

Triple Bottom Line Analysis of Candidate Saanich East-North Oak Bay Wastewater Treatment Facility Sites



Prepared for:



Making a difference...together

July 2009

Prepared by:



Contents

1.0	INTRODUCTION AND PROJECT DESCRIPTION	1
1.1	The project	1
1.2	The Triple Bottom Line approach.....	3
1.3	Objective	3
2.0	METHODS AND ANALYSIS	4
2.1	Triple Bottom Line evaluation process.....	4
2.2	Analysis criteria and results	4
	Environment.....	4
	Geotechnical development constraints	5
	Hydrology and water quality.....	5
	Vegetation	6
	Wildlife and wildlife habitat.....	6
	Total energy use	7
	Social and community	8
	Odour	8
	Traffic and Roads.....	9
	Visual aesthetics	10
	Community use	11
	Nuisance effects.....	12
	Property values	13
	Economic	13
	Capital cost (excluding land).....	13
	Operating cost.....	14
	Land cost.....	14
	Resource recovery potential	15
	Weighting	15
	Rating results	15
3.0	INTERPRETATION AND CONCLUSIONS.....	17
3.1	Finnerty-Arbutus property	17
3.2	Cedar Hill Corner property	18
3.3	UVic Fields property.....	18
3.4	Effects of enhanced mitigation.....	18
3.5	Conclusions.....	19
4.0	REFERENCES.....	21
	APPENDIX A.....	22

Figures

Figure 1	Candidate sites for a wastewater treatment facility in Saanich East-North Oak Bay	2
Figure 2	Triple bottom line comparison of candidate sites	17
Figure 3	Triple bottom line comparison of candidate sites, using “enhanced mitigation”	19

Tables

Table 1	Geotechnical development constraints.....	5
Table 2	Potential hydrological and water quality effects.....	6
Table 3	Potential vegetation effects	6

Table 4	Potential wildlife and wildlife habitat effects	7
Table 5	Total energy use evaluation	8
Table 6	Population potentially affected by odour releases	9
Table 7	Total number of trips potentially affected by construction	10
Table 8	Potential visual aesthetics effects	11
Table 9	Potential community use effects	12
Table 10	Potential nuisance effects	12
Table 11	Residential properties that could experience value effects	13
Table 12	Capital cost (excluding land)	14
Table 13	Operating cost	14
Table 14	Resource recovery potential	15
Table 15	Triple Bottom Line Evaluation of Candidate Sites	16

1.0 INTRODUCTION AND PROJECT DESCRIPTION

1.1 The Project

In 2006, the British Columbia Minister of Environment directed the Capital Regional District (CRD) to begin planning to provide a higher level of wastewater treatment for the core area municipalities. Subsequently, the province requested the CRD to consider resource recovery as part of its wastewater treatment program. The Core Area Liquid Waste Management Committee (CALWMC) considered several options for delivering a decentralized model of wastewater treatment in the region. All of the shortlisted options included a treatment facility in Saanich East-North Oak Bay (SENOB). The CALWMC has authorized staff and consultants to undertake a variety of planning studies associated with wastewater treatment technology, resource recovery and reuse, facility siting, and an Environmental and Social Review (ESR) in the Saanich East-North Oak Bay area.

As part of the site selection process, three candidate sites for a wastewater facility were identified in the area shown in Figure 1. The following sites were presented to the CALWMC in April 2008 and approved for further investigation:

- Finnerty-Arbutus site,
- Cedar Hill Corner site, and
- UVic Fields site.

For each site, engineering staff of the CRD and their consultants developed conceptual facility footprints. The potential impacts of constructing and operating a treatment facility on each of these sites are described and evaluated in the ESR. The ESR and this Triple Bottom Line (TBL) analysis also include the ancillary facilities (gravity mains, forcemains, and a small-diameter pressurized pipe from Penrhyn Pump Station to the treatment facility) that are needed to support operation of the treatment facility. The analyses of Cedar Hill Corner and UVic Fields sites include a pump station at the Finnerty-Arbutus site because of their location in the catchment area.



Figure 1 Candidate sites for a wastewater treatment facility in Saanich East-North Oak Bay

1.2 The Triple Bottom Line approach

Site selection is a complex process, and so the CRD has elected to use a Triple Bottom Line assessment and comparison of the three candidate wastewater treatment sites in the Saanich East-North Oak Bay study area. The results of this analysis will be used by the CALWMC as part of the site selection process.

The TBL approach provides a basis for examining the performance of alternative sites for a wastewater treatment facility and associated ancillary facilities. TBL is a tool that provides decision makers with a comparison of the socio-community, economic, and environmental ratings of the candidate sites. The approach allows technical and subjective assessments to be combined in a single score. The results of the TBL analysis can be used in combination with other information available to the CALWMC in selecting an optimum wastewater treatment facility site.

1.3 Objective

The purpose of this report is to outline the approach and results of the TBL analysis, comparing the three candidate sites in the Saanich-East North Oak Bay study area.

2.0 METHODS AND ANALYSIS

2.1 Triple Bottom Line evaluation process

This TBL analysis assesses and compares the environmental, social-community, and economic performance of the three candidate wastewater treatment sites in Saanich East-North Oak Bay (SENOB). For each topic, a set of criteria was developed, based in part on the topics examined in the ESR of the sites.

Each TBL criterion contains a statement that indicates the desired goal in selecting a site for a wastewater treatment facility in the SENOB area. The criteria are evaluated and assigned a rating of 1, 2, or 3, with 3 indicating the greatest suitability for a treatment facility, and 1 being least suitable.

Once all the criteria have been evaluated and ratings assigned according to the performance of each candidate site, a total score is assigned by adding the ratings for each criterion. The result is a rating value for each of the three main topic categories (environmental, social-community, and economic) for each candidate site, as well as a total rating value for each site. This rating system provides a clear, simple, and objective evaluation of the criteria and allows for direct comparison of the performance of each candidate site.

The public and the CALWMC have indicated that social, economic, and environmental topics should be given equal weights in TBL analyses. Within each of the three topic areas, however, weights must be assigned to compensate for unequal numbers of criteria, and to reflect the importance of the individual criteria to facility siting. These “criteria weights” are shown on Table 15, presented later in this report.

2.2 Analysis criteria and results

Environment

The following criteria were used to evaluate the environmental impacts:

- geotechnical development constraints,
- hydrology and water quality,
- vegetation,
- wildlife and wildlife habitat, and
- total energy use.

Geotechnical development constraints

The main goal of this analysis criterion is to minimize seismic, liquefaction, and slope instability risk, and to ensure presence of satisfactory soils to support a treatment facility at each candidate site. Each site option is assessed based on three rating categories:

- 1= Considerable geotechnical development constraints,
- 2= Minor geotechnical development constraints, and
- 3= No identified geotechnical development constraints.

In assessing geotechnical development constraints, indicators such as soil bearing conditions, settlement concerns, site drainage constraints, and soil behaviour during seismic loading were considered. The presence of faults and the risks they may pose were carefully reviewed as part of the geotechnical assessment.

Geotechnical suitability information was gathered using the BC Ministry of Energy, Mines and Petroleum Resources' Quaternary geology mapping of Greater Victoria (Monahan et al. 2000). This information was supplemented by an examination of historical aerial photographs and site visits by C.N. Ryzuk and Associates to assess the sites' geotechnical properties and construction conditions. The geology and soils of all of the sites are adequate for constructing a wastewater facility, though care must be exercised in design and construction to avoid erosion or stability concerns.

Table 1 Geotechnical development constraints

Candidate site	Rating
Finnerty-Arbutus	2
Cedar Hill Corner	2
UVic Fields	2

Hydrology and water quality

The main goal of this criterion is to minimize adverse effects of construction at the candidate treatment facility sites on hydrology and surface water quality, assuming the use of standard construction techniques to avoid such effects. Each site option is assessed based on three rating categories, where:

- 1 = Substantial effect on hydrology or water quality during construction,
- 2 = Moderate effect on hydrology or water quality during construction, and
- 3 = No effect on hydrology or water quality during construction.

The ratings consider short term effects during construction, because there are no identified long term operations effects on hydrology or water quality. These effects include direct treatment facility and ancillary facility construction effects on watercourses, or erosion and sedimentation

events that could affect downstream water. The ratings are based on field inspections of the sites and review of available maps and reports on hydrology of the study area.

Table 2 Potential hydrological and water quality effects

Candidate site	Rating
Finnerty-Arbutus	3
Cedar Hill Corner	2
UVic Fields	3

Vegetation

The fundamental goal of this criterion is to minimize the area of native plant communities that will need to be removed for the construction of the wastewater treatment facility and ancillary facilities. The assessment of each treatment facility site option is based on three rating categories:

- 1= 1 ha or more of red-listed plant communities would be removed,
- 2= Between 0.25 and 1 ha of red-listed plant communities would be removed, and
- 3= Less than 0.25 ha of red-listed plant communities would be removed.

Southern Vancouver Island’s native plant communities are considered threatened, or “red-listed”, by the British Columbia Conservation Data Centre. Candidate sites that require less removal of red listed plant communities are favourable. The ratings are based on review of maps and reports, and the conduct of field inspections.

Table 3 Potential vegetation effects

Candidate site	Rating
Finnerty-Arbutus	1
Cedar Hill Corner	2
UVic Fields	3

Wildlife and wildlife habitat

The main goal is to minimize the area of wildlife habitat that needs to be removed for the construction of the wastewater treatment facility and ancillary facilities. Each site option is assessed based on three rating categories, namely:

- 1= 1 ha or more of forested wildlife habitat would be removed,
- 2= Between 0.25 and 1 ha of forested wildlife habitat would be removed, and
- 3= Less than 0.25 ha of forested wildlife habitat would be removed.

Mature and old forests support important wildlife habitat functions, including reproduction (such as wildlife trees), security (such as coarse woody debris and dense shrub cover), and foraging and thermal habitat attributes. The structural attributes of mature and old forest are important for a variety of native wildlife species, including mammals, amphibians, birds, and invertebrates. Candidate sites that require less removal of forested wildlife habitat are favourable. Reports, field inspections, and review of maps and orthoimagery were used to support the analysis.

Table 4 Potential wildlife and wildlife habitat effects

Candidate site	Rating
Finnerty-Arbutus	1
Cedar Hill Corner	2
UVic Fields	3

Total energy use

The key goal of this analysis criterion is to minimize the total energy used to operate a wastewater treatment facility. The assessment of each treatment facility site option is based on three rating categories that describe how many kilowatt-hours (kWh) of energy is required to treat a cubic metre (m³) of wastewater:

- 1= High energy consumption (more than 1.0 kWh/m³,
- 2= Moderate energy consumption (0.65 to 1.0 kWh/m³)*, and
- 3= Minimal energy consumption (less than 0.65 kWh/m³).

Energy is required to:

- pump wastewater from Penrhyn Pump Station,
- pump wastewater to the facility,
- treat the wastewater, and
- pump sludge from the facility.

The energy required for pumping operations increases with a treatment facility site's distance horizontally and vertically from the existing sewer main (the East Coast Interceptor). Energy requirements are affected by length of pipe (energy lost due to friction, also known as head loss) and elevation change. The power required for treatment is considered to be the same for all three plants due to identical treatment processes and anticipated volumes of treatment.

* 0.65 kWh/m³ represents the approximate amount of energy used for conventional treatment with sand filters (van Bentem, 2008).

Table 5 Total energy use evaluation

Candidate site	Energy required (kWh/m³)	Rating
Finnerty-Arbutus	0.62	3
Cedar Hill Corner	0.77	2
UVic Fields	0.78	2

Social and community

The following criteria were used to represent potential social and community impacts:

- odour,
- traffic and roads,
- visual aesthetics,
- community use,
- nuisance effects, and
- property values.

Odour

The main goal is to minimize the number of people potentially affected by odour of the treatment facility at each candidate site. The treatment facility would be designed and operated to generate no detectable odour at the property line, so the estimates in this analysis assume an odour release caused by a malfunction of the facility and backup systems.

The three rating categories for assessing the site options are:

- 1 = Many people potentially affected by odour (> 1,000),
- 2 = Some people potentially affect by odour (500 to 1,000), and
- 3 = Few people potentially affected by odour (< 500).

These ratings are based on results of odour dispersion modeling performed by Genesis Engineering Ltd., which identified a maximum likely transmission of noticeable odour under worst-case (low wind) meteorological conditions prevailing at the time of an odour release. This maximum distance is 500 m, and the scale of effect reflects total numbers of residents within 500 m of the treatment facility footprint. The number of people who would actually be affected during an odour release would be much smaller than the estimates, because only those “downwind” of the facility would notice the odour.

Table 6 Population potentially affected by odour releases

Candidate site	Population within 500 m of site	Rating
Finnerty-Arbutus	1,120	1
Cedar Hill Corner	817	2
UVic Fields	1,942	1

Traffic and Roads

The main goal of this analysis criterion is to minimize the number of vehicle trips affected by construction of the wastewater treatment facility and ancillary facilities. No traffic effects are anticipated during operation of a facility.

Each site option is assessed based on three rating categories:

- 1= Many vehicle trips potentially affected by construction disruptions (> 500,000 trips),
- 2= Some vehicle trips potentially affected by construction disruptions (250,000 to 500,000 trips), and
- 3= Few vehicle trips potentially affected by construction disruptions (<250,000 trips).

These ratings are based on an estimate of total numbers of trips potentially affected during the entire construction period. The access roads to the treatment facility and pump station sites, and the roads disturbed during construction of the ancillary pipes were included in the analysis. Traffic counts for the access roads to the treatment facility and pump station sites, namely McKenzie Avenue, Arbutus Road, and Cedar Hill Cross Road, were provided by the CRD. Seventy percent of the 24 hour traffic counts were used to estimate the number of vehicles using the roads during construction hours (7 am to 5 pm).

Traffic counts were not available for the local roads where the ancillary pipes would be constructed. To obtain this information, households adjacent to the ancillary pipes or in cul-de-sacs that would require those roads were counted from 2008 orthoimagery provided by the CRD. To determine the number of daily vehicle trips by local residents on roads affected by ancillary pipe construction, the number of affected households was multiplied by 7 (assuming an average of 10 trips per day per household, and 70% of vehicle trips occurring between 7 am and 5 pm).

It was assumed that construction would affect traffic for one third of the total construction period (for instance, when heavy truck traffic is generated). On these busy days, it was further assumed that traffic would be affected an average of half of the time for treatment facility construction, one-third of the time for pump station construction, and one-quarter of the time for the ancillary

pipe construction. Applying these assumptions, construction is expected to affect traffic for the following number of days:

- Wastewater treatment facility - 100 days,
- Pump station - 27 days, and
- Ancillary pipes - 18 days.

Many of the construction activities for the treatment facility, pump station, and ancillary pipes are expected to occur concurrently.

To determine the total number of vehicle trips affected during construction, the number of vehicle trips per day (based on traffic counts or from estimates based on household counts) was multiplied by the number of days construction is expected to affect traffic. The number vehicle trips that could be affected by the construction of the treatment facility and ancillary facilities for each candidate site are presented in Table 7.

Table 7 Total number of trips potentially affected by construction

Candidate site	Number of vehicle trips affected	Rating
Finnerty-Arbutus	366,000	2
Cedar Hill Corner	623,000	1
UVic Fields	995,000	1

The large number of potentially affected trips at the UVic Fields site reflects the larger traffic volumes on McKenzie Avenue, compared to access roads for the other two sites.

Visual aesthetics

The main goal is to minimize visual impacts of the treatment facility at each candidate site. Each site option is assessed on the basis of the following three rating categories, which consider the potential to screen the wastewater facilities to reduce visual effects:

- 1= Substantial adverse change to existing viewsheds,
- 2= Moderate adverse change to existing viewsheds, and
- 3= Little adverse change to existing viewsheds.

The visual assessment entails a subjective assessment of the changes in the attractiveness of a location as a result of construction of a wastewater treatment facility and ancillary facilities. The assessment considers the degree of landscape modification, and the compatibility of the structures with surrounding landscape features. Modifications can include the removal of existing trees and shrubs, changes to slopes and the addition of roads, buildings, lighting, and other utility structures. The effects of these visual changes on the landscape were assessed

through field visits and through the construction of digital 3-D models of the facilities at the candidate locations.

The TBL assessment considers the visual aesthetic effects of treatment on existing site conditions during construction and operation. The potential to mitigate visual impacts of locating a facility at each of the sites emphasized planting of landscape plants to provide screening. Mitigation options consider the proximity of residential areas, roads, and other vantage points.

Table 8 Potential visual aesthetics effects

Candidate site	Rating
Finnerty-Arbutus	1
Cedar Hill Corner	3
UVic Fields	2

Community use

The fundamental goal is to minimize disruption to permitted public uses at each candidate site. The three rating categories for assessing the site options are:

- 1= Considerable disruption to permitted public uses,
- 2= Some disruption to permitted public uses, and
- 3= Minimal disruption to permitted public uses.

The three sites under investigation are located in developed communities and public use of the current sites or neighbouring areas occurs. Public athletic and recreation use is permitted and encouraged at the UVic Fields site, and a bicycle and pedestrian path crosses the conceptual facility footprint. Dog walking is a popular use of the Cedar Hill Corner site, a use that is recognized and tolerated by the University of Victoria. The Finnerty-Arbutus site is posted as a no trespassing area, so the public access to this property, though common, is not considered to be a permitted use.

The ratings consider the degree of effect that the presence of a wastewater facility would have on permitted public use. Public use of the Finnerty-Arbutus property, though not permitted, occurs nonetheless and would be affected by a facility. The public could, however, continue to use the adjacent properties owned by the District of Saanich and the University of Victoria during facility construction. Dog walking could continue to occur on portions of the Cedar Hill Corner property outside of the treatment facility footprint. At the UVic Fields site, a treatment facility would require closure of the bicycle-pedestrian path, and would displace use of a grass practice field.

Table 9 Potential community use effects

Candidate site	Rating
Finnerty-Arbutus	2
Cedar Hill Corner	2
UVic Fields	1

Nuisance effects

The goal of this analysis criterion is to minimize potential nuisance effects (*i.e.*, dust, noise, vibration, and lighting) on neighbouring residential properties. Each site option is assessed on the basis of the following three rating categories:

- 1 = Many residential units affected by construction and operations nuisances (>200 units)
- 2 = Some residential units affected by construction and operations nuisances (100 to 200 units)
- 3 = Few residential units affected by construction and operations nuisances (<100 units)

The ratings consider the number of residential units within 30 m of the edge of the candidate sites or ancillary pipes. Details of the method of calculating the number of potentially affected properties are presented in Appendix A.

Ancillary facility effects would occur only during construction (with the exception of the pump station at Finnerty-Arbutus for the Cedar Hill Corner and UVic Fields sites). Most nuisance effects of the treatment facility would occur during construction, though the potential exists for light, noise, or vibration to continue during operation. The design standard for the facilities is to produce no detectable noise or vibration effects at the property line.

Table 10 Potential nuisance effects

Candidate site	Units within 30 m of:		Total units	Rating
	Candidate site boundary	Ancillary facility routes		
Finnerty-Arbutus	23	101	124	2
Cedar Hill Corner	49	186	235	1
UVic Fields	57	151	208	1

The large number of potentially affected properties for the Cedar Hill Corner and UVic Fields sites result from the great length of ancillary facility pipes required, some of which (in the case of Cedar Hill Corner) pass near to medium-density student housing.

Property values

The goal is to minimize a treatment facility's effects on value of neighbouring properties. It is important to note that there is no research that indicates how much a treatment plant would affect values of adjacent properties, or even that there is a consistent effect on property values. Hence this indicator only assumes that there could be a property value effect related to proximity to a treatment facility, visibility of the facility from a nearby property, or the potential "stigma" effect of having a treatment facility in a neighbourhood. Of the ancillary facilities, only the pump station is considered in estimating potential property value effects.†

Using these assumptions the assessment of each treatment facility site option is based on three rating categories:

- 1 = Many properties could experience property value effects (> 50),
- 2 = Several properties could experience property value effects (20 to 50), and
- 3 = Few properties could experience property value effects (< 20).

Table 11 Residential properties that could experience value effects

Candidate site	Attached residences	Detached residences	Total	Rating
Finnerty-Arbutus	0	14	14	3
Cedar Hill Corner	25	25	50	2
UVic Fields	42	14	56	1

Economic

The following criteria were used to evaluate the potential economic impacts of a wastewater facility:

- capital cost (excluding land),
- operating cost,
- land cost, and
- resource recovery potential.

Capital cost (excluding land)

The main goal of this analysis criterion is to minimize the capital cost (excluding land) of the project. The assessment of each treatment facility site option is based on three rating categories:

† Other wastewater pump stations in the CRD have been shown to have no measurable effect on the value of properties—even immediate neighbours.

- 1= \$141 to \$149 million,
- 2= \$134 to \$141 million, and
- 3= \$126 to \$134 million.

This factor considers the difference in construction costs for a treatment facility and necessary ancillary facilities, and does not take land acquisition into account. The capital cost figures were provided by the CRD. Table 12 presents the estimated capital costs and subsequent rating for each candidate site.

Table 12 Capital cost (excluding land)

Candidate site	Estimated capital cost	Rating
Finnerty-Arbutus	\$126.4 million	3
Cedar Hill Corner	\$149.1 million	1
UVic Fields	\$146.1 million	1

Operating cost

The fundamental goal of this criterion is to minimize the cost of operating the treatment and ancillary facilities. The following three rating categories are applied:

- 1= \$2.4 to \$2.6 million per year,
- 2= \$2.2 to \$2.4 million per year, and
- 3= \$2 to \$2.2 million per year.

Facility operating costs differ among the three candidate sites because two of the sites are located at higher elevation and require pumping of wastewater to the treatment facility. The operating cost figures were provided by the CRD. Table 13 presents the estimated annual operating costs and the subsequent rating for each candidate site.

Table 13 Operating cost

Candidate site	Operating cost (per year)	Rating
Finnerty-Arbutus	\$2.1 million	3
Cedar Hill Corner	\$2.5 million	1
UVic Fields	\$2.4 million	1

Land cost

The main goal is to minimize land costs associated with the proposed treatment facility. The land cost associated with building a wastewater treatment facility is an important economic factor. At the time this study was conducted, land cost information was not available for Cedar Hill Corner or UVic Fields so this criterion could not be completed for this analysis. To

maintain the mathematical integrity of the TBL evaluation, all three candidate sites were assigned a value of “2”. This value will be amended if necessary when the land costs are estimated.

Resource recovery potential

The main goal of this analysis criterion is to maximize the potential use of reclaimed water and recovered energy from the proposed treatment facility. The resource recovery potential differs for each candidate site and is assessed on the basis of three rating categories:

- 1= Few potential opportunities for resource recovery nearby,
- 2= Several potential opportunities for resource recovery nearby, and
- 3= Many potential opportunities for resource recovery nearby.

Water for non-potable use and heat energy can be recovered from wastewater. In this analysis, locations in the SENOB study area that have the potential to use recovered heat energy or treated water from the treatment facility were identified using land use classifications. These areas are termed resource recovery opportunity areas. The various land use classes of the SENOB study area were rated high, moderate, or low, depending on their potential for the use of either treated water or recovered energy. As distance increases from the site to the resource recovery opportunity area, the cost of installing pipes and other infrastructure to utilize the recovered resources also increases. The rating system considers proximity of potential resource users to treatment facility sites. The ratings for each site are presented in Table 14.

Table 14 Resource recovery potential

Candidate site	Rating
Finnerty-Arbutus	2
Cedar Hill Corner	2
UVic Fields	3

Weighting

Environment, social-community, and economic topics were weighed equally in the analysis, each given a weight of 100 points. The 100 points were distributed among the criteria in each topic. The criteria that were considered more important to site selection decisions were assigned a greater proportion of the 100 points (Table 15).

Rating results

Table 15 presents the topics, criteria, ratings, and weightings for each site. The highest possible score a site could receive is 900 points, which would be attained if a site scores a “3” for every criterion. The rating results are interpreted and compared in Section 3 of this report.

Table 15 Triple Bottom Line Evaluation of Candidate Sites

Topic	Criteria and goals	Rating categories	Ratings			Criteria Weight	Topic Weight
			Finnerty-Arbutus	Cedar Hill Corner	UVic Fields		
ENVIRONMENT	Geotechnical development constraints Minimize effects of seismic and liquefaction risk, slope instability, and surficial material.	1 Considerable geotechnical development constraints. 2 Minor geotechnical development constraints. 3 No identified geotechnical development constraints.	2	2	2	15.00	
	Hydrology and water quality Minimize effect on hydrology and surface water quality.	1 Substantial effect on hydrology or water quality during construction. 2 Moderate effect on hydrology or water quality during construction. 3 No effect on hydrology or water quality during construction.	3	2	3	15.00	
	Vegetation Minimize the removal of red-listed plant communities.	1 1 ha or more of red-listed plant communities would be removed. 2 Between 0.25 and 1 ha of red-listed plant communities would be removed. 3 Less than 0.25 ha of red-listed plant communities would be removed.	1	2	3	25.00	
	Wildlife Minimize the removal of forested wildlife habitat.	1 1 ha or more of forested wildlife habitat would be removed. 2 Between 0.25 and 1 ha of forested wildlife habitat would be removed. 3 Less than 0.25 ha of forested wildlife habitat would be removed.	1	2	3	25.00	
	Total energy use Minimize total energy use during facility operation.	1 High energy consumption (> 1 kWh/m3). 2 Moderate energy consumption (0.65 - 1 kWh/m3). 3 Minimal energy consumption (< 0.65 kWh/m3).	3	2	2	20.00	
SOCIAL AND COMMUNITY	Odour Minimize the number of people affected by odour.	1 Many people potentially affected by odour (>500). 2 Some people potentially affected by odour (100-500). 3 Few people potentially affected by odour (<100).	1	2	1	16.67	
	Traffic and roads Minimize the number of road users impacted by construction.	1 Many road users potentially affected by construction disruptions (> 500,000 trips). 2 Some road users potentially affected by construction disruptions (250,000 to 500,000 trips). 3 Few road users potentially affected by construction disruptions (< 250,000 trips).	2	1	1	16.67	
	Visual aesthetics Minimize visual impacts.	1 Limited potential to mitigate most visual impacts. 2 Potential to mitigate most visual impacts. 3 Potential for no visual impacts after mitigation.	1	3	2	16.67	
	Community use Minimize disruption to permitted public uses.	1 Considerable disruption to permitted public uses. 2 Some disruption to permitted public uses. 3 Minimal disruption to permitted public uses.	2	2	1	16.67	
	Nuisance effects Minimize nuisance effects, such as dust, noise, vibration, and lighting, on neighbouring properties.	1 Many people affected by construction and operations nuisances (>100). 2 Some people affected by construction and operations nuisances (>20-100). 3 Few people affected by construction and operations nuisances (<20).	2	1	1	16.67	
	Property values Minimize effects on value of neighbouring properties.	1 Several properties likely to experience property value effects. 2 Few properties likely to experience property value effects. 3 No properties likely to experience property value effects.	3	2	1	16.67	
ECONOMIC	Capital cost (excluding land) Minimize the capital cost (excluding land) of the project.	1 141 to 149 million 2 134 to 141 million 3 126 to 134 million	3	1	1	40.00	
	Operating cost Minimize the operating cost of the project.	1 2.4 to 2.6 million per year 2 2.2 to 2.4 million per year 3 2 to 2.2 million per year	3	1	1	30.00	
	Land cost Minimize land costs.	1 TBD 2 TBD 3 TBD	2	2	2	15.00	
	Resource recovery potential Maximize potential to use recovered energy or water.	1 Few potential opportunities for resource recovery nearby. 2 Several potential opportunities for resource recovery nearby. 3 Many potential opportunities for resource recovery nearby.	2	2	3	15.00	

Total weighted score out of a possible 900 points

638

513

527

3.0 INTERPRETATION AND CONCLUSIONS

This triple bottom line analysis measures and compares the performance of the candidate wastewater treatment sites. The criteria are designed to assist decision makers in evaluating important considerations in siting a wastewater treatment facility. Invariably, there are tradeoffs that need to be considered. This section interprets the results of the triple bottom line analysis and discusses some of the tradeoffs for each candidate site. Figure 2 graphically compares each site's performance environmentally, socially, and economically.

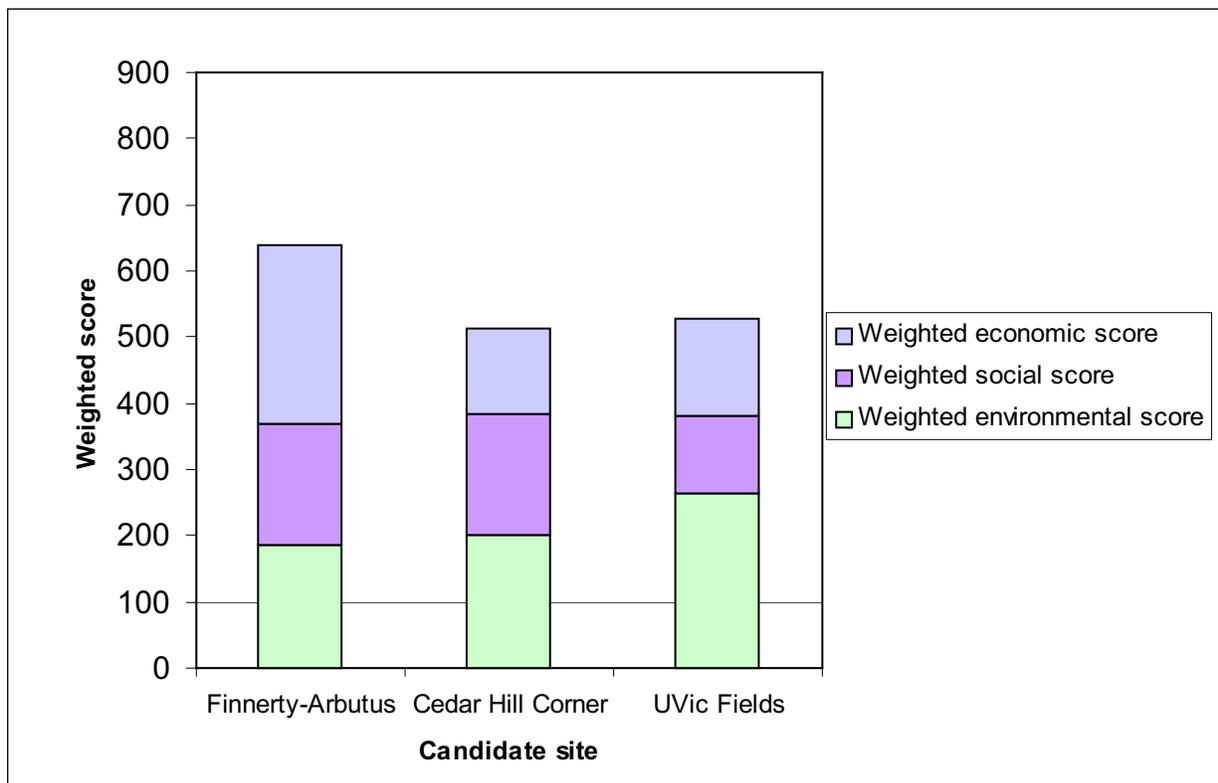


Figure 2 Triple bottom line comparison of candidate sites

3.1 Finnerty-Arbutus property

The Finnerty-Arbutus site performed the best overall in the analysis (Figure 2). Economically the site received the highest rating because it requires the fewest ancillary facilities and has the lowest operational costs. Socially, although this site is used for recreation by residents in the neighbourhood, it is not a permitted use of the site, a circumstance reflected in the ratings. The forested character of the site would assist in reducing visual impacts and other nuisance effects. Environmentally, the site received the lowest rating because the site currently supports second growth forest whereas the other two candidate sites are already cleared of native vegetation.

Enhanced mitigation that could improve rating. If the facility footprint were moved to the southeast, onto land owned by the District of Saanich that has lower ecological values, the environmental rating for vegetation and wildlife would improve to a “2.”

3.2 Cedar Hill Corner property

The Cedar Hill Corner property performed the worst overall in the analysis (Figure 2). Environmentally and socially, the site performed low to moderately well. The site is already cleared, but the environmental scores were reduced because the ancillary pipes are routed through mature forest in Upper Hobbs Creek drainage and the pump station is sited on the Finnerty-Arbutus property. Both facilities would require clearing of forested areas. Socially, the community could expect some traffic, community use, and nuisance effects. The site received the lowest economic score because of the higher capital and operating costs associated with the pump station and additional ancillary pipes, and a lower potential for resource recovery than at other candidate sites.

Enhanced mitigation that could improve rating. If the ancillary facility pipes required to serve the Cedar Hill Corner site were to be re-routed south along the Haro Road right-of-way to Cedar Hill Road, thereby avoiding a crossing of Upper Hobbs Creek drainage, the ratings for hydrology and water quality, vegetation, and wildlife would improve.

3.3 UVic Fields property

The UVic Fields property ranked second overall in the analysis. The site received the highest environmental score because it is already cleared. Little additional vegetation would need to be cleared to accommodate the ancillary pipes. However, the site received the lowest social score, mainly because of the proximity of housing to the site. Local residents could be affected more by traffic, visual aesthetics, community use, nuisance effects, and property value changes than at the other two sites. Economically, the site received a low score because of higher expected capital and operating costs for the pump station and ancillary pipes. The UVic Fields site is considered to have the greatest potential for resource recovery, because it is near the University of Victoria.

Enhanced mitigation that could improve rating. Re-orientation of the facility footprint to move the structures further from housing would improve the ratings for visual aesthetics and property value effects. If such changes to facility siting could avoid effects on Wallace Field and permit continued use of the bicycle-pedestrian path, then community use ratings would also improve.

3.4 Effects of enhanced mitigation

If the “enhanced mitigation” measures described in sections 3.1, 3.2, and 3.3 are applied, the scores of the sites change (Figure 3). The Cedar Hill Corner site moves into second place,

slightly ahead of UVic Fields. Finnerty-Arbutus, however, retains the highest TBL scores, mainly because of its dominance in the economic category.

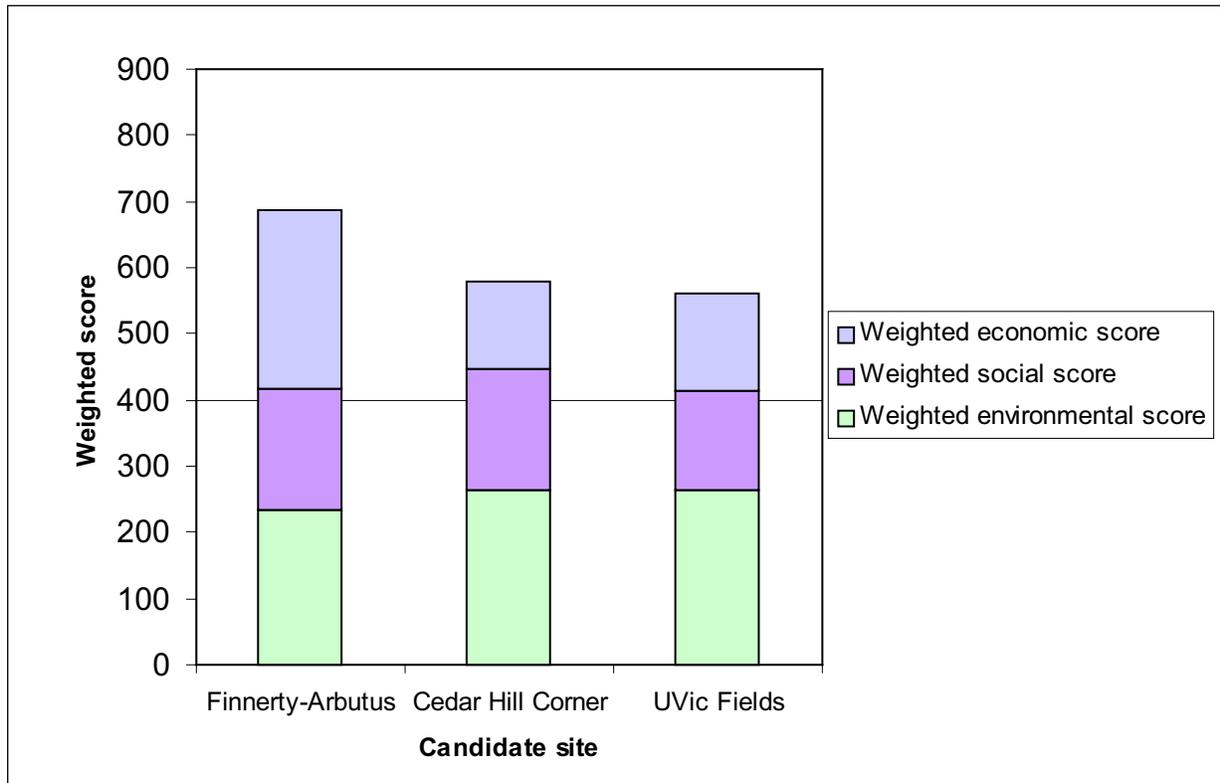


Figure 3 Triple bottom line comparison of candidate sites, using “enhanced mitigation”

3.5 Conclusions

The TBL analysis leads to several conclusions:

- a. Despite its relatively poor environmental performance, the Finnerty-Arbutus site continues to achieve higher overall scores than the other two sites due to its lower economic costs (both capital and operating) and fewer social impacts.
- b. Applying mitigation measures changes the absolute scores of the three sites, but Finnerty-Arbutus retains its high rank. Mitigation should be applied regardless of which site is selected, to minimize project impacts.
- c. The ancillary facilities add substantially to the economic, environmental, and social impacts of the Cedar Hill Corner and UVic Fields sites.

- d. Even if the land costs of the Cedar Hill Corner or UVic Fields sites prove to be remarkably low, they are unlikely to offset the high costs of additional ancillary facilities and annual operations.
- e. When the CRD's marine studies are completed and the outfall location can be determined, some change in effects and ratings may occur. These effects, however, would apply equally to all three candidate sites, and would not affect the relative results.
- f. If the Finnerty-Arbutus site is determined to be the preferred treatment facility site, an investigation of the feasibility of moving all or a part of the facility onto the adjacent Saanich-owned parcel should be conducted. This relocation has been recommended by participants in the public involvement program and by biologists involved in the ESR and TBL analyses.

The findings of this TBL analysis are intended to support the selection of a preferred site for a wastewater facility. Other sources of information—from the public, other technical studies, and the ESR—may complement the decision process.

4.0 REFERENCES

A.van Bentem, C. Petri, P. Schyns 2008. *Membrane Bioreactors: Operation & Results of A MBR Wastewater Treatment Plant.*

Monahan, P.A., Levson, V.M., Henderson, P. and Sy, A. 2000. *Quaternary Geological Map of Greater Victoria.* British Columbia Geological Survey, Ministry of Energy and Mines, Geoscience map 2000-2. Available online:
<http://www.empr.gov.bc.ca/Mining/Geoscience/SurficialGeologyandHazards/VictoriaEarthquakeMaps/Pages/QGMapLegend.aspx#>

APPENDIX A

Finnerty-Arbutus Adjacent Properties--Nuisance effects

	Detached res.	Attached res.	School	Daycare	Total
Candidate site:	7	15	0	1	23
Outfall	32	0	1	0	33
SDPP	62	6	0	0	68
Total	101	21	1	1	124

Uvic Fields

	Detached res.	Attached res.	School	Daycare	Total
Candidate site:	13	44	0	0	57
Outfall/Forcemain	65	16	1	1	83
SDPP	62	6	0	0	68
Total	140	66	1	1	208

Cedar Hill Corner

	Detached res.	Attached res.	School	Daycare	Total
Candidate site:	26	23	0	0	49
Outfall/Forcemain	26	90	1	1	118
SDPP	62	6	0	0	68
Total	114	119	1	1	235