Associated Engineering | 75 YEARS

SUMMARY OF THE 2014-2016 SOUTH REGION STAGE 1/2 LWMP PROGRAM

Comox Valley Regional District

SEPTEMBER 2022

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1 INTRODUCTION

1.1 Overview

Baynes Sound is one of the most productive ecosystems on the east coast of Vancouver Island, with significant recreational, cultural, and economic value. Protection of shellfish in and around Baynes Sound is of key importance to the local economy, a significant portion of which is based on the harvesting of shellfish resources.

For many years, there has been concern that a large number of on-site septic systems in the waterfront communities of Royston and Union Bay were failing and impacting the water quality of Baynes Sound. Evidence indicating problems with the effectiveness of these systems due to system age, environmental constraints, lot size and density has resulted in significant focus over the years to deliver improved wastewater services to these communities.

The CVRD's planning efforts, studies and investigations have established a sizeable body of knowledge about the wastewater management needs of the South Region, with work dating back over 30 years. The following list provides a summary of reports and investigations that had been conducted prior to initiating the Stage 1/2 South Region LWMP process in 2014:

1. Integrated Resource Recovery Interim Report: South Region Project, Farallon Consulting, August 2012
2. South Region Sewage Collection, Treatment and Discharge Study, Associated Engineering, April 2011
3. Comox Valley Regional District Regional Growth Strategy, Bylaw No. 120, 2010
4. Comox Valley Regional District Sanitary Sewer Master Plan, McElhanney Consulting, 2010
5. Royston/Union Bay Sewage Collection, Treatment and Discharge Study Update, Koers and Associates, November 2009
6. Royston and Union Bay Sewage Study: Effects of Onsite Sewage Systems on Water Quality, Payne Engineering Geology, May 2009
7. Royston/Union Bay Sewage Collection, Treatment and Discharge Study, Koers and Associates, September 2005
8. Royston/Union Bay Liquid Waste Management Plan Comparative Evaluation of Integrated Wastewater Management Alternatives, Komex International, January 2005
9. Royston Union Bay Sewage Project: Feasibility of Soil Based Treatment of Wastewater, Payne Engineering Geology, July 2005
10. Marine Disposal Feasibility Report, Royston/Union Bay Sewage Collection, Treatment and Disposal Study, Komex International, December 2004
11. Royston Liquid Waste Management Plan Stage 1, Anderson Civil Engineering, May 2002
12. Union Bay Liquid Waste Management Plan Stage 2 Report, February 2001
13. Review of Secondary Wastewater Treatment Technologies for Union Bay, Leslie Consultants, December 2000
14. Union Bay Liquid Waste Management Plan Stage 1 Report - September 1998
15. Comox-Strathcona Electoral Area A Liquid Waste Management Plan Stage 1, Stanley Associates Engineering, April 1996
16. Impact of Connecting Cumberland and Royston to the Comox-Strathcona Regional Collection System and Wastewater Treatment Plant, NovaTech Consultants, May 1992
17. Royston, Union Bay Sewerage System Preliminary Review, Associated Engineering, December 1979

In 2013, a $15 million grant from the Gas Tax Strategic Priorities Fund (SPF) was allocated towards construction of a wastewater collection system and treatment facility for the area in partnership with the Village of Cumberland (Cumberland) and the K'ómoks First Nation (KFN).

In 2014, following the allocation of SPF funding, the Comox Valley Regional District (CVRD) retained Associated Engineering (B.C.) Ltd. (AE) to complete a combined Stage 1 and 2 Liquid Waste Management Plan (LWMP) and an Environmental Impact Study (EIS) for the South Region. The overall objective of the LWMP was to evaluate wastewater management alternatives and with the help of the Technical Advisory Committee (TAC) and Public Advisory Committee (PAC), establish a firm direction for the CVRD to move forward with a sewage collection, treatment and disposal system for the CVRD's South Region. Through the evaluation of options, the LWMP eventually focused on the implementation of the South Sewer Project (SSP), which included construction of a new collection system, treatment facility, and conveyance infrastructure which would transport treated wastewater to the CVRD's regional Comox Valley Water Pollution Control Centre for discharge through the existing outfall off Cape Lazo. The concept of a new outfall into Baynes Sound was not supported by the LWMP Public and Technical Advisory Committees.

At the time of study, the communities within Electoral Area A that were included in the South Region LWMP were:

- Royston
- Union Bay

Note: the Village of Cumberland was undergoing a separate LWMP to the CVRD's South Region LWMP, but, were included as project partners in the South Sewer Project and were thus included in the CVRD's overall plan. K'ómoks First Nation (KFN) was also partner in the South Sewer Project.

In 2015, the LWMP development process was paused, and in 2016, after an unsuccessful referendum on the South Sewer Project, it was evident that there was a need to pivot the LWMP process. This summary memorandum generally covers the work performed between July 2014 to March 2015.

In 2022, the Sewer Extension South Project is now being developed with a new lens. The new plan will be developed in cooperation with the KFN as a key partner and will support environmental protection of Baynes Sound. The proposal builds on the options evaluated through the South Region LWMP, supporting discharge to the environment via the existing outfall at Cape Lazo, while providing greater cost efficiencies through a partnership with the Comox Valley Sewer Service.

1.2 Objectives

The objectives of this summary memorandum are as follows:

- Provide the newly formed LWMP TAC/PAC with a summary of the 2014-2015 LWMP Stage 1 and 2 efforts for the South Region, including Royston, Union Bay and Cumberland.
- Provide assistance to the CVRD and new TAC/PAC members by providing the history/context for LWMP efforts that are being restarted in 2022.

2 DESCRIPTION OF 2014-2015 LWMP PROGRAM

2.1 Objectives

The LWMP process is normally divided into three stages. Stage 1 involves high-level investigations that examine the current wastewater management strategies. Stage 2 uses information developed during Stage 1 as well as supplemental studies to evaluate specific questions related to future wastewater management strategy alternatives. And finally, Stage 3 uses the information developed in both Stage 1 and Stage 2 to establish and advance the implementation plan for the communities preferred wastewater management strategy. The 2014-2015 South Region LWMP process summarized in this report was being developed as a combined Stage 1/2 process, relying on the previous planning work that had already been undertaken.

The objective of the 2014 Stage 1/2 South Region LWMP process was to develop an overall plan for municipal wastewater management through adequate public consultation that protects public health and the environment. Additional objectives of the LWMP were to address topics such as water conservation, climate change adaptation, sustainable financial management, and resource and energy recovery. The public consultation portion of the LWMP aimed to provide adequate consultation of stakeholders, general public, and local First Nation communities to facilitate the development of community acceptance and ownership.

As part of the Stage 1/2 South Region LWMP, an environmental impact study (EIS) of the receiving environment was initiated. EIS investigations, which were largely focused on the shortlisted wastewater management scenarios and supported the analyses of options for the discharge of treated wastewater to the environment.

2.2 Regulatory Requirements

2.2.1 Provincial Regulations

The regulatory landscape for wastewater collection, treatment, and management in British Columbia is somewhat complex. In 2014, there were two different pathways for a local government to obtain a formal authorization for a return of treated effluent to the environment from the British Columbia Ministry of Environment (BC MOE). Note this process is generally the same in 2022.

Municipal Wastewater Regulation (MWR)

The MWR Registration pathway requires the discharger be fully compliant with the MWR. In order to register, the discharger must submit a formal detailed application for review and acceptance by BC MOE. Registration formally replaces any/all previous discharge permits.

- British Columbia Municipal Wastewater Regulation (MWR),
  - https://www.bclaws.gov.bc.ca/civix/document/id/lc/statreg/87_2012

Liquid Waste Management Planning Process (LWMP)

- Liquid Waste Management Process
  - https://www2.gov.bc.ca/gov/content/environment/waste-management/sewage/liquid-waste-management-plans

The LWMP process is intended to provide a more flexible pathway to an Owner for formal authorization. As mentioned in **Section 2.1**, it is a three-stage planning process, that requires the Owner to form a Technical Advisory Committee (TAC) and Public Advisory Committee (PAC) and work with these committees to form a waste management plan that is tailored to the community. It can also provide a community with additional time to achieve

full compliance with the MWR, if necessary and beneficial. Acceptance of a Stage 3 LWMP by the BC MOE grants the Owner an Operational Certificate.

One added advantage of an approved LWMP is that it provides the local government the necessary authority to move forward with plan implementation (Section 24(7) of the Environmental Management Act) without requiring further elector assent or approval. By contrast, registration under the MWR does not provide the same authority, therefore an assent process in alignment with the *Local Government Act* is required to borrow funds and construct new liquid waste infrastructure.

The CVRD elected to follow the LWMP process, as it provided the community with more flexibility and the ability to manage community-specific priorities of the South Region.

2.2.2 Federal Regulation

The Wastewater Systems Effluent Regulation (WSER), was first introduced in 2012, and came into effect in 2015. The requirements set out in WSER impact the majority of wastewater dischargers in Canada, including the CVRD, and require that all facilities meet at least secondary treatment standards.

- https://laws-lois.justice.gc.ca/PDF/SOR-2012-139.pdf

The WSER includes some treated effluent discharge criteria that are not contained in the provincial MWR.

2.2.3 Other Considerations

Vancouver Island In-Stream Phosphorus Objective

In 2012, the BC MOE published a Vancouver Island Phosphorus Objective for streams. This objective sets an average allowable limit of 0.005 mg/L, and a maximum no greater than 0.010 mg/L for Total Phosphorus levels in Vancouver Island streams during the summer season (May 1st to September 31st). The objective of the guidance is to control excessive nutrient input and resulting impact to steams.

- https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-reference-documents/phosphorous_management_vi_streams_guidance_2014.pdf

2.3 Flows and Loads

2.3.1 Flows

Population projections were made to the year 2060, using a steady annual growth rate of 2.7% for the following areas:

- Royston
- Union Bay
- Village of Cumberland

At the time, 2006 BC Statistics were used to estimate the present-day population at the time (to 2010) for the communities of Royston and Union Bay, while 2010 BC Statistics were used for the Village of Cumberland. The South Region LWMP considered that development projects on the horizon would increase the contributing population, potentially in the order of 9900 units from 2010 to 2030.

For the South Region LWMP, flows were projected from 2010 to 2060. The average dry weather flows were developed based on a per-capita flow rate of 240 L/cap/day. Since municipal wastewater flows have daily and seasonal variation, a variety of "peaking factors" are used to estimate the range of municipal wastewater flows that the system will need to manage, as follows:

- Average Dry Factor 1.25
- Maximum Month Factor 1.5
- Maximum Day Factor (2010) 2.0
- Maximum Day Factor (2035) 1.9
- Maximum Day Factor (2060) 1.8
- Peak Hour Factor 3.0

Inflow and Infiltration (I&I) is a key component contributing to peaking factors. I&I is classified as groundwater and/or stormwater that enters into a wastewater collection system. This can occur through groundwater seeping into broken sewer pipes and stormwater entering through improper connections from sump pumps, roof drains, yard drains, manhole lids, and catch-basins. Projected wastewater flows for the South Region collection included I&I allowances in accordance with the guidelines provided in The Master Municipal Construction Document Associated (MMCD).

In 2014, the Village of Cumberland was underway to separate stormwater and wastewater collection systems in an effort to reduce I&I which was reported to be as high as 0.17 L/s/ha. Conversely, a Royston/Union Bay study conducted by Koers and Associates (2005) assumed I&I for the design of the wastewater collection system was a conservative estimate of 0.06 L/s/ha.

2.3.2 Loads

The characteristics of the wastewater were estimated based on the product of the 2035 Average Dry Weather Flow or the 2035 Maximum Month Flow by the typical constituent generation rate (Metcalf & Eddy, 2003). **Table 2-1** shows the assumed wastewater quality characteristics developed in 2014.

Table 2-1
Estimated Wastewater Characteristics

Constituent	Unit	During Average Dry Weather Flow Conditions	During Wet Weather Flow Conditions
5-day biochemical oxygen demand (BOD_5)	mg/L	335	280
Chemical oxygen demand (COD)	mg/L	735	610
Total suspended solids (TSS)	mg/L	370	305
Ammonia nitrogen (NH_3-N)	mg/L	28	24
Total phosphorus (TP)	mg/L	12	10
Temperature	°C	20	12

2.3.3 Biosolids Production

For the purpose of the South Region Stage 1/2 LWMP, it was assumed that the dewatered solids produced from treatment would be trucked to the CVRD's Skyrocket Composting facility. At the time, CVRD was readying to expand the Skyrocket facility to provide capacity for growth.

2.4 Environmental Impact

As part of the LWMP development, an important requirement from the BC MOE was that an Environmental Impact Assessment be completed prior to any authorization being granted. The South Region project was considered to be a "greater risk" project according to the Ministry guidelines since the location of the treatment effluent discharge would be in a sensitive receiving environment, in proximity to shellfish and commercial fishing. This required the EIS to be undertaken in two stages.

The intent of the first stage (Stage 1) was to review existing information and develop recommendations for site-specific data collection and analysis. After completion of a Stage 1 assessment, the intention would have been for the BC MOE to provide comment and confirm the scope of the Stage 2 investigation. The key outcome of the Stage 2 EIS would have been to determine whether or not the level of treatment specified in the MWR was adequate to protect human health and the environment. If not, recommendations on additional treatment or other mitigation measures would be made.

During the South Region LWMP, neither a Stage 1 nor Stage 2 EIS was completed due to the cancellation of the program. Notwithstanding, the work that was completed can be grouped into two categories:

1. Investigations that supported the analyses of the options for the discharge of treated wastewater to the environment, which are presented in **Section 3.** The major environmental technical memorandums that were completed during the LWMP work are summarized in **Table 2-2.**
2. Initial preparations for the Stage 1 Environmental Impact Study (EIS) for the preferred option. This work was only completed to a 30% level before the program was cancelled. The background data collected and reviewed prior to cancellation included the following:
    - Geospatial information for mapping sensitive areas (eelgrass beds, shellfish tenures, herring spawning areas, etc.).
    - Water quality data from shellfish harvesting areas collected by Environment Canada.
    - Literature on the local shellfish industry.
    - Previously completed environmental assessment and monitoring reports from the Comox Valley Water Pollution Control Centre (CVWPCC).
    - Fisheries data.

Table 2-2
Summary of Environmental Assessment Work undertaken during the 2014-2015 LWMP process

Document Date	Title	Key Findings
November 2014	South Region Liquid Waste Management Plan Discharge-to-Ground Options Technical Memorandum	Led to the decision to carry out field investigations.
April 2015	Feasibility of Continuing to Use Private Septic Systems as Primary Wastewater Strategy Technical Memorandum	Led to the TAC/PAC recommending that CVRD not pursue an "enhanced status quo" option that would see private on-site systems remain as the wastewater treatment system in the region. The "enhanced" aspect is that on-site systems would be subject to a new bylaw that would require higher construction and maintenance standards. Click here for a link to the memorandum.
April 2015	Southern Region Liquid Waste Management Plan Subsurface Discharge Options Technical Memorandum	The TAC/PAC chose not to proceed further with this option because the Vancouver Island Health Authority expressed concerns over potential future effects on drinking water wells.
November 2015	Advantages and Disadvantages of Cape Lazo Discharge Options and Regulatory Requirements for CVWPCC Upgrades Technical Memorandum	Led to the recommendation that a single outfall combining the CVWPCC and new South Region would be preferred over separate outfalls based on a combination of lower ecological footprint, regulatory risk, and operation, maintenance, and monitoring costs.
May 2016	South Region Wastewater Project Environmental Overview Study: Treated Effluent Main and Water Reclamation Facility Site	Was completed to provide a resource for future discussions regarding the selected option

2.5 Advisory Committees and Public Outreach

Input from local First Nations, stakeholders, and the local public was sought to guide the development of the LWMP so that it would be in-line with the community's goals and objectives and accepted by the community as a whole. A Technical Advisory Committee (TAC) and a Public Advisory Committee (PAC) were established for this purpose. (Refer to **Appendix A** for a summary of the TAC and PAC members during the 2014 South Region LWMP.)

In addition to the TAC/PAC, a public consultation program was undertaken through multiple avenues. Public events were held where members of the general public viewed information regarding the LWMP, and interacted with the project team. Information was also exchanged through the CVRD's LWMP website (www.comoxvalleyrd.ca under Departments – Sewer Services – Regional Sewer Initiatives – South Region) where meeting minutes and newsletters were made available, comment forms submitted to southsewer@comoxvalleyrd.ca, and PlaceSpeak (www.placespeak.com/southregionlwmp), an online public forum. A comprehensive summary of the public engagement efforts undertaken to support 2014-15 LWMP efforts is available on the CVRD's website (click here for link).

2.6 Timeline of Meetings

Five joint TAC/PAC meetings were held as part of the LWMP Stage 1/2 process. A summary of the meeting timelines is provided in **Table 2-3**. The recommendations from the PAC and TAC were directed to the Steering Committee (SC).

Table 2-3
Summary of TAC/PAC Meetings during the 2014 South Region LWMP

Meeting Title	Meeting Date	Objectives
TAC/PAC Meeting #1	July 14, 2014	The purpose was to discuss the LWMP committee's terms of reference and provide an overview of the LWMP process and environmental impact study.
TAC/PAC Meeting #2	September 9, 2014	The purpose was to brainstorm and gather feedback from the TAC/PAC membership to assist AE in developing a long list of options to initiate the screening and evaluation process.
TAC/PAC Meeting #3	October 30, 2014	The purpose was to present an overview of the screening and comparative evaluation process, review the raw elements, and undertake a discharge option location screening exercise.
TAC/PAC Meeting #4	January 13, 2015	The purpose was to present an overview of the updated screening table of the short list of options and undertake a scenario development exercise.
TAC/PAC Meeting #5	Part a March 4, 2015 Part b March 5, 2015	Part a The purpose was to present the results of previous investigations to the committees and to engage the committee members in the triple bottom line analysis (TBL). The results of the TBL analysis were then carried forward to day two of the workshop, which included a TBL plus risk (TBL + R) analysis. Part b On Day two, the objective was to review the TBL analysis conducted on the previous day for the four scenarios, and to add the risk factors to the analysis. The committee would then be able to make a recommendation to the steering committee for a preferred south region wastewater management solution.

3 DESCRIPTION OF 2016 LWMP OPTIONS ANALYSIS

3.1 Overview of the Triple Bottom Line Methodology and Glossary of the Options

The desired goal for the Stage 1/2 South Region LWMP was for the CVRD, stakeholders, and the public to have confidence that all viable alternatives have been considered and evaluated in an unbiased, understandable, documented and defensible manner. The purpose of the process utilized throughout the CVRD's South Region LWMP was to conduct a thorough analysis, ultimately resulting in a preferred wastewater management scenario. The following sequence of events describes the step-wise process used to select the preferred scenario:

1. Achieve an understanding of the framework (i.e. the provincial and federal regulations) applicable to the LWMP
2. Collect the raw elements (including interests, ideas, values, and risks)
3. Organize the raw elements into discharge options for the proposed wastewater treatment facility (long list of options)
4. Identify any 'show stoppers' and screen the discharge options
5. Develop the short list of scenarios (a scenario is comprised of a collection and conveyance system, a wastewater treatment system, potential IRR opportunities, and a discharge location)
6. Conduct a comparative evaluation for the short-listed scenarios
7. Select the preferred wastewater management scenario

For Step 6, a structured Triple Bottom Line + Risk (TBL + R) evaluation process was used to optimize the delicate balance between social, environmental and economic considerations.

The TBL+R process is a comparative evaluation framework that combines familiar multi-criteria analyses with standard risk assessment methodologies. The key strength of this approach is the discussion it generates over a series of interactions between attributes, which ultimately enables stakeholders, First Nations, and the general public to develop evaluation criteria, weight these criteria according to their values, and then make comparisons between alternatives based on the information the analysis provides to them. The output from the TBL+R process illustrates the relative ranking of the alternative scenarios in a consistent and understandable format that accurately reflects the community's values. This approach also encourages contributions and input that will directly inform the decision-making process.

For each option, quantifiable metrics were developed (e.g. how many kilometers a truck is going to need to drive). From here, for each metric, the team developed weightings in a collaborative approach using input from the TAC/PAC. A score was assigned to each of the metrics for each option, and from here, a final score was attributed to each option. In addition, a risk assessment of the wastewater management scenarios was subsequently conducted to understand how the consideration of risk affected the TBL ranking.

The process is further illustrated by the graphic included in **Appendix B**.

3.2 Long List Discharge Options Overview

Nine wastewater discharge options were developed in 2014, which were based on previous studies as well as feedback received from the TAC/PAC. The discharge options are summarized in Column 1 of **Table 3-1**.

In order for high-level screening of the long list, each of the discharge options was evaluated based on screening categories. A detailed colour-coded table was developed for the purpose of documenting the high-level evaluation. The following categories were reviewed:

- Compliance with the MWR
- Other regulatory implications
- Wastewater treatment implications
- Social community aspects
- Archaeological considerations

Column 2 of **Table 3-1** summarizes the overall findings and decision made for each of the options on the long-list of discharge options. From the nine different discharge options, four scenarios were developed (Scenarios A through D).

Table 3-1
Summary of discharge options and screening exercise results

Discharge Option	Decision
1. Discharge to Baynes Sound	- Developed into Scenario A
2. Discharge to Strait of Georgia beyond Comox Bar (Sandy Island Marine Park)	- Developed into Scenario B
3. a. Discharge to Cape Lazo	- Eliminated by the Steering Committee due to redundancy of having twin outfall pipes side by side
3. b. Treatment in the South Region, conveyance of treated effluent to the CVWPCC to be combined with final effluent discharge to the outfall off Cape Lazo	- Developed into Scenario C
4. Connect to the existing Comox Valley Water Pollution Control Centre (CVWPCC)	- Although this option was under consideration by the TAC/PAC, it was eliminated by the Steering Committee because it involved conveyance of raw wastewater across the estuary - The governance of Comox Valley Sewerage Service did not have provision for sewerage service to Electoral Area A or to the Village of Cumberland. Board support to an amendment to the governance structure would have been required
5. Discharge to the Trent River or to Washer / Hart Creek	- Eliminated given the inability to meet the dilution requirements as set in the MWR and the In-stream Phosphorus objective set by the MOE
6. Ground Discharge to a single location	- Eliminated due to the insufficient land availability and capacity
7. Ground discharge to multiple locations	- Eliminated due to inadequate soil characteristics and water table conditions
8. Discharge to sub-surface ground (i.e. injection)	- Developed into Scenario D
9. Management and improvement of existing on-site systems	- Eliminated based on the feasibility of upgrading the existing on-site systems for full compliance

3.3 Short List Scenarios Overview

The short-listed discharge options were developed into the scenarios shown in **Table 3-2**. For all scenarios, collection and conveyance would be through eight pumps stations, separated into three phases.

The discharge locations for the shortlisted options are shown in **Figure 3-1.**

On the treatment side, all treatment options would be sited in the South Region and flows from the Village of Cumberland were included in the planning.

From a resource recovery perspective, all options could consider an energy recovery system and reuse of treated/reclaimed effluent.

Table 3-2
Shortlisted Scenarios for LWMP

	Scenario A: Discharge to Baynes Sound	Scenario B: Discharge to the Strait of Georgia	Scenario C: Discharge to Cape Lazo	Scenario D: Discharge to Ground at Depth
Treatment	- Advanced secondary treatment to produce high quality effluent	- Secondary treatment to meet the regulatory effluent requirements	- Advanced secondary treatment to produce high quality effluent	- Advanced secondary treatment to produce high quality effluent
Discharge	- Discharge to Baynes Sound	- Discharge to the Strait of Georgia beyond Comox Bar (Sandy Island Marine Park)	- Discharge to Cape Lazo through a shared/upgraded outfall with the CVWPCC	- 6 discharge wells, with approximately 300 m to 600 m spacing between each well
Resource Recovery Opportunities	- Beneficial reuse of biosolids from SkyRocket composting facility	- Beneficial reuse of biosolids from SkyRocket composting facility	- Beneficial reuse of biosolids from SkyRocket composting facility	- Beneficial reuse of biosolids from SkyRocket composting facility

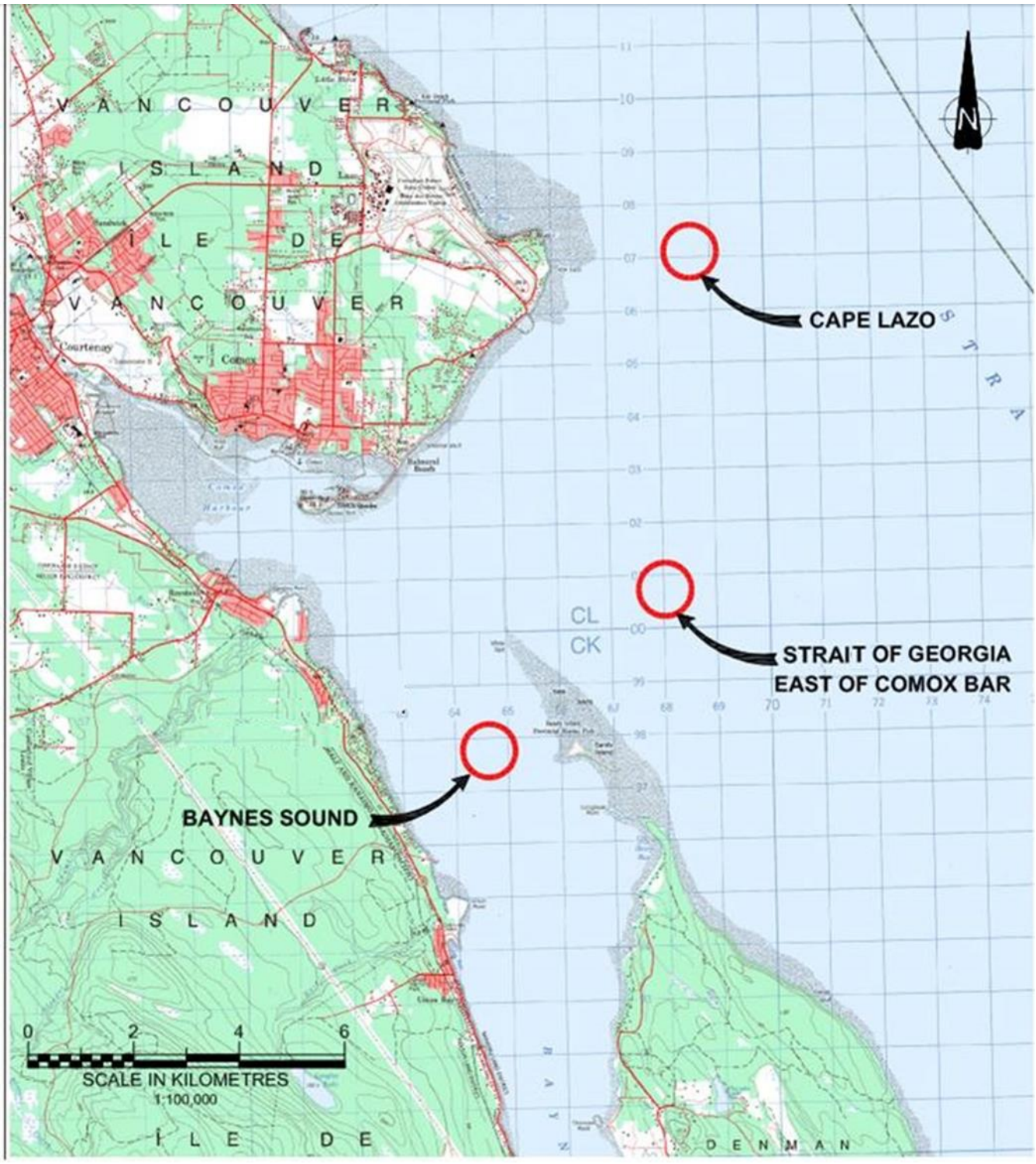

Figure 3-1
Marine Discharge Locations for the Short-Listed Scenarios (Scenario A = Baynes Sound; Scenario B = Strait of Georgia beyond Comox Bar (Sandy Island Marine Park); Scenario C = Cape Lazo; Scenario D = not indicated (ground discharge)

3.4 Evaluation and Selected Scenario

The TBL method required that quantifiable metrics be developed for use in the evaluation of options. **Table 3-3** summarizes the quantifiable attributes that were utilized in the Stage 1/2 South Region LWMP.

Table 3-3
Summary of Quantifiable Metrics Developed for the TBL Analysis

TBL Category	Quantifiable Attribute	Method of Quantification	Units
Environmental	Carbon footprint	Green House Gas (GHG) emissions associated with operations over an analysis horizon from 2019 to 2060	tonnes of Carbon Dioxide (CO_2) emissions
	Receiving environment loading	The sum of the anticipated ratio of the effluent to the influent concentrations for Biochemical Oxygen Demand (BOD_5), Total Suspended Solids (TSS), total phosphorus, and total nitrogen	Unitless
	Effluent dilution potential	The dilution ratio in the receiving environment at the edge of the Initial Dilution Zone (IDZ) as defined by the MWR	Dilution : 1
	Sensitive land and foreshore disturbance	Disturbed terrestrial and foreshore area in locations classified as 'sensitive ecosystems'	Area in m^2
Social	Residential area truck traffic	The number truck trips associated with transporting solids to the SkyRocket facility with operations over an analysis horizon from 2019 to 2060	Number of trucks
Economic	Life cycle costs	Total net present value of capital and O&M costs, as well as revenues from IRR opportunities to year 2060	2015 dollars
	Initial Phase 1 capital costs	Phase 1 (2018) Capital Costs for property, collection, treatment, and outfall	2015 dollars

In addition to the quantifiable attributes within the TBL framework, six risk factors (RF) were developed to address the stakeholder's concerns:

- RF 1: Need to address viruses in the short term
- RF 2: Need to address viruses in the long term
- RF 3: Need to address trace organic compounds in the long term
- RF 4: Need to address microplastics in the long term
- RF 5: Regulatory rejection
- RF 6: Schedule delay

For each Scenario, the RFs were evaluated as the product of the probability of such an event occurring and its severity should the event occur. The scoring included input from experts in the field (Brian Kingzett – Vancouver Island University) as well as local knowledge provided by the TAC/PAC members.

3.4.1 Weightings

Once the quantified attributes and the risk factors were presented to the TAC/PAC, the committee participated in an exercise that yielded an agreed-upon weighting for each of the criteria. The TAC/PAC were instructed to rate the main attribute (i.e. Environmental, Social, Economic, Risk) that is of most importance at 100. All other main attributes were to be rated in relation to the most important one. Similarly, within each main attribute, the sub-attribute that is of most importance was rated at 100. All remainder sub-attributes were weighted in relation to the most important sub-attribute.

Table 3-4 summarizes the weighting of the main attributes and the sub-attributes as adopted by the TAC/PAC. The Environmental and Risk categories were of most importance to the TAC/PAC. Within the Environmental Category, the Receiving Environment Loading was of the most importance.

Table 3-4
Summary of Weightings

Main Attribute	Sub-Attribute	Weighting	
Environmental		**100**	
	Carbon footprint		50
	Receiving environment loading		100
	Effluent dilution potential		100
	Sensitive land disturbance		60
Social		**40**	
	Residential area truck traffic		100
Economic		**70**	
	Life cycle cost (2018 to 2060)		100
	Initial capital cost (2018)		100
Risk		**100**	
	Risk Factor Consequence		100

3.4.2 Results

Figure 3-2 and **Figure 3-3** show the results of the TBL assessment without risk, and with risk, respectively. Risks associated with Scenario D were determined to be inherent (i.e. risks that could not be mitigated by design) and as a result, Scenario D was not shown in **Figure 3-3**, and this scenario was eliminated.

In addition, for the risk analysis (**Figure 3-3**), the Social category was removed (i.e. a total weighting = 0). Although the number of truck trips associated with Scenario B was greater than that associated with the remainder of the scenarios, the number of truck trips for all scenarios was agreed to be inconsequential over a time period of one year.

The modifications to the attributes and weightings resulted in a considerable change from the analysis that excluded consideration of risk. Based on the weightings agreed upon by the TAC/PAC, and the changes applied to the analysis, Scenario C (Discharge to Cape Lazo) had the highest score. This is attributed to the favourable scoring in the risk

category (shown by the size of the Red-coloured bar) and the Environmental Category (shown by the size of the Green-coloured bar).

Scenario A (Baynes Sound) scored highest until inherent risks were considered. The TAC/PAC expressed considerable concern over the short- and long-term risk to the shellfish industry in Baynes Sound including the potential for future international regulations that could hurt the shellfish industry. This was a key contributor to the collapse of social license for this option.

Notwithstanding the addition of the Risk category to the analysis (which was the most detrimental to Scenario A, the total score associated with Scenario A (discharge to Baynes Sound) trailed only slightly behind Scenario C. This is owing to Scenario A being the most economically feasible. Finally, Scenario B (discharge to the Strait of Georgia) had the lowest score due to its lower economic feasibility, and increased risk associated with the scenario.

On March 5, 2015, after five meetings over seven months, the TAC and PAC recommended discharge to the Strait of Georgia off Cape Lazo through a combined outfall with the existing Comox Valley Waste Pollution Control Centre (CVWPCC) as the preferred solution (Scenario C).

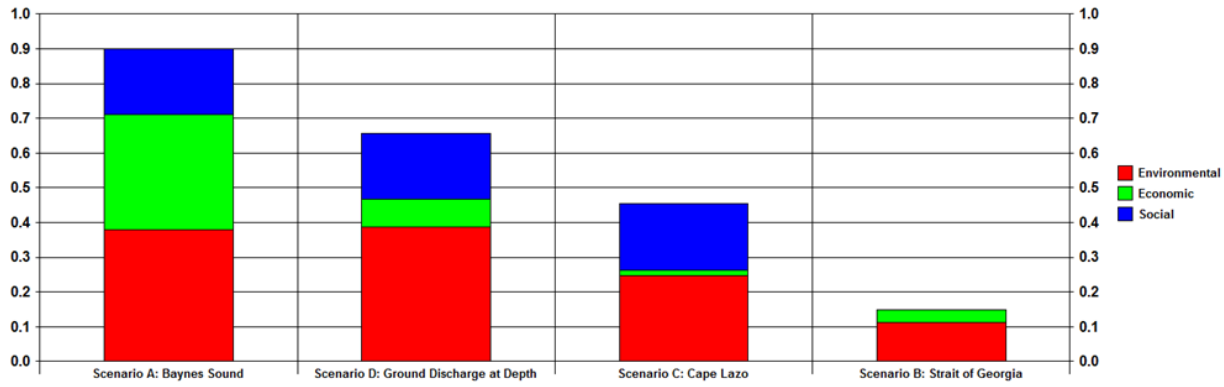

Figure 3-2
TBL Results (without risk metrics)

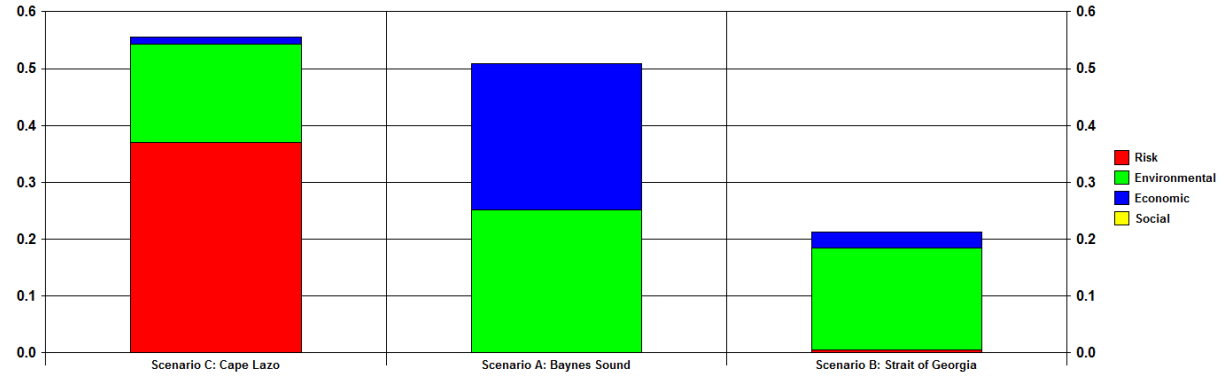

Figure 3-3
TBL Results (with risk metrics)

3.5 Capital Cost Overview

As part of the TBL analysis, capital and life-cycle costs for the different scenarios were developed for the four scenarios (**Table 3-5**). The estimates were developed in $CAD 2015 and at the time, it was recognized that the level of accuracy for the cost estimates was +/- 30%. Due to this level of precision, the attributes under the Economic category were determined to be not statistically different among the four scenarios. This resulted in a slightly lower weighting of the Economic category relative to the Environmental and Risk categories.

Table 3-5
Capital and Lifecycle Costs Developed during the 2014-2015 LWMP TBL Evaluation ($CAD 2015)

Criteria	Units	Scenario A	Scenario B	Scenario C	Scenario D
Life cycle cost (2018 to 2060)	2015 $	$163,910,000	$179,100,000	$183,320,000	$176,180,000
Initial capital cost (2018)	2015 $	$49,700,000	$58,850,000	$57,890,000	$57,770,000

4 TERMINATION OF LWMP PROCESS

Despite the collaborative approach taken on the LWMP, on June 18, 2016, a referendum for the South Sewer Project failed to achieve support of the electorate.

Following the referendum, extensive collaboration with the Comox Valley Sewage Commission has resulted in a revised proposal whereby untreated wastewater from the south region would be conveyed into existing Comox Valley Sewer Service infrastructure for treatment at the Comox Valley Water Pollution Control Centre and discharge via the Cape Lazo outfall, thus eliminating the need for a separate treatment plant in the south.

Concurrent to these efforts, the Comox Valley Sewer Service is part way through a LWMP process, being executed as a combined Stage 1 and 2 process. The final LWMP Stage 1 and 2 report outlining the preferred options for conveyance, treatment and resource recovery is expected to be submitted for provincial review this fall.

Through consultation with the BC Ministry of Environment and Climate Change Strategy, the decision was made to consider the extension of sewer services south through an addendum to the Comox Valley Sewer Service LWMP that is currently underway.

CLOSURE

This report was prepared for the Comox Valley Regional District.

The services provided by Associated Engineering (B.C.) Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,
Associated Engineering (B.C.) Ltd.

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Wastewater Process Engineer

Tom Robinson, M.A.Sc., P.Eng.
Project Manager

TR/fd

APPENDIX A – TAC/PAC MEMBERS

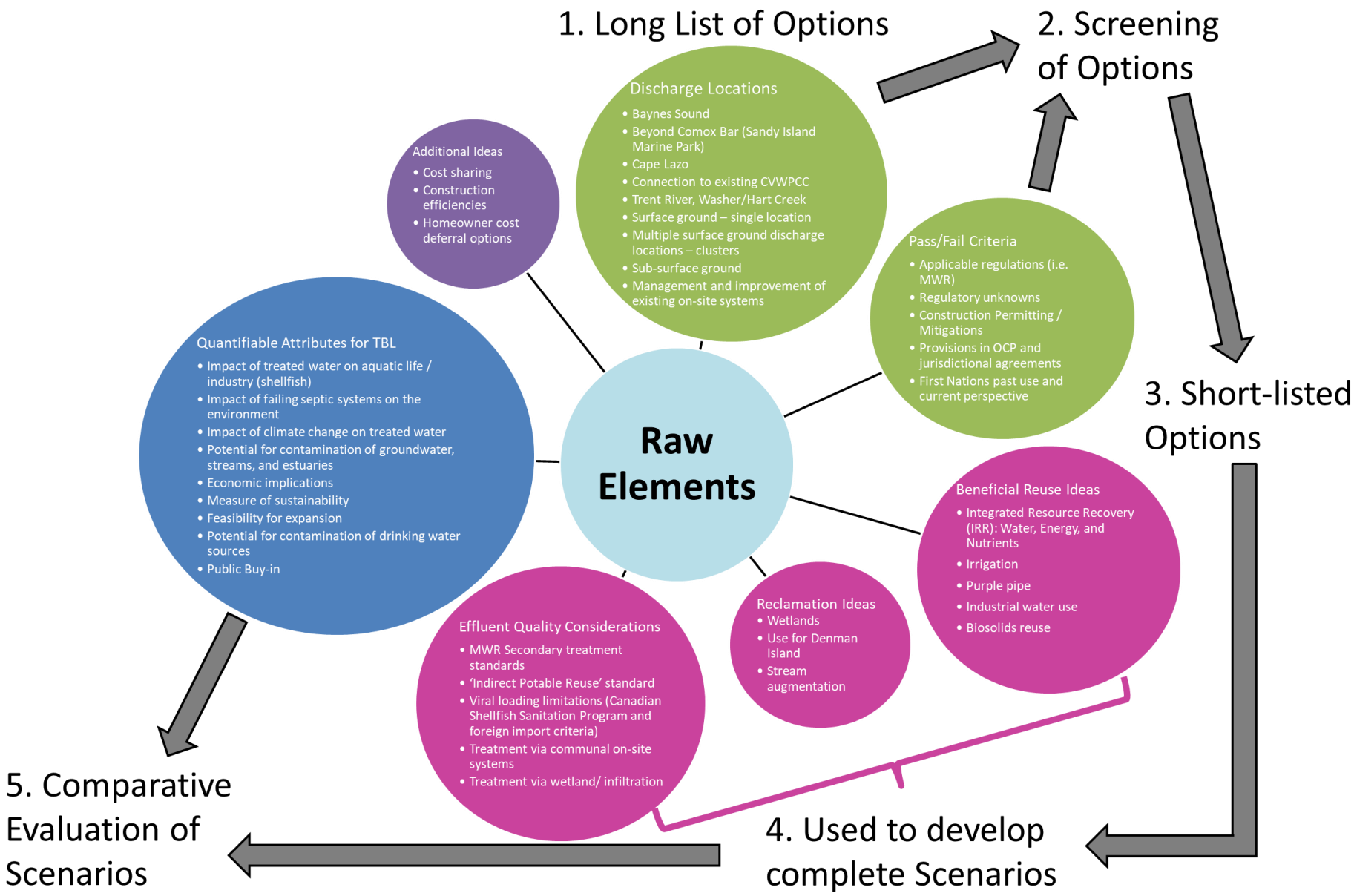
Table A-1
List of Technical Advisory Committee Members

Organization	Appointed	Alternate
Union Bay Improvement District	Alan Webb	Kevin Douville
Ministry of Community, Sport, and Cultural Development	Catriona Weidman	Brian Bedford
Island Health	David Cherry	Gary Anderson
Fisheries and Oceans Canada	Juanita Rogers	
Ministry of Environment	Kirsten White	
City of Courtenay	Lesley Hatch	Craigh Parry
Village of Cumberland	Rob Crisfield	Sundance Topham
Town of Comox	Shelly Ashfield	Glenn Westendorp
K'ómoks First Nation	Pam Shaw	Wilma Mack/Nicole Rempel
Island Trust	Rob Milne	Courtney Simpson

Table A-2
List of Public Advisory Committee Members

Organization	Appointed	Alternate
Resident, Royston	Alun Jones	
Resident, Union Bay	Anne Alcock	Bruce Livesey
Resident, Royston	Claudette Dlawse	
Comox Valley Environmental Council	Larry Peterson	
Underwater Harvesters Association	Grant Dovey	Mike Atkins
Friends of Baynes Sound Society	Phil Robertshaw	Norm Prince
BC Shellfish Growers Association	Roberta Stevenson	
Resident, Royston	Brigid Walters	
Resident, Kilmarnock, Union Bay	Susanna Kaljur	Rob Smith
Estuary Working Group	Wayne White	Bill Heath
Association of Denman Island Marine Stewards	Edina Johnston	
Resident, Denman Island	David Critchley	
Association of Denman Island Marine Stewards	Liz Johnson	David Graham

APPENDIX B – OVERVIEW OF THE SELECTION PROCESS GRAPHIC


1. Long List of Options
2. Screening of Options
3. Short-listed Options
4. Used to develop complete Scenarios
5. Comparative Evaluation of Scenarios
Raw Elements
Discharge Locations
• Baynes Sound
• Beyond Comox Bar (Sandy Island Marine Park)
• Cape Lazo
• Connection to existing CVWPCC
• Trent River, Washer/Hart Creek
• Surface ground – single location
• Multiple surface ground discharge locations – clusters
• Sub-surface ground
• Management and improvement of existing on-site systems
Additional Ideas
• Cost sharing
• Construction efficiencies
• Homeowner cost deferral options
Pass/Fail Criteria
• Applicable regulations (i.e. MWR)
• Regulatory unknowns
• Construction Permitting / Mitigations
• Provisions in OCP and jurisdictional agreements
• First Nations past use and current perspective
Quantifiable Attributes for TBL
• Impact of treated water on aquatic life / industry (shellfish)
• Impact of failing septic systems on the environment
• Impact of climate change on treated water
• Potential for contamination of groundwater, streams, and estuaries
• Economic implications
• Measure of sustainability
• Feasibility for expansion
• Potential for contamination of drinking water sources
• Public Buy-in
Beneficial Reuse Ideas
• Integrated Resource Recovery (IRR): Water, Energy, and Nutrients
• Irrigation
• Purple pipe
• Industrial water use
• Biosolids reuse
Reclamation Ideas
• Wetlands
• Use for Denman Island
• Stream augmentation
Effluent Quality Considerations
• MWR Secondary treatment standards
• 'Indirect Potable Reuse' standard
• Viral loading limitations (Canadian Shellfish Sanitation Program and foreign import criteria)
• Treatment via communal on-site systems
• Treatment via wetland/ infiltration