DISCUSSION PAPER

Comox Valley Regional District – South Region LWMP – Combined Stages 1 & 2

Discussion Paper 1 – LWMP Process Overview and Prior Investigations

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1 Introduction

Existing on-site sewage systems in the Royston and Union Bay areas of CVRD Electoral Area A, and the Cumberland wastewater treatment facility are experiencing failures that are impacting the surrounding environment and public health. In addition, the lack of servicing in the CVRD south region is constraining the future development potential of the K'ómoks First Nation territory. To address these issues, the CVRD and the Village of Cumberland are working with the K'ómoks First Nation to develop and implement a new wastewater collection, treatment, discharge and resource recovery system for the communities in the South Region.

2 Project Background

The CVRD's planning efforts, studies, and investigations over the years have established a sizeable body of knowledge about the wastewater management Infrastructure needs of the South Region. This work spans over 30 years, with the most recent work completed in 2012.

The following is a list of reports and investigations conducted to date:

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

The CVRD has elected to follow the BC Ministry of Environment's (MOE) Liquid Waste Management Plan (LWMP) process. The South Region LWMP will establish the planning framework for liquid waste management for the South Region and establish a new authorization to return reclaimed water to the receiving environment. The overall strategy set forth by the LWMP will replace existing private on-site septic systems and disposal fields in identified residential communities and provide wastewater collection, treatment, discharge, and resource recovery.

3 Plan Area

The plan area for the LWMP includes Electoral Area "A", excluding Denman and Hornby Islands. The initial LWMP will focus on sections of the plan area to be serviced by the proposed wastewater treatment plant, with the subsequent plan amendment addressing areas likely to remain on private on-site disposal systems for the foreseeable future. The Village of Cumberland is currently in the process of completing their own LWMP. The relationship between the two plans will be explained within each plan.

4 The LWMP Process Overview

4.1 REGULATORY FRAMEWORK

The following section outlines the provincial and federal regulations in the context of providing wastewater treatment to a municipality or regional district.

4.1.1 The BC Municipal Wastewater Regulation (MWR)

In April 2012, the BC MOE implemented the new Municipal Wastewater Regulation (MWR), replacing the Municipal Sewage Regulation (MSR). Compliance with the MWR provides local governments with authorization for treatment, reuse, and discharge of reclaimed water. The MWR prescribes the minimum standards of municipal wastewater quality, relating to Biological Oxygen Demand (BOD) and Total Suspended Solids (TSS).

BOD is a measure of the strength of organic material, relating to the quantity of oxygen required to breakdown organic matter by aerobic (requiring oxygen) microorganisms. TSS is a measure of the quantity of particulate matter present. The MWR maximum limits for both BOD and TSS in the treated effluent are 45 mg/L.

4.1.2 The Federal Wastewater System Effluent Regulations (WSER)

The federal government regulates municipal discharges under the Wastewater Systems Effluent Regulation (WSER) of the *Fisheries Act*. WSER specifies the conditions that must be met to deposit effluent containing deleterious substances, including requirements concerning toxicity, effluent monitoring, record keeping, and reporting. WSER requires a monthly average composite sample concentration of 25 mg/L for each of BOD and TSS.

4.1.3 The MOE's Vancouver Island Phosphorus Objective

In addition to the MWR, the BC MOE establish a new Vancouver Island Phosphorus Objective in 2012. This objective sets an average limit of 0.005 mg/L, and a maximum no greater than 0.010 mg/L for streams. This objective will only apply to non-marine effluent discharges being considered as part of the CVRD's LWMP.

4.1.4 The Canadian Environmental Assessment Act (CEAA)

New and expanded projects are subject to a federal Environmental Assessment (EA) under the Canadian Environmental Assessment Act (CEAA) if they meet the definition of a "Designated Project" in subsection 2(1) of CEAA (2012). A Designated Project is a "Physical Activity" that is:

- Carried out on federal land (e.g. land under federal jurisdiction such as a military base or Indian Reserve),
- Carried out by a federal government agency or
- Is listed in Schedule 1 of the federal Regulations Designating Physical Activities

Since the anticipated wastewater treatment facility would not be located on federal land, and the federal government is not the proponent, the only remaining applicable criterion for a federal EA would be if wastewater treatment facilities are listed in the Regulations Designating Physical Activities. Municipal wastewater treatment facilities are not listed; therefore the WWTF is not subject to federal EA under CEAA 2012.

4.1.5 The BC Environmental Assessment Act (BCEAA) and Federal EA Involvement

Wastewater projects may be subject to an EA under the BC Environmental Assessment Act (BCEAA) if they are either:

- A new facility that serves a population equal to or greater than 10,000 people or
- An expansion that would either serve 10,000 more people or increase the capacity by 30%.

However, new or expanded projects are excused from the BCEAA if the facility "is a component of a Municipal Liquid Waste Management Plan approved under the Environmental Management Act". The planned wastewater treatment facility is a component of a LWMP; therefore to achieve regulatory authorization an Environmental Impact Study (EIS) is required. Federal government involvement in EIS is typically limited to voluntary participation on the Public Advisory Committee, although BC Ministry of the Environment (MOE) may ask federal agencies (i.e. Fisheries and Oceans Canada and Environment Canada) to review the EIS report and provide comment.

4.2 THE LWMP PROCESS

In British Columbia, municipalities have two regulatory alternatives with respect to wastewater management. The first one requires registration under the Municipal Wastewater Regulation (MWR), with effluent compliance required at the project inception. The second alternative allows for a local government to undertake a LWMP, to develop the community's proposed wastewater management strategy. The latter approach constitutes a planning process involving stakeholders and the public, with the ultimate target of compliance with the MWR. The CVRD must ensure that all of the applicable regulations (federal and provincial) will be met following full implementation of the LWMP.

The LWMP 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 City's preferred wastewater management strategy. The CVRD has chosen to combine Stages 1 and 2 of the LWMP, in order to make use of prior investigations, and advance the LWMP process efficiently.

In support of the CVRD's proposed wastewater management strategy, a site-specific environmental impact study (EIS) of the receiving environment will be used to identify whether more stringent discharge quality criteria are needed than those set by the MWR. The EIS will be divided into two parts: a desktop review of available information and development the scope of further investigations required, the second part entails conducting those investigations (i.e. field sampling, modelling) and analyzing/presenting the results.

In addition to the technical work required to complete an LWMP, input from local First Nations, stakeholders, and the local public is required to guide the development of the LWMP so that it is consistent 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) will be establish and consulted throughout the LWMP process; their recommendations will be directed to the Steering Committee (SC).

The SC will have the authority to provide recommendations to the CVRD Board on matters pertaining to the LWMP. The CVRD LWMP Steering Committee receives input and recommendations from the TAC and PAC, provide guidance in response when necessary (i.e. if further investigations are required), in order to ultimately make recommendations to the CVRD Board.

The TAC is an advisory group that will consider technical information related to the LWMP Stage 1 & 2 and the EIS on behalf of the Steering Committee. It is the responsibility of the TAC to review and become familiar with the CVRD's LWMP process. The TAC will also provide input and feedback on relevant technical reports, discussion papers, and other documents provided by CVRD project staff and the Consultant.

The PAC is an advisory group who will consider public opinion related to the LWMP Stage 1 & 2 and the EIS on behalf of the Steering Committee. The PAC will also provide feedback on documents provided by the CVRD project staff and/or the Consultant. The PAC will have the authority to provide input and recommendations to the Steering Committee on matters pertaining to the LWMP.

5 Summary of Prior Investigations

The aim of this section is to meet the requirements of Stage 1 of the LWMP by providing a summary of the relevant engineering and science work done to date. The EIS Part 1 document will provide a separate desktop review and analyses of existing environmental data, leading to recommendations for the scope of the EIS Part 2.

5.1 WASTEWATER FLOWS AND LOADS

During the conceptual design of a new WWTP, population projections are used to estimate the flows and loads at the design horizon. Table 4-1 summarizes populations for Royston, Union Bay, and Cumberland, based on BC Stats census data from 2006 and 2010. Assuming 25% of the CVRD's population growth will occur in the South Region, the population was projected for 2035 and 2060 (Associated Engineering, 2011), also shown in Table 4-1.

Table 4-1
Population Projections for South Region Communities

	2010	2035	2060 (Ultimate)
Royston	1,570	3,060	4,550
Union Bay	1,290	2,510	3,735
Cumberland	3,250	6,330	9,415
Total	6110	11,900	17,700

Wastewater flows, shown in Table 4-2 were estimated based on the populations in Table 4-1 and a typical per-capita flow rate of 240 L/s. Typical WWTP flow factors for facilities of a similar size were also applied, as follows (Associated Engineering, 2011):

- Average Day 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

Table 4-2
Projected Wastewater Flows for Royston, Union Bay, and Cumberland

	2010	2035	2060 (Ultimate)
Sewered Population	6,110	11,900	17,700
Average Dry Weather Flow (ADWF) (m^3/d)	1,500	2,900	4,300
Average Day Flow (ADF) (m^3/d)	1,850	3,600	5,300
Maximum Month Flow (MMF) (m^3/d)	2,200	4,300	6,400
Maximum Day Flow (MDF) (m^3/d)	3,000	5,500	7,700
Peak Hour Flow (L/s)	50	100	150

Using typical constituent generation rates, the influent wastewater characteristics were estimated, and are presented in Table 4-3 (Associated Engineering, 2011).

Table 4-3
Estimated Wastewater Characteristics

Constituent	Average Day Flow	Wet Weather Flow
5-Day Biological 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

5.2 SOURCE CONTROL AND WASTE VOLUME REDUCTION

An effective source control program serves to protect wastewater conveyance and treatment infrastructure, the receiving environment, and the public, from inputs that may pose risks to the safety and proper operation of the system. One of the main objectives of Part 1 of the EIS is to develop a desktop study addressing source control measures. Part 1 of the EIS, when undertaken, will address these details further.

5.3 STORMWATER MANAGEMENT

Stormwater is water that collects in the piping infrastructure during wet weather (rainfall) events. There is no current service area. The collection system for the Village of Cumberland is a combined sewage and stormwater collection system. As a result, the flows originating from Cumberland are extremely high during high wet weather events (i.e. high precipitation). It will be Cumberland's responsibility to manage these high flows. As mentioned, the Village of Cumberland is developing a separate Stage 2 LWMP which should be referenced for further information.

5.4 WASTEWATER MANAGEMENT AND REUSE OPTIONS

5.4.1 Treated Water Discharge Options

Considerable study of municipal wastewater collection, treatment, and discharge within the CVRD has been conducted over the past 30 years. Work that was completed for the CVRD in 1979 provided rationale for alternative discharge locations for treated effluent that is no longer in keeping with current best practices. In general, three possible receiving environments exist for effluent disposal: ground, river/stream, and marine. The LWMP will confirm the discharge location.

5.4.1.1 Discharge into Ground

Ground disposal is a method of discharging treated water into a subsurface environment. Adequate soil conditions and available land are required to allow for effective infiltration into the ground.

Ground disposal was investigated on a number of occasions, most recently by Payne Engineering Geology as part of a study led by Koers and Associates (2005). Ground disposal was found to be unfeasible in the South Region due to limited land availability, low infiltration capacity, relatively high cost, need for extensive site investigations, and the possibility of polluting groundwater or surface water drinking water sources. This finding generally agreed with earlier work.

5.4.1.2 Discharge into Surface Waters

There are limited options for discharge to surface waters in the South Region. The most significant water courses are Hart/Washer Creek, which passes through Union Bay, and the Trent River, which flows through Royston. Both of these streams have low flows, especially during the summer season, which means that compliance with the minimum dilution requirements of the MWR would be challenging. At one time, consideration was given to Comox Lake, but this was subsequently discarded given the use of Comox Lake as a drinking water source (Stanley Associated Engineering Ltd., 1996).

Discharge to river/stream has two stipulations under the MWR. Disposal of effluent into a river/stream is prohibited if the dilution ratio is less than 10:1. Given the low flow of the neighbouring Trent River, this is not achievable. The second stipulation for discharge into a river/stream requires the discharge of reclaimed water meeting "greater exposure potential" requirements for stream flow augmentation. Hart/Washer Creek in Union Bay could be considered a viable location for stream augmentation.

In addition to the MWR, the MOE has introduced a new total phosphorus guideline for streams on Vancouver Island. The phosphorus limits set in this guideline would be difficult, if not impractical to achieve in a reliable and cost-effective manner with available technology (Associated Engineering, 2011).

5.4.1.3 Discharge into the Marine Environment

Based on work done previously, marine discharge appears to be the most feasible discharge solution for the CVRD.

Previous studies concluded that a safe marine discharge is feasible (Stanley Associates Engineering Ltd., 1996). Other reports investigated a submarine connection to the existing Comox Valley Water Pollution Control Centre (CVWPCC) / Cape Lazo Outfall (Koers and Associates, 2009, Komex International Ltd., 2005 & 2004).

Given the thriving shellfish, water quality in and around Baynes Sound is of extreme importance. To minimize the potential for impacting the shellfish habitat, three possible marine discharge locations were examined: Baynes Sound, Comox Bar, and Cape Lazo (Associated Engineering, 2011). Based on the findings of the comparative evaluation, a discharge into Baynes Sound emerged as the preferred scenario along with treatment providing very high-quality effluent meeting the requirements for reclaimed water with "unrestricted public access".

5.4.2 Wastewater Treatment System

The MWR prescribes a minimum standard of secondary treatment for discharges to the marine environment, as does the federal WSER. Secondary treatment is a broad term referring to the many different processes that provide biological treatment of municipal wastewater through the reduction of organic material and the removal of suspended solids from the effluent. The Comox Valley WPCC provides secondary treatment for Comox/Courtenay using a High Rate Activated Sludge (HRAS) process. At a minimum, the South Regional system will be required to meet secondary treatment requirements.

There are many different treatment technologies that can be utilized to provide secondary treatment. The objective of the LWMP is not to select the specific treatment technology or process, but rather to define the treatment objectives and ascertain that the discharge will not have an adverse impact on human health or the receiving environment.

The use of representative technologies during the LWMP reduces the possibility for specific technology bias, and will ultimately be used to develop cost estimates for evaluation and planning purposes.

5.4.2.1 Treatment Objectives

Previous studies completed for the CVRD investigated numerous options for the treatment technology and configuration to manage wastewater from the Royston/Union Bay Area. The reports examined a centralized treatment facility at the CVWPCC versus decentralized treatment facilities (McElhanney, 2011; Koers and Associates, 2009). The latter being the most widely accepted given that connecting to the existing CVWPCC system would require Royston/Union Bay to join Courtenay or Comox, or form a new municipality (Koers and Associates, 2005).

5.4.2.2 Treatment Technologies

Building on the Koers 2005 report, and contingent on the marine discharge location, Associated Engineering selected two secondary wastewater treatment technologies on which to base the concept design to support the 2011 work.

The first is Membrane Bioreactor (MBR) with Ultraviolet (UV) Disinfection. This combination was introduced as indicative technologies that could be expected to reliably meet the most stringent of the requirements presented in the MWR, specifically those prescribed for very sensitive receiving waters with low dilution availability and/or reclaimed water requirements in a location of significant exposure potential to the public.

Other technologies exist that could achieve secondary treatment quality, such as High-Rate Activated Sludge (HRAS) treatment with UV Disinfection. This application is comprised of a biological treatment system coupled with a clarification system, followed by pathogen inactivation (Associated Engineering, 2011).

Table 4-4 details the wastewater treatment configuration, detailing the indicative treatment technology and the discharge location developed by Associated Engineering in 2011.

Table 4-4
Summary of Indicative Treatment Technologies Selected for Marine Discharge Locations

Baynes Sound	Comox Bar	Cape Lazo
Membrane Bioreactor plus Ultraviolet Disinfection	High-Rate Activated Sludge plus Ultraviolet Disinfection is suitable for the higher dilutions predicted at this point of discharge	High-Rate Activated Sludge plus Ultraviolet Disinfection is suitable within the context of the existing Cape Lazo outfall

Baynes Sound	Comox Bar	Cape Lazo
Very high-quality effluent meeting the Reclaimed Water requirements for "unrestricted public access"; may require chlorination for some reuse applications	Similar treatment process as CVPCC but including disinfection of final effluent to reduce the levels of pathogens assumed to be present	Similar treatment process as CVPCC but including disinfection of final effluent to reduce the levels of pathogens assumed to be present
Reclaimed water would be suitable for the full range of resource recovery opportunities that the CVRD may wish to pursue for the South Region	Effluent would require tertiary filtration and chlorination to be suitable for the full range of resource recovery opportunities that the CVRD may wish to pursue for the South Region	Effluent would require tertiary filtration and chlorination to be suitable for the full range of resource recovery opportunities that the CVRD may wish to pursue for the South Region

Note: taken from Associated Engineering (2011) report, and based on the MSR, which was enforced at the time.

Other treatment technologies investigated previously have included solar aquatics technology (Union Bay Improvement District Liquid Waste Committee, 1998); sequencing batch reactors (SBR), rotating biological contactor (RBC), and oxidation ditches (Leslie Consultants Ltd., 2000); and fluidized/moving bed fixed-film reactor (Komex International, 2005).

Technology innovation has been substantial in the past few decades, shifting the attention to robust technologies such as MBRs with UV disinfection (Koers and Associates, 2009).

5.4.3 Resource Recovery

Wastewater should be thought of as "used" water, which contains important and valuable resources such as nutrients including nitrogen and phosphorus; energy in thermal, chemical and kinetic forms; and water itself.

Water resource recovery refers simply to the act of recapturing such renewable commodities for beneficial purposes. In its most basic form it produces clean water that can be re-integrated back into the watershed and hydrologic cycle from which it came.

Resource recovery opportunities will be integral to the South Region's LWMP. The overall design of the south sewer project will incorporate not only resource recovery opportunities that are feasible or economically viable today, but those that could become so in the future. For this reason, the system should be designed to enable, and not preclude, additional opportunities that could develop in the future.

A number of resource recovery initiatives have already been investigated, including direct energy recovery, heat recovery and reuse, nutrient recovery and water reclamation. Hydroelectric energy can be recovered from Cumberland wastewater, owing to the hydrostatic head available from this flow. Heat recovery from reclaimed water has become a standard design approach in recent years, for heating and cooling of the WWTP facility buildings at a minimum. When excess heat becomes available, the CVRD is also interested in partnering provision of heat to a third-party. Reclaimed water can also be made available for domestic purposes. In addition, reclaimed water provides additional nutrients for irrigation. Nutrients recovered in the biosolids will become an additional feed stock for the CVRD's SkyRocket Composting Facility. Waste heat from the SkyRocket Facility could also be recovered and reused.

The Water Environment Federation (WEF) is the North American leader on emerging water issues, and works to build the public's understanding and support of water's value and importance, and support clean and safe water worldwide. Valuable information on water reclamation and resource recovery initiatives can be found at their website, http://www.wef.org.

6 References

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