vpd	1,100	1,180	92	8%
		vph – PM peak hour	115	120	36	30%
Lampson Street	major	vpd	11,300	12,100	92	< 1%
		vph – PM peak hour	1,190	1,270	36	3%
OPTIONS						
Esquimalt Road	major	vpd	16,350	17,500	92	< 1%
		vph – PM peak hour	1,720	1,840	36	2%
Bay Street	arterial	vpd	23,000	24,700	92	< 1%
		vph – PM peak hour	2,070	2,220	36	2%
Blanshard Street	arterial	vpd	45,000	48,250	92	< 1%
		vph – PM peak hour	4,725	5,050	36	< 1%
OR						
Tillicum Road	major	vpd	24,200	25,900	92	< 1%
		vph – PM peak hour	2,540	2,720	36	1%
OR						
Esquimalt Road	major	vpd	11,600	12,500	92	< 1%
		vph – PM peak hour	1,220	1,310	36	3%
Admirals Road	major	vpd	14,300	15,300	92	< 1%
		vph – PM peak hour	1,500	1,610	36	2%

5.10.2.2 Clover Point

Construction

Potential Impact: Construction at the Clover Point site may result in increases in local traffic congestion, parking concerns and safety risks.

The daily and PM peak hour traffic volumes and construction traffic increases associated with the Clover Point facility expansion plans are presented in Table 30. Most of the daily vehicular traffic volume increases less than 2%. The exceptions are Moss Street and the peak hour traffic on the secondary arterial portion of Dallas Road, where present volumes are relatively low. Moss Street is a secondary collector and Dallas Road is a secondary arterial. Both roads have substantial surplus capacity to accommodate the forecast increases in vehicular volumes.

Increased volumes of traffic are generally considered to be accompanied by commensurate increases in the potential for traffic accidents. However, with standard traffic control measures for projects of this nature, safety risk can be effectively managed during facility construction.

Mitigation Measures: Standard traffic control measures for projects of this nature will be implemented. Nearby residents will be notified in advance of disruptive construction activities. With the use of flag persons and signage, the risk to the public from vehicle movement is greatly reduced. The construction site will be fenced to prevent access by the public. In areas near travel routes to schools, flag persons will be present during school hours. If pedestrian risks are identified on other roads or intersections, flag persons will be assigned to those locations during high traffic periods.

The Clover Point site is part of Clover Point Park and is adjacent to the Fairfield residential neighbourhood to the north of Dallas Road. There will be limited options for additional parking near the site. If there is not sufficient space to accommodate all the parking on-site, it is recommended that van-pooling, ride-sharing and park-and-ride programs be developed to reduce the number of trips. Additional

parking should be developed if construction worker vehicles cannot be accommodated on-site, and if van-pooling, ride sharing and park-and-ride programs will not be effective in mitigating on-street parking.

Traffic increases will be occasional over the construction period. Parking effects, if any, can be reduced by creating parking areas elsewhere. Construction traffic impacts associated with the pump station upgrades are considered to be local, short-term, reversible, of low magnitude and **less than significant.**

TABLE 30

IMPACT OF DAILY AND PEAK HOUR CONSTRUCTION TRAFFIC ON ACCESS ROADS FOR CLOVER POINT

Road Name	Classification	Units	Traffic Volumes		Construction Traffic 2016	
			2009	2016	Vehicle Trips	% Volume Change
Dallas Road	collector	vpd	10,600	11,330	70	< 1%
		vph – PM peak hour	1,110	1,190	24	2%
OPTIONS						
Moss Street	secondary collector	vpd	2,050	2,200	70	3%
		vph – PM peak hour	215	230	24	10%
Fairfield Road	collector	vpd	10,820	11,600	70	< 1%
		vph – PM peak hour	1,140	1,220	24	2%
Cook Street	arterial	vpd	25,650	27,500	70	< 1%
		vph – PM peak hour	2,700	2,890	24	< 1%
Pandora Avenue	secondary arterial	vpd	12,550	13,440	70	< 1%
		vph – PM peak hour	1,320	1,410	24	2%
Blanshard Street	arterial	vpd	45,000	48,250	70	< 1%
		vph – PM peak hour	4,725	5,050	24	< 1%
OR						
Cook Street	secondary arterial	vpd	16,600	17,800	70	< 1%
		vph – PM peak hour	1,750	1,850	24	1%
Cook Street	arterial	vpd	25,650	27,500	70	< 1%
		vph – PM peak hour	2,700	2,890	24	< 1%
Pandora Avenue	secondary arterial	vpd	12,550	13,440	70	< 1%
		vph – PM peak hour	1,320	1,410	24	2%
Blanshard Street	arterial	vpd	45,000	48,250	70	< 1%
		vph – PM peak hour	4,725	5,050	24	< 1%
OR						
Dallas Road	secondary arterial	vpd	4,740	5,080	70	1%
		vph – PM peak hour	500	530	24	4%
Douglas Street	secondary arterial	vpd	11,650	12,500	70	< 1%
		vph – PM peak hour	1,220	1,310	24	2 %
Blanshard Street	arterial	vpd	45,000	48,250	70	< 1%
		vph – PM peak hour	4,725	5,050	24	< 1%

5.10.2.3 McLoughlin Point

Construction

Potential Impact: Construction at the McLoughlin Point site may increase local traffic congestion, parking concerns and safety risks.

Construction traffic impacts associated with construction of the McLoughlin Point facility are illustrated in Table 31. This new facility will generate substantial excavation and concrete truck traffic and a large labour force, which results in an increase of 582 vpd and 243 vph. The roads near the site are either local or collector roads and volume increases of this magnitude cause increases of up to 18% over the day and up to 69% in the PM peak hour, resulting in capacity and congestion during peak hours of travel. The high vehicular volumes of hauling excavation material from the site, delivery of construction supplies and equipment to the site and the large numbers of workers requiring parking will require enhanced mitigation

measures. Without enhanced mitigation, the traffic and roads effects of McLoughlin Point construction will be **significant**.

The McLoughlin Point site is relatively isolated, and is accessible only via Victoria View Road, a DND road on which access can be controlled. No walkways or other public accesses reach the site. Hence, public safety risks on or near the site are limited. Truck traffic in residential and commercial areas may increase safety risks.

Mitigation Measures: With the large number of workers required on-site during peak periods, there will not be sufficient parking either on-site or adjacent to the site. Parking areas will need to be identified for the various stages of the project and buses used to shuttle workers to and from the work site and the parking areas. These parking areas may be shared with workers employed in construction at the Macaulay Point site.

With truck trips estimated to total more than 4,100 for McLoughlin Point facility construction, measures to reduce this traffic on the local road network include considering the use of barges to transport excavated materials from the site and to deliver construction materials and equipment to the site. Depending on timing of the various construction stages, the construction activities at Macaulay Point could also access the barges to reduce truck traffic.

The impact of the forecast increases in construction traffic at the various sites is compared to the existing and forecast average weekday PM peak hour traffic volumes on the access roads. Work schedules for the construction activities may be adjusted so that much of the construction traffic to and from the site occurs outside of the peak commuting hours.

Standard traffic control measures for projects of this nature will be implemented. With the use of flag persons and signage, the risk to the public from vehicle movement is greatly reduced. In areas near travel routes to schools, flag persons will be present during school hours. Nearby residents will be notified in advance of disruptive construction activities.

With the various mitigation measures available to reduce the impact of the construction traffic for the McLoughlin Point and Macaulay Point sites, it is recommended that a comprehensive traffic management plan (TMP) be developed to provide an integrated approach to minimising the impact of vehicular traffic associated with this project. The issues discussed in the previous paragraphs should be included in the Traffic Management Plan. Affected parties should be consulted during preparation of the Traffic Management Plan. Meeting with planners with the Township of Esquimalt to identify and refine construction routes to minimize traffic effects would be an integral component of preparing the Traffic Management Plan.

The magnitude of construction traffic impacts on local roads is considered high in most cases. Overall, the impact of increased construction traffic will be local, medium-term, periodic, reversible, and is evaluated as **significant**. With the implementation of enhanced mitigation measures and provision of offsite parking and buses, the magnitude of traffic effects is reduced to moderate, and the impact becomes **less than significant**.

TABLE 31

IMPACT OF DAILY AND PEAK HOUR CONSTRUCTION TRAFFIC ON ACCESS ROADS FOR THE MCLOUGHLIN POINT SITE

Road Name	Classification	Units	Traffic volumes		Construction traffic 2016	
			2009	2016	Vehicle trips	% volume change
Victoria View Rd	local		N/A		--	--
Patricia Way	local		N/A		--	--
Peters Street	local		N/A		--	--
OPTIONS						
Lyall Street	collector	vpd	3,410	3,660	582	16%
		vph – PM peak hour	350	385	243	63%

TABLE 31 Cont'd

Road Name	Classification	Units	Traffic volumes		Construction traffic 2016	
			2009	2016	Vehicle trips	% volume change
Gore Street	collector	vpd	N/A		--	--
		vph – PM peak hour			--	--
Head Street	collector	vpd	3,100	3,320	582	18%
		vph – PM peak hour	325	350	243	69%
Esquimalt Road	major	vpd	16,350	17,500	582	3%
		vph – PM peak hour	1,720	1,840	243	13%
Bay Street	arterial	vpd	23,000	24,700	582	2%
		vph – PM peak hour	2,070	2,220	243	11%
Blanshard Street	arterial	vpd	45,000	48,250	582	1%
		vph – PM peak hour	4,725	5,050	243	4.8%
OR						
Lyall Street	collector	vpd	3,410	3,660	582	16%
		vph – PM peak hour	350	385	243	63%
Lampson Street	major	vpd	11,300	12,100	582	5%
		vph – PM peak hour	1,190	1,270	243	19%
Tillicum Road	major	vpd	24,200	25,900	582	2%
		vph – PM peak hour	2,540	2,720	243	9%
OR						
Lyall Street	collector	vpd	4,160	4,460	582	13%
		vph – PM peak hour	440	470	243	52%
Admirals Road	major	vpd	14,300	15,300	582	4%
		vph – PM peak hour	1,500	1,610	243	15%

5.10.2.4 Arbutus Road

Construction

Potential Impact: Construction at the Arbutus Road site may increase local traffic congestion, parking concerns and safety risks.

The attenuation tank site will be accessed from Arbutus Road, Finnerty Road and McKenzie Avenue. Arbutus Road and Finnerty Road are classified as collector roads by the municipality. McKenzie Avenue has a functional classification as an arterial road and is also the nearest designated truck route. Table 32 shows the traffic volumes in vehicles per day (vpd) and vehicles per hour (vph) for the PM Peak Hour period for each road link. An assumed growth rate of 1% per annum was used to forecast these traffic volumes to 2016 in order to analyse the percent volume change anticipated with the added construction traffic. The largest increase (5%) occurs on Arbutus Road. The percent increase is considered to have a moderate impact on traffic. Collector roads are expected to carry traffic volumes of 5,000 to 20,000 vpd. As the volume on Arbutus road and Finnerty Road is quite low, these roads have substantial surplus capacity to accommodate the forecast increases in vehicular volumes associated with the construction of the attenuation tank.

Additional parking will be required for construction workers driving to and from the site. Parking is restricted on Arbutus Road. A potential opportunity exists to reach an agreement with the District of Saanich to temporarily allow worker parking on Arbutus Road during the construction phase.

Mitigation Measure: No special access or traffic control measures are needed, beyond those applied as part of standard construction practices for projects of this nature. With the use of flaggers and signage, the risk to the public from vehicle movement is greatly reduced. The construction site will be fenced to prevent access by walkers, mountain bikers or other members of the public. Flaggers will be present during school hours to ensure that students, particularly those walking to elementary or junior secondary schools, remain a safe distance away from construction traffic and activities.

Traffic increases will be occasional over the construction period. Parking effects can be reduced by creating parking areas elsewhere. Construction traffic impacts associated with construction of the attenuation tank are considered to be local, short-term, reversible, of low magnitude and **less than significant.**

TABLE 32

CONSTRUCTION AVERAGE WEEKDAY TRAFFIC VOLUMES AND PERCENT FOR THE ARBUTUS ROAD SITE

Road Name	Classification	Units	Traffic volumes		Construction traffic 2016	
			2009	2016	Vehicle trips	% volume change
Arbutus Road	collector	vpd	4,940	5,290	74	1%
		vph – PM peak hour	400	430	21	5%
Finnerty Road	collector	vpd	6,510	6,930	74	1%
		vph – PM peak hour	640	680	21	3%
McKenzie Avenue	arterial	vpd	35,990	38,430	74	< 1%
		vph – PM peak hour	3,170	3,380	21	< 1%
Patricia Bay	highway	vpd	59,700	63,800	74	< 1%
		vph – PM peak hour	4,790	5,120	21	< 1%
Blanshard Street	arterial	vpd	45,000	48,250	74	< 1%
		vph – PM peak hour	4,725	5,050	21	< 1%
OR						
Arbutus Road	collector	vpd	4,940	5,290	74	1%
		vph – PM peak hour	400	430	21	5%
Finnerty Road	collector	vpd	6,510	6,930	74	1%
		vph – PM peak hour	640	680	21	3%
Edgelow Street	collector	vpd	N/A		--	--
		vph – PM peak hour			--	--
Gordon Head Road	collector	vpd	13,170	14,070	74	< 1%
		vph – PM peak hour	1,110	1,190	21	2%
McKenzie Avenue	arterial	vpd	35,990	38,430	74	< 1%
		vph – PM peak hour	3,170	3,380	21	< 1%
Shelbourne Street	major arterial	vpd	11,980	12,800	74	< 1%
		vph – PM peak hour	1,000	1,070	21	2%
Bay Street	minor arterial	vpd	23,000	24,700	74	< 1%
		vph – PM peak hour	2,070	2,220	21	1%

5.10.2.5 Craigflower

Existing traffic volumes on the access roads to the Craigflower site are presented in Table 33. The table shows the current traffic volumes in vehicles per day (vpd) and vehicles per hour (vph) for the afternoon and evening (PM) peak hour period for each road. An assumed growth rate of 1% annum was used to forecast traffic volumes in order to analyse percent volume increases in traffic associated with the construction of the pump station.

The highest projected change in volume is associated with Helmcken Road at 3% increase during the peak hour. The Helmcken route would only potentially be used for trucks accessing the site from the Swartz Bay ferry terminal, via Pat Bay Highway, McKenzie and Trans Canada route. Construction traffic coming from the Upper Victoria Harbour area will likely use the Bay Street, Craigflower, Old Island Highway route.

TABLE 33

CONSTRUCTION AVERAGE WEEKDAY TRAFFIC VOLUMES AND PERCENT FOR THE CRAIGFLOWER SITE

Road Name	Classification	Units	Traffic volumes		Construction traffic 2016	
			2009	2016	vehicle trips	% volume change
Shoreline Drive	local	vpd	N/A		--	--
		vph – PM peak hour			--	--
Old Island Highway	major arterial	vpd	47,290	50,600	52	< 1%
		vph – PM peak hour	3,770	4,030	18	< 1%
Craigflower	major arterial	vpd	14,650	15,660	52	< 1%
		vph – PM peak hour	1,230	1,310	18	1%
Bay Street	minor arterial	vpd	23,000	24,700	52	< 1%
		vph – PM peak hour	2,070	2,220	18	< 1%
OR						
Old Island Highway	major arterial	vpd	47,290	50,600	52	< 1%
		vph – PM peak hour	3,770	4,030	18	< 1%
Craigflower	major arterial	vpd	14,650	15,660	52	< 1%
		vph – PM peak hour	1,230	1,310	18	1%
Tillicum	major collector	vpd	24,200	25,900	52	< 1%
		vph – PM peak hour	2,540	2,720	18	< 1%
Gorge Road West	major collector	vpd	16,460	17,620	52	< 1%
		vph – PM peak hour	1,510	1,620	18	1%
Government Street	major collector	vpd	10,980	11,730	52	< 1%
		vph – PM peak hour	970	1,040	18	2%
OR						
Old Island Highway	major arterial	vpd	47,290	50,600	52	< 1%
		vph – PM peak hour	3,770	4,030	18	< 1%
Helmcken	minor arterial	vpd	6,330	6,770	52	< 1%
		vph – PM peak hour	540	580	18	3%
Trans Canada Highway	freeway	vpd	67,280	71,900	52	< 1%
		vph – PM peak hour	5,970	6,380	18	< 1%
McKenzie Avenue	major collector	vpd	35,990	38,430	52	< 1%
		vph – PM peak hour	3,170	3,380	18	<1%

Construction

Potential Impact: Construction at the Craigflower site may result in increases in local traffic congestion, parking concerns and safety risks.

Construction could potentially disrupt traffic along the Old Island Highway at the gravel driveway access point. The amount of disturbance is anticipated to be minimal, though left turn movements could require flagger assistance during peak construction and traffic periods. Additional parking may be required for construction workers driving to and from the site. The Old Island Highway has a high volume of vehicular traffic, especially during peak hours. Public safety risks may result from the presence of additional vehicles and heavy equipment arriving to and departing from the construction site. However, standard construction practices will reduce any potential impacts.

Mitigation Measures: No special access or traffic control measures will be necessary apart from those applied during standard construction practices for similar projects. The use of flaggers and adequate signage substantially reduce the risk to public resulting from an increase in vehicular traffic. The construction site will be fenced to prevent access by the general public. Flaggers also will be present during school hours to ensure that students are not able to access the site.

The proposed site and work area should provide sufficient parking for construction workers, mitigation parking impacts. If more space is required, it is recommended that ride-sharing be initiated to reduce the number of trips or the need for additional parking.

Projected construction traffic impacts associated with the Craigflower pump station are considered to be local, short-term, reversible, of low magnitude and **less than significant.**

5.10.2.6 All Facilities

Operation

Potential Impact: Operation of the CAWTP facilities may result in increases in traffic congestion.

Operational effects are similar for all CAWTP facilities. Daily and peak hour operational traffic volumes for the facilities are presented in Table 34. The numbers of site-generated trips for the operation of the facilities are quite small, and when compared to the existing and forecast vehicular trips on access roads, constitute a negligible impact. The exceptions are the peak hour traffic volumes on Lyall Street and Head Street associated with the operation of the McLoughlin Point site. With the modest volumes currently using these routes, the forecasted increase of 12 vph during peak hour represents a 3% increase in traffic, but it is unlikely that all 12 vehicles will use the same route to and from the facility resulting in a minimal impact on the capacity of these roads.

Traffic effects of facility operation will be local, continuous, long-term in duration and irreversible. The magnitude of the effect is low to negligible, so the impact is assessed to be **less than significant**.

TABLE 34

DAILY AND PEAK HOUR OPERATIONAL TRAFFIC VOLUMES FOR ALL SITES

Materials or Activities		Vehicle Impact				
		Macaulay Point	McLoughlin Point	Clover Point	Arbutus Road	Craigflower
Screenings and grits transferred to the Hartland landfill site		1 every 5 to 6 days	0	1 every 5 to 6 days	0	0
Chemicals (aluminum sulfate)		0	1 per month	0	0	0
Biosolids polymer		0	1 per month	0	0	0
Staff and maintenance traffic		2 per day	12 per day	2 per day	1 per month	2-3 per week
Total daily one-way trips	Trucks	5 per month	2 per month	5 per month	0	0
	Staff vehicles per day	2	12	2	0	1
Total peak hour one-way trips	All vehicles per peak hour	2	12	2	0	0
Total daily two-way trips	All vehicles per day	5	25	5	0	1

5.10.3 Ancillary Facility Construction

Ancillary facility pipes will be installed beneath road travel lanes, using cut and cover methods. Public safety effects of installing pipes in roadways are primarily associated with operation of heavy equipment and the presence of open trenches. Flag persons will be employed during the day to manage vehicles and pedestrians near the work sites. Barriers or flagging will be installed to alert people to the presence of open trenches.

Construction of ancillary facilities will disrupt vehicular traffic on affected routes. The extent and severity of disruption will be a function of the traffic volumes and available opportunities to keep some lanes open or to reroute traffic. The roads potentially affected by the construction of ancillary facilities are two-lane. This assessment assumes that one lane could remain open and alternating directions of traffic utilize the remaining lane.

5.10.3.1 Macaulay Point to McLoughlin Point

Potential Impact: Construction of the ancillary facilities connecting Macaulay Point and McLoughlin Point may result in increases in traffic congestion.

Construction of the underground utilities will be installed in a trench along Peters Street and Victoria View Road for approximately 680 m. The route is located on DND property and has low traffic volumes.

The road distances and the planned route for the 1,500 mm forcemain between the Macaulay Point and McLoughlin Point facilities are presented in Table 35. All roads are local two-lane roads with low traffic volumes.

TABLE 35

ROUTE AND LENGTH OF ANCILLARY PIPES BETWEEN MACAULAY POINT AND MCLOUGHLIN POINT FACILITIES

Roads	Length (m)
View Point Road	30
Vaughn Street	50
Anson Street	425
Bewdley Avenue	215
Peters Street	50
Patricia Way	185
Victoria View Road	135
Total Length	1,090

Mitigation Measures: Standard procedures for managing vehicular traffic in a construction zone will be implemented, keeping one lane open to alternating directions of traffic. Ancillary pipe construction should be restricted to single blocks at a time and, to the extent feasible, scheduled outside of peak periods of vehicular activity.

Increases in traffic will be local, short-term in duration and continuous during the construction period. Only small volumes of traffic will be affected, so the impact is considered low in magnitude. One-way alternating traffic will be permitted and there will be no residual impact, resulting in a rating of **less than significant**.

5.10.3.2 Clover Point

Potential Impact: Construction of the ancillary facilities connecting Currie Road to Clover Point may increase traffic congestion.

The construction of the ancillary facilities connecting the Currie Road pump station to the Clover Point pump station may result in temporary access disruptions to local residents. Traffic management measures will be applied during construction.

Mitigation measures: Standard procedures for managing vehicular traffic in a construction zone will be implemented, keeping one lane open to alternating directions of traffic. Ancillary pipe construction should be restricted to single blocks at a time and, to the extent feasible, scheduled outside of peak periods of vehicular activity.

Increases in traffic will be local, short-term in duration and continuous during the construction period. Only small volumes of traffic will be affected, so the impact is considered low in magnitude. One-way alternating traffic will be permitted and there will be no residual impact, resulting in a rating of **less than significant**.

Potential Impact: Construction of the ancillary facilities connecting Clover Point and McLoughlin Point may increase traffic congestion.

A 1,200 mm forcemain will be installed from the Clover Point facility to the McLoughlin Point facility. The conveyance pipeline will be installed in the grassy area south of the boulevard to align with a proposed City of Victoria bike path or in a trench along Dallas Road from Clover Point to Ogden Point at the James Bay Anglers boat ramp (3,300 m), and continue via HDD tunnel (850 m) beneath Victoria Harbour to McLoughlin Point.

In most places, Dallas Road is a fairly wide road and has areas assigned to angle parking, so it is assumed that one lane could remain open and alternating directions of traffic utilize the remaining lane.

Dallas Road is busy during peak tourist season, is a primary link to the regional helicopter and cruise ship terminals. The road is one of Victoria's most scenic routes and provides a linear connection to parks for a variety of transportation modes, and constitutes a portion of the popular cycling Seaside Touring Route.

Bicycles, tour buses, horse-drawn carriages and many pedestrians use Dallas Road. With the volumes and types of traffic that will be affected on Dallas Road, traffic effects during construction of conveyance pipelines from Clover Point to McLoughlin Point during peak use period are considered local, short-term, reversible, high in magnitude, and **significant**.

Mitigation Measures: The volume and nature of traffic on Dallas Road will require enhance procedures for managing vehicular traffic in the construction zone. Typically one lane will remain open to alternating directions of traffic. Flag persons will be employed during the day to manage vehicles and pedestrians near the work sites. Barriers or flagging will be installed to alert people to the presence of open trenches. Construction should be restricted to single blocks at a time. Measures to maintain safe cycling will be required. Access to high-density apartments along Dallas Road will need to be maintained, as will access to Ogden Point and the helicopter terminal.

Traffic impacts can be reduced by scheduling the ancillary pipeline construction along Dallas Road outside the peak use period, preferably in the late fall, winter, or early spring.

If enhanced mitigation is implemented, and a traffic lane remains open at all times, impacts of constructing the conveyance pipe from Clover Point to McLoughlin Point will be local, short-term, reversible, moderate in magnitude and assessed to be **less than significant**.

5.10.3.3 Arbutus Road

Potential Impact: Construction of the Arbutus Road ancillary facilities connecting the attenuation tank to existing sewer infrastructure may increase traffic congestion.

The ancillary pipes at Arbutus Road are located within the property boundaries. As such, few impacts on traffic are anticipated during construction. Standard traffic management measures will be applied during delivery of pipe equipment and installation of the materials.

Mitigation Measures: No special mitigation measures are necessary.

The impact on traffic associated with the construction of the ancillary facilities at Arbutus Road will be local, short-term, reversible, low magnitude and **less than significant**.

Potential Impact: Construction of the proposed roadworks on Arbutus Road may increase traffic congestion.

Construction required to upgrade Arbutus road with a bike lane and separated sidewalk will temporarily disturb traffic flows on Arbutus Road. Traffic management measures will be applied during construction.

Mitigation Measures: No special mitigation measures are necessary.

The impact on traffic associated with road upgrades on Arbutus Road will be local, short-term, reversible, low magnitude and **less than significant**.

5.10.3.4 Craigflower

Potential Impact: Construction of the Craigflower ancillaries may increase traffic congestion.

The ancillary pipes associated with the Craigflower site are located in the property boundaries, on Shoreline School grounds and beneath Portage Inlet. Standard traffic management measures will be applied during delivery of pipe equipment and installation of the materials.

Mitigation Measures: No special mitigation measures are necessary.

The impact on traffic associated with the construction of the ancillaries at Craigflower will be local, short-term, reversible, low magnitude and **less than significant**.

5.10.4 Ancillary Facility Operation

No traffic impacts will result from normal operation of the ancillary facilities, because the pipes will be underground. In the event that a pipe needs to be repaired, standard traffic management practices will be followed.

Traffic impacts of ancillary facility operation are limited to maintenance and repair activities, which may require short-term road closures. Impact is considered reversible, low magnitude and **less than significant**.

5.11 Noise, Vibration, and Lighting

5.11.1 Facility and Ancillary Site Conditions

Refer to Section 5.9 Land Use in this report for a description of treatment and ancillary facility site conditions as they relate to noise, vibration and lighting effects of the project.

Construction of the treatment facilities will involve the use of heavy machinery, compressors, pumps, concrete pouring equipment and other equipment to prepare the site and build the treatment facilities.

5.11.2 Impact Assessment and Mitigation Measures

5.11.2.1 Macaulay Point

Construction

Potential Impact: Nuisance effects of noise, vibration and lighting may occur during facility construction.

During the construction period, noise and vibration impacts will affect neighbouring residents and DND, in particular, the detached residence on the northeast side of the facility and the cluster of military residences to the east and northeast.

Construction of the Macaulay Point facility is expected to take 1 year to complete. Peak construction activity and potential noise and vibration effects will occur in the first few months, during the excavation and concrete pouring phase. After the peak construction period, the construction activities will be similar to the construction of utility or industrial buildings.

Mitigation Measures: Construction activities will comply with the applicable Township of Esquimalt bylaws for hours of work and noise levels. Work will usually occur on weekdays from 7 am to 5 pm with no work on Sundays or holidays (except in an emergency or where a critical piece of work must be completed in a specified work window). If required, construction lighting will be oriented downward to reduce effects on neighbours and institutional users. Discussions will be conducted with DND and neighbouring residents during project planning and before construction to confirm noise mitigation measures.

Nuisance effects of noise and vibration during facility construction at Macaulay Point are local, short-term, of moderate magnitude, reversible, and **less than significant**.

Operation

Potential Impact: Nuisance effects of noise, lighting and vibration may occur during facility operation.

The operation of the expanded pump station at Macaulay Point will not result in additional noise, vibration and lighting effects on neighbours. The new buildings will require additional lighting and during power outages, the backup power generator will be operational, generating noise and vibration. Differences in lighting, noise and vibration are anticipated to be minimal.

Mitigation Measures: Noise from the treatment facilities will not exceed 45 dB and 55 dB at the edge of the facility footprints at night and day, respectively. Sound attenuation will be installed in buildings housing noise-generating equipment and on diesel engine exhaust to ensure that decibel levels remain below 45 dB at the property lines. Noise levels will meet the Township of Esquimalt noise control bylaw requirements and WCB-OHSA criteria for worker safety. Noise-generating equipment will be installed in soundproofed rooms to meet these requirements.

All installed vibrating equipment will be contained in isolated structures that meet vibration limits acceptable in residential areas. The pump station does not include excessive vibrating equipment. Vibration issues are not anticipated and, if present, can be mitigated.

The lighting plan for the facility is expected to specify the use normal post top sodium vapour lighting similar to that on residential streets. Lighting will be directed downward and will have shields installed to minimize scatter lighting of the night sky where appropriate. LED lighting that uses less energy and emits low Ultra Violet light will be specified.

Nuisance effects of noise, vibration and lighting during facility operation at Macaulay Point will be local, intermittent, long-term, of low magnitude, and **less than significant.**

5.11.2.2 Clover Point

Construction

Potential Impact: Nuisance effects of noise, vibration and lighting may occur during facility construction.

During the construction period, noise and vibration impacts will affect neighbouring residents and park users, in particular, the detached residences 80 m north of the facility.

Peak construction activity and potential noise, vibration, and lighting effects will occur in the first few months of the one year construction period during the excavation and concrete pouring phase. After the peak construction period, construction activities will be similar to the construction of utility or industrial buildings.

Mitigation Measures: Construction activities will comply with the applicable City of Victoria bylaws for hours of work and noise levels. Work will usually occur on weekdays from 7 am to 5 pm with no work on Sundays or holidays (except in an emergency or where a critical piece of work must be completed in a specified work window). If required, construction lighting will be oriented downward to reduce effects on neighbours and park users. Discussions will be conducted with neighbouring residents and the City of Victoria Parks department during project planning and before construction to confirm noise and lighting mitigation measures.

Nuisance effects of noise and vibration during construction of facility upgrades at Clover Point will be local, short-term, reversible, of low magnitude, and **less than significant**.

Operation

Potential Impact: Nuisance effects of noise, lighting and vibration may occur during facility operation.

The operation of the upgraded Clover Point facility will not result in a noticeable increase in noise, vibration or lighting effects on neighbours or park users. Presently, Clover Point Park is illuminated by nine street lights and the roadway loop and parking area are heavily used by vehicles. Additional noise and lighting effects of the new buildings would not measurably change the current conditions.

Mitigation Measures: No additional mitigation measures are required.

Nuisance effects of noise, vibration and lighting during facility operation at Clover Point will be local, long-term, irreversible, of negligible magnitude, and **less than significant.**

5.11.2.3 McLoughlin Point

Construction

Potential Impact: Nuisance effects of noise, vibration and lighting may occur during facility construction.

During the construction period, noise and vibration impacts will affect neighbouring residents and institutional uses, in particular, the military housing to the west of the McLoughlin Point facility, but the residences near the McLoughlin Point site are more than 180 m distant, so noise and vibration effects during construction are expected to be minor. Blasting may be needed on the rocky McLoughlin Point site. If so, vibration and noise could be felt within 250 m of the site.

Peak activity and potential noise and vibration will occur in the first 9 months of construction, during the excavation and concrete pouring phase. Construction of the McLoughlin Point facility is expected to take 3.5 years to complete. After the 9-month peak construction activity has occurred, the construction activities will be similar to the construction of utility or industrial buildings.

Mitigation Measures: Construction activities will comply with the applicable Township of Esquimalt bylaws for hours of work and noise levels. Work will usually occur on weekdays from 7 am to 5 pm with no work on Sundays or holidays (except in an emergency or where a critical piece of work must be completed in a specified work window). If required, construction lighting will be oriented downward to reduce effects on neighbours and institutional users. Discussions will be conducted with DND and neighbouring residents during project planning and before construction to confirm noise and lighting mitigation measures.

Nuisance effects of noise, vibration and lighting during facility construction at McLoughlin Point are local, medium-term, of low magnitude, reversible and **less than significant**.

Operation

Potential Impact: Nuisance effects of noise, lighting and vibration may occur during facility operation.

During facility operation, noise, lighting and vibration effects are unlikely to affect neighbouring residents and institutional uses. Residences near the McLoughlin Point site are approximately 70 m away. DND training and administrative activities to the northwest are unlikely to be disrupted. Victoria Harbour traffic, particularly aircraft, generates substantial noise, especially during the daytime. This area is accustomed to intermittent periods of noise.

Noise-generating equipment will include:

- air-driven pumps;
- compressors;
- fans and blowers;
- diesel-driven pumps; and
- standby diesel power generators.

Mitigation Measures: Noise from the treatment facility will not exceed 45 dB and 55 dB at the edge of the facility footprint at night and day, respectively. Sound attenuation will be installed in the buildings housing noise-generating equipment and on diesel engine exhaust to ensure that decibel levels remained below 45 dB at the property lines. Noise levels will meet the Township of Esquimalt noise bylaw requirements and WCB-OSHA criteria for worker safety. Noise-generating equipment will be installed in soundproofed rooms to meet these requirements.

All installed vibrating equipment will be contained in isolated structures that meet vibration limits acceptable in residential areas. The facility equipment does not include excessive vibrating equipment. Vibration issues are not anticipated and if present, can be mitigated.

The lighting plan for the facility is expected to specify the use normal post top sodium vapour lighting similar to that on residential streets. Lighting will be directed downward and will have shields installed to minimize scatter lighting of the night sky where appropriate. LED lighting that uses less energy and emits low Ultra Violet light will be specified.

Nuisance effects of noise, vibration and lighting during facility operation at McLoughlin Point will be local, irreversible, long-term, of low magnitude and **less than significant**.

5.11.2.4 Arbutus Road

Construction

Potential Impact: Nuisance effects of noise, vibration and lighting may occur during facility construction.

During the construction period, noise and vibration impacts will affect neighbouring residents, the Queen Alexandra Centre, the G. R. Pearkes Child Care Centre and recreational users of Haro Woods.

Construction of the tank is expected to take approximately 1 year to complete. Peak construction activity and potential noise, vibration, and lighting effects will occur in the first few months during the excavation and concrete pouring phase. After the peak construction period, the construction activities will be similar to the construction of utility or industrial buildings.

Mitigation Measures: Construction activities will comply with the applicable District of Saanich bylaws for hours of work and noise levels. Work will usually occur on weekdays from 7 am to 5 pm with no work on Sundays or holidays (except in an emergency or when a critical piece of work must be completed in a specified work window). If required, construction lighting will be oriented downward to reduce effects on neighbours and park users. Discussions will be conducted with the Queen Alexandra, neighbouring residents and the District of Saanich during project planning and before construction to confirm noise, and lighting mitigation measures.

Noise and vibration impacts will mainly occur during excavation, concrete work and backfill at the site during the preparation period, but may occur occasionally at other times during the construction phase. As a result, the impact is considered to be local and short-term. The noise and vibration effects are reversible once construction is complete. With adherence to the mitigation measures discussed with the Queen Alexandra, the District of Saanich, and local residents, noise and vibration impacts are considered **less than significant.**

Operation

Potential Impact: Operation of the attenuation tank will generate noise, vibration and lighting effects.

When operational, the attenuation tank will be located underground and no noise or vibrations are expected to occur. There will be no change in the lighting conditions at the site. The attenuation tank will not be used often, and will be filled and emptied by use of gravity, so minimal pumping is required.

Mitigation Measures: No specific mitigation measures are needed.

With appropriate design and maintenance, noise, vibration and lighting impacts are considered to be negligible. The operation of the attenuation tank will result in no change to the existing conditions, and impacts are considered **less than significant**.

5.11.2.5 Craigflower

Construction

Potential Impact: Nuisance effects of noise, vibration, and lighting may occur during construction of the proposed pump station.

During construction, noise and vibration impacts will affect neighbouring residents and other users, in particular, the residences located 40 m west of the proposed site.

Construction of the pump station is expected to be complete in one year. Peak construction activity and potential noise, vibration and lighting effects will occur in the initial period during the excavation and concrete pouring phase. After the peak construction period, construction activities will be typical of the construction of utility or industrial buildings.

Mitigation Measures: Construction activities will comply with the applicable Town of View Royal bylaws for hours of work and noise levels. Work will usually occur on weekdays from 7 am to 5 pm with no work on Sundays or holidays (except in an emergency or where a critical piece of work must be completed in a specified work window). If required, construction lighting will be oriented downward to reduce effects on residents. Discussions will be conducted with neighbouring residents and the Town of View Royal planning department prior to construction to confirm noise and lighting mitigation measures.

Nuisance effects of noise and vibration during construction of the pump station will be local, short-term, reversible, of low magnitude, and **less than significant**.

Operation

Potential Impact: Nuisance effects of noise, lighting and vibration may occur during pump station operation.

Noise-generating equipment will include pumps, compressors, HVAC systems, odour control unit, fans, blowers, and the standby diesel generator. The operation of the pump station will not exceed the recommended night time maximum noise level of 40 dB, with the exception of power failure events requiring the use of a generator. The HVAC system and odour control unit will be designed to meet the recommended level of noise (Associated Engineering 2008). Noise levels will meet the WCB-OSHA criteria for worker safety.

Equipment that may emit vibrations will be housed in isolated structures that meet acceptable vibration limits for residential areas. Equipment that has the potential to vibrate will be installed on pads and vibration isolation devices to minimize transmission of vibration to nearby residences or roadways. Vibration will be kept within acceptable operating limits for protection of the equipment and operational staff and will meet the requirements of the OSHA of the *Workers Compensation Act*. It is expected that the proposed pump station will use equipment typical of other pump station operating systems. Vibration issues, therefore, are not anticipated during operation and, if present, can be mitigated.

The lighting plan for the proposed pump station will consist of full cut-off luminaries. All lighting will be directed downward with shields to prevent lighting of the night sky or adjacent residences.

Mitigation Measures: No mitigation measures are needed, aside from specified design measures.

Nuisance effects of noise, vibration and lighting during pump station operation will be local, long-term, irreversible, of low magnitude, and **less than significant.**

5.11.3 Ancillary Facilities

Construction

Potential Impact: Nuisance effects from noise and vibration may occur during ancillary facility construction.

Construction of the ancillary facilities will introduce noise, vibration and lighting impacts for residents, institutional, and industrial users near the construction areas. The ancillary facilities will be constructed in urban areas that are accustomed to occasional noise and vibration from road and building construction.

From Macaulay Point to McLoughlin Point, the ancillary route is adjacent to military housing and DND administrative buildings. The underground utilities from Lyall Street to McLoughlin Point will be located along Peters Street and Victoria View Road.

From Currie Road to Clover Point, the ancillary route passes mostly through residential neighbourhoods, except for small sections where the route is adjacent to Windsor and Pemberton Parks and the Ross Bay Cemetery.

From Clover Point to McLoughlin Point, the ancillary route is adjacent to housing, tourist accommodations, industrial and commercial facilities and three parks that constitute a popular tourist destination.

The ancillary route for the Arbutus Road site is located within the property boundary and is away from residences and institutions, except for the portion where the route connects to the trunk on Haro Road.

The Craigflower ancillary route is located in the Shoreline School playing field. The nearest residences are located 50 m west of the pipe terminus, across the railway right-of-way.

Mitigation Measures: Discussions with potentially affected residents, DND, District of Saanich, Township of Esquimalt, District of Oak Bay, Town of View Royal, City of Victoria and other potentially affected parties prior to construction will help to ensure mitigation measures are appropriate to minimize disturbance. CRD representatives will work with the DND, relevant municipalities and community groups to minimize impacts of constructing the conveyance pipes through residential neighbourhoods. Pipe construction will be conducted in accordance with local municipal bylaws to minimize disturbance. The CRD will consider scheduling the construction of the Clover Point to McLoughlin Point route outside the peak summer season.

Nuisance effects of noise and vibration during ancillary facility construction are local, short-term, reversible, of low magnitude, and **less than significant**.

Operation

After the pipes are in service, few noise, vibration, or lighting effects are anticipated. Noise, lighting and vibration effects are considered local, short term, reversible, low magnitude and **less than significant**.

5.12 Human Health

Wastewater treatment is one of the great public health advances of modern times. The liveability of our cities depends in large measure on the effectiveness of wastewater treatment and effluent management. Nonetheless, wastewater management is not without some health risks.

With the exception of odours being occasionally detectable (Section 4.2.6), it is expected that the CAWTP facilities will have few impacts on human health once operational. No impacts are expected from the Clover Point, Macaulay Point, or Craigflower pump stations or the Arbutus Road attenuation tank. Due to their underground locations, ancillary facilities will have negligible effects on human health. Impacts on human health are mostly restricted to the construction phase of the facilities. There is potential, however, for the treatment facility at McLoughlin Point to have some health effects on humans.

Recent health research reports indicate that microbial aerosols released from wastewater treatment facilities may constitute health risks for treatment facility workers, but there is no conclusive evidence of risk to nearby residents (Carducci *et al.* 2000, Heinonen-Tanski *et al.* 2009, Fracchia *et al.* 2006, Lee *et al.* 2006, Brandi *et al.* 2000, Health Canada 2009). This research indicates that the level of risk depends on work practices, worker hygiene, wastewater treatment processes, facility design and environmental factors. More specifically, health risks depend on the exposure pathways (*e.g.*, equipment failure or emissions of gas, liquids or solid waste) and the kind of potential risk factor (*e.g.*, gases, chemicals,

bacteria, odours). Inhalation of aerosols originating from wastewater has been reported to be the primary source of worker exposure (Brown 1997).

Health Canada (2009) indicates that the probability of exposure to health risks associated with the construction and operation of wastewater treatment facilities ranges from very rare to moderate to unknown. Health Canada lists potential health impacts on urban areas and recreational users adjacent to wastewater treatment facilities (Table 36).

TABLE 36

POTENTIAL HEALTH IMPACTS ASSOCIATED WITH WASTEWATER TREATMENT FACILITY CONSTRUCTION AND OPERATION

Exposure	Nature of Exposure	Effects on Health	Population at Risk	Probability of Occurrence	Biological- Environmental Monitoring Indicators
Gas emissions or emissions to air	Nitrogen oxide (NO_x)	Irritation of respiratory tract	Urban and suburban areas	Rare to moderate	Ambient air measurements
	Dioxins, furans	Some carcinogenic compounds	Unknown	Rare or unknown	Ambient air measurements; epidemiological studies
	Polycyclic Aromatic Hydrocarbons (PAHs)	Some carcinogenic compounds	Workers and local population	Unknown	Ambient air sampling; beno[a]pyrene and other PAH concentrations
Nuisances	Odours	Quality of life	Vicinity	Rare to moderate	Complaints, perception

Source: Health Canada. Canadian Handbook on Health Impact Assessment – Volume 4: Health Impacts by Industry Sector. Chapter 8: Wastewater and Sludge Management.

The physical design of traditional wastewater treatment facilities can include open settlement tanks, aeration basins, sludge handling processes and areas of mechanical agitation of waste material. Such layouts are typically not designed to prevent the dispersion of wastewater aerosols (Brown 1997) and may release localized airborne microbes and fungi that are measurable within 20 m of the facility (Heinonen-Tanski *et al.* 2009 and Brandi *et al.* 2000).

As stated, recent health research reports have found no conclusive evidence of health risks to nearby residents, but they note that some health risks may be present for treatment facility workers. Research on health risks to wastewater treatment workers indicates that the workers have an increased risk of exposure to bacteria, funguses, parasites and viruses that can cause intestinal and lung infections (Center for Construction Research and Training 2004). These illnesses, sometimes referred to as "sewage worker's syndrome," include infections of the airway, gastrointestinal system, central nervous system and joint pain (Thorn *et al.* 2002 and Carducci *et al.* 2000). The researchers call for clinical investigations to determine exact causes of reported symptoms.

The CAWTP facilities will be entirely enclosed, and air will be filtered with advanced odour control and air filtration systems before it is released. This enclosed design will reduce exposure to microbial aerosol releases outside treatment facilities. The ventilation systems will not be connected to the odour control system in the facility. These ventilation systems will filter air vented from the interior of the facility to the outside.

The odour control system will employ proven and reliable technology. One such system that could be used, a three stage chemical scrubber, includes absorption, adsorption, filtration, entrapment, and chemical conversion systems designed to remove disease-causing organisms. Chemical scrubbers typically use an acid followed by hypochlorite and water to remove amine and reduced sulphur compounds. Sometimes a caustic is also used. This system provides a barrier to most viruses and bacteria. Next, the activated carbon filter absorbs residual molecular organic compounds not completely oxidized by the scrubber. Through the use of these technologies, it is unlikely that disease causing organisms will pass through the odour treatment system and pose a risk to nearby residents.

Birds, rodents and insects have been known to serve as vectors for transmitting bacteria and viruses from traditional wastewater facilities. Because the CAWTP facilities are to be enclosed, the risk of disease transfer by birds, rodents or insects is negligible.

5.12.1 Impact Assessment and Mitigation Measures

Construction

At all facilities locations, health risks during construction are limited to exposure to dust and noise.

Potential Impact: Human health risks could result from exposure to dust and noise.

Dust control measures will be implemented if dust is generated during construction. Noise levels will be typical of a major construction project and will follow all noise bylaws.

Mitigation Measures: Nearby residents, businesses, industry and institutions will be notified in advance of potentially disruptive construction activities. Dust control measures, such as box covers on trucks and washing down roads, should be used as needed.

Human health risks associated with exposure to dust and noise during facility construction are local, short-term, reversible and low magnitude at Clover Point and Macaulay Point. Human health risks associated with exposure to dust and noise during facility construction are local, medium-term, reversible, and low magnitude at McLoughlin Point, Arbutus Road and Craigflower.

At all locations, human health risks associated with construction of the facilities are considered **less than significant**.

Operation

Potential Impact: Human contact with disease organisms could constitute a health risk.

Few public safety risks will be associated with treatment facility operation. Health risks would be limited to treatment facility workers who may come into contact with untreated wastewater or microbial aerosols. Enclosed facilities prevent transmission of disease organisms to residents. The two-stage odour control system reduces the risk of viruses, bacteria or other contaminants being discharged by air from the treatment facility. The distance between the treatment facilities and other residences or institutions further reduces public health risks.

Mitigation Measures: No measures are needed to protect public health during facility operation beyond those included in facility design specifications and standard operating procedures.

Health risks associated with human contact of disease organisms are local, long-term, reversible, of low magnitude and **less than significant**.

Potential Impact: Safety risks may be associated with the public accessing the facilities.

It is unlikely that the public would gain entry into any of the treatment facilities. All facilities and equipment will be locked and appropriately monitored to minimize unauthorized public entry.

Mitigation Measures: No measures are needed to protect public health during facility operation beyond those included in facility design specifications and standard operating procedures.

Safety risks associated with the public accessing the facilities are local, long-term, reversible, of low magnitude and **less than significant**.

5.12.2 Ancillary Facilities

Construction

Aside from temporary noise and dust during pipe installation, no human health effects are anticipated during ancillary facility construction, so impacts are negligible and **less than significant**.

Operation

After the ancillary facilities are in service, no human health impacts are anticipated, so impacts are negligible and **less than significant**.

5.13 Visual Aesthetics

This section contains information on the visual aesthetic character of Macaulay Point, Clover Point, McLoughlin Point, Arbutus Road and Craigflower, as well as an assessment of the significance of visual impacts of the construction and operation of wastewater facilities on these sites.

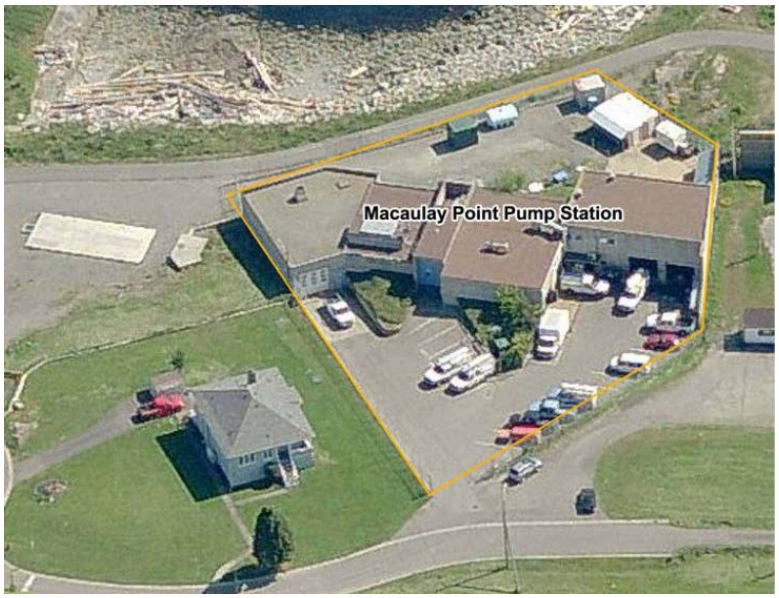
5.13.1 Treatment Facility Site Conditions

5.13.1.1 Macaulay Point

Macaulay Point is the site of an existing CRD pump station and outfall. The facility is on a gently sloping area adjacent to a rocky shoreline to the south. There is a baseball field to the north, detached dwellings to the east (the nearest is 20 m from the property line) of the CRD property. Further to the west are a parking lot and Macaulay Point Park. A public walkway is routed between the pump station and the rocky coastline, providing access between Macaulay Point Park and Aston Rd (Figure 11).

The existing CRD pump station occupies a parcel of approximately 0.3 ha. A 2 m high chain link fence surrounds the parcel. The site has ground-level parking and flat-roofed concrete and steel industrial buildings ranging in height from 2 m to 7 m (Figure 61).

Figure 61 Macaulay Point Pump Station Oblique View (Looking South)



Source: Bing Maps

The existing facility adds an industrial element to an area that is predominately residential and open space. However, a large DND training and warehousing buildings are about 200 m north of the facility. The pump station can be viewed from the following streets:

- Anson Street, 50 m to the east;
- Vaughn Street, 5 m to the north;
- Clifton Terrace, 225 m to the northwest;
- Munro Street, 225 m to the north; and
- Bewdley Avenue, 450 m to the north.

Nearby streets are local access roads with detached residential dwellings and limited traffic. Munro Street provides access for a DND training facility, and Bewdley Avenue is a collector road with light traffic and

distant views of the pump station. The walkway immediately to the south of the pump station provides local access to Macaulay Point Park and is heavily used by the public. Walkway users have close-up and uninterrupted views of the facility. Marine traffic will have limited views of the facility as nearby rocky islands and peninsulas constrain marine approaches, consequently views of the facility, from the water will typically be from at least 200 m distant (although kayaks can come close to shore).

5.13.1.2 Clover Point

The Clover Point site has an existing underground CRD pump station. It is a grassy area, with an adjacent access road leading to a small peninsula (Figure 62). To the north of the site (60 m) is Dallas Road. On the north side of Dallas Road are detached residential dwellings. There are heavily used walkways to the east and west. Figure 12 presents an oblique view of the existing pump station and the surrounding area. The existing pump station is underground, so its visual impact is minimal and mainly confined to the facility's doorways and retaining walls, which can only be seen from the south and east (Figure 13). Views of the entryway are available to pedestrians on the coastline walkways to the south (Figure 63) and east of the site, and to marine traffic to the southeast. The rock wall and steel doors generate a relatively low level of visual intrusion in an open coastal landscape of rocky coastline, concrete walkways, parking areas and grassy backshore. The new underground grit removal facilities will be constructed adjacent to the south side of the existing facilities.

Figure 62 View of Clover Point Site Looking South from Dallas Road

Figure 63 View of Clover Point Facility Looking Northeast from Walkway

5.13.1.3 McLoughlin Point

McLoughlin Point is a rocky peninsula at the western side of the entrance to Victoria Harbour. Victoria View Road bisects the peninsula in a north south direction. The western half of the peninsula is partially treed and contains two detached dwellings and several heritage fortification structures. The eastern half is the proposed location of the CRD wastewater treatment facility. The site was formerly an Imperial Oil tank farm (Figure 64) that was decommissioned in 2008.

Figure 64 McLoughlin Point Site before Fuel Tank Decommissioning in 2008 (Looking West)

Source: Bing Maps

The McLoughlin Point site is flat or gently sloping, with rocky outcrops, gravel and concrete base material, 3 m high concrete retaining walls and several spoil heaps. A chain link fence surrounds the north, east and south boundaries of the property (Figure 65). The vacant, partially remediated site has few features that would be considered visually appealing. The site's relatively low profile reduces its visual impact when viewed from the south or east, near sea level.

Figure 65 McLoughlin Point in 2013 (Looking Northwest)

Trees and rock outcrops to the west and north shield the McLoughlin Point site from view, except from Victoria View Road and a neighbouring small-boat storage yard to the north (Figure 66). The two dwellings on the western side of Victoria View Road have partial views of the site when the intervening deciduous trees are not in leaf.

Figure 66 McLoughlin Point Site Looking Southeast from Victoria View Road, December 2009

From the east and south, close views of the site are available only from the water (for example, from cruise ships and ferries), or the air (the site is close to floatplane and helicopter landing and takeoff areas). Distant views (greater than 500 m) of the site are available from the east side of Victoria Harbour and from the north (> 1200 m) along the West-song Walkway.

5.13.1.4 Arbutus Road

The Arbutus Road site (Figure 67) is partially forested and on a moderately sloping hillside south of Arbutus Road. The site location and neighbouring forested parcels are used for informal recreation by the local community and contain a network of paths and numerous bicycle jumps. The forest understory varies from open areas lacking vegetation to areas of dense ocean spray and big-leafed maple. The surrounding area is forested to the south, west and east of the site. On the north side of Arbutus Road, there is an open grassy field. The closest neighbouring structure is the G. R. Pearkes Child Care Center building approximately 130 m to the east of the site. The nearest dwellings are roughly 120 m south of the site and are effectively screened by vegetation and break of slope. Visibility of the site is restricted to Arbutus Road, a two-lane collector road with a narrow sidewalk (Figure 68) and the Queen Alexandra fields. Traffic volumes are low to moderate and Arbutus Road is not a designated truck route. There are two bus stops, one on either side of the site location on Arbutus Road, from which people might see the site. Drivers and pedestrian also would glimpse the tank site through existing and future accesses along Arbutus Road. A buffered wooded area will remain between much of the attenuation tank clearing and Arbutus Road, which will help minimize views of the clearing from the road and sidewalk. However, the buffered area has the potential to be adversely affected by wind throw (see section 5.4.4.4) and construction of the bicycle lane, road widening and separated sidewalk on Arbutus Road. Consequently, if trees in the buffered area are lost, visibility of the attenuation tank site from Arbutus Road would be greater than if the vegetation is retained.

Figure 67 CRD Arbutus Road Property Looking West Toward Proposed Site

Figure 68 Arbutus Road and Sidewalk North of the Site Location (Looking Northwest)

5.13.1.5 Craigflower

The proposed pump station site is filled area supporting native and invasive plants. The site is bordered by a gravel driveway to the west, which leads to a residence approximately 160 m to the north. The site is fringed by trees along the shore of Portage Inlet to the north and east (Figure 69). Much of the site is covered by blackberry bushes and is subject to dumping of rubbish. The visual aesthetic quality of the proposed site is modest.

Figure 69 Facing East Towards the Craigflower Pump Station Site from the E&N Right-of-Way

Some trees and shrubbery are located between the Craigflower site and the Old Island Highway, and the proposed site is located in a slight depression, so visibility from vehicles on the Old Island Highway is limited. As shown in Figure 69, the proposed pump station location is plainly visible from the E&N Railway grade. Walkers and cyclist using the future E&N Rail Trail will be able to clearly see the pump station. Residences located to the west of the site (50 m) are elevated well above the proposed site (Figure 70). Owners of these homes will be able to view the pump station from their back yards or rear windows, although trees and shrubs along the E&N Railway right-of-way provide some screening.

Figure 70 View of Residence to the West of the E&N Railway

5.13.2 Ancillary Facility Site Conditions

5.13.2.1 Macaulay Point to McLoughlin Point

The ancillary facilities connecting Macaulay Point and McLoughlin Point and from Lyall Street to McLoughlin Point will be installed beneath roadways on DND property. The ancillary facilities route will be visible from the sports field north of Vaughan St and from residential housing that front roads on both sides of the routes. Views of the ancillaries are limited from the Juan de Fuca Strait.

5.13.2.2 Clover Point

The ancillary facilities from Currie Road to Clover Point will be installed in trenches along road rights-of-way through residential areas in southern Oak Bay and Fairfield. The route will be visible from homes that front the roads on both sides.

The route from Clover Point to Ogden Point is one of the most scenic in Greater Victoria. The area is a popular recreational destination used by pedestrians, vehicles and scenic bus tours. The route is also part of the scenic bike route that runs along Dallas Road and Beach Drive. The ancillary facility route passes through three City of Victoria parks, and a portion of the route is visible from the top of Beacon Hill, a popular view point overlooking the Strait of Juan de Fuca in Beacon Hill Park. The western portion of the route passes north of a major entry point for tourists arriving and departing from the cruise ship terminal at Ogden Point.

5.13.2.3 Arbutus Road

The ancillary route at Arbutus Road is located between the tank and the East Coast Interceptor trunk on Haro Rd. The ancillary facilities are contained within the eastern portion of Haro Woods and are only visible by people using the site for recreation or by pedestrian using the sidewalk on Haro Rd.

5.13.2.4 Craigflower Site

The proposed conveyance pipes will be installed in the grassed sports field adjacent to an existing sewer main. The route is visible from the Shoreline School and from a limited area along the Old Island Highway. The Portage Inlet shoreline directly north of the conveyance pipes is vegetated with trees and shrubs, which minimizes views of the route from the north.

5.13.3 Impact Assessment and Mitigation Measures

5.13.3.1 Macaulay Point

Figure 71 provides an aerial view of Macaulay Point before, and a conceptual representation after upgrades.

Figure 71 Aerial View of Macaulay Point before (Left) and After (Right) Upgrades

Source: Stantec

Figures 72 and 73 provide visual representations of Macaulay Point pump station before and after upgrades. Views are from Vaughan Street directly north of the site.

Figure 72 View of Macaulay Point Pump Station Looking South from Vaughan Street

Source: Google Earth

Figure 73 Rendering of Macaulay Point Pump Station after Upgrades Looking South

Source: Stantec

Construction

Potential Impact: Construction of Macaulay Point facility will affect local views of the site.

Construction at Macaulay Point Pump Station will introduce construction equipment, materials, and associated traffic near an area bordered by a detached dwelling and open grassy fields used for DND training. Construction at the front (north) of the existing buildings will be visible from nearby houses on the east and northeast. At the rear of the Macaulay Point facility, construction will be fully visible from the adjacent public walkway. Dwellings to the northwest will have partial views of construction activities through trees, hedges, and other screening material. Foot and vehicle traffic on Bewdley Avenue and Clifton Terrace will have screened views of distant construction activities. Traffic on Munro Street and Vaughan Street will have partially screened and unobstructed views of construction activities. Topography, vegetation and buildings will block views of construction from Macaulay Point Park.

The construction period is estimated to be approximately one year.

Mitigation Measures: Because of the proximity of construction activity to a local walkway that provides access to the nearby Macaulay Point Park, visual screens should be installed as part of security fencing on the south side of the property. The proximity of the dwelling to the east should be considered when siting the staging area to minimize visual disturbance to local residents.

Construction at Macaulay will result in short-term and reversible visual impacts on residents and users of the footpaths. Construction will result in limited change to existing viewscapes. In consequence, the visual impacts of construction related to constructing an expanded pump station at this site are considered local, short-term, reversible, of moderate magnitude and **less than significant**.

Operation

Potential Impact: The pump station will affect views from nearby homes, trails and fields.

New construction on the north side of Macaulay Point Pump Station will convert an area of parking into a light industrial building. The southern portion of the site will see a steel enclosure placed on a partially grassed and paved area that is now used for material and equipment storage. Neither the additional building nor enclosure will exceed the height of existing structures.

Five residential dwellings within 100 m of the pump station will have unobstructed views of the expanded facility. Walkway users accessing Macaulay Point Park from Anson Street will have views of a new utility structure.

Mitigation Measures: The use of vegetation screens along the north property line (where feasible), and the northeast property line is suggested as a means of screening facility structures from nearby residences. At the south side of the property, the existing chain link fence should be replaced with a solid attractive fence to reduce the visibility of the facility from the heavily used walkway.

The Macaulay facility upgrade provides an opportunity to improve the visual aesthetic quality of the site, primarily via enhanced screening. The relatively small size of the additions, and the screening that partially obscures both new and existing structures from view, indicate that the mitigated visual impact of expanding the Macaulay Point facility is local, short-term, irreversible, of low magnitude and **less than significant**. With the addition of screening on the south side of the facility, adjacent to a public walkway, the visual impact of the project could be considered **beneficial**.

5.13.3.2 Clover Point

Figures 74 to 77 provide a visual representation of Clover Point pump station before and after upgrades. Views are from Dallas Road. Figure 78 provides a conceptual rendering of the Clover Point pump station after upgrades.

Figure 74 Clover Point Pump Station Looking South from Dallas Road

Source: Google Earth

Figure 75 Rendering of Clover Point Pump Station after Upgrades Looking South from Dallas Road

Source: Stantec

Figure 76 Clover Point Pump Station Looking East from Dallas Road

Source: Google Earth

Figure 77 Rendering of Clover Point Pump Station after Upgrades Looking East from Dallas Road

Source: Stantec

Figure 78 provides a representation of Clover Point pump station after upgrades.

Figure 78 Conceptual Rendering of Clover Point Pump Station after Upgrades Looking West from the Strait of Juan de Fuca

Source: Stantec

Construction

Potential Impact: Construction activities may affect view of Clover Point Park.

Construction of an expanded facility at Clover Point will introduce:

- earth moving machinery;
- security fencing;
- security and work lighting;
- truck traffic;
- potentially, stockpiled construction material; and
- covered and uncovered fill.

The relatively exposed Clover Point location will provide unobstructed views of construction activities in a recreation park environment from all directions. The adjacent walkways, the road accessing the peninsula parking lot and grassy slopes are in use all year and in heavy use in the summer. Park users and drivers will have close and uninterrupted views of construction. Foot and vehicle traffic on Dallas Road, and dwellings on the north side of Dallas Road, will also have uninterrupted views of construction activities.

The construction period is estimated to be one year. Construction activities at Clover Point will adversely, though temporarily, affect the visual environment of the surrounding area.

Mitigation Measures: To reduce visual impact, consideration should be given to locating the staging and storage area to the south of the pump station where topography provides limited visual relief for Dallas Road residents and travellers. Efforts should be made to minimising the construction footprint and potentially limiting the use of heavy equipment during the summer when viewing numbers are highest. Construction area security fencing should incorporate visual screening material. Some people find construction activities interesting to watch and viewing areas could be provided to allow safe observation of construction progress.

Construction activities associated with Clover Point facility will adversely affect a visually sensitive area. Because the effects are local, short-term and reversible, the overall visual impacts of construction will be of low magnitude and **less than significant**.

Operation

Potential Impact: Facility operation may affect the Clover Point Park viewshed.

Because the expanded Clover Point facility will be underground, the viewshed will not differ materially from present day. No adverse effects to the visual aesthetic character of the Clover Point facility are expected impacts will be **less than significant**.

5.13.3.3 McLoughlin Point

Figure 79 shows a massing diagram, representing the appearance of the proposed treatment facility at McLoughlin Point from different directions.

Figure 79 Massing Diagram of the Proposed McLoughlin Point Wastewater Treatment Facility Showing Structure Elevations from Different Perspectives

Source: Stantec

The following figures provide a photographic record of current site conditions at McLoughlin Point and a graphic representation of the site post-development. Viewpoints have been selected based on areas of high traffic and high site visibility. The locations chosen are Shoal Point (Figures 79 and 80), Ogden Point (Figures 81 and 82) and the Songhees Walkway (Figures 83 and 84).

Figure 80 View of McLoughlin Point Site Looking West from Shoal Point

Figure 81 Rendered View of the McLoughlin Point Site with the Proposed Wastewater Treatment Facility Superimposed

Source: Stantec

Figure 82 View of McLoughlin Point Site Looking Northeast from Ogden Point

Figure 83 Rendered View of the McLoughlin Point Site from Ogden Point with the Proposed Wastewater Treatment Facility Superimposed

Source: Stantec

Figure 84 View of McLoughlin Point Site from the Upper Songhees Walkway

Figure 85 Rendered View of the McLoughlin Point Site with Wastewater Treatment Facility Superimposed

Source: Stantec

Construction

Potential Impact: Construction activities at McLoughlin Point will affect visual quality of the site.

During construction, the following visual elements will be introduced into the McLoughlin Point landscape:

- earth moving equipment, cranes and other large construction equipment;
- soil and aggregate stockpiles;
- stockpiled construction materials;
- security and work lighting;
- truck and other construction traffic; and
- partially completed treatment facility structures.

Because of the site's location in an area that is a mix of natural rocky coastline, vegetated waterfront, and urban waterfront, the introduction of the identified visual elements during construction will constitute a change from existing conditions.

The principle viewers of construction activities will be users of Victoria Harbour. Air and marine traffic will have unobstructed views of the site from the northeast, east, and southeast as they enter and exit the harbour. Because of established harbour traffic routes and the presence of a rocky shoreline, most ground and water-based views will be distant.

The construction period for the facility is estimated to last approximately 3.5 years.

Mitigation Measures: Most viewers will see the site from several hundred metres distant, and obliquely from ferry decks, cruise ship decks or float planes. Because of the long period of construction, consideration should be given to selecting security fence materials that screen the site, for example green or black chain link fence slats. Selecting colours for such screens that are analogous to background colours would lessen the visual impact of construction to viewers from Victoria View Road (not a public road) and from distant viewpoints around the Harbour.

The temporary nature of the construction activities associated with the McLoughlin Point facility, and the lack of intrusion into, or development of, visually sensitive areas(such as forested areas), creates visual impacts that are local, long-term, reversible, of moderate magnitude and **less than significant**.

Operation

Potential Impact: Siting a wastewater treatment facility at McLoughlin Point will affect views from Victoria Harbour.

Viewed from various points around Victoria Harbour, such as Ogden Point, Shoal Point, and the Songhees Walkway, the McLoughlin Point site appears presently as a distant low concrete retaining wall against a treed backdrop. The wastewater treatment facility will add industrial buildings, parking, administration offices and landscaping. Viewers near sea level looking at the site from around the harbour will see partially screened industrial and office buildings against a treed background. The distances between land based viewers and the facility (greater than 500 m) reduces the magnitude of visual impacts.

Mitigation Measures: Vegetation screens and landscaping are recommended along the east and south shorelines of the site to partially screen the facility and to blend the site with the surrounding landscape. Ensuring that the facility is built to meet the design guidelines for the site, which were developed by Esquimalt and the CRD design panel, will reduce the perception of adverse aesthetic effect.

The appearance of the McLoughlin Point facility is largely mitigated by the distance between most viewers and the proposed facility and by the treed backdrop. In consequence, the mitigated visual impact

of the McLoughlin Point wastewater treatment facility, as viewed from around Victoria Harbour, is considered local, long-term, irreversible, of low magnitude and **less than significant**.

Potential Impact: Siting a wastewater treatment facility at McLoughlin Point will affect views when entering or leaving Victoria by cruise ship, ferry, floatplane or helicopter.

The McLoughlin Point site is in a prominent location at the entrance to Victoria Harbour. Potentially some 400,000 viewers per year enter or exit the harbour by large vessel, helicopter or floatplane (Dykes, 2009). High vantages provide a more oblique view of the site, so these viewers presently have unscreened views of a vacant 1.5 ha area of broken concrete, spoil heaps and evidence of contaminated site remediation. After construction, these viewers will have unobstructed or partially screened views of wastewater treatment facility buildings and associated infrastructure and landscaping.

For most viewers entering or exiting the harbour, a wastewater treatment plant at McLoughlin Point may be considered a neutral or even a positive visual effect, because it replaces an unattractive vacant industrial lot with modern, well-designed industrial buildings and landscaping. Because the proposed McLoughlin Point facility will be entirely enclosed, viewers will not see settling tanks, which are commonly associated with wastewater treatment facilities.

Mitigation Measures: It is recommended that buildings be designed to meet the revised 2013 design guidelines prepared for the CRD by City Spaces. Where feasible, facades on east and south faces should be designed and finished to reduce the industrial appearance of the facility. Vegetated screens and landscaping are recommended along the east and south shorelines of the site to partially screen the facility and to blend the site with the surrounding landscape.

The site's development will replace a vacant remediation site with a well-designed industrial facility that is highly visible to harbour marine and air traffic. In consequence, the mitigated visual impact of development of this site as a wastewater treatment facility on most viewers entering or leaving the harbour is considered to be **less than significant** or **beneficial**.

Potential Impact: Views of vacant McLoughlin Point industrial land from Victoria View Road will be replaced by views of an industrial facility

Victoria View Road is a private DND road used to access two detached residential dwellings on the west side of the peninsula. Viewers on the road have unscreened views of a vacant, partially remediated, industrial lot in the foreground with marine and harbour views in the middle distance and background. Before the Imperial Oil tank farm was decommissioned, views from the road were obstructed by high white fuel tanks. Viewers from the detached residences have heavily screened and occasional glimpses of the site (when deciduous foliage is absent). Development of the McLoughlin Point site will replace a vacant lot and marine views with views of a partially screened, modern, wastewater treatment plant.

Mitigation Measures: It is recommended that vegetation screens be planted adjacent to Victoria View Road to partially screen the facility from view and to complement the treed, character of the west side of the road.

Siting a wastewater treatment plant at McLoughlin Point will replace a vacant lot with infrastructure buildings, but will obscure harbour and marine views. The limited use of Victoria View Road and the glimpses of the site from the residential dwellings on the west, combined with the replacement of a vacant lot with a wastewater treatment facility balance the loss of marine views. In consequence, the mitigated visual impact of development of McLoughlin Point as viewed from Victoria View Road is considered local, long-term, irreversible, of low magnitude and **less than significant**.

5.13.3.4 Arbutus Road

Figure 86 represents the Arbutus Road property. Note how the site is bordered by forested areas in every direction.

Figure 86 Oblique View of Arbutus Road Site Looking Southwest

Construction

Potential Impact: Construction of the Arbutus Road attenuation tank may alter the visual landscape of the site.

Construction of the attenuation tank at Arbutus road will introduce:

- earth moving machinery;
- security fencing;
- security and work lighting;
- truck traffic;
- stockpiled construction material; and
- covered and uncovered fill.

The wooded area around the site is considered a natural park by many residents. Construction of the attenuation tank will require a clearing of approximately 4,200 m^2. This area accounts for the land required for tank installation and a 10 m buffer area required for machinery and workspace during construction. This clearing will impact the overall visual experience of recreational users at the site. Site disturbance and vegetation removal will be minimized and restricted to the site as much as possible.

Mitigation Measures: To reduce visual impact, consideration should be given to locate the staging and storage area off-site, minimize the construction footprint and relocate access to north end of site on previously-cleared pipe route. Construction area security fencing should incorporate visual screening material.

Construction activities associated with the Arbutus Road attenuation tank facility will adversely affect a visually sensitive area, but because the effects are local, short-term and reversible, the overall visual impacts of construction will be of moderate magnitude and **less than significant**.

Potential Impact: Construction of an attenuation tank on the site will transform a semi-forested viewscape to one of a vegetated "meadow" with a forested background.

Except for surface vents, access hatches and parking, the attenuation tank facility will be located entirely underground. One metre on soil will be placed over the tanks, which will be planted with native shrubs and grasses. No fencing will be installed. The vents will be painted green and will be surrounded by native vegetation in order to blend with the natural surroundings.

Mitigation Measures: Clearing of forested area at the site and specifically between the site and Arbutus Rd. should be minimized to preserve the natural surroundings and provide a visual buffer that will substantially mitigate the visual impact of the facility from Arbutus Road and trails through the area.

The visual impact of the clearing required for the attenuation tank is considered to be medium-term, reversible and of moderate magnitude due to the loss in forested landscape and sensitivity of the area for local residents. For these reasons, the visual impact on the Arbutus Road site is considered to be **significant**. If mitigation measures are successful in achieving a representational "natural landscape" post-construction, visual impact would be reduced to **less than significant** levels.

Operation

Potential Impact: Operation of the proposed attenuation tank facility may affect views from adjacent properties.

View of the site is limited to select views from the north along Arbutus Road and the field at Queen Alexandra Centre. Views from residential properties located east, west and south are screened from forested areas and will not be affected by construction activities.

Mitigation Measures: No mitigation measures are required

The magnitude of visual impacts of the attenuation tank facility during operation on adjacent properties is considered to be negligible and **less than significant.**

5.13.3.5 Craigflower

Figure 87 provides a conceptual rendering of the Craigflower pump station post-construction and following revegetation.

Figure 87 Artist Rendering of Craigflower Pump Station Looking Northwest

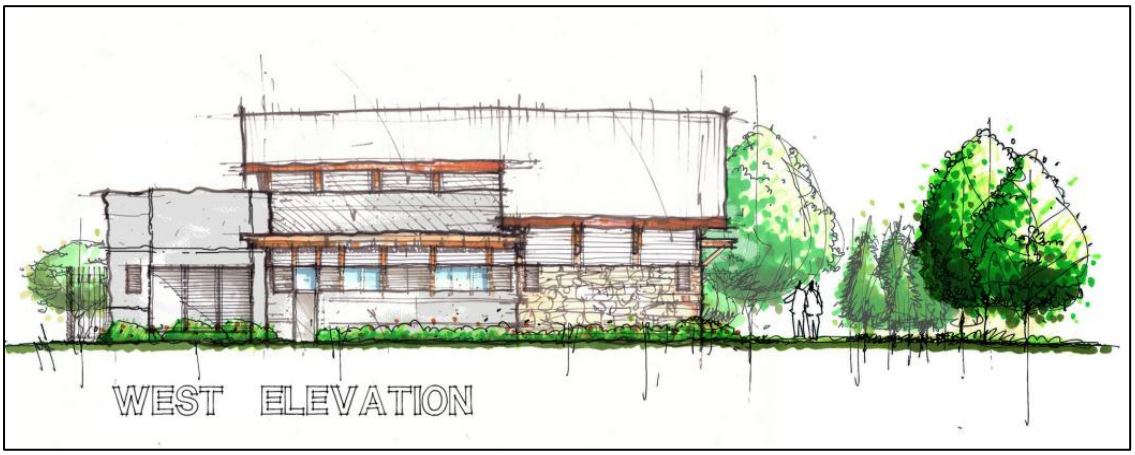
Figures 88 to 91 show conceptual renderings of the Craigflower pump station from east, north, south and west elevations.

Figure 88 Artist Rendering of the Craigflower Pump Station Viewed from the East

Figure 89 Artist Rendering of the Craigflower Pump Station Viewed from the North

Figure 90 Artist Rendering of the Craigflower Pump Station Viewed from the South

Figure 91 Artist Rendering of the Craigflower Pump Station Viewed from the West



Source: CRD

Construction

Potential Impact: Construction of the pump station will affect local views.

Construction at the proposed pump station site will introduce construction equipment, materials and associated traffic near an area close to residences and Shoreline School. This activity will alter the visual character of the site. Most of the trees on the site and to the south in the proposed work space will be cleared before construction. Due to the reduced number of trees, construction will be visible from the sidewalk along the Old Island Highway to the south of the proposed site. Recreational users of Portage Inlet and the E&N Rail Trail will also have an unobstructed view of the construction activities.

Construction will be visible from nearby houses to the west. However, due to the elevated topographical position of the residences, facility construction is not expected to obstruct the scenic views of Portage Inlet. Partial views of construction activities for the residences across Portage Inlet to the east may be obtained through trees, shrubs and other screening material

Mitigation Measures: Avoid clearing trees and vegetation where possible in order to reduce the visual impacts to Shoreline school, traffic on the Old Island Highway, and residences across the water to the northwest along Shoreline Drive. Replant native trees and shrubs on the workspace area, which will screen the facility from the south.

Construction of the proposed pump station will result in local, short-term visual impacts. Although the impacts will be irreversible due to the loss of grassed and treed area, the small footprint of the proposed site will result in a low magnitude impact. Consequently, the visual aesthetic impacts of construction are considered **less than significant**.

Operation

Potential Impact: The pump station will affect views from nearby homes, Shoreline School and the E&N Rail-Trail.

Residential dwellings located approximately 40 m to the west of the pump station and to the east across Portage Inlet (~ 250 m) will have views of the completed facility. Future users of the E&N Rail Trail also will be able to see the pump station. Vegetation and topography reduce visibility of the facility from Shoreline school and the Old Island Highway.

Mitigation Measures: Architectural design of the pump station should consider the appearance of the structure from above, not just from ground level. The use of roofed covers over outdoor tanks and equipment should be considered. Landscape design should incorporate vegetation screens along the property lines, where feasible, as a means of screening the pump station from surrounding areas.

Due to the small footprint of the pump station building and screening that will partially obscure the facility from all directions, the visual impacts associated with the operations of the facility is considered local, short-term, irreversible, of low magnitude and **less than significant**.

5.13.4 Ancillary Facilities

5.13.4.1 Macaulay Point to McLoughlin Point

Construction

Potential Impact: Installation of conveyance pipes will affect streetscapes on DND property.

Construction of ancillary sewer pipes from Macaulay to McLoughlin Point and from Lyall Street to McLoughlin Point will result in trenching and construction along approximately 1,150 m and 670 m respectively of the urban and institutional streetscapes of DND property. The introduction of construction equipment, materials and related traffic into non-industrial residential areas is considered an adverse visual impact. Views of construction equipment and construction traffic will be localized and short duration.

Mitigation Measures: No mitigation is required beyond normal construction activities.

The temporary nature of the construction activities associated with the ancillary facilities, and the lack of intrusion into or development of, visually sensitive areas ensures that the visual impacts of constructing ancillary facilities are local, short-term, reversible, of low magnitude and **less than significant**.

Operation

After construction, the pipes will be located underground and no visual impact will occur. Impacts are, therefore, considered **less than significant.**

5.13.4.2 Clover Point

Construction

Potential Impact: Installation of conveyance pipes will affect streetscapes of Oak Bay, Fairfield, James Bay and Victoria.

Construction of ancillary sewer pipes will result in trenching and construction along 3,100 m of residential roads in Oak Bay and Fairfield from Currie Road to Clover Point and 3,300 m of urban and park streetscapes of Fairfield, James Bay and Victoria for the Clover Point to McLoughlin Point portion. The introduction of construction equipment, materials and related traffic into non-industrial residential areas is considered an adverse visual impact. Views of construction equipment and construction traffic will be localized and of moderate duration (occurring over a one year period). Construction of the 850 m pipe segment between Ogden Point and McLoughlin Point site is expected to create visual impacts only at the entry and exit points of the HDD.

On Dallas Road, between Montreal and Simcoe streets, street trees have been identified as contributing greatly to the area's visual quality. Tree removal would cause an adverse visual impact.

Mitigation Measures: As feasible, construction along Dallas Road should be scheduled for winter months when viewers in Beacon Hill Park, Clover Point Park, and on Dallas Road are at their lowest numbers. Pipe routing and construction options should be selected to ensure that street trees are not damaged, and a professional arborist should be retained to plan and supervise pipe installation near trees.

The temporary nature of the construction activities associated with the ancillary facilities, and the lack of intrusion into, or development of, visually sensitive areas ensures that the overall mitigated visual impacts of development of these facilities are local, short-term, reversible, of low magnitude and **less than significant**.

Operation

After construction, the pipes will be located underground and no visual impact will occur. Impacts are, therefore, considered **less than significant.**

5.13.4.3 Arbutus Road

Construction

Construction of the updated ancillary sewer pipes will occur entirely within the property boundary. As such, views of construction equipment will only be visible by people using the site for recreational purposes. In the absence of detached design drawings or a tree survey of the site, vegetation impacts of pipe construction can only be estimated. It is likely that installing the ancillary facilities will require tree removal and cause associated visual impacts. Similarly, constructing sidewalks and storm drains (or swales) as specified by the District of Saanich will require tree removal, causing adverse visual impacts along Arbutus Road. The impacts are long-term, irreversible, of moderate magnitude and considered to be **significant**. If the Saanich requirements can be amended to eliminate impacts on trees along Arbutus Road, and native shrubs and trees are planted on the ancillary pipe rights-of-way, then impacts are reduced to low magnitude and **less than significant**.

Operation

After construction, the pipes will be located underground and no visual impact will occur. Impacts are, therefore, considered negligible and **less than significant.**

5.13.4.4 Craigflower

Construction

Potential Impact: Installation of conveyance pipes will be visible to users of Shoreline Community School's sports field and a small portion of the Old Island Highway.

Construction of conveyance pipes will result in trenching and construction in the grassed sports field to the south and east of the treed and shrubby shoreline of Portage Inlet. The introduction of construction equipment, materials and security fencing into an institutional area could be considered an adverse visual impact. Users of the sports fields include Shoreline students, organized teams and informal walkers from the neighbourhood. Views of pipeline construction equipment and construction traffic will be localized and of short duration (occurring over a period of less than one year).

Mitigation Measure: Construction of the conveyance pipes should be scheduled for summer months when school is not in session to minimize the visual impacts to students, teachers and sports teams. Pipe routing and construction options should be selected to ensure that trees in visually sensitive areas are not damaged.

The temporary nature of the construction activities associated with the ancillary facilities, and the reversibility of the visual aesthetic impacts with the removal of construction equipment and the replanting of trees, shrubs and grass ensures that the mitigated visual impacts of ancillary facility construction are local, short-term, reversible, of low magnitude and **less than significant**.

Operation

After construction, the pipes will be located underground and no visual impact will occur. Impacts are, therefore, considered negligible and **less than significant.**

5.14 Site Contaminants

Based on review of previous land uses for the CAWTP sites, no contamination or remediation has occurred on any the site locations except for Macaulay Point, McLoughlin Point and Craigflower. Because of this, only these sites are addressed in this EIS.

5.14.1.1 Macaulay Point

A site investigation was conducted on DND land surrounding the Macaulay Point pump station site. No sampling is known to have been conducted on CRD land, though the facility site is included in mapping conducted as part of the study of surrounding areas (Golder Associates 1997).

The Macaulay Point pump station site is adjacent to Department of National Defence (DND) property. Surrounding lands are used as a Firefighter Training Area, a pistol firing range and a residence. Areas adjacent to the Macaulay Point pump station are classified as AECs and given an NCSCS class of 3. Part of the pump station site is included in this classification, but no soil sampling was done on the site itself. Soil and fill material tested from adjacent areas on DND land exceeded provincial and federal standards for metal contaminants and contaminant leachability. The extent and source of contaminated material was not delineated (SNC Lavalin Environment 2012). Golder Associates (2010) recommended developing a soil management plan for handling and disposing of contaminated soils if construction were to occur on tested sites.

Excavation taking place on DND land must follow protocols for contaminants outlined in Directive 6 – Contaminated and Archaeological Sites, of the DND Formation SEMS Manual (DND 2011). A soil management plan must be developed when excavation occurs in a known contaminated site, when a new contaminated site is discovered, or when soil is exported from the site. If contaminated soil is discovered during project activities, work must be stopped and appropriate authorities in DND contacted. Before importing soil on DND land, it must be verified that the material meets the appropriate CCME *Soil Quality Guidelines* (Residential/Parkland, Commercial or Industrial).

5.14.1.2 McLoughlin Point

The McLoughlin Point site is a decommissioned Imperial Oil tank farm, making the potential for contamination high. A stage 2 Preliminary Site Investigation (PSI) was conducted by Golder Associates in 2011 covering the entire McLoughlin site. The PSI included subsurface investigation comprised of 40 mechanically excavated test pits to a depth of 5 m and 38 auger holes to a maximum depth of 16.5 m or until hitting bedrock. Of the 38 auger holes, 35 were installed as monitoring wells (Stantec 2013). Based on the findings of the PSI, several areas were identified as being contaminated by hydrocarbons and remediation was deemed necessary.

Golder conducted remedial work on the site in 2011 and 2012.

The first of the locations to be remediated comprised an area of 60 m by 25 m in the southern portion of the site, which was excavated to depths ranging from 1 m to 4 m. The excavation extended into native silt on the western portion and hit bedrock on the eastern portion. The area was backfill with imported silt materials, and some excavated clean gravel and sand material at lower depths. The clean gravel and sand materials were then covered with 75 mm minus crushed gravel up to the surface level (Stantec 2013).

The second location involved excavation of contaminated soils from an area approximately 25 m by 30 m in the southwestern portion of the site, adjacent to two bedrock outcrops, to depths ranging from 1 m to 2.5 m. The excavation exposed the underlying bedrock (Stantec 2013).

The third location involved excavation of contaminated soils from a 25 m by 43 m area in the central portion of the site to the west of the bedrock outcrops to depths ranging from 1 m to 2.5 m. The excavation exposed bedrock in the central portion of the area, while the remaining area consisted of native silt and clay (Stantec 2013).

The last location was in the northeast corner of the site and consisted of an area approximately 20 m by 36 m excavated to depths ranging from 1 m to 2.5 m. This excavation exposed mostly native silt and clay, however there bedrock was encountered in the southeast portion of the area (Stantec 2013).

The last three locations were backfilled with various materials, which included blast-rock, excavated sand and gravel, 75 mm to 150 mm clear stone, imported silty material, and 75 mm and 19 mm minus crushed gravel (Stantec 2013).

The McLoughlin site still requires some remediation. The extent of remaining contamination will be determined before construction of the treatment facility. Remediation will be completed during site excavation for the wastewater treatment facility. Excavation is scheduled to start in March of 2014 (Brcic pers. comm.).

5.14.1.3 Craigflower

The Craigflower site is filled foreshore. The fill was place in 1958, and the material consists mainly of mixed heterogeneous granular fill (boulders, cobble, gravel and sand), with silty topsoil.

A Stage 1 and Stage 2 Preliminary Site Investigations were conducted at the Craigflower site by Golder in 2006. During the collection of soil samples, a distinct hydrocarbon odour was noticeable, suggesting possible contamination. Results of the chemical analysis indicated that some of the soil samples exceeded standards for residential land use and commercial land use set by the *Contaminated Sites Regulation* (CRD 2012).

The contaminants of potential concern for the site include benzene, toluene, ethylbenzene, xylenes, volatile petroleum hydrocarbons, light and heavy extractable petroleum hydrocarbons and polycyclic aromatic hydrocarbons (CRD 2012).

Contaminated fill may be encountered during excavation for the pump station. The CRD will develop and implement a soil management plan that will include actions to be taken if contamination is encountered during construction of the pump station (CRD 2012).

5.14.2 Brownfield Development on Private Land

The Province of British Columbia defines brownfields as "abandoned, vacant, derelict or underutilized commercial or industrial properties where past actions have resulted in actual or perceived contamination and where there is an active potential for redevelopment" (National Round Table on the Environment and the Economy 2003, pp. 1). Under this definition, the McLoughlin Point site can be considered a brownfield site. The BC Brownfield Renewal Strategy may assist in identifying constraints and opportunities associated with development of wastewater treatment facilities on these sites.

The *Environmental Management Act* (*EMA*) and *Contaminated Sites Regulation* outlines the framework for identification and remediation of contaminated and brownfield sites, and include remediation standards for site assessment and cleanup, the principles of liability for remediation, and requirements for approving remediation activities at sites in British Columbia.

Under EMA, a proponent may request an Approval in Principle (AiP) of a remediation plan, which confirms that the planned actions area high likely to successfully remediate the site. Following implementation of a remediation plan, proponents may apply for a Certificate of Compliance (CoC), which confirms site remediation that meets environmental quality standards. AiPs and CoCs provide increased certainty to lending institutions and other parties that liability associated with contamination will be reduced or eliminated.

Financial Incentives

The BC Brownfield Renewal Funding Program contributes funding to land owners or developers (including local governments) for environmental investigations or remediation of brownfield sites where it is possible to achieve triple-bottom-line benefits. Eligible activities and costs include:

- preliminary site investigations, up to 85% of eligible project costs or $40,000, whichever is less;
- detailed site investigations, up to 70% of eligible project costs or $125,000, whichever is less; and
- other environmental investigations or related environmental activities, up to 50%, or $125,000, whichever is less.

The *Community Charter* provides local governments with the ability to offer revitalization tax exemptions to owners of brownfield sites. The Ministry of Community Development has published a primer document for local governments on the *Community Charter*, which enables the Revitalization Tax Exemption tool for local governments. Using this tool, local governments can offer developers tax exemptions for up to 10 years on brownfield redevelopment sites.

The Federation of Canadian Municipalities' Green Municipal Fund (GMF) grants and below-market loans support municipal initiatives, such as brownfield redevelopment initiatives.

The federal SD Tech Fund from Sustainable Development Technology Canada is available to private organisations involved in remediation and green building technology development.

As the CRD's wastewater program proceeds, it may be feasible to apply some or all of the foregoing programs to development on the McLoughlin Point site.

6.0 CUMULATIVE EFFECTS ASSESSMENT

For the purposes of this EIS, cumulative effects refer to the regional or local effects of constructing and operating wastewater treatment facilities in combination with the effects of other existing or planned developments in the core area of the CRD.

The area considered in this cumulative effects assessment includes Victoria Harbour, James Bay, southwest Fairfield, the Songhees area of Victoria, southern Esquimalt, southern Saanich and southern View Royal and southern Oak Bay. With exception of the lands near Arbutus Road, this area is the urban core of the region, and includes residential neighbourhoods, offices, industry and DND training and housing. Several parks are located near the proposed wastewater facilities and conveyance pipeline routes, including Beacon Hill Park, Clover Point Park, Holland Point Park, Banfield Park, Pemberton Park, Windsor Park, MacDonald Park, Macaulay Point Park, the Galloping Goose Regional Trail and the future E & N Rail Trail.

In the urban core, virtually all native forests have been removed in the study area; old growth is limited to scattered trees and small residual stands, mainly in Beacon Hill Park and some second growth stands near Arbutus Road. Naturally occurring water courses in this urban area have been enclosed in storm drains and the natural landscape has been largely replaced by roads, buildings and landscaping. The few remnant natural foreshore areas retain some ecological value.

6.1 Environmental Effects of a Wastewater Facility

The geotechnical setting, hydrology, water quality, vegetation and wildlife collectively represent the “environment” of the study area. It is evident from aerial photographs or a cursory field inspection that past urban development in the study area constitutes a high magnitude, long-term, irreversible impact on the environment that must be considered **significant.**

The treatment facilities and their supporting ancillary infrastructure will affect a total of approximately 5.5 ha of land. Nearly all areas where the treatment facilities will be constructed have been affected by previous human activity. The facility footprints at McLoughlin Point, Macaulay Point, Craigflower and Clover Point have already been altered by clearing of vegetation, filling, paving and similar actions. The Arbutus Road site was previously logged, and is criss-crossed by sewer trunks, footpaths, and bicycle paths and jumps. The wastewater conveyance pipelines will be installed along roadways and beneath Victoria Harbour. Because existing developed areas will be “re-used” for the wastewater facilities, the project will make a negligible contribution to the cumulative effects of development on the environment.

In assessing the cumulative effects of the Project, it should be noted that the rationale for providing wastewater treatment is to improve environmental quality. These improvements include:

- benefits to the marine environment by discharging much cleaner effluent than is the case today, with associated long term reductions in impacts on the sea;
- removal of invasive species at Craigflower and Arbutus Road sites and replanting with native vegetation;
- reduction of sewer overflows; and
- the ability to recover energy for reuse, particularly in the McLoughlin Point facility; and
- remediation of the contaminated site at McLoughlin Point.

The negligible contribution of the wastewater facilities to existing cumulative environmental effects of development in the Core Area is considered **less than significant.**

The improved marine conditions resulting from wastewater treatment improve the net environmental effect of this project.

6.2 Social Effects

Cumulative effects of development on socio-community conditions in the study area are associated with archaeology, heritage, traffic, health, visual aesthetics, air quality, noise, vibration, lighting and land use change. Based on the results of this EIS, the following statements can be made about the potential contribution of the proposed wastewater treatment facilities to cumulative effects on socio-community conditions.

The cumulative effects of existing development on archaeological and heritage resources in the study area can be considered adverse and **significant**. It is unlikely that the wastewater facilities will contribute to further damage or loss of archaeological or heritage resources. Compliance with the *Heritage Conservation Act* and the conduct of an AIA study of conveyance pipes after routes have been finalized will mitigate effects of the wastewater project.

With regard to socio-community effects, travel and mobility are commonly disrupted by construction activity in the urban area. New buildings and infrastructure installation and replacement often result in road closures that affect travel patterns and generate dust and vibration. Most people accept the occasional travel disruption and associated nuisance effects, because they recognize the importance of development and redevelopment in maintaining the vitality of an urban area.

The cumulative effects of motor vehicle-dependent developments in the core area already have **significant** cumulative effects on roadways and neighbourhoods. The small volumes of traffic generated by operation of the wastewater facilities will not contribute materially to congestion on roadways.

Construction of the wastewater facilities could combine with other construction projects to cause cumulative travel and nuisance effects on nearby neighbourhoods. For example, truck traffic, noise and dust associated with constructing buildings or repairing roads could compound the similar effects of wastewater facility construction if the activities occur at the same time. Because the construction periods associated with the wastewater facilities are long (up to three and a half years), it is likely that other construction or utility maintenance work will occur at the same time and neighbourhood as the wastewater facilities, resulting in cumulative effects on residents, businesses and travellers. Traffic generated by construction at McLoughlin Point, compounded by the concurrent construction at Macaulay Point, has the potential to cause **significant** cumulative effects on traffic and roads, particularly if municipal work occurs on nearby major roads or bridges during construction of the wastewater facilities.

The spatial and temporal extent, magnitude and significance of cumulative traffic and community effects of facility construction are **unknown** at this time. Even considering this uncertainty, certain project impacts can be mitigated by:

- identifying other private sector or public sector construction or maintenance projects that are planned to occur near to, and at the same time as, the wastewater facilities;
- avoiding or minimising community disruption through scheduling or other measures; and
- seeking ways of coordinating activities to shorten construction intervals or road work (*e.g.*, delaying road resurfacing to follow, rather than to precede, installing wastewater pipes).

Municipal and CRD coordination of major construction activities will reduce the cumulative effects of multiple projects on communities to **less than significant** levels.

Compared with the combined impacts on human health of urban form, design of existing developments, and personal behaviour choices, the contribution of the wastewater project's noise, vibration, lighting, and air quality effects will be negligible and **less than significant**.

The visual aesthetics effects of the proposed wastewater facility will be small in comparison with the aesthetic effects of other structures throughout the study area. Some of the proposed wastewater facilities may constitute a **beneficial** visual effect when compared with present conditions, and others will be neutral or **less-than significantly** adverse.

Wastewater treatment has the potential to release unpleasant odours that could affect areas near the treatment facilities, but the CRD is committed to a goal of eliminating noticeable odours emitted by the facilities. Compared to other sources of airborne odour effects, such as domestic fireplaces and diesel exhaust from vehicles, the wastewater facilities are not expected to contribute to cumulative odour effects. Air quality in the CRD is generally very good, and the proposed wastewater treatment facilities are not expected to materially affect air quality. Cumulative effects of wastewater treatment combined with other emissions in the core area are considered **less than significant**.

The cumulative effects of development in the study area on socio-community conditions are rarely considered in the development review process. The analysis conducted in this EIS, however, indicates that the contribution of the wastewater facilities to the cumulative social and community effects of development in the study area will be of low magnitude and **less than significant.**

7.0 RECOMMENDATIONS

This section summarizes the mitigation measures identified in this EIS and confirms the CRD's commitment to implement these recommendations.

7.1 Mitigation Measures

The CRD commits to the following mitigation measures for the construction and operation of the CAWTP facilities, including associated ancillary facilities.

- A geotechnical investigation and review of the treatment facility design will be conducted.
- Careful consideration will be given to groundwater levels of excavations deeper than 3-4 m below existing grades and any excavations below sea level.
- Appropriate measures will be implemented to avoid or control seepage from fill or rock cuts, to ensure use of suitable fill materials, and to respond to potential buoyancy concerns where structures are below the water table.
- Earthquake and tsunami risks, and projected 100-year sea level rise, will be factored into facility designs.
- When blasting, the CRD will limit the size of charge detonated per delay to avoid or minimize vibration effects on adjacent facilities and structures.
- The CRD will follow WorkSafe BC standards.
- Areas of native vegetation and plant communities located on or near facility footprints will be avoided, where possible, and will be protected from construction damage by installation of fencing.
- Temporary workspace and workspace areas will be located in areas that will not substantially affect native plant communities or public access to parkland, especially during construction of the McLoughlin Point facility, the Clover Point upgrades and ancillary facilities along Dallas Road.
- Vegetation clearing work will be avoided during the nesting bird season (March 15 to July 31). Otherwise, nest searches will be performed by a qualified biologist before vegetation removal occurs, in accordance with Canadian Wildlife Service recommendations for compliance with the *Migratory Birds Convention Act*.
- Redundant odour control systems and backup generators will be installed where required to reduce the risk of untreated air discharge from the treatment facilities.
- The CRD will respond to neighbourhood concerns about odour.
- The CRD will take measures to identify and avoid, archaeological sites and features, where feasible, and in all cases will comply with requirements of the *Heritage Conservation Act*.
- An AIA will be conducted along specified pipe routes before construction takes place.
- Signs, newspaper advertisements or other measures will be used to inform residents and businesses about the construction schedule and temporary walkway, park, and vehicle parking closures or other potentially disruptive construction activities.
- Users of facilities that could be affected by pipeline construction will be notified about the work schedule and potential disruptions.
- The CRD will seek to comply fully with City of Victoria, District of Saanich, Town of View Royal, District of Oak Bay and Township of Esquimalt plans and bylaws in siting, design, construction and operation of the facilities.

- Construction of the conveyance pipes near CRD Regional Parks, Victoria parks and the Seaside Touring Route will be scheduled to occur between late October and May, as feasible, to avoid the peak tourist season.

- The CRD will meet with City of Victoria representatives to ensure that the Clover Point facility expansion complies with the Clover Point Park covenant.

- Design of the facilities on the McLoughlin Point site will follow the Transport Canada guidelines.

- A registered arborist will be retained during the conveyance pipeline route planning and design stages to determine further measures to avoid or mitigate potential damage to street trees.

- The construction site will be fenced to prevent access by the public. In areas near travel routes to schools, flag persons will be present during school hours.

- The CRD will discuss and refine construction traffic routes with engineers and planners at the Township of Esquimalt, City of Victoria, Town of View Royal, District of Oak Bay and District of Saanich.

- The CRD will consider the use of barges to transport excavated rock and soil from the McLoughlin Point site, and to deliver concrete and other bulk materials to the site.

- To reduce employee traffic during construction at McLoughlin Point and Macaulay Point, contractors will be required to provide offsite parking, as feasible, and to bus employees to and from the work sites.

- The CRD will prepare detailed traffic management plans for construction at Clover Point, Macaulay Point, McLoughlin Point, Arbutus Road, Craigflower and ancillary facilities. The plans will identify measures to reduce traffic effects on surrounding neighbourhoods, maintain safety, reduce damage to road surfaces and reduce fuel use and emissions. Ancillary pipe construction will be scheduled outside of peak periods of vehicular activity, whenever practical.

- CRD representatives will work with the DND and community groups to minimize impacts of constructing the conveyance pipes through residential neighbourhoods.

- The CRD will engage in discussions with nearby institutions and neighbouring residents during project planning and before construction to confirm noise mitigation measures.

- All buildings will be designed to a high architectural standard and, where feasible, designed and finished to reduce the industrial appearance of the facility.

- The Contractor will develop and implement a soil management plan during construction of the Craigflower pump station.

- Where feasible, vegetated screens, security fencing materials, and landscaping will be used to partially screen the facilities and to blend the facilities with the surrounding landscape.

- Location of staging areas will be chosen to minimize visual disturbance.

- If practical, the area atop and near the new Clover Point facilities will be seeded with native grasses and restored with native plants.

- The CRD will consider providing viewing areas near Clover Point from which the public may safely observe construction progress.

- The CRD will encourage the District of Saanich to remove the fisheries sensitive stream status and associated setbacks requirements from “Finnerty Creek” to reduce adverse effects on siting the access to the attenuation tank site.

- A water management plan will be prepared to minimize on-site and off-site effects of groundwater changes associated with project facilities. If feasible, on-site infiltration of runoff will be included in project design.

- Water used in concrete pouring will be managed to prevent entry into storm drains or the ocean.

- The CRD will work with the District of Saanich to minimize damage or removal of trees for the sidewalks and storm drain construction on Arbutus Road.

- Stockpiles of excavated soil will be covered to prevent erosion, as determined by on-site environmental monitors.

- The CRD will retain a professional arborist to develop a plan for minimising root damage and wind throw risk at the Arbutus Road site.

- During construction, settlement ponds or filtration basins will be provided to reduce suspended sediments in construction drainage. Silt fencing may be appropriate to control movement of sediments.

- During operation, runoff water should pass through oil, grease and sediment traps before being released to the ocean or storm drains.

- As part of the Environmental Protection Plan for the CAWTP facilities, a spill response plan will be prepared that specifies procedures to follow in case of an accidental spill of wastewater, sludge or biosolids.

7.2 Environmental Protection Plans

Environmental Protection Plans (EPP) for each wastewater facility project will contain a set of instructions that are developed to avoid or minimize adverse clearing and construction effects of the project on the environment.

The mitigation measures described in Section 5 of this EIS and the marine EIS will be incorporated in the EPPs. The EPPs will apply to each phase of the project, including clearing, grading, construction, operation and restoration.

The EPPs will be developed by CRD's contractors. The EPPs will incorporate the appropriate requirements of the CRD's existing procedures and manuals that are applicable to the construction and operation phases of the CAWTP facilities. The EPPs will examine the following topics:

- identification of relevant environmental standards;
- adherence to applicable permits;
- use and handling of approved materials;
- construction practices;
- protection of vegetation;
- proper disposal of waste; and
- compliance with the Workplace Hazardous Materials Information System (WHMIS) and other pertinent regulations.

The requirement for an EPP will be incorporated into the building contracts, and compliance will be a legal obligation for contractors.

The EPPs will be written in construction specification format so that it is clear and can be easily interpreted and followed in the field by contractors, trade and environmental inspectors, regulatory inspectors, and other government representatives.

Before construction of the CAWTP facilities, workers will receive environmental orientation and training describing requirements related to safety and environment.

The EPPs will include a series of contingency plans covering:

- wet soils,
- soil erosion or siltation,
- flooding or excessive flow,
- accidental spills,
- fire,
- accidental release of drilling mud during horizontal direction drilling,
- wildlife incidents,
- discovery of plant species or wildlife species of concern during construction, and
- discovery of archaeological or heritage resources during construction.

7.3 CRD Commitment

By accepting this EIS, the CRD commits that it will make best efforts to implement the recommended actions identified in Section 7.1. Acceptance of the EIS also obligates the CRD to develop Environmental Protection Plans as described in Section 7.2 and to implement the actions described in the EPPs.

The timing and sequence of the implementation actions will be linked to the schedules for planning, design, construction and restoration stages of the wastewater project. The actions will be subject to approval by the CALWMC or Board of the CRD, and will be contingent on availability of adequate funds to conduct the tasks.

8.0 PREPARERS OF THE REPORT

The EIS was prepared by TERA Environmental Consultants and affiliated consultants, with the involvement of CRD personnel. The study team was headed by senior planners and environmental scientists at TERA. Support for the engineering and facility construction elements of the report was provided by staff from the CRD and Stantec. Expertise was provided in the following areas:

- land use planning and analysis;
- biology (vegetation and wildlife);
- hydrology and water quality;
- community effects (noise, odour, light and glare);
- archaeology and heritage;
- Geographic Information Systems-based mapping and spatial analysis;
- traffic and roads;
- facility design, construction, and operation;
- odour dispersion modelling;
- geotechnical analysis;
- archaeology;
- visual aesthetic analysis; and
- meteorology.

All of the consultants in the TERA team have professional registrations in their respective fields and are experienced in conducting studies of this type.

8.1 TERA Environmental Consultants

David Harper, Ph.D., P. Ag., CPESC, MCIP, is the Project Manager for the siting and environmental assessments. He led several elements of the project, including municipal planning issues, neighbourhood and socioeconomic impacts, First Nations issues, facilitation of meetings with the Core Area Liquid Waste Management Committee (CALWMC), oversight of the GIS analysis, report preparation, quality assurance and administration. Dr. Harper has more than 30 years of experience in community and environmental planning, resource and watershed management, site location studies, impact assessment, and public involvement for the private sector and for local and senior governments. He has developed environmental assessment methods for local government and First Nations, and has participated in siting and impact assessment studies for industrial clients throughout British Columbia. Dr. Harper is a Registered Planner, a Professional Agrologist, and a Certified Professional in Erosion and Sediment Control.

Wayne Biggs, M.Sc., P.Ag., R.P.Bio., is the Project Biologist and Assistant Project Manager for the siting and environmental assessments. He is responsible for identifying sensitive ecosystems, vegetation communities, wildlife habitats and other ecosystem elements for the siting study and ESRs. Mr. Biggs is a Registered Professional Biologist, who has more than 30 years' experience as an environmental consultant in British Columbia. He has conducted numerous environmental planning, biological inventory, habitat resource mapping and restoration projects in the province, and participated in the CRD biosolids facility site selection and environmental studies. He has worked with the CRD on several engineering projects, including the septage disposal siting study and the Hartland Road composting study.

Carmen Holschuh, M.Sc., R.P.Bio., is the Vegetation and Species at Risk Specialist for the project. Ms. Holschuh has conducted environmental impact assessments on Vancouver Island and throughout British Columbia, including inventory and site characterisation, potential impact identification, mitigation planning, and evaluation of the significance of impacts. She has experience in environmental research design, data collection and analysis, field-based wildlife and vegetation inventories, and species at risk assessment and management. Ms. Holschuh has conducted many biological studies on Vancouver Island, including identifying and mapping sensitive habitats for CRD Parks, habitat and species inventories on proposed development sites in the CRD that assessed potential project impacts and guided the form and location of development.

Rahul Ray, B.Sc., DEIA, M.R.M, MCIP, is an Environmental Planner and is Community Planning Specialist for the project. Mr. Ray has co-ordinated socioeconomic studies for major industrial projects in federal and provincial environmental regulatory processes, leading to the assessment of potential effects and identification of mitigation measures. He is familiar with collecting and analysing information on land and resource use, public health, demography, community infrastructure, and services. Mr. Ray has participated in a broad range of resource management projects across British Columbia, often involving multi-stakeholder groups created to address complex resource issues. He has experience working collaboratively with representatives from government, industry, communities, environmental groups and First Nations. Mr. Ray has an educational background and experience in land use planning and environmental and social impact assessment.

Dave Nicolson, B. Sc., is the Senior GIS Analyst for the project. Mr. Nicholson has more than 20 years' experience in mapping and geospatial analysis. His work includes providing information to improve planning for communities and to foster sustainable resource use. Mr. Nicholson has experience conducting community planning initiatives, ecological assessments, resource inventories, and use of geospatial tools to support broad policy initiatives. He has worked with government, corporate, and professional clients. His recent work has focused on collaborative, multi-disciplinary projects that support science-based planning and decision-making.

Janine Owen, B.A. (hons.), is a geographer and GIS Technician for the project. Ms. Owen has a bachelor of arts in urban geography from McGill University and three years of professional experience in the environmental consulting sector. Ms. Owen is a proficient user of ArcGIS by Esri, Geomatica by PCI Geomatics, Matlab by MathWorks, and various open source GIS packages. She has worked extensively with oceanographic datasets from Arctic regions, analysing upward-looking sonar data, mapping Arctic sea ice motion and creating ice profile time series plots.

Jason Collier, B. Sc., EPt., is an Environmental Planner and is the Environmental Assessment Analyst for the project. Mr. Collier has a bachelor of science in environmental sciences from Royal Roads University, a diploma in environmental technology and several years of professional environmental consulting experience. Mr. Collier has been involved in field work and report preparation for Environmental Impact Assessments, Constraints Assessments and Riparian Area Assessments. He has collaborated on a provincial watershed governance initiative, which involved research, survey design, public outreach, data analysis and report preparation.

Tara Lindsay, B.Sc., A. Ag., MCIP, RPP, is an Environmental Planner and is a Data Analyst for the project. Ms. Lindsay has a bachelor of science in geography from the University of Victoria. She has nine years' experience managing and conducting environmental projects in the CRD. She has training and experience collecting environmental data, producing and analysing Geographic Information Systems data and maps, collecting field and published data, facilitating meetings, and engaging and educating the public. She is highly skilled with graphic and analytic computer programs. She has worked extensively on environmental projects and has prepared environmental assessments for major industrial projects. Her work has included collaboration with federal, provincial and local governments, non-governmental organisations, businesses, and the public.

Lynne Atwood M. SC. R. P. Bio., is the Vegetation Specialist for the project. She is a vegetation and restoration ecologist with 18 years experience in biological assessment, environmental impact assessment, risk assessment, restoration ecology and resource management. Her biological expertise includes classifying and evaluating the ecological condition of plant communities, including the presence and extent of alien invasive plant species; identifying and assessing plant communities at risk; organising

and participating in rare plant surveys; developing and implementing invasive plant control programs; and designing and executing scientifically rigorous ecological monitoring programs that assess the effectiveness of natural plant community restoration techniques and invasive plant treatments. She has worked extensively with provincial and federal environmental assessment processes. As a professional biologist, she has worked closely with all levels of government, First Nations, industry and private consultants.

Richard H. Dixon, P. Eng., is the project's Transportation Engineer with Bunt Engineering. A Professional Engineer, he has had extensive experience in transportation projects over the past 30 years in a variety of public and private positions. He was involved in the traffic impact component of the ESR for the CRD's Biosolids Facility Site Comparison, which examined the impacts of candidate sites on local transportation infrastructure, changes to traffic volumes, and potential mitigation measures. Mr. Dixon's experience includes the Transportation Master Plan for the Town of View Royal and the analysis of the impacts of the redevelopment of the Town & Country Shopping Centre from 230,000 to almost 700,000 square feet. Other significant projects have involved the proposed redevelopment of the Bamberton Lands as a community of approximately 3,200 residences and transportation demand management plans for the Pacific Sport Institute.

Gordon J. Esplin, M.Sc., P.Eng., is the Principal and Senior Engineer of Genesis Engineering Inc., a company devoted to advanced environmental technology and to solving air pollution problems. He is the Air Emissions Specialist for the project. Mr. Esplin has more than 30 years' experience, and is an expert in odour control measurements and odour control modelling. His experience includes air pollution dispersion modelling for Vancouver International Airport, pulp mills, shipyards, landfills, and large wastewater treatment facilities. Previously, Mr. Esplin was Head of the Air Quality Division of B.C. Research Inc. He prepared the odour emissions and air dispersion modelling, impact assessment, and mitigation components of the ESR for the CRD's biosolids study.

Stanton Tuller, Ph.D., is an accredited consulting meteorologist in topics including applied climatology, climate impact assessment and wind engineering and a professor at the University of Victoria. His major research interests are in the area of applied climatology including effects of ground surface alterations on the overlying climate, human thermal bioclimate, microclimatic and applied effects of onshore winds and time and space variations in wind. Current research focuses on changes in coastal wind speed and wind power over the period of observational record. Dr. Tuller supplied data and support for the odour modelling performed by Genesis Engineering.

C. N. Ryzuk, M.Eng., P.Eng., is the Geotechnical Engineer for the project. The Principal of C. N. Ryzuk and Associates, he applied his substantial local knowledge and experience to identifying geotechnical conditions and issues associated with the treatment facilities. Mr. Ryzuk has worked extensively in the CRD on large and small geotechnical site investigations. He is one of the most experienced geotechnical engineers in the Capital Region, and has been responsible for geotechnical assessments and recommendations affecting some of the largest and most complex structures on southern Vancouver Island.

Lane Campbell, M.Eng., is a senior geotechnical engineer and principal of C.N. Ryzuk & Associates Ltd. with over 19 years of experience in civil and geotechnical engineering. He received his B.Sc. in Civil/Forest Engineering from the University of New Brunswick, and his M.Eng. in Geotechnical Engineering from the University of Alberta, and has been involved with numerous commercial developments throughout the Victoria area. Mr. Campbell has extensive experience with in-ground shoring systems, shallow and deep foundation design, and earth retaining structures, as well as project engineer for the wastewater treatment plant and associated infrastructure for Dockside Green.

Dannica Switzer, EIT, GIT, is a Project Engineer with C.N. Ryzuk & Associates. She assisted in the Geotechnical assessments for the project. She has degrees in Civil Engineering and Earth Sciences from Dalhousie University. She has been involved with a variety of commercial and residential projects throughout the Victoria area, including site investigations, geotechnical assessments and analyses, and associated reporting.

D'Ann Owens, B.A., is a Senior Archaeologist for Millennia Research. D'Ann has intensive archaeological experience participating in and directing large scale archaeological projects since 1994. She has directed traditional use studies in the southern interior for the Cook's Ferry and Lytton First nations, Lillooet (Lookout Point) and the Pavilion First Nation, on the midcoast for the Kitasoo Indian Band, and with the Kitkatia on the north coast.

Vashti Thiesson, B.A., is an Archaeologist with Millennia Research. She has experience in a variety of archaeological field methods and reporting formats. Her primary activities at Millennia include fieldwork, including survey and excavation, lab work, including analysis and processing of samples and report production, including writing, and editing to Archaeology Branch of British Columbia standards.

Bjorn Simonsen, B.A., M.A., is a Heritage and Archaeology Specialist for the project. Mr Simonsen is the Principal of The Bastion Group Heritage Consultants, and has more than 35 years of experience in the cultural resources management field in Canada, including 10 years as British Columbia's Provincial Archaeologist. He is a well known and respected professional in the fields of cultural resources management and archaeological research and site management.

Mr. Simonsen has also managed the day-to-day operation of five historic sites in Greater Victoria, including Helmcken House, Craigflower Farm, and the Emily Carr House. He has conducted AIA studies, heritage resources feasibility and management studies, First Nations economic development initiatives, and treaty and land claims related work. He worked with Westland on the ESRs for the CRD's candidate biosolids treatment facilities. In the course of his work, Mr. Simonsen has authored more than 300 reports on various aspects of British Columbia's First Nations culture and archaeological heritage and has an excellent working relationship with numerous First Nations communities throughout the province.

Thomas Munson, M.Sc., Dipl. E.R., supported the archaeological and heritage component of the siting and environmental assessments. Mr. Munson has worked with First Nations in the Yukon Territory, British Columbia, and Colombia, South America for much of the past 20 years. His has assessed development impacts on archaeological and cultural sites, conducted ethno-botanical field studies, traditional use research, multi-party treaty negotiations, and environmental impact assessments. Mr. Munson has worked as an Archaeological Field Technician in Greater Victoria, conducting fieldwork and preparing AIA reports on the Bear Mountain Resort development area, a sewer trunk project in North Saanich, Portage Cove Regional Park, and proposed private property developments. He has worked alongside members of the Esquimalt Nation, Songhees First Nation, Tsartlip First Nation and Tseycum First Nation, and other First Nations in the Lower Mainland and British Columbia interior.

Roxanne Tripp, B.Sc., is a project biologist and field technician. She assisted in preparing the vegetation and wildlife impact assessments. Ms. Tripp has more than five years experience working as a technician and wildlife biologist in the forestry and wildlife sector of British Columbia. She has successfully participated in, lead, and trained data collection crews and is familiar with vegetation and wildlife standards set by British Columbia's Resources Information Standards Committee (RISC). Past projects have included habitat analysis, vegetation plot assessments, riparian area assessments, breeding bird surveys, and water quality sampling.

James Miskelly, M.Sc., is a biologist and Species at Risk specialist who participated in habitat and rare species inventories of the wastewater management facility sites. Mr. Miskelly is a trained and experienced botanist and entomologist who has provided services to the DND, the Royal British Columbia Museum, CRD Parks, and other organisations in the Capital Regional District.

Ewan Anderson, B.A., is a Senior Archaeologist at Terra Archaeology Limited. Mr. Anderson has 10 year's consulting archaeology experience throughout British Columbia. He has managed projects for a variety of proponents including transportation, forestry, oil and gas, power generation industries, private property owners, municipalities, provincial and federal government agencies, and First Nations. Mr. Anderson has directed excavations in the northeast and southern interior of BC, large-scale archaeological potential modeling projects, culturally modified tree and other traditional use surveys in the interior and on Vancouver Island, and hundreds of smaller impact assessments all over the province. Mr. Anderson also worked at the BC Archaeology Branch, which administers almost all archaeological studies in the province, consults with every First Nation on cultural heritage issues and liaises with all other levels of government on matters of heritage conservation and protection.

8.2 Stantec Team

Reno Fiorante, P.Eng., is a professional engineer and Vice President of Environmental Infrastructure for Stantec. He is a consulting engineer for this project. Reno has 25 years experience in the design and management of wastewater treatment projects in Canada and the USA. Reno recently served as project manager for the 2007 Lions Gate WWTP Site Assessment Feasibility Study and was involved in the 2005 Facility Plan for the Iona WWTP. He was the project manager for plant expansions for the Whistler BNR plant, the Kelowna BNR plant, and the Squamish WWTP. The Whistler and Kelowna plants are designed using a sustainable design philosophy and resource recovery for biosolids and liquid treatment streams. Reno was the design manager for the award winning Kamloops Membrane WTP (first LEED Gold in Canada for a treatment facility), Missoula BNR Plant, and an enhanced nutrient removal facility in Howard County, Maryland.

C. M. Paul Pai, M.Sc., P.Eng., is a Senior Project Engineer with Stantec and is a consulting engineer for this project. His 37 years of experience have included the design of wastewater treatment plant upgrades for the cities of Kelowna, Okotoks, and Vernon, Whistler, Howard County in Maryland, Helena, and Missoula in Montana, as well as water treatment plants for Metro Vancouver, Kamloops, Penticton, and St. Lucia. Mr. Pai has provided senior level input in process selection and complete site layouts for several large projects for both the preliminary and detailed design of the selected alternatives, and provided input into the preparation of related opinions of probable costs.

Enrico Dimzon, CAD Technologist, has over 29 years of experience and has been responsible for architectural, structural, mechanical and civil drafting on a variety of water, sewer and transportation projects. Mr. Dimzon has provided his design and drafting expertise experience in Canada, Alaska, the Caribbean, Asia and the Middle East.

Mitchell Hahn, P.Eng., is a Civil Engineer and Project Manager for Stantec Consulting Ltd. He has 13 years of experience in the engineer field, both as a technologist and an engineer, and has provided conceptual to detailed design of water and wastewater treatment plants, feasibility studies, engineering condition assessments, municipal infrastructure and highways.

Gilbert Cote, BA Sc., P.Eng., was a Senior Project Manager with Stantec and a consulting engineer for this project.

8.3 CRD Team

Tony Brcic, P.Eng., is a professional engineer and the Project Manager for the Seaterra Program. He has considerable experience working on small and large infrastructure projects, such as planning Sooke's secondary wastewater treatment plant in 2005 and Vancouver Island's natural gas pipeline in the 1990s.

Malcolm Cowley, P. Eng., is a professional engineer and Manager of Conveyance Infrastructure for the Seaterra Program. Mr. Cowley has worked at the CRD since 2004 and has successfully completed a number of infrastructure projects, including the award-winning Trent Pump Station. He is a member of BC Water & Waste Association and Water Environment Federation and has presented technical papers at annual conferences to both those organisations. Prior to joining the CRD, Mr. Cowley was the Senior Project Engineer with the Greater Vancouver Regional District and over 13 years has completed numerous water and wastewater projects.

Dan Telford, P. Eng., is a Professional engineer and Senior Manager of Environmental Engineering. He has considerable experience managing a variety of small and large potable water, wastewater and building facility projects, such as the Saanich Peninsula Water System (1990 to 1995), Saanich Peninsula Wastewater Treatment Plant (1995 to 2000) and the Capital Regional District Headquarters (2000 to 2006).

Jack Hull P.Eng, MBA, is a Professional Engineer and acted as the Interim Program Director for the Core area Wastewater Treatment Program. During his over 40 year career he has worked in construction, consulting engineering, corporate banking and utility management specialising in the design and management of water supply and treatment systems in both the private and public sectors. He had overall responsibility for the significant investments in the CRD's drinking water infrastructure since 1995.

Seamus McDonnell, P.Eng., is a Project Engineer for the Core Area Wastewater Treatment Program. He is a professional engineer with 35 years of experience in a variety of wastewater projects. He was the Project Manager for the Saanich Peninsula Wastewater Treatment Plant.

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TERA wishes to acknowledge those people indentified in the Personal Communications for their assistance in supplying information and comments incorporated into this report.

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McKelvey, I. Brown and Caldwell. Seattle, WA

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