ENVIRONMENTAL AND SOCIAL REVIEW OF CAPITAL REGIONAL DISTRICT CANDIDATE BIOSOLIDS FACILITY SITES

Prepared for

Environmental Services Department
Capital Regional District

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WESTLAND RESOURCE GROUP INC.

CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF PHOTOS

Photo 5-11 This cleared and levelled portion of the Hartland site would house administration, wastewater treatment, and garage structures. The CRD proposes to store gravel on most of the site. Treed buffers would be retained around this pad.

1.0 Summary

The Capital Regional District (CRD) commissioned this Environmental and Social Review (ESR) of two potential sites for a biosolids treatment facility to serve the core municipalities if and when additional sewage treatment is required. The province has required that the CRD secure a site for sewage and biosolids treatment as a condition of approving the CRD's *Liquid Waste Management Plan* (LWMP). The two candidate sites were selected following a review of the entire regional district conducted between September 2003 and May 2004, and detailed in the report *Selection of Candidate Sites for a Biosolids Facility in the Capital Region*, prepared by Westland Resource Group Inc.

The ESR is intended to provide information on the potential effects of building and operating an anaerobic thermophilic digester with ancillary composting on the two sites. The ESR examined the two sites and their surroundings. The results of the assessment are presented in the text of this report. Table 1-1 presents a summary of construction-related impacts, and Table 1-2 summarizes impacts of facility operation. The significance of potential impacts with and without mitigation is shown for each site. The categories are significant, less than significant, or not applicable. Details of the investigation methods are presented in the body of the report.

Table 1-1
Summary of construction impacts at the Millstream and Hartland sites.

L =	Less than significant
S =	Significant
N/A =	Not applicable

Impact	Impact Significance			
	Millstream Site		Hartland Site	
	Unmitigated	Mitigated	Unmitigated	Mitigated
Landforms, geology, and soils				
• Reconfiguration of landforms	L	L	L	L
• Removal of soil	L	L	L	L
• Potential increase in erosion and sedimentation	L	L	L	L
Hydrology and water quality				
• Changes in flow regime, drainage patterns, infiltration rates, and stormwater runoff	L	L	L	L
• Discharges to surface water and groundwater	L	L	L	L
• Potential increase in erosion and sedimentation in surface water	L	L	L	L

Impact	Impact Significance			
	Millstream Site		Hartland Site	
	Unmitigated	Mitigated	Unmitigated	Mitigated
• Changes in quantity or flow of groundwater	L	L	L	L
Plant life				
• Removal of native plant communities	S	L	S	L
• Removal of the soil surface horizon	S	L	S	L
• Changes to the natural drainage patterns and hydrological cycle on the site	S	L	L	L
• Possible disturbance to thin soils in rock outcrop communities	S	L	N/A	N/A
Animal life				
• Loss of wildlife habitat	L	L	L	L
• Increased forest edge habitat and reduction in available forest interior habitat due to clearing	L	L	S	L
Odour				
• Odour impacts	L	L	L	L
Traffic				
• Construction traffic effects on the roadway system	S	L	S	L
Visual Aesthetics				
• Effect of construction and site modification on visual aesthetics	L	L	L	L
Land use and neighbourhood				
• Community effects of facility construction	L	L	L	L
• Compatibility of the development with local land use plans	L	L	L	L
Property values				
• Odour impacts on property values	L	L	L	L
Archaeology and heritage				
• Archaeology and heritage impacts	L	L	L	L

Table 1-2
Summary of operations impacts at the Millstream and Hartland sites.

L =	Less than significant
S =	Significant
N/A =	Not applicable

Impact	**Impact Significance**			
	Millstream Site		**Hartland Site**	
	Unmitigated	**Mitigated**	**Unmitigated**	**Mitigated**
Landforms, geology, and soils				
• Landform and geology effects	**L**	**L**	**L**	**L**
• Erosion and sedimentation risk	**L**	**L**	**L**	**L**
• Cumulative effects – landforms, geology, and soils	**L**	**L**	**L**	**L**
Hydrology and water quality				
• Changes in flow regime, drainage patterns, infiltration rates and stormwater runoff	**L**	**L**	**L**	**L**
• Erosion and sedimentation in groundwater and surface water	**L**	**L**	**L**	**L**
• Discharges to surface water and groundwater	**L**	**L**	**L**	**L**
• Changes in quantity or flow of groundwater	**N/A**	**N/A**	**L**	**L**
• Cumulative effects – hydrology and water quality	**L**	**L**	**L**	**L**
Plant life				
• Introduction of invasive species	**L**	**L**	**L**	**L**
• Changes in plant communities in the vegetated buffer and in neighbouring natural areas	**L**	**L**	**L**	**L**
• Mortality of native plants following adjacent construction	**L**	**L**	**L**	**L**
• Possible blowdown of trees in the vegetated buffer	**L**	**L**	**L**	**L**
• Cumulative effects – plant life	**L**	**L**	**L**	**L**
Animal Life				
• Loss of wildlife habitat	**L**	**L**	**L**	**L**
• Cumulative effects – animal life	**L**	**L**	**S**	**L**
Odour				
• Odour impacts	**L**	**L**	**L**	**L**

Impact	Impact Significance			
	Millstream Site		Hartland Site	
	Unmitigated	Mitigated	Unmitigated	Mitigated
• Cumulative effects – odour	L	L	L	L
Traffic				
• Traffic impacts of facility operations near pump stations	S	L	S	L
• Traffic impacts of facility operations	L	L	L	L
• Cumulative effects – traffic	L	L	L	L
Visual Aesthetics				
• Appearance of biosolids facility structures and site alteration	L	L	L	L
• Effect of facility lighting on visual aesthetics	L	L	L	L
• Cumulative effects – visual aesthetics	L	L	L	L
Land use and neighbourhood				
• Biosolids odour effects on adjacent land uses	L	L	L	L
• Effect of operational traffic on the neighbourhood	L	L	L	L
• Cumulative effects – land use and neighbourhood	L	L	S	L
Property values				
• Odour impacts on property values	L	L	L	L
• Cumulative effects – property values	L	L	L	L
Archaeology and heritage				
• Archaeology and heritage impacts	L	L	L	L
• Cumulative effects – archaeology and heritage	L	L	L	L

The ESR reveals that the biosolids facility would be unlikely to cause significant impacts on land uses or human activity in the vicinity of the candidate sites. Mitigation of identified impacts could be relatively easily implemented. The report recommends a variety of measures that could reduce social impacts of the project. Managing some identified cumulative effects would require coordinated changes in planning and land use policy by several jurisdictions.

Both sites were found to have ecological values that would be reduced by construction and operation of the facility. Mitigation measures are described in the text to reduce potential impacts to less than significant levels. By implementing recommended mitigation measures, a biosolids facility could be built and operated on either the Millstream or Hartland sites without causing significant impacts.

Section 6.0 of this report provides a side-by-side comparison of the relative merits of the two candidate sites. This comparison is based on the information collected and analyzed in this report and reflects the opinions of the report preparers. Based on the review of impacts on specified features shown in Tables 6-1 to 6-10, the two candidate sites compare as follows:

Millstream site better:	19 topics
Hartland site better:	8 topics
Both sites considered the same:	14 topics.

This comparison should not be construed as a recommendation that the Millstream site is preferred from an environmental and social perspective. All of the topics examined in this report do not necessarily have equal "weight" or importance in making decisions. The consultants who prepared this report are not in a position to assign priorities to the evaluated topics, nor to recommend a preferred site. The information provided in this ESR is intended to support and inform discussions during the public involvement program that will precede CRD decisions on biosolids facility site selection.

2.0 Introduction

2.1 Context and background

As a condition of approval of the Capital Regional District's (CRD) Liquid Waste Management Plan issued in March 2003, the Minister of Water, Land, and Air Protection required that the CRD be prepared to implement additional sewage treatment if specified environmental conditions occur in the future. In response to the conditions of approval, the CRD initiated a program to study sewage treatment options and to select a site for processing biosolids resulting from the treatment process.

Dayton & Knight Engineers Ltd. was retained by the CRD in September 2003 to develop a sludge management Options Study for the Core Area. The objectives of the study were to evaluate the viability of various beneficial use and treatment options for sludge generated in the Core Area. The Options Study recommended anaerobic thermophilic digestion as the preferred treatment option and silviculture and agricultural land spreading as the most promising beneficial use options for the stabilized biosolids. In the future, producing a compost product using the stabilized biosolids is also recommended. The biosolids processing and composting operations would most efficiently be conducted at the same site.

Due to severe site constraints at Clover and Macaulay points, the location of the existing sewage pump stations, another site must be chosen for the biosolids facility and associated composting operations. The CRD and its Sludge Management Advisory Committee (SMAC) worked with Westland Resource Group to identify a short list of biosolids facility locations. Using remotely sensed data, adopted land use plans, and a set of coarse criteria, lands in the entire region, excluding the Gulf Islands, were examined for potentially suitable biosolids treatment sites. This process essentially eliminated unsuitable areas and resulted in 22 potential sites. A set of more specific criteria was then applied to these sites in order to create a list of 12 candidate sites. These sites were further short-listed, using preliminary site investigations, discussions with municipal planners, evaluation of current and adjacent land use, future development plans, cost, and other site-specific factors.

The site selection short-listing process identified two sites for an Environmental and Social Review (ESR). The ESR is intended to assess site suitability and to evaluate the impacts of a biosolids facility on the site and surrounding area. The information collected will assist CRD staff to communicate information about the candidate sites to the public during the public consultation phase of the site selection process. The two sites examined in the ESR are:

- the Millstream site, owned by the CRD and located east of Millstream Road north of an industrial park, and

- the Hartland site, also owned by the CRD, located to the northwest of the Hartland landfill, off Willis Point Road.

Figure 2-1 shows the location of candidate sites in a regional context.

A public consultation process regarding the short-listed sites and other biosolids-related issues is planned for 2005. A preferred site will be selected following that process. Following the public involvement program, the CRD Board will select and commence the process to secure the preferred site for a future biosolids facility.

2.2 Terms of Reference

In response to the Minister's directive, the CRD issued a Request for Proposal (RFP) for the ESR of the candidate biosolids facility sites to qualified firms in April 2004. The RFP identified the following key objectives of the ESR:

- fully characterize each short-listed site,
- identify impacts that both construction and operation of a biosolids facility will have on the site, and
- identify mitigation measures for these impacts.

The RFP for the project called for the successful consultant to meet these objectives by conducting site visits to each site and preparing an evaluation using the following four-part approach.

Conduct a detailed assessment of the existing site including:

- physical characteristics including slope, surface water features, erosion potential;
- biological aspects including ecosystems, flora, and fauna;
- social aspects including current land use, recreational value, surrounding land use; and
- archaeological values.

The site investigations are to be limited to site visits and observations and are not to include ground disturbance.

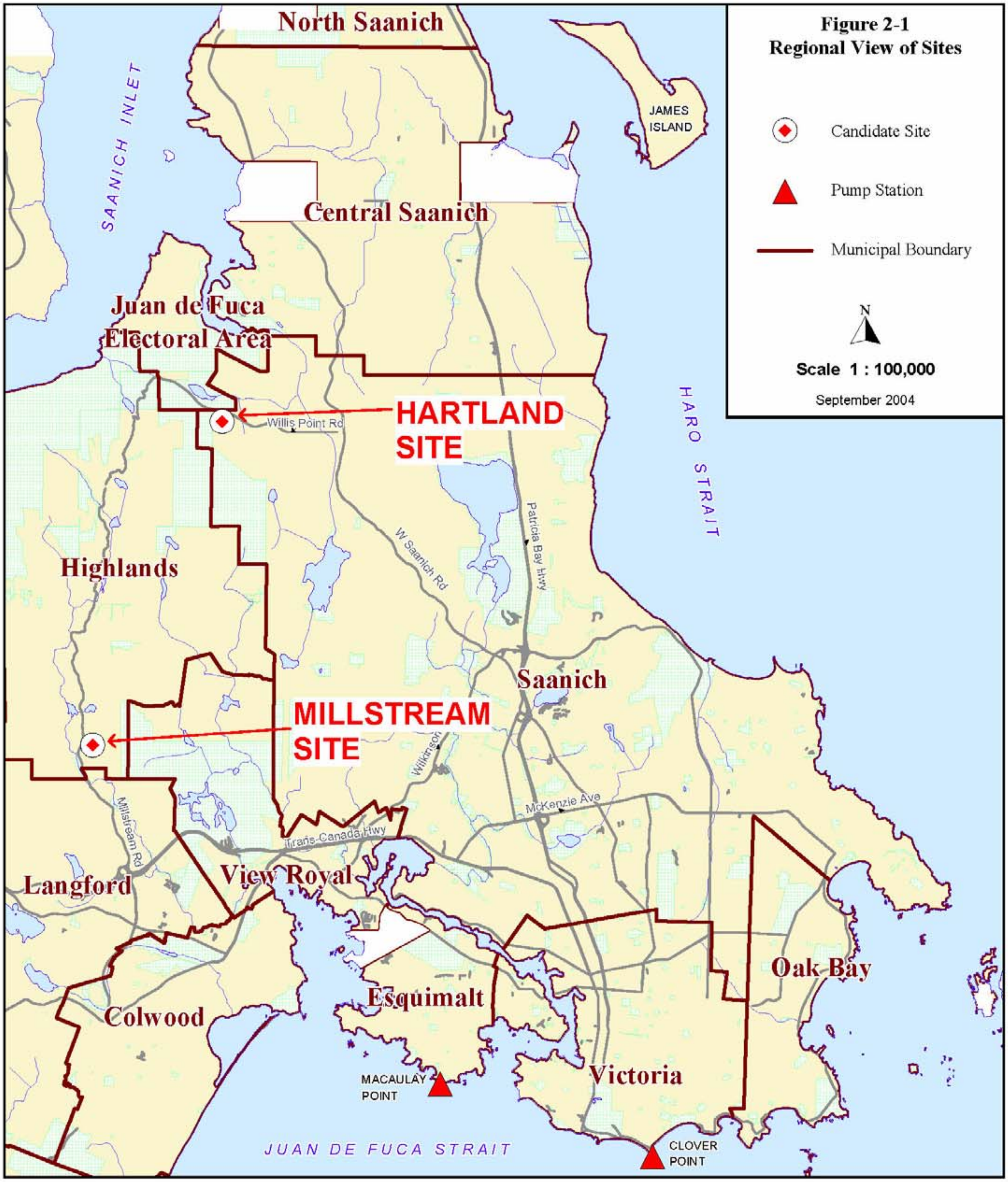


Figure 2-1
Regional View of Sites
Candidate Site
Pump Station
Municipal Boundary
N
Scale 1 : 100,000
September 2004
North Saanich
Central Saanich
JAMES ISLAND
SAANICH INLET
Juan de Fuca Electoral Area
HARTLAND SITE
Willis Point Rd
HARO STRAIT
Patricia Bay Hwy
W Saanich Rd
Highlands
Saanich
MILLSTREAM SITE
Wilkinson
McKenzie Ave
Millstream Rd
Trans-Canada Hwy
View Royal
Langford
Oak Bay
Esquimalt
Colwood
Victoria
MACAULAY POINT
CLOVER POINT
JUAN DE FUCA STRAIT

2. Identify and rate impacts of construction of the facility with respect to the site characteristics identified in Part 1, including:
    - site development including blasting, excavation, and soil removal,
    - facility construction and commissioning including traffic, noise, safety, air quality.

3. Identify and rate impacts of operation of the facility with respect to the site characteristics identified in Part 1, including:
    - general aesthetics (view scape)
    - facility odours
    - traffic, including road maintenance or upgrading requirements
    - site safety including facility security
    - noise and vibration
    - biosolids storage
    - air quality
    - economic issues.

4. Identify any mitigation measures that could be implemented to address identified impacts.

Westland Resource Group Inc. prepared a proposal to conduct the ESR, complying with the CRD's Terms of Reference, and was subsequently retained to conduct the project.

2.3 Approach to the study

The ESR is intended to focus on potential biosolids facility impacts on environmental conditions, human activities, and land uses in the vicinity of the candidate sites. The approach taken to preparing the ESR includes the following elements:

- Collection of relevant and available information,
- Description of site characteristics and ecological and social features,
- Analysis of published data and information collected in the field and from other unpublished sources,
- Identification of impacts resulting from the construction and operation of the biosolids facility, including spatial extent, duration, magnitude, reversibility, and ecological importance of identified impacts,
- Rating the significance of identified impacts,

- Recommendation of mitigation measures to avoid or reduce the magnitude and significance of identified impacts, and
- Reporting of the results for use in the site selection process.

The ESR process applied to the biosolids facilities is based on similar assessments conducted for local government elsewhere in the Capital Region. ESRs focus on localized project effects, consistency with local plans, compliance with provincial and local regulations, neighbourhood concerns, and ways of mitigating negative project impacts.

The main focus of the ESR is on the candidate sites and their surrounding neighbourhoods. The study areas for the topics under study vary, to allow the analysis to capture the potential effects of the facility construction and operation. For instance, most ecological topics focus on the sites to be directly affected by construction of the facility, though offsite effects of habitat loss are also examined. The traffic study, on the other hand, reviews the movement of trucks from the Clover and Macaulay Point pump stations to the candidate biosolids sites. The cumulative effects assessments associated with each topic generally examine areas within several kilometres of the candidate sites, though a regional perspective is taken on some topics, such as traffic.

2.4 Impact ratings used for the Environmental and Social Review

The main purpose of an ESR is to identify and assess impacts and to recommend mitigation measures. The culmination of the assessment is the determination of whether an impact is **significant** or **less than significant**. This finding of significance is based on criteria described later in this section, and on the consideration of the aggregate implications of the following impact characteristics.

- *Nature of the impact*—a description of what effect construction and operation of the facility would have on the physical environment, biota, human activity, nearby properties, etc.
- *Spatial extent*—how large an area is likely to be affected by the impact? Descriptors include *site* (confined to the area where the facility would be located), *local* (the site and immediate adjacent areas), *neighbourhood* (an identifiable area that includes the subject site and nearby areas), or *regional* (a portion of the CRD, in this case the core municipalities, southern Saanich Peninsula, and a portion of the western communities),
- *Duration*—how long would the impact persist? Answers include *short term* (during construction or shortly thereafter), *moderate term* (up to 5 years), or *long term* (more than 5 years).

- *Reversibility*—will the impact cease of its own accord or in response to human actions, or will the impact result in permanent change?
- *Magnitude*—how severe is the identified impact in terms of its effect on the topic under study (biota, air quality, water quality, land use, etc.). Magnitude is described as being *negligible, low, moderate, or high.*

After characterizing a potential impact, the preparers of the ESR considered the following criteria of significance. An impact is normally considered to be significant if it will:

a) Conflict with adopted plans and goals of the community;
b) Have a substantial, demonstrable negative aesthetic effect;
c) Substantially affect a rare or endangered species of animal or plant or the habitat of the species;
d) Substantially diminish habitat for fish, wildlife, or plants;
e) Interfere substantially with the movement of any resident or migratory fish or wildlife species;
f) Breach published federal, provincial, or local standards relating to solid waste or litter;
g) Substantially degrade quality of surface water or groundwater;
h) Contaminate a public water supply;
i) Substantially deplete surface or groundwater resources;
j) Interfere substantially with groundwater recharge;
k) Disrupt or adversely affect a prehistoric or historic archaeological site or a property of historic or cultural significance to a community or ethnic or social group; or a paleontological site except as a part of a scientific study;
l) Induce substantial growth or concentration of population;
m) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system;
n) Displace a large number of people;
o) Encourage activities which result in the use of large amounts of fuel, water, or energy;
p) Use fuel, water, or energy in a wasteful manner;
q) Increase substantially the ambient noise levels for adjoining areas;
r) Cause substantial flooding, erosion, or siltation;
s) Expose people or structures to major geologic hazards;
t) Substantially alter the character of an established community;

u) Disrupt or divide the physical arrangement of an established community;

v) Create a potential public health hazard or involve the use, production or disposal of materials which pose a hazard to people, animals, or plants;

w) Conflict with established recreational, educational, religious, or scientific uses of the area;

x) Violate any ambient air quality standard or contribute substantially to existing or projected air quality problems;

y) Convert prime agricultural land to non-agricultural land use or impair the agricultural productivity of prime agricultural land; or

z) Interfere with emergency response plans or emergency evacuation plans.

These criteria have been assembled from a variety of sources by Westland Resource Group and adapted for use in conducting ESRs.

Preparers of the ESR have recommended a series of mitigation measures intended to avoid identified impacts or reduce their magnitude, extent, duration, and significance. Mitigation measures are presented even if an impact is considered to be less than significant.

2.5 Project team

The members of the project team who contributed to this Environmental and Social Review include (in alphabetical order):

- Mr. Les Archer (Bunt and Associates), traffic,
- Ms. Lynne Atwood, M.Sc (Genoa Environmental Consulting Ltd.), plant life,
- Mr. Wayne Biggs, M.Sc., P.Ag., R.P.Bio (Westland Resource Group Inc.), animal life,
- Mr. Joseph Boyd, mapping,
- Ms. Kellie Bunting, B.Sc., DPTES (Westland Resource Group Inc.), hydrology and water quality, report assembly,
- Ms. Stella Chiu (Dayton & Knight Ltd.), site layout,
- Mr. Gordon Esplin, M.A.Sc., P.Eng. (Genesis Engineering Inc.), odour assessment,
- Mr. Wayne Gibson (Bunt and Associates), traffic,
- Dr. David Harper, Ph.D, MCIP (Westland Resource Group Inc.), project manager; land use and neighbourhood; visual aesthetics; landforms, geology, and soils,
- Mr. Harlan Kelly, P.Eng. (Dayton & Knight Ltd.), facility construction and operation description, odour generation,
- Mr. John Sedley (Decision Economics), property values,

- Mr. Bjorn Simonsen (Madrone Environmental Services Ltd.), archaeology and heritage,
- Dr. Stan Tuller, Ph.D (Climatologist, University of Victoria), meteorological data.

The ESR team worked closely with Ms. Larisa Hutcheson of the CRD Environmental Services Department. Mr. Seamus McDonnell, Mr. Chris Riddell, and Mr. Shane Ruljancich provided additional CRD support.

3.0 Description of the biosolids facility and operation

3.1 Purpose of biosolids processing

If the marine based triggers require the CRD to implement additional sewage treatment, sludge generated by treatment plants at Clover and Macaulay Points will need to be stabilized. The purpose of biosolids processing is to stabilize the biosolids (make them less biologically active and reduce concentrations of pathogens) to permit beneficial use. The beneficial uses to which biosolids can be put include application to forest land, composting of the biosolids and other organic materials to produce soil amendments for yard and garden application, and a variety of other uses.

3.2 Selected biosolids processing option

Dayton & Knight Consulting Engineers prepared a report for the CRD describing the options available for managing sludge in the region (*Core Area LWMP Sludge Management Option, Study*, 2004). The report provides forecasts of CRD sludge generation to the years 2025 and 2045, an assessment of beneficial uses for stabilized biosolids, and analysis of sludge processing technologies for producing the desired quality of biosolids. The report recommends thermophilic anaerobic digestion as the optimal treatment process for the CRD.

Beneficial uses emphasize biosolids application to forest land (most of which is in the western parts of the Capital Region), and agricultural land (most of which is on the Saanich Peninsula). Composting of the biosolids, in combination with other organic material could, in the future, increase the market for domestic use of the compost as a soil amendment. The composted biosolids could also be used by local government in public flower beds, gardens, roadside plantings, and for other horticulture purposes. Such use is already occurring in the Capital Region, where municipalities use processed biosolids from the Saanich Peninsula Treatment Plant on municipal property.

3.3 Steps in the anaerobic, thermophilic process

A process schematic is shown on Figure 3-1. The biosolids process incorporates the following treatment steps:

- dewatering of sludge at the CRD Clover Point and Macaulay Point primary treatment plants to 30% solids by weight to facilitate transport to the biosolids treatment facility;
- trucking of sludge from the Clover Point and Macaulay Point facilities to the proposed biosolids facilities using 13 m^3 closed box trucks;
- rewatering of sludge upon arrival by closed 13 m^3 trucks at the site to obtain optimum solids concentration for digestion (i.e., dilution of sludge from about 30% solids by weight to approximately 5% solids by weight);
- anaerobic digestion of rewatered solids to oxidize volatile solids and produce combustible gas (mainly methane);
- scrubbing of digester gas to remove sulphur compounds - this reduced sulphur is bound to adsorbents and is a solid waste that may be landfilled;
- cogeneration to produce combined heat and electrical power (CHP) from combustion of digester gas, including flare for excess gas;
- dewatering of digested biosolids to obtain suitable moisture content for composting and forestry application (approximately 25% to 35% solids by weight).
- transport stable biosolids to forest or agricultural application sites. If composting facilities are operated in conjunction with biosolids processing, only 1/3 of the biosolids will go to composting with the remaining 2/3 used for forestry application;
- mixing of organic amendments (e.g., wood chips or green waste) to dewatered biosolids to obtain mix suitable for composting;
- in-vessel composting of dewatered biosolids and amendment mix;
- on-site curing and storage of composted material[1]; and
- capture and treatment of foul air from all solids and composting processing and handling operations except part of the uncovered curing and storage, and the storage of composting amendment.

Ancillary structures in addition to the above include an administration building, garage, shops, and storage areas for the compost amendment material and dewatered biosolids before going

[1] Note, all unscreened product is held in covered areas for 20 days to allow drying for final screening. Once screened and cured the product will be removed off site or stored for up to 70 days in an uncovered paved site.

to forestry application. All processes will be covered except part of the curing and storage of biosolids and the storage of amendment.

Appurtenant equipment includes weigh scales, mixing mills, waste treatment, reclaimed water facilities and related utilities.

A breakdown of the area required for individual process components for anaerobic digestion and invessel composting are illustrated in Tables 3-3 and 3-4 in Section 3.11.

A glossary of terms used to describe biosolids processing is included in Appendix A.

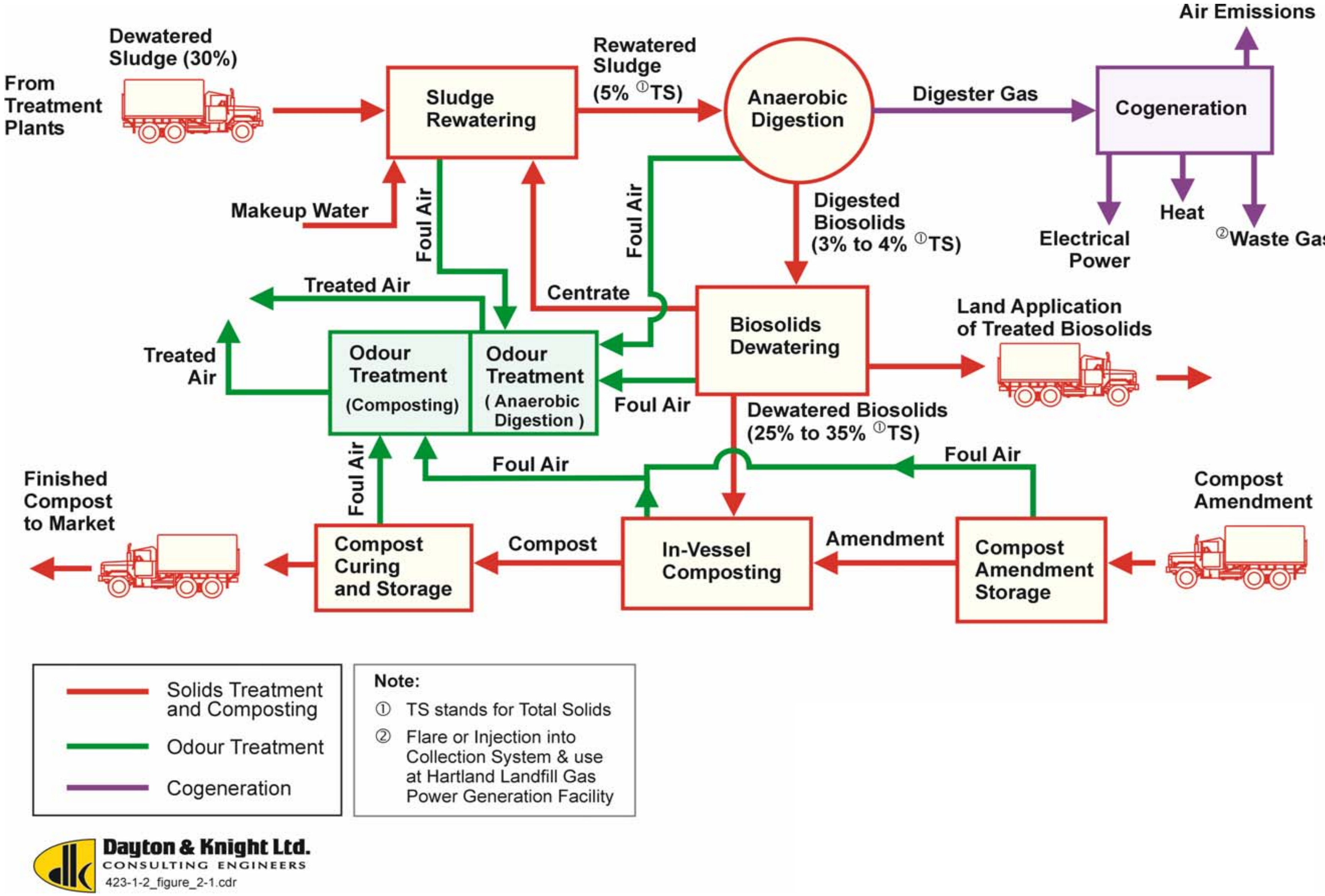


Figure 3-1 Biosolids treatment and composting process schematic.

3.4 Use of the sites for biosolids processing

Dayton & Knight Ltd. and Genesis Engineering conducted a site visit to both the Millstream site and the Hartland site on August 11, 2004. Pictures of both sites with descriptions are contained in Appendix B.

Millstream site

The Millstream site is located on Millstream Road in the District of Highlands on the northwestern margins of Greater Victoria. The area available for construction of biosolids facilities for the Millstream site excluding buffer is about 60,000 m^2 (6 ha). The width of the buffer area is 50 m measured from the site boundary inwardly as shown in Figure 3-2. Elevations of the site range from 105 m to 120 m. Currently portions of the site are used by the CRD Parks Department as a storage facility for materials such as topsoil, fill, aggregates, and timbers.

The site encompasses two properties: the western property is owned by the CRD, and the eastern property is owned by the Province. Only the CRD property is being considered for the biosolids facilities because adjacent provincial lands would not be needed to accommodate the biosolids facility. Contamination of soils, groundwater, and surface water by heavy metals and hydrocarbons has been experienced in the western portion of the site, because of past disposal of septage and industrial waste, including oily waste.

Results from a preliminary Phase I site investigation conducted by Golder Associates at the Millstream Meadows site in early 2000 and a supplementary investigation in 2001 confirmed that contamination exists on the site.

The most extensive contamination was present in the former septage lagoons. Drilling and soil sampling results showed that the thickness of fill in the lagoons generally ranges between 3 m and 14 m, with an average thickness of 7.5 m. The volume of soil in the lagoons is estimated to be 40,000 m^3 to 45,000 m^3.

The general soil stratigraphy in the upper lagoon area consists of layers of sand and gravel fill, coarse sand fill, sandy silt fill, or clayey silt fill overlying native silt till and/or bedrock.

The layout for the Millstream site is illustrated on Figure 3-2. As illustrated, this site is considered able to accommodate the process components for the proposed anaerobic digestion and composting facilities.

Due to contamination of soil in the lagoons in this site, process components that require extensive excavation to construct below grade substructure (i.e. digesters) were located away from the lagoons as illustrated on Figure 3-2. Components to be constructed on slab can be located in the fill areas without extensive remediation, as long as extensive excavation of contaminated soils is not involved. Some structures may need pile foundations.

Water will be supplied to the site from the existing water supply system in the area for on site facilities. We have assumed a new watermain will be constructed from the water system to the site. Sanitary sewage from the site will be pumped to a sewer collection system for treatment. If these options prove too costly, onsite provision of water wells and waste treatment will be explored.

No services are currently available on the site. Water and sewer presently stop at the Bear Mountain Parkway and Millstream Road. The Millstream site is inside the regional service area and is likely to be serviced before the treatment facility is constructed; otherwise, the services would have to be extended to the site. If a water supply cannot be made available and an onsite well is impractical, an offsite well will need to be investigated.

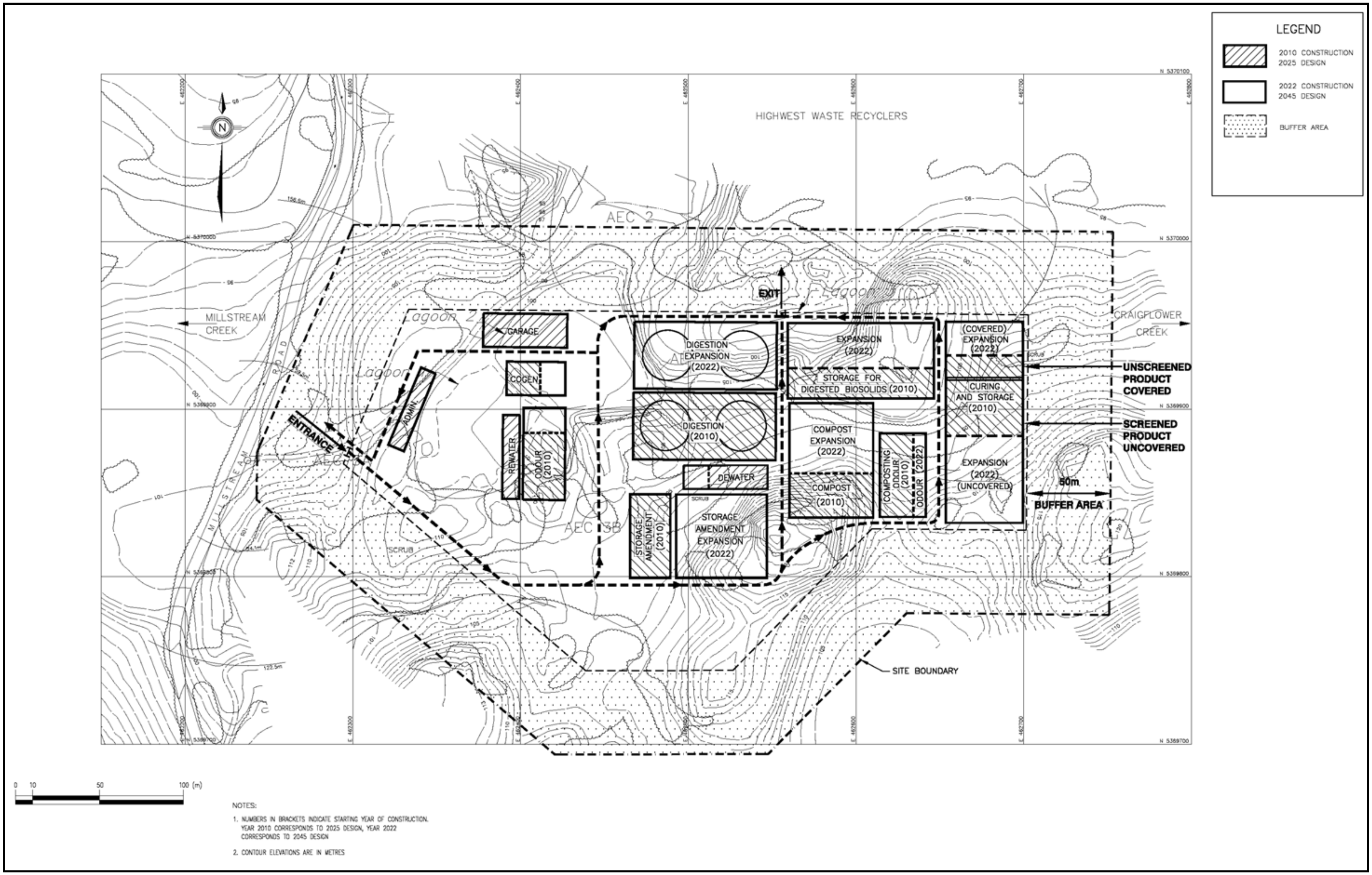


Figure 3-2 Site layout of biosolids facility at the Millstream site.

Hartland site

The Hartland site is located on the northwest portion of the Hartland landfill property and is accessed off of Willis Point Road via Wallace Drive and West Saanich Road. This site has been partially cleared and levelled. The available area for construction of biosolids processing facilities excluding buffer is about 68,000 m (6.8 ha). Approximately half of the levelled lower portion is currently used for yard and garden windrow composting. The uncleared portion of the site, the upper bench to the south, remains heavily treed and is outside of the final landfill footprint. Elevations at the site range from 160 m to 240 m.

The western portion of the compost pad on the site is comprised of rock fill underlain by peat bog sediments, in turn underlain by silty sands and gravels, and finally bedrock. The rock fill thickness is about 4.5 m. This rock fill was blasted from the eastern portion of the site. The fill was underlain by a 2.0 m thick layer of dark brown peat, which was relatively compacted. The peat is underlain by 1.2 to 3.1 m of brownish grey silty sandy gravel, which is very wet.

The layout for the Hartland site is illustrated on Figure 3-3. The site can accommodate the process components for the biosolids processing and composting facility. The CRD wishes to retain about half of the lower area for gravel storage. Due to the limited space in the site, the southwest portion of the site will then be needed for construction of facilities. Major cutting and filling to level the site is expected. There might be an opportunity to use the gravel storage area for the 2045 expansion, depending on the timing and sequence of gravel use for Hartland landfill.

Water servicing decisions would be made during the detailed design phase of the project. For this study we have assumed a water supply main will be constructed to supply water to the site coinciding with future developments to the east of the area. Alternatively, a groundwater well may be developed on the northern portion of the site, to supply both washdown and potable water to the facility should the water quality be acceptable. If a well is not suitable on site, an off site well could be found. An on-site wastewater treatment facility will be required to treat sanitary sewage. If a ground disposal field is needed, sufficient area is available on the eastern portion of the site, (within the treed buffer).

Facility and area requirements

The components and processing equipment for the proposed biosolids facility are essentially the same for both sites. The area requirements or “footprints” for both sites are summarized in Table 3-1.

The biosolids facility needed to service the Core Area population from 2010 to 2025 is roughly half of the size of the facility required to serve the region for 2025 to 2045 population. Therefore, construction will be undertaken in 2 stages: 2010 construction for 2025 design, and 2022 construction for 2045 design.

Table 3-1
Recommended area required for anaerobic digestion and invessel composting.

Year	Individual Process				Total Site	
	Anaerobic Digestion		In-vessel Composting			
	2010	2022	2010	2022	2010	2022
Area required for Process components (m^2)	11,800	18,700	11,600	21,300	17,957	33,500
Area required for buffer (m^2)	31,800	37,300	31,600	39,300	36,800	46,600
Total Area Required (m^2)	43,600	56,000	43,200	60,600	54,800	80,100

NOTE: Area requirement for 2022 include the 2010 facilities. Total site is the combination of both processes without repetition of areas for administration, garage, parking and road. In-vessel composting site reflects a facility size that handles 1/3 of the sludge production.
Area required for buffer assumes 50 m around the area required for process components.

3.5 Transportation and traffic – operations

Table 3-2 illustrates the number of trucks required for sludge and woodchips for year 2025 and 2045 designs.

Table 3-2
Operational traffic for year 2024 and 2045 design.

		2025 Design (Trucks/day)	2045 Design (Trucks/day)
a) Anaerobic digestion only	In	5-7	17-26
	Out	3	6
b) Anaerobic digestion and composting	In	6-8 (5-7 trucks for sludge; 1 truck for woodchips/amendments)	19-28 (17–26 trucks for sludge; 2 trucks for woodchips amendment)
	Out	4 (2 trucks to land spreading site, 2 trucks to market for composting)	8-9 (4 trucks to land spreading site, 4-5 trucks to market for composting)

NOTE: A 13 m^3 closed box truck is assumed for sludge transporting. A 30 m^3 container is assumed for dry solids, bulking agent and compost product

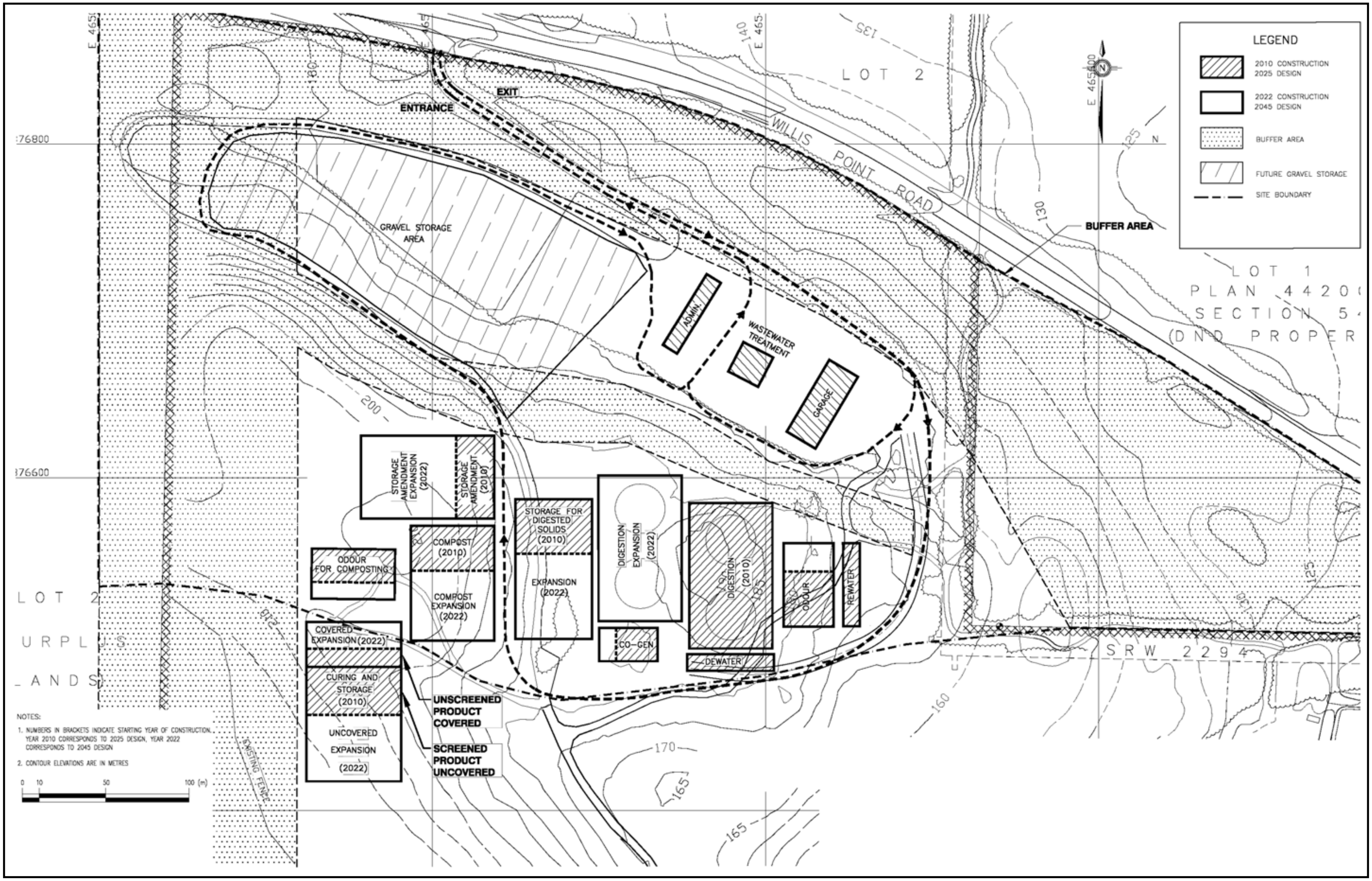


Figure 3-3 Site layout of biosolids facility at the Hartland site.

3.6 Chemicals and energy use

Chemicals

Chemicals would be largely inorganic materials such as acids, caustics, oxidizing chemicals agents and cleaning compounds that are in liquid or gaseous forms. These chemicals would be delivered on weekly or less frequent basis in small to medium sized shipments (10-20 m^3) and stored in secured areas with containment structures in the covered facilities at the locations of use.

Energy use

Facility planning would incorporate energy efficiency, BC Hydro power smart initiatives, and the applicable Leadership in Energy and Environmental Design (LEED™) standards for green buildings. This standard would be considered throughout all stages of the program.

3.7 Noise, vibration, light, and emissions

Construction phase

Noise would be similar to typical construction sites such as subdivision work for the utilities, roads, and standard block or concrete building construction practices. Trucks, excavators, cranes, scaffolding, form construction, and related activities would form the main components of noise for the construction site. Drilling and blasting would create the most noise among all the construction activities, followed by site grading. Unless otherwise permitted, the work would normally be held to an 8-hour day, Monday to Friday only.

Dust would be largely a result of dry unpaved road conditions, and would be occasionally problematic during initial road construction. Dust would also occur during excavation, blasting, and filling, but would generally be controlled with water sprays.

Other concerns would be related to onsite housekeeping and clean-up measures. Best Management Practice (BMP) guidelines would be required, and would be part of the construction specification requirements. These BMPs would include safe handling of materials, spill containment, use of hazardous waste professional on 24 hour call, safety and site management manuals. Most large contractors have safety and hazard manuals as normal operating practice. Specifications for the work would require environmental and safety precautions as a component of the work.

Tall lighting set up during construction activities might be another concern to nearby residents. Bright light and the transformer hum produced might create annoyance at night. Also, tall lighting posts could be a visual intrusion.

For the 2010 construction, parking arrangements can be made on site for either location since only half of the area is needed for the facility assuming 1 car/worker. In the 2022 design and construction off site parking may be needed but with careful planning this could be contained on site.

Operations phase

Operation of the biosolids facility would generate noise by the following equipment on site:

- air-driven pumps;
- compressors;
- blowers; and
- gas-driven diesel-operated engines.

Equipment noise levels could be 100 dB or greater. Mufflers would be installed on diesel engines to ensure that decibel levels remained below 70 dB at the property line, to meet the local municipal bylaw requirement, and to meet WCB/OSHA criteria for worker safety.

All noise-generating equipment would be installed in soundproof vaults or rooms to meet the above requirement.

Current design is unlikely to use the commercial lighting standard. The lighting is expected to follow normal residential post top lighting standards similar to those on residential streets. Where night work is required higher intensity lamps are needed. No night work requirements are anticipated at this time, however. All lighting would be directed downward and would have shields installed to prevent lighting of the night sky.

3.8 Sources of odour and odour control

For the purposes of this discussion, odour sources were classified as primary and secondary. Primary sources would be those that tend to generate strong and objectionable odours that must be contained and treated using a multi-stage process. A multi-stage process could include biological oxidation (bioscrubber tower or soil biofilter), followed by chemical oxidation (ultra violet, ozone, etc.), and a final treatment by wet or dry scrubbing (e.g. chlorine, caustics, acids, activated carbon). Secondary odour sources would be more dilute and less objectionable, and might require capture and treatment (normally using a single-stage process such as a soil biofilter), depending on site-specific factors such as the strength and nature of the odour, meteorological conditions, proximity to neighbours, etc.

Multi-stage treatment (3 stages) is needed to secure redundancy and also to recognize treatment requirements for different odours and odour concentrations. A series design is used in which a lower cost, high efficiency biological treatment is followed by a low cost channel (ozone, UV, etc.). These steps are followed by a final polishing step using wet or dry scrubbers.

The biosolids rewatering operation would be a primary source of odour, where trucks would be dumping dewatered crude solids into tanks to mix with water (recycled reject water from other unit processes with makeup water as required). Untreated sludge tends to generate strong and objectionable odours, particularly if the solids have been stored under anaerobic (unaerated) conditions. The rewatering operation would be fully enclosed in a building that uses a two-door entrance system for trucks to facilitate containment of foul air. The foul air would be piped to a dedicated multi-stage odour treatment facility along with foul air streams from other primary odour sources.

Anaerobic digestion is a fully enclosed process designed to capture off gases in a dome above the digestion tank, and as such lends itself to effective odour control. After the digester gas is scrubbed to remove corrosive sulphur compounds, the gas would be burned in the biosolids facility cogeneration engine, used as submerged combustions process at the digesters, or burned as waste gas flare, which would incinerate odorous compounds. At Hartland, the gas could be transported to the energy generation facility. The air in ancillary structures associated with the digester (e.g., pipe galleries) might contain nuisance odours and are therefore contained and treated. The anaerobic digestion and cogeneration processes would be classified as secondary odour sources.

Dewatering of digested biosolids was assumed to be accomplished using centrifuges (fully enclosed process). The stream of digested solids would be piped directly from the digester to the centrifuge, to minimize odour generation. The centrifuge facility would be housed within a fully enclosed structure, to allow capture and treatment of foul air generated by the centrate and the dewatered solids exiting the centrifuges. The centrifuge operations would be classified as a primary odour source, if thermophilic digestion is to be used.

The dewatered biosolids would be transported from the centrifuge building by a fully enclosed conveyor to the composting facility. The composting facility is the in-vessel type, with integrated mixing (e.g., rotating drum or similar). The dewatered biosolids from the centrifuge building could then be conveyed directly into the composting vessel(s), to minimize the escape of foul air. Composting would be a primary odour source, and foul air generated within the composting vessels would be routed to multi-stage treatment (i.e., capture of foul air with subsequent treatment).

Other processes would be enclosed within structures as required, to facilitate collection and treatment of foul air. Odour generation and impacts associated with the facilities are discussed later in this report.

The composting amendment would typically be wood chips or some other relatively stable bulking agent, and was not considered a source of nuisance odours.

Portions of the compost curing and storage operation would be fully enclosed, with capture and treatment of foul air. The curing piles would be considered a primary odour source during the initial curing step. Air would be drawn downward through the curing piles to an underlying pipe network, and this foul air would be routed to multi-stage treatment.

Appendix C contains general descriptions of several Pacific Northwest Wastewater Treatment Facilities that have similar treatment and odour solutions. These descriptions reveal the kinds of mitigation measures used in different plants to manage foul air problems. Information presented can serve as a reference for the CRD as to how to mitigate odour problems.

3.9 Drainage management

Current principles for low impact development and stormwater management would be employed in facility planning. Uncontaminated storm runoff from roofs of structures would be directed to infiltration facilities where site conditions allow. Parking areas and other on-grade surfaces would be constructed using permeable pavers, or the runoff from these areas would be directed to biofiltration swales or similar facilities. In general, disturbance of the natural hydrology of the site would be minimized as far as practical. Landscaping would incorporate absorbent soils and vegetation to minimize increases in site runoff due to construction of the facilities. Native vegetation would be used in landscaping to reduce irrigation demand.

A credit for stormwater management towards Leadership in Energy and Environmental Design (LEED™) certification is available if disruption of natural water flows is limited by minimizing stormwater runoff, increasing on-site infiltration, and reducing contaminants.

Further information on the credit is included in Appendix D.

3.10 Safety, security, and effects on surrounding properties

Biosolids processing facilities exist in hundreds of communities across the industrialized world, posing little or no safety or security hazard to surrounding residents. In the case of the CRD biosolids facility, the perimeter of the biosolids plant would be fenced to prevent public access to the property. Most of the biosolids processing activities conducted on the site would occur in buildings that can be secured.

The anaerobic thermophilic technology recommended for the site was selected in part because of its safety. Risk of incident associated with methane, high heat, or use of chemicals is very low. Odour control on the site requires the use of some industrial chemicals. These chemicals (which could be caustic or acidic) would be stored in secure containers in locked buildings on the site. Overall, the operation of the biosolids facility would pose no safety or security risk to the public.

During construction of the biosolids facility, standard construction site public safety measures would be in place. For instance, the public would not be allowed on site without approval of the construction manager. Hard hats, safety boots, and vests would typically be required for people on the site. Blasting conducted as part of site preparation would be undertaken by licensed, experienced, professional firms. If explosives were kept on site during the site preparation phase of the project, they would be stored under lock and key in secure containers. The site would be gated and locked at night and on weekends.

During construction or operation phases, a security firm could be employed if deemed appropriate. Security personnel could provide round-the-clock observation of the site. Contractors are often required to prepare emergency response plans to ensure quick and safe handling of accidents on the site. Contractors or facility operators are typically responsible for preparing and implementing such plans.

3.11 Likely construction activities

3.11.1 Site preparation

The area requirements for individual process components are summarized in Tables 3-3 and 3-4 for anaerobic digestion and composting respectively. Anaerobic digestion will be used first with the composting process afterwards as a value-added process. Upon built-out condition (2045 design), all process components in Tables 3–3 and 3-4 will be required without duplication of roads and paving, administration, and garage and shops. Each column represents the total area needed for the specific design year. For example about 11,800 m^2 of site area is needed for the 2010 construction for digestion and an additional 6,900 m^2 is needed for the 2022 construction, for a total of about 18,700 m^2.

Table 3-3
Area requirement for anaerobic digestion process components.

	AREA (m^2)	
CONSTRUCTION YEAR	**2010**	**2022**
Roads and Parking	4,000	5,000
Administration	500	500
Garage and Shops	1,000	1,000
Rewater and Treatment	500	500
Thickening and Dewatering	300	500
Odour Control	500	1,000
Digesters	3,000	5,625
Co-generation	500	700
Storage, 90 days	1,517	3,864
Total, m^2	**11,817**	**18,689**

NOTE: The 2022 area includes the 2010 facilities.

Table 3-4
Area requirement for composting process components.

	AREA (m^2)	
CONSTRUCTION YEAR	**2010**	**2022**
Roads and Parking	4,000	5,000
Administration	500	500
Garage and Shops	1,000	1,000
Odour	1,00	1,500
Covered Compost	1,584	3,564
Covered Curing and Storage	640	1,562
Uncovered Storage	1,558	3,913
Silos	200	300
Storage Amendment, 60 days	1,157	4,001
Total, m^2	**11,640**	**21,340**

NOTE: The 2022 area includes the 2010 facilities.

Whether the entire site is cleared or only the part needed for Phase 1, will be decided when decisions are made to proceed with the biosolids facility. For the purposes of this study, we assume that the site area required for Phase 1 and Phase 2 would both be cleared and graded initially.

3.11.2 Construction methods and scheduling

The biosolids facility needed to service the Core Area population from 2010 to 2025 is roughly half of the size of the facility needed to serve the region in 2045. Construction work would therefore be undertaken in two stages for either site. The 2025 design is anticipated to be constructed by 2013 with work starting in 2010. The 2045 design is anticipated to be in service in 2025, with work starting in 2022.

For either site, the construction period for the year 2025 design for an 18 dry tonnes per day facility would be completed in 3 years by the year 2013, assuming that the full digestion and partial invessel composting are built concurrently. Whether the work is delivered as a design-build or design-tender construction project, the time frame for construction activity would be roughly the same. Expansion of the facility to the year 2045 design would be completed in another 3 years starting in 2022.

The construction would be done in the following stages:

1. clearing and grubbing for the portion of the site for construction of facilities. This could be undertaken in the first year;
2. rough grading, road construction, site servicing, excavation and filling to prepare the site. This will be completed for both the initial and expanded phase of the facility. This stage of construction would likely be undertaken in the early part of the second year and would also include installation of foundations, and where necessary, pilings would be driven in place;
3. slabs, structures and site facilities would then be constructed, and equipment would be installed in the second year;
4. equipment would be delivered throughout the last two years of the construction period, and installed in accordance with the project management scheduling.

Different sections of the plant might be under construction in differing stages at any one time.

In today's dollars, the facility to serve the 2010 to 2025 population would cost about $53 million, and the facility to serve the 2025 to 2045 population would cost an additional $41 million for a total of $94 million. This includes the anaerobic thermophilic digestion for all of the sludge and the in vessel compost for 1/3 of the digested product. About 80% of the $53 million would be spent in the first 2 years of the program. The maximum activity would use a peak monthly labour component of about 80 to 90 workers on a daily basis. This pattern would repeat for the 2045 construction.

Labour force during construction

If one assumes the ecological "trigger" is reached by 2005, to meet the needs of the core area population in 2025, construction of the biosolids facility would be undertaken in 2010 for the $53 million program, with about 250-350 person-years of site labour needed over 3 years, assuming the labour component was about 25%-30% of the program cost. (This assumes that 40%-50% of the cost would be equipment purchase and an additional 25%-35% would be for construction materials, leaving about 25%-30% for labour). The labour required would be similar for the 2045 design work over a similar 3-year period starting 2022, if one assumes secondary treatment is required by 2025.

The 3-year construction period requires pre-design, detailed design, and permit acquisition to be undertaken prior to the inception of the construction. Clearing and grubbing will likely occur in the latter part of the first year over a 6-month period. Trucking and excavation would be the predominant activity. The following 1 to 1.5 years would include concrete foundation and building construction. The main focus of plant construction work and completion would be undertaken over the ensuing 1.5 to 2.5 year duration.

3.11.3 Volumes and kind of construction traffic

Construction traffic would include equipment and supply deliveries and site crew traffic. For 2010 construction, material, suppliers and equipment deliveries would make up about $39 million (75% of the work). Material and equipment deliveries would range from 12 m^3 concrete trucks supplying concrete placements of 10 m^3 to 200 m^3 per pour, as well as trucks delivering reinforcing steel, major equipment and general service materials.

The estimated truck traffic for concrete and granular/spoil transport during construction for the 2025 and 2045 facilities at the Millstream and Hartland sites are shown in Tables 3-5 and 3-6, respectively. Cut and fill volumes required for site preparation were estimated from topographic mapping and from the facilities plans shown on Figures 3-2 and 3-3 in Section 3.4.

The assumptions in estimating the cut and fill volumes for both sites were as follows:

- all cut and fill would be done for the construction of the 2025 design to prepare the site;
- a minimum 0.5 m cut depth for clearing and grubbing was assumed over the portion required for construction of facilities for each site;
- cut materials on site would be used as fill. Materials not reused would be materials from clearing and grubbing and contaminated soil; and

- a layer of gravel 0.3 m deep would be required to cover the cleared site.

At the Millstream site, rock outcrops were observed during the August 11 site visit on the eastern and southeastern portions of the site. All of the rock materials would be cut to level the site and was assumed to be reused as fill. Trucking required would be for clearing and grubbing materials and gravel. Cut materials from the lagoon area would not be reused and would be trucked off the site for disposal.

For the Hartland site, cut materials would be largely rock. All cut materials would be used as fill. Trucking required would be for removal of clearing and grubbing materials and for supply of gravel.

Concrete volumes were estimated assuming building height for all unit processes at 4 m, except for anaerobic digesters which were assumed to be 16 m high, of which about 8 to 10 m would be above grade. A 300 mm slab was assumed for all unit processes.

Vehicle types would include flatbed trucks, tandems, small to large delivery vehicles, cranes, excavators, and related equipment.

Table 3-5
Construction truck traffic for the Millstream site.

	Concrete	**Clearing/Grubbing and Aggregate**
No. of loads (2025)	1,100	5,000
No. of loads (2045)	1,300	0
TOTAL NO. OF LOADS	2,400	5,000

Table 3-6
Construction truck traffic for the Hartland site.

	Concrete	**Clearing/Grubbing and Aggregate**
No. of loads (2025)	1,100	5,500
No. of loads (2045)	1,300	0
TOTAL NO. OF LOADS	2,400	5,500

NOTE: For Tables 3-5 and 3-6, a volume of 10 m^3 is assumed for cut and fill dump truck and 12 m^3 for concrete truck in the estimates. A 25% adjustment factor is used to allow for contingency.

In all likelihood, a batch plant on site would provide the concrete. This would still require trucks to bring aggregate and cement, and therefore would not likely lessen total traffic significantly. Other trucks to bring reinforcing steel, equipment and general construction materials would be less than the estimated concrete truck delivery. For example, for every 100 concrete trucks, about 10 additional trucks carrying reinforcing steel would be needed.

4.0 Millstream Site

4.1 General site description and reasons for selection

Compared to other candidate biosolids facility sites in the region, the Millstream site was deemed to have several advantages:

- The site is well separated from other residential uses in the area;
- Nearby land uses are compatible with the proposed facility, particularly industrial development to the south and north, and a pending industrial zone to the east;
- Previous uses (such as a septage facility) are consistent with the proposed waste management activities of the biosolids facility;
- The District of Highlands intends the site for future industrial use;
- The site is centrally located in the region, avoiding the need for long distance transport of biosolids;
- The site is owned by the Capital Regional District;
- Topography and vegetation screen the site from other users; and
- Good road access exists from Highway 1 and Millstream Road.

The Millstream site is not without some concerns, however. For instance, the irregular topography of the site would necessitate substantial grading and filling prior to use for a biosolids facility. Site contamination resulting from past use as a septage facility could affect the future development of the Millstream site. Potential future residential development to the west of Millstream Road, particularly the Bear Mountain Highlands Neighbourhood, if approved, could bring housing closer to the biosolids site.

The Millstream site has mature coniferous vegetation around most of its perimeter, which provides a visual screen from adjacent properties. The exception is the north-central portion of this site, adjacent to the road to the Highwest Recyclers facility. Access to the site, off Millstream Road, rises relatively steeply to a bench. This bench was created by fill placed atop the old septage ponds. Weedy species, grasses, and bare ground characterize the bench. CRD Parks stores related material on the site. To the east of the bench, the site drops into a hummocky landscape of natural drainages and rocky outcrops. Nearly the entire site drains to the east, towards Thetis Lake Park. The exception is a small corner in the southwestern portion of the site that drains to the west towards Millstream Creek.

Other aspects of the Millstream site are discussed in the following sections.

4.2 Environmental and social review

4.2.1 Landforms, geology, and soils

4.2.1.1 Study methods

The landform, geological, and soil conditions on the Millstream site were determined on the basis of a review of existing reports and field inspections. No surface or subsurface testing was conducted as part of this study. The site has been extensively investigated by a variety of engineering and geology firms over the past decade.

4.2.1.2 Existing conditions

Landforms and Geology

The geology of the Millstream area is characterized by rolling to steeply sloping terrain. The candidate biosolids facility site has strong local topography, particularly in the central and eastern portions of the site. In these areas, bedrock outcrops slope steeply to small, enclosed basins and drainages. The western portion of the site has been levelled for industrial purposes. This levelled topography is primarily the result of fill that was placed over septage ponds.

Soils

Soils on the Millstream site are of the Sprucebark Soil Association. The soils occur in the coastal grand fir-western redcedar forest zone in the Nanaimo lowland physiographic subdivision. These soils develop in sandy, bouldery, or sandy-rubbly colluvial or morainal deposits. Sprucebark soils are usually less than one metre thick, overlie intrusive bedrock, and occur at elevations below 300 m. On the Millstream site, the soils are rapidly drained orthic dystric brunisols. These colluvial soils make up approximately 60 percent of the soils on the site. Somenos soils comprise an additional 30 percent of the site coverage. These gravelly sandy loams typically form in moraines. The poorly drained basins on the site feature Metchosin soils. These organic humic terric mesosols are found on approximately ten percent of the site.

4.2.1.3 Landforms, geology, and soils impacts and mitigation measures

Construction phase

Impact: Reconfiguration of Millstream site landforms. Most of the site disturbance associated with the biosolids project will occur during the construction phase. Substantial cutting and filling will occur on the site, affecting much of the presently undisturbed landscape. The extent of disturbance would not be known until completion of detailed designs for the facility. Based on the hypothetical design that forms a basis for this assessment, however, much of the building envelope would be levelled by balancing the cutting and filling within the site. The present design calls for relatively little disturbance of the existing filled area in the western portion of the site.

The landform reconfiguration will not be highly noticeable from beyond the boundaries of the site. The reconfiguration will occur only in the areas subject to construction of roads, buildings, and ancillary facilities. The largest elevation change likely to occur following construction is approximately four metres, with most changes being much less than this. These landscape changes will be permanent and irreversible. Their extent will include most of the building envelope on the site, and the impact will begin with site preparation for the biosolids facility. Considering the Millstream site in the context of the surrounding properties, the magnitude of landscape change is considered moderate. Because a relatively small area will be affected, the grade changes will be less than four metres, and the overall appearance of the local area will not be affected, this impact is considered to be **less than significant**.

Mitigation: No mitigation is required for this impact.

Impact: Removal of soil. Prior to grading, topsoils from the area to the east of the existing fill will be stripped and stockpiled. Due to the shallowness of most of the soils, the volumes of soil affected are not expected to be large. Sprucebark soils are generally considered to be forest soils, and are not highly productive. Metchosin soils can be commercially productive, but their extent on the Millstream site is quite limited (10 percent of the site or less). Following construction, the stockpiled soils will be used in landscaping of the property, so they will not actually be removed from the site, but rather relocated. Damage to soil structure and productivity typically accompanies such soil handling, but soil quality recovers after several years.

The spatial extent of the soil impact is considered local, being limited to the area of the building envelope. The duration of the impact will last as long as facility construction (1-1/2 to 3 years) plus several years to recover soil productivity, and so is considered moderate term. Although the total volume of soil affected by construction is not yet known, these Millstream soils are typically shallow and so the magnitude is considered moderate. Because the soils will be reused on the site following construction, the impact is considered reversible, though the area on which soils will be replaced will be smaller than the existing area. Considered in the context of the local area, the relatively low productivity, and the small area affected by construction leads to a conclusion that the impact of construction on soils will be **less than significant**.

> ***Mitigation:*** Careful removal and stockpiling of soil prior to construction would allow it to be spread on the site later. Protection of the soil against erosion or contamination by chemicals or noxious weeds would improve its value when spread on the site following construction.

Impact: Potential increase in erosion and sedimentation. During construction, vegetation will be cleared and grubbed from the building envelope. Following this step, soils will be stripped and stockpiled. During both of these intervals, the occurrence of heavy rainfall could lead to increased erosion. Today's typical construction practices include minimizing soil exposure to rainfall by covering or reseeding during the construction period. The two-year construction interval suggests that seeding stockpiles with quick-growing grasses could be the most effective way to minimize erosion. The sprucebark soils are typically coarse and well-drained, characteristics that do not contribute to high rates of erodibility. The humic Metchosin soils, too, are not highly prone to erosion, although the organic matter in the soil oxidizes and the soils deflate if the soil is not kept moist.

The spatial extent of the erosion risk is limited to the areas where soils would be exposed to rainfall, where stockpiles are located, and where active excavation is occurring on the site. The duration of the impact will extend from the clearing and grubbing stage to the establishment of vegetation in newly landscaped areas, a moderate term of up to four years. Erosion and sedimentation impacts are typically reversible, through revegetation of depositional areas, and re-establishment of soil in eroded areas. The magnitude of the erosion and sedimentation risk on the Millstream property is considered low, as long as standard construction practices are followed. The relatively small spatial extent of the erosion and sedimentation risk, the relatively small volume of soil affected, and the temporary nature of the soil disturbance leads to a rating of **less than significant**.

> ***Mitigation****:* The erosion and sedimentation risk can be reduced further by taking the following actions:

- Preparing and implementing an erosion and sediment control plan prior to construction.
- Covering stockpiles of soils with tarps if heavy rain is anticipated.
- Seeding stockpiled soils with fast-growing grasses to provide moderate-term protection against erosion and sedimentation.
- Making good use of sediment fences, straw bales, etc. during soil stripping and site levelling activities, to prevent sediments from leaving the site.
- Ensuring the full reuse of stockpiled soils during site landscaping.
- Using an "avoidance and control" approach to preventing erosion and sedimentation rather than responding to an event after it has occurred.
- Having an environmental monitor onsite during soil stripping, stockpiling, and extensive land levelling activities. The monitor should inform construction staff about erosion and sediment control, and stockpile a supply of erosion control materials onsite.

Operations phase

Impact: Landform and geology effects. Following the end of construction and the onset of operation of the biosolids facility, no additional impacts on the landforms or geology of the Millstream site are expected. This impact is considered **less than significant.**

Mitigation: No mitigation is required for this impact.

Impact: Erosion and sedimentation risk during operation. Any risk of erosion or sedimentation during biosolids facility operation would be the result of heavy rainfall on exposed soils. Once landscaping has matured, these events should be relatively uncommon. Any steep grades topped with soil would remain liable to erosion following completion of construction until full vegetation cover is restored. In the absence of detailed designs, the extent of such erosion risks cannot be estimated.

If standard facility design and construction practices are followed, the area subject to erosion and sedimentation risk during operation is considered to be relatively small. The duration of such risk should be highest during the period following the end of construction, and decline thereafter as vegetation matures. During construction of the Phase II expansion of the biosolids facility, some additional soil exposure and erosion risk could be expected. This impact would be considered an extension of the construction related impacts. Erosion and sedimentation from operations are considered to be local in extent and reversible. The magnitude is considered to be low and the impact **less than significant**.

Mitigation: To ensure that operational erosion and sedimentation impacts remain less than significant, the following actions could be taken:

- Maintain a stock of erosion control materials onsite (straw bales, erosion fences, etc.).
- Minimize areas of steep fill around the facility where soils are exposed to rainfall. Terraces should be created to minimize erosion on long, steep slopes.
- Use dense plantings of native vegetation to ensure good coverage of bare soils, thereby reducing erosion risk.

4.2.1.4 Cumulative effects assessment – Landforms, geology, and soils

Urban development and industrial activity in the vicinity of the Millstream site has resulted in removal of substantial areas of native vegetation and has exposed soil to erosion. A long history of logging in the area has created a network of logging roads, and periodic removal of forest cover. In recent decades, the operation of rock quarries and gravel operations (such as those just to the south of the Millstream site on Industrial Way) have increased erosion risk. Construction and operation of the biosolids facility at the Millstream site would make a **less than significant** contribution to the cumulative impact on erosion and sedimentation risk in the local area.

In terms of landscape change, nothing on the Millstream site can compare with the substantial reconfiguration of the landscape that has occurred along Bear Mountain Parkway and at Western Speedway. The relatively limited extent and degree of landscape change that would occur at the proposed Millstream biosolids facility constitutes a **less than significant** addition to the cumulative effects of human activity on landscape and geology change in the area.

4.2.2 Hydrology and water quality

4.2.2.1 Study methods

The hydrology and water quality conditions on the Millstream site were determined on the basis of a review of existing reports and field inspections. No surface or subsurface testing was conducted as part of this study.

4.2.2.2 Existing conditions

Surface water

Surface water drainage at the site is generally to the west, north, and east from the central portion of the site, which forms a local topographical high. The site drains to an unnamed creek located to the northeast of the site and west to Millstream Creek, which in turn drains into the Esquimalt Harbour.

The site is characterized by intermittent water features such as seeps, rivulets, or small, localized wetlands. Several seasonal watercourses appear during the winter months and traverse the site toward the southeast. A small wetland located near the centre of the site is present during the fall, winter and spring months but dries up completely in the summer. A small seepage, possibly a vernal pool, is located in the southeast corner of the site and a larger seepage area in the southern portion of the site. A red alder–willow wetland system crosses the site from southwest to northeast. This system is connected to a drainage that runs northeast through the site and drains into a wetland to the north of the site, on the north side of the road that accesses Highwest Waste Recyclers. Another wetland is located to the southeast of the Millstream site.

To date, three groups have conducted surface water investigations at the Millstream site: AGRA Earth & Environmental Ltd. (AGRA), Reid Crowther & Partners Ltd. (RCPL), and Golder Associates Ltd. Eleven surface water sampling sites, shown on Figure 4-1, have been monitored for metals, general inorganic parameters and hydrocarbons. With the exception of the concentration of zinc at SS-2, the concentrations of all parameters measured in the surface water samples were below the CSR AW[2] standards. The zinc detected at SS-2 was believed to be related to the presence of elevated concentrations of zinc in soil in this area, and not indicative of groundwater or surface water contamination. (Golder Associates Ltd., 2000)

Groundwater

Groundwater is water that flows or seeps downward and saturates soil or rock, and also may supply springs and wells. Groundwater flow zones of interest at the Millstream site include:

- shallow groundwater flow in the fill and overburden layer,
- groundwater flow in the shallow bedrock, and
- regional groundwater flow in the deep bedrock.

[2] Contaminated Sites Regulation freshwater Aquatic Quality

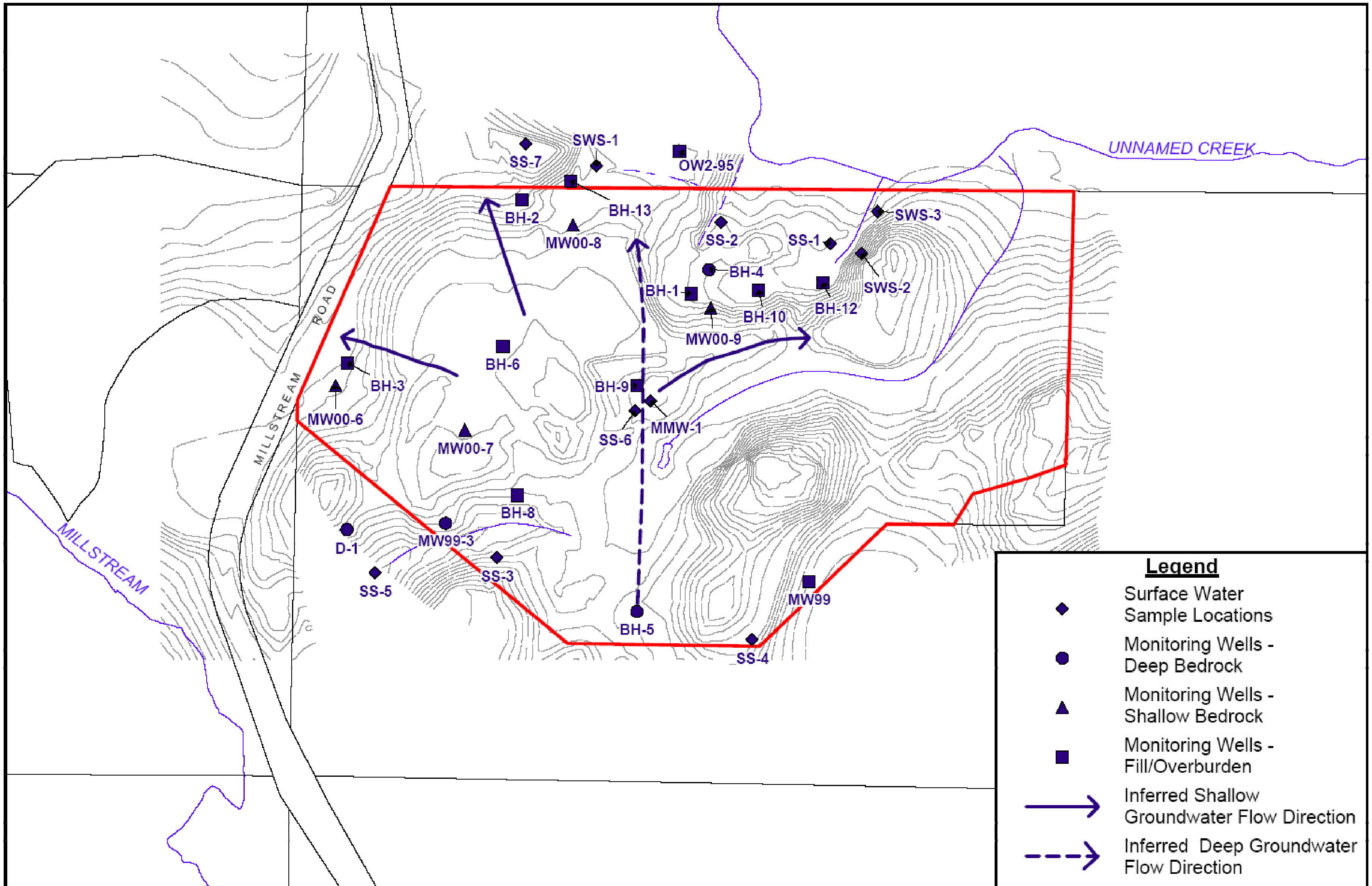


FIGURE 4-1
GROUNDWATER AND SURFACE WATER SAMPLE LOCATIONS AT THE MILLSTREAM SITE

N

0 10 50 100 m

Scale 1 : 3,500

September 2004

Eleven wells in the fill and overburden layer, four wells in the shallow bedrock zone, and four wells in the deep bedrock zone have been monitored by AGRA, RCPL, and Golder for water level, hydraulic conductivity, interpretation of groundwater flow, and assessment of groundwater quality. The monitoring well locations are shown in Figure 4-1.

The inferred groundwater flow directions in the fill and overburden layer appear to radiate outward towards the west, north, and east from the local topographical high at the centre of the site. A groundwater divide, which separates northerly groundwater flow from southerly groundwater flow, is believed to be located along the topographical ridgeline located at the southwest corner of the site.

The topographical high is also thought to be the area of highest potential for groundwater infiltration. Approximately 5% ($5m^3$/day) of the total infiltration in this area is anticipated to recharge to the regional (deep) groundwater system. Shallow groundwater that does not enter the regional system is anticipated to discharge locally in low areas of the site or return to the atmosphere via evapotranspiration.

Groundwater velocity is determined based on the hydraulic conductivity, or the rate at which water can flow through a permeable medium, the hydraulic gradient, or the slope of the water table or aquifer, and the effective porosity, or the portion of pore space in saturated permeable material where the movement of water takes place. The hydraulic conductivity, gradient, and porosity of the fill and overburden layer are estimated to be 5×10^{-6} m/s, 0.05 m/m, and 0.3, respectively. The groundwater velocity is 26 m/year. Seasonally, water table fluctuations on the order of 1.5 m have been observed in the fill and overburden layer, although the groundwater flow direction in this layer is anticipated to remain relatively constant throughout the year.

Groundwater flow in the shallow bedrock zone also appears to radiate outward towards the west, north, and east from the local topographical high at the centre of the site. The hydraulic conductivity of this unit is estimated to be 2×10^{-6} m/s, the gradient 2×10^{-6}, and the porosity 0.05. The linear groundwater velocity in the shallow bedrock layer is estimated to range from 75 to 100 m/year. Seasonally, water table fluctuations within the shallow bedrock are anticipated to be on the order of 2 m or more. The groundwater flow direction within the bedrock is anticipated to remain relatively constant throughout the year.

The inferred groundwater flow direction in the deep regional bedrock zone is from south to north. The hydraulic conductivity, gradient, and porosity of the fill and overburden layer are estimated to be 5×10^{-8} m/s, 0.05 m/m, and 1×10^{-3}, respectively. The groundwater velocity is estimated to be 79 m/year.

Groundwater quality has been assessed at the monitoring wells. The tested parameters include metals, general inorganic parameters (total dissolved solids, bicarbonate, nitrate, etc.), and hydrocarbons. The results of testing indicate that contaminated groundwater appears to be restricted to the vicinity of the former septage Lagoons 1 and 2. With the exception of wells MW00-07, MW00-08, and BH-1, which are located immediately adjacent to or in the former lagoon areas, contaminant levels in groundwater samples taken at all monitoring wells were below the CSR AW and CSR DW[3] standards. (Golder Associates Ltd., 2000)

4.2.2.3 Hydrology and water quality impacts and mitigation measures

Construction phase

Impact: Changes in flow regime, drainage patterns, infiltration rates and stormwater runoff. Potential impacts to drainage features in the footprint of the site could result from physical alterations of the channels or encroachment of new construction into the drainage features. Clearing and grubbing of vegetation and levelling and grading of site slopes could result in changes to stormwater runoff patterns and flows during construction.

The site design layout provided by Dayton & Knight indicates that the red alder-willow wetland system would be affected by the 2010 storage amendment and 2022 storage amendment expansion buildings, the dewater building, the southeast corner of the 2010 digestion structure, the 2010 compost structure, and the 2010 curing and storage and 2024 curing and storage expansion buildings. The 2010 digestion facility would be built on top of the wetland in the centre of the property. The remaining seepages are located in the buffer zone and would not be affected by construction of the facility.

Considering the Millstream site in the context of the surrounding properties, the magnitude of changes to the hydrology is considered moderate. Impacts would be local in extent and long-term in duration. The project description provided by Dayton & Knight calls for the use of “low impact” drainage management techniques. If these techniques are fully and effectively used, the construction impact to flows and infiltration would be **less than significant.**

[3] Contaminated Sites Regulation Drinking Water Quality

Mitigation: To ensure that impacts from physical alterations to natural drainage channels and wetlands remain less than significant, the following actions should be taken:

- Minimize disturbance of the natural hydrology of the site as far as practical.
- Implement a drainage management plan prior to construction that identifies sensitive or potential problem areas and provides a strategy for dealing with them. Such a strategy should describe planned stormwater runoff controls.

Impact: Discharges to surface water and groundwater. Temporary construction activities can create the potential for discharges to surface water and groundwater, with the consequent risk of pollution. The main sources of potentially polluting discharges are:

- leakages and spills of fuels and lubricants from vehicles;
- runoff from operations such as concrete placement; and
- runoff of turbid surface water as a result of topsoil removal and excavation.

Any potentially polluting discharges will be dealt with immediately to ensure these impacts are local in extent, short-term in duration, and moderate in magnitude. No contaminants are expected to reach the unnamed creek to the north of the site, Millstream Creek, or Upper and Lower Thetis Lakes. The lack of sensitive receiving areas on-site for contaminants, and the proposed commitment to immediate containment and clean up of polluting discharges leads to a rating of **less than significant.**

Mitigation: To ensure that impacts of discharges to groundwater during the construction phase are less than significant, the following actions should be taken:

- Develop and implement stormwater best management practices (BMPs) pertaining to hazardous materials handling, waste management and general housekeeping procedures.
- Ensure all equipment used on-site is well maintained and free of fluid leaks.
- Prepare an Emergency Response Plan (ERP) that includes spill prevention and contingency planning.
- Include the ERP in the project orientation and safety meetings and train project personnel in spill response and reporting.
- Ensure the ERP is readily available at the work site, and all emergency response materials and equipment are on-site and readily available for immediate use.

- Implement a water quality monitoring program during construction to ensure acceptable water quality is maintained.

Impact: Potential increase in erosion and sedimentation in surface water. Stripping and stockpiling of soils will follow clearing and grubbing of vegetation prior to construction. Exposure of soil to heavy rainfall could lead to erosion and sedimentation of surface water and groundwater. Covering or reseeding of soil stockpiles during the construction period reduces erosion risk. Reseeding with grasses during the two-year construction period could effectively minimize erosion.

The spatial extent of the erosion risk is limited to the areas where soils would be exposed to rainfall, mainly soil stockpiles and exposed cut and fill areas. The duration of the impact would last from vegetation clearing to the establishment of vegetation in re-seeded or landscaped areas, a moderate term of up to four years. Erosion and sedimentation impacts are typically reversible, through revegetation of depositional and eroded areas. The lack of sensitive depositional areas for sediments on the Millstream site, the relatively small area subject to erosion and sedimentation risk, the small volume of soil affected, and the temporary nature of the soil disturbance leads to a rating of **less than significant**.

Mitigation: Taking the following actions can reduce the erosion and sedimentation risk further:

- Prepare and implement an erosion and sediment control plan prior to construction.
- Cover stockpiles of soils with tarps if heavy rain is anticipated.
- Seed stockpiled soils with fast-growing grasses to provide moderate-term protection against erosion and sedimentation.
- Make good use of sediment fences, straw bales, etc. during soil stripping and site levelling activities, to prevent sediments from leaving the site.
- Use an "avoidance and control" approach to preventing erosion and sedimentation rather than responding to an event after it has occurred.
- Have an environmental monitor on-site during soil stripping, stockpiling, and extensive land levelling activities. The monitor should inform construction staff about erosion and sediment control, and maintain a supply of erosion control materials on-site.

Impact: Changes in quantity or flow of groundwater. Where extensive subsurface structures form a barrier to horizontal groundwater flow through an aquifer, a damming effect may occur. Groundwater levels may rise on the upstream side of the structure, and be lowered on the downstream side. Cuts and excavations may intercept the aquifer and change groundwater flow patterns.

A portion of the digestion tanks will be constructed below ground, but the cylindrical nature of the tanks will not impede groundwater flow. The extent of cuts and excavations would not be known until completion of detailed designs for the facility. The construction of the facility is expected to have no affect on the quantity or flow of groundwater in the area because no structure will fully interrupt the aquifer and cutting and filling will be done in a relatively small area in proportion to the size of the aquifer. Any impacts on groundwater are expected to be local in nature and low in magnitude. The impact is considered to be **less than significant**.

Mitigation: None required.

Operations phase

Impact: Changes in flow regime, drainage patterns, infiltration rates and stormwater runoff. Stormwater runoff flows may increase due to clearing of vegetation and an increase in impervious surfaces. Infiltration rates may also be reduced. The low impact design proposed for the facility would minimize stormwater runoff from the site and increase on-site infiltration by using pervious materials. Drainage flows and patterns are not expected to change in the unnamed creek to the north of the site, in Millstream Creek, or in Craigflower Creek. The local nature of the impact and the implementation of "low impact" drainage management techniques leads to a rating of **less than significant.**

Mitigation: To ensure that operational stormwater runoff impacts remain less than significant, the following actions should be taken:

- Direct uncontaminated stormwater runoff from the roofs of structures to infiltration facilities where site conditions allow.
- Construct parking areas and other on-grade surfaces using permeable pavers, or direct the runoff from these areas to biofiltration swales or similar facilities.
- Use captured and stored stormwater for non-potable uses such as landscape irrigation, toilet and urinal flushing, washdown water for the site, and other custodial uses.
- Incorporate absorbent soils and vegetation into landscaping to minimize increases in site runoff.

Impact: Erosion and sedimentation risk during operation. Heavy rainfall on exposed soils can increase erosion risk and sedimentation of surface and groundwater. This risk is greatly reduced under established vegetative cover. The extent of post-construction erosion risks cannot be estimated until detailed designs are prepared.

Under typical facility design and construction practices, the area of exposed soils subject to erosion during operation is considered to be relatively small. The duration of such risk would be highest during the interval between the end of construction and establishment of vegetation. Some additional soil exposure and erosion risk could be expected during construction of the expanded biosolids facility, although this should be considered a construction impact. Erosion and sedimentation from operations are considered to be local in extent and reversible. The magnitude is considered to be low and the impact **less than significant**.

> ***Mitigation:*** To ensure that operational erosion and sedimentation impacts remain less than significant, the following actions could be taken:
>
> - Maintain a stock of erosion control materials on-site (straw bales, erosion fences, etc.).
> - Minimize areas of steep fill around the facility where soils are exposed to rainfall.
> - Use dense plantings of native vegetation to ensure good coverage of bare soils, thereby reducing erosion risk.

Impact: Discharges to surface water and groundwater. Inorganic materials such as acids, caustics, oxidizing agents and cleaning compounds that are in liquid or gaseous forms will be stored on-site in secured areas with containment structures. Discharges to surface water or groundwater are not expected to occur. An Emergency Response Plan should be implemented in case of a spill during transport of the chemicals or leakage from the containment structures occurs. Because chemicals will be stored on-site and an Emergency Response Plan will be implemented the impact is considered to be local, short-term in duration, and low in magnitude, leading to a rating of **less than significant.**

> ***Mitigation:*** To ensure that impacts from discharges to surface water and groundwater remain less than significant, the following actions could be taken:
>
> - Prepare an Emergency Response Plan (ERP) that includes spill prevention and contingency planning.
> - Ensure project personnel are informed about the ERP at the project orientation and safety meetings.

- Ensure the ERP is readily available at the work site, and all emergency response materials and equipment will be on-site and readily available for immediate use.
- Implement a water quality monitoring program to ensure acceptable water quality is maintained.

4.2.2.4 Cumulative effects assessment – Hydrology and water quality

The following projects and activities were identified as potentially contributing to cumulative effects on hydrology and water quality at and near the Millstream site:

- changes in flow regime, drainage patterns, infiltration rates and stormwater runoff as a result of the construction and operation of Millstream Road, residential development in the area, and operation of the Millstream Industrial Park;
- channelization of streams in rural and suburban residential areas;
- operation of the landfill on Highwest Waste Recyclers property adjacent (north) to the site;
- historical disposal of waste at the site, including appliances, automobile parts and miscellaneous household debris;
- historical disposal of septage and other trucked liquid wastes in the former lagoon areas on the site; and
- former Hypo Bio Gas and Oil Refinery, located immediately south of the site.

The relatively small area of disturbance and commitment to low impact design and operation mean that the biosolids facility's contribution to cumulative effects on hydrology and water quality would be **less than significant**.

4.2.3 Plant life

4.2.3.1 Study methods

Vegetation resources at the Millstream site were assessed following a review of the published literature and a reconnaissance survey. The reconnaissance survey was conducted at the Millstream site on August 11 and August 31, 2004. The objectives of the survey were to:

- Identify special site features, including specialized habitats,
- Determine dominant tree, shrub and herb species,
- Identify plant communities that are at risk, and

- Locate the plant communities at the site in relation to the proposed biosolids facility locations.

A complete rare plant survey was not conducted because many rare species are only visible in the spring and early summer.

4.2.3.2 Existing conditions

The Millstream site is located in the Nanaimo Lowlands ecosection and the Coastal Douglas Fir moist maritime (CDFmm) biogeoclimatic subzone. The CDFmm is one of the most restricted ecosystems in Canada and is confined to the low elevations along southeastern Vancouver Island, the Gulf Islands, and a very narrow strip of the lower mainland. This zone contains a unique assemblage of plant communities and some of the most endangered plant species in British Columbia. Almost all identified plant communities are considered provincially endangered or threatened (red-list) or of special concern (blue-list) because they commonly occur in areas with high development pressure.

A significant proportion of the native vegetation at the Millstream site has been disturbed by past logging and industrial use, and industrial activities are occurring to the north and south of the site. Approximately one-half of the candidate biosolids site is highly disturbed and covered with a mix of non-native and invasive species, including Canada thistle (*Cirsium arvense*), Scotch broom (*Cytisum scoparius*), Himalayan blackberry (*Rubus discolor*), scentless chamomile (*Matricaria perforata* var. *Merat*) and coast tarweed (*Madia sativa* var. *Molina*) (Photo 4-1). Approximately one-half of the proposed biosolids building sites are located in the heavily disturbed portion of this site (Photo 4-2).

Photo 4-1 Large patch of Himalayan blackberry on the disturbed northern section of the Millstream site. The blackberry patch is the proposed location of 2024 digestion facility expansion.

Photo 4-2 The proposed location for the 2010 digestion facility is a wet depression that is dominated by weedy vegetation. Note the rock outcrops covered by Arbutus in the centre – back of the photo. A small patch of Douglas-fir – dull Oregon grape forest is behind the rock outcrops.

The remainder of the site contains a mix of second growth Douglas-fir forests, open Arbutus woodlands (including vegetated rock outcrops), and wetland complexes. The natural areas occur on the west, south, and east sides of the site. There is an old road network and numerous dumpsites throughout the natural habitats and in general, the plant communities are in fair to poor condition because they contain a number of weedy species.

There are four main natural plant communities at the Millstream site: Douglas-fir–Arbutus woodlands, Douglas-fir–dull Oregon grape forests, Douglas-fir–Lodgepole pine–Arbutus forests, and Black cottonwood–willow wetlands (Table 4-1 and Figure 4.2).

Table 4-1
Natural plant communities located at the Millstream site.

Common Name	Scientific name	Biogeoclimatic subzone and variant	Species at Risk Designation (provincial status)
Douglas-fir - Arbutus	*Pseudotsuga menziesii - Arbutus menziesii*	CDFmm00	RED
Douglas-fir – Dull Oregon grape	*Pseudotsuga menziesii – Mahonia nervosa*	CDFmm01	RED
Douglas-fir – Lodgepole pine – Arbutus	*Pseudotsuga menziesii – Pinus contorta – Arbutus menziesii*	CDFmm02	BLUE
Black cottonwood – Willow	*Populus balsamifera ssp. trichocarpa – Salix sp*	CDFmm09	Not Listed

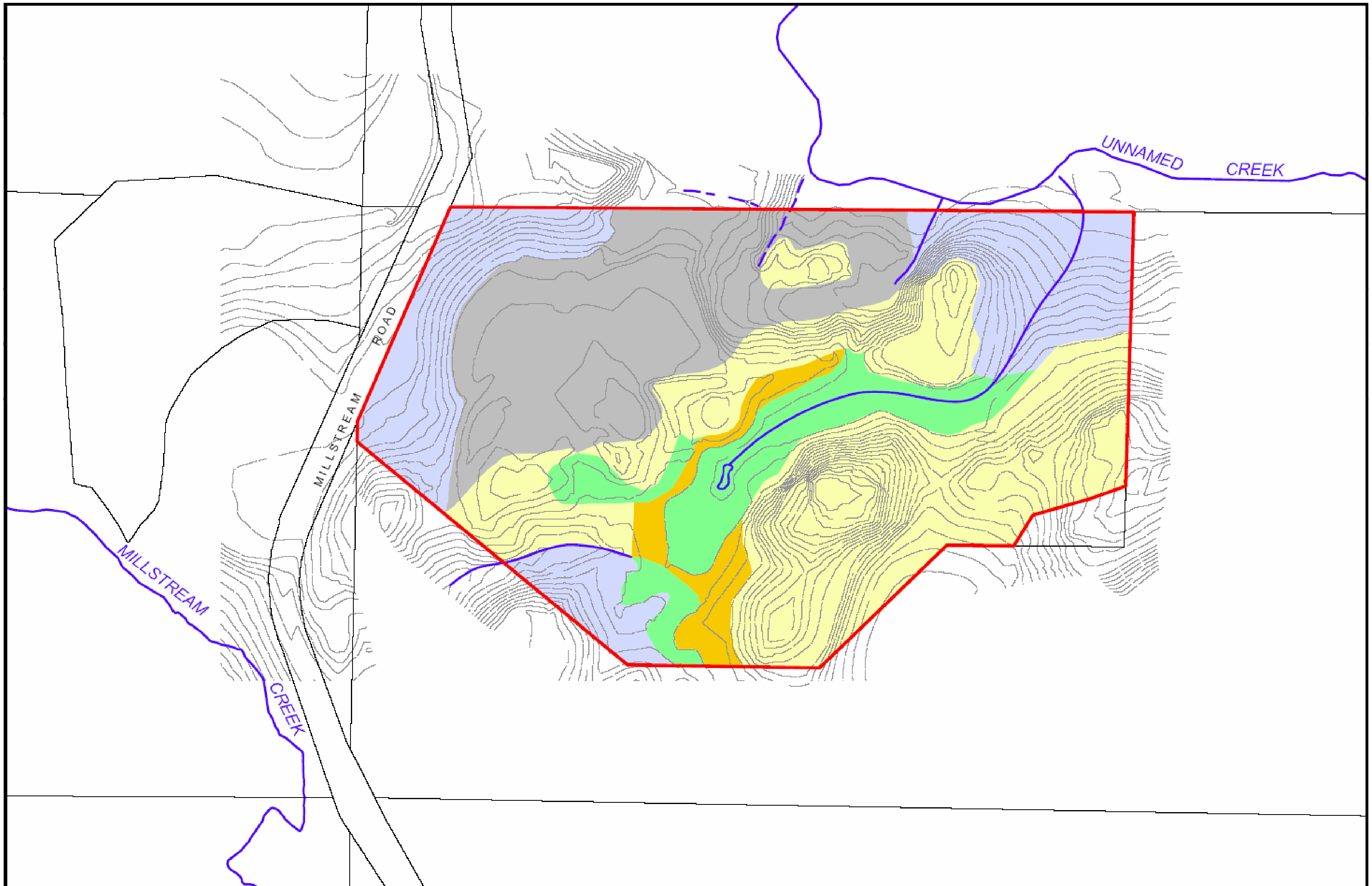
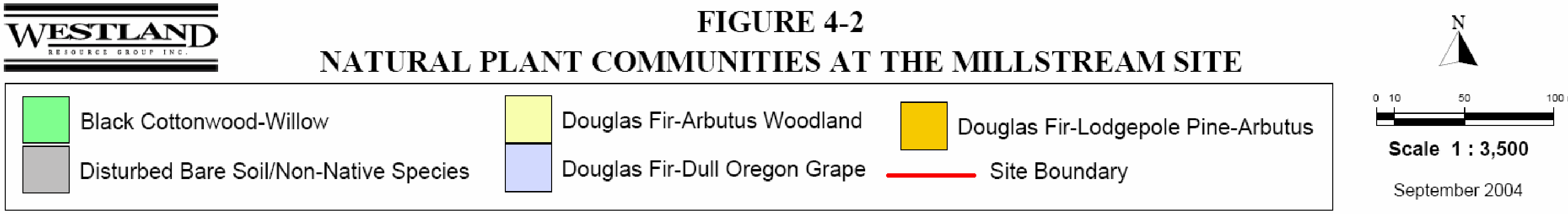


FIGURE 4-2
NATURAL PLANT COMMUNITIES AT THE MILLSTREAM SITE



Douglas fir – Arbutus open woodland accounts for approximately 25% of the natural communities at the Millstream site. The woodland covers the rock outcrops scattered throughout the disturbed central portion of the site, and is also found in the west, southwest, and southeast sections of the site. Biosolids facilities that would affect this community include:

- The proposed road to the west of the site,
- 2010 rewater and odour facility,
- Dewater facility,
- 2010 and 2022 odour facility associated with composting, and
- A large portion of the 2010 and 2022 curing and storage facilities.

The Douglas-fir-Arbutus plant community is dominated by Douglas-fir and Arbutus, the occasional Lodgepole or shore pine (*Pinus contorta)* and a well developed shrub layer that is dominated by oceanspray (*Holodiscus discolor*) (Photo 4-3). Garry oak (*Quercus garryana*) may occupy canopy gaps, but only three Garry oaks, all immature, were seen during the site assessment. The tallest Garry oak was approximately 2.5-m in height and the other two were less than 1-m tall.

Photo 4-3 The open canopy structure common to Douglas-fir – Arbutus woodlands. This area will be impacted by the 2010 curing and storage facility.

Common shrubs and herbs that occur in the Douglas-fir-arbutus community include:

- snowberry (*Symphoricarpos albus)*,
- Dull and tall Oregon-grape (*Mahonia nervosa and M.aquifolium,* respectively*),*
- baldhip rose (*Rosa gymnocarpa),*
- saskatoon (*Amelanchier alnifolia),*
- salal *(Gaultheria shallon*), hairy honeysuckle *(Lonicera hispidula),*
- western fescue (*Festuca occidentalis),*
- blue wildrye *(Elymus glaucus),*
- California and Columbia bromes (*Bromus carinatus and B. vulgaris,* respectively),
- swordfern (*Polystichum munitum),*
- broad-leaved stonecrop *(Sedum spathulifolium),*
- Pacific sanicle *(Sanicula crassicaulis),*
- sea blush *(Plectritis congesta)* and
- white hawkweed (*Hieracium albiflorum*).

Mosses are common on the rock outcrops and include grey rock moss (*Racomitrium canescens*), broom moss (Dicranum scoparium) and Oregon beaked-moss (*Eurhynchium oreganum)*.

The rock outcrops in the Douglas-fir–Arbutus woodland are sensitive ecosystems. The communities contain numerous specialized microhabitats, such as vernal pools, and occur in close association with other ecosystems, such as woodlands or older forests, factors that contribute to very high biodiversity. These plant communities are vulnerable to human disturbance (Photo 4-4). Thetis Lake Regional Park is a neighboring area that contains many examples of the terrestrial herbaceous rock-outcrop ecosystems.

Photo 4-4 Rocky knolls dominated by Arbutus and oceanspray on the south side of the Millstream site in the vicinity of the 2010 rewater and odour control facility.

The rock outcrops in the southeast corner of the site, primarily the vegetated buffer and the southern portion of the 2010 curing and storage facility, were designated a sensitive ecosystem (terrestrial herbaceous–rock outcrop and woodland) in the Sensitive Ecosystems Inventory for Eastern Vancouver Island and the Gulf Islands (1998). This area is in good condition, with little disturbance and few weeds. Other examples of this rare community occur at the Millstream site, but the sites are in fair to poor condition because they have been affected by past use and contain several weedy species, including Scotch broom, spurge laurel (*Daphne laureola),* gorse *(Ulex europaeus)* and western St. John's-wort (*Hypericum formosum*).

Douglas-fir – Dull Oregon grape forest community covers approximately 10% of the site and is located in the vegetated buffer in the northwest and northeast corners of the site. Portions of the 2022 curing and storage facility are in this ecosystem.

The Douglas-fir–Dull Oregon grape forest is dominated by Douglas-fir, western redcedar (*Thuja plicata*), and grand fir (*Abies grandis*). These forests have a dense tree cover, and understory species are sparse. The forested areas of the Millstream site contain a few large old Douglas-fir, with diameters greater than 60-cm (Photo 4-5). Shrubs that are found in these systems include salal (*Gaultheria shallon*), Dull Oregon-grape, ocean spray, and baldhip rose (*Rosa gymnocarpa*). Mosses are plentiful and include Oregon beaked moss, step moss (*Hylocomium splendens),* and electrified cat's tail moss (*Rhytidiadelphus triquetrus*).

Photo 4-5 A large old Douglas-fir in the Douglas-fir – dull Oregon grape forest on the east side of the Millstream site. This tree will be impacted by the 2024 Curing and Storage expansion.

The Douglas-fir–Dull Oregon grape forest was a common ecosystem at low elevations on Eastern Vancouver Island. The community is now seriously depleted throughout its range because of continued harvesting and development.

Douglas-fir – Lodgepole pine – Arbutus forested community is limited to approximately 5% of the site. It is concentrated in the south and southeast and will be affected by the 2022 storage amendment expansion facility and 2010 compost facility. This community is similar to the Douglas-fir–Arbutus woodland community, except that the tree canopy is denser than the woodland community and lodgepole pine is a more dominant species. Ocean spray, Dull Oregon grape, baldhip rose and common snowberry are the primary understory species (Photo 4-6).

Photo 4-6 The Douglas-fir – Lodgepole pine – Arbutus plant community in the southern area of the Millstream site. This community will be impacted by the 2024 storage amendment expansion.

Black cottonwood – willow wetland complex: Several seepage sites and swamp systems occur throughout the candidate site. It is estimated that approximately 10% of the natural communities at the site are flooded annually. Seepage areas are located between several of the rock outcrops that occur in the disturbed central portion of the site and larger, more contiguous wetland complexes occur in the south–central and southeastern sections of the site. Biosolids facilities that will impact the wetland complexes include:

- The planned road network across the south end of the site,
- 2010 storage amendment,
- Northwest corner of the 2022 storage amendment expansion,
- Eastern end of the dewater facility,
- A portion of the 2010 compost facility,
- Northwest corner of the 2010 curing and storage facility, and,
- West side of the 2022 curing and storage expansion.

The wetland complexes on the Millstream site are dominated by red alder (*Alnus rubra*), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*, western redcedar and Pacific and Scouler's willow (*Salix lucida* ssp. *lasiandra* and *S. scouleriana*, respectively). Occasional Douglas-firs and big-leaf maples also occur in the low-lying wet areas. The shrub layer is very dense and although the most common species is hardhack *(Spiraea* *douglasii)*, other shrubs include red osier dogwood (*Cornus stolonifera*), salmonberry (*Rubus spectabilis*), baldhip rose, saskatoon, and sweet gale (*Myrica gale*). Blue wildrye (*Elymus glaucus*) is the most common herb in this ecosystem. Seepage sites (Photo 4-7), vernal pools and swamp systems (Photo 4-8) are critical habitat for all wildlife species.

Photo 4-7 A seepage site that will be crossed by the proposed access road on the south-side of the Millstream site.

Photo 4-8 A section of the dense red alder – willow wetland that runs from southwest to northeast across the Millstream site. This area will be impacted by the 2010 compost facility and the 2010 curing and storage facility.

Species and Plant Communities at Risk

There are no recorded occurrences of threatened or endangered plants or plant communities on the Millstream site, but a survey has not been completed at the site during the spring and early summer, the optimal time for identifying rare plant species. However, several occurrences were recorded in the area surrounding the site (Table 4-4), and it is likely that these species occur on the Millstream site. Some of the red- and blue-listed plant species that may occur on the Millstream site are listed in Table 4-2. In addition, three of the four plant communities recorded on the site are classified as plant communities at risk (Table 4-3).

Table 4-2
Some plant species at risk that may occur at the Millstream site.

Common Name	Scientific Name	BC Status
Deltoid balsamroot	*Balsamorhiza deltoidea*	RED COSEWIC-E
Geyer's onion	*Allium geyeri*	RED
Northern adder's tongue	*Ophioglossum pusillum*	RED
Scalepod	*Idahoa scapigera*	RED
Yellow montane violet	*Viola praemorsa*	RED
Dune bentgrass	*Agrostis pallens*	BLUE
Green-sheathed sedge	*Carex feta*	BLUE
Water-pepper	*Polygonum hydropiperoides*	BLUE
Source: McPhee et al. 1998		

Table 4-3
Plant communities at risk at the Millstream site.

Common Name	Scientific Name	Global[1]	Provincial[2]	BC Status[3]
Douglas-fir - arbutus	*Pseudotsuga menziesii - Arbutus menziesii*	GNR	S2	RED
Douglas-fir – dull Oregon grape	*Pseudotsuga menziesii – Mahonia nervosa*	GNR	S2	RED
Douglas-fir - lodgepole pine - arbutus	*Pseudotsuga menziesii - Pinus contorta - Arbutus menziesii*	GNR	S3	BLUE

[1] Global Status: Ranks: GNR = not ranked at the global scale

[2] Provincial (Sub-national status): S2 = Imperiled because of restricted range. S3 = Vulnerable due to restricted range and relatively few populations.

[3] BC Status: RED: extirpated, endangered or threatened in British Columbia.
BLUE: of special concern (formerly vulnerable) in BC

Source: British Columbia Conservation Data Centre, Ministry of Sustainable Resource Management. August 2004. http://srmwww.gov.bc.ca/cdc/

Table 4-4
Recorded occurrences of species at risk in the vicinity of the Millstream site.

Common Name	Scientific Name	Status*				Nearest Recorded Occurrence Location	Preferred Habitat
		Global	COSEWIC	Provincial	BC Status		
Howell's violet	*Viola howellii*	G4		S2S3	Blue	West of Millstream site in Thetis Lake Park (1957) and on Scafe Hill (1973)	Coastal forest usually under light coniferous cover
Coast microseris	*Microseris bigelovii*	G4		S1	Red	West of Millstream site in Thetis Lake Park (1953)	Moist, open grassy areas
Slender popcorn flower	*Plagiobothrys tenellus*	G4G5		S2	Red	West of Millstream site in Thetis Lake park (1958)	Low elevation mesic to dry rock outcrops and cliffs
Rough-leaved aster	*Aster radulinus*	G4G5		S1	Red	West of Millstream site in Thetis Lake park (1975)	Low elevation dry open forests and rock outcrops
Lace fern	*Cheilanthes gracillima*	G4G5		S2S3	Blue	East of Millstream site in the Mt. Finlayson area (1990)	Low elevation rock outcrops and rock crevices
Pacific Waterleaf	*Hydrophyllum tenuipes*	G4G5		S2S3	Blue	East of Millstream site at the base of Mt. Finlayson (1961)	Shaded, dense woods in mucky soils
Scalepod	*Idahoa scapigera*	G5		S2	Red	East of Millstream site in the Mt. Finlayson area (1986)	Dry to moist rocky slopes and grassy terraces
White-Top aster	*Aster curtus*	G3	T (May 2000)	S2	Red	East of Millstream site in the Mt. Finlayson area (1993)	Dry meadows and rock outcrops
Slender woolly heads	*Psilocarphus tenellus var. tenellus*	G4T4	NAR 1996	S2	Red	North of the site in the Millstream Rd – Finlayson Arm Road area (1951). Northeast of the Millstream site on Millstream Road just south of Matheson Lake	Low elevation moist seepage areas. Newest record indicates the plant was growing on a gravely roadside
Macoun's Groundsel	*Senecio macounii*	G5		S3	Blue	West of Millstream site in Thetis Lake Park along Craigflower Trail	Low elevation dry, open forests or the edges of salt marshes

Status definitions are included in Appendix E
Source: British Columbia Conservation Data Centre, Ministry of Sustainable Resource Management http://srmwww.gov.bc.ca/cdc/

4.2.3.3 Plant life impacts and mitigation measures

Construction phase

Impact: Construction-related removal or degradation of native vegetation. This impact would result from site preparation and building construction that would occur in the 2010 and 2022 construction phases (unless all site clearing is conducted during the initial 2010 site preparation interval). This impact has the following effects.

- *Removal of native plant communities*. Approximately 3-ha of native plant communities would be removed prior to facility construction. Three of the four communities that would be impacted are red- or blue-listed plant communities. There is also the possible loss of red- and blue-listed plant species that are associated with the plant communities on the site.

  Highlands District Bylaw # 10: A By-Law of the District of Highlands to regulate and prohibit the cutting of trees without first obtaining a permit would apply to removal of all trees with a diameter > 80-cm, Douglas-fir > 60-cm in diameter and Arbutus, Garry Oak, Cascara, Pacific Yew, Pacific Dogwood, and Manzanita > 10-cm in diameter.
  (See http://www.highlands.bc.ca/municipal_office/Municipal_Docs/Municipal_Bylaws/001-025/010_TREE.txt)

- *Removal of the soil surface horizon.* The project area would be levelled and covered with 0.3-m of gravel. The topsoil would likely be removed from the site during the grubbing and levelling activities. Removal of the native topsoil would reduce the seed bank, permanently alter successional trends in the impacted area, and may affect native species recruitment in neighbouring habitats (animal and wind transport of native seed would be reduced)

- *Changes to the natural drainage patterns and hydrological cycle on the site.* Changes to the hydrological regime on the site would impact wetland vegetation both on- and off-site. Seepage areas and wetlands would be levelled and covered with the layer of gravel or drained and used as building sites. Wetland vegetation within the facility footprint would be removed, but the changes to the hydrological cycle may change the soil moisture conditions in the vegetated buffer zone and off-site. Permanent changes in soil moisture would alter the structure and composition of vegetation communities.

The impact on vegetation would be of long-term duration, and non-reversible. The spatial extent of the impact would be limited to the building envelope. The magnitude is considered to be high, and the impact **significant.**

Mitigation: Construction impacts on native vegetation could be reduced by fully implementing the following mitigation measures.

- A rare plant survey of the project area should be conducted prior to construction. If rare plants are found in the building site, they should be removed and replanted in a similar habitat as close to the project area as possible.
- Some of the proposed building sites should be relocated to minimize disturbance to the rocky bluffs that occur on the south and southeast areas of the site. In particular, the 2010 curing and storage facility overlaps the woodland and terrestrial herbaceous plant communities identified as sensitive ecosystems in 1998. The southeast corner of the Millstream site is the most pristine area of the site and although not in as good a condition, the rocky knolls to be used for the rewater, odour, dewater and 2022 compost expansion facilities are also examples of this increasingly rare ecosystem. These areas should be retained in their natural condition. Wherever possible, development should be located a minimum of 15-m from natural plant communities.
- A tree survey should be completed to identify the number of trees that would be cleared that would require a permit before removal under the Highlands District tree-cutting bylaw. If a certified arborist determines that some trees could be retained onsite, they should be fenced past the dripline to protect root zones, and other suitable protection measures should be employed. A qualified arborist with experience in native tree protection should be retained to review construction plans, monitor surface-altering works, conduct root pruning, and to train construction workers.
- Wherever possible, native plant communities should be retained instead of landscaping with non-native species. Landscape plans between and around the building sites should use native plant materials. Some native plant materials could be salvaged from the construction site prior to clearing and then replanted after the construction phase.
- Native topsoil that is removed from natural areas during clearing should be stockpiled and redistributed in areas that would be landscaped with native plants. If necessary, the topsoil should be seeded with an agronomic annual to prevent wind erosion and weed invasion. Care

should be taken to not redistribute soil from the potentially contaminated western portion of the site.

- The road network should be designed to minimize disturbance to the Douglas-fir – Arbutus woodlands and to minimize the levelling of rocky out-crops and filling of wetlands.
- A drainage management plan should be prepared and implemented to ensure natural drainages and wetland complexes that occur in the vegetated buffer and off-site are not affected by project activities.
- The spread of noxious weeds and invasive non-native plant species should be controlled during construction. Control programs should focus on Scotch broom, Himalayan blackberry, scentless chamomile, gorse, and Canada thistle.

Full implementation of these measures would reduce the impact on native vegetation to **less than significant** levels.

Impact: Possible disturbance to thin soils in rock outcrop communities. The construction phase would see increased use of the site and possibly trampling on the rock outcrops that would be retained in the vegetated buffer on the west, south and east sides of the site. Herbaceous species are easily trampled or dislodged from the thin soils that are common on the rock outcrops. Use of these areas for material or equipment storage, or even walking by construction workers, could seriously affect these fragile communities. The impacts could be long term and reversible only over many decades. The spatial extent is the rock outcrops in the buffer area of the site. The magnitude of this impact is considered moderate and **significant.**

> Mitigation: Work activities should be restricted to the building envelopes to minimize disturbance to the woodland and rock outcrop communities that would be retained in the vegetated buffer. The buffers should be fully fenced and workers informed that these areas are "off limits" for use or material storage. Protection of the buffer area would reduce the impact to **less than significant** levels.

Operations phase

Most vegetation impacts would occur during construction. Nonetheless, the following impacts may occur during the post-construction operations phase.

Impact: Changes in plant communities in the vegetated buffer and in neighbouring natural areas. Plants that are off-site may be harmed if drainage patterns at the site are significantly altered. Water management during the fall and winter would have the greatest impact on plant communities. Native species associated with Coastal Douglas-fir seepage sites and wetlands require periodic flooding and flooding generally occurs in the fall and winter months. Any alteration to this natural pattern would impact the structure and species composition of the plant communities in the vegetated buffer and off-site. Mortality of native plants is common following adjacent construction. Mature trees are most susceptible to root damage, changes in grade, and changes to hydrology. It often takes several years for plants to die following alteration of nearby environments. The introduction of invasive species from daily transport trucks and workers at the site could also affect the health of native plant communities.

The impacts would be of long-term duration, and of limited spatial extent. Because most of the disturbance would occur during the construction phase, impacts of the operational phase of the biosolids facility at the Millstream site would be of low magnitude and would be **less than significant**.

> ***Mitigation:*** A long-term and comprehensive invasive species management program should be implemented at the site. A hydrological assessment that would determine frequency and depth of flooding in the seepage and wetland areas on the site should be conducted before construction. All efforts should be made to ensure the natural drainage patterns are maintained.

4.2.3.4 Cumulative effects assessment – Plant life

The landscape in the vicinity of the Millstream site has historically been considered an important natural area in the Capital Region. The belt of natural vegetation from Thetis Lake Park to Mt. Finlayson has suffered serious loss from urbanization in recent years, and the erosion of this greenbelt area can be expected to continue and even accelerate. Past vegetation altering activities include Western Speedway, associated recreation facility, and gravel extraction and suburban development in Langford to the south. The largest recent vegetation losses near the Millstream site have resulted from the Bear Mountain golf course and housing development and the “big box” commercial development north of Highway 1. Planned future development of golf courses, hotels, commercial facilities and housing in the Highlands as part of the extension of the Bear Mountain development would result in significant regional losses of native vegetation to the west of Millstream Road. Industrial development of the Crown land to the south and east of the Millstream site will also have significant impacts on the vegetation in the local area.

In light of these widespread impacts on regional vegetation, the relatively small alteration of the vegetative regime resulting from the biosolids development of the

Millstream site constitute a **less than significant** cumulative impact, particularly if the mitigation measures recommended in this report are implemented.

4.2.4 Animal life

4.2.4.1 Study methods

Information on wildlife use of the Millstream site was gathered from available information and two half-day field investigations conducted in May and August 2004.

4.2.4.2 Existing conditions

The diverse habitats of the Millstream site, like many other open spaces in urban areas, are used by several common wildlife species. Common mammals observed at the site include: black-tailed deer, deer mouse, domestic (European) rabbits, and racoon. Cougars are known to occur in the area, but this species is not expected to reside on the site.

A search of the Conservation Data Centre (CDC) database and review of the Sensitive Ecosystem Inventory information for the area was conducted. No rare wildlife element occurrences were found for the Millstream site in the database.

The seasonal wetland areas on the Millstream site are used by Pacific treefrogs. A northwestern garter snake was observed on the site in the weedy vegetation covering rocky outcrops. The wandering garter snake is also expected to occur in this area.

Birds observed at the Millstream site include California quail, northwestern crow, American robin, Bewick’s wren, killdeer, chestnut-backed chickadee, house finch, pileated woodpecker, raven, white crowned sparrow, northwestern crow, rufus-sided towhee, song sparrow, violet green sparrow, red winged blackbird, starling, and common flicker. Large coniferous and deciduous trees located at the western side of the site provide suitable nesting and feeding habitat for a variety of bird species. The flowering berry-bearing shrubs of the site such as hawthorn and blackberry provide foraging habitat for fruit-eating songbirds. No nests of large raptorial birds were found on the site, though bald eagle, red-tailed hawk, and turkey vultures were recorded in flight in the Millstream Road area.

4.2.4.3 Animal life impacts and mitigation measures

*Impact: Loss of wildlife habitat. A*pproximately 50% of the upland and wetland habitats of the Millstream site have been significantly degraded by past clearing, filling, and dumping of deleterious substances. The second growth forest areas found on the north, west, and south edges of the site and wetland habitats of the site currently provide suitable nesting, feeding, and shelter habitat for several amphibian, reptile, bird, and mammal species. As most of the forested habitats at the western and southern edges of the site will not be disturbed by the biosolids facility, the magnitude of wildlife impacts at the site are assessed to be low. The loss of the seasonal wetland habitats will result in a loss of biodiversity and may cause a change in the distribution of species that utilize these areas (primarily amphibians, birds, and black-tailed deer). This change in wildlife use of the site is assessed to be **less than significant**.

Impact: Clearing would result in increased forest edge habitat and subsequent reduction of the amount of available forest interior habitat in the local area. Removal of the plant communities at the Millstream site would increase the size of a large opening in a fairly contiguous forested area of the Saanich Peninsula. Increased edge habitat changes the natural light, temperature, wind, and fire conditions of the local forest and inhibits the free movement of wildlife species that depend on interior forest conditions. The changes in the climatic conditions of the surrounding forest would affect plant community composition and can contribute to the establishment of invasive species. These changes are local in extent, of long-term duration, and are irreversible.

Loss of forest vegetation and wildlife habitat features such as nest sites and wildlife trees is expected to have a high magnitude, long-term, local impact on wildlife. As most of the forested habitats at the western and southern edges of the site will not be disturbed by the biosolids facility, the magnitude of wildlife impacts at the site are assessed to be **less than significant**.

> ***Mitigation:*** The mitigation measures outlined in Section 4.2.3 will help reduce or avoid wildlife habitat impacts. Mitigation measures could also include retaining as large an area of continuous forested buffer zone as practical and landscaping the site with native plant species to provide new habitats for birds and small mammals. Wetland areas and forested rocky outcrops not required for buildings should be maintained whenever practical. By implementing these mitigation measures, habitat can be preserved and impacts reduced to **less than significant**.

4.2.4.4 Cumulative effects assessment – Animal life

Until recent years, the wildlife habitat value of the southern District of Highlands was reasonably intact. Past human activities that affected wildlife populations in the study area include hunting, logging, and rural residential development. More recently, development of the industrial areas at Highwest Recyclers and the Industrial Way industrial park have constituted more permanent barriers to wildlife movement and permanent loss of habitat. The operation of septage facilities on the Millstream site would have affected habitat quality, though filling of the lagoons mitigated those impacts somewhat. In the last few years, the Bear Mountain development to the west and increasing commercial and residential development to the south have reduced, degraded, or eliminated large areas of wildlife habitat. Western Speedway and associated recreational and gravel pit developments have no value for wildlife and have eliminated wildlife habitat in that area. If the Highlands portion of the Bear Mountain development is approved, another large area of relatively intact and valuable wildlife habitat will be seriously degraded or lost. If the Crown Land immediately to the south and east of the biosolids candidate site develops as planned for industrial use, a wildlife corridor between Thetis Lake and Mount Finlayson will be potentially interrupted.

In light of the past and proposed developments affecting wildlife habitat near the Millstream site, protecting the wildlife values in the small area of the Millstream biosolids site would have little beneficial effect. The cumulative effects of land use change in the southern Highlands and northern Langford area on wildlife must be considered **significant**. The contribution of the development of the candidate biosolids site to wildlife impacts and wildlife habitat loss, however, is considered **less than significant**.

> ***Mitigation.*** Reducing the cumulative effects of development in the vicinity of the Millstream site on wildlife and wildlife habitat would require a change in planning direction in Highlands and Langford; ecological protection would have to be assigned a higher priority than urban development. Without these broad-scale changes to land use, there is no mitigation of the biosolids facility development that could affect the significance of wildlife and wildlife habitat cumulative impacts.

4.2.5 Odour

4.2.5.1 Study methods

Odour measurement. Odour is measured by sampling discrete volumes of air, testing for the presence of particular compounds in the air, and measuring the compounds against some standard, typically an odour recognition concentration. When odour pollutants are known, this is a good method for determining presence of the odour and treatment efficiencies. Since the numbers of odour compounds are numerous, olfactory measurement is a better substitute for testing for the presence of odour. This approach requires similar discrete sampling but the presence of odour and related characteristics is determined by a panel of trained odour analysts using "sniff" technologies. This information is reported in dilutions to threshold (D/T) and recognition threshold (R/T), intensity (relative to a standard compound), persistence (hang time), odour character, and pleasantness (hedonic tone) rated as pleasant to neutral to unpleasant.

The D/T is considered an odour unit concentration or odour units/m^3, (OU/m^3) and is useful in measuring the presence of odour. An odour unit is defined by the number of times the foul air that should be treated with odourless air to reach the desired odour threshold. The odour threshold is defined as the concentration of a gaseous substance that would be discerned from odourless air by at least half of an odour panel.

Odour modelling. Table 4-5 provides the volumes of air flow treatment used in odour modeling undertaken by Genesis Engineering for the Millstream site for the year 2022 construction odour. The footprint area, height and volume of the facility are also summarized in Table 4-5. Only the impacts of odour in the year 2022 construction were investigated under this study as the full build-out scenario.

Table 4-5
Building volumes used to calculate air exchanges for the year 2045 at the Millstream site

Source	Building Perimeters (m)	Building Area (m^2)	Building Height (m)	Building Volume (m^3)
ANAEROBIC DIGESTION				
Administration	120	500	4	2000
Garage and Shops	140	1000	4	4000
Digesters (Gallery)	200	1200	8 – 10	9600
Odour Control	160	1000	4	4000
Rewatering and Treatment	108	500	4	2000
Thickening and Dewatering	132	500	4	2000
Co-generation and Flare	110	700	4	2800
COMPOSTING – Value-added process				
Compost	612	3564	4	14256
Curing and Storage (Covered)	160	1562	4	6248
Curing and Storage (Uncovered)	264	3913	4	15652
Storage Amendment (60 days)	484	4001	4	16003
Odour Control	160	1500	4	6000
Storage for Digested Solids	264	3864	4	15456

Several scenarios were evaluated to investigate the effect of odour with and without on-site odour control. Scenario 0 is used as a base case representing complete odour treatment failure. Scenario 1 and Scenario 2 represent different levels of odour control for comparison

- **Scenario 0 – no odour control.** Under this scenario, all process units on site are odour sources with odour concentration summarized in Table 4-6. No odour control is provided (all stages of odour control are inactive).

- **Scenario 1 – two-stage odour control.** Foul air provided from all process components would be piped to the odour control buildings for treatment. Two-stage odour control is assumed for this scenario to remove 97% of odour (third stage missing or inactive, and only two stages are active). Table 4-7 summarizes the equivalent odour concentration after treatment.

- **Scenario 2 – three-stage odour control.** Foul air provided from all process components would be piped to the odour control buildings for treatment. Three-stage odour control is assumed for this scenario to achieve 99% removal of foul air (all stages active with full effectiveness). Table 4-8 summarizes the equivalent concentration after treatment.

Odour, if present, is never entirely eliminated and many odours that exist will contribute to the ambient level of odour. An odour D/T of 7 at the property line for residential and commercial levels (above background) is considered acceptable for most North American agencies that specify odour limits. The aim of odour control is to reduce the odour produced by different process components on site to this D/T. The sample measurements are taken over a stipulated period since odours can occur as fugitive “puffs” or as continuous “point source”. Generally three sample measurements taken over a one-hour period are required to obtain an odour D/T to compare to odour limits specified by North American agencies. For the purpose of modeling, a continuous “point source” odour emission is used.

Tables 4-6 to 4-8 illustrate the typical odour concentration produced from each process component and the calculated odour flux rate for each component in each scenario for the year 2045 design. Gas velocity from the stack is assumed to be about 25 m/s (5000 fpm). Stack height for all process components were assumed to be 10 m (30 ft) for odour modeling purposes. Odour flux rate is further discussed in the following sections.

Column 1 (odour concentration) of the tables shows the anticipated worst-case odour for each source shown. Column 2 (air changes/hour) shows the required air exchanges for health and safety for each building source. Column 3 (air flow) is the air flow using the building volumes from Table 4-5 multiplied by the air exchange in Column 2. Column 4 is the product of Column 1 and Column 3. Column 5 is the mean odour concentration at the stack discharge of the odour control facilities for anaerobic digestion and composting. The mean concentration is calculated by dividing the total calculated flux rate (Column 4) by the total air flow (Column 3) for each process. Tables 4-7 and 4-8 represent treated air flow release from the odour treatment facility.

Table 4-6
Calculated odour flux rate for Scenario 0: no odour control.

		1	2	3	4	5
		Odour Conc. (OU/m^3)	**Air changes/ hour**	**Air flow (m^3/hr)**	**Calculated Flux Rate (OU/hr)**	**Equivalent Odour Conc. (OU/m^3)**
	ANAEROBIC DIGESTION					
1	Administration	10	12	24,000	240,000	
2	Garage and Shops	10	12	48,000	480,000	
3	Digesters (Gallery)	5,000	12	115,200	576,000,000	
4	Odour Control	0	12	0	0	
5	Rewatering and Treatment	100,000	6	12,000	1,200,000,000	
5	Thickening and Dewatering	10,000	12	24,000	240,000,000	
6	Co-generation and flare	5,000	12	17,000	85,000,000	
			TOTAL	**240,200**	**2,101,720,000**	**8,750**
	COMPOSTING – Value-added process					
8	Compost	1,000	12	170,976	170,976,000	
9	Curing and Storage (Covered)	550	12	74,976	41,236,800	
10	Curing and Storage (Uncovered)	200	0	0	0	
11	Storage Amendment (60 days)	200	0	0	0	
12	Odour Control	0	12	0	0	
13	Storage for Digested Solids	600	12	185,472	111,283,200	
			TOTAL	**431,424**	**323,496,000**	**750**

Table 4-7
Calculated odour flux rate for Scenario 1: 97% odour control.

		Odour Conc. (OU/m^3)	**Air changes/ hour**	**Air flow (m^3/hr)**	**Calculated Flux Rate (OU/hr)**	**Equivalent Odour Conc. (OU/m^3)**
	ANAEROBIC DIGESTION					
1	Administration	0	12	0	0	
2	Garage and Shops	0	12	0	0	
3	Digesters (Gallery)	0	12	0	0	
4	Odour Control	262	12	240,200	63,051,600	
5	Rewatering and Treatment	0	6	0	0	
5	Thickening and Dewatering	0	12	0	0	
6	Co-generation and flare	0	12	0	0	
			TOTAL	**240,200**	**63,051,600**	**262**
	COMPOSTING – Value-added process					
8	Compost	0	12	0	0	
9	Curing and Storage (Covered)	0	12	0	0	
10	Curing and Storage (Uncovered)	0	0	0	0	
11	Storage Amendment (60 days)	0	0	0	0	
12	Odour Control	22	12	431,424	9,704,880	
13	Storage for Digested Solids	0	12	0	0	
			TOTAL	**431,424**	**9,704,880**	**22**

Table 4-8
Calculated odour flux rate for Scenario 2: 99% odour control.

		Odour Conc. (OU/m^3)	Air changes/ hour	Air flow (m^3/hr)	Calculated Flux Rate (OU/hr)	Equivalent Odour Conc. (OU/m^3)
	ANAEROBIC DIGESTION					
1	Administration	0	12	0	0	
2	Garage and Shops	0	12	0	0	
3	Digesters (Gallery)	0	12	0	0	
4	Odour Control	87	12	240,200	21,017,200	
5	Rewatering and Treatment	0	6	0	0	
5	Thickening and Dewatering	0	12	0	0	
6	Co-generation and flare	0	12	0	0	
			TOTAL	**240,200**	**21,017,200**	**87**
	COMPOSTING – Value-added process					
8	Compost	0	12	0	0	
9	Curing and Storage (Covered)	0	12	0	0	
10	Curing and Storage (Uncovered)	0	0	0	0	
11	Storage Amendment (60 days)	0	0	0	0	
12	Odour Control	7	12	431,424	3,234,960	
13	Storage for Digested Solids	0	12	0	0	
			TOTAL	**431,424**	**3,234,960**	**7**

The method used to estimate possible future odour impacts resulting from the development of this site was to use computerized atmospheric-dispersion modeling.

Computer Model

A commercial version (*ISC-AIRMOD View*) of a widely recognized USEPA regulatory model (ISCST3) was used to model the off-site dispersion of odours from the two proposed Capital Regional District sludge treatment plant candidate sites. *ISC-AIRMOD View* is an air pollution dispersion/deposition modeling software package developed by Lakes Environmental Software, Waterloo, Ontario. The software provides a powerful graphical user interface for the latest models developed by the U.S. Environmental Protection Agency, including the regulatory ISCST3 (Industrial Source Complex Short-Term 3) model. Meteorological input is prepared by a preprocessor (*RAMVIEW*) which has utilities to help prepare the necessary input files from rudimentary wind data, such as that obtained from local meteorological stations. Building-induced plume downwash is accounted for using another preprocessor (*BPIP View* – Building Profile Input Program).

The ISCST3 model is widely used for odour modeling (e.g., Wu, Nerissa, May 2000, "Odour Modelling as First Line of Defence", BioCycle, p.64-68). It can be used for specific chemical species as well as for odour intensity. Several types of inputs are factored in to determine atmospheric dispersion. These inputs include local topography, meteorological data, output concentration, output dimensions, facility layout and hours of operation. Site maps can be input in several different formats, including the readily available bitmap format.

Output can be presented as colour-coded odour contours (isopleths in odour units) on an underlying site map, and as tabulated concentrations or odour intensities at selected receptor locations.

Site Input Data

Worst-case odour emissions (year 2045 design odour concentrations) and worst-case weather conditions were assumed for three modeling scenarios: no odour controls, 97% odour controls, and 99% odour controls. The emission rates are presented in Table 4-6, 4-7 and 4-8 in odour units per hour, which are the product of the odour concentration (odour units per cubic meter) and the gas flow rate (cubic meters per hour). The odour concentration is the number of cubic meters of clean air that are required to dilute 1 cubic meter of foul air down to the odour threshold, where 50% of a panel of odour testers can barely perceive the odour under ideal, laboratory conditions. Under real-world conditions, where other competing odours are present, the odour threshold would be higher.

Building locations and dimensions were graphically input directly from a site map supplied by Dayton and Knight Ltd. (Figure 3-2 in Section 3.4), using a BPIP-View preprocessor. It was assumed that there would be two stacks on the site from the odour treatment facilities, one for the digestion process and one for the composting process. Both stacks are assumed to be 9.1 meters (30 ft) high and to have a gas velocity of 25.4 meters/second (5000 feet/minute).

Forty-six discrete receptors were selected from the area of a 1:20,000 topographic map (BC 092B043, Colwood) around the Millstream site that coincides with that shown in Figure 4-3. The receptors were chosen to represent sensitive areas (e.g. housing) and to accurately reflect the general topography of the area.

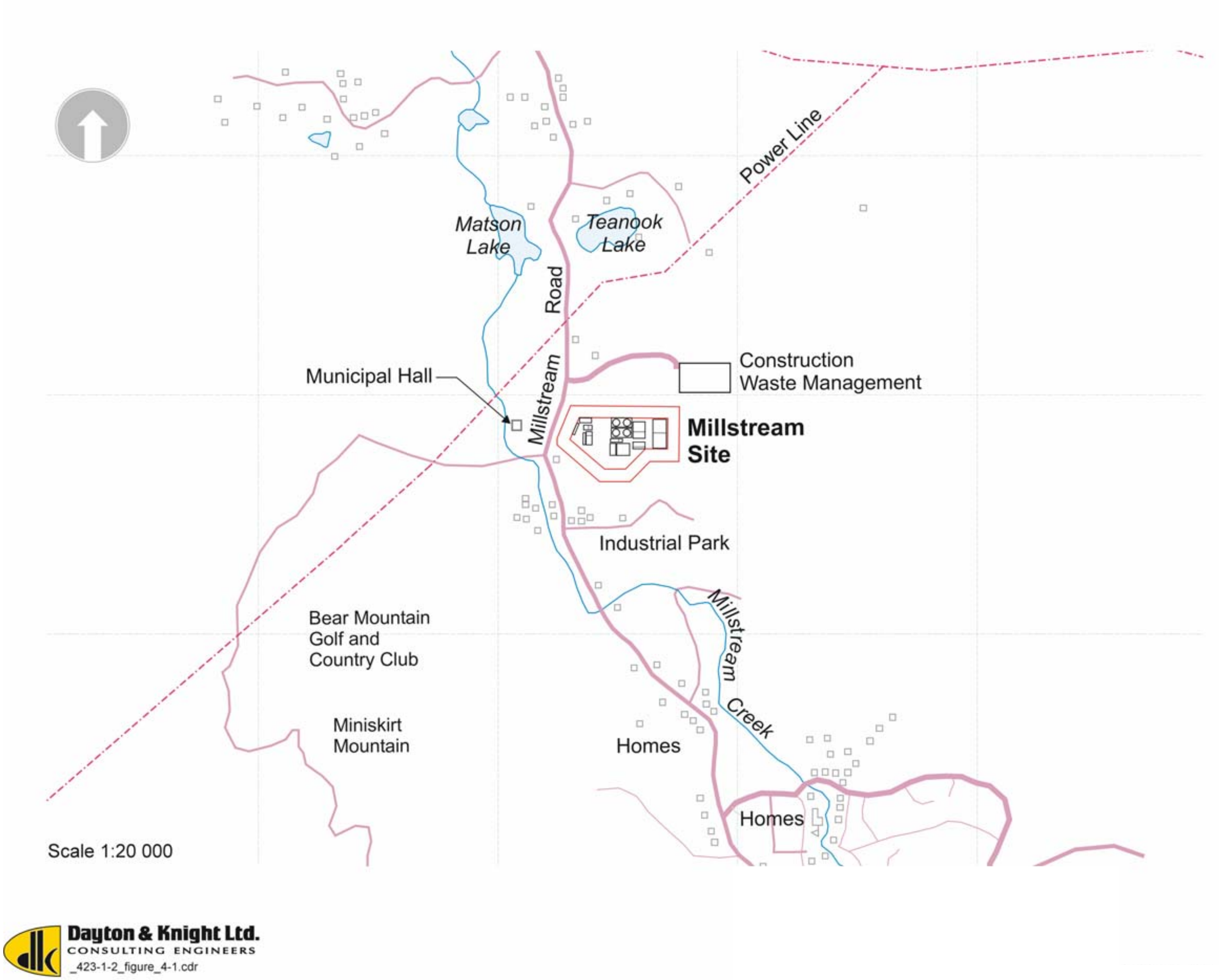


Figure 4-3 Location of Millstream site with surrounding waterbodies and receptors.

Meteorology Input

Modeling assumed worst-case meteorological conditions. Generally adverse atmospheric-dispersion conditions arise from low-wind, stable atmosphere conditions wherein the emission “plumes” slowly drift off-site with little atmospheric mixing and dilution taking place. These conditions generally occur in the evening hours during stationary highs, when clear skies allow the ground to rapidly loose heat by radiation, thereby cooling the ground surfaces and the air above. The cool air is denser and heavier than the air above and hence tends to flow downhill. The nocturnal temperature inversion and resulting drainage winds usually give rise to worst-case meteorological conditions.

Dr. Stan Tuller (University of Victoria Climatologist) extracted nocturnal drainage wind data from meteorological data recorded at the Victoria Airport, located 18 kilometres north of the site on the Saanich Peninsula. The date extraction was based on evening clear-sky, low-wind events when there was a definite indication of a wind direction shift from a daytime sea breeze to an evening land breeze. The general drainage wind pattern at the Airport is seen from Appendix F, Table F-1 as to be from the north.

The percentage of evenings with poor atmospheric dispersion (F-stability) was estimated to be 64% during July and August, 52% during September and October, and approximately one-half of these frequencies during the remaining months.

The data in Appendix F, Table F-1, representing six unique adverse weather events, was combined into one file. Zero wind velocities were arbitrarily assigned a small, finite value since the ISC dispersion model assumes a finite wind. The resulting file was preprocessed to provide the meteorological input for the dispersion modeling. No allowance was made for major wind shifts due to topography, as the August 11, 2004 site visit indicated that the area is fairly flat, interrupted by rock outcrops.

The Millstream Creek drainage is seen (Figure 4-4) to be generally to the south of the biosolids site, passing to the east of Miniskirt Mountain. The flank of this mountain may be expected to experience some plume impingement during light winds from the north.

Figure 4-4 Millstream topography.

The Millstream Creek drainage is seen (Figure 4-4) to be generally to the south of the biosolids site, passing to the east of Miniskirt Mountain. The flank of this mountain may be expected to experience some plume impingement during light winds from the north.

4.2.5.2 Existing conditions

A visit to the proposed Millstream site on August 11, 2004 showed that there were no significant odours emitting from this site. However, there are other industrial activities surrounding the site that may be potential sources of odour, such as a construction waste management facility to the north of the site and an asphalt plant located to the south.

4.2.5.3 Odour impacts and mitigation measures

Odour dispersion modeling assumed full build-out (year 2045) odour emissions and worst-case meteorology, as described above. (Supplementary modeling was also carried out under other meteorological conditions to confirm that the conditions used in this study were indeed the worst-case meteorology.)

Modeling output is presented in Figures 4-5, 4-6 and 4-7 as isopleths (contours) of constant odour concentration, expressed as odour units per cubic meter, overlying the site map. The concentrations are the maximum 1-hour concentrations experienced during the combined six drainage events (total of 54 hours of adverse meteorological conditions).

Normally there would be three stages of odour removal, providing an overall odour reduction of 99%. However, if one stage fails or is out of service due to routine maintenance, then the odour reduction decreases to 97% (two-stage). If all three stages of odour reduction fail (an extremely unlikely event) then the odour reduction would be 0%.

The modelling results represent the worst case concentration at each receptor for the weather conditions investigated (north and south drainage) over the specified period of time (6 drainage events in July and August 2003).

- **Scenario 0 - no odour control.** Figure 4-5 represents the no-controls scenario (all three stages of odour reduction are not functioning). The elevated plumes from the two stacks become embedded in a stable atmosphere that impinges against the flank of Miniskirt Mountain to the SSW and also on a rural residential area north of Matson and Teanook Lake. Maximum ground-level concentrations (61 OU/m^3) occur on the flank of Miniskirt Mountain. The maximum concentration in the populated area north of Matson and Teanook Lake is 40 OU/m^3.

- **Scenario 1 - two-stage odour control.** Figure 4-6 represents the two-stage control scenario (two stages of odour reduction is functioning). It can be seen that the maximum odour concentration (1.8 OU/m^3) occurs against the flank of Miniskirt Mountain to the SSW. The maximum concentration in the residential area north of Matson and Teanook Lake is 1.2 OU/m^3. No or very little odour should be discernable off-site with either one or two stages of odour reduction assuming that all malodors are collected and sent up two separate 9.1 meter (30 ft.) stacks at a velocity of 254 m/s (5000 fpm).

- **Scenario 2 - three-stage odour control.** Figure 4-7 represents the three-stage control scenario (all three stages of odour reduction are functioning). Again the maximum odour concentration (0.61 OU/m^3) occurs against the flank of Miniskirt Mountain to the SSW. This level of odour would be undetectable.

<u>Summary</u>

Maximum 1-hour odour concentrations, estimated for the residential area north of Teanook Lake[4] are 40 OU/m^3 with no controls, 1.2 OU/m^3 with two controls giving 97% odour removal, and less than 1 OU/m^3 with three levels of control and 99% odour removal. No off-site odour will be discernable from the Millstream site operations under normal operation with three stages of odour control. Odour emissions from the biosolids facility are anticipated to be infrequent, and any impacts limited to the site or its immediate surroundings. The magnitude of odour impacts is considered negligible, and therefore **less than significant**.

[4] XYZ coordinates: 1480, 3200, 140 meters

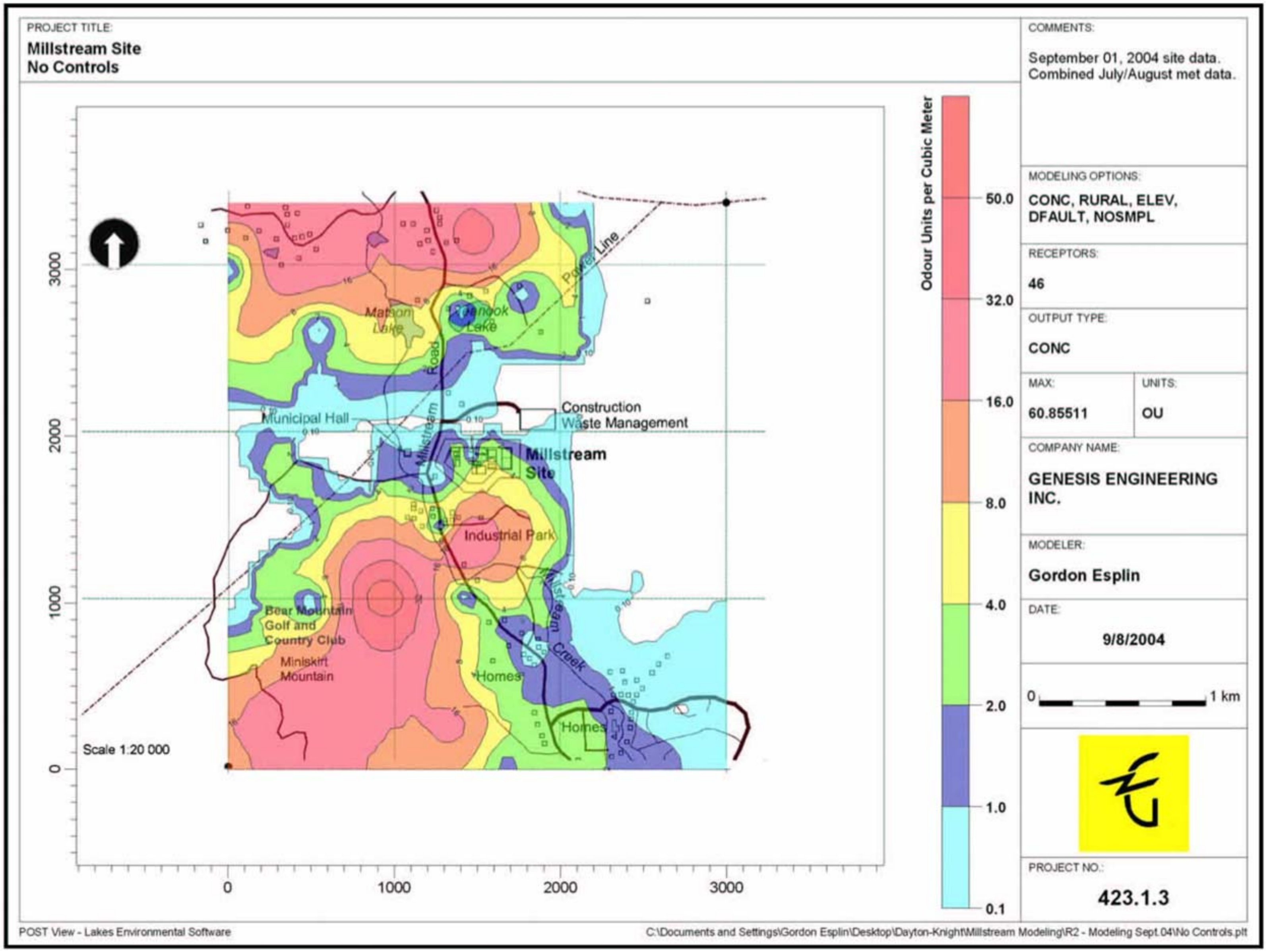


Figure 4-5 Millstream site odour modeling results - no odour control.

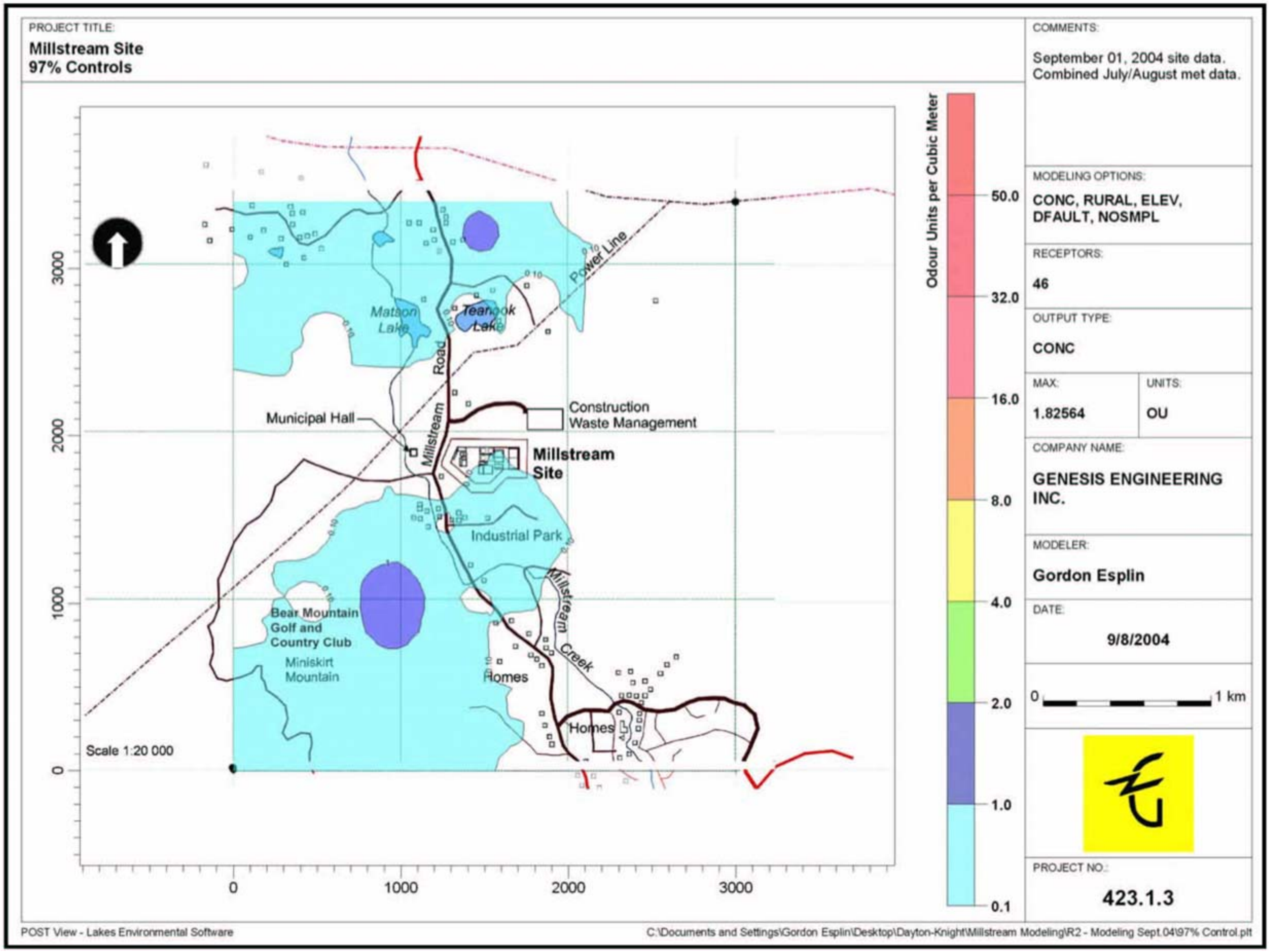


Figure 4-6 Millstream site odour modeling results - 97% odour control.

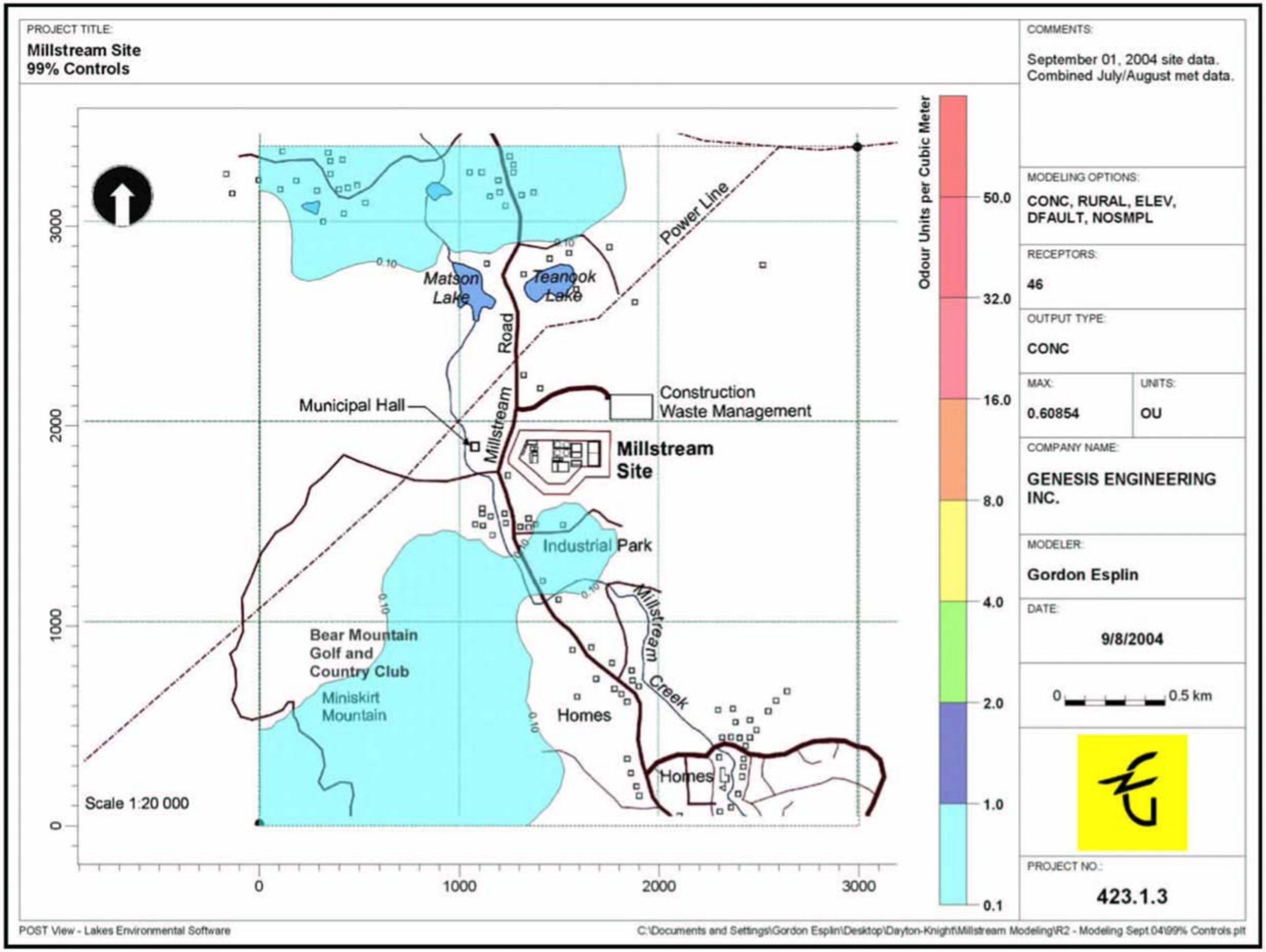


Figure 4-7 Millstream site odour modeling results - 99% odour control.

4.2.5.4 Cumulative effects assessment – Odour

The biosolids facility is not expected to contribute to cumulative odour effects near the Millstream Road Site, because normally there will be no off-site odours from this area when the biosolids facility's proposed odour-control system is properly operating. Off site generated odours may be generated by industrial activity and vehicular traffic. Odour emissions from the biosolids facility are anticipated to be infrequent, and even these impacts would be limited to the site or its immediate surroundings. The magnitude of the biosolids facility's contribution to odour impacts is considered negligible, and therefore **less than significant**.

If there were no odour controls on site at all, then there may be minor cumulative effects. In all cases, however, the contribution of the biosolids facility to odours in the study area is considered **less than significant**.

4.2.6 Traffic

4.2.6.1 Study methods

The study methods used for this traffic impact analysis were as follows:

- Address the relevant transportation and traffic related issues, including determination of the type and amount of traffic that would be generated by the project for both the construction and operation time frames,
- Identify and estimate the current and future vehicular traffic volumes on the impacted road system, including a sense of magnitude of the cycling and pedestrian traffic,
- Review current and future roadway data on access routings between the candidate site locations and the sludge haul source locations of the Macaulay and Clover Point sewage pump stations,
- Determine the level of impact on affected neighbourhoods and road users,
- Make suitable recommendations for truck routings and for mitigating identified impacts along those routes, and prepare a report of findings.

Integral to these tasks was the following:

- Obtaining and reviewing relevant traffic flow data, plans and reports from the CRD, the affected municipalities, and other sources. This task included the pertinent Municipal Official Community Plan (OCP) transportation sections,

street classification, traffic flow, and truck route bylaw maps (note that copies of the Municipal Truck Route Maps are included in attached Appendix G), and
- Conducting numerous detailed field inspections of the candidate sites, relevant routings and road system, and affected neighbourhoods.

4.2.6.2 Existing conditions

The Millstream site is located on the east side of Millstream Road in the District of Highlands. It is near the Municipality's southern border just north of their Industrial Park, which is accessed via Industrial Way. The proposed biosolids treatment plant site is currently accessed via a gated gravel driveway directly onto Millstream Road, located approximately 75 m north of Hannington Road. The existing driveway has poor visibility for vehicular egress onto Millstream Road from the site.

The traffic impact assessment for this project relates to the traffic volumes, vehicle types, and the classification, cross section and condition of the roadway for the preferred site-related truck haul routings that connect Macaulay and Clover Points to the proposed Millstream site for the following time frames:

- 2004: Present conditions,
- 2010 – 2012: Construction of initial (Phase 1) facility,
- 2025: Operation at full capacity of initial (Phase 1) facility,
- 2022 – 2025: Construction of expanded (Final Phase) facility,
- 2045: Operation at full capacity of expanded (Final Phase) facility.

The route sections have been broken down as follows:

1. Millstream Road between its interchange at the Trans Canada Highway, and the site's future driveway location to the north, in the City of Langford and the District of Highlands. Most of the construction and operations traffic will use this section of roadway,
2. The pertinent local and collector roadway routing sections in the Township of Esquimalt and the City of Victoria, which would be used by the biosolids haul trucks accessing the Macaulay Point and Clover Point pump stations, and
3. The major roads in the Township of Esquimalt, the City of Victoria, the District of Saanich, the Town of View Royal, and the City of Langford that comprise the connecting routes between the biosolids haul sources of Macaulay and Clover Points sewage pump stations and the proposed Millstream site.

It is important to note that, except for the roads near Macaulay Point and Clover Point, the preferred routing(s) to the Millstream site follow municipally identified truck routes. The existing roadway infrastructure (i.e., number of through and turning lanes, provision of adequate stop controls, pedestrian and cyclists facilities, etc.), classifications, and carrying capacities for all of the routing sections are adequate and compatible for accommodating the current and future traffic volumes, along with the vehicular (truck and other) traffic generated by the subject CRD biosolids treatment facility.

Figure 4-8, appended to the ESR document, provides a pictorial truck routing(s) map showing recommended, or preferred, routes connecting the sludge haul origins of the Macaulay Point and Clover Point sewage treatment facilities to the CRD's candidate Millstream and Hartland sites. Roadway photographs have been included for additional information. Table 4-9 describes the routings in detail. It should be noted that we have recommended a one-way system with outbound traffic through the Department of National Defence (DND) Base housing, and inbound traffic using a Fraser Street and Munro Street routing for the Macaulay Point site. Our preferred routing recommendations consider roadway conditions (i.e., availability of sidewalks, on-street parking bans, etc.) in addition to other factors, such as impact on school zones and Safe Route to School areas.

Table 4-9
Preferred truck routings for the Millstream site.

Source	Trip Segments
Clover Point	• For outbound traffic, begin from driveway west on Dallas Road to • North on Douglas Street to • North on Blanshard Street to • West on Cloverdale Avenue to • North on Douglas Street to • West on Hwy 1 (Trans Canada Highway) to • North on Millstream Road into site
Macaulay Point	• For outbound traffic, begin from driveway north on Anson Street to • * East on Bewdley Avenue to • * North on Peters Street to • * West on Lyall Street to • North on Admirals Road to • West on Hwy 1 (Trans Canada Highway) to • North on Millstream Road into site • For inbound southbound traffic on Admirals Road to • * East on Lyall Street to • * South on Fraser Street to • * East on Munro Street to • South on Anson Street into Macaulay Point site driveway.

NOTE: *Indicates reverse directions for proposed one-way component of recommended routing.

Regarding the one-way outbound route, an optional routing may be to travel north from the Macaulay Point pump station via Anson Street, west on Munro Street, and then north on Lampson Street to the Lyall Street route. It is not a preferred route due to its impact on a school zone and Safe Route to School. An alternative routing for Clover Point is a one-way system that would have outbound traffic travel west on Dallas Road, north on Moss Street, west on Fairfield Road, north on Cook Street and west on Pandora Street to northbound Blanshard Street. The inbound trips would be south on Blanshard Street, east on Johnson Street, south on Cook Street and east on Dallas Road to the site. It is not a preferred routing due to the impact on a school zone, Safe Route to School, and the Moss Street residential and Cook Street Village areas.

For all of the identified road segments, Tables H-1 and H-2 in attached Appendix H provide:

- Street classifications with associated expected carrying capacities,
- Approximate base year traffic volumes for Year 2004 and Year 2025 time frames,

- Estimated facility-generated operational traffic volumes for both Year 2025 and Year 2045 scenarios when both the initial and expanded facilities are operating at full capacity, and
- Percentage increases relative to the projected Year 2025 base traffic volumes.

Any traffic volume changes less than 1% of roadway totals were considered to have a negligible magnitude of impact. In general, unless other more detailed future traffic data becomes available, we estimated the Year 2025 daily traffic volumes by applying a 20% increase to the existing Year 2004 volumes in order to approximate a simple growth rate of 1% per annum. We did not attempt to project the road system traffic volumes to the Year 2045 because there are too many uncertainties affecting such projections (amount of developable land available after 2026, regarding future transportation infrastructure, travel-modes, modal splits, etc.).

4.2.6.3 Traffic impacts and mitigation measures

Table 4-10 provides a summary of the estimated (two-way) daily vehicle trips that are generated by the construction and operational stages associated with the 2025 initial facility and the 2045 expanded facility. These traffic volumes and their impact on the road network are discussed in the following sections for the construction and operational phases of the facilities.

Construction phase

Impact: Construction traffic effects on the roadway system. The only roadway section where the traffic impacts exceed negligible levels is Millstream Road between its interchange with the Trans Canada Highway and the site's driveway north of Industrial Way. It should be noted that the initial 2025 facility will result in construction-related traffic during 2010-2012 and the expanded 2045 facility will result in construction-related traffic during 2022 - 2025.

During the 2010 - 2012 initial facility construction period, which is expected to last for two years, maximum two-way total vehicle trips of approximately 158 vehicles per day (vpd) will occasionally be generated by the project. Most of the 120 vpd crew-related trips, and all of the 38 vpd delivery truck trips, will be to and from the south. The estimated base Millstream Road traffic ranges from 28,000 vpd just north of the TCH interchange to approximately 5,000 vpd in the vicinity of the subject site. The portion of Millstream Road between the interchange and Treanor Road is classified as an arterial roadway and is expected to carry traffic volumes in excess of 14,000 vpd. It can easily accommodate the additional construction traffic which will have negligible magnitude impact. The addition of the approximately 158 construction-related vpd to the portion of Millstream Road north of Treanor Road, representing a traffic increase of approximately 3 %, is judged to be an impact of moderate magnitude. The requirement for parking for construction crew vehicles could potentially have a high magnitude impact on Millstream Road and the neighbourhood(s) near the site. However, this impact becomes negligible, as the project plan will provide for sufficient parking on site for all construction workers as part of the initial site clearing.

The facility expansion, expected to occur during 2022–2025, would occasionally generate maximum construction-related two-way total vehicle trips of approximately 140 vpd (i.e. 120 crew associated vehicles and 20 delivery truck trips). Although this represents an approximate 3% increase in the traffic volumes on the northern part of Millstream Road, it is well within the capacity of the roadway and would have an impact of moderate magnitude.

The greatest construction traffic volumes would be generated if site preparation were done for the project buildout (to 2045) during the initial 2010 – 2012 construction period. The clearing, grubbing and gravel base fill related truck hauls to and from the site, estimated to be a maximum of 100 truck trips per day (50 inbound and 50 outbound), would all occur during the initial 6 months to 1 year of the construction time period. Clearing and grubbing would be completed before other construction-related traffic such as trade crews and delivery of concrete and steel begins. If full site preparation is not conducted in 2010 – 2012, then a portion of the site preparation traffic would occur during 2025 – 2027.

Construction traffic at the Millstream site is considered to be of moderate magnitude, moderate duration (2 to 3 years), local extent and reversible in that no permanent traffic volume change will result from this limited temporal activity. The impact is considered ***significant***.

> ***Mitigation:*** The construction related truck traffic can be mitigated to a **less than significant** level by utilizing the concrete, gravel, asphalt and related services provided in the District of Highlands Industrial Park (on Industrial Way), located immediately south of the subject site. The establishment of an access road between the subject site and Industrial Way that would eliminate the need to use Millstream Road for these trips would further reduce this impact. The construction crew related traffic could also be mitigated to a **less than significant** level by providing sufficient crew parking on the site and by providing a van-pooling or crummy park and ride program for the construction workers.

Operations phase

The 2025 initial facility and the 2045 expanded facility, operating at full capacity, will have a maximum of 15 and 20 employees respectively. The forecast traffic volumes are contained in Table 4-10.

Impact: Traffic impacts of facility operations. The main areas affected by the operation of the facility are the neighbourhoods near Macaulay Point and Clover Point along haul truck routes, and along the Millstream Road access to the proposed site. The neighbourhood roads near the two pump stations are not on Municipal Truck Routes. When the 2025 initial facility is operating at full capacity, the maximum two-way trips would be eight trucks per day at Macaulay Point and six trucks per day at Clover Point. The combination of the sludge haul traffic, the trucking trips related to composting, and employee traffic, results in total daily two-way trips at Millstream of 50 vehicles for the initial facility in 2025.

When the 2045 expanded facility is operating at full capacity, these volumes will increase to a maximum daily two-way volume of 20 – 32 trucks at Macaulay Point and 14 – 20 trucks at Clover Point. This increased sludge haul traffic, the higher volumes of trucking trips related to composting, and higher employee traffic, produces forecasted total daily two-way trips of 92 – 116 vehicles at the expanded facility in 2045.

Table 4-10
Approximate Millstream site construction and operational traffic volumes.

Construction Traffic			
	YEAR 2011		**Max. two-way trips (vpd) ***
	Clearing and Grubbing		**100 Trucks ****
	YEAR 2011 - 2012		**Max. two-way trips (vpd)**
	Workers		**120 Cars *****
	Concrete trucks		**34 Trucks**
	Steel and other trucks		**4 Trucks**
		Total	**158 Vehicles**
	YEAR 2022 – 2025		**Max. two-way trips (vpd)**
	Workers		**120 Cars**
	Concrete trucks		**16 Trucks**
	Steel and other trucks		**4 Trucks**
		Total	**140 Vehicles**
Operational Traffic			
	YEAR 2025		**Total two-way trips (vpd)**
A	Anaerobic digestion only	From Macaulay Point	**8 Trucks**
		From Clover Point	**6 Trucks**
		Anaerobic digestion only – Sub-Total	**14 trucks ******
B	Anaerobic digestion and Composting	(from other sources to and from site)	**16 Trucks**
		Trucks Sub-Total	**30 Trucks**
C	Employees - Plant operation		**20 Cars**
		Total Vehicles	**50 vehicles**
	YEAR 2045		**Total two-way trips (vpd)**
A	Anaerobic digestion only	From Macaulay Point	**20 – 32 Trucks**
		From Clover Point	**14 – 20 Trucks**
		Anaerobic digestion only – Sub-Total	**34 – 52 trucks**
B	Anaerobic digestion + Composting	(from other sources to/from site)	**32 – 38 Trucks**
		Trucks Sub-Total	**66 – 90 Trucks**
C	Employees - Plant operation		**26 Cars**
		Total Vehicles	**92 – 116 vehicles**

* vpd (vehicles per day)
** Assume one year period for Clearing and Grubbing for total site. None required for 2022-2025.
*** Assume 1.5 passengers per vehicle for workers and employees
**** Ratio of truck trips from Macaulay Point and Clover Point is 1.5:1.

The nature of the facility operation traffic is such that there will be:

- Additional truck traffic on neighbourhood streets near the Macaulay Point and Clover Point sewage pump stations,
- Additional truck traffic on an arterial street system that experiences high congestion during the weekday PM peak time period.
- Additional traffic generated on Millstream Road for the section north of the Trans Canada Highway, and
- A new industrial access on Millstream Road to the proposed site.

The amount and type of traffic generated by the proposed CRD Biosolids Treatment Facility will affect the area street system in terms of increased truck traffic volumes. Roadway capacity is not an issue. Safety and the introduction of truck traffic onto neighbourhood streets are the main issues to be considered and appropriately mitigated.

Except for the end sections of the routings, most roadways will experience a negligible magnitude of impact because they are high volume arterial routes designed to accommodate heavy traffic. Operations traffic related to the Millstream site is considered to be of moderate magnitude, ongoing duration, local extent, and irreversible. Thus, the impact of the facility operation is deemed to be **significant** on the neighbourhood street routes near Macaulay Point and Clover Point, and to be **less than significant** on the other routing sections.

***Mitigation*:** The operations related traffic can be mitigated to a **less than significant** level by:

- minimizing use of the neighbourhood streets near Clover Point, and using the shortest routes to arterial roads at Macaulay Point,
- ensuring the truck routings have adequate clearance for turning (i.e. prohibit on-street parking where relevant, etc.),
- ensuring the access to the site has adequate sight distance, or visibility, for entering onto Millstream Road,
- providing an appropriately designed (right turn) deceleration lane on Millstream Road into the site, and
- avoiding School and Safe Route to School zones where possible.

In addition, the site-generated truck traffic should be limited to travelling outside the 3 p.m. to 6 p.m. weekday peak traffic periods and ensuring that the truck operators travel within the road's speed limits and refrain from using 'engine brakes' in residential neighbourhoods. Finally, the Canadian Forces Base (CFB)

Esquimalt housing on the DND property (encompassing the CRD's Macaulay Point pump station) is likely to redevelop in the future. This redevelopment should make appropriate revisions to the road network through the DND property to accommodate a preferred truck route connecting the treatment facility to Lyall Street, thus eliminating the need to use the Munro Street and Fraser Street (one-way) routing section.

4.2.6.4 Cumulative effects assessment – Traffic

Future development in the Western Communities will be certain to affect traffic and roadway capacity, particularly because virtually all of the development occurring is "automobile dependent." The industrial park and "big box" development on Millstream Road generate larger-than-average proportions of truck traffic. Providing a new access from the Bear Mountain development onto Highway 1 in the future will temporarily mitigate Millstream Road congestion, but volumes on Highway 1 will continue to increase.

During the timeframe of the biosolids facility (2010 to 2045), vehicular traffic volumes will grow substantially throughout the region. Without significant changes to land use practices in the region to reduce the need for vehicular travel, or the implementation of a more effective transit system, traffic problems afflicting other North American cities will become common in the Capital Region. Blanshard Street, Highway 17, and Highway 1 will see great increases in traffic, as will arterial streets. As biosolids trucks travel between the Clover and Macaulay Point treatment plants and the Millstream biosolids facility, they will face increasing traffic volumes as the years pass, particularly during the weekday afternoon peak time period. Compared to the hundreds of millions of annual vehicle trips forecast for the CRD core municipalities, the 20,000 yearly truck and employee trips associated with the biosolids facility constitute a **less than significant** contribution. Nonetheless, all vehicular trips contribute to the problem, and efforts should be made to minimize travel associated with the biosolids facility.

With the implementation of the mitigation options summarized in Table 4-11, the resultant cumulative impact will be **less than significant**.

Table 4-11
Traffic impacts and mitigation for the Millstream Site

Issue	Potential Impact of Development	Mitigation
New Traffic	Increase in traffic volumes and truck traffic. Includes adding to existing weekday peak hour and Saturday afternoon congestion currently occurring on the SB to EB left turn off Millstream Road onto Trans Canada Highway.	1. Encourage employee car, van pooling, etc. 2. Minimize trucks travel during the 3 p.m. to 6 p.m. peak during weekdays. 3. Ensure trucks travel within the speed limits. 4. Consider improving the capacity of Millstream Road SB to TCH EB left turn movement.
Routing	Impact on neighbourhood	1. Recommend route with least residential frontages. 2. Minimize truck traffic impact on any one (local) neighbourhood street by using a one-way circuit from and to Macaulay Point. 3. Limit sludge haul truck sizes to less than 26,500 kg GVW. 4. Ensure use of truck routes where available. 5. Avoid School and Safe Route to School zones where possible. 6. Provide a direct truck route link between Macaulay Point sewage pump station and Lyall Street when DND
Noise	Impact on neighbourhood	1. Prohibit use of Engine Brakes in residential neighbourhoods. 2. Discourage trucks from being left idling.
Engineering Standards	Safety	1. Ensure appropriate road widths and truck turning radii along truck routes. 2. Use routings that provide appropriate infrastructure for safe pedestrian and cyclist travel.
Construction Traffic	Increased Traffic	1. Provide shuttles from Park and Ride locations. 2. Provide adequate crew parking on-site. 3. Promote use of nearest construction material suppliers and debris dump sites. 4. Consider constructing an access road connecting the site and Industrial Way. 5. If the site access is gated, ensure adequate magazine storage outside gate so that stopped vehicles will not be parked on Millstream Road waiting for gate to be opened.
Parking	Impact on Roadway	1. Provide sufficient on-site parking for construction staff; reduced upon completion of construction for ongoing staffing requirements.

Issue	Potential Impact of Development	Mitigation
Site Access	Safety and Capacity	1. Ensure Site driveway has adequate sight distance for egress onto Millstream Road by moving the current driveway 60 m to the north and cutting back the rock outcrop to the north. 2. Construct right turn deceleration exit taper off Millstream Road into site driveway. 3. Ensure driveway is constructed to Industrial width standards

4.2.7 Visual aesthetics

4.2.7.1 Study methods

An assessment of visual aesthetics entails a description of the changes in the attractiveness of a landscape or a site as a result of a project. The aesthetic assessment for the Millstream site is based on field inspections of the study area and its surroundings, interpretation of aerial photography, and the inspection of ground level digital photographs of the site and the landscape. The preliminary nature of the site layout designs precluded the use of digital elevation model-based visual assessments.

4.2.7.2 Existing conditions

Topography and forested screens limit the visibility of the Millstream site from Millstream Road or nearby developed areas. The bench and rolling land of the Millstream site is three to four metres higher than the elevation of Millstream Road. The lack of residential development to the north (where the Highwest Recyclers facility is located) or to the south (Crown-owned future industrial land, and the industrial park) reduce the number of people who could potentially see the Millstream site. The site itself features open vistas to surrounding lands, forested buffers, and undulating rock outcrops. The colour and texture of the site vary with these environmental features.

4.2.7.3 Aesthetic impacts and mitigation measures

Construction phase

Impact: Effect of building and site modification on visual aesthetics. The internal visual character of the site would be altered by construction of the biosolids facility. Topography of the eastern portion of the site would be changed from rolling rock outcrops to flat benches suitable for construction. The varied visual texture (rock, shrubs, conifers, deciduous trees, grasses) would be replaced by pavement and buildings. Little alteration to the topography of the western filled portion of the site would be likely. The addition of industrial-looking structures and equipment would constitute a change to the internal appearance of the site from the present undeveloped state.

Construction activities most likely to affect visual aesthetics are vegetation removal, blasting, and levelling. The visual isolation of the site suggests that few people would be capable of seeing these construction activities. With so few opportunities for observing the site, the visual aesthetic impact of construction is considered to be local, of moderate duration (up to two years), and reversible. The magnitude of the impact is considered low and **less than significant**.

Mitigation: Construction-related impacts on visual quality could be reduced even further by taking the following actions:

- Avoiding slash burning by hauling cleared vegetation material to other sites for disposal or by chipping onsite, and
- Using dust suppression techniques as necessary to reduce dust from travelling off the site.

Operations phase

Impact: Appearance of biosolids facility structures and site alteration. Construction of the biosolids processing facility on the site would transform the visual character of the property from a vacant and forested site to an industrial property. This change to the internal visual character of the site will be substantial (Photos 4-9 and 4-10) but the site topography and a 50 m vegetated buffer around the parcel will minimize visibility from Millstream Road or adjacent properties. Photo 4-11 shows that the biosolids facility would not be visible from the industrial park to the south. Similarly, Photo 4-12 shows that the Millstream site is effectively screened from view from Millstream Road by topography and vegetation. The facility may be visible from the private road to the Highwest Recyclers facility, but this road is not open to the public.

Based on this analysis, the visual impact of facility and site modifications at Millstream are considered to be long term and irreversible, but of low magnitude because of their limited visibility off the site. For this reason, the visual impact of facilities and site modification is deemed to be **less than significant**.

***Mitigation**:* The visibility of the Millstream site from the north, along the Highwest Recyclers private road, could be reduced by planting tall-growing coniferous trees and evergreen shrubs. Tasteful landscaping with native plants could also reduce the visual impact of the facility. Careful retention of vegetation in the designated buffer around the margin of the Millstream site would be necessary to maintain the **less than significant** rating.

Impact: Effect of facility lighting on visual aesthetics. Residential-style down-directed lighting is planned for the biosolids facility, rather than high-level industrial lighting. The introduction of lighting into this part of the Highlands will constitute an incremental increase in industrial light in the environment. Lighting has already been installed at the industrial park along Industrial Way, and similar lighting can be expected to be used when the Crown Land parcel to the south and east of the subject site develops.

Lighting from the biosolids facility is not expected to be noticeable from residential areas on the east side of Millstream Road. The facility is several hundred metres from the nearest housing. If and when housing develops on the west side of Millstream Road, it is likely to install residential style lighting. Any lighting potentially visible from the biosolids facility would be unlikely to be perceived as a negative impact by new residents to the west.

The relatively low levels of lighting proposed for the biosolids facility and the physical separation of the site from human observers indicates that the impacts would be long-term but of low magnitude. The lighting impacts are, therefore, considered to have a **less than significant** impact on the visual quality of the area.

Mitigation: The lighting impacts can be further reduced by taking the following actions:

- Minimize security lighting. Some recent studies have suggested that lighting does not discourage vandalism, and a dark site is less prone to these activities than those that are lit; hence lighting should be limited to that necessary for worker safety during night time periods,
- Use low intensity lighting, and
- Light only ground areas or facilities where maintenance or security requires such lighting. Avoid placing lighting high on poles if possible.

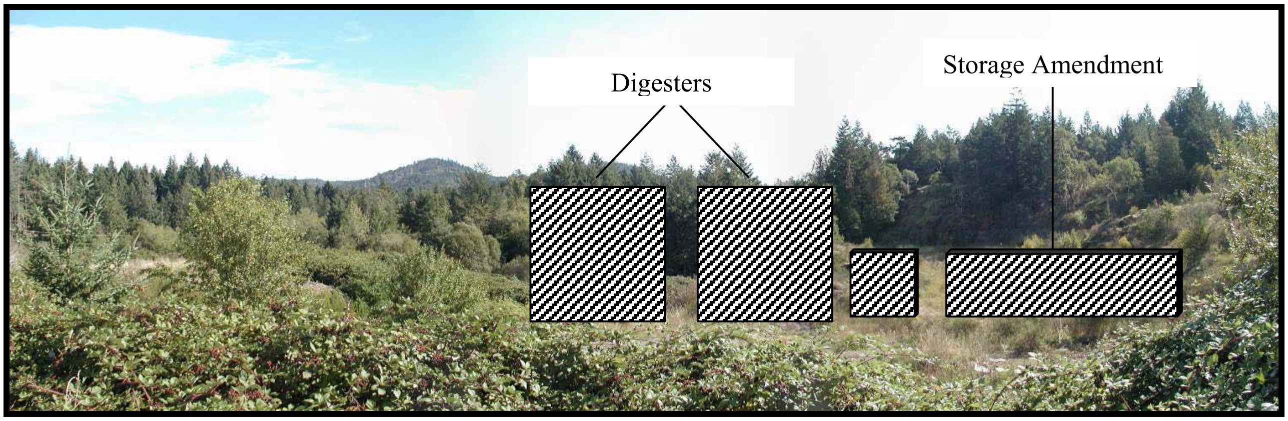


Photo 4-9 The biosolids facility structures on the Millstream site would be screened from view by surrounding trees and topographic buffers. This view looks east from within the site.

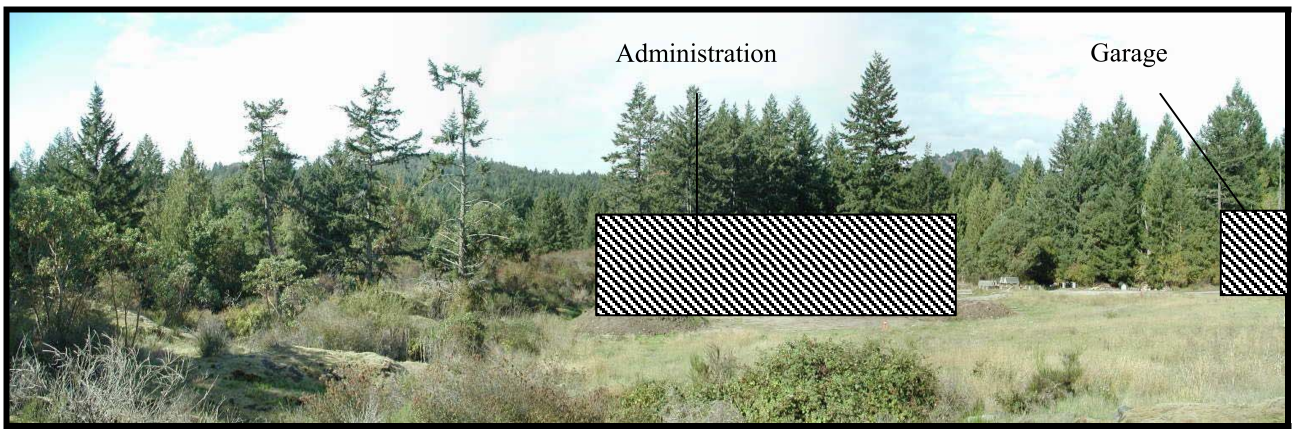


Photo 4-10 Looking north, the administration and garage would be visible from the Millstream site. Topography and trees would screen these buildings and the adjacent odour control and cogeneration structures.

Photo 4-11 From Industrial Way looking north, the biosolids facility on the Millstream site would not be visible beyond a forest and topographic buffer.

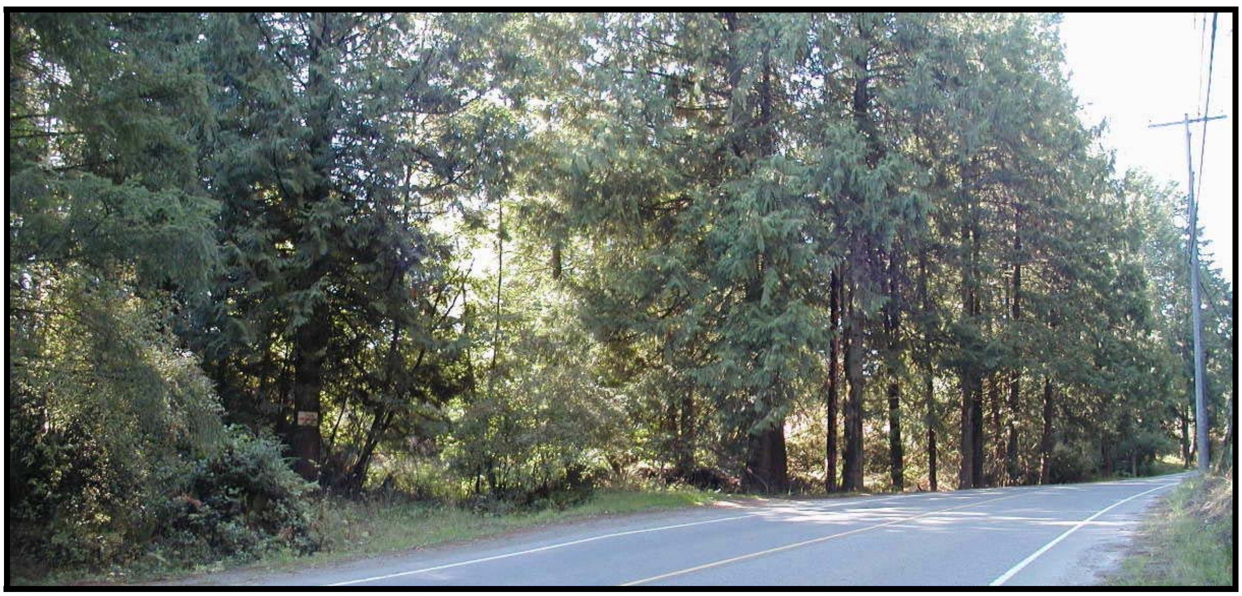


Photo 4-12 South on Millstream Road, the biosolids facility, beyond the trees on the left, would not be visible.

4.2.7.4 Cumulative effects assessment – Aesthetics

The urbanization of land to the south of the Millstream site constitutes a substantial visual quality change in the region. The replacement of coniferous and garry oak woodland landscapes with big-box commercial, golf course, and residential development constitutes cumulative degradation of visual quality in the local area. Other land uses near the Millstream site, such as Western Speedway, associated gravel extraction operations, and the Industrial Way industrial park also display a generally low level of design and visual quality. In the future, the potential for the development of substantial areas of land to the west of Millstream Road will extend the visual quality impacts of urbanization. In light of the extent of cumulative effects on visual quality in this part of the region, the contribution of the construction of a biosolids facility on the well-screened Millstream site is considered to be **less than significant**.

4.2.8 Land use and neighbourhood

4.2.8.1 Study methods

The land use and neighbourhood analysis is based on a review of existing plans and reports, discussions with municipal staff, and field inspection and assessment of local conditions.

4.2.8.2 Existing conditions

The Millstream site is owned by the Capital Regional District and lies in the District of Highlands, approximately 400 metres north of the District of Langford boundary. The subject site is bounded on the south and east by vacant forest land that is owned by the Crown and managed by Land and Water British Columbia. To the south of the Crown property on the east side of Millstream Road is the Industrial Way industrial park that includes a gravel pit, cement and asphalt batch plant, an auto wrecker, and assorted other land-extensive industrial uses. A single detached residence is built on a triangular property to the southwest of the Millstream site. To the north of the Millstream site lies a property used for construction waste disposal operated by Highwest Recyclers.

To the west of Millstream Road, most land is forested and vacant. The District of Highlands' new municipal hall is located just to the southwest of the subject site, west of Millstream Road. These actual land uses are shown on Figure 4-9.

The planned land uses in the vicinity of the subject property are somewhat uncertain because the District of Highlands is in the midst of an Official Community Plan (OCP) review and amendment. The existing OCP, as represented in the CRD's urban capacity inventory, shows land to the north and south of the Millstream site to be slated for industrial use, with some industry in the midst of the subject property (Figure 4-10). The remainder of the subject property and surrounding Crown Land is designated as "special status," meaning that it is controlled by a jurisdiction that is not regulated by municipal planning or zoning. This designation likely dates back to when the subject property was owned by the provincial government, before its transfer to the CRD.

Under the draft OCP (a document that lacks legal standing), the subject property, Highwest Recyclers to the north, and the industrial park to the south are all designated "commercial-industrial." The draft OCP also designates land to the west of the subject property as a "special study area." This land is subject to a rezoning application, to permit the Bear Mountain Highlands Neighbourhood Concept, which would see the large forested parcel converted to a golf course, driving range, 300 tourist accommodation units, 160 permanent dwellings, and ancillary commercial development. Lands to the southwest of the subject property are shown in the draft OCP as a combination of recreation-residential, intensive residential, rural residential, and park. These designations differ from the existing plan, which shows rural, commercial, park, new neighbourhood, and undesignated land to the west and southwest of the subject property.

The existing conditions in the Highlands near the subject site are characterized by sparse rural residential development, substantial industrial activity, and the potential for future development to the west.

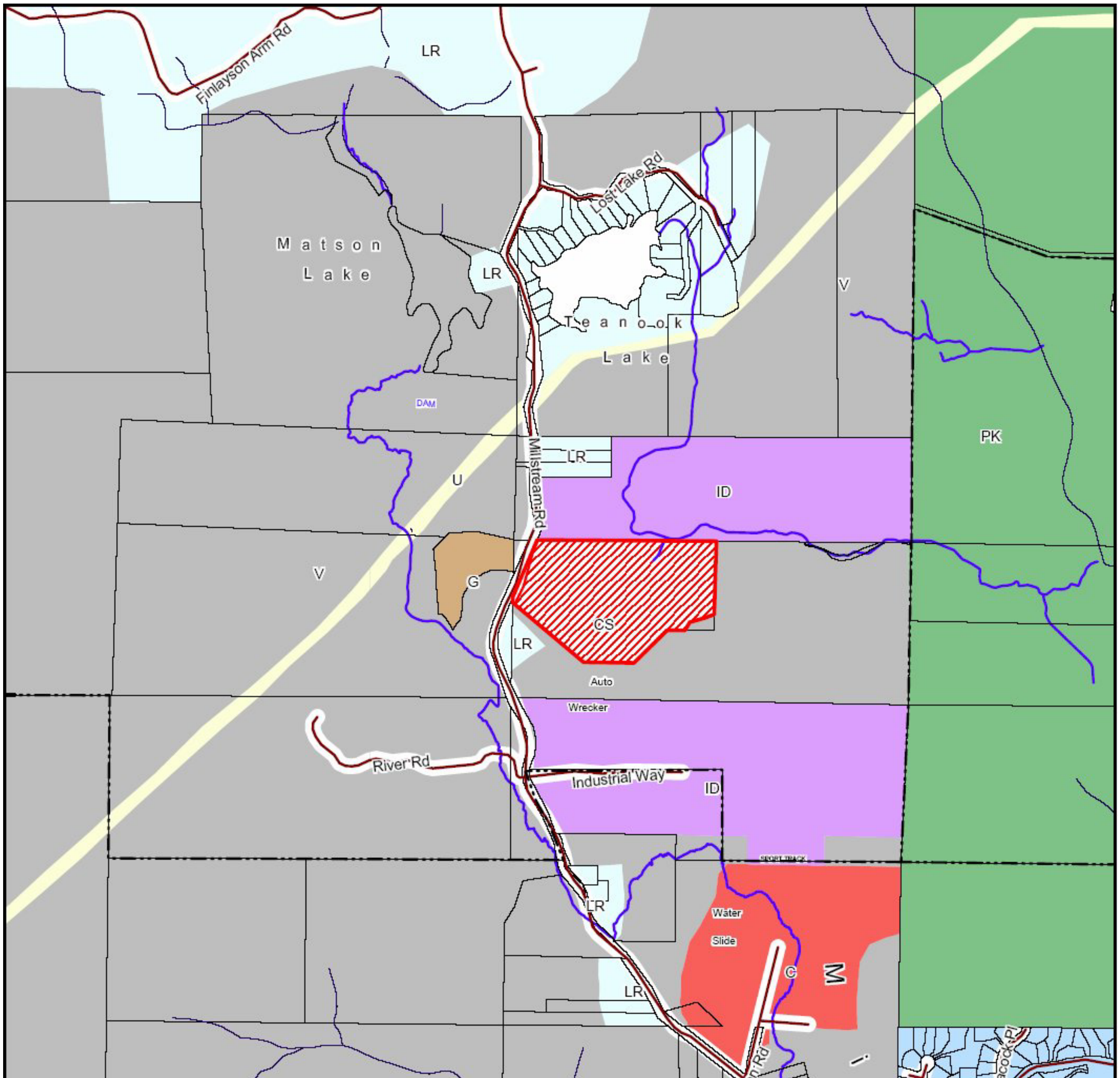


FIGURE 4-9
ACTUAL LAND USE NEAR THE MILLSTREAM SITE

CS	Candidate Site	C	Commercial
S	Suburban Residential	ID	Industrial
LR	Large-Lot Rural	AG	Agriculture
L	Landfill	G	Institutional
D	Defense Training	U	Utility
PK	Park	V	Vacant

Municipal Boundary
Cadastre (ICI)

N

0 100 500 m

Scale 1 : 15,000

WESTLAND RESOURCE GROUP INC.

September 2004

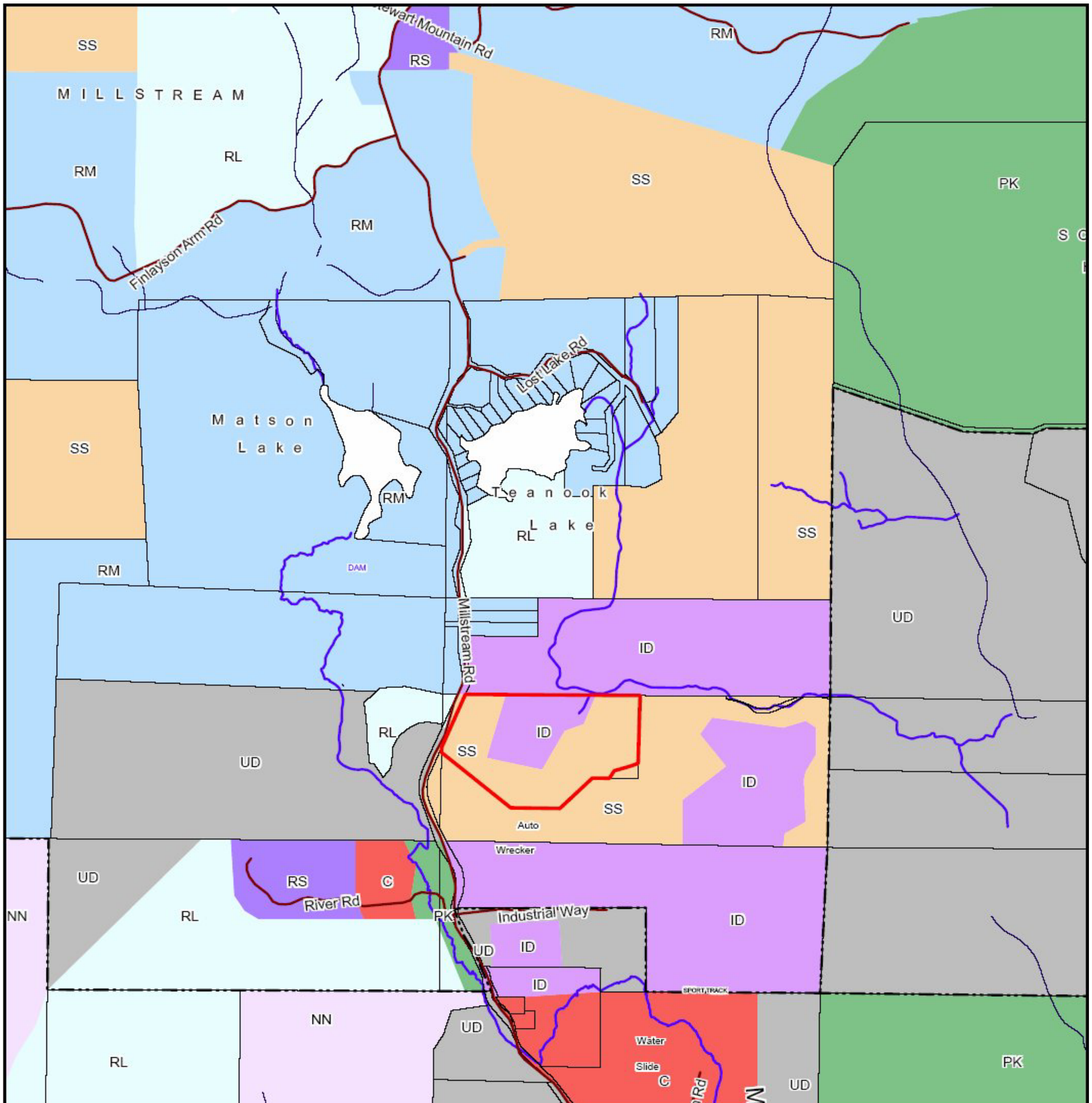


FIGURE 4-10
PLANNED LAND USE NEAR THE MILLSTREAM SITE

RS	Small-Lot Rural (0.2 - 1.0 ha min.)	C	Commercial
RM	Medium-Lot Rural (1 - 4 ha min.)	ID	Industrial
RL	Large-Lot Rural (4+ ha min.)	IS	Institutional
NN	New Neighbourhood	U	Utility
SS	Special Status	UD	Undesginated
PK	Park		

Source: CRD RPS SLUPS, 2002

Site Boundary
Municipal Boundary
Cadastre (ICI)

N

0 100 500 m

Scale 1 : 15,000

WESTLAND RESOURCE GROUP INC.

September 2004

None of the development permit areas (DPAs) described in the draft OCP apply to the subject property. Small areas of wetland DPA are designated to the north of the property and along Millstream Creek to the west of Millstream Road. A small area of sensitive woodland is designated a development permit area in the southeastern corner of the biosolids site. This portion of the site is designated as "buffer" in the biosolids facility draft site development plan, and would remain undeveloped.

The southern portion of the highlands on the east side of Millstream Road (where the biosolids candidate site is located) is reportedly in a servicing area identified in the Regional Growth Strategy. The area on the west side of Millstream Road, however, is outside the designated service area (Woodbury, pers. comm.).

4.2.8.3 Land use and neighbourhood impacts and mitigation measures

Construction phase

Impact: Community effects of facility construction. Construction of the biosolids facility, like any major construction initiative, could prove disruptive to surrounding residents. Major sources of disruption include:

- Construction traffic, particularly heavy trucks,
- Site preparation noise and vibration caused by blasting and grading,
- Dust from site preparation and truck traffic, and
- Parking on adjacent streets by construction workers.

In the case of the Millstream property, few residential properties near to the candidate site are used for residential purposes, so few Highlands residents would experience disruption during construction. Only one residence borders the Millstream site to the southwest. In Langford, the residential area south of the Western Speedway site and north of Home Depot may experience a modest increase in truck traffic. These residents, however, have been subject to heavy traffic volumes associated with construction generated by the Bear Mountain development. The additional traffic volumes associated with building the biosolids facility are unlikely to increase impacts on adjacent residences above existing levels.

The duration of biosolids facility construction impacts on the community would be approximately two years during the initial phase and an additional two years during the expansion period. During this time frame, the level of construction activity and associated impact would be unevenly distributed. The magnitude of the impacts are considered to be generally low, though occasionally may rise to moderate if temporary road closures are required. The construction impacts are considered temporary and reversible. Overall, the land use and neighbourhood impacts of biosolids facility construction are considered **less than significant**.

Impact: Compatibility of the development with local land use plans: The biosolids facility is generally consistent with the land uses proposed for the candidate site in the Official Community Plan. Rezoning would be required, however, from the existing Greenbelt 2 (GB2) zone to a zone permitting the biosolids activities. The GB2 zone allows residential, agricultural, home based business, and accessory uses. All of the CRD-owned property, adjacent Crown Land, Highwest Recyclers, and most of the industrial park are also zoned GB2. This non-conforming zoning on or near the site could be resolved by rezoning to permit industrial uses, which would be consistent with the intent of Highlands Council (Woodbury, pers. comm.).

The land use impacts of the biosolids facility, particularly the requirement for rezoning, constitute a medium term impact that would be reversed when rezoning occurs. The spatial extent of the land use impact extends only to the boundaries of the candidate property. The magnitude of this impact is considered moderate, because the public and Highlands Council need to be engaged in the process of rezoning, but overall it is considered to be a **less than significant** impact because the biosolids use is consistent with the stated aims of Highlands Council.

> ***Mitigation****:* The compatibility of biosolids facility construction with local land use plans can be assured by having the necessary zoning in place well before construction is necessary. In this way, public discussion can occur and municipal approvals be provided without undue scheduling pressures.

Operations phase

Impact: Biosolids odour effects on adjacent land uses. The odour model run for the biosolids facility indicates that odours at the site boundary would not reach detectable levels under planned treatment. Hence, no odour impacts on adjacent land uses are expected to result from the operation of the biosolids facility. Equipment malfunctions, human error, or facility maintenance may result in the release of noticeable odours from the facility, however. These events are expected to be short-term, and rare in occurrence. Odour impacts are entirely reversible, and the magnitude of this potential impact is considered low. The impact of odour impacts on adjacent land uses, therefore, is deemed to be **less than significant**.

> ***Mitigation:*** To ensure that land use effects of odour emissions remain less than significant, the following mitigation measures must be implemented.

- Ensure that the highest level of odour treatment is installed at the biosolids facility at the time it is constructed.
- Rigorously monitor the effectiveness of odour control in eliminating impacts on adjacent properties.
- Regularly maintain and upgrade the facilities to ensure sufficient odour control necessary to eliminate impacts.

Impact: Effect of operational traffic on the neighbourhood. Once the biosolids facility is in operation, relatively low volumes of traffic are expected at the site (see Section 4.2.6). As long as traffic volumes are consistent with those predicted in this study, and the rural character of the area is maintained, this impact is considered **less than significant**.

> ***Mitigation:*** Ensure mitigation measure identified in Section 4.2.6 are fully implemented.

4.2.8.4 Cumulative effects assessment – Land use and neighbourhood

The Western Communities of the Capital Region have been subject to intense development pressure in recent years. The policies of some municipal councils have encouraged rapid residential and commercial development. With the development of "big box" area north of the Millstream interchange, the construction of the Bear Mountain golf course and associated housing, and other residential development along Bear Mountain Parkway, land use change has been dramatic south of the candidate biosolids site. To the north and east of the candidate site, less land use change has occurred recently and limited change is foreseeable, so the greenbelt and residential character of this part of the Highlands will remain for the foreseeable future. The Crown property to the south and east of the candidate site has been discussed for industrial development, as has intensification of land uses in the existing industrial park. Rezoning the area to the west of the candidate site, the so-called special study area, would result in dramatic change in land use from the existing forested landscape to an urban landscape. In the context of this high level of land use change, constructing the biosolids processing facility on a site previously used for liquid waste management is not considered to materially affect land use or neighbourhood conditions in the municipality. The biosolids facility, therefore, is judged to make a **less than significant** contribution to local cumulative effects on land use or neighbourhoods.

4.2.9 Property values

4.2.9.1 Study methods

Potential impacts of the proposed biosolids disposal facility on property values were investigated. Several attributes of the facility (including odour, traffic and general operations) were considered as potentially affecting the values of nearby property. A review of the most recent literature on the subject of land use impacts on property values was undertaken.

Whereas most property value impact analyses seek potential impacts on property values, recent research[5] indicates that if one tests the null hypothesis (i.e. that there is no impact on property values), no diminution in property value could be detected. Such results were found even in cases where conditions strongly suggest the presence of negative impacts. If the null hypothesis cannot be rejected, then further statistical efforts to measure a diminution of property value may be meaningless or misleading. Theoretical issues aside, a recent study[6] (of more than 8,000 property transactions over a four year period) of the impacts on property values (in Pennsylvania) found the following:

Operation	Change in value of nearby properties
Landfill within 800 meters	-6.9% (no impacts further than 3,200 meters from site)
Animal production facility (large scale) within 800 meters	-4.1% (no impacts further than 1,600 meters from site)
Mushroom production facility within 800 meters	-0.4%
Regional airport	-0.2%
Sewage treatment plant	No impact

These results, regardless of theoretical objections as previously discussed, make intuitive sense in terms of relative magnitude of impacts of operations that involve the potential emission of strong odours (landfill, animal production, mushroom production, and sewage treatment). It is evident that a biosolids facility would have lower magnitude odour impacts than a sewage treatment plant, and thus would be less likely to cause negative property value effects.

In the case of non-odour impacts, consideration was given to the impacts of increased truck traffic on property values. Information provided by the traffic consultants

[5] Albert Wilson, "Proximity Stigma: Testing the Hypothesis (Property Valuation)" in Appraisal Journal, June, 2004
[6] Richard Ready and Charles Abdalla, GIS Analysis of Land Use on the Rural-Urban Fringe: The Impact of Land Use and Potential Local Disamenities on Residential Property Values and on the Location of Residential Development in Berks County, Pennsylvania (Penn State University Staff Paper 364, June 2003).

indicated that haul routes under consideration already support high volumes of truck and bus traffic, so property value effects of traffic are already reflected in existing property values. Discussions with CRD Property, Building and Bylaw Enforcement staff confirmed this opinion. The aesthetics section of this report determines that the biosolids facility will not be visible from residential areas, so appearance of the facility is unlikely to affect property values.

Based on this assessment, the characteristic of the biosolids facility most likely to result in property value impacts was odour. Hence, the remainder of the analysis focuses on the determination of potential odour impacts on property values.

The analysis of potential odours on property values is based on a review of property valuation literature, property assessment data, existing plans and reports, discussions with municipal staff, and field inspection and assessment of local conditions.

4.2.9.2 Existing conditions

The area surrounding the Millstream site is generally industrial with sparse residential development. The site is bounded on the south and east by vacant, Crown-owned forested land. To the south of the Crown property is the Industrial Way industrial park that includes a gravel pit, cement and asphalt batch plant, an auto wrecker and assorted other industrial uses; this industrial activity includes potentially odour-producing activities on-site as well as a steady stream of diesel trucks, which are also odour producing. To the north of the candidate site is a construction waste disposal operation (Highwest Recyclers) that contributes to the diesel truck traffic along Millstream Road. Burning of construction waste regularly generates smoke in the study area. The land to the west is mostly forested and vacant. The District of Highlands' new municipal hall is located southwest of the subject site.

The existing District of Highlands OCP shows land to the north and south of the Millstream site to be slated for industrial use, with some industry in the midst of the subject property. The District is now reviewing the OCP, and the draft plan shows the candidate site, Highwest Recyclers to the north and the industrial park to the south to be designated “commercial-industrial”.

4.2.9.3 Property value impacts and mitigation measures

Construction phase

Much of the area surrounding the candidate site is undergoing industrial, commercial and residential development. Odours resulting from such development are caused by intermittent slash burning of woodlands and a continuous and high volume of diesel trucks and other heavy equipment, particularly on Millstream Road. These odour and related development impacts are already factored in to property values. In this context, it is anticipated that there will be no odour-related impacts on property values during the construction phase. Odour impacts on property values during the biosolids facility construction phase are expected to be **less than significant**.

Operations phase

No odour impacts on the market values of adjacent properties are expected to result from the operation of the biosolids facility. Section 4 of this report examines the potential for odours from the biosolids processing plant to affect surrounding properties. The analysis concludes that with the high quality odour control technology proposed to be installed at the biosolids facility, it is unlikely that noticeable odours would affect the surroundings. The odour model run for the biosolids facility indicates that odours would not be detectable (i.e. would be less than 7 odour units) beyond the site boundary under normal operating conditions (when 99% odour removal is achieved by on-site treatment) or under routine maintenance conditions (when 97% odour removal is achieved by on-site treatment). Equipment malfunctions or human error might result in the release of noticeable odours from the facility, but such events are expected to be rare and of short duration. Given that existing odour-emitting land uses are already active in the study area, industrial, property values are assumed to already have compensated for the operation of facilities of an industrial nature such as the biosolids facility. Odour emissions impacts on adjacent property values during the operations phase are expected to be **less than significant**.

> ***Mitigation:*** To ensure that there will be no property value effects of odour emissions, the following measures should be implemented:
>
> - Install the highest available level of odour treatment at the biosolids facility at the time it is constructed;
> - Rigorously monitor the effectiveness of the odour control treatment;
> - Regularly maintain and upgrade the facilities to ensure the highest level of odour control necessary to eliminate any potential impacts.

4.2.9.4 Cumulative effects assessment – Property values

The general area of the candidate site has undergone significant land use development over the past several years. Presently, the operation of a cement and asphalt batch plant south of the candidate site and a construction waste disposal operation north of the candidate site produce odour emission in the study area, as do diesel truck and heavy equipment traffic. Slash burning to clear land for commercial and residential development also occurs. Thus, the area is already subject to odour-producing activities. Although future use of Crown-owned forest land north and east of the candidate site cannot be known, the area surrounding the candidate site is likely to remain "commercial-industrial" in the OCP. In this context, the operation of a biosolids facility, under which odours are not expected to be detectable off the site except in cases of equipment malfunction or human error, cannot be expected to contribute to cumulative impacts on the value of nearby properties.

4.2.10 Archaeology and heritage

4.2.10.1 Study methods

A review was carried out of both archaeological and ethnographic reports and related material pertaining to the study area. This process included a review of archaeological site inventory records (maintained by the Archaeology and Registry Services Branch of the British Columbia Ministry of Sustainable Resource Management) and a review of old maps and legal survey data from the British Columbia Surveyor General's Office in Victoria for both of the biosolids facility sites. The latter source often contains records of mid to late 1800s land-use and settlement by local First Nations people.

Although the background research, carried out prior to a field examination of the two subject locations, revealed that neither location contained any previously documented archaeological sites or features, both areas were considered to have some potential for containing rock cairn structures (sometimes used by local First Nations to bury their dead). Both locations also had a potential for culturally modified tree (CMT) features. The latter are usually found in association with stands of red cedar, with the most common CMT type being tapered bark-stripped trees. Both of the study locations were also deemed to have some potential for containing inland "shell midden" deposits. However, the possibility of finding evidence of such sites was considered to be quite low, given the steepness of terrain within both areas and their considerable distance from the nearest ocean shoreline (where most such sites are found).

After gathering information about the history of First Nations land-use and settlement in the general vicinity of the two subject facility locations, a limited archaeological field reconnaissance was carried out. This work was accomplished over a period of two days during July and August 2004. The field reconnaissance involved an examination of lands within the two biosolids facility sites by means of a series of foot traverses during which a detailed inspection was made of cedar trees and existing sub-surface exposures. Special attention was paid to boulder clusters that might represent cairn burial locations. It should be noted that no sub-surface testing for buried archaeological deposits was carried out in the course of the field reconnaissance.

4.2.10.2 Existing conditions

The Millstream site contains no previously documented archaeological sites or features and none of the references consulted mentioned any traditional use areas or aboriginal settlement sites within, or in the vicinity of the Millstream location. The area was deemed to have a low potential for the presence of archaeological or other cultural heritage sites or features, due mainly to the site's rugged topography (being characterized by a series of steep rocky knolls, separated by heavily vegetated wetlands). There are no major creeks or other drainage features on the subject site. Red cedar stands are sparse and where they occur, these are mostly second-growth. No evidence of past aboriginal use or occupation was observed in the course of the field reconnaissance.

Based on the lack of recorded archaeological or aboriginal land-use evidence, coupled with the negative results from our field examination of the Millstream Site, it is our opinion that this proposed site has minimal potential for containing any archaeological evidence of past First Nations use. Following from this conclusion, we do not recommend additional archaeological investigations prior to the construction of a biosolids facility at this location.

4.2.10.3 Archaeology and heritage impacts and mitigation measures

As a result of the investigations conducted, building and operating the proposed biosolids facilities at the Millstream site are deemed to have no impact on archaeological or heritage features. The impact is deemed **less than significant**.

Mitigation: None required.

4.2.10.4 Cumulative effects assessment – Archaeology and heritage

The relatively long period of European settlement in Greater Victoria has resulted in disturbance of many archaeological and heritage sites in the region. The extensive site disturbance associated with land development in the vicinity of the Millstream site, particularly to the south, has the potential to have affected archaeological features. Future land use change (see Section 2.4.8.4) could affect remnant archaeological sites that survived initial logging and settlement activities in the study area. The cumulative effect of planned future development in the study area on archaeological and heritage features is considered **significant**. Because this ESR has determined that there is little likelihood of encountering archaeological features on the biosolids facility site, however, the biosolids development is deemed to make a **less than significant** contribution to archaeology and heritage cumulative effects.

5.0 Hartland Site

5.1 General site description and reasons for selection

The Hartland site is a CRD-owned property located to the northwest of the Hartland landfill. Except for the cleared lower pad, the Hartland site has mature second-growth forest on most of the parcel. Access to the candidate site is from Willis Point Road, which has a long left turn bay (heading west). A vegetated buffer and raised berm (south of the driveway access) screen the site from view from Willis Point Road. The graded lower bench was previously used to compost garden waste. Some organic material is still composted on the site. The northern two-thirds of the candidate site drains to the north, towards Willis Point Road. The southern one-third of the site drains southeastward, toward the Hartland Landfill.

The advantages of the Hartland site, compared to other parts of the CRD that were assessed for the biosolids facility, include:

- The site is well separated from residential uses by designated treed buffers and non-residential land uses, including Department of National Defence land, parks, and the landfill,
- Locating this liquid waste processing facility adjacent to the solid waste facility at Hartland Landfill is appropriate from a land use perspective,
- Methane generated by biosolids processing could be beneficially used for energy generation at the Hartland Landfill power generation facility,
- The site is partially graded, ready for construction of part of the facility,
- The proposed zoning for the site, based on the Solid Waste Management Plan, permits uses slated for the biosolids facility,
- The site has good road access on highways and arterial roads, and
- The site is owned by the Capital Regional District.

The Hartland site's drawbacks include:

- Site topography would require grading to permit facility construction,
- The CRD commitment to retain treed buffers in the centre and west edge of the property limit siting flexibility and increase cost,
- CRD plans to store gravel on the level lower pad reduced the ability to use this portion of the site for biosolids facilities.

5.2 Environmental and social review

5.2.1 Landforms, geology, and soils

5.2.1.1 Study methods

The landform, geological, and soil conditions on the Hartland site were determined on the basis of a review of existing reports and field inspections. No surface or subsurface testing was conducted as part of this study. Engineering studies of the Hartland Landfill have aided the description of this adjacent candidate site.

5.2.1.2 Existing conditions

Landforms and Geology

The geology of the Hartland area is characterized as hilly to strongly rolling terrain. The candidate biosolids facility site has strong local topography, with a north-facing bench on the northern portion of the site, crossing a saddle to south and east-sloping areas in the southern portion of the site. Bedrock is always near to the surface on the sloping portions of the site. The graded bench in the northern portion of the site was constructed on an old enclosed drainage, atop some organic soils.

Soils

Hartland site soils are of the Sprucebark Soil Association on 60 percent of the site. These soils occur in the coastal grand fir-western redcedar forest zone in the Nanaimo lowland physiographic subdivision, and develop in sandy, bouldery, or sandy-rubbly colluvial or morainal deposits. Sprucebark soils are usually less than one metre thick, and are rapidly drained orthic dystric brunisols that overlie intrusive bedrock. These soils typically occur at elevations below 300 m.

Bedrock outcrops are found on approximately 30 percent of the Hartland site, particularly at higher elevations. On the remaining 10 percent of the site, Somenos soils overly the bedrock. Somenos soils are gravelly sandy loams that typically form on moraines. Both Sprucebark and Somenos soils are typical of Vancouver Island forests, and neither are considered to be highly productive.

5.2.1.3 Landforms, geology, and soils impacts and mitigation measures

Construction phase

Impact: Reconfiguration of Hartland site landforms. Most of the landscape disturbance associated with the project would occur during the construction phase. Much of the presently-undisturbed landscape would be cleared and graded. The extent of disturbance would not be known until completion of detailed designs for the facility. Little site preparation work would be needed for construction on the graded bench that already exists on the site. Upgrading and modest realignment of the existing road system would also be required.

Little of the Hartland landform recontouring would be visible from outside the property. Although grade changes of up to 10 m could occur in the southwestern portion of the site, these cuts and fills would be screened by adjacent treed areas. These landscape changes are considered to be permanent and irreversible. The impacts would affect building envelopes on all but the lower bench of the Hartland site, and roads. The duration of the impact would include all site preparation activities for the biosolids facility. Considering the Hartland site in the context of the surrounding properties, the magnitude of landscape change is considered moderate. Because a relatively small area would be affected (approximately 4.5 ha), the substantial landscape change that has occurred and will continue on the adjacent Hartland Landfill site, and because of the screening of the change from beyond site boundaries, this impact is considered to be **less than significant**.

> ***Mitigation:*** If site clearing and regrading on the southwestern portion of the site is deferred, it may be possible that the lower bench will be freed for construction of the biosolids facility expansion. Although present CRD plans call for storage of gravel on the lower bench until 2040, by 2020 plans may have changed or alternative storage areas may have been identified. If construction of the expansion areas can be relocated to the lower bench, most of the landscape impacts on the southwestern portion of the site can be avoided.

Impact: Removal of soils. Prior to grading, soils would be stripped from the central and western portions of the Hartland site. The soils are typically shallow in this area, so the volume of soil to be moved is expected to be modest. Soils would be stockpiled for later use in landscaping the property, so they would be relocated rather than removed from the site. Soil quality, damaged by handling, typically recovers after several years.

The soil removal impacts are considered local, as they are limited to the building envelope and road prisms. The duration of the impact is considered to be moderate term, because it would include facility construction (1-1/2 to 3 years) and several years to recover soil productivity. The volume of soil affected by construction would not be known until detailed designs are prepared, but the soils on the Hartland site are shallow, and the magnitude is considered moderate. Because the soils will be reused on the site following construction, the impact is considered reversible, recognizing that the area on which soils will be replaced will be smaller than the existing area under soil. Considered in the context of the local area, the relatively low productivity, and the small volumes of soil affected by construction suggest that the impact of construction on soils would be **less than significant**.

> ***Mitigation:*** Careful removal and stockpiling of soil prior to construction would allow it to be spread on the site later. Protection of the soil against erosion or contamination by chemicals or noxious weeds would improve its value when spread on the site following construction.

Impact: Potential increase in erosion and sedimentation. Clearing and grubbing of vegetation prior to construction would be followed by stripping and stockpiling of soils. Exposure of soil to heavy rainfall could lead to erosion. Covering or reseeding of soil stockpiles during the construction period reduces erosion risk. Reseeding with grasses during the two-year construction period could effectively minimize erosion. The Sprucebark and Somenos soils are typically coarse and well-drained, reducing inherent erodibility.

The spatial extent of the erosion risk is limited to the areas where soils would be exposed to rainfall, mainly soil stockpiles and exposed cut and fill areas. The duration of the impact would last from vegetation clearing to the establishment of vegetation in re-seeded or landscaped areas, a moderate term of up to four years. Erosion and sedimentation impacts are typically reversible, through revegetation of depositional areas, and deposition of soil in eroded areas. The magnitude of the erosion and sedimentation risk on the Hartland site is considered moderate, due to the steep slopes involved. The lack of sensitive depositional areas for sediments, the relatively small area subject to erosion and sedimentation risk, the small volume of soil affected, and the temporary nature of the soil disturbance leads to a rating of **less than significant**.

> ***Mitigation:*** The erosion and sedimentation risk can be reduced further by taking the following actions:
>
> - Preparing and implementing an erosion and sediment control plan prior to construction.

- Covering stockpiles of soils with tarps if heavy rain is anticipated.
- Seeding stockpiled soils with fast-growing grasses to provide moderate-term protection against erosion and sedimentation.
- Making good use of sediment fences, straw bales, etc. during soil stripping and site levelling activities, to prevent sediments from leaving the site.
- Ensuring the full reuse of stockpiled soils during site landscaping.
- Using an "avoidance and control" approach to preventing erosion and sedimentation rather than responding to an event after it has occurred.
- Having an environmental monitor onsite during soil stripping, stockpiling, and extensive land levelling activities. The monitor should inform construction staff about erosion and sediment control, and stockpile a supply of erosion control materials onsite.

Operations phase

Impact: Landform and geology effects. After the construction is completed and operation of the biosolids facility begins, no additional impacts on the landforms or geology of the Hartland site are expected.

Impact: Erosion and sedimentation risk during operation. Heavy rainfall on exposed soils can increase erosion risk. This risk is greatly reduced under established vegetative cover. The extent of post-construction erosion risks cannot be estimated until detailed designs are prepared.

Under typical facility design and construction practices, the area of exposed soils subject to erosion during operation is considered to be relatively small. The duration of such risk would be highest during the interval between the end of construction and establishment of vegetation. Some additional soil exposure and erosion risk could be expected during construction of the expanded biosolids facility, although this should be considered a construction impact. Erosion and sedimentation from operations are considered to be local in extent and reversible. The magnitude is considered to be low and the impact **less than significant**.

Mitigation: To ensure that operational erosion and sedimentation impacts remain less than significant, the following actions could be taken:

- Maintain a stock of erosion control materials onsite (straw bales, erosion fences, etc.).
- Minimize areas of steep fill around the facility where soils are exposed to rainfall.

- Use dense plantings of native vegetation to ensure good coverage of bare soils, thereby reducing erosion risk.

5.2.1.4 Cumulative effects assessment – Landforms, geology, and soils

The most substantial landform-altering urban development that has occurred near the Hartland site is the expansion and change to the Hartland landfill, but within a kilometre of the Hartland site, human activity has affected the environment in a variety of ways. Rural residential development in the Highlands and Juan de Fuca electoral area, and suburban residential development near Hartland Road have affected the landscape and increased motor vehicle traffic near the site. Clearing at the Department of National Defence Heals Range has reduced forest cover, as has agricultural development of the Tod Valley well to the east of the Hartland site. Establishment of Mount Work Regional Park to the west and north of the Hartland site provide a buffer of undeveloped land, though even here the effects of human recreational activity will be felt. Except for the Hartland Landfill, the largest agent of landscape change near the Hartland site was the expansion of Willis Point Road. The relatively small area affected by the biosolids facility suggests that cumulative effects on landscape, geology, and soils would be **less than significant.**

5.2.2 Hydrology and water quality

5.2.2.1 Study methods

The hydrology and water quality conditions on the Hartland site were determined on the basis of a review of existing reports and field inspections. No surface or subsurface testing was conducted as part of this study. Engineering studies of Hartland landfill have aided the description of this adjacent site.

5.2.2.2 Existing conditions

Surface Water

Surface water flow at the Hartland site is split between the Tod Creek-Prospect Lake watershed and the Craigflower Creek watershed. Most of the site slopes to the northeast, directing runoff toward Willis Point Road. This part of the site drains through an ephemeral channel that originates at the northwest corner of the facility. The water is carried through a culvert under Willis Point Road and into the drainage channel, eventually discharging into Durrance Lake approximately 450 m from the site. Flow through the channel only occurs during wet weather. During dry periods, several wetlands persist along the drainage course but are not connected by surface flows. Approximately 300m northeast of the Hartland site, the flow in the creek increases due to the inflow of groundwater. A small wetland and its associated drainage are located in the northwest forested area of the site. Another drainage crosses the Hartland site just east of the cleared and levelled area along the edge of the power line right-of-way. The southern and western portion of the site slopes to the southeast, directing surface water runoff toward Hartland landfill.

Durrance Lake has a surface area of approximately 8 ha and an average depth of 8 m, and discharges into Durrance Creek. Durrance Creek flows from the lake in an easterly direction to its confluence with Heal Creek, a small creek that flows northeasternward from Heal Basin. Heal Creek frequently dries up during the summer months except near its confluence with Durrance Creek, where springs maintain year-round flow. Durrance Creek continues discharges to Tod Creek, which in turn discharges to Tod Inlet, about 3 km north of the Hartland site.

Surface water quality is monitored in the vicinity of the Hartland site by the CRD as part of the overall program for the Hartland landfill, as shown in Figure 5-1. Samples are also taken at Heal, Durrance, and Tod Creeks. The tested parameters include temperature, nitrogen-ammonia, chloride, electrical conductivity, total and dissolved iron, nitrogen-nitrate, nitrogen-nitrite, pH, potassium, sodium, and sulphate. Additional parameters for the compost area include chemical oxygen demand (COD), total suspended solids (TSS), and manganese. No samples taken in 2001 and 2002 reported parameter concentrations that exceeded the *British Columbia Approved Water Quality Guidelines for the Protection of Aquatic Life* (Ministry of Water, Land and Air Protection, 1998a, updated 2001). (Gartner Lee Ltd., 2003)

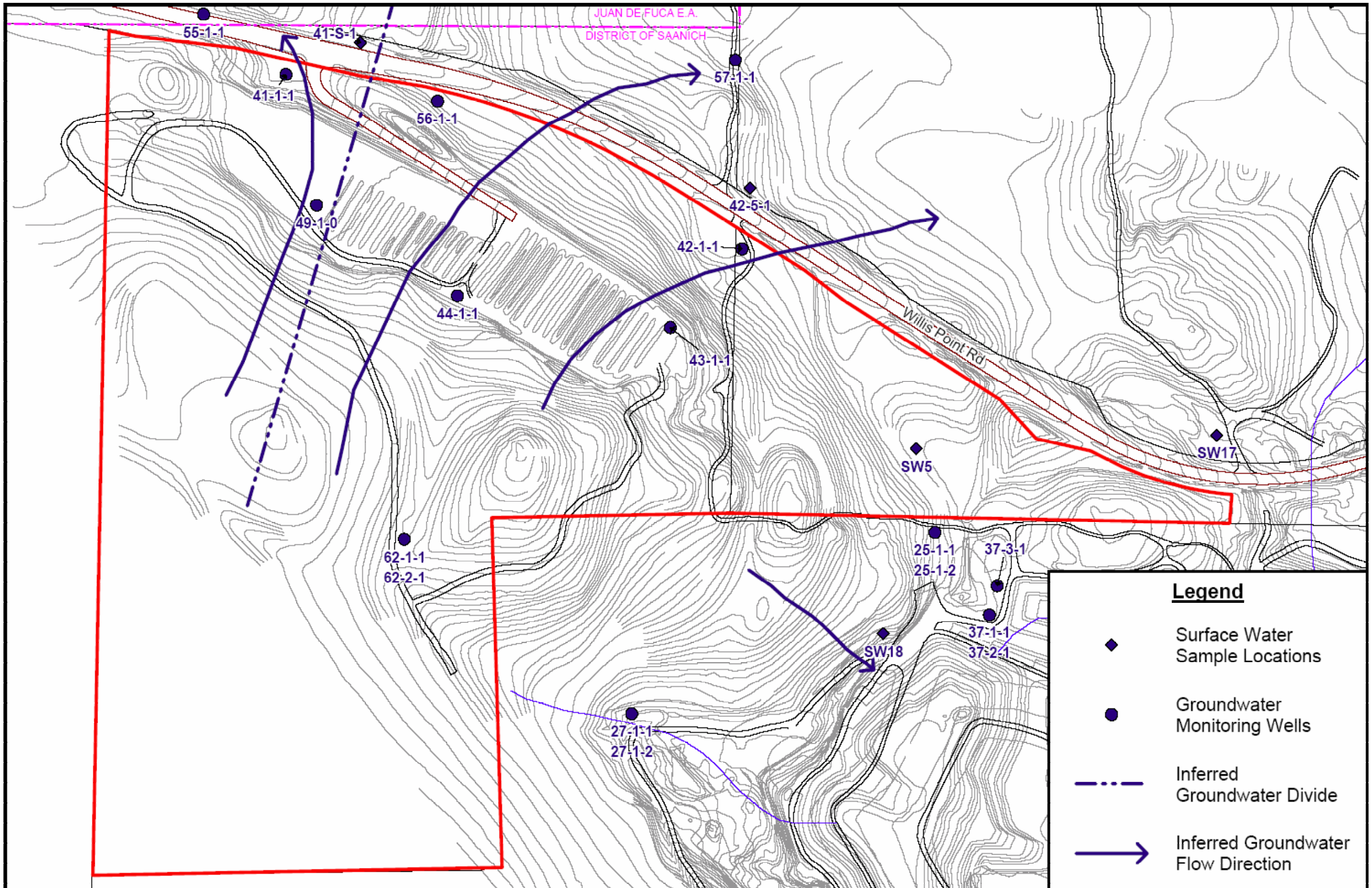


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FIGURE 5-1
GROUNDWATER AND SURFACE WATER SAMPLE LOCATIONS AT THE HARTLAND SITE

N

0 10 50 100 m

Scale 1 : 4,000

September 2004

Groundwater

Groundwater is water that flows or seeps downward and saturates soil or rock, supplying springs and wells. Ten monitoring wells, shown in Figure 5-1, reveal groundwater conditions at the Hartland site. These wells have been monitored for water level, hydraulic conductivity, interpretation of groundwater flow, and assessment of groundwater quality.

The inferred groundwater flow under the Hartland site is northward toward Willis Point Road and southeast toward Hartland landfill, as shown in Figure 5-1. North of Willis Point Road, the groundwater flow separates and diverges around a bedrock knoll where a groundwater divide is located. The groundwater under the western quarter of the site flows northwest, towards Durrance Lake. The flow from the eastern three quarters of the site is to the northeast, towards Durrance Creek and Heal Creek, and to the southeast toward the Hartland landfill. Groundwater in the footprint area of the landfill is collected by an underdrain system that creates a hydraulic trap, which precludes migration of leachate out of the basin. The collected groundwater and leachate is stored in a leachate lagoon and discharged to a dedicated leachate pipeline.

Based on the groundwater velocity determined in previous studies, the travel time for groundwater to move 400 m from the middle of the Hartland site to Durrance Lake is approximately five years. It is likely that the travel time is reduced by groundwater discharges to the ephemeral creek north of Willis Point Road prior to reaching Durrance Lake. (Gartner Lee Ltd., 1997)

Groundwater quality in the vicinity of Hartland landfill has been monitored since 1983. Annual monitoring reports have been issued since 1988. Groundwater quality is assessed at the monitoring wells to look for changes in water chemistry that could indicate effects of landfill leachate on groundwater. The tested parameters include electrical conductivity, pH, nitrogen-ammonia, chloride, sulphate, iron, sodium and potassium. Additional parameters for the compost area include chemical oxygen demand (COD) and manganese. The data are compared to the *British Columbia Approved Water Quality Guidelines (Criteria)* (Ministry of Water, Land and Air Protection, 1998a, updated 2001).

In 2001 and 2002, samples taken southeast of the site at locations 25, 27, and 31-2-1 were in compliance with water quality criteria. Iron concentrations at location 37-3-1 exceeded the drinking water criteria, but this exceedence was thought to be related to natural conditions. Groundwater sampling results at the site (41-1-1, 42-1-1, 43-1-1, 44-1-1, 49-1-0, 55-1-1, 56-1-1, 57-1-1, and 62-1-1) were generally within guidelines with the exception of iron and manganese concentrations at several locations and conductivity in wells 42-1-1 and 43-1-1. These results show that the operation of the yard waste composting site continues to have a small but measurable effect on groundwater quality in the vicinity of the site. (Gartner Lee Ltd., 2003)

5.2.2.3 Hydrology and water quality impacts and mitigation measures

Construction phase

Impact: Changes in flow regime, drainage patterns, infiltration rates and stormwater runoff. Potential impacts to drainage features in the footprint of the site could result from physical alterations of the channels or encroachment of new construction into the drainage features. Clearing and grubbing of vegetation and levelling and grading of Hartland site slopes could result in changes to stormwater runoff patterns and flows during and after construction.

The site design layout provided by Dayton & Knight indicates that the wetland is located in the northwest forested buffer area and would not be affected by construction of the facility. The drainages are small and ephemeral. Impacts would be local in extent, long-term in duration, and low in magnitude. The project description provided by Dayton & Knight calls for the use of "low impact" drainage management techniques. If these techniques are fully and effectively used, this impact would be **less than significant.**

> ***Mitigation:*** To ensure that impacts from physical alterations to natural drainage channels and wetlands remain less than significant, the following actions should be taken:
>
> - Minimize disturbance of the natural hydrology of the site to the extent practical, and
> - Implement a drainage management plan prior to construction that identifies sensitive or potential problem areas and provides a strategy for dealing with them. Such a strategy should describe planned stormwater runoff controls.

Impact: Discharges to surface water and groundwater. Temporary construction activities can create the potential for discharges to surface water and groundwater, with the consequent risk of pollution. The main sources of potentially polluting discharges are:

- leakages and spills of fuels and lubricants from vehicles,
- runoff from operations such as concrete placement; and

- runoff of turbid surface water as a result of topsoil removal and excavation.

As long as potentially polluting discharges are managed immediately, these impacts would be local in extent, short-term in duration, and moderate in magnitude. No contaminants are expected to reach Durrance Lake, Durrance Creek, Heal Creek, Tod Creek, or Tod Inlet. The lack of sensitive receiving areas for contaminants, and the proposed commitment to immediate containment and clean up of polluting discharges leads to a rating of **less than significant.**

Mitigation: To ensure that impacts of discharges to groundwater during the construction phase are less than significant, the following actions should be taken.

- Develop and implement stormwater best management practices (BMPs) pertaining to hazardous materials handling, waste management and general housekeeping procedures.
- Ensure all equipment used on-site is well maintained and free of fluid leaks.
- Prepare an Emergency Response Plan (ERP) that includes spill prevention and contingency planning.
- Outline the ERP to project personnel at the project orientation and safety meetings and train project personnel in spill response and reporting.
- Ensure the ERP is readily available at the work site, and all emergency response materials and equipment will be on-site and readily available for immediate use.
- Implement a water quality data collection program during construction to ensure acceptable water quality is maintained.

Impact: Potential increase in erosion and sedimentation in surface water. Stripping and stockpiling of soils would be followed clearing and grubbing of vegetation prior to construction. Exposure of soil to heavy rainfall could lead to erosion and sedimentation of surface water and groundwater. The Sprucebark and Somenos soils are typically coarse and well-drained, reducing inherent erodibility. Covering or reseeding of soil stockpiles during the construction period reduces erosion risk. Reseeding with grasses during the two-year construction period would effectively minimize erosion.

The spatial extent of the erosion risk is limited to the areas where soils would be exposed to rainfall, mainly soil stockpiles and exposed cut and fill areas. The duration of the impact would last from vegetation clearing to the establishment of new vegetation in re-seeded or landscaped areas, a moderate term of up to four years. Erosion and sedimentation impacts are typically reversible, through revegetation of depositional and eroded areas, and deposition of soil in eroded areas. The magnitude of the erosion and sedimentation risk on the Hartland site is considered moderate, due to the steep slopes involved. The lack of sensitive depositional areas for sediments, the relatively small area subject to erosion and sedimentation risk, the small volume of soil affected, and the temporary nature of the soil disturbance leads to a rating of **less than significant**.

***Mitigation**:* Taking the following actions can reduce the erosion and sedimentation risk further.

- Prepare and implement an erosion and sediment control plan prior to construction.
- Cover stockpiles of soils with tarps if heavy rain is anticipated.
- Seed stockpiled soils with fast-growing grasses to provide moderate-term protection against erosion and sedimentation.
- Make good use of sediment fences, straw bales, etc. during soil stripping and site levelling activities, to prevent sediments from leaving the site.
- Use an "avoidance and control" approach to preventing erosion and sedimentation rather than responding to an event after it has occurred.
- Have an environmental monitor on-site during soil stripping, stockpiling, and extensive land levelling activities. The monitor should inform construction staff about erosion and sediment control, and maintain a supply of erosion control materials on-site.

Impact: Changes in quantity or flow of groundwater. Where extensive subsurface structures form a barrier to horizontal groundwater flow through an aquifer, a damming effect may occur. Groundwater levels may rise on the upstream side of the structure, and be lowered on the downstream side. Cuts and excavations may intercept the aquifer and change groundwater flow patterns.

Groundwater at the Hartland site is encountered in the bedrock at depths varying from 3 to 5 m below the surface. The extent of cutting and filling associated with the biosolids project will not be known until completion of detailed designs for the facility. A portion of the digestion tanks will be constructed below ground, but the cylindrical nature of the tanks will not impede groundwater flow. The construction of the facility is expected to have no affect on the quantity or flow of groundwater in the area because no structure will fully interrupt the aquifer and cutting and filling will be done in a relatively small area in proportion to the size of the aquifer. Any impact on groundwater quantity or flow is expected to be local in nature and moderate in magnitude due to the cutting and filling required in the southwest corner of the site. The impact is considered to be **less than significant**.

Mitigation: A monitoring program should be implemented to ensure there are no changes in the quantity or flow of groundwater as a result of withdrawals for the operation of the facility.

Operations phase

Impact: Changes in flow regime, drainage patterns, infiltration rates and stormwater runoff. Stormwater runoff flows may increase on-site due to clearing of vegetation and an increase in impervious surfaces. Infiltration rates may also be reduced. Minimizing stormwater runoff from the site and increasing on-site infiltration by using pervious materials wherever possible is expected to limit any impact to the site footprint. Drainage flows and patterns are not expected to change in the ephemeral drainage to the north of Willis Point Road or in Heal Creek. The local nature of the impact and the implementation of “low impact” drainage management techniques leads to a rating of **less than significant.**

Mitigation: To ensure that operational stormwater runoff impacts remain less than significant, the following actions could be taken:

- Direct uncontaminated stormwater runoff from the roofs of structures to infiltration facilities where site conditions allow.
- Construct parking areas and other on-grade surfaces using permeable pavers, or direct the runoff from these areas to biofiltration swales or similar facilities.
- Reuse stormwater volumes generated for non-potable uses such as landscape irrigation, toilet and urinal flushing, washdown water for the site, and other custodial uses.
- Incorporate absorbent soils and vegetation into landscaping to minimize increases in site runoff.

Impact: Erosion and sedimentation risk during operation. Heavy rainfall on exposed soils can increase erosion risk and sedimentation of surface and groundwater. This risk is greatly reduced under established vegetative cover. The extent of post-construction erosion risks cannot be estimated until detailed designs are prepared.

Under typical facility design and construction practices, the area of exposed soils subject to erosion during operation is considered to be relatively small. The duration of such risk would be highest during the interval between the end of construction and establishment of vegetation. Some additional soil exposure and erosion risk could be expected during construction of the expanded biosolids facility, although this should be considered a construction impact. Erosion and sedimentation from operations are considered to be local in extent and reversible. The magnitude is considered to be low and the impact **less than significant**.

Mitigation: To ensure that operational erosion and sedimentation impacts remain less than significant, the following actions could be taken.

- Maintain a stock of erosion control materials on-site (straw bales, erosion fences, etc.).
- Minimize areas of steep fill around the facility where soils are exposed to rainfall.
- Use dense plantings of native vegetation to ensure good coverage of bare soils, thereby reducing erosion risk.

Impact: Discharges to surface water and groundwater. Inorganic materials such as acids, caustics, oxidizing agents and cleaning compounds that are in liquid or gaseous forms will be stored on-site in secured areas with containment structures. Discharges to surface water or groundwater are not expected to occur. An Emergency Response Plan should be implemented in case of a spill during transport of the chemicals or leakage from the containment structures occurs. Since chemicals will be stored on-site and an Emergency Response Plan will be implemented the impact is considered to be local, short-term in duration, and low in magnitude, leading to a rating of **less than significant.**

Mitigation: To ensure that impacts from discharges to surface water and groundwater remain less than significant, the following actions could be taken.

- Prepare an Emergency Response Plan (ERP) that includes spill prevention and contingency planning.
- Explain the ERP to project personnel at the project orientation and safety meetings.
- Ensure the ERP is readily available at the work site, and all emergency response materials and equipment will be on-site and readily available for immediate use.
- Implement a water quality data collection program to ensure acceptable water quality is maintained.

Impact: Changes in quantity or flow of groundwater. If a public water main is not extended to the Hartland site, a groundwater well may be developed on the northern portion of the site to supply washdown and potable water to the facility. Direct withdrawals may result in changes to the quantity or flow of groundwater.

The amount of water required for the facility is very small in relation to the size of the groundwater aquifer. The impact is considered to be local, long-term in duration, and low in magnitude, leading to a rating of **less than significant**.

> ***Mitigation:*** A monitoring program should be implemented to ensure there are no changes in the quantity or flow of groundwater as a result of withdrawals for the operation of the facility.

5.2.2.4 Cumulative effects assessment – Hydrology and water quality

The following activities were identified as potentially contributing to cumulative effects on hydrology and water quality in the vicinity of the Hartland site:

- changes in flow regime, drainage patterns, infiltration rates and stormwater runoff as a result of the construction and operation of Willis Point Road, rural residential development in the Highlands and Juan de Fuca electoral area, and suburban residential development near Hartland Avenue,
- channelization of streams in rural and suburban residential areas and along Willis Point Road;
- agricultural contaminants in Tod Creek;
- historic effects of logging the entire study area; and
- construction and operation of Hartland landfill.

The relatively small area of disturbance at the Hartland site and commitment to low impact design and operation mean that the biosolids facility's contribution to cumulative effects on hydrology and water quality would be **less than significant**.

5.2.3 Plant life

5.2.3.1 Study methods

Vegetation resources at the Hartland site were assessed following a review of the published literature and a reconnaissance survey. Reconnaissance surveys were conducted at the Millstream site on August 11, 24, 27 and 31, 2004. The objectives of the survey were to:

- Identify special site features, including specialized habitats,
- Determine dominant tree, shrub and herb species,
- Identify plant communities that are at risk, and

- Locate the plant communities at the site in relation to the proposed biosolid building sites.

A complete rare plant survey was not conducted because many rare species are only visible in the spring and early summer.

5.2.3.2 Existing conditions

The Hartland site is an older second growth Douglas-fir forest. Similar to the Millstream site, Hartland is located in the Nanaimo lowland ecosection and the Coastal Douglas-fir moist maritime (CDFmm) biogeoclimatic zone. The primary plant community on the site is the Douglas-fir-Dull Oregon grape (CDFmm01). The stands are a mix of older trees (more than 100 years old) and younger second growth (50 to 60 years old). Many older trees that are scattered through the sight show signs of wildlife use (Photo 5-1). Several rock bluffs dominated by arbutus and oceanspray are located on the western boundary and in the centre of the site, between the access roads. The mixed arbutus stands are identified as sensitive woodland ecosystems in the CRD Natural Areas Atlas (Photo 5-2). Similar forests and rock bluffs border the site to the west in Mount Work Regional Park and to the north in the Heal's Rifle range.

Approximately 15% of the Hartland site has been cleared and levelled or affected by road construction. Most of this disturbed area is confined to the northern section of the site (Photo 5-3).

Photo 5-1 Wildlife use of older trees at the Hartland site.

Photo 5-2 Large, old Arbutus on the rocky bluffs at Hartland site. This area would be impacted by the 2010 compost facility and the 2024 storage amendment expansion.

Photo 5-3 The disturbed area at the northern end of the Hartland site. The area in the background will house the administration, wastewater treatment and garage facilities.

The Douglas-fir-Dull Oregon grape forest community is similar in composition to the stands that occur at the Millstream site. The site is dominated by Douglas-fir, western redcedar (*Thuja plicata*), and grand fir (*Abies grandis*). These forests have a dense tree cover and understory species are sparse. The western slopes on the site are drier and contain less coarse woody debris than the mid and lower-slope positions (Photo 5-4). Shrubs found in the forested areas included salal, Dull Oregon-grape, red huckleberry (*Vaccinium parvifolium*) ocean spray, and baldhip rose. Herbs included swordfern (*Polystichum munitum*), bracken (*Pteridium aquilinum*), licorice fern (*Polypodium glycyrrhiza*), and vanilla leaf (*Achlys triphylla*). Canopy cover decreases on the rock outcrops, which contain arbutus, Douglas-fir, and the occasional western redcedar, big-leaf maple (*Acer macrophyllum*), and red alder. Ocean spray is the dominant shrub along with snowberry, and Dull Oregon grape. The remains of meadow death-camas (*Zygadenus venenosus*) and harvest brodiaea (*Brodiaea coronaria*) were evident in the open, rocky areas that also contained California oatgrass (*Danthonia californica*). Mosses are plentiful at the Hartland site and include Oregon beaked moss, step moss (*Hylocomium splendens)* and electrified cat's tail moss (*Rhytidiadelphus triquetrus*), hairy cap-moss (*Polytrichum commune*), and awned hair-cap moss (*Polytrichum piliferum*).

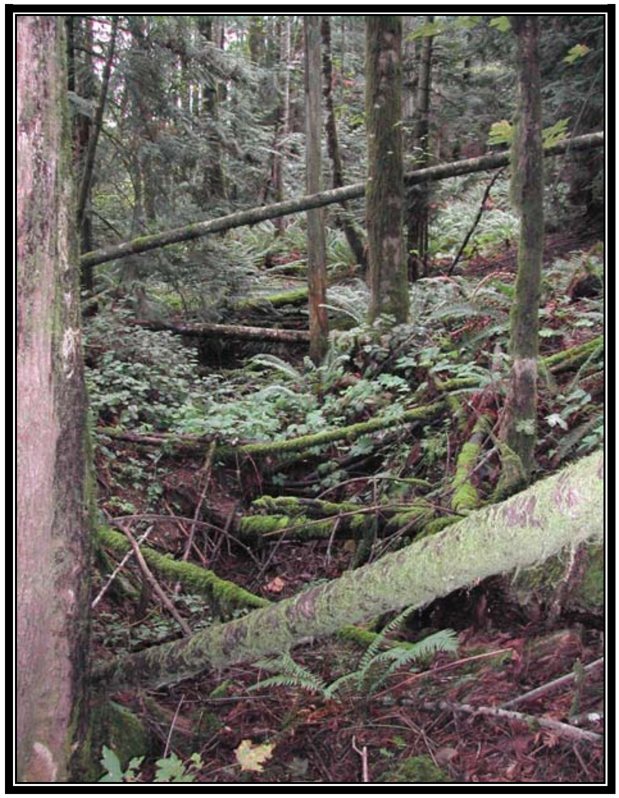

Photo 5-4 Coarse woody debris in the vegetated buffer between the rewater, odour, and digestion facilities and the administration, wastewater treatment and garage.

The Douglas-fir-Dull Oregon grape forest was a common ecosystem along the eastern side of Vancouver Island. However, it has been seriously depleted throughout its range because of continued logging and urban development pressures (Photo 5-5 and Photo 5-6). Large, self-sustaining stands, like the one that is formed by Heal's Rifle range, the Hartland site, and Mount Work Regional Park are rare.

Photo 5-5 The forested community that will be impacted by the 2010 curing and storage facility.

Photo 5-6 The forested area in the vicinity of the 2010 curing and storage facility and the 2024 expansion.

Weedy species are evident in the disturbed portions of the site, primarily the disturbed soils at the north end of the site that was used as a composting facility. Very few weedy species were seen in the forest. Weedy species that were observed on the site include Scotch broom, Himalayan blackberry, Canada thistle, and a variety of horticultural species likely brought onto the site during composting operations.

Figure 5-2 shows the plant communities on the Hartland site.

Species and Plant Communities at Risk

There are no recorded occurrences of threatened or endangered plants or plant communities on the proposed Hartland site, but several occurrences were found in the surrounding area (Table 5-2). However, the Douglas-fir-Dull Oregon grape forest that occurs on the site is a red-listed plant community and was identified as a sensitive older second growth ecosystem by the Sensitive Ecosystems Inventory of Eastern Vancouver Island and the Gulf Islands (1998). Some of the red- and blue-listed plant species that may occur on the Hartland site in association with the forested habitats and rock outcrops are listed in Table 5-1.

Table 5-1
Some plant species at risk that may occur in the undisturbed habitats at the Hartland site.

Common Name	Scientific Name	BC Status
Deltoid balsamroot	*Balsamorhiza deltoidea*	RED COSEWIC-E (Endangered)
Scalepod	*Idahoa scapigera*	RED
Yellow montane violet	*Viola praemorsa*	RED
Dune bentgrass	*Agrostis pallens*	BLUE
Smith's fairybells	*Disporum smithii*	BLUE

NOTE: Status definitions are included in Appendix E

Table 5-2
Recorded occurrences of species and plant communities at risk near the Hartland site.

Common Name	Scientific Name	Status*			Nearest Recorded Occurrence Location	Preferred Habitat
		Global	Provincial	BC Status		
Red alder / slough sedge [black cottonwood	*Alnus rubra / Carex obnupta [Populus balsamifera ssp. trichocarpa*	GNR	S1	RED	Hartland landfill surplus lands to the south of the landfill.	Borders low elevation stream courses.
Douglas-fir - arbutus	*Pseudotsuga menziesii - Arbutus menziesii*	GNR	S2	RED	Heal's Rifle Range – community is rated as poor	Found on south, southwest and west slopes
Douglas-fir / Dull Oregon-grape	*Pseudotsuga menziesii / Mahonia nervosa*	GNR	S2	RED	Heal's Rifle Range – several locations	East and south facing slopes and at the northern edge of the property
Rough-leaved Aster	*Aster radulinus*	G4G5	S1	RED	Thetis Lake Park	Low elevation dry open forests and rock outcrops
Western Mannagrass	*Glyceria occidentalis*	G5	S2S3	BLUE	Durrance Lake Road	Low elevation forests, marshes, wet meadows, and lakeshores
Coast Microseris	*Microseris bigelovii*	G4	S1	RED	Thetis Lake Park	Moist, open grassy areas
Slender Popcornflower	*Plagiobothrys tenellus*	G4G5	S2	RED	Thetis Lake Park	Low elevation mesic to dry rock outcrops and cliffs
Slender Woolly-heads	*Psilocarphus tenellus var. tenellus*	G4T4	S2	RED	Millstream Road / Finlayson Arm Road	Low elevation moist seepage areas. Newest record indicates the plant was growing on a gravely roadside
Macoun's Groundsel	*Senecio macounii*	G5	S3	BLUE	Thetis Lake Park	Low elevation dry, open forests
Howell's Violet	*Viola howellii*	G4	S2S3	BLUE	Thetis Lake Park and Scafe Hill	Coastal forest usually under light coniferous cover
Lace fern	*Cheilanthes gracillima*	G4G5	S2S3	BLUE	Mt. Work Regional Park	Low elevation rock outcrops and rock crevices

NOTE: Status definitions are included in Appendix E
Source: Conservation Data Centre, Ministry of Sustainable Resource Management. July 2004.

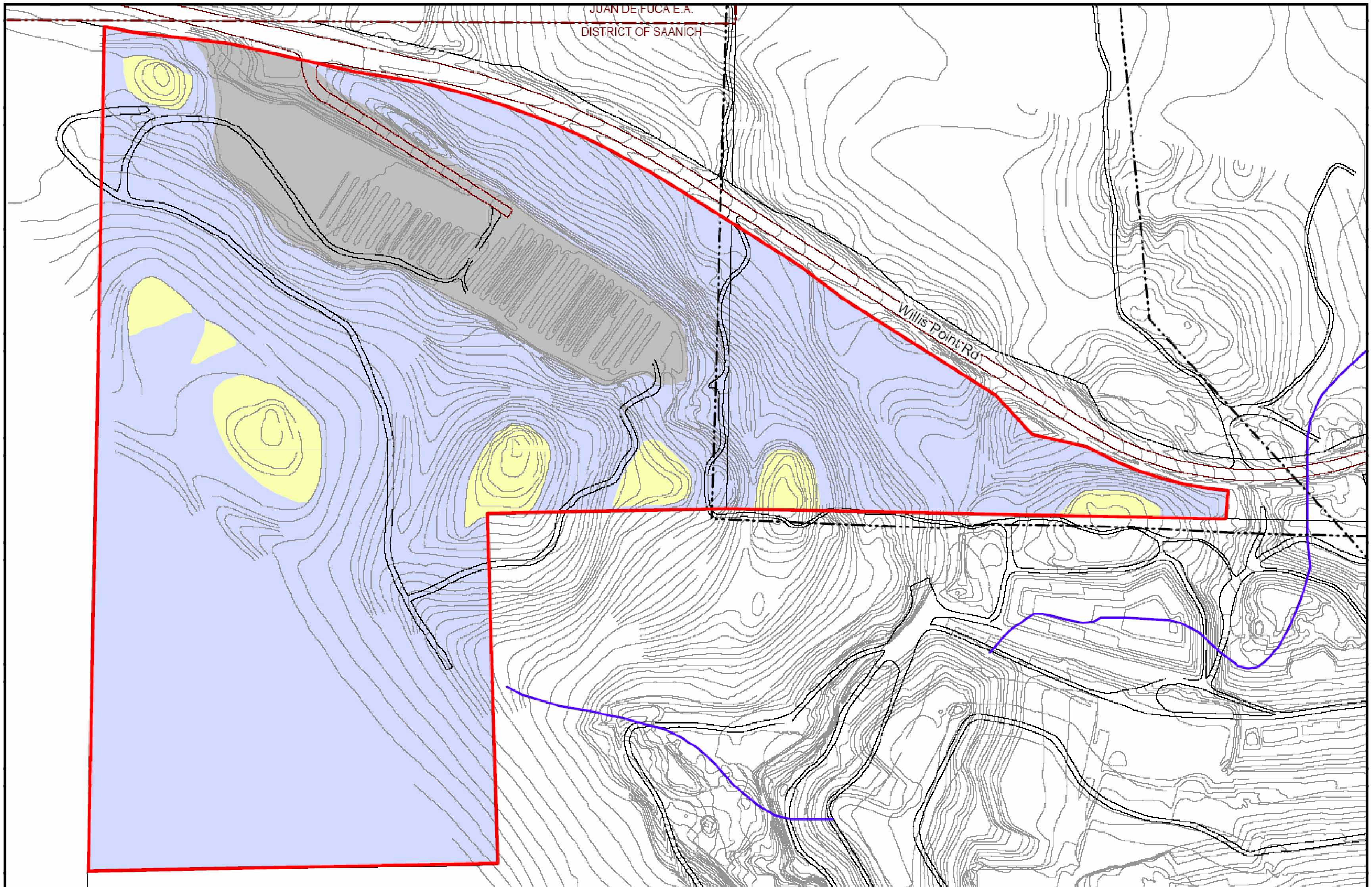

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FIGURE 5-2
NATURAL PLANT COMMUNITIES AT THE HARTLAND SITE

Douglas Fir-Dull Oregon Grape
Disturbed Bare Soil/Non-Native Species
Douglas Fir-Arbutus Woodland
Site Boundary
Transmission Line
River/Stream Channel

N

0 10 50 100 m

Scale 1 : 4,000

September 2004

5.2.3.3 Plant life impacts and mitigation measures

Construction phase

Impact: Construction-related removal or degradation of native vegetation. This impact would result from site preparation and building construction that would occur in the 2010 and 2022 construction phases (unless all site clearing is conducted during the initial 2010 site preparation interval). Approximately 10% of the biosolids facility would be built on disturbed habitats at the Hartland site, while the remainder would require the clearing and levelling of the Douglas-fir-Dull Oregon grape forested habitat and arbutus woodland. In assessing the impacts described in this section, the Hartland site is considered in the context of the southern Saanich Peninsula and Western Communities (as far as East Sooke). Construction activities would result in the following impacts.

- *Remove existing plant communities*. Approximately 4.5 ha of older second growth Douglas-fir forest and arbutus woodland would be removed from the area. The affected forest community is red-listed and the woodland community is a sensitive ecosystem. There is also the possible loss of red- and blue-listed plant species that are associated with the plant communities on the site.

- *Removal of the soil surface horizon.* The project area would be levelled into three terraces and covered with 0.3 m of gravel. The soil might be removed from the site during the grubbing and levelling activities. Removal of the native topsoil would reduce the seed bank, permanently alter successional trends in the affected area, and may limit native species recruitment in neighbouring habitats (animal and wind transport of native seed would be reduced).

- *Changes to the natural drainage patterns and hydrological cycle on the site would be changed.* Changes to the hydrological regime on the site would affect vegetation in the buffer zones and may affect off-site plant communities. Currently, the forests on the mid- and lower-slopes are wetter and contain a higher proportion of western redcedar, big-leaf maple, and red alder, which are moisture-dependent species. The habitats in these lower slope areas have a more complex structure because of their large amount of coarse woody debris and the diverse understory. Changes to the natural drainage patterns on the site might reduce the available moisture in these areas and subsequently alter the species composition at the site. The project description calls for use of "low impact" drainage management techniques.

These impact components are all local in extent, of long-term duration, generally irreversible, and of moderate to high magnitude. The impact is considered to be **significant.**

Mitigation:

- The key mitigation action is to relocate some of the proposed building sites to other parts of the CRD-owned property that is already cleared, thereby minimizing the amount of forested habitat that must be removed and minimizing disturbance to the rocky bluffs along the western and southern boundaries of the site. The current site layout impacts every major rock outcrop on the site.
- A rare plant survey of the project area should be conducted prior to construction. If rare plants are found in the building site, they should be removed and replanted in a similar habitat as close to the project area as possible. This survey should be conducted in the spring.
- An assessment of blowdown potential in the vegetated buffer should be completed before clearing is initiated. If blowdown is a significant problem, feathering the edges of the buffer and pruning 'at risk' trees to reduce the sail could reduce blowdown potential
- Wherever possible, native plant communities should be retained instead of landscaping with non-native species. Landscaping between and around the building sites should use native plant materials. Some native plant materials could be salvaged from the construction site prior to clearing and then replanted after the construction phase.
- Native topsoil that is removed from natural areas that would be cleared should be stockpiled and redistributed in areas that would be landscaped with native plants. When it is stockpiled, the topsoil should be seeded with an agronomic annual species to prevent wind erosion and weed invasion.
- A drainage management plan should be prepared and implemented to minimize disruption of the natural drainage pattern.
- The spread of noxious weeds and invasive non-native species should be controlled during construction. Control programs should focus on Scotch broom, Himalayan blackberry, and Canada thistle.

If fully implemented, these mitigation measures would reduce the impact on vegetation to **less than significant** levels. If the key action (relocating buildings to the cleared bench) is not implemented, the impact remains **significant**.

Operations phase

Impact: Changes in plant communities in the vegetated buffer and in neighbouring natural areas. This impact has the following components:

- *Introduction of invasive species* from daily transport trucks and workers at the site

- *Change in plant community composition and structure* in the vegetated buffers and lower-slope off site communities as a result of the changes to the natural drainage pattern,

- *Mortality of native plants following adjacent construction*. Mature trees are most susceptible to root damage, changes in grade, and changes to hydrology. It often takes several years for plants to die following alteration of nearby environments. The buffer between the Hartland building envelope and Mt. Work Park is expected to protect the park against any changes to the vegetation regime following construction.

- *Possible blowdown of trees in the vegetated buffer.* In the buffer that separates the digestion, odour and rewater facilities from the administration, wastewater treatment and garage, blowdown of trees following construction could occur. The vegetated buffer in this area is approximately 40 m wide and southwest (downslope) winds could affect trees in the buffer. It should be noted that this is not expected to be a significant impact as Douglas-fir and western redcedar are quite wind firm.

Impacts of the operational phase of the biosolids facility at the Hartland site are expected to be local in extent, long-term in duration, and generally reversible (but only after decades). The magnitude is considered moderate, as there is a risk to vegetation intended to be protected in the buffer zone. For this reason, the operational impacts on vegetation are considered **significant.**

> ***Mitigation:*** A long-term and comprehensive invasive species management program should be implemented at the site. The natural drainage patterns should be maintained. A qualified arborist with experience in native tree protection should be retained to review construction plans, monitor surface-altering works, conduct root pruning, and to train construction workers. A tree management plan intended to protect the buffer trees against blowdown should be prepared during the facility design phase. If fully implemented, these mitigation measures could reduce the impact to **less than significant** levels.

5.2.3.4 Cumulative effects assessment – Plant life

Past vegetation loss in the vicinity of the Hartland site has resulted from logging, clearing for agriculture and Heals Range, road construction, and residential development. More recently, native vegetation has been lost to the Hartland Landfill, the composting pad, and continued rural and suburban residential development. In the future, housing development can be expected to occur in Saanich to the east of Hartland Landfill, and in Partridge Hills. The future of the Department of National Defence lands just north of the biosolids site are unclear, but could include uses that would result in substantial vegetation clearing. The cumulative effects of this clearing would have a negative effect on the contiguous band of mature forest around the Hartland site. The removal of 4.5 ha of vegetation as part of the Hartland biosolids development would constitute a **significant** contribution to the cumulative effects on vegetation.

> ***Mitigation.*** Mitigating cumulative effects on vegetation, as with other ecological impacts, requires coordinated and dedicated effort by a variety of jurisdictions. In the case of the lands surrounding the Hartland site, for instance, the Capital Regional District, District of Saanich, and the Department of National Defence would need to develop and implement policies that discourage rural residential development, golf courses, and other land uses that require forest clearing. By relocating as many biosolids structures as possible to the cleared lower bench the need for vegetation removal would be minimized and the project's contribution to cumulative effects would be reduced to **less than significant.**

5.2.4 Animal life

5.2.4.1 Study methods

Information on wildlife use and wildlife habitats of the proposed Hartland biosolids facility site was obtained from available published regional wildlife information and site visits conducted in May, July, and August 2004.

5.2.4.2 Existing conditions

Wildlife habitats at the north side of the Hartland site have been severely degraded by past land clearing and land levelling work done by the CRD. This work was completed approximately ten years ago to create a level composting area in a once-forested hillside part of the CRD property south of Willis Point Road.

Approximately 15 percent of the proposed biosolids facility will be constructed in this previously disturbed area of the Hartland site. Much of this graded site, which would be ideal for the biosolids facility, is planned for gravel storage associated with the Hartland landfill.

Forested habitats located at the south and west sides of the site currently are used by wildlife. These forested areas provide suitable nesting and foraging habitat for forest-dwelling birds, and as a movement corridor for larger mammals such as black-tailed deer and cougar.

At least two "wildlife trees"[7] were recorded in the forested area of the Hartland Road site. These trees are used by pileated woodpeckers and cavity-nesting birds.

Common raven was the most conspicuous bird species at the Hartland site. A large nest, believed to be a raven's nest, was observed in a mature Douglas-fir tree near the southern portion of the proposed construction envelope.

Other wildlife species observed include black-tailed deer, racoon, Cooper's hawk, red-tailed hawk, northwestern crow, northern flicker, rufous-sided towhee, and chestnut backed chickadee.

5.2.4.3 Animal life impacts and mitigation measures

Impact: Loss of wildlife habitat. Approximately 15% of the Hartland site has been significantly altered by past land clearing and levelling. Much of the remainder of the site will have to be cleared, levelled and serviced prior to the construction of the biosolids facility. Treed buffers will be retained along the northern and western boundaries, and through the centre of the site. This change in wildlife use of the site is assessed to be **less than significant**.

Impact: Clearing would result in increased forest edge habitat and subsequent reduction of the amount of available forest interior habitat in the local area. Removal of the plant communities at the Hartland site would increase the size of a large opening in a fairly contiguous forested area of the Saanich Peninsula. Increased edge habitat changes the natural light, temperature, wind, and fire conditions of the local forest and inhibits the free movement of wildlife species that depend on interior forest conditions. The changes in the climatic conditions of the surrounding forest would affect plant

[7] A wildlife tree is a standing tree, usually dead, with special characteristics that provide habitat for wildlife.

community composition and can contribute to the establishment of invasive species. These changes are local in extent, of long-term duration, and are irreversible

Loss of forest vegetation and wildlife habitat features such as nest sites and wildlife trees is expected to have a high magnitude, long-term, local impact on wildlife. The loss of this forested habitat is considered to be **significant**. This forested habitat is increasingly rare in the region. If wildlife cannot relocate to use available habitats in the adjacent forested buffer zone and similar areas in Mount Work Park, Durrance Lake, and Willis Point area, loss of wildlife – particularly small mammals and birds, can be expected.

> ***Mitigation:*** The mitigation measures outlined in the Section 5.2.3 will help reduce or avoid wildlife habitat impacts. Infringement of the biosolids facility on areas of moderate to high quality habitat could be mitigated by constructing most of the facilities on the site's cleared lower bench. Temporary gravel storage planned for this bench has forced the facility to be sited on higher-elevation forested lands. By finding another location for the temporary gravel storage, the biosolids facility could be constructed on this bench, saving up to 3 hectares of forest land from permanent development. By relocating structures to the cleared lower bench on the Hartland site, habitat can be preserved and impacts reduce to **less than significant**.

5.2.4.4 Cumulative effects assessment – Animal life

Much of the landscape within two kilometres of the candidate Hartland biosolids site still has high to moderate wildlife habitat value, particularly in the areas to the north, west, and southwest of the site. To the east, residential development on Hartland Avenue and Kiowa Place, agricultural development in the Tod Valley, and military training activities on the Department of National Defence lands have reduced habitat value. The largest single contributor to habitat loss in the vicinity of the biosolids site is Hartland landfill to the southeast of the candidate site. The transformation of this area from forest to an engineered landfill has eliminated habitat value on the site. Mount Work Regional Park to the west and the Partridge Hills to the north, however, still have moderate to high wildlife values.

Planned future development could lead to some erosion of wildlife habitat in these areas. Further residential development immediately to the east of the Hartland Landfill will convert forested land to a suburban development. The large-lot development recently approved for the Partridge Hills could see increased road, utility, and housing development in that area, all of which will reduce habitat quality. In the future, little expansion of the land already affected by Hartland landfill is feasible, so additional habitat loss on that site is not expected.

The cumulative effect of past, present, and potential future development in the vicinity of the Hartland biosolids facility site on wildlife habitat is considered to be **significant**. Development of the Hartland site, which will see the removal of 4.5 hectares of forest land, will have a modest effect on habitat quality. Construction and operation of the biosolids facility on the Hartland site is determined to be a **significant** contributor to cumulative habitat loss in this area.

> ***Mitigation:*** Amending the site design to relocate structures to the lower bench would reduce wildlife impacts. This design change would result in a reduction of the cumulative impact of the biosolids facility on wildlife and wildlife habitat to **less than significant** levels.

5.2.5 Odour

5.2.5.1 Study methods

The method used to estimate possible future odour impacts resulting from the development of the Hartland site is described in Section 4.2.5.1. Computerized atmospheric-dispersion modeling was used, and worst-case odour emissions and worst-case weather conditions were assumed for three modeling scenarios: no odour controls, 97% odour controls (two-stage control), and 99% odour controls (three-stage control).

Table 5-3 provides the volumes of air flow treatment used in odour modeling undertaken by Genesis Engineering the Hartland site for the year 2022 construction odour. The footprint area, height and volume of the facility are also summarized in Table 5-3. Only the impacts of odour in the year 2022 construction were investigated under this study as the full build-out scenario.

Table 5-3
Plant volumes used to calculate air exchanges for the year 2045.

Source	Building Perimeters (m)	Building Area (m^2)	Building Height (m)	Building Volume (m^3)
ANAEROBIC DIGESTION				
Administration	120	500	4	2000
Garage and Shops	140	1000	4	4000
Digesters (Gallery)	200	1200	8 – 10	9600
Odour Control	160	1000	4	4000
Rewatering and Treatment	108	500	4	2000
Thickening and Dewatering	92	500	4	2000
Co-generation and Flare	108	700	4	2800
COMPOSTING – Value-added process				
Compost	408	3564	4	14256
Curing and Storage (Covered)	168	1562	4	6248
Curing and Storage (Uncovered)	254	3913	4	15652
Storage Amendment (60 days)	444	4001	4	16003
Odour Control	160	1500	4	6000
Storage for Digested Solids	260	3864	4	15456

<u>Computer Model</u>

The computer model used (*ISC-AIRMOD View)* is described in Section 4.2.5.1. The model can deal with complex terrain, multiple odour sources, and plume down wash caused by nearby large buildings.

<u>Site Input Data</u>

Site input data for the model and the odour emission rate data are the same as that for the Millstream Road site and are presented in Tables 4-6, 4-7, and 4-8 in Section 4.2.5.1.

Building locations and dimensions were graphically input directly from a site-map supplied by Dayton & Knight Ltd. (Figure 3-3 in Section 3.4), using the BPIP-View preprocessor.

Fifty discrete receptors were selected from the area of a 1:20,000 topographic map (BC 092B053, Brentwood Bay) that coincides with that shown in Figure 5-3. The receptors were chosen to represent sensitive areas (e.g. residential housing) and to accurately reflect the general topography of the area.

Meteorology Input

The meteorological data used (Appendix F, Table F-2) was the same as that used for the Millstream Site (Appendix F, Table F-1), except that the wind direction was shifted 35 degrees anti-clockwise at the recommendation of Dr. Stan Tuller, Climatologist, University of Victoria.

The percentage of evenings with poor atmospheric dispersion (F-stability) was estimated to be 64% during July and August, 52% during September and October, and approximately one-half of these frequencies during the remaining months.

Table F-2 (Appendix F) lists the wind vectors (the direction toward which the wind blows) used in this study. Zero wind velocities were also converted to small, non-zero values for use in the ISC3 model.

Figure 5-4 shows that a major topographic ridge feature (Mount Work) exists to the southwest of the site. This ridge will tend to force light drainage winds to move in a southeasterly direction.

5.2.5.2 Existing conditions

A visit to the proposed Hartland site on August 11, 2004 revealed no sources of odour on the proposed biosolids site. The regional landfill located to the south of the site is an occasional source of local odour. Most odour-causing gases are captured and burned in the CRD's recently installed landfill gas-to-electricity facility that produces 1.6 MW of "green power". However, malodorous landfill gas may still occasionally escape from the landfill perimeter, especially when a low-pressure weather system moves in and the higher-pressure landfill gases are released.

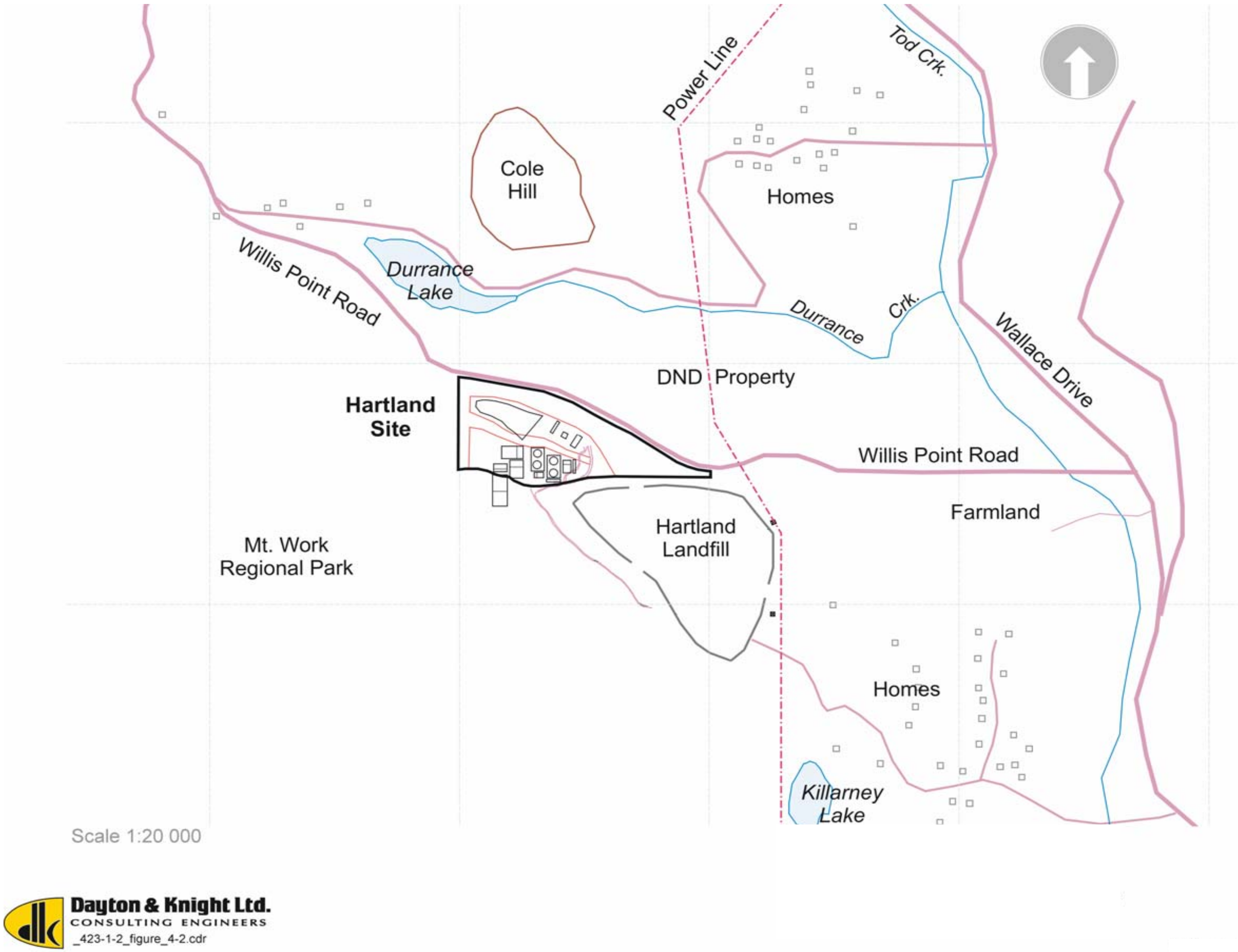

Figure 5-3 Location of Hartland site with surrounding waterbodies and receptors.

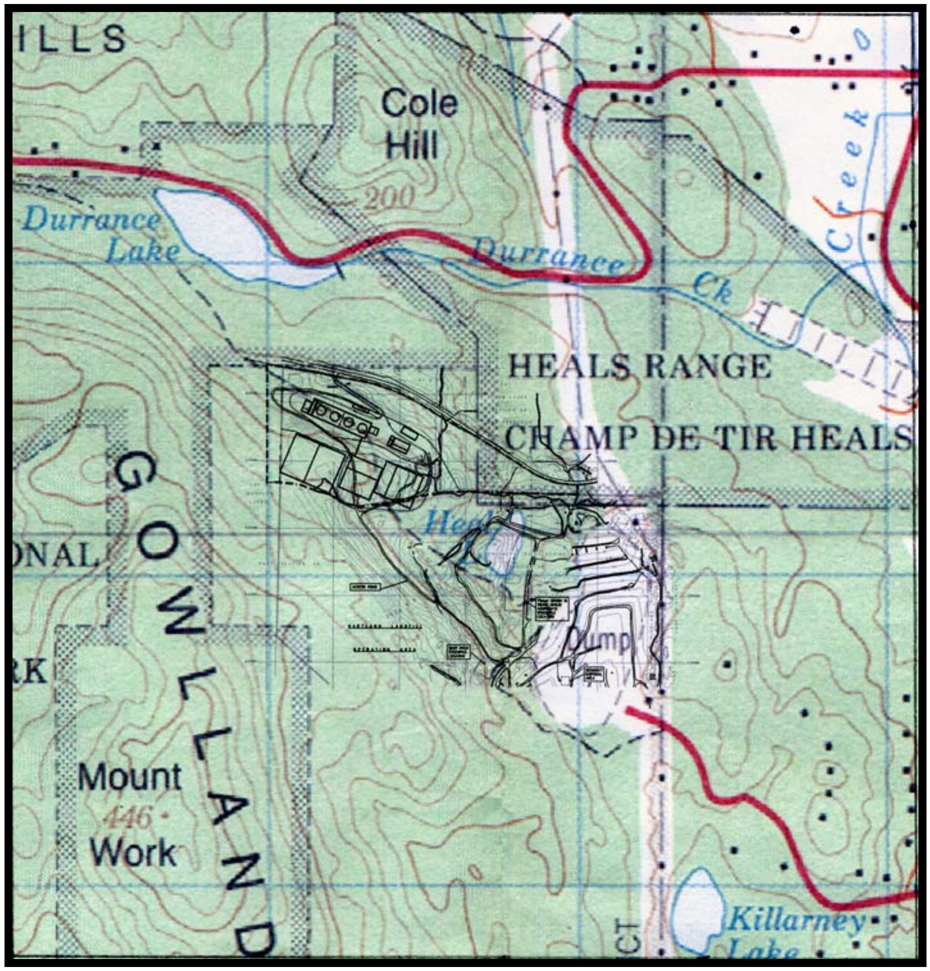

Figure 5-4 Hartland site topography.

5.2.5.3 Odour impacts and mitigation measures

Odour dispersion modeling was carried out assuming worst-case (full buildout at year 2045) odour emissions and worst-case meteorology.

Modeling output is presented in Figure 5-5, 5-6, and 5-7 as isopleths (contours) of constant odour concentration, expressed as odour units per cubic meter (OU/m^3), overlying the site map. The concentrations are the maximum 1-hour concentrations experienced during the combined six drainage events (total of 54 hours of adverse meteorological conditions).

Normally there would be three stages of odour removal, providing an overall odour reduction of 99%. However, if one stage fails or is out of service due to routine maintenance, then the odour reduction decreases to 97%. If all three stages of odour reduction fail (an extremely unlikely event) then the odour reduction would be 0%. Figures 5-5, 5-6 and 5-7 show the model results.

- **Scenario 0 – no odour control.** Figure 5-5 represents the no-controls scenario (all three stages of odour reduction are not functioning). The elevated plumes from the two stacks become embedded in a stable atmosphere that impinges against the flank of Mount Work to the west of the site, south of Willis Point Road. Maximum ground-level concentrations (49 OU/m^3) occur on the flank of Mount Work. The maximum concentration to the south of the site is approximately 3.5 OU/m^3. Clearly a no-controls scenario would cause an odour impact in the vicinity of the Hartland Site.

- **Scenario 1 – two-stage odour control.** Figure 5-6 represents the two-stage control scenario (two stages of odour reduction are functioning). It can be seen that the maximum odour concentration (1.5 OU/m^3) again occurs against the flank of Mount Work to the west. This odour would be barely discernable under most conditions. No odour should be discernable to the south of the site.

- **Scenario 2 – three-stage odour control.** Figure 5-7 represents the three-stage control scenario (all three stages of odour reduction are functioning). Again the maximum odour concentration (0.49 OU/m^3) occurs against the flank of Mount Work to the west. No off-site odour would be discernable from the Hartland Site operations under normal operation with three stages of odour control, assuming that all malodors are collected and sent up two separate 9.1 meter (30 ft.) stacks at a velocity of 25.4 m/s (5000 fpm).

<u>Summary</u>

Maximum 1 – hour odour concentrations estimated for west of the Hartland site and beside the Willis Point Road[8] would experience 49 OU/m^3 if there were no odour controls present, 1.5 OU/m^3 if two-stage (97% control) were used, and less than 1 OU/m^3 if three-stage (99% control) of odour reduction were used. Odour emissions from the biosolids facility are anticipated to be infrequent, and any impacts limited to the site or its immediate surroundings. The magnitude of odour impacts is considered negligible, and therefore **less than significant**.

[8] X, Y, Z coordinates: 400, 1860, 300 metres

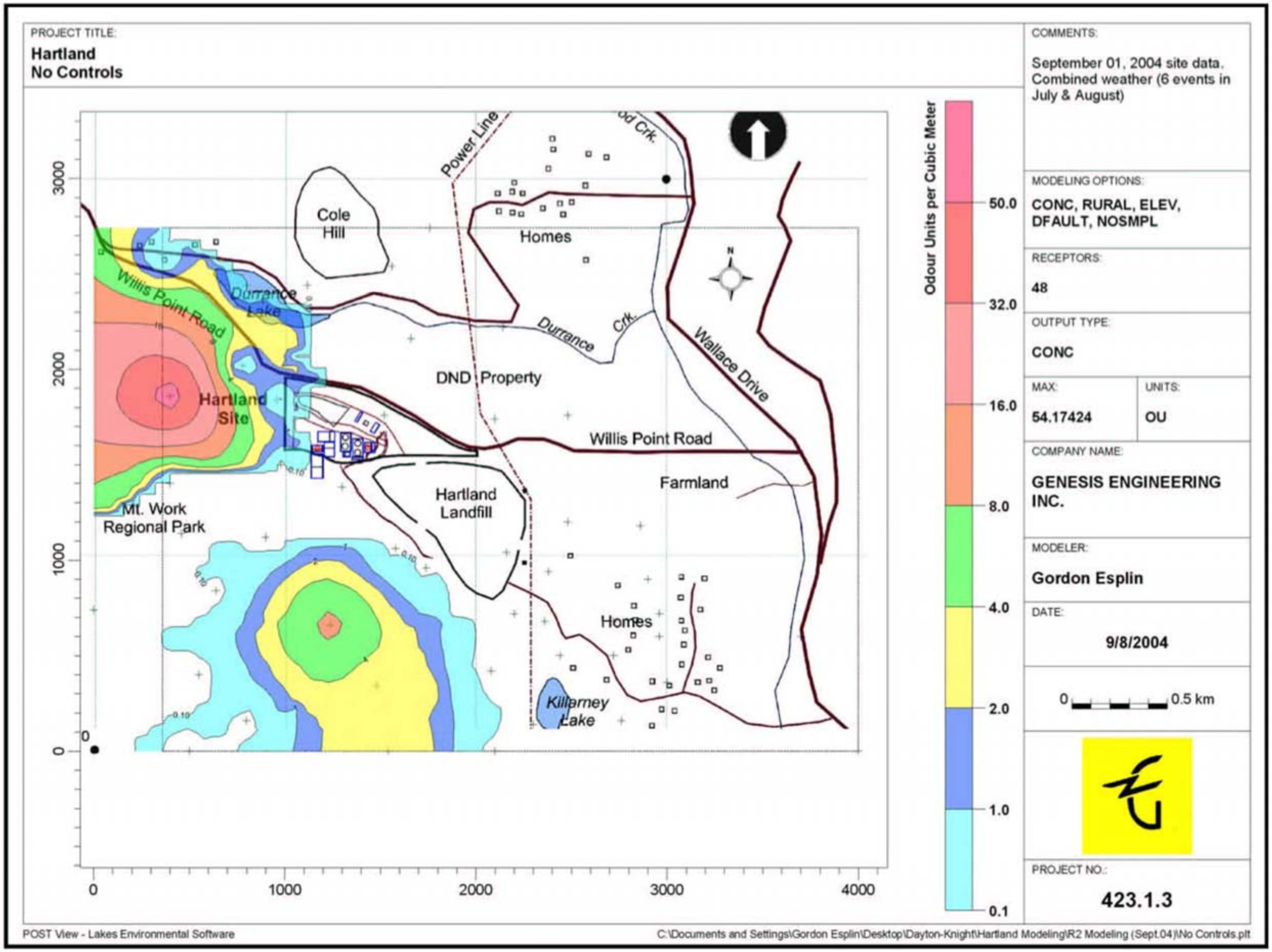

Figure 5-5 Hartland site odour modeling results - no odour control.

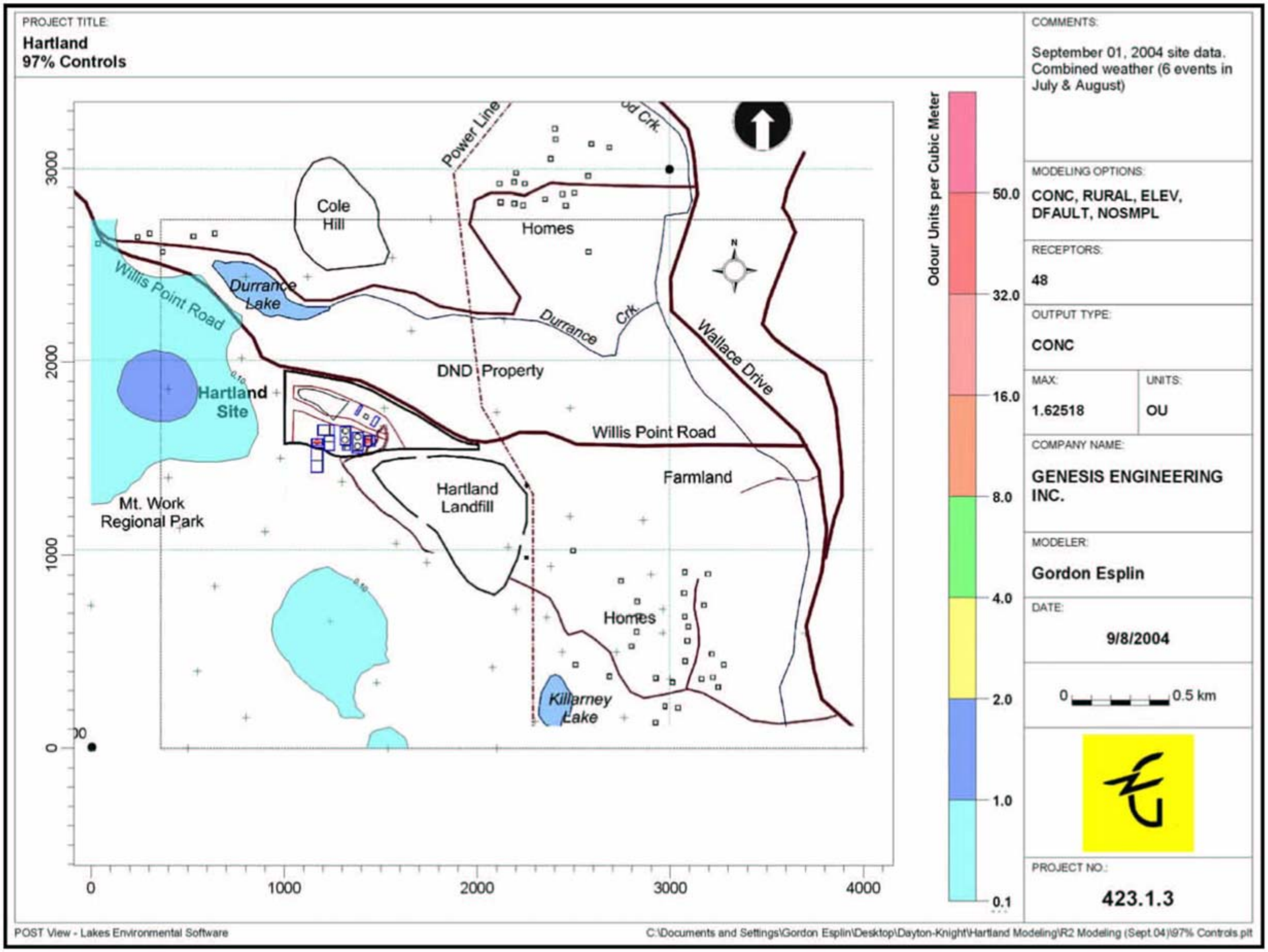

Figure 5-6 Hartland site odour modeling results - 97% odour control.

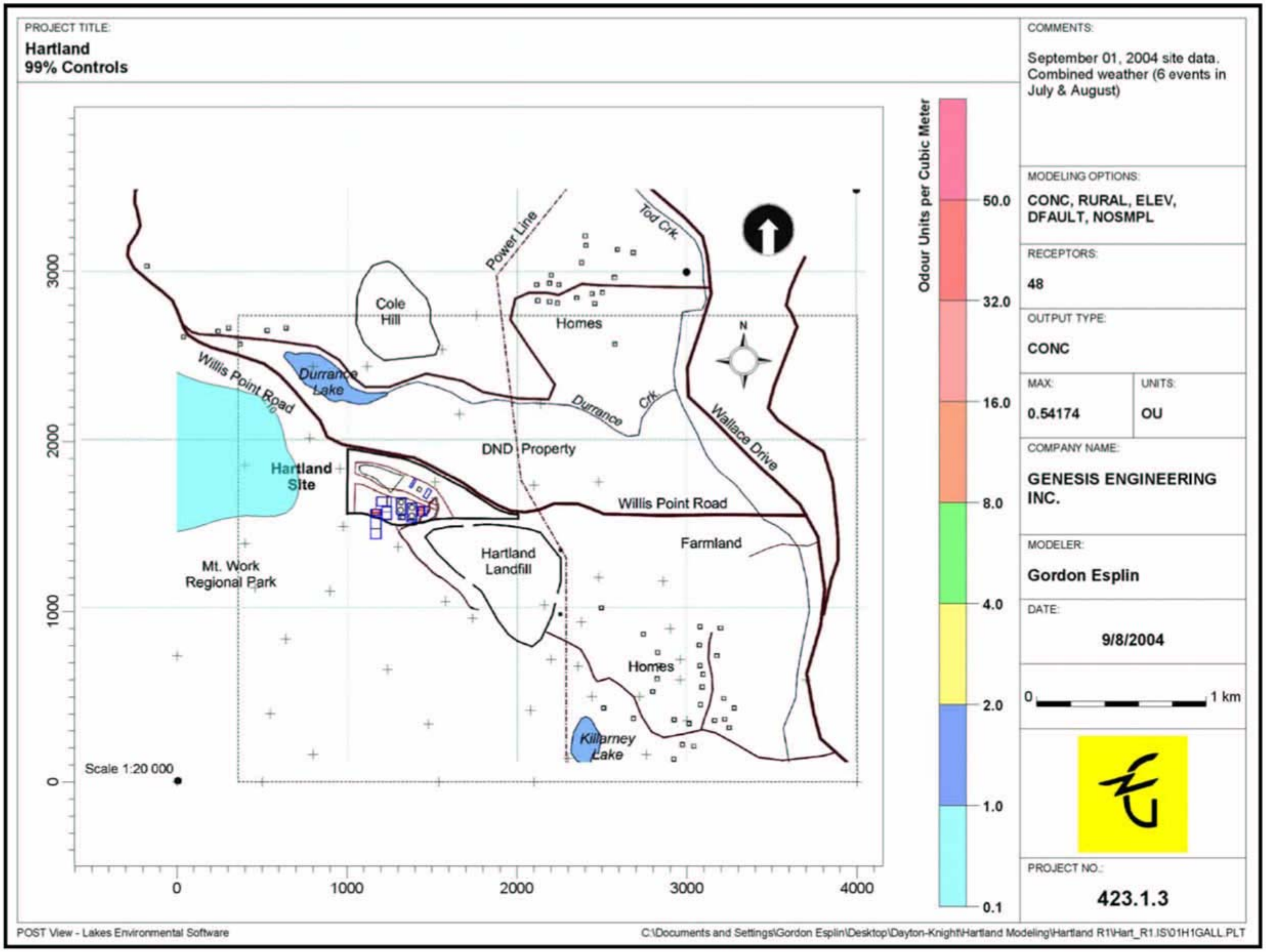

Figure 5-7 Hartland site odour modeling results - 99% odour control.

5.2.5.4 Cumulative effects assessment – Odour

The biosolids facility is not expected to contribute to cumulative effects arising from odour emissions from the Hartland site, because normally there will be no off-site odours from the biosolids facility when the proposed odour-control system is properly operating. However, background odour from adjacent industrial or public works activities (landfill) may result in ambient odours. The biosolids facility's contribution to cumulative odour impacts is considered **less than significant**.

5.2.6 Traffic

5.2.6.1 Study methods

The study methods used for this traffic impact analysis project are described in Section 4.2.6.2.

5.2.6.2 Existing conditions

The Hartland site is located on the south side of Willis Point Road in the District of Saanich. The candidate biosolids site is currently accessed via a well designed paved industrial driveway directly onto Willis Point Road. The existing driveway has excellent visibility for vehicular egress onto and off of Willis Point Road. Willis Point Road is classified as a major collector–arterial roadway by Saanich and is currently underutilized, carrying approximately 1,400 vehicles per day (vpd). It was recently upgraded to a high standard two-lane roadway capable of carrying 5,000 to 20,000 vpd, and features a long dedicated left turn lane provided for access into the site.

The traffic impact assessment for this project relates to the traffic volumes, vehicle types, and the classification, cross section and condition of the roadway, for the preferred site-related truck haul routings that connect Macaulay and Clover Points to the proposed Hartland site for the following time frames:

- 2004: Present conditions,
- 2010 – 2012: Construction of initial (Phase 1) facility,
- 2025: Operation at full capacity of initial (Phase 1) facility,
- 2022 – 2025: Construction of expanded (Final Phase) facility,
- 2045: Operation at full capacity of expanded (Final Phase) facility.

The route sections have been broken down as follows:

1. Willis Point Road between West Saanich Road and the site's existing driveway. Most of the site-related construction and operations traffic will use this section of roadway,
2. The pertinent local and collector roadway routing sections in the Township of Esquimalt and the City of Victoria, which would be used by the biosolids haul trucks accessing the Macaulay Point and Clover Point sewage pump stations, and
3. The major roads in the Township of Esquimalt, the City of Victoria, the Town of View Royal, and the District of Saanich that comprise the connecting routes between the biosolids haul sources of the Macaulay and Clover Points pump stations and the candidate Hartland treatment site.

As noted in Section 4.2.6.1 while describing the Millstream site, the preferred routing(s) to the Hartland site follow municipally identified truck routes except for the roads in proximity to Macaulay Point and Clover Point. The existing roadway infrastructure is adequate and compatible for accommodating the current and future traffic volumes along with the vehicular (truck and other) traffic generated by the subject CRD biosolids treatment.

Figure 4-8 in Section 4.2.6.1 provides a pictorial truck routing(s) map showing recommended, or preferred, routes connecting the sludge haul origins of Macaulay Point and Clover Point to the CRD's candidate Hartland biosolids treatment plant site. Table 5-4 describes the routings in detail. As previously noted, we recommend a one-way system regarding outbound and inbound traffic for the Macaulay Point Site, based on roadway use conditions (i.e., availability of sidewalks, on-street parking bans, etc.), and to reduce cumulative impacts.

Table 5-4
Preferred truck routings for the Hartland site

Source	Trip Segments
Clover Point	• Begin driveway west along Dallas Road to • North on Douglas Street to • North on Blanshard Street to • North on Vernon Avenue to • North on Hwy 17 to Royal Oak Interchange to • West on Royal Oak Drive to • North on West Saanich Road to • North on Wallace Drive to • West on Willis Point Road into site.
Macaulay Point	• For outbound traffic, begin from driveway north on Anson Street to • *East on Bewdley Avenue to • *North on Peters Street to • *West on Lyall Street to • North on Admirals Road to • North on McKenzie Road to • North on Hwy 17 to Royal Oak Interchange to • West on Royal Oak Drive to • North on West Saanich Road to • North on Wallace Drive to • West on Willis Point Road into site. • For inbound traffic southbound on Admirals Road to • *East on Lyall Street to • *South on Fraser Street to • *East on Munro Street to • South on Anson Street into Macaulay Point site driveway.

NOTE: * Indicates reverse directions for proposed one-way component of recommended routing.

For all of the identified road segments, Tables H-1 and H-2 in attached Appendix H provide:

- Street classifications with associated expected carrying capacities,
- Approximate base year traffic volumes for Year 2004 and Year 2025 time frames,
- Estimated facility-generated operational traffic volumes for both Year 2025 and Year 2045 scenarios when both the initial and expanded facilities are operating at full capacity, and
- Percentage increases relative to the projected Year 2025 base traffic volumes.

Any traffic volume changes of less than 1% of roadway totals were considered to have a negligible magnitude of impact. Traffic volumes in the Year 2025 were estimated by applying a 20% increase to the existing Year 2004 volumes, in order to approximate a simple growth rate of 1% per annum. This study does not attempt to project road system traffic volumes to the Year 2045, because there are too many uncertainties affecting such projections (amount of developable land that will be available after 2026, regarding future transportation infrastructure, travel-modes, modal splits, etc.).

5.2.6.3 Traffic impacts and mitigation measures

Table 4-10 in Section 4.2.6.3 provides a summary of the estimated (two-way) daily site-generated construction-period and operational vehicle trips associated with both the 2025 initial facility and 2045 expanded facility. These traffic volumes and their impact on the road network are discussed in detail for the construction and operational phases for both 2025 and 2045 time frames for the Hartland site.

Construction phase

Impact: Construction traffic effects on the roadway system. The only roadway section significantly affected by development of the Hartland site is Willis Point Road between West Saanich Road and the site's driveway. The 2012 initial facility will result in construction-related traffic during 2010–2012; the 2025 facility will result in construction-related traffic during 2022–2025.

During the 2010-2012 construction interval, the maximum two-way total vehicle trips generated by the construction would be approximately 158 vpd. Most of the 120 vpd crew-related trips, and all of the 38 delivery truck trips, would be to and from the south.

The base Willis Point Road traffic is currently approximately 1,400 vpd and estimated to be approximately 2,000 vpd by 2025. Willis Point Road is classified as a major collector-arterial roadway by the District of Saanich and is expected to carry traffic volumes in the range of 5,000 to 20,000 vpd, meaning that Willis Point Road can easily accommodate the construction-related increase in traffic. The addition of approximately 160 vpd, while representing an 8% increase in traffic, is considered to an impact of moderate magnitude, but **less than significant** due to this available surplus capacity.

The need for parking for construction crew vehicles could potentially have a high magnitude of impact on Willis Point Road in the vicinity of the treatment site. However, the magnitude of this impact would be negligible as the project plan would provide sufficient parking on site for all construction workers as part of the initial site clearing.

The facility expansion, scheduled to occur during 2022–2025 would occasionally generate maximum construction-related two-way total vehicle trips of approximately 140 vpd (i.e. 120 vpd crew associated vehicles and 20 delivery truck trips). Although this represents an approximate 7% increase in the traffic volumes on Willis Point Road, it is well within the capacity of the roadway and would have an impact of moderate magnitude.

As previously indicated, the site preparation would be done for the whole facility during the initial 2010–2011 initial facility construction period. The clearing, grubbing and gravel base fill related truck hauls to and from the site, estimated to be a maximum of 100 truck trips per day (50 inbound and 50 outbound), would all occur during the initial six months to one year construction time period, and would be completed before other construction-related traffic, such as trade crews and delivery of concrete and steel, begins. Therefore, there would be little site preparation related traffic occurring during the expanded facility construction during 2022-2025.

Construction traffic at the Harland site is considered to be of moderate magnitude, moderate duration (2 to 3 years), local extent and reversible in that no permanent traffic volume change would result from the limited temporal activity. The impact is considered to be **less than significant.**

Mitigation: Taking the following actions can minimize construction traffic impacts:

- provide sufficient trades crew parking on the site, implementing crew van pooling, or providing a park and ride program for the construction workers,
- explore the feasibility of obtaining gravel requirements for the site base preparation from the CRD crushing operation currently underway at the Hartland site for the use by the landfill, and
- determine if the clearing debris from site preparation can be disposed at the Hartland landfill facility

Operations phase

When operating at maximum capacity, the 2025 initial facility and the 2045 expanded facility would have a maximum of 15 and 20 employees respectively. The forecasted traffic volumes resulting from sludge haul, composting, and employee traffic are contained in Table 4-10 in Section 4.2.6.3; their impact on the road network is discussed below.

Impact: Traffic impacts of facility operation. The main areas affected by the operation of the Hartland biosolids facility are the neighbourhoods near Macaulay Point and Clover Point, where the sludge haul trucks travel, and along the Willis Point Road access to the proposed treatment facility. The neighbourhood roads near the two pump stations are not on Municipal Truck Routes. When the 2025 initial facility is operating at full capacity, the maximum two-way trips would be eight trucks per day at Macaulay Point and six trucks per day at Clover Point. The combination of sludge haul, composting and employee traffic would result in a total daily two-way volume at Hartland of 50 vehicles for the 2025 initial facility when operating at full capacity.

When the 2045 expanded facility is operating at full capacity, the sludge haul trips would increase to a maximum daily two-way volume of 20–32 trucks at Macaulay Point and 14–20 trucks at Clover Point. This increased sludge haul traffic, the higher volumes of truck trips associated with composting, and additional employee traffic result in total daily two-way driveway trips of 92–116 vehicles for the 2045 expanded facility operating at full capacity.

The nature of the facility operation traffic is such that there would be:

- Additional truck traffic on neighbourhood streets near the Macaulay Point and Clover Point sewage pump stations,
- Additional truck traffic on an arterial street system that experiences high congestion during the weekday PM peak time period, and
- Additional traffic generated on Willis Point Road.

The amount and type of traffic generated by the proposed CRD Biosolids Treatment Facility will affect the area street system in terms of increased truck traffic volumes. Roadway capacity is not an issue. Safety and the introduction of truck traffic onto neighbourhood streets are the main issues to be considered and appropriately mitigated. Traffic impact is addressed from the perspective of the ability of the pertinent road system to accommodate the site-generated vehicle trips.

Except for the end sections of the routings, most of the routes used by this traffic will experience a negligible magnitude of impact because they are high volume arterial routes designed to accommodate heavy traffic. Operations traffic related to the Hartland site is considered to be of moderate magnitude, long-term duration, and local extent. Therefore, the impact of facility operations would be **significant** on the neighbourhood street routes near Macaulay Point and Clover Point and **less than significant** on the other routing sections.

***Mitigation*:** The operations related traffic can be mitigated to a **less than significant** level by:

- minimizing use of the neighbourhood streets near Macaulay and Clover Points,
- ensuring the truck routings have adequate clearance for turning (i.e., prohibit on-street parking where relevant), and
- avoiding School and Safe Route to School zones where possible.

In addition, the site-generated truck traffic should be restricted to travelling outside the 3 p.m. to 6 p.m. weekday peak traffic periods and truck operators should travel within the road's speed limits and refrain from using 'engine brakes' in residential neighbourhoods. Finally, the Canadian Forces Base (CFB) Esquimalt housing on the DND property (encompassing the CRD's Macaulay Point pump station) is likely to redevelop in the future. This redevelopment should make appropriate revisions to the road network through the DND property to accommodate a preferred truck route connecting the pump station to Lyall Street, thus eliminating the need to use the Munro Street and Fraser Street (one-way) routing section.

5.2.6.4 Cumulative effects assessment – Traffic

Traffic volume increases associated with land use change near the Hartland site are expected to be modest for the foreseeable future. The housing at Willis Point, and the anticipated large-lot subdivision at Partridge Hills are, and will be, vehicle-dependent developments. As long as the total number of residences remains low, traffic generation is not expected to cause congestion on Willis Point Road. Volumes on West Saanich Road and Wallace Drive could grow modestly in coming decades, reflecting continued development on the Saanich Peninsula and the imbalance of jobs and services (in the Core) and low-density housing (in the suburbs).

Vehicles traveling between the Clover and Macaulay Point treatment plants and the Hartland biosolids facility would encounter increasing congestion on Blanshard Street, Highway 17, and other arterial roads, particularly during the weekday afternoon peak time period. Relatively little change is expected in the traffic conditions near Clover Point, but redevelopment of Department of National Defence lands in Esquimalt could see substantial changes in traffic volumes and patterns. Unless the region benefits from improved public transit (particularly rail transit, which does not rely on roadways) and more mixed-use, higher density development, traffic will worsen as it does in other jurisdictions suffering from sprawl. The scale of the traffic increases anticipated in the region is substantial, eventually exceeding half a billion trips per year, and the cumulative effect of this traffic increase on the region is considered significant. The contribution to regional traffic of the 20,000 trips per year associated with the biosolids facility in 2045 (4 out of every 100,000 trips) is **less than significant**. Even so, efforts need to be made to reduce travel associated with biosolids processing, to avoid incremental worsening of cumulative traffic impacts.

Implementing the mitigation options summarized in Table 5-5 would help to reduce both local and cumulative effects of the biosolids facility.

Table 5-5
Traffic impacts and mitigation for the Hartland site.

Issue	Potential Impact of Development	Mitigation
New Traffic	Increase in Traffic Volumes and Truck Traffic	1. Encourage employee car, van pooling, etc. 2. Avoid trucks travel during the 3 p.m. to 6 p.m. peak during weekdays. 3. Ensure trucks travel within the speed limits.
Routing	Impact on neighbourhood	1. Recommend route with least residential frontages. 2. Minimize truck traffic impact on any one (local) neighbourhood street by using a one-way circuit from and to Macaulay Point. 3. Limit sludge haul truck sizes to less than 26,500 kg GVW. 4. Ensure use of truck routes where available. 5. Avoid School and Safe Route to School zones where possible. 6. Provide a direct truck route link between Macaulay Point sewage pump station and Lyall Street when DND property redevelops
Noise	Impact on neighbourhood	1. Prohibit use of Engine Brakes in residential neighbourhoods. 2. Discourage trucks from being left idling.
Engineering Standards	Safety	1. Ensure appropriate road widths and truck turning radii along truck routes. 2. Use routings that provide appropriate infrastructure for safe pedestrian and cyclist travel.

Issue	Potential Impact of Development	Mitigation
Construction Traffic	Increased Traffic	1. Provide shuttles from Park and Ride locations. 2. Provide adequate crew parking on-site. 3. Promote use of nearest construction material suppliers and debris dump sites. 4. Consider constructing an access road connecting the site and Industrial Way. 5. If the site access is gated, ensure adequate magazine storage outside gate so that stopped vehicles will not be parked on Millstream Road waiting for gate to be opened.
Parking	Impact on Roadway	1. Provide sufficient on-site parking for construction staff; reduced upon completion of construction for ongoing staffing requirements.
Site Access	Safety and Capacity	None required; the Site currently has a high standard of access to Willis Point Road.

5.2.7 Visual aesthetics

5.2.7.1 Study methods

An assessment of visual aesthetics entails a description of the changes in the attractiveness of a landscape or a site as a result of a project. The aesthetic assessment for the Hartland site is based on field inspections of the study area and its surroundings, interpretation of aerial photography, and the inspection of ground level digital photographs of the site and the landscape. The preliminary nature of the site layout designs precluded the use of digital elevation model-based visual assessments.

5.2.7.2 Existing conditions

The Hartland site lies on the north-eastern flanks of Mount Work on a bench a minimum of 10 m above Willis Point Road. Visually, the site is characterized by immature deciduous and coniferous vegetation along its northern margin, with mature conifers on the slopes rising up to Mount Work. The northern portion of the proposed biosolids site is in a slightly different viewshed from that of the Hartland landfill to the southeast.

5.2.7.3 Aesthetic impacts and mitigation measures

Construction phase

Impact: Effects of construction and site modification on visual aesthetics. The construction phase impacts most likely to affect visual aesthetics are vegetation clearing and re-grading of the site. Because the Hartland site is screened from Willis Point Road by elevation and vegetation, few passing motorists would be able to observe the construction activities on the site. If slash burning occurs on the site (and this has not yet been determined to be part of the work program) smoke could affect the visual quality of the surrounding area. Because no residents would be able to see the site from their homes, aesthetic impacts would be limited to drivers on Willis Point Road who might glimpse the site. Photos 5-7 and 5-8 shows the limited visibility of the site from lower Willis Point Road, and Photo 5-9 shows the extent of visual screening from the road near the driveway access to the site. The CRD has entered into an agreement with the District of Saanich to protect and plant vegetation along a roadway buffer, an interior buffer, and along an elevated berm adjacent to the site. This visual screening greatly reduces the ability to view the site from Willis Point Road.

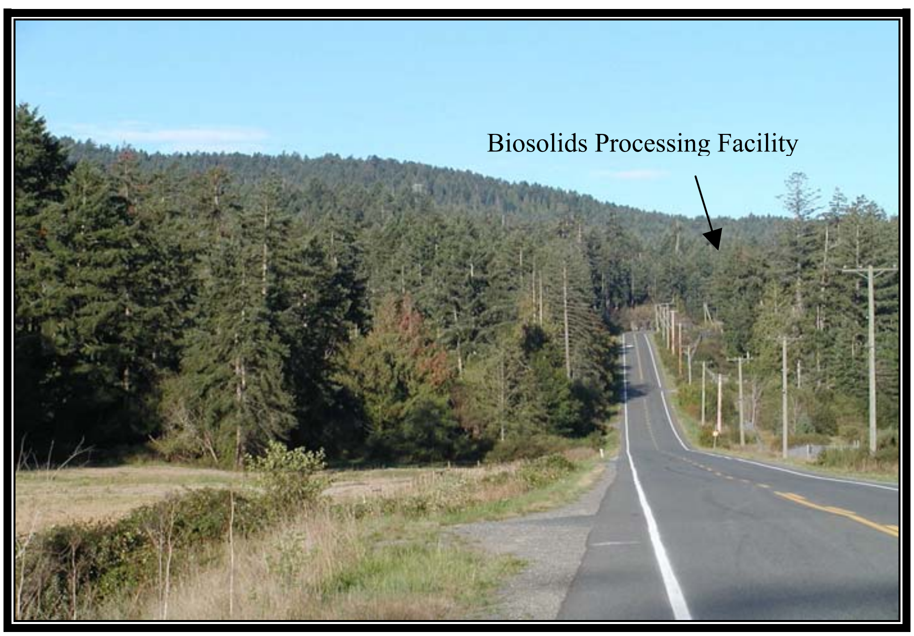

Photo 5-7 Viewed west from Willis Point Road, the biosolids facility on the Hartland site would be screened by trees and topography.

Photo 5-8 Westbound drivers on Willis Point Road might glimpse the biosolids facility on the Hartland site in the left distance, more than 800 metres away.

Photo 5-9 It is unlikely that the biosolids facility on the Hartland site could be seen from the access off Willis Point Road.

Visual aesthetic impacts of facility construction are considered to be medium term (lasting two years) and long-term (site contouring would be permanent). Because of the limited visibility of the site, the magnitude of visual aesthetic impacts are considered to be low, and the impact **less than significant**.

> ***Mitigation.*** Visual effects of construction could be minimized by limiting the amount of site alteration conducted, and by ensuring the protection of mature vegetation.

Operations phase

Impact: Appearance of biosolids facility structures and site alteration. The re-grading of the Hartland site and the construction of biosolids digesters, composting facilities, and ancillary structures, will alter the visual appearance of the site. Most of the structures will be four meters in height, on average, and the digesters will be approximately ten meters high. The form and colour of the site will be transformed from a dark green coniferous forest to a lighter-coloured site with typical-looking industrial structures and equipment.

Although the visual aesthetics of the site will be changed, few people will be able to see it. The biosolids site will be most visible from the landfill itself (Photo 5-10). Few members of the public would be able to view the site from this southern vantage point. From Mount Work, recreationists may be able to glimpse the biosolids facility, but the density of vegetation on Mount Work would make such viewing difficult. As Photos 5-7, 5-8 and 5-9 show, from Willis Point Road the structures would be scarcely visible, if at all. Photo 5-7 shows that from one point on Willis Point Road, a westbound motorist may be able to see the biosolids structures 800 meters to the west. Travelling at the posted speed limit of 50 kilometres per hour, the biosolids facility might be visible for a period of up to three seconds. The eastern end of the lower bench is proposed for three structures, but most of this site is slated for gravel storage (Photo 5-11). Aesthetic change on the site is considered to be a long term impact, but due to lack of visibility to the public, is considered to be low magnitude. The spatial extent of the impact is one or perhaps two small "windows" in vegetation along Willis Point Road. The extent of vegetation clearing and site modification required for the facility will not be known until detailed designs are completed. The existing information indicates that the visual aesthetic impact of the facilities and site modification would be **less than significant**.

> ***Mitigation:*** Additional plantings of coniferous trees and evergreen shrubs along Willis Point Road could completely screen the Hartland site from passing vehicles.

Landscaping using tall-growing plants around the facilities could also improve screening.

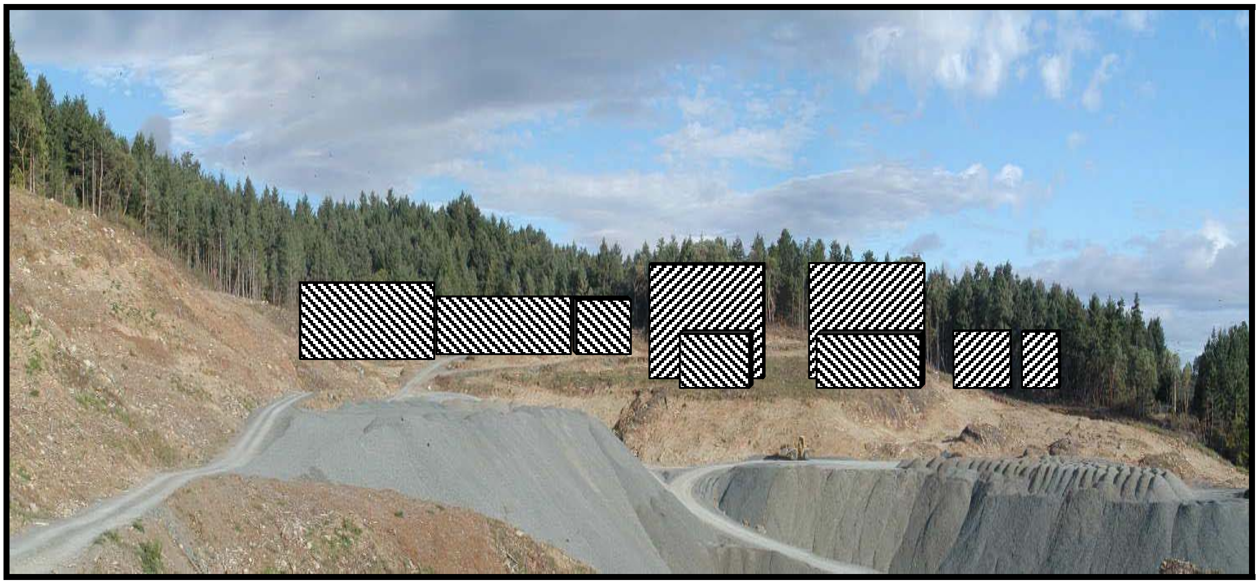

Photo 5-10 Viewed to the north from Hartland landfill, the biosolids processing buildings (right) and composting (left) would be visible. Treed buffers would screen the structures from Mt. Work Regional Park (left).

Photo 5-11 This cleared and levelled portion of the Hartland site would house administration, wastewater treatment, and garage structures. The CRD proposes to store gravel on most of the site. Treed buffers would be retained around this pad.

Impact: Effect of light and glare on visual aesthetics. Lighting associated with operation of the biosolids facility would be limited to residential-standard lighting. High-pole industrial lighting would not be installed. As the facility would be operated primarily during working hours during the week, and would not be staffed 24 hours a day, only security lighting will be needed. The project would be required to comply with District of Saanich lighting regulations to protect the Dominion Observatory. These regulations require downward illumination.

Introduction of lighting into this forested, rural setting would have an effect on the night time aesthetics of the landscape. Because few people reside near the proposed facility, night time lighting would not be noticed by residents. Motorists on Willis Point Road may observe facility lighting as they drive past. Lighting effects would constitute a local impact, of long term duration. The limited extent of lighting likely to be needed on the site suggests that the magnitude would be low, and the impact **less than significant**.

Mitigation: Lighting impacts could be reduced even further by taking the following actions:

- Minimize lighting requirements for security. Some recent studies have suggested that lighting does not discourage vandalism, and a dark site is less prone to these activities than those that are lit; hence lighting should be limited to that necessary for worker safety during night time periods,
- Use low intensity lighting, and
- Light only ground areas or facilities where maintenance or security require such lighting. Avoid placing lighting high on poles if possible.

5.2.7.4 Cumulative effects assessment – Aesthetics

Limited urban development in the vicinity of the Hartland site has preserved a high quality visual aesthetics environment. The landscape has largely recovered from logging that occurred in the late nineteenth and early twentieth centuries. Most rural residential development near the site has occurred on large lots with limited effect on the visual character of the area. The landscape transformation that accompanied development of the Hartland landfill is scarcely visible from housing, parks, or Willis Point Road. The topographic and vegetation screening that limits the visual impacts of Hartland landfill also benefit the candidate biosolids site. Although on-site changes to landforms, vegetation, and visual character would accompany construction of the biosolids facility, few people would witness this change. Hence, the development of the Hartland site for a biosolids facility is deemed to have a **less than significant** effect on the cumulative effect of development on visual aesthetics in the study area.

5.2.8 Land use and neighbourhood

5.2.8.1 Study methods

This land use and neighbourhood analysis is based on official community plans and zoning bylaws adopted by the District of Saanich and the Juan de Fuca Electoral Area, and on field inspections of the study area. The CRD's Urban Capacity Inventory, which interprets Official Community Plan land use information, was used in the preparation of Figure 5-8. Discussions were held with planners from the District of Saanich and the Juan de Fuca Electoral Area.

5.2.8.2 Existing conditions

Figure 5-9 shows the existing land uses in the vicinity of the Hartland candidate site. Most of the land to the west and north of the site is in Mount Work Regional Park. To the northeast, the Department of National Defence operates the Heals Rifle Range and associated training area along Durance Creek. Land immediately to the southeast of the candidate site is used for the Hartland landfill, which is operated by the CRD. The active portion of the landfill is separated from the candidate site by a band of vacant land. The nearest residences are approximately 700 m to the northwest of the Hartland site, an area of large lot residential holdings near Durance Lake. To the southeast of the landfill, suburban residential development has occurred along Hartland Avenue and Kiowa Place.

Planned uses (Figure 5-8) indicate relatively little future change in surrounding land uses. The rural large lot residential development shown to the north of the Hartland site on Figure 5-8 is an artefact of the age of the Urban Capacity Inventory database. Most of the land around Durance Lake has now been acquired as parkland by the CRD. Similarly, land exchanges with the Department of National Defence have confined the defence lands to the area north of Willis Point Road. Along the eastern boundary of the landfill, the CRD has acquired (or is in the process of acquiring) a buffer to separate existing and planned residential development from the landfill.

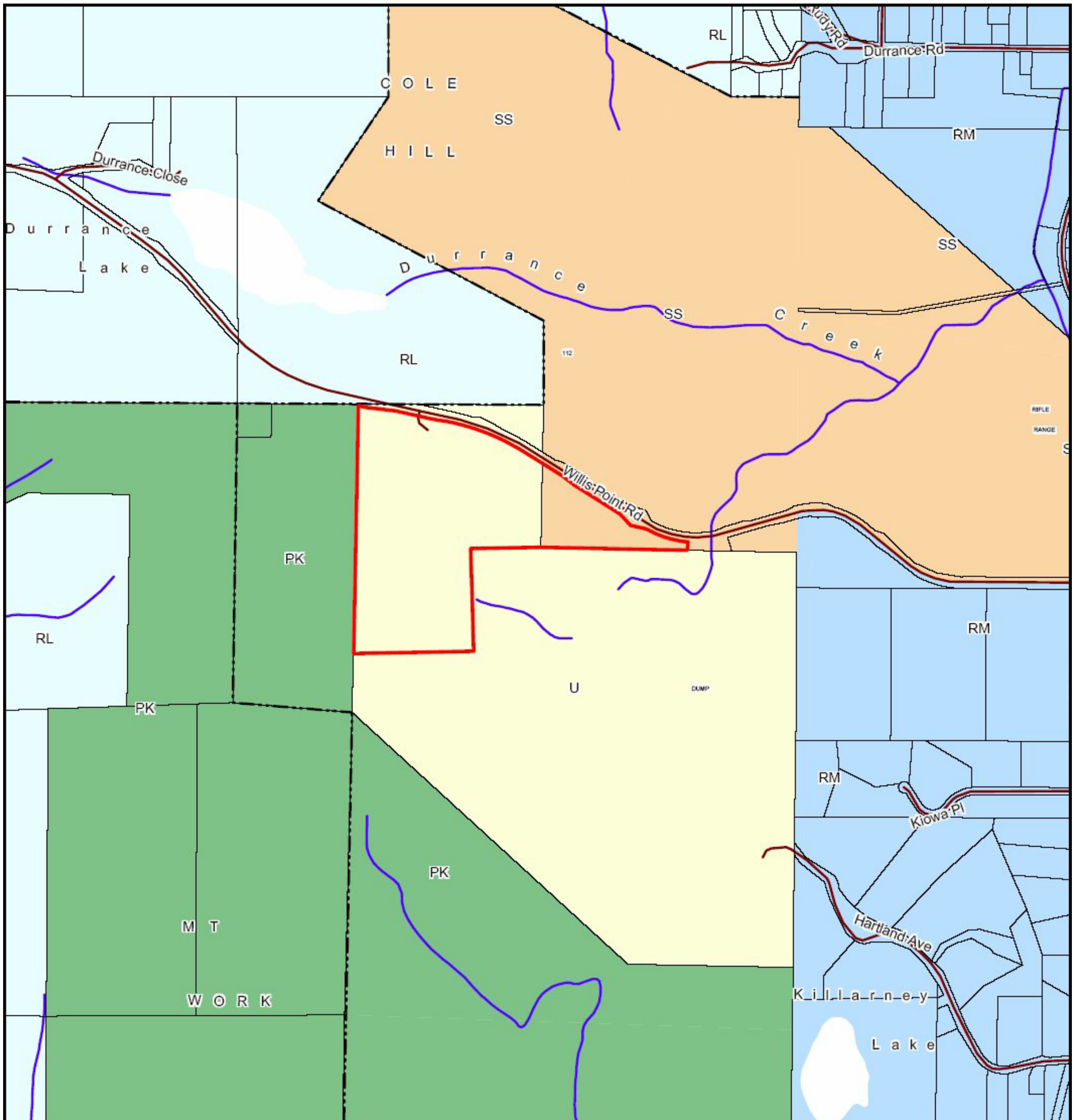

FIGURE 5-8
PLANNED LAND USE NEAR THE HARTLAND SITE

RS	Small-Lot Rural (0.2 - 1.0 ha min.)	C	Commercial
RM	Medium-Lot Rural (1 - 4 ha min.)	ID	Industrial
RL	Large-Lot Rural (4+ ha min.)	IS	Institutional
NN	New Neighbourhood	U	Utility
SS	Special Status	UD	Undesginated
PK	Park		

Source: CRD RPS SLUPS, 2002

Site Boundary
Municipal Boundary
Cadastre (ICI)

N

0 100 500 m

Scale 1 : 15,000

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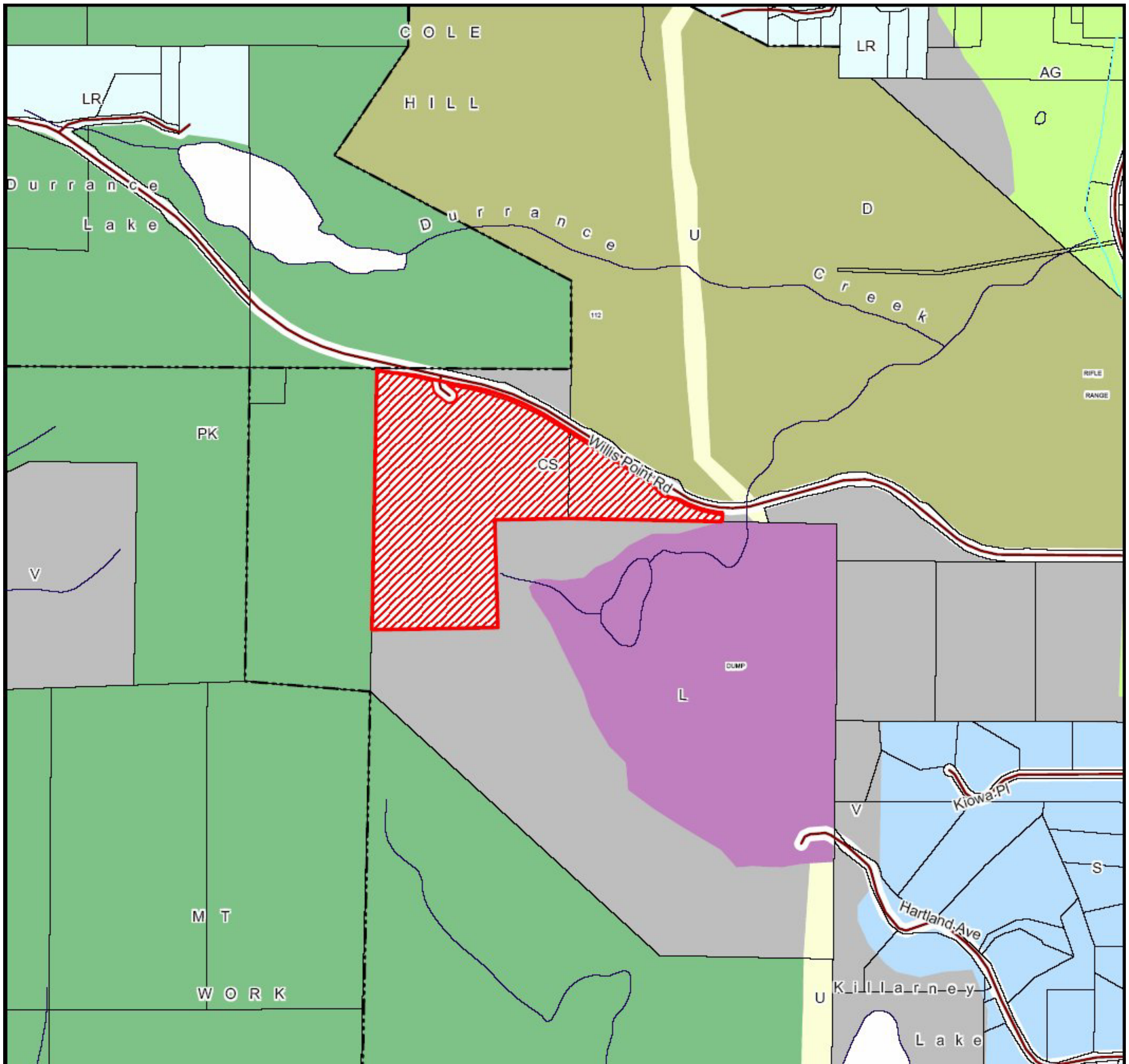
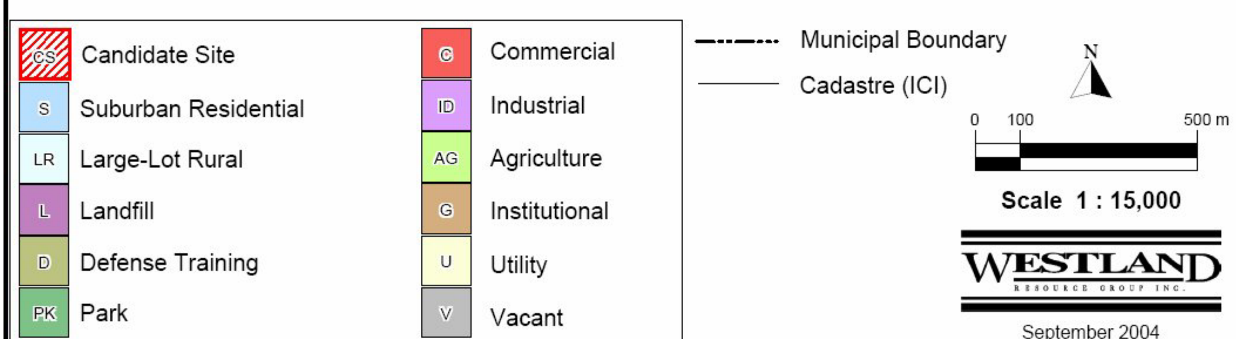


FIGURE 5-9
ACTUAL LAND USE NEAR THE HARTLAND SITE



5.2.8.3 Land use and neighbourhood impacts and mitigation measures

Construction phase

Impact: Community effects of facility construction. As in the case of the Millstream site, community effects of construction on the Hartland site could feature the following sources of disruption:

- Construction traffic, particularly heavy trucks,
- Site preparation noise and vibration caused by blasting and grading,
- Dust from site preparation and truck traffic, and
- Parking on adjacent streets by construction workers.

Construction of the biosolids facility at the Hartland site would require considerable blasting and grading of the middle and upper benches. Blasting and heavy equipment work associated with this activity might be heard, under quiet conditions, in the residential areas to the northwest or southeast. The separation distance between the site and residences is great enough, however, that it is unlikely that any discernable impact will result. The site preparation phase of construction would last approximately one year, a moderate term, after which such impacts would cease.

Truck traffic and worker vehicles accessing the Hartland site will cause intermittent increases in traffic volumes on Willis Point Road (see Section 5.2.6). There are virtually no residences on Willis Point Road that would be affected, and changes in traffic volumes on West Saanich Road are not expected to be noticeable.

The impacts of construction on the surrounding community are considered to be of moderate term duration, local extent, reversible, and of low magnitude. This impact is, therefore, deemed to be **less than significant**.

> ***Mitigation*:** The impact of site preparation could be further reduced by informing the municipality and any nearby residents of the schedule and duration of potentially disturbing activities (such as blasting).
>
> By taking the following mitigation measures, the effects of traffic near the Hartland site could be further reduced:
>
> - Providing off-street parking for construction workers or providing "park and ride" access, and

- Ensuring that dirt tracked onto Willis Point Road is quickly cleaned up.

Impact: Compatibility of the development with local land use plans. The biosolids facility and Hartland landfill site are in an area of the District of Saanich where no zoning is in effect. A rezoning application has been submitted by the CRD for this site that would permit waste management activities such as those that would be conducted at the biosolids facility site. The community will have a voice in the adoption of this bylaw before Council acts on the application. No schedule has yet been established for holding a public hearing on the zoning bylaw amendment. Because no incompatibility presently exists between the potential biosolids use and zoning designations (or lack of such designations), and a process must be conducted to adopt appropriate zoning, the magnitude of this impact is considered moderate. It can be anticipated that the rezoning will eventually be adopted for the Hartland site, so this impact is deemed to be **less than significant**.

> ***Mitigation**: The compatibility of biosolids facility construction with local land use plans can be assured by having the necessary zoning in place well before construction is necessary. In this way, public discussion can occur and municipal approvals be provided without undue scheduling pressures.*

Operations phase

Impact: Biosolids odour effects on adjacent land uses. The odour model run for the biosolids facility indicates that odours at the site boundary would not reach detectable levels under planned treatment. Hence, no odour impacts on adjacent land uses are expected to result from the operation of the biosolids facility. Equipment malfunctions, human error, or facility maintenance may result in the release of noticeable odours from the facility, however. These events are expected to be short-term, and rare in occurrence. Odour impacts are entirely reversible, and the magnitude of this potential impact is considered low. The impact of odour impacts on adjacent land uses, therefore, is deemed to be **less than significant**.

Mitigation: To ensure that land use effects of odour emissions remain less than significant, the following mitigation measures must be implemented.

- Ensure that the highest level of odour treatment is installed at the biosolids facility at the time it is constructed.
- Rigorously monitor the effectiveness of odour control in eliminating impacts on adjacent properties.
- Regularly maintain and upgrade the facilities to ensure sufficient odour control necessary to eliminate impacts.

Impact: Effect of operational traffic on the neighbourhood. Once the biosolids facility is in operation, relatively low volumes of traffic are expected at the site (see Section 5.2.6). The limited development along Willis Point Road and the rural nature of development along West Saanich Road indicate that traffic impacts on neighbourhoods would be of low magnitude, even though they would be long term. As long as traffic volumes are consistent with those predicted in this study, and residential development in the study area remains rural, this impact is considered **less than significant**.

> ***Mitigation:*** Ensure mitigation measures identified in Section 5.2.6 are fully implemented.

5.2.8.4 Cumulative effects assessment – Land use and neighbourhood

Historic land use change in the vicinity of the Hartland site has been relatively limited compared to many parts of the region. As with most of Southern Vancouver Island, logging roads and other evidence of logging activity are common throughout the area. Only remnant old growth forest remains in the area, none of it on the candidate site. The expansion of Mount Work Regional Park will limit future land use change to the west and north of the Hartland site. The Department of National Defence property to the northwest of the Hartland site has been extensively used for training and target practice. This use is likely to continue for the foreseeable future. Alternative uses for this property, and outright sale of the property, have been discussed but no firm plans are yet in place. Hartland landfill will continue to be used for decades, so no foreseeable change in land use on the Hartland landfill site is anticipated. To the east of the landfill, additional residential development can be expected in the future.

Residential development would transform presently vacant forested land into an urban landscape. The extent of this change is not presently known.

In the context of this cumulative change in land use in the study area, the clearing of 4.5 hectares of land and the subsequent construction of a biosolids facility adjacent to a solid waste landfill constitutes a permanent change in land use pattern. The magnitude of this change is considered moderate, in cumulative terms. Because the Hartland site is located in an area where little future change in land use is anticipated, the contribution of the biosolids facility to cumulative land use change in the study area is considered **significant**.

> ***Mitigation:*** Redesign of the biosolids site plan to maximize the use of the cleared lower bench would greatly reduce the conversion of forest land to biosolids facility.

This design change would reduce the contribution of the biosolids development to cumulative land use change to **less than significant** levels.

5.2.9 Property values

5.2.9.1 Study methods

The study methods outlined in Section 4.2.9.1 were also used for the Hartland site.

5.2.9.2 Existing conditions

Land immediately to the southeast of the Hartland candidate site is used for the Hartland Landfill, operated by the CRD. The active portion of the landfill is separated from the candidate site by a band of vacant land. Although landfill operations now include methane gas collection and is operated to best practice conditions, some odours are produced. Along the eastern boundary of the landfill, the CRD is in the process of acquiring a buffer between existing and planned residential development and the landfill. To the west and north of the site is in Mount Work Regional Park, and to the northeast is the Department of National Defence Heals Rifle Range and training area. The nearest residential areas are approximately 700 meters to the northwest. To the southeast, some suburban residential development has occurred along Hartland Avenue and Kiowa Place. Most of the land around Durance Lake has now been acquired as park land by the CRD.

5.2.9.3 Property value impacts and mitigation measures

Construction phase

The general area of the candidate site is used for landfill operations and the roads are used by waste collection vehicles. In this context, odour impacts on property values during the construction phase are expected to be **less than significant**.

Operations phase

No odour impacts on the market values of adjacent properties are expected to result from the operation of the biosolids facility. Section 4.0 of this report examines the potential for odours from the biosolids processing plant to affect surrounding properties. The analysis concludes that with high quality odour control technology installed at the facility, it is unlikely that noticeable odours would affect the surroundings. The odour model run for the biosolids facility indicated that odours would not be detectable (i.e. would not be greater than 7 odour units) beyond the site boundary under normal operating conditions (when 99% odour removal is achieved by on-site treatment) or under maintenance conditions (when 97% odour removal is achieved by on-site treatment). Equipment malfunctions or human error might result in the release of noticeable odours from the facility, but such events are expected to be rare and of short duration. Given that the candidate site is next to the long established Hartland landfill, which is planned to be in operation for the next 25 years, property values will already reflect the industrial nature of a land use such as the biosolids facility. Therefore, odour impacts on property values during the operations phase are expected to be **less than significant**.

Mitigation: To ensure that there will be no property value effects of odour emissions, the following measures should be implemented:

- Install the highest level of odour treatment at the biosolids facility at the time it is constructed;
- Rigorously monitor the effectiveness of the odour control treatment;
- Regularly maintain and upgrade the facilities to ensure the highest level of odour control necessary to eliminate any potential impacts.

5.2.9.4 Cumulative effects assessment – Property values

The area in the vicinity of the candidate site has long established land uses, including the Hartland Landfill and a Ministry of Defence rifle range and training area. In the past, the landfill was considered to be noisy, odorous and dirty. Substantial improvements to the landfill's design and operation make it a well-managed operation that includes methane gas collection. The proposed biosolids facility is not expected to produce odours that are detectable beyond the site itself except in cases of equipment malfunction or human error, which might result in the release of noticeable odours from the facility. However, these events are expected to be short-term, rare in occurrence and entirely reversible. Given the established landfill, a new facility of the nature of the biosolids operation is not expected to affect the value of nearby properties. Therefore, **less than significant** odour impacts on property values are anticipated.

5.2.10 Archaeology and heritage

5.2.10.1 Study methods

A review was carried out of both archaeological and ethnographic reports and related material pertaining to the study area. This process included a review of archaeological site inventory records (maintained by the Archaeology and Registry Services Branch of the British Columbia Ministry of Sustainable Resource Management) and a review of old maps and legal survey data from the British Columbia Surveyor General's Office in Victoria for both of the biosolids facility sites. The latter source often contains records of mid to late 1800s land-use and settlement by local First Nations people.

Although the background research, carried out prior to a field examination of the two subject locations, revealed that neither location contained any previously documented archaeological sites or features, both areas were considered to have some potential for containing rock cairn structures (sometimes used by local First Nations to bury their dead). Both locations also had a potential for culturally modified tree (CMT) features. The latter are usually found in association with stands of red cedar, with the most common CMT type being tapered bark-stripped trees. Both of the study locations were also deemed to have some potential for containing inland "shell midden" deposits. However, the possibility of finding evidence of such sites was considered to be quite low, given the steepness of terrain within both areas and their considerable distance from the nearest ocean shoreline (where most such sites are found).

After gathering information about the history of First Nations land-use and settlement in the general vicinity of the two subject facility locations, a limited archaeological field reconnaissance was carried out. This work was accomplished over a period of two days during July and August 2004 by Simonsen and Somogyi. The field reconnaissance involved an examination of lands within the two Biosolids Facility sites by means of a series of foot traverses during which a detailed inspection was made of cedar trees and existing sub-surface exposures. Special attention was paid to boulder clusters that might represent cairn burial locations. It should be noted that no sub-surface testing for buried archaeological deposits was carried out in the course of the field reconnaissance.

5.2.10.2 Existing conditions

The Hartland site, situated to the northwest of the existing CRD landfill complex, contains no previously recorded archaeological site locations. Our pre-field archaeological potential rating for the proposed biosolids facility site was very low, due mostly to the steepness of terrain throughout most of the subject site and the general lack of good red cedar stands. A somewhat higher potential level was ascribed to the potential for finding rock cairn features, because a number of such features have been found in similar settings in other parts of the Capital Regional District, notably in the East Sooke and View Royal locales.

Our initial field reconnaissance of the Hartland Road Site found no evidence of past aboriginal land-use or settlement. However, a later field examination of the area by ecologist Lynn Atwood discovered several possible culturally modified trees. These features were later examined by Archaeologist Bjorn Simonsen who confirmed the presence of one bona-fide CMT. A second CMT feature was also located by Simonsen in the course of an examination of a new area that was added to the original Hartland site. The two CMT locations are shown on Figure 5-10.

Although two culturally modified tree features were documented within the proposed Hartland biosolids site, one (CMT #2) falls outside of the direct impact area, as shown on the latest Site Layout Plan. CMT #1 may also be outside of the actual site construction area, being located down-slope of one of the proposed "Compost Expansion" facilities. However, it may be that both CMT features will be affected by pre-construction clearing and other site preparation activity. In this context, it must be pointed out that neither of the two CMT features on the Hartland site appear old enough to be afforded protection under the British Columbia Heritage Conservation Act – the year 1846 being the cut-off date for automatic protection. However, we recommend that increment cores be obtained from the bark healing lobes from the two CMTs to verify our post-1846 age estimate. If the CMT features are shown to post-date the year 1846, there would be no legal requirement for the CRD to obtain a Site Alteration Permit under the Heritage Conservation Act.

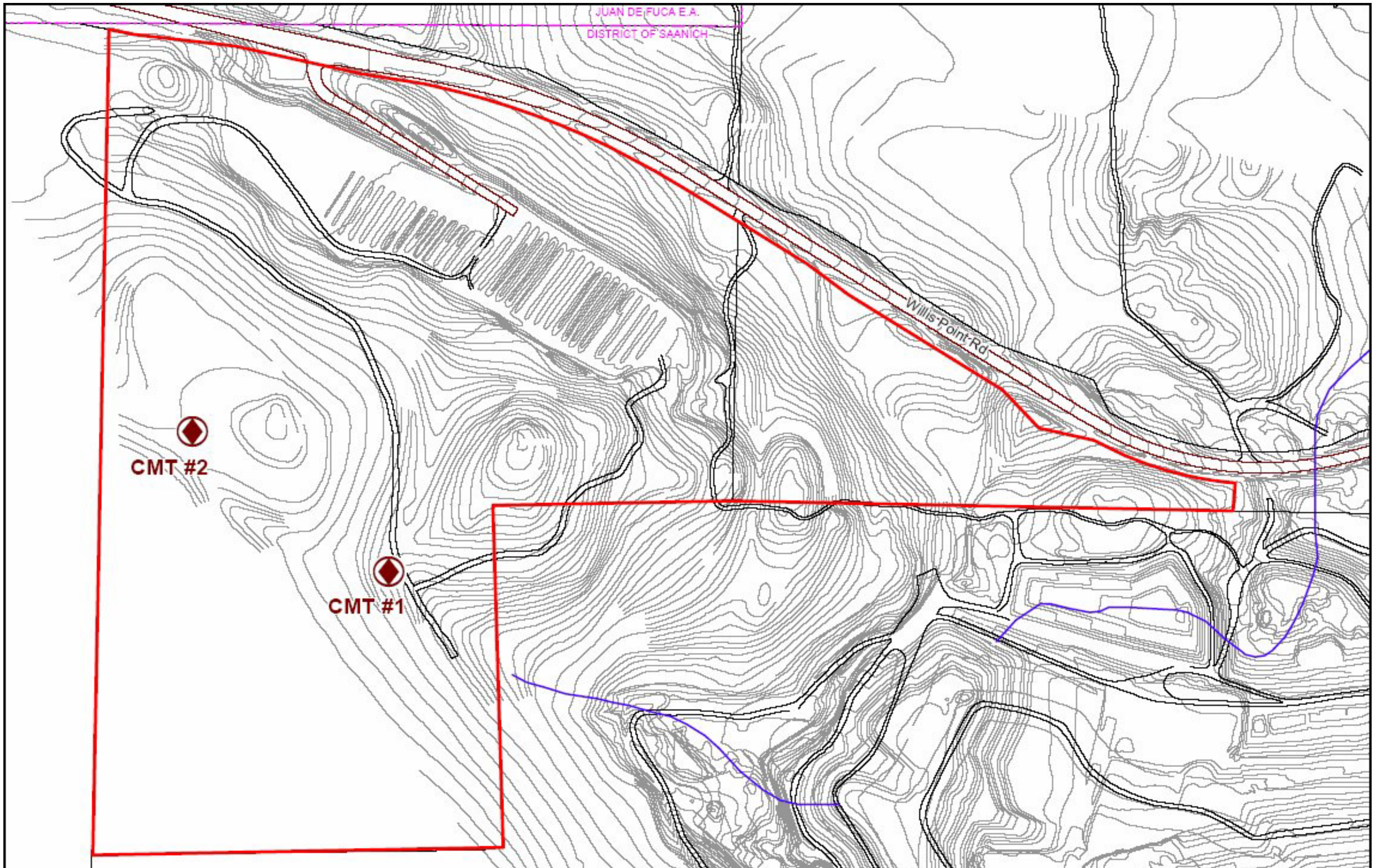


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FIGURE 5-10
CULTURALLY-MODIFIED TREES ON THE HARTLAND SITE

Site Boundary | Culturally-Modified Tree | Transmission Line | River/Stream Channel

N

0 10 50 100 m

Scale 1 : 4,000

September 2004

5.2.10.3 Archaeology and heritage impacts and mitigation measures

With the exception of the two CMT features described above, no other evidence of past aboriginal land-use or occupation of the Hartland Road Site was found in the course of our field examination and it is our opinion that no additional archaeological investigations are warranted, beyond obtaining a more precise estimate of the age of cultural modification for the two CMT features.

As a result of this work, archaeological and heritage impacts of building and operating the proposed biosolids facilities at the Hartland site is deemed to be of low magnitude, localized spatial extent (limited to the area of the two potential CMTs), and long-term duration. The impact is deemed to be **less than significant**.

> ***Mitigation****:* If the CRD agrees to protect the two potential CMTs from disturbance during construction, so that the trees' life expectancies are not shortened, then the risk of any archaeological or heritage impact is reduced further, remaining **less than significant**.

5.2.10.4 Cumulative effects assessment – Archaeology and heritage

Cumulative effects on archaeology and heritage resources in the vicinity of the Hartland site would mainly result from:

- extensive logging that occurred in this area over the past 100 years,
- development of the Hartland Landfill,
- agricultural development in the Tod Valley, and
- rural residential development and associated roads and services.

Planned future development is unlikely to materially affect archaeology and heritage resources near the Hartland site. Modest residential development to be east of the Hartland Landfill and in Partridge Hills is unlikely to contribute materially to cumulative archaeology and heritage impacts. The potential effect of the Hartland biosolids facility on two identified culturally modified trees is deemed to make a **less than significant** contribution to heritage and cumulative impacts in the area.

6.0 Comparison of the two sites

This ESR has assessed the potential environmental and social effects of building and operating a biosolids facility on either the Millstream or Hartland sites. This section of the report provides a side-by-side comparison of the relative merits of the two sites. This comparison is based on the information collected and analysed in this report and reflects the opinions of the report preparers.

The table contents sometimes provide a more "detailed" review than the categorization of impact ratings. For instance, the impact rating for a topic might be "less than significant" for both sites, but one site is nonetheless considered superior to the other. The comparison is intended to stimulate discussion during the site selection process and to summarize the findings of this study.

Landforms, geology, and soils

Table 6-1
Comparison of landforms, geology, and soil impacts for Millstream and Hartland sites.

Impacts	#1 – Millstream Site	#2 – Hartland Site	Comparative Rating
Extent of site reconfiguration needed	Some—Rock outcrops and adjacent basins would be graded out.	Substantial—Steep slopes require blasting and levelling	#1 better
Slope-related erosion risk	Relatively low-gradient site, modest erosion risk	Steep site, greater erosion risk	#1 better
Vegetation removal effects on erosion risk	Most vegetation removed only where roads or buildings to be built—little effect on erosion	Most vegetation removed only where roads or buildings to be built—little effect on erosion	Same
Cumulative effects	Substantial future development likely in vicinity—biosolids facility would make less than significant contribution to cumulative effects	Limited past or planned development in vicinity (except Hartland landfill)—biosolids facility would make less than significant contribution to cumulative effects	#1 better

Hydrology and water quality

Table 6-2
Comparison of hydrology and water quality impacts for Millstream and Hartland sites.

Impacts	#1 – Millstream Site	#2 – Hartland Site	Comparative Rating
Effects on surface water flows	Substantial areas of seepage and drainage affected by facility construction	Small areas of wetland affected by facility construction	#2 better
Effects on surface water quality	Relatively low-gradient site, modest sedimentation risk	Steep slopes require blasting and levelling, greater sedimentation risk	#1 better
Effects on groundwater flows	Relatively low risk that cut and fill operations will affect groundwater flows	Extensive cut and fill operations required, greater risk of affecting groundwater flows	#1 better
Effects on groundwater quality	It is unlikely that there will be any effects on groundwater quality as a result of facility construction and operation	It is unlikely that there will be any effects on groundwater quality as a result of facility construction and operation	Same
Cumulative effects	Changes in flow regime and channelization of streams as a result of development near the site, historical disposal of waste at the site, and the operation of industrial facilities adjacent to the site have affected surface and groundwater at the site.	Changes in flow regime and channelization of streams as a result of development near the site, the composting of yard waste at the site, logging of entire site, and construction and operation of the Hartland landfill have affected surface and groundwater at the site.	Same

Plant life

Table 6-3
Comparison of plant life impacts for Millstream and Hartland sites.

Impacts	#1 – Millstream Site	#2 – Hartland Site	Comparative Rating
Extent and quality of native plants removed	3 ha of native plant communities removed, including red- or blue-listed communities	4.5 ha of native red-listed plant communities removed	Same
Effects of changing hydrology on plants	Substantial areas of seepage and drainage dependent communities likely to be affected	Small areas of wetland affected	#2 better
Effects of disturbing thin soils on rock outcrop plant communities	Substantial areas of fragile rock outcrop communities at risk	Limited area of fragile outcrop communities at risk	#2 better

Impacts	#1 – Millstream Site	#2 – Hartland Site	Comparative Rating
Risk of blowdown on residual forest trees	Relatively little new wind exposure risk would result from clearing	Clearing will expose upslope forest to winds	#1 better
Risk of introduction of additional weed species	Existing plant communities vulnerable to noxious weeds	Residual adjacent forest relatively unaffected by noxious weeds	#1 better
Cumulative effects	1. Future development would result in substantial loss of native vegetation 2. Biosolids facility would contribute little to change	1. Limited future development will have minor effect on native plant communities 2. Clearing for biosolids facility contributes to effect	#1 better

Animal life

Table 6-4
Comparison of animal life impacts for Millstream and Hartland sites.

Impacts	#1 – Millstream Site	#2 – Hartland Site	Comparative Rating
Loss of upland wildlife habitat	Western portion of site already degraded, remaining 3 ha area is good, varied habitat	4.5 ha of dry forest habitat of moderate quality habitat would be lost	Same
Loss of wetland wildlife habitat	Site has several small wetlands that support wildlife	One minor wetland near northern site boundary	#2 better
Chance of affecting rare or endangered species	Diverse habitat likely to support species at risk	Less diverse forest habitat less likely to support species at risk	#2 better
Increased area of forest edge habitat	Limited increase due to nature of forest structure	Substantial increase as contiguous forest would be removed	#1 better
Cumulative effects	1. Substantial future planned land use change will degrade substantial areas of habitat. 2. Millstream development would not make significant contribution to cumulative effects	1. Limited future land use change will have minor effect on regional wildlife habitat. 2. Biosolids facility could contribute to cumulative effects	#1 better

Odour

Table 6-5
Comparison of odour impacts for Millstream and Hartland sites.

Impacts	#1 – Millstream Site	#2 – Hartland Site	Comparative Rating
Effects of odour under proposed (99%) or partial (97%) reduction	No or little effect on nearest residential areas	No or little effect on nearest residential areas or Mt. Work Park	Same
Effects of odour with no treatment	Noticeable odour at numerous houses in Bear Mountain development and at Matson and Teanook Lake	Noticeable odour at small number of Durance Lake homes and Mt. Work Park	#2 better
Cumulative effects	1. Existing industrial activities and diesel trucks are main source of odour. 2. Biosolids facility would not contribute to cumulative effects	1. Hartland landfill is main source of odour. 2. Biosolids facility would not contribute to cumulative effects	Same

Traffic

Table 6-6
Comparison of traffic impacts for Millstream and Hartland sites.

Impacts (For Non-Common Route Sections)	#1 – Millstream Site	#2 – Hartland Site	Comparative Rating
Average one-way route distance	19 km	20 km	Same
Routing – approximate distance traveled on freeway	7.4 km	3.5 km	#1 better
New traffic impact on main access roads to site (i.e. base traffic volumes relative to roadway condition, congestion points, etc.)	1. Congestion due to southbound Millstream traffic southbound movement making left turn eastbound on Trans Canada Highway during weekday AM and PM peak periods and Saturday afternoons. 2. The section of Millstream Road north of Bear Mountain Parkway has numerous vertical and horizontal curves (approx. 1.3 km). 3. Millstream Road has a posted 50 km/h speed limit but there is a high incidence of speeding.	1. Some weekday PM peak period congestion on Royal Oak Drive between Highway 17 Interchange and West Saanich Road. 2. Willis Point Road has excellent roadway and access condition, good design and excellent visibility at site plus long left turn lane provided at driveway. 3. Much of routing (approx. 7km) uses West Saanich Road. Although recently upgraded, it is still winding with numerous direct accesses onto it. 4. 50 km/h speed limit along Willis Point Road and drivers regularly speed.	#1 better

Impacts (For Non-Common Route Sections)	#1 – Millstream Site	#2 – Hartland Site	Comparative Rating
New traffic impact on Millstream Road and Willis Point/West Saanich Road residential neighbourhoods	1. Arterial roadway and truck route classification. 2. A few houses impacted.	1. Major collector–arterial and truck route classification. 2. Numerous houses impacted.	#1 better
Noise	Some receptors north of the Trans Canada Highway	Many receptors on West Saanich Road, Royal Oak Drive.	#1 better
Engineering standards under existing conditions	1. Southern section of Millstream Road is constructed to a good standard. 2. Northern section is a lower standard than West Saanich Road but is a short distance (approx. 1.3 km).	1. Willis Point Road is constructed to an excellent standard. 2. West Saanich Road, although recently upgraded with new paving and cycling lanes, is winding with numerous vertical and horizontal curves for a relatively long distance (approx. 7 km).	#1 better
Required road and driveway upgrades at site access	Some	None	#2 better
Construction traffic	1. Possibility of utilizing services of adjacent Industrial Park. 2. All truck traffic and most of construction workers have southern origins and destinations.	1. Services must travel greater distances 2. All truck traffic and most of construction workers have eastern origins and destinations. 3. It may be possible to use Hartland landfill to obtain gravel supplies and to dump clearing refuse	#1 better

Visual aesthetics

Table 6-7
Comparison of visual aesthetics impacts for Millstream and Hartland sites.

Impacts	#1 – Millstream Site	#2 – Hartland Site	Comparative Rating
Construction stage effects	Site is well screened from view, few impacts anticipated	Site is well screened from view, few impacts anticipated	Same
Effect of buildings and site modification	1. Buildings visible only from private road to north. 2. Modest site modification required.	1. Buildings barely visible from Willis Point Road. 2. Extensive site modification needed.	#1 better
Effects of facility lighting	Lighting on biosolids site similar to that on surrounding residential and industrial properties	Few or no residents to observe modest increases in levels of lighting	Same

Impacts	#1 – Millstream Site	#2 – Hartland Site	Comparative Rating
Cumulative effects	1. Substantial change to visual landscape of surrounding properties is planned. 2. Biosolids facility would contribute little to cumulative visual effects	1. Little change in visual quality of surroundings anticipated. 2. Biosolids facility is effectively screened, and would contribute little to cumulative visual effects.	Same

Land use and neighbourhood

Table 6-8
Comparison of land use and neighbourhood impacts for Millstream and Hartland sites.

Impacts	#1 – Millstream Site	#2 – Hartland Site	Comparative Rating
Community effects of biosolids facility construction	1. Increased truck traffic noticeable by Langford residents of Millstream Rd. 2. Some residents may notice blasting and grading noise 3. Impacts would be intermittent and moderate term.	1. Few, if any, residents affected by increased traffic or site preparation noise 2. Impacts would be intermittent and moderate term.	#2 better
Compatibility of development with local land use plans	1. Draft OCP calls for industrial use 2. Rezoning from GB2 zone needed 3. Public process needed prior to land use plan change	1. No zoning in place on the Hartland site 2. Rezoning application is in process 3. Public process needed prior to land use plan change	Same
Cumulative effects	1. Substantial land use change planned for areas east, south, and west of Millstream site 2. Biosolids facility development would contribute little to extensive land use change	1. Little change in land use anticipated for lands near Hartland site 2. Biosolids development would constitute noticeable land use change in the local area	#1 better

Property values

Table 6-9
Comparison of property value impacts for Millstream and Hartland sites.

Impacts	#1 – Millstream Site	#2 – Hartland Site	Comparative Rating
Effects of odour on value of nearby properties	1. No odour impacts expected from normally-functioning biosolids facility 2. Biosolids facility would not affect property value	1. No odour impacts expected from normally-functioning biosolids facility 2. Biosolids facility would not affect property value	Same
Cumulative effects	1. Some odour-generating activities already in the area 2. Planned industrial expansion could contribute to odours 3. Biosolids facility not expected to contribute to cumulative effects	1. Some odour-generating activities already in the area 2. No new odour generators expected in future 3. Biosolids facility not expected to contribute to cumulative effects	Same

Archaeology and heritage

Table 6-10
Comparison of archaeology and heritage impacts for Millstream and Hartland sites.

Impacts	#1 – Millstream Site	#2 – Hartland Site	Comparative Rating
Effects of biosolids facility construction on archaeological resources.	1. No archaeological features identified on the site 2. Facility unlikely to affect archaeological resources	1. Two culturally modified trees located on the site 2. Facility poses low risk of affecting other archaeological resources	#1 better
Cumulative effects	1. Substantial past disturbance of lands to south, and planned disturbance of lands to west of site 2. Biosolids facility would not contribute materially to cumulative effects on archaeological resources	1. Limited past or planned future development of land to west and north, substantial past disturbance to south and east 2. Biosolids facility would not contribute materially to cumulative effects on archaeological resources	Same

Overall comparison

Based on the review of identified impacts on specified features in Tables 6-1 to 6-10, the two candidate sites compare as follows:

Millstream site better:	19 topics
Hartland site better:	8 topics
Both sites considered the same:	14 topics

This comparison should not be construed as a recommendation that the Millstream site is preferred from an environmental and social perspective. All of the topics examined in this report do not necessarily have equal "weight" or importance in making decisions. The consultants who prepared this report are not in a position to assign priorities to the evaluated topics, nor to recommend one site or the other. The information provided in this ESR is intended to support and inform discussions during the public involvement program that will precede CRD decisions on biosolids facility site selection.

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8.0 Appendices

Appendix A	Glossary of Terms
Appendix B	Photographs of Millstream and Hartland Sites
Appendix C	Survey Descriptions of Several Pacific Northwest Wastewater Treatment Facilities
Appendix D	Information on LEED Stormwater Credit
Appendix E	Status Definitions (species at risk)
Appendix F	Meteorological Data
Appendix G	Municipal Truck Route Maps
Appendix H	Traffic Volumes

APPENDIX A

GLOSSARY OF TERMS

Activated Sludge (AS)	A suspended growth process in which a mass of biological growth is held in a reactor to convert soluble organic pollutants to more biological mass. The growth of biological mass is removed as biosolids for further treatment before or after settling.
Alkaline Treatment	A chemical stabilization process that combines alkaline materials such as quick lime with sludge to create high pH (>12) to produce a Class B (and possibly Class A) biosolids product.
Anaerobic Digestion Gas (ADG)	Gas produced by the biological breakdown of organic wastes and comprised of primarily methane and carbon dioxide at 22.7 MJ/m^3 of calorific content.
Autogenous Combustion	Self-generated combustion as in the case of a sludge that is above 35% dry solids of which 70 to 80% are volatile.
Average Dry Weather Flow (ADWF)	Sewage flow measured during period of no rainfall. Rates of flow exhibit typical hourly and daily variations. Infiltration is assumed present, but is generally low due to a low water table in dry weather.
Average Wet Weather Flow (AWWF)	Sewage flow following periods prolonged of rainfall. Storm water inflow and infiltration may increase the wet weather flow to rates many times larger than the dry weather flow, and unless capacity is available in the collectors and treatment facilities, hydraulic overloads may cause sewerage backups and overflows to public streets or watercourses.
Biochemical Oxygen Demand	The quantity of oxygen needed to satisfy biological oxidation of the degradable fraction of organic matter contained in sewage. Usually referred to as BOD_5 this oxygen requirement is often used to determine in part the degree of treatment which must be used to produce an acceptable effluent quality. Values for five days used in the report and refer to the oxidation of organic wastes (carbon) only. Biochemical oxygen requirements for conversion of ammonia to nitrates is termed Nitrogenous Oxygen Demand and is included in the BOD_5 value.
Biomass	Microbial community in the wastewater treatment plant either held in suspension in the SGR, fastened to the fixed surfaces of the FGR, or settled in the final clarifier.

Commercial Sewage	Sewage generated in areas predominantly commercial in business mature, includes sanitary wastes and wastes resulting from the activities of the business itself. Typically, commercial sewage may include wastewaters from laundromats, restaurants, car washes, and garbage.
Composting	A co-digestion process that requires the mixing of biosolids (anaerobic Class B digested product) with organic bulking material to further oxidize the organics and bulking agent while achieving pasteurizing temperatures (55ºC) created by biological destruction of the organics, to produce a Class A compost product.
Domestic Sewage	Sewage principally derived from residential source or produced by normal residential activities.
Expert System Analysis	An expert system is a rule-based computer solution that can enhance the abilities of an expert or a general practitioner, and assist in guiding his or her solutions; it is not intended to take the place of the acquired skills and intuition of a true expert. Experts who collectively contribute a breadth of experience and skills to a workshop use the expert system through the contribution of others that have relevant information on parts of the system, to establish the rules and weighting for a series of goals, constraints and options. The expert system can now be seen as a tool that gives highly credible solutions that represents a fuller understanding of the system under study. The expert system solution was used in consultation with experts to help identify appropriate beneficial use and treatment options for the CRD sludge management study.
Facultative Bacteria	Prefer to use free oxygen as an electron acceptor if it is available, but if not they can turn to other compounds - in this case we are interested in the ones that can use nitrate (NO_3^-) and nitrite (NO_2^-) as electron acceptors in the absence of free oxygen.
Fixed Growth Reactor (FGR)	Trickling filter or fixed media process where biomass (bacterial slimes) grow on a fixed surface and wastewater is trickled over the surface.
Fugitive Source Odours	Odours from identifiable sources, large or small such as a pump seal, open clarifier.
Gasification	A two stage thermal reduction process that converts organic waste at high temperature (700-1400ºC) and pressure (6-26 atmospheres) to produce beneficial use gas and liquid by products, and a char like solid product.

Harmon Peaking Factor	A method of peaking sanitary flow in inverse proportion to the square root of the total population served.
Heterotrophic Bacteria	Use organic carbon as carbon source; need organic materials constructed by other life forms to obtain small building block molecules for growth and reproduction - also get their energy from breaking the bonds in organic molecules.
Industrial Sewage	Wastewater from manufacturing and industrial processes distinct from domestic or commercial sewage.
Infiltration	Groundwater movement into the sewage collection system for faulty construction, disrepair or defective materials. High groundwater tables or saturation of the soil form rains or irrigation waters may add to the infiltration in a sewage collection system.
Inflow	Rain which enters the sewage collection system through direct connections or available openings in the sewer system. Entry may originate from illegal storm connections, manhole lid submergences or catch basin connections. Direct storm inflow is distinct form infiltration and is observed as a peak flow during a rainstorm. In contrast, infiltration would be observed as an extended period of inflow.
Mesophilic Anaerobic Digestion (MAD)	A suspended growth reactor where mixing is used in absence of free oxygen to enhance biological fermentation and oxidation of organic matter to stable materials, low molecular weight compounds, gases and water at mesophilic temperatures (35ºC) created by heat recovery and heating to produce a Class B biosolids product.
Monofill	A sludge landfill process that is constructed of dykes or shallow trenches, filled with sludge and covered. No other wastes are included in the landfill. The sludge will anaerobically digest over time and digestion gas could presumably be extracted and in time the solids could presumably be mined.
Obligate Bacteria	Can only use free oxygen as an electron acceptor.
Odour Concentration Sensory (Odour Test from St. Croix)	• Odour Intensity • Odour Persistence • Odour Character

Odour Concentration	The odour concentration or odour strength is a number derived from the laboratory dilution of s ample odour. The sample odour is dynamically diluted using an instrument called an olfactometer.

Trained odour panellists (typically eight) sniff the diluted odour sample as it is discharged from one of three presentation ports and must select one of the three that is different from the other two.

This statistical approach is called "triangular forced-choice". The panellist declares to the panel leader if the selection was a "guess", "detection" or "recognition".

The panelist then sniffs the next set of three samples, one of which also contains the diluted odour sample. However, this next set presents the odour at a high concentration (ie., two or three times).

The panelist continues to additional sets of three samples. This statistical approach is called "ascending concentration series".

The ASTM Standard practice for odour concentration determination is E679-91, Determination of Odour and Taste Thresholds by a Forced-Choice Ascending Concentration Series of Limits.

The Olfactometer is called a "Dynamic Dilution Forced-Choice Triangle Olfactormeter". Testing can also be conducted in a Binary Mode or a Yes/No Mode.

The dilution ratio of the derived threshold is called the detection threshold. The dilution ratio is dimensionless, however, the dimensions of "Odour Unit per Unit Volume" are commonly applied. For example: Odour Units per Cubic Foot or Odour Units per Cubic Meter.

Odour Concentration have been reported as:

D/T (OU/m^3)	Detection Threshold
R/T	Recognition Threshold
DT	Dilution to threshold
ED50	Effective Dosage at 50 Percentile
Z	Dilution Ratio
OU	Odour Units
ODU	Odour Dilution Units
BET	Best Estimate Threshold

Dilution of the odour is the physical process that occurs in the atmosphere down wind of the odour generating source. The "receptor" (citizen in the community) sniffs the diluted odour. The dilution ratio is an estimate of the number of dilutions needed to make the odour "non-detectable" (threshold). If the receptor detects the odour, then the odour in the atmosphere is above the threshold level (suprathreshold).

Odour Persistence	Persistency is a term used in conjunction with intensity. The perceived intensity of an odour will change in relation to its concentration. However, the rate of change in intensity versus concentration is not the same for all odours. This rate of change is termed the persistency of the odour. The persistency of an odour can be represented as a "dose-response" function. The dose-response function is determined from intensity measurements of an odour at full strength and at several dilution levels above the threshold level.
Odour Character	The character of an odour is reported using "odour descriptors". Odour character is also known as "odour quality". Odour descriptors provide a referencing volabulary for odour character/odour quality. Numerous "standard" odour descriptor lists are available to use as a referencing vocabulary. One standard "list" published by the International Association on Water Pollution Research and Control (IAWPRC) is the "Flavour Wheel". A flavour wheel is a simple method to assign descriptors. The odour descriptors most frequently assigned by the evaluating odour panel are reported for referencing purposes.
Odour Pleasantness	The pleasantness or unpleasantness is identified as hedonic tone of an odour sample. The hedonic tone is independent of its character. An arbitrary but common scale for ranking odours by hedonic tone is the use of a 20 point scale. + 10 Pleasant 0 Neutral -10 Unpleasant The assigning of a hedonic tone value to an odour sample by an odour panelist is "subjective" to the panelist. A panelist uses his/her person experience and memories of odours as a referencing scale. The panelists, during training, become aware of their individual

odour experience ad memory referencing. The average value of the odour panel is the reported "Hedonic Tone" for the odour sample.

Peaking Factor	A factor to describe the peak instantaneous or maximum hourly sewage flow either as sanitary or ADWF. The peaking factor is a function of the number of contributors, or tributary area size.
Peak Wet Weather Flow (PWWF)	Wet weather flow during an instantaneous peak sanitary sewage flow. The peak wet weather flow is derived by age the I&I to a peaked sanitary flow or ADWF.
Point Sources Odours	Odours from identifiable sources, large or small such as a pump seal, or open clarifier.
Sanitary Flow	Domestic, commercial and industrial sewage at the point of source and not including extraneous infiltration or inflow amounts.
Sewage	A combination of water carried wastes originating form residential, commercial, institutional and industrial sources, together with any groundwater, surfaces and storm waters which may be present.
Suspended Solids	The suspended matter transported in sewage. Suspended solids and BOD_5 are two basic criteria used to grade the strength of sewage and quality of effluent. The quantity of suspended material removed during treatment is dependent on the type and extent of treatment used and has an important bearing on sizing of treatment components.
Suspended Growth	A biological means held unsupported in suspension by mixing in a reactor.
Suspended Growth Reactor (SGR)	Activated sludge or solids contact basins where biomass is held in suspension by mixer agitation or aeration and may or may not contain dissolved oxygen depending on the process configuration.
Thermophilic Anaerobic Digestion (TAD)	A suspended growth reactor where mixing is used in absence of free oxygen to enhance biological fermentation and oxidation of organic matter to stable materials, low molecular weight compounds, gases and water at pasteurizing (>50ºC) temperatures created by heat recovery and heating to produce a Class A biosolids product.
Thermal Chemical Treatment	A chemical stabilization process that uses high temperatures and the addition of pH adjusting chemicals (such as quick lime) to

	achieve pasteurizing temperatures (>55ºC) and high pH (>12) to produce a Class A or Class B biosolids product.
Thermal Oxidation (Fluidized Bed Incineration)	An efficient low air pollution thermal reduction process that uses high temperature of 500-900ºC and oxygen to oxidize and reduce organic wastes to ash or at higher temperatures to a non-leachable clinker.

APPENDIX B

PHOTOS OF MILLSTREAM AND HARTLAND SITES

Photo 3-1 Millstream site at entrance looking northeast along buffer to the left.

Photo 3-2 Millstream site at entrance looking east and northeast.

Photo 3-3 Millstream site at entrance looking east and southeast along the south buffer to the right.

Photo 3-4 Millstream site atop rock outcrop viewed in Photo 3-2 looking north and northeast (edge of old fill face to the right).

Photo 3-5 Millstream site atop rock outcrop viewed in Photo 3-3 looking east.

Photo 3-6 Millstream site.

Photo 3-7 Millstream site from north buffer edge near north running gully looking east to eastern property edge and treeline.

Photo 3-8 Millstream site at Photo 3-7 looking southeast.

Photo 3-9 Hartland site at south entrance looking north to proposed compost site.

Photo 3-10 Hartland site at south entrance looking northwest to proposed compost site.

Photo 3-11 Hartland site at lower bench looking west to western buffer.

Photo 3-12 Hartland site at lower bench looking east to proposed digester site.

Photo 3-13 Hartland site at lower bench looking east to proposed digester site.

APPENDIX C

SURVEY OF ODOUR CONTROL AT WASTEWATER TREATMENT FACILITIES IN PACIFIC NORTHWEST

1. Spokane WWTP, Washington

This plant serves a population of 230,000 people. Primary tanks and headworks are located at the foot of a hill with solids processing facility located to the North of the plant over 61 m (200 ft) uphill. Odour sources experienced in the past included gravity thickener, belt filter press and burned digester gas from anaerobic digestion.

To mitigate the odour problem, belt filter presses and gravity thickeners have been fully enclosed. The plant also has two soil biofilters that treat the foul air. These soil biofilters are designed to handle the above processes through redundancy to allow changing of the media so that there will be no down time for the solids processing.

The plant has received complaints from residential areas regarding burned digester gas and primary tanks. There is an ongoing process to upgrade the plant and the primary tanks might be enclosed in the future. (No primary tanks are used in the CRD sites although the rewatering facility could be compared). Flared digester gas may or may not need to be treated, experience by others suggest that it is not needed, see Annacis Island).

Photo C-1 Spokane Wastewater Treatment Plant, Washington.

2. Annacis Island Wastewater Treatment Plant, GVRD

The population served by this plant is 740,000 people. Very few problems have been experienced at the solids processing facility of the plant. Hot biosolids cake used to be stored on the ground by the centrifuge building, and many complaints were received from an adjacent food processing facility. To mitigate the problem, biosolids hoppers were constructed, and since completed the complaints are minimal. The key to mitigate foul air problem is to keep the biosolids contained and prevent them from getting wet.

No odour problem has been experienced with the co-generation facility on site, which gives support to the assumption that odour is not a concern for the CRD cogeneration plant.

Photo C-2 Annacis Island Wastewater Treatment Plant, Greater Vancouver Regional District.

3. Monterey Regional Water Pollution Control Plant, CA

A population of 244,000 is served by this plant. Solids processing facilities include anaerobic digestion, belt filter press, lagoons and solar drying beds. The plant is located in a remote area and is not near any residences. A landfill is located near the plant, and a composting facility is located to the west of the plant. No complaints have been received with regard to foul air from the plant. The composting facility at the landfill is the main odour source in the area.

Most of the plant is covered to minimize odours. A monitoring program is in place to monitor H_2S around the perimeter of the plant. The CRD would monitor olfactory conditions as well as specified odour constituents such as H_2S.

4. Stockton Wastewater Treatment Plant, CA

A population of 330,000 is served by this plant. The main odour sources are at the collection system in the headworks. Minimal odour problems have been experienced with the solids processing facilities. The plant is planning an upgrade for a biological odour control facility in July of 2005 for the headworks only. This is similar to what may be experienced at the rewatering facility for the CRD and three stages of treatment are therefore proposed.

APPENDIX D

LEED STORMWATER MANAGEMENT CREDIT
(taken from the LEED-BC Adaptation Guide)

Site Credit 6: Stormwater Management

1-2 points

Intent

Limit disruption of natural water flows by minimising stormwater runoff, increasing on-site infiltration and reducing contaminants.

There are two (2) sub-credits for the Stormwater Management credit:

- *Credit 6.1:* Rate and Quantity (1 point)
- *Credit 6.2:* Treatment (1 point)

Site Credit 6.1: Rate and Quantity
1 point

Requirement

- If existing imperviousness is less than or equal to 50%, implement a stormwater management plan that prevents the post-development 1.5 year, 24 hour peak discharge rate from exceeding the pre-development 1.5 year, 24 hour peak discharge rate.

OR,

- If existing imperviousness is greater than 50%, implement a stormwater management plan that results in a 25% decrease in the rate and quantity of stormwater runoff.

Potential Technologies & Strategies

Design the project site to maintain natural stormwater flows by promoting infiltration. Specify garden roofs and pervious paving to minimize impervious surfaces. Reuse stormwater volumes generated for non-potable uses such as landscape irrigation, toilet and urinal flushing and custodial uses.

Submittals

- Provide the LEED Letter Template, signed by the civil engineer or responsible party, declaring that the post-development 1.5 year, 24 hour peak discharge rate does not exceed the pre-development 1.5 year 24 hour peak discharge rate. Provide calculations demonstrating that existing site imperviousness is less than or equal to 50%.

OR,

- Provide the LEED Letter Template, signed by the civil engineer or responsible party, declaring that the stormwater management strategies result in at least a 25% decrease in the rate and quantity of stormwater runoff. Provide calculations demonstrating that existing site imperviousness exceeds 50%.

Applicable Standards

Guidance Specifying Management Measures for Sources of Non-point Pollution in Coastal Waters, EPA Document no. EPA 840-B-93-001c January 1993
Site: http://www.epa.gov/owow/nps/MMGI/

Resources

Websites:

- *Stormwater Planning: A Guidebook for British Columbia* provides a framework for effective stormwater management throughout the province. The stormwater planning guidebook — a new tool for local governments — presents a methodology for moving from planning to action that focuses on implementing early action where it is most needed. The guidebook approach is designed to eliminate the root cause of negative ecological and property impacts of stormwater by addressing the spectrum of rainfall events.
  Site: http://wlapwww.gov.bc.ca/epd/epdpa/mpp/stormwater/stormwater.html
- GVRD Stormwater Homepage: Site providing numerous resources for stormwater management
  Site: http://www.gvrd.bc.ca/services/sewers/drain/Stormwater_home.html

Site Credit 6.2: Treatment
1 point

Requirements

Construct site stormwater treatment systems designed to remove 80% of the average annual post-development total suspended solids (TSS) and 40% of the average annual post-development total phosphorous (TP) based on the average annual loadings from all storms less than or equal to the 2-year/24-hour storm. Do so by implementing Best Management Practices (BMPs) outlined in Chapter 4, Part 2 (Urban Runoff), of the United States Environmental Protection Agency's (EPA's) *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* (Document No. EPA-840-B-93-001c January 1993) or the local government's BMP document (whichever is more stringent).

Potential Technologies & Strategies

Design mechanical or natural treatment systems such as constructed wetlands, vegetated filter strips and bioswales to treat the site's stormwater.

Submittals

Provide the LEED Letter Template, signed by the civil engineer or responsible party, demonstrating and declaring that the design complies with or exceeds EPA or local government Best Management Practices (whichever set is more stringent) for removal of TSS and TP.

Applicable Standards

Guidance Specifying Management Measures for Sources of Non-point Pollution in Coastal Waters, EPA Document no. EPA 840-B-93-001c, January 1993
Site: http://www.epa.gov/owow/nps/MMGI/

Definitions

- *Stormwater Runoff:* water volumes that are created during precipitation events and flows over surfaces into sewer systems or receiving waters. All precipitation waters that leave project site boundaries on the surface are considered to be stormwater runoff volumes.
- *Impervious surface:* surfaces that promote runoff precipitation volumes instead of infiltration into the sub-surface. The imperviousness or degree of runoff potential can be estimated for different surface materials.
- *Total Phosphorous (TP):* Organically bound phosphates, poly-phosphates and orthophosphates in stormwater, the majority of which originate from fertiliser application. Chemical precipitation is the typical removal mechanism for phosphorous.
- *Total Suspended Solids (TTS):* particles or flocs that are too small or light to be removed from stormwater via gravity settling. Suspended solid concentrations are typically removed via filtration.

Resources

Web-sites

- *Stormwater Planning: A Guidebook for British Columbia* provides a framework for effective stormwater management throughout the province. The stormwater planning guidebook — a new tool for local governments — presents a methodology for moving from planning to action that focuses on implementing early action where it is most needed. The guidebook approach is designed to eliminate the root cause of negative ecological and property impacts of stormwater by addressing the spectrum of rainfall events.
  Site: http://wlapwww.gov.bc.ca/epd/epdpa/mpp/stormwater/stormwater.html
- GVRD Stormwater Homepage: Site providing numerous resources for stormwater management

  Site: http://www.gvrd.bc.ca/services/sewers/drain/Stormwater_home.html
- The Health of Our water, Agriculture and Agri-food, Research Branch: Comprehensive coverage of water quality issues. Although primarily from the standpoint of agricultural impacts and consequences, makes links to urban issues and stormwater.

  Site: http://res2.agr.ca/research-recherche/science/Healthy_Water/e10g2.html

Print Media

- Richman,Tom, et al, *Start at the Source. Residential Site Planning and Design Guidelines: Manual for Stormwater Quality Protection*, Bay Area Stormwater Management Agencies (San Francisco) January 1997

Calculations

The calculation methodology for support the credit submittals are outlined in LEED Green Building System Version 2, Reference Guide, June 2001.

APPENDIX E

BC CONSERVATION CENTRE DATA RANKING STATUS DESCRIPTIONS

BC STATUS

RED: List of indigenous species, subspecies and natural plant communities that are extirpated, endangered or threatened in British Columbia. Red listed species and sub-species have- or are candidates for- official Extirpated, Endangered or Threatened Status in BC. Not all red-listed taxa will necessarily become formally designated. Placing taxa on these lists flags them as being at risk and requiring investigation.

BLUE: List of indigenous species, subspecies and natural plant communities of special concern (formerly vulnerable) in British Columbia.

Table E-1
COSEWIC Status Abbreviations.

NatureServe Explorer Abbreviation	COSEWIC Status	DEFINITION
X	Extinct	A species that no longer exists.
XT	Extirpated	A species no longer existing in the wild in Canada, but occurring elsewhere.
E	Endangered	A species facing imminent extirpation or extinction.
T	Threatened	A species likely to become endangered if limiting factors are not reversed.
SC	Special Concern	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
NAR	Not At Risk	A species that has been evaluated and found to be not at risk.
DD	Data Deficient	A species for which there is insufficient scientific information to support status designation.
	Null value	Usually indicates that the taxon does not have any COSEWIC status. However, because of potential lag time between publication of the Canadian Species at Risk list and entry in the NatureServe Central Databases and refresh of this website, some taxa may have a status that does not yet appear.

Table E-2
Global (National - N) and Provincial (Subnational -S) Conservation Status Ranks.

Status	Definition
NX **SX**	**Presumed Extirpated**—Species or community is believed to be extirpated from the nation or state/province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
NH **SH**	**Possibly Extirpated** (Historical)—Species or community occurred historically in the nation or state/province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become NH or SH without such a 20-40 year delay if the only known occurrences in a nation or state/province were destroyed or if it had been extensively and unsuccessfully looked for. The NH or SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.
N1 **S1**	**Critically Imperiled**—Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
N2 **S2**	**Imperiled**—Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
N3 **S3**	**Vulnerable**—Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
N4 **S4**	**Apparently Secure**—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
N5 **S5**	**Secure**—Common, widespread, and abundant in the nation or state/province.
NNR **SNR**	**Unranked**—Nation or state/province conservation status not yet assessed.
NU **SU**	**Unrankable**—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
NNA **SNA**	**Not Applicable** —A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
N#N# **S#S#**	**Range Rank** —A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).
Not Provided	Species is known to occur in this nation or state/province. Contact the relevant natural heritage program for assigned conservation status.
?	**Inexact or Uncertain**—Denotes inexact or uncertain numeric rank. (The ? qualifies the character immediately preceding it in the S-rank

Source: BC Conservation Data Centre, Ministry of Sustainable Resource Management.
http://srmwww.gov.bc.ca/cdc/

APPENDIX F

METEOROLOGICAL DATA FOR MILLSTREAM AND HARTLAND SITES

Table F-1
Drainage wind events for the Millstream site.

Time	Speed Knots	Airtemp °C	Cloudcov Tenths	Direction Degrees
July				
9	0	16.4	0	360
10	0	15.6	0	360
11	4.05	15.9	1	370
0	4.05	16.1	0	350
1	4.95	14	0	360
2	3.15	15	0	340
3	3.15	15.2	0	330
4	2.7	14.5	0	330
9	0.9	18	0	382
10	1.8	16.8	0	350
11	2.7	16.5	0	340
0	2.7	16.3	0	340
1	0.9	14.3	0	180
2	1.8	14	0	370
3	0	13.2	0	360
4	2.7	13	0	360
9	0	17.2	0	360
10	0	16.3	0	360
11	2.7	15.1	0	360
0	0	14.1	0	360
1	0.9	12.7	2	350
2	0.9	12	2	180
3	0.9	11.2	2	150
4	0	11.8	1	360
August				
8	0	23.3	0	360
9	0.9	21.6	0	365
10	0	19.9	0	360
11	0	19.1	1	360
12	0	18.1	0	360
1	0	18.1	0	360
2	3.15	18.3	0	360
3	2.7	16.5	0	330
4	2.7	15.2	0	360
5	0	15.1	0	360
8	4.05	20	0	360
9	0	18.9	0	360
10	0	18.	0	360
11	0	18.1	0	360
12	0	16.6	0	360
1	0	16.7	0	360
2	05.85	15.6	0	360
3	4.05	15.8	0	360
4	0	14.6	0	360

Time	Speed Knots	Airtemp °C	Cloudcov Tenths	Direction Degrees
5	0	14.3	1	360
8	5.85	17.2	1	350
9	2.7	16.4	1	340
10	2.7	16	0	360
11	1.8	15	0	340
12	0.9	14.6	0	520
1	0.9	15	0	350
2	0	14.7	0	360
3	0.9	13.6	0	330
4	3.15	13.3	0	370
5	2.7	13.3	2	350

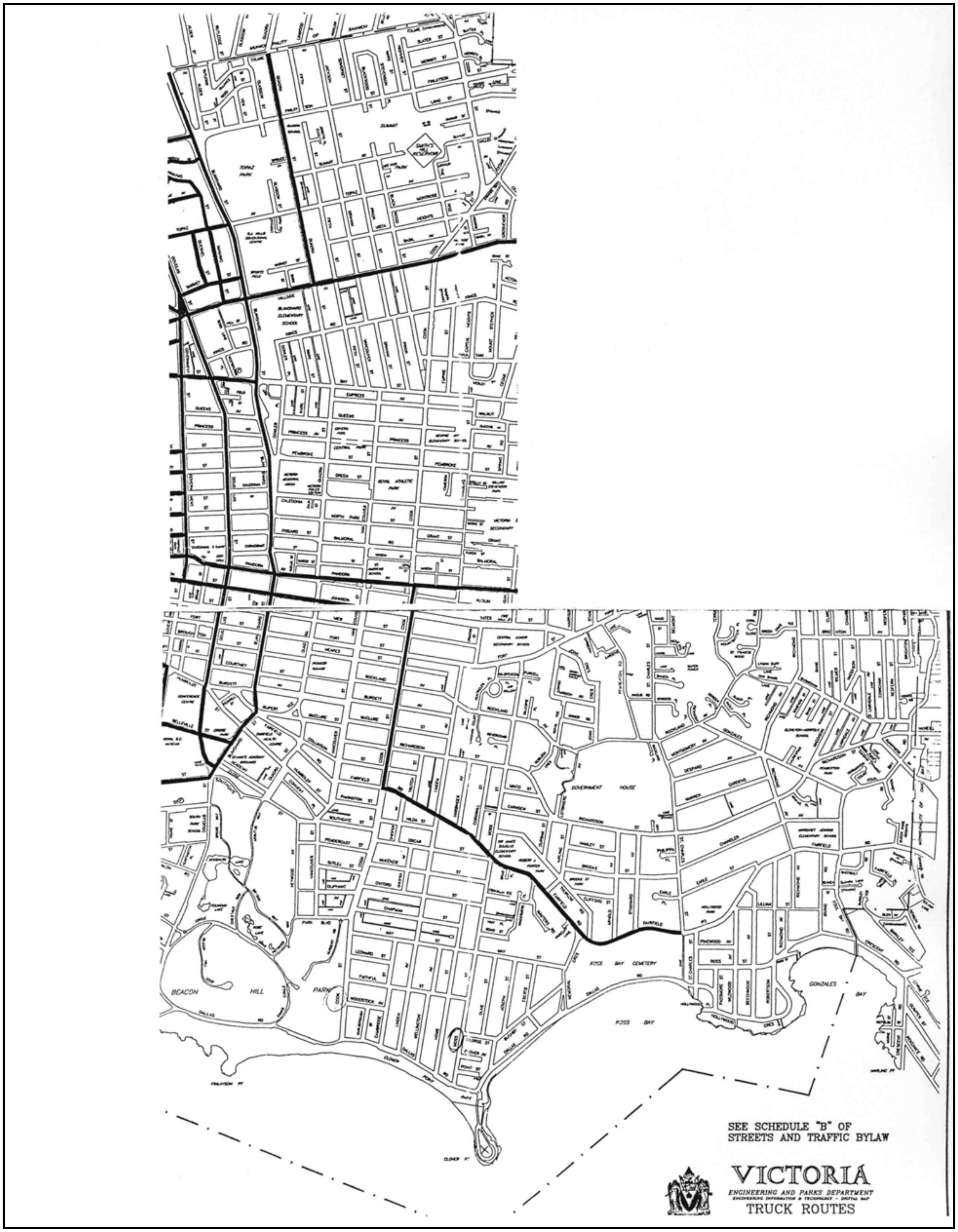
Table F-2
Combined meteorological data for the Hartland site.

Day	Hour	Vector (-35)	Speed (m/s)	Temp (K)
1	9	145	0.00	289
1	10	145	0.00	289
1	11	155	2.08	289
1	0	135	2.08	289
2	1	145	2.55	287
2	2	125	1.62	288
2	3	115	1.62	288
2	4	115	1.39	288
2	9	175	0.46	291
2	10	135	0.93	290
2	11	125	1.39	290
3	0	125	1.39	289
3	1	325	0.46	287
3	2	155	0.93	287
3	3	145	0.00	286
3	4	145	1.39	286
3	9	145	0.00	290
3	10	145	0.00	289
3	11	145	1.39	288
3	0	145	0.00	287
4	1	135	0.46	286
4	2	325	0.46	285
4	3	295	0.46	284
4	4	145	0.00	285
4	8	145	0.00	296
4	9	150	0.46	295
4	10	145	0.00	293
4	11	145	0.00	292
4	12	145	0.00	291
5	1	145	0.00	291
5	2	145	1.62	291

Day	Hour	Vector (-35)	Speed (m/s)	Temp (K)
5	3	115	1.39	290
5	4	145	1.39	288
5	5	145	0.00	288
5	8	145	2.08	293
5	9	145	0.00	292
5	10	145	0.00	291
5	11	145	0.00	291
5	12	145	0.00	290
6	1	145	0.00	290
6	2	145	3.01	289
6	3	145	2.08	289
6	4	145	0.00	288
6	5	145	0.00	287
6	8	135	3.01	290
6	9	125	1.39	289
6	10	145	1.39	289
6	11	125	0.93	288
6	12	305	0.46	288
7	1	135	0.46	288
7	2	145	0.00	288
7	3	115	0.46	287
7	4	155	1.62	286
7	5	135	1.39	286

APPENDIX G

MUNICIPAL TRUCK BYLAWS AND ROUTE MAPS


SEE SCHEDULE "B" OF
STREETS AND TRAFFIC BYLAW
VICTORIA
ENGINEERING AND PARKS DEPARTMENT
TRUCK ROUTES

Official Community Plan Excerpt For the Township of Esquimalt

3.6 ROADS AND UTILITY POLICIES

3.6.1 Future Roads

Except for intersection improvements and signalization, no major roads will be constructed or widened within the 5 year time horizon of this Plan. The capacity of the existing major road network is considered to be sufficient to adequately handle traffic volumes generated by both existing and proposed development. Minor improvements will be undertaken throughout the municipality as traffic volumes increase. Specifically to address the Admirals Road peak period volumes, when new townhouse development occurs in the Parklands area, the following improvements are contemplated:

a) a new intersection between Parklands Drive and the municipal boundary, to service the new developments on both sides of Admirals Road; and

b) signalization of the new intersection to improve traffic flows and to allow safer access onto Admirals Road from other access points.

3.6.2 Major Road Network - North/South

Admirals Road and Lampson Street are considered as the major north/south collector roads of the municipality. Traffic will be encouraged to utilize these two roads and not local residential streets.

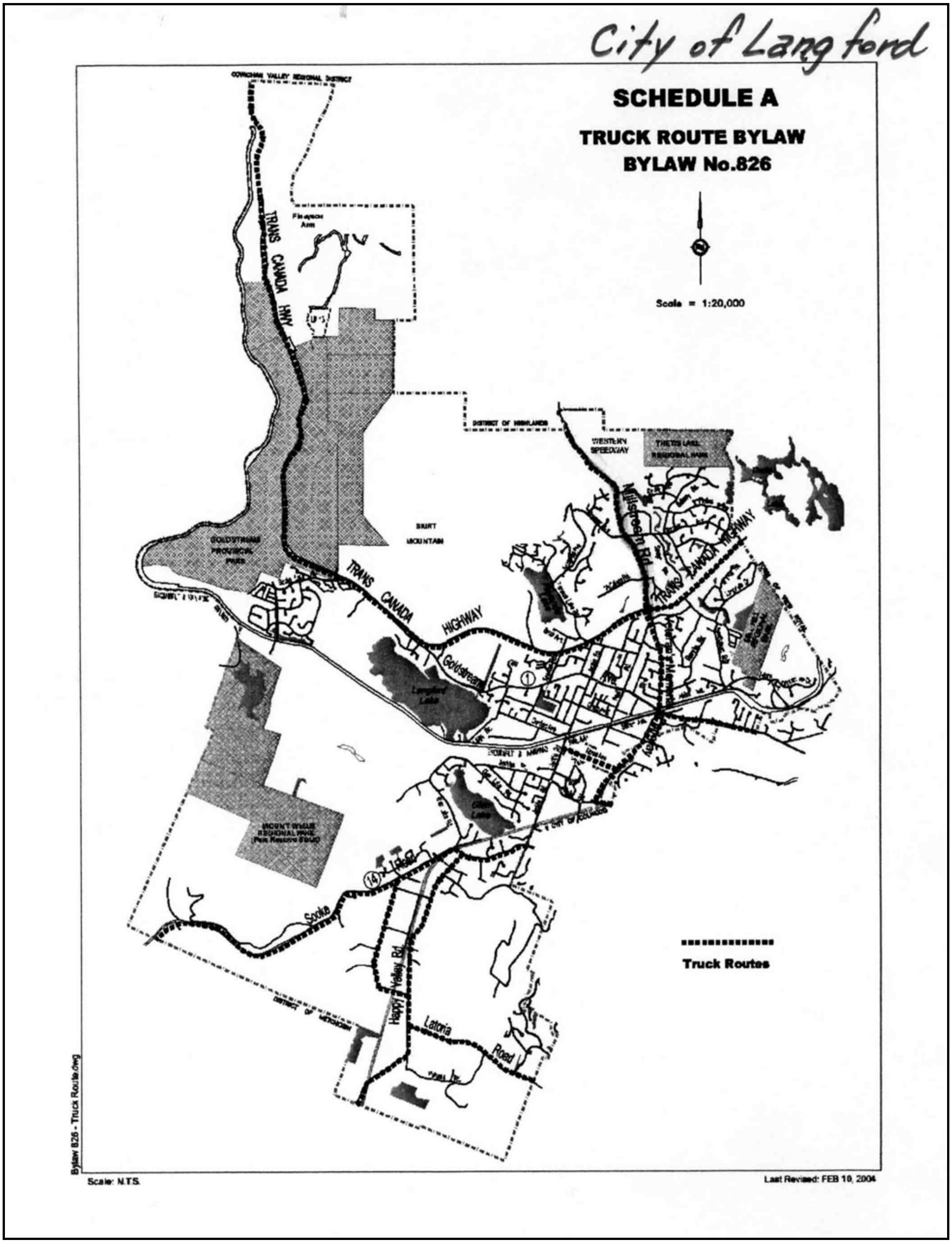
3.6.3 Major Road Network - East/West

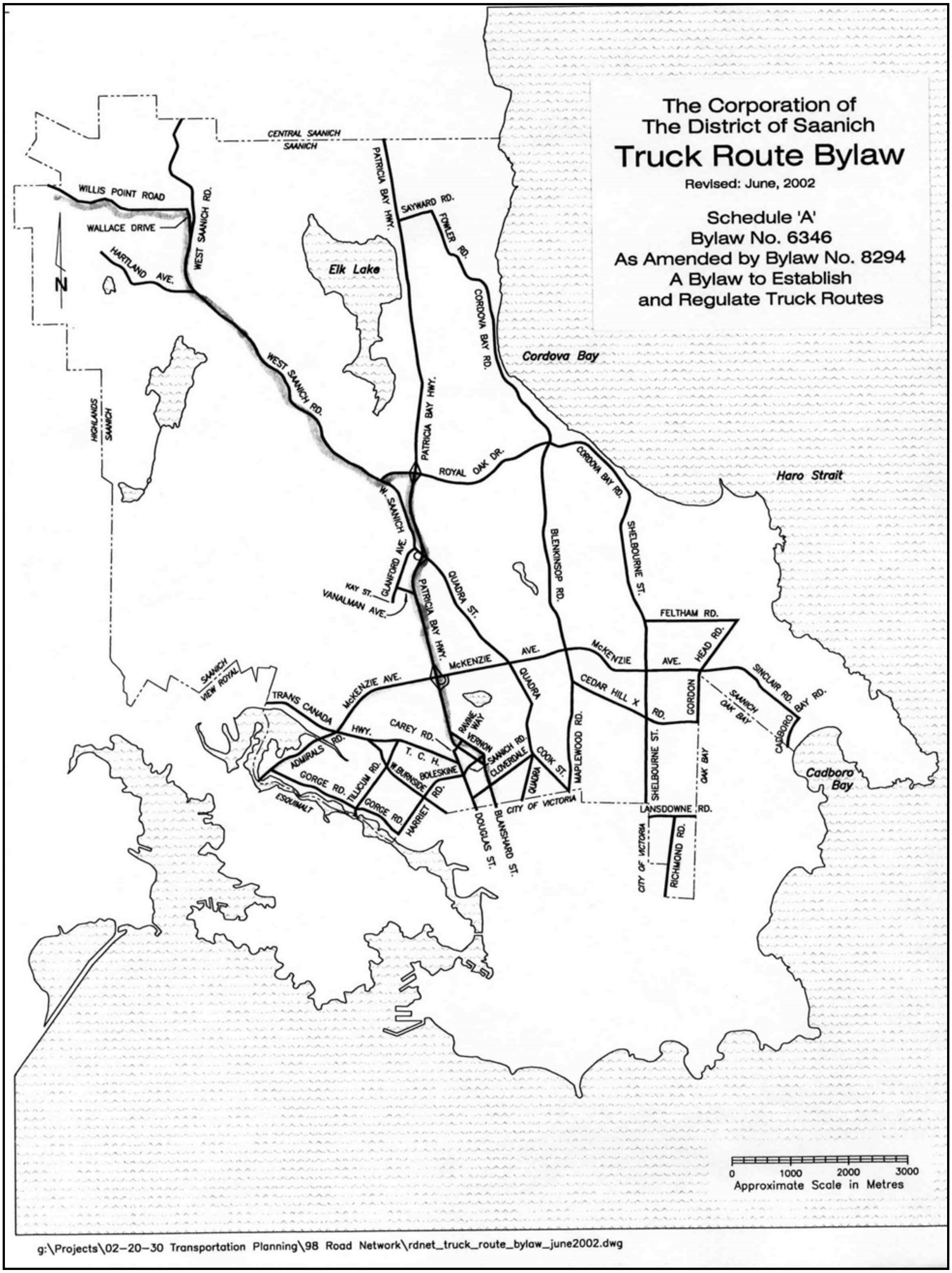
Esquimalt Road, Old Esquimalt Road, Colville Road, Craigflower Road and Lyall Street are considered as the major east/west collector roads of the municipality. Traffic will be encouraged to utilize these five roads and not local streets.

3.6.4 Water Supply

No major water main upgrading will be required over the 5 year time horizon of this Plan. Minor improvements to increase water pressure in localized circumstances will be undertaken.

*Informal Agreement/Policy in place re: DND & McLoughlin Point (Oil Tank Facilities) truck traffic to use Peters St./Lyall St. routing directly onto Admirals Rd.


City of Langford
SCHEDULE A
TRUCK ROUTE BYLAW
BYLAW No.826
Scale = 1:20,000
TRANS CANADA HWY
TRANS CANADA HIGHWAY
Goldstream
Millstream Rd.
Sooke
Happy Valley Rd.
Latoria
Road
Truck Routes
Bylaw 826 - Truck Route.dwg
Scale: N.T.S.
Last Revised: FEB 10, 2004


The Corporation of
The District of Saanich
Truck Route Bylaw
Revised: June, 2002
Schedule 'A'
Bylaw No. 6346
As Amended by Bylaw No. 8294
A Bylaw to Establish
and Regulate Truck Routes
CENTRAL SAANICH
SAANICH
WILLIS POINT ROAD
WALLACE DRIVE
HARTLAND AVE.
WEST SAANICH RD.
PATRICIA BAY HWY.
SAYWARD RD.
FOWLER RD.
Elk Lake
CORDOVA BAY RD.
Cordova Bay
HIGHLANDS
SAANICH
ROYAL OAK DR.
Haro Strait
W. SAANICH
BLENKINSOP RD.
SHELBOURNE ST.
GLANFORD AVE.
KAY ST.
VANALMAN AVE.
QUADRA ST.
FELTHAM RD.
HEAD RD.
McKENZIE AVE.
SINCLAIR RD.
CEDAR HILL X RD.
GORDON
SAANICH
OAK BAY
CADBORO BAY RD.
Cadboro Bay
SAANICH
VIEW ROYAL
TRANS CANADA HWY.
CAREY RD.
RAVINE WAY
VERNON
ADMIRALS RD.
T. C. H.
SAANICH RD.
CLOVERDALE
COOK ST.
MAPLEWOOD RD.
QUADRA
GORGE RD.
TILLICUM RD.
W. BURNSIDE
BOLESKINE
HARRIET RD.
ESQUIMALT
DOUGLAS ST.
BLANSHARD ST.
CITY OF VICTORIA
LANSDOWNE RD.
OAK BAY
RICHMOND RD.
N
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Approximate Scale in Metres
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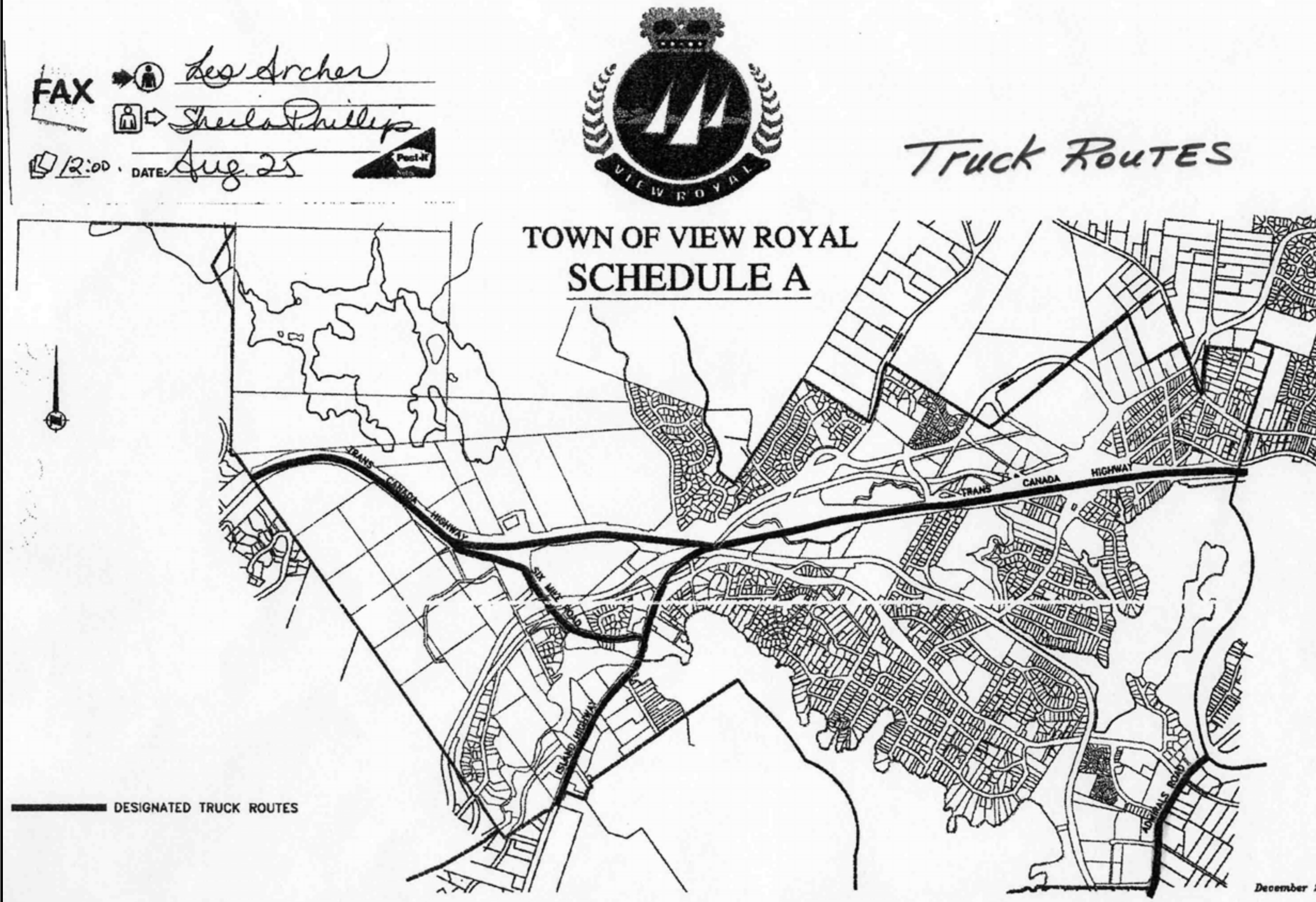
FAX
Leo Archer
Sheila Phillips
12:00
DATE: Aug. 25
Post-it
VIEW ROYAL
Truck Routes
TOWN OF VIEW ROYAL
SCHEDULE A
TRANS CANADA HIGHWAY
SIX MILE ROAD
ISLAND HIGHWAY
ADMIRALS ROAD
DESIGNATED TRUCK ROUTES
December 2003

APPENDIX H

AVERAGE WEEKDAY DAILY TRAFFIC VOLUMES FOR MACAULAY POINT AND CLOVER POINT SLUDGE HAUL TRIPS TO THE CANDIDATE MILLSTREAM AND HARTLAND TREATMENT SITES.

Table H-1
Comparison of average weekday two-way daily total traffic volumes for Clover Point and Macaulay Point to Millstream site trips (preferred routes).[1]

ROAD – SEGMENT	STREET CLASSIFICATION (Capacity)	APPROXIMATE 'BASE YEAR' VOLUMES		ESTIMATED DEVELOPMENT-GENERATED OPERATIONAL TRAFFIC VOLUMES		% INCREASE RELATIVE TO YEAR 2025 'BASE TRAFFIC' VOLUMES	
		2004 (vpd)	2025 (vpd)	2025 (vpd)	2045 (vpd)	2025 (vpd)	2045 (vpd)
From Clover Point Pump Station							
Dallas Road: Clover Point to Cook Street	Collector (3,000 – 8,000 vpd)	10,000	12,000	6	14 –20	Negligible	Negligible
Dallas Road: Cook Street to Douglas Street	Secondary Arterial (5,000 – 20,000 vpd)	9,200	11,000	6	14 –20	Negligible	Negligible
Douglas Street: Dallas Road to Blanshard Street	Secondary Arterial (5,000 – 20,000 vpd)	ranges between 1,600 to 12,000	ranges between 1,900 to 14,000	6	14 –20	Negligible	Negligible
Blanshard Street: Douglas Street to Pandora Avenue	Arterial (> 18,000 vpd)	ranges between 5,000 to 13,000 to 30,000	ranges between 6,000 to 15,000 to 36,000	6	14 –20	Negligible	Negligible
Blanshard Street: Pandora Avenue to Cloverdale Avenue	Arterial Hwy. (> 20,000 vpd)	ranges between 30,000 to 49,000	Ranges between 36,000 and 59,000	6	14 –20	Negligible	Negligible
Cloverdale Avenue: Blanshard Street to Douglas Street	Major Road (5,000 – 20,000 vpd)	ranges between 13,000 to 16,000	ranges between 15,000 to 19,000	6	14 – 20	Negligible	Negligible
Douglas Street – Trans Canada Highway: Cloverdale Avenue to Admirals Road	Highway (10,000 - 60,000 vpd)	ranges between 35,500 to 38,000 to 45,000	ranges between 42,000 to 45,000 to 54,000	6	14 – 20	Negligible	Negligible
From Macaulay Point Pump Station							

[1] Note: The following are common to Tables H-1 and H-2.

- Volumes are total of two directions
- Daily volumes are in vehicles per day (vpd)
- Percentage increases are in relation to Year 2025, interim facility operating at full capacity

ROAD – SEGMENT	STREET CLASSIFICATION (Capacity)	APPROXIMATE 'BASE YEAR' VOLUMES		ESTIMATED DEVELOPMENT-GENERATED OPERATIONAL TRAFFIC VOLUMES		% INCREASE RELATIVE TO YEAR 2025 'BASE TRAFFIC' VOLUMES	
		2004 (vpd)	**2025 (vpd)**	**2025 (vpd)**	**2045 (vpd)**	**2025 (vpd)**	**2045 (vpd)**
<u>Anson Street</u>: Site to Munro Street (On DND Housing Land)	Local road (< 1,000 vpd)	< 100	< 200	8	20-32	(8/200) **4.0**	(20-32/200) **10-16**
<u>Anson Street</u>: Munro Street to Bewdley Avenue. (On DND Housing Land) (outbound)	Local road (< 1,000 vpd)	< 400	400	4	10-16	(4/400) **1.0**	(10-16/400) **2.5-4.0**
<u>Bewdley Avenue</u>: Anson Street to Peters Street. (On DND Housing Land) (outbound)	Local road (< 1,000 vpd)	< 400	400	4	10-16	(4/400) **1.0**	(10-16/400) **2.5-4.0**
<u>Peters Street</u>: Bewdley Avenue to Lyall Street. (On DND Housing Land) (outbound)	Local road (< 1,000 vpd)	< 400	400	4	10-16	(4/400) **1.0**	(10-16/400) **2.5-4.0**
<u>Lyall Street</u>: Peters Street to Fraser Street (outbound)	Collector (3,000 - 8,000 vpd)	ranges between 1,000 to 3,350	ranges between 1,200 to 4,000	4	10-16	Negligible	(10/4000-16/1200) **0.23-1.3**
<u>Lyall Street</u>: Fraser Street to Admirals Road	Collector (3,000 - 8,000 vpd)	3,550	4,000	8	20-32	Negligible	Negligible
<u>Admirals Road</u>: Lyall Street to Esquimalt Municipal Boundary (Caroline Road)	Major Collector-Arterial (5,000 - 20,000 vpd)	ranges between 4,300 to 15,000	ranges between 5,000 to 18,000	8	20-32	Negligible	Negligible
<u>Admirals Road</u>: Esquimalt Municipal Boundary (Caroline Road) to Gorge Road	Major-Arterial Rd. (10,000 - 30,000 vpd)	ranges between 15,000 to 18,000	ranges between 18,000 to 22,000	8	20-32	Negligible	Negligible
<u>Admirals Road</u>: Gorge Road to Highway 1 (TCH)	Major-Arterial Rd. (10,000 - 30,000 vpd)	ranges between 11,000 to 12,500	ranges between 13,000 to 15,000	8	20-32	Negligible	Negligible

ROAD – SEGMENT	STREET CLASSIFICATION (Capacity)	APPROXIMATE 'BASE YEAR' VOLUMES		ESTIMATED DEVELOPMENT-GENERATED OPERATIONAL TRAFFIC VOLUMES		% INCREASE RELATIVE TO YEAR 2025 'BASE TRAFFIC' VOLUMES	
		2004 (vpd)	**2025 (vpd)**	**2025 (vpd)**	**2045 (vpd)**	**2025 (vpd)**	**2045 (vpd)**
Fraser Street: Lyall Street to Munro Street (inbound)	Minor Collector (3,000 – 7,000 vpd)	Approx. 1,000 – 1,500	1,500	4	10-16	Negligible	(10-16/1,500) **0.7-1.1**
Munro Street: Anson Street to Fraser Road (inbound)	Minor Collector (3,000 - 7,000 vpd)	Less than 1,000	1,000	4	10-16	Negligible	(10-16/1,000) **1.0-1.6**
Note: Shading indicates one-way segments for accessing Macaulay Point							
Common Route to Millstream Candidate Site							
Trans Canada Highway (Hwy. 1): Admirals Road to Millstream Road	Arterial Highway (> 20,000 vpd)	Ranges between 63,000 down to 45,000	Ranges between 75,000 down to 54,000	50	92-116	Negligible	Negligible
Millstream Road: Trans Canada Highway to Treanor Road	Arterial (> 14,000 vpd)	Ranges between 21,000 down to 19,000	Ranges between 28,000 down to 25,000	50	92-116	Negligible	Negligible
Millstream Road: Treanor Rd. to Bear Mtn Parkway to Site Access just north of Industrial Way	Arterial (> 14,000 vpd)	Ranges between 10,000 down to 5,000 to 3,500	Ranges between 10,000 down to 6,000 to 5,000	50	92-116	Negligible	Negligible

Table H-2
Comparison of average weekday two-way daily total traffic volumes for Clover Point and Macaulay Point to Hartland site trips (preferred routes).

ROAD – SEGMENT	STREET CLASSIFICATION (Capacity)	APPROXIMATE 'BASE YEAR' VOLUMES		ESTIMATED DEVELOPMENT-GENERATED OPERATIONAL TRAFFIC VOLUMES		% INCREASE RELATIVE TO YEAR 2025 'BASE TRAFFIC' VOLUMES	
		2004 (vpd)	2025 (vpd)	2025 (vpd)	2045 (vpd)	2025 (vpd)	2045 (vpd)
From Clover Point Pump Station							
Dallas Road: Site to Cook Street	Collector (3,000 - 8,000 vpd)	10,000	12,000	6	14 - 20	Negligible	Negligible
Dallas Road: Cook Street to Douglas Street	Secondary Arterial (5,000 - 20,000 vpd)	9,200	11,000	6	14 - 20	Negligible	Negligible
Douglas Street: Dallas Road to Blanshard Street	Secondary Arterial (5,000 - 20,000 vpd)	ranges between 1,600 to 12,000	ranges between 1,900 to 14,000	6	14 - 20	Negligible	Negligible
Blanshard Street: Douglas Street to Pandora Avenue	Arterial (> 18,000 vpd)	ranges between 5,000 to 13,000 to 30,000	ranges between 6,000 to 15,000 to 36,000	6	14 - 20	Negligible	Negligible
Blanshard Street: Pandora Avenue to Vernon Avenue	Arterial Highway (> 20,000 vpd)	49,000	59,000	6	14 - 20	Negligible	Negligible
Blanshard Street/Highway 17: Vernon Street to McKenzie Avenue (outbound)	Arterial Highway (> 20,000 vpd)	ranges between 21,500 on one-way to 47,000	ranges between 25,000 on one-way to 56,000	3	7-10 (one-way outbound)	Negligible	Negligible
Highway 17/ Blanshard Street: McKenzie Avenue to Vernon Avenue. (inbound)	Arterial Highway (> 20,000 vpd)	ranges between 47,000 down to 29,000 on one-way Section	ranges between 56,000 down to 34,000 on one-way Section	3	7-10 (one-way inbound)	Negligible	Negligible
Note: Shading indicates one-way segments of route							
From Macaulay Point Pump Station							
Anson Street: Site to Munro Street (On DND Housing Land)	Local road (< 1,000 vpd)	< 100	< 200	8	20-32	(8/200) **4.0**	(20-32/200) **10-16**

ROAD – SEGMENT	STREET CLASSIFICATION (Capacity)	APPROXIMATE 'BASE YEAR' VOLUMES		ESTIMATED DEVELOPMENT-GENERATED OPERATIONAL TRAFFIC VOLUMES		% INCREASE RELATIVE TO YEAR 2025 'BASE TRAFFIC' VOLUMES	
		2004 (vpd)	**2025 (vpd)**	**2025 (vpd)**	**2045 (vpd)**	**2025 (vpd)**	**2045 (vpd)**
Anson Street: Munro Street to Bewdley Avenue. (On DND Housing Land) (outbound)	Local road (< 1,000 vpd)	< 400	400	4	10-16	(4/400) **1.0**	(10-16/400) **2.5-4.0**
Bewdley Avenue: Anson Street to Peters Street. (On DND Housing Land) (outbound)	Local road (< 1,000 vpd)	< 400	400	4	10-16	(4/400) **1.0**	(10-16/400) **2.5-4.0**
Peters Street: Bewdley Avenue to Lyall Street. (On DND Housing Land) (outbound)	Local road (< 1,000 vpd)	< 400	400	4	10-16	(4/400) **1.0**	(10-16/400) **2.5-4.0**
Lyall Street: Peters Street to Fraser Street (outbound)	Collector (3,000 - 8,000 vpd)	ranges between 1,000 to 3,350	ranges between 1,200 to 4,000	4	10-16	Negligible	(10/4000-16/1200) **0.23-1.3**
Lyall Street: Fraser Street to Admirals Road	Collector (3,000 - 8,000 vpd)	3,550	4,000	8	20-32	Negligible	Negligible
Admirals Road: Lyall Street to Esquimalt Municipal Boundary (Caroline Road)	Major Collector-Arterial (5,000 - 20,000 vpd)	ranges between 4,300 to 15,000	ranges between 5,000 to 18,000	8	20-32	Negligible	Negligible
Admirals Road: Esquimalt Municipal Boundary (Caroline Road) to Gorge Road	Major-Arterial Rd. (10,000 - 30,000 vpd)	ranges between 15,000 to 18,000	ranges between 18,000 to 22,000	8	20-32	Negligible	Negligible
Admirals Road: Gorge Road to Highway 1 (TCH)	Major-Arterial Rd. (10,000 - 30,000 vpd)	ranges between 11,000 to 12,500	ranges between 13,000 to 15,000	8	20-32	Negligible	Negligible
McKenzie Avenue: Trans Canada Highway to Highway 17	Arterial Highway (> 20,000 vpd)	ranges between 27,000 to 36,000	ranges between 28,000 to 36,000	8	20-32	Negligible	Negligible

ROAD – SEGMENT	STREET CLASSIFICATION (Capacity)	APPROXIMATE 'BASE YEAR' VOLUMES		ESTIMATED DEVELOPMENT-GENERATED OPERATIONAL TRAFFIC VOLUMES		% INCREASE RELATIVE TO YEAR 2025 'BASE TRAFFIC' VOLUMES	
		2004 (vpd)	**2025 (vpd)**	**2025 (vpd)**	**2045 (vpd)**	**2025 (vpd)**	**2045 (vpd)**
Fraser Street: Lyall Street to Munro Street (inbound)	Minor Collector (3,000 – 7,000 vpd)	Approx. 1,000 – 1,500	1,500	4	10-16	Negligible	(10-16/1,500) **0.7-1.1**
Munro Street: Anson Street to Fraser Road (inbound)	Minor Collector (3,000 - 7,000 vpd)	Less than 1,000	1,000	4	10-16	Negligible	(10-16/1,000) **1.0-1.6**
Note: Shading indicates one-way segments for accessing Macaulay Point							
Common Route to Hartland Candidate Site							
Highway 17: McKenzie Avenue to Royal Oak Drive Interchange	Arterial HIGHWAY (> 20,000 vpd)	ranges between 47,000 to 53,000	ranges between 50,000 to 55,000	50	92-116	Negligible	Negligible
Royal Oak Drive: Highway 17 to West Saanich Road	Major-Arterial Rd. (10,000 - 30,000 vpd)	ranges between 20,500 down to 16,600	ranges between 24,000 down to 19,000	50	92-116	Negligible	Negligible
West Saanich Road: Royal Oak Drive to Hartland Road	Major-Arterial Rd. (10,000 - 30,000 vpd)	ranges between 14,200 down to 12,600 to 10,800	ranges between 16,000 down to 14,000 to 12,000	50	92-116	Negligible	Negligible
West Saanich Road: Hartland Road to Wallace Drive	Major-Arterial Rd. (10,000 - 30,000 vpd)	10,000	12,000	50	92-116	Negligible	Negligible
Wallace Drive: West Saanich Road to Willis Point Road	Major Collector-Arterial (5,000 - 20,000 vpd)	3,400	5,400	50	92-116	Negligible	(116/5,400) **2.1**
Willis Point Road: Wallace Drive to Site Driveway	Major Collector-Arterial (5,000 - 20,000 vpd)	1,400	2,000	50	92-116	(50/2,000) **2.5**	(116/2,000) **5.8**

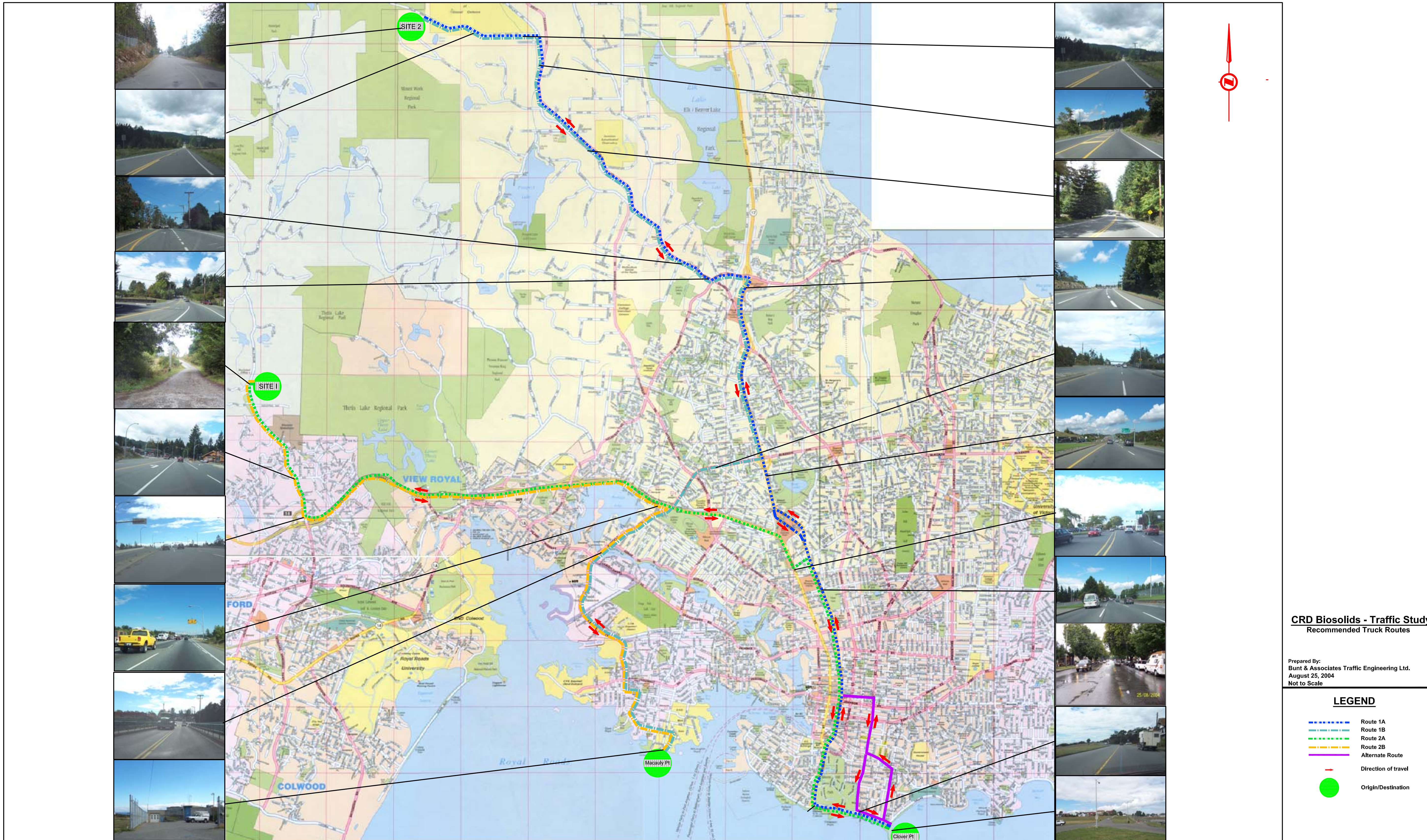

Figure 4-8 Recommended, or preferred, routes connecting the sludge haul origins of the Macaulay Point and Clover Point sewage treatment facilities to the Millstream and Hartland candidate biosolids facility sites. Roadway photographs have been included for additional information.