



REGIONAL
DISTRICT
OF NANAIMO



2018 Annual Report

Liquid Waste Management Plan

Submitted to the Ministry of Environment and Climate Change Strategy
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1) Introduction

Wastewater treatment is necessary to protect our water resources. The Regional District of Nanaimo (RDN) operates four wastewater treatment facilities to serve 118,000 people on sewer:

- Greater Nanaimo Pollution Control Centre (GNPCC)
- French Creek Pollution Control Centre (FCPCC)
- Nanoose Bay Pollution Control Centre (NBPCC)
- Duke Point Pollution Control Centre (DPPCC).

Property owners not connected to sewer, largely those residing in rural areas and island communities, are responsible for their own wastewater treatment and often use privately-owned septic and onsite systems (septic systems). A small number of properties are authorized by Island Health (VIHA) to use pump and haul services and the RDN receives and treats holding tank waste from these properties as well as septage from pumped septic tanks.

The RDN Liquid Waste Management Plan (LWMP) is the region's long-range plan to manage wastewater. It is a commitment to manage wastewater in a manner that aligns with the provincial Municipal Wastewater Regulation and forms our Authorization to Discharge along with Permits and an Operational Certificate.

The RDN's original LWMP was approved in 1999. The current LWMP was approved by the Minister of Environment on October 30, 2014. Annual reporting is a requirement of an approved LWMP. This report was prepared by RDN staff, with the oversight of the LWMP monitoring committee, to document LWMP implementation in 2018 and summarize progress since approval of the LWMP.

An independent audit of the LWMP is scheduled for every five years. The first audit will be completed in 2020 for the previous five years and the final two months of 2014.

2) Approval Conditions

The current LWMP was approved by the Minister of Environment with two conditions.

Condition #1 states:

Within 30 days of receipt of this letter, provide terms of reference, plan and schedule for completion of Stages 1 & 2 of an Environmental Impact Study for each of the GNPCC, NBPCC and French Creek Pollution Control Centre (FCPCC) sewage treatment and disposal facilities.

Condition #2 states:

By January 31, 2015, provide the Environmental Impact Study for the marine portion of the GNPCC outfall replacement project.

The RDN fulfilled the conditions and responded to the Ministry of Environment (the Ministry) regarding Condition 1 on November 24, 2014, and regarding Condition 2 on January 30, 2015. Copies of letters to the Ministry are included in the 2014 Annual Report.

3) Meetings

3.1 LWMP Monitoring Committee

The Ministry of Environment’s Interim Guidelines for Preparing Liquid Waste Management Plans recommend that LWMP monitoring begin shortly after the approved plan implementation begins, once the scope of work for the monitoring committee has been defined and committee members have been established.

The LWMP Monitoring Committee was established in 2015 and meetings were held on:

- June 1 and October 16, 2015
- February 3, March 29, June 21, and October 18, 2016
- March 17, June 12, and November 2, 2017
- May 17 and October 16, 2018.

Meeting agendas and minutes are available at www.rdn.bc.ca/liquid-waste-management-plan.

3.2 W3C Meetings

RDN staff meet biannually with staff from the City of Nanaimo, District of Lantzville, City of Parksville and Town of Qualicum Beach to advance regional programs and policies related to the LWMP. Meetings are called the Wastewater and Water Collaborative Meeting (W3C).

W3C meetings were held on:

- April 15 and October 16, 2014
- March 12 and September 25, 2015
- March 4 and September 30, 2016
- April 21 and September 22, 2017
- March 2 and September 14, 2018.

Minutes from meetings held in 2018 are attached in Appendix A.

4) Program Implementation

The LWMP organizes specific commitments into ten programs. The ten LWMP Programs are:

1. Public Wastewater Systems Program
2. Private Onsite Systems Program
3. Source Control Program
4. Odour Control Program
5. Rainwater Management / Drinking Water & Watershed Protection (DWWP) Program
6. Volume Reduction Program

7. Inflow & Infiltration (I&I) Program
8. Pollution Control Centres Program
9. Resource Recovery Program
10. Biosolids Program

Within each program are objectives, targets and actions. Program objectives are the long-range goals. Targets are ten-year commitments that measure progress towards the objectives. Actions are incremental strategies designed to achieve the target.

4.1 Highlights

Key accomplishments towards LWMP implementation in 2018 include:

- Continued to inform residents of major projects and key initiatives via numerous resource tools such as the website, newspaper ads, newsletters, letters to residents, education programs, open houses, etc.
- Continued with construction of the GNPCC Secondary Treatment Upgrade Project. Construction will continue through 2019.
- Completed year 2 of the 2017-2019 GNPCC Receiving Environment Monitoring Program.
- Began detailed design of the FCPCC Expansion and Odour Control Upgrade Project.
- Beneficially reused 4,945 tonnes of biosolids.
- Finalized detailed design and submitted applications for permits and approvals for Bowser Village Centre Wastewater Project.
- Delivered four SepticSmart workshops to a total of 121 participants.
- Continued the Septic Maintenance Rebate Program which, has stimulated an investment of about \$1.4 million to maintain septic systems in the region since 2014.
- Held two LWMP Monitoring Committee meetings.
- Held two W3C meetings to advance LWMP implementation.
- Commissioned an advisory memorandum on Emerging Substances of Concern (ESOCs) and microplastics, attached in Appendix B.

Table 1 is adapted from Table 12 of the 2014 LWMP and outlines progress towards key non-capital LWMP deliverables. Table 2 is adapted from Table 13 of the 2014 LWMP and outlines key capital projects. A detailed summary of program implementation is provided in Sections 4.2 through 4.11.

Table 1. Cost Estimates and Timelines for Key Non-capital LWMP Deliverables

Program	Deliverable	Cost Estimate	Target / Completion Date
Public Wastewater Systems	Village Centre Review	\$10,000	Complete in 2013
	Review and update DCC bylaws where necessary	\$49,000	Complete in 2017

Program	Deliverable	Cost Estimate	Target / Completion Date
Private Onsite Systems	Mandatory Maintenance Feasibility Study	\$15,000	Complete in 2012
	Revise Pump & Haul Bylaw (No. 975)	\$2,000	Complete in 2017
Source Control	Enhanced Public Education Program	\$10,000	<ul style="list-style-type: none"> • Ongoing, in 2017 the RDN partnered with Metro Vancouver to share the “Don’t Flush Wipes” campaign • In 2018 Wastewater Services invested over \$5,000 to update public education material to align with the RDN 2018 Graphic Standard
Odour Control	Review the odour management system at GNPCC	\$15,000	<ul style="list-style-type: none"> • Complete in 2013 • An odour control strategy was finalized 2017 in the 100% design report for the GNPCC Secondary Treatment Upgrade Project
Rainwater Management	Revised Rainwater Management Strategy	\$15,000	In progress. Developing strategy with partners
Volume Reduction	Study of overflow potential and elimination strategies	\$10,000	The Nanaimo Interceptor Hydraulic Modeling Study was completed in 2017
Inflow and Infiltration	CCTV monitoring of the GNPCC Interceptor	\$15,000	Sections of the GNPCC interceptor are CCTV monitored annually. In 2018 the RDN CCTV monitored three siphon lines at Maffeo Sutton Park
	CCTV monitoring of the FCPC Interceptor	\$23,000	FCPC interceptor is CCTV monitored every 5 years. In 2018, 3.7 km of inspected by CCTV (manholes 40-24 in Qualicum Beach; manholes 36-29 in Parksville)
	Set up an I&I monitoring function for FCPC and GNPCC	n/a	FlowWorks data are reviewed regularly. Catchments with high flows are further investigated by municipal staff as needed
	I&I Study	\$15,000	The City of Nanaimo completed an Inflow and Infiltration Reduction Strategy in 2018.

Program	Deliverable	Cost Estimate	Target / Completion Date
Biosolids	Biosolids Management Plan	\$15,000	A Biosolids Management Plan was completed in 2011. A Biosolids Options Study was completed in 2016. A Site Optimization Study was completed in 2018.
Resource Recovery	Resource Recovery Options Study	\$25,000	Resource recovery options were considered in the GNPCC Secondary Treatment Upgrade Project engineering design, completed in 2016.
Emerging Issues	Climate Change Vulnerability Study	\$15,000 (\$150,000 grant awarded to the RDN)	A Sea Level Rise Adaptation Study for the RDN is underway: <ul style="list-style-type: none"> • 2015: a Terms of Reference was completed • 2017: the RDN acquired the LIDAR data (with a \$10,000 contribution from Wastewater Services) • 2017: the RDN was awarded a \$150,000 grant to acquire coastal floodplain mapping • 2018-2019: Phase 1 of the Sea Level Rise Adaptation Study is underway • 2019: Phase 2 of the study is scheduled to begin • See Section 5.4 for more information.
LWMP	5-year Audit	\$5,000	First audit will be completed in 2020 for 2015-2019.

Table 2. Cost Estimates and Timelines for Major Wastewater Capital Projects

Service Area	Major Capital Projects	Cost Estimate	Target Completion
GNPCC	Outfall Replacement	\$18,000,000	Complete in 2016
	Maintenance and Storage Facilities	\$2,200,000	2019 (revised from 2018)
	Digester #2 Refurbishment	\$1,400,000	2019 (revised from 2018)
	Centrifuge 2 and Polymer System	\$1,400,000	2019 (revised from 2018)

Service Area	Major Capital Projects	Cost Estimate	Target Completion
	Primary Headworks	\$3,400,000	2019 (revised from 2018)
	Odour Control Upgrades	\$2,200,000	2019 (revised from 2018)
	Secondary Treatment ^a	\$81,700,000	2019 (revised from 2018)
	Departure Bay Pump Station Upgrade	\$2,400,000	2016-2023
	Departure Bay Forcemain Replacement and Expansion	\$18,000,000	Monitor
FCPCC	Reversal of the air flow through the trickling filter	\$600,000	Complete
	Seacrest Place forcemain repairs	\$660,000	Complete
	Lee Road Pump Station Expansion and Upgrade	\$659,000	Complete
	Grit Channel Expansion	\$677,000	Complete
	Outfall repairs	\$600,000	Complete
	Hall Road Pump station upgrade	\$900,000	Complete
	Increasing effluent pumping capacity	\$350,000	2018-2025
	Commission 5th digester cell	\$200,000	2018-2025
	Chemically Enhanced Primary Treatment works	\$930,000	2018-2025
	Interceptor / pump station expansion	\$5,000,000	2025
	Treatment plant capacity expansion, outfall replacement	\$32,000,000	Expansion is scheduled for completion in 2022 (Updated from 2018-2025)
NBPCC	Odour management improvements at outfall manhole	\$10,000	Complete
	Secondary Treatment for 2,000 residents ^{b,c}	\$4,100,000	2023

Service Area	Major Capital Projects	Cost Estimate	Target Completion
DPCCC	No major changes planned	–	–

NOTE: a. The 2014 LWMP provided a Class C cost estimate of \$67,500,000 and an estimated 2018 completion date
b. Cost estimates provided by AECOM (2012)
c. 2012 dollars

4.2 Public Wastewater Systems

Public wastewater systems, or community sewer systems, are wastewater collection, treatment, and disposal systems owned and operated by the RDN or a municipality. According to the Regional Growth Strategy and Official Community Plans (OCPs), public wastewater systems may be provided a) within a municipality, b) within growth containment areas or c) adjacent to growth containment boundaries where there is a threat of public health or the environment from failing septic systems. Generally speaking, the provision of public wastewater systems is not supported in rural areas.

Objectives of the LWMP Public Wastewater Systems Program are to:

- 1) address OCP goals of providing wastewater services in growth containment areas, and
- 2) reduce the threat to human and environmental health from failing onsite systems.

Table 3 summarizes progress towards the LWMP commitments.

Table 3. Public Wastewater Systems Program Commitments

Target: A strategy to achieve wastewater servicing in growth containment areas	
Commitment	Progress
i. A study to identify Village Centres with the development potential to warrant an investment in wastewater infrastructure	A Rural Village Centres Study was completed in 2013. It concluded that Cedar Village has the greatest potential to develop as a complete community with an investment in sewer. Bowser, Red Gap, Coombs, and Fairwinds were ranked second (Fairwinds is already serviced by sewer)
ii. Complete sewer servicing engineering studies for Bowser and Cedar villages	In 2014, the RDN dedicated \$350,000 in Gas Tax Funds to complete sewer servicing studies for Bowser Village and Cedar Village. <ul style="list-style-type: none"> • The <i>Capacity and Cost Review of the Duke Point Pollution Control Centre</i> (for Cedar Village Centre sewer servicing) was complete in 2016 and was included in the 2016 Annual Report. • In 2017, the RDN completed the Bowser Village Sewer Servicing Study • In 2017, the RDN was awarded a Clean Water and Wastewater Grant of \$7,590,328 to complete design of a disposal option and construct the treatment plant, collection

	<p>system and outfall for the Bowser Village Centre Wastewater Project</p> <ul style="list-style-type: none"> • In 2017, the RDN adopted bylaws establishing the Bowser Village Sanitary Sewer Service and its funding mechanisms • In 2018, the RDN updated the collection system and treatment plant design; started submitting the applications for regulatory permits and approvals; continued communicating with First Nations; investigated alternate outfall routes and began detailed design of the marine outfall.
iii. Coordinate with Development Services through the OCP review process to identify property owners in growth containment boundaries who are interested in establishing public wastewater services	<p>Wastewater Services participates in the OPC process as they occur:</p> <ul style="list-style-type: none"> • Area H OCP review 2015 to 2017 • No OCP reviews occurred in 2018

Target: A strategy to achieve wastewater servicing for properties with failing private onsite systems

Commitment	Progress
i. Draft a bylaw to allow properties with failing onsite systems to connect to sewer services, where available	Requires an update to several sewage rates and regulations bylaws. This will be addressed in a larger bylaw review project.
ii. Improve public awareness of areas which may connect to RDN sewer systems for health and environmental reasons (failing onsite system) and create a guide which walks homeowners through the sewer connection application process	Still to come. Requires completion of bylaw update, above.
iii. Work with property owners, as needed, in locations where there are known onsite system failures to establish connections to public wastewater infrastructure	Ongoing, as needed
iv. Develop a webpage to inform the public of historic sewer servicing studies and of the criteria for the provision of future sewer services.	A website was developed in 2015 for the Bowser Village Sewer Servicing Study. In 2017, the site was upgraded to the RDN Get Involved platform hosted at getinvolved.rdn.ca/bowser-village-sewer

4.3 Private Onsite Systems

Approximately 12,000 homes in the RDN use onsite systems, often called septic systems, to treat wastewater. Septic systems are regulated provincially by the Ministry of Health and Island Health. Property owners are responsible for ensuring their septic system is properly maintained. While the RDN does not have jurisdiction over private onsite systems, the RDN offers a public education program called

SepticSmart to empower property owners with care and maintenance tips to maximize the healthy operation of their septic system¹.

The objective of the LWMP Private Onsite Systems Program is to protect the environment and human health from failing private onsite systems.

Table 4 summarises progress towards the LWMP commitments.

Table 4. Private Onsite Systems Program Commitments

Target: Enhance the SepticSmart education program content to encourage regular onsite system maintenance with the intent of prolonging the life of functioning systems and reducing the number of failing systems	
Commitment	Progress
i. Annually review the SepticSmart education program; update where necessary	Ongoing. The Septic Maintenance Rebate Program was added in 2014 and is revised annually. See Section 4.3.1 for more information
ii. Enhance the source control component of the SepticSmart program	Ongoing. Updates to the workshop component of SepticSmart were completed in 2013
iii. Work with VIHA and Water Services to develop area-specific communications or newsletters for areas at high risk for groundwater contamination	A SepticSmart newsletter was sent to electoral area residents in 2014, 2016, 2017 and 2018
iv. Host at least four SepticSmart education workshops annually	In 2018, 121 people participated in one of four workshops held on April 5, April 12, April 26 and May 2. Since 2008, more than 1,500 people have attended an RDN SepticSmart workshop
v. Evaluate the potential for a mandatory onsite system maintenance program in the RDN	A Mandatory Maintenance Feasibility study was completed in 2012. A Mandatory Maintenance program was not supported by the RDN Board, which carried a motion instead to continue with an educational role through the existing SepticSmart program
Target: At the request of the owner, allow RDN acquisition of privately owned onsite systems which serve a minimum of 60 parcels	
Commitment	Progress
i. Work with Development Services to adopt draft changes to Land Use and Subdivision Bylaw (No. 500) which would enable the RDN to acquire privately-owned onsite systems serving at least 60 parcels, if petitioned	Still to come
Target: Limit holding tanks in the RDN	
Commitment	Progress
i. Review and revise the Pump & Haul Local Service Establishment Bylaw (No. 975) and the Sewage	A review of the trucked liquid waste and pump & haul bylaws began 2015 to clarify the role of

¹ The RDN also treats septage that is pumped from a septic tank and trucked to one of two RDN septage receiving facilities.

Disposal Regulation Bylaw (No. 1224) so only grandfathered properties and properties with failed onsite systems qualify for the septage receiving rate reduction	Wastewater Services and to make the service delivery more efficient. Pump and Haul is now regulated under Bylaw No. 1732 which was adopted in January 2017. Repeal of Bylaws No. 975, 988, 1217, and 1224 occurred in 2017. Key points are summarized in the 2016 Annual Report.
ii. Work with VIHA and Building Inspection Services to limit holding tanks on new developments.	Still to come

4.3.1 Septic Maintenance Rebates

In September 2014, the RDN launched the Septic Maintenance Rebate program with the goals of

1. making it easier for residents to manage their septic system maintenance
2. promoting long-term maintenance habits, and
3. maximizing the longevity of existing onsite systems.

In 2018, the RDN provided over \$33,000 in Septic Maintenance Rebates to help residents maintain their septic systems. Rebates were offered in the following four categories:

- Category 1: Distribution Box (maximum rebate of \$200)
- Category 2: Riser Installation (maximum rebate of \$300)
- Category 3: Effluent Filter Installation (maximum rebate of \$100)
- Category 4: Replace a Malfunctioning System (\$600 flat rate).

A bonus rebate increased the maximum rebate amount by up to \$100 for applicants who attended a SepticSmart workshop.

The RDN rebate covered 75% of eligible expenses, to a maximum amount, for Category 1, 2, 3, and the Bonus. The RDN provided a flat rate for Category 4.

From 2014 to 2018, the program stimulated an investment of \$1,400,000 to maintain septic systems in the region. The breakdown of the investment is as follows:

RDN Investment	\$150,000
WCOWMA-BC Investment ²	\$17,000
Homeowner Investment	\$1,233,000
TOTAL	\$1,400,000

Applications to the Septic Maintenance Rebate program have come from every electoral area plus the City of Nanaimo, City of Parksville and District of Lantzville.

² In 2014 and 2015, the RDN partnered with the Western Canadian Onsite Wastewater Management Association of BC (WCOWMA-BC) to deliver the septic maintenance incentive program. For the two years, WCOWMA-BC contributed \$8,500 each year to boost the SepticSmart incentive program. After 2015, the RDN continued the rebate program funded entirely from revenue generated from septage receiving fees.

4.4 Source Control

Preventing pollution before it happens is called Source Control. Source control is one of the most effective and economical ways to protect the environment and our natural resources. It also lessens the cost to maintain wastewater infrastructure.

The Source Control Program objective is to reduce contaminants at the source to improve the quality of influent, effluent and biosolids. Progress towards the LWMP commitments is summarized in Table 5.

Table 5. Source Control Program Commitments

Target: Enhance regional source control through a single unified bylaw similar to the Sewer Use Regulatory Bylaw (No. 1225) or through consistent municipal bylaws	
Commitment	Progress
i. Work with the municipalities to develop similar source control bylaws or adopt a single bylaw	The W3C Source Control working group formed in 2015, in part to advance regional source control. Regional Sewage Source Control Bylaw No. 1730, 2015 and Bylaw Enforcement Ticket Regulation Amendment Bylaw No. 1418.04, 2015 were adopted on November 24, 2015 and replace Bylaw No. 1225, and include updated and improved contaminant restrictions, user fees for waste discharge permits. Legal advice regarding the use or reference of Bylaw 1730 by each of the RDN's member municipalities was provided to municipal wastewater staff in 2016
ii. Amend the Trucked Liquid Waste Disposal Bylaw (No. 988) to allow marinas to apply for reduced holding tank waste disposal rates if they provide free pump-out services to discourage marine dumping	Trucked Liquid Waste Bylaw No. 1732 was adopted in January 2017 and allows a reduced rate of \$0.01/gallon for holding tank waste from marine sewage reception facilities, with approved application. Bylaw No. 1732 repealed and replaced Bylaw No. 988.
iii. Work with municipalities, marinas, and/or harbour authorities to accept wastewater from marine vessels as opportunities arise	The RDN accepts wastewater from BC Ferries' ships docking at the Departure Bay, Gabriola Island and Duke Point terminals. In 2016 the RDN began accepting wastewater from Seaspan vessels.
Target: Enhance the education and outreach strategy, as required	
Commitment	Progress
i. Collaborate with other RDN departments to promote pollution prevention strategies	In 2013, the RDN (led by Wastewater Services) launched a unified outreach website called "RDN Get Involved" with a goal of promoting RDN outreach strategies including pollution prevention. In 2017, the RDN Get Involved program was replaced with a new platform at www.getinvolved.rdn.ca .

ii. Liaise with other local governments to share source control strategies	<ul style="list-style-type: none"> • Source control is addressed at the W3C meetings held on: <ul style="list-style-type: none"> ○ April 15 and October 16, 2014 ○ March 12 and September 25, 2015 ○ March 4 and September 30, 2016 ○ April 21 and September 22, 2017 ○ March 2 and September 14, 2018 • In 2018, Wastewater Services began participating in the new BCWWA Source Control Community of Practice meetings.
iii. Promote source control through the SepticSmart program	SepticSmart continued promoting source control in 2018.
iv. Encourage green boating practices	Still to come
v. Target the outreach program on RDN residents, medical clinics, the hospital, and businesses to address pharmaceuticals, personal care products, organics, fat, oil, grease, and I&I	The RDN teams with the BC Pharmacy Association to encourage residents to take part in the BC Medications Return program, which allows for the return of medication to participating pharmacies. On May 17, 2016, the RDN and the BC Pharmacy Association issued a joint media release on the topic of safe disposal of unused medications.
vi. Partner with RDN community members with an interest in promoting source control (e.g. non-governmental organizations; local stewardship groups)	Progress is ongoing. From March 10 to April 21, 2018, RDN Team WaterSmart hosted events and activities for “Water to Earth month”. This included workshops on topics related to water conservation and watershed protection, field trips and steam walks. Community partners co-hosted many of the events alongside RDN Team WaterSmart.
vii. Consider publishing regular articles (e.g. newspaper or Regional Perspectives) promoting source control	In 2018, the RDN began publishing monthly advertisements in the local newspapers. Since then, the ads have included information on rebates, SepticSmart workshops, water conservation, and open house opportunities.
viii. Update the RDN website information on source control	ONGOING – rdn.bc.ca/pollution-prevention is updated periodically
Target: Monitor wastewater influent	
Commitment	Progress
i. Monitor influent and biosolids quality and review discharge permits to assess potential contaminant sources	<ul style="list-style-type: none"> • Biosolids quality is monitored and reviewed regularly according to the Organic Matter Recycling Regulation
ii. Work with RDN Bylaw Services to provide enforcement as needed.	As needed. No incidents required bylaw enforcement in 2018.

4.5 Odour Control

Odours refer to nuisance odours emitted by wastewater treatment facilities and associated interceptors, pump stations, outfalls, and other RDN wastewater collection and treatment infrastructure. Odour is managed at all wastewater facilities.

The Odour Control Program objective is to reduce nuisance odours from RDN wastewater infrastructure, including the wastewater treatment plants and associated facilities. Progress towards the LWMP commitments is summarized in Table 6.

Table 6. Odour Control Program Commitments

Target: Maintain and upgrade equipment so <10 nuisance odour complaints are made per facility per year	
Commitment	Progress
i. Continue using current odour control measures; consider new control technologies as required	Ongoing
ii. Address odour at Bay Ave Pump Station	Completed 2011
iii. Replace biofilter media at GNPCC and FCPC	Completed 2011 at GNPCC Completed 2012 and 2018 at FCPC
iv. Reverse the air flow through the trickling filter at FCPC	Completed 2012
v. Install ion generators at Hall Road and Chase River Pump Stations	Completed 2011 & 2012
vi. Review the odour management system at GNPCC to identify potential improvements	Completed 2013
vii. Complete improvements to the NBPC outfall manhole odour management system	Completed 2013
viii. Incorporate odour controls into the design phase of future capital works projects including upgrade of GNPCC, NBPC and expansion of FCPC	<ul style="list-style-type: none"> The GNPCC Secondary Treatment Upgrade Project will improve the odour control system with the intent that odours will be undetectable outside the property boundary. Upgrades include carbon scrubbers for the headworks and dewatering building bin loading area; new synthetic media biofilters for the primary tanks and thickeners; and covers over the primary sedimentation tank weirs. Detailed design of the FCPC expansion began in 2018 and the project will include a significant odour control upgrade. The RDN has also partnered with Vancouver Island University who will use sophisticated equipment to fingerprint FCPC's current odour emissions and recommend odour control strategies.
ix. Seek resident input before upgrading or expanding facilities	<ul style="list-style-type: none"> The RDN completed extensive public consultation during the LWMP amendment process and continues to seek input through

- open houses, public meetings and through the LWMP Monitoring Committee.
- The RDN offered open houses specific to the GNPCC upgrade before the construction tender was awarded in early 2017 for the Secondary Treatment Upgrade Project. Open houses were held on February 10th and 11th, 2015, July 8, 2015 and June 11, 2016.
- The RDN offered an open house at FCPC on May 9, 2015, April 30, 2016, and June 2, 2018.

Target: Investigate, document, and respond to odour complaints within 24 hours	
Commitment	Progress
i. Investigate, document, and respond to odour complaints within 24 hours	Ongoing. In 2018, there were 61 foul odour reports for FCPC, six for GNPCC, six for NBPC, and no reports for DPPC. The 2018 annual report for each facility provides more detail.

4.6 Rainwater Management / Drinking Water and Watershed Protection

Rainwater management, often referred to in the past as stormwater management, refers to the management of precipitation and associated strategies to protect the health of watersheds and maintain a pre-development water balance. The RDN utilizes a wide range of management tools for rainwater, through strategic planning, the Regional Growth Strategy, Official Community Plans, the Drinking Water & Watershed Protection (DWWP) Program, infrastructure engineering standards and the LWMP.

The DWWP program, offered through the RDN Water Services department, serves as the platform for implementing the rainwater management commitments under the LWMP. The DWWP program focuses on learning more about our water resources to better manage and protect them, ultimately with an integrated watershed management approach. Effective partnerships with community members, government agencies, academia, and business are key to the success of the initiatives under this program.

The Rainwater Management / Drinking Water & Watershed Protection Program objectives are:

- 1) use rain as a resource
- 2) promote the maintenance of hydrologic function, and
- 3) protect the quality of water.

Progress towards the LWMP commitments is summarized in Table 7.

Table 7. Rainwater Management / Drinking Water & Watershed Protection Program Commitments

Target: Develop a regional strategy on rainwater management in coordination with member municipalities	
Commitment	Progress
i. Collaborate with Development Services, Water Services, Energy & Sustainability Services, and member municipalities to create a Rainwater Management Plan	<ul style="list-style-type: none"> • In 2010, the study Overcoming Barriers to Green Buildings in the RDN was completed. • In 2012, the RDN published the Rainwater Harvesting Guidebook.
ii. Liaise with other local governments to share rainwater management strategies	<ul style="list-style-type: none"> • In 2014, the RDN reviewed the current land use bylaws and regulations to identify potential barriers to green building features, including rainwater harvesting, and to propose regulatory changes. Green building bylaw amendments received first and second reading in October 2014 and were adopted in February 2015.
iii. When developing the plan, consider subdivision development standards (i.e. low impact development principles, green infrastructure policies, erosion and control standards, onsite rainwater management, watercourse protection, and wetland protection) and non-point source control (i.e. runoff pollution)	<ul style="list-style-type: none"> • In 2016, the RDN Board submitted a resolution to AVICC urging the Province to develop rainwater-specific standards for sourcing, treatment, and infrastructure to further enable the implementation and approval of rainwater sources for potable water. This resolution was enabled at the AVICC Conference in April 2016, and subsequently at the Union of BC Municipalities (UBCM) Conference in September 2016.
iv. Support Building Code changes that remove barriers to rainwater harvesting	
v. Subject to Board approval of the Rainwater Management Plan, Wastewater Services and Water Services will coordinate the plan, administer the budget, and oversee collaboration with other departments and jurisdictions	
vi. Establish watershed performance targets and standards to mitigate the impacts of land development	<ul style="list-style-type: none"> • In 2018, several RDN Directors met with the Minister of Health, Adrian Dix at the Union of British Columbia Municipalities (UBCM) Convention to discuss the challenges of securing water in the Regional District and Gulf Islands and to request the Province develop guidance and standards to permit the use of rainwater as a potable water source for small water systems. • The RDN Co-hosted the Nanaimo Water Stewardship Symposium 2018, that had a focus on green infrastructure, natural assets and watercourse protection. • In 2018, the City of Nanaimo completed the Municipal Natural Asset Initiative; a benchmark study across Canada that calculated the value of Buttertubs Marsh as a natural stormwater asset. • In 2018, planning was underway for the RDN Drinking Water and Watershed Protection 10-year Action Plan update. A key element of the update (scheduled for 2019) will be to add synergies with related plans such as the LWMP

	and coordination with the rainwater management commitment.
Target: Implement rainwater management initiatives as detailed in DWWP Action Plan	
Commitment	Progress
i. Develop a regional Water Budget to increase our understanding of ground and surface water resources	Phase 1 completed in 2013. Phase 2 is underway – added additional groundwater and surface water monitoring sites in 2017, in priority target areas including Cedar-Yellowpoint, Nanoose and French Creek. See rdnwaterbudget.ca
ii. Monitor water quality in selected streams to study the impact of land use on watershed health (e.g. Community Watershed Monitoring)	<ul style="list-style-type: none"> • In 2018, the RDN DWWP program hired consultants to analyze and report on surface water quality data trends observed over the past 7 years of the Community Watershed Monitoring Network (CWMN) in a comprehensive review that included streamflow, climate and land use. See “Surface Water Quality Trend Analysis CWMN 2011-2017” • The CWMN completed its eighth year in 2018, continuing to collect surface water quality data – turbidity, dissolved oxygen, temperature, conductivity – from over 60 established monitoring locations and refining processes for data management. • Two sampling sites were added to the CWMN specifically to monitor wastewater infrastructure where it intersects or neighbours streams (lower Chase River and Holden Creek).
iii. Monitor the impacts of climate change on hydrology in the RDN to identify flood risks	<ul style="list-style-type: none"> • Ongoing. In 2014, the RDN completed a regional hydrometric and climate monitoring review and identified priority areas and partners interested in expanding data network. • In 2015 a snow pillow / weather station at Mt. Arrowsmith was installed in collaboration with several partners. • A hydrometric monitoring station on Haslam Creek was installed in 2016 and on Nanoose Creek in 2017, to address those priority data gaps. A geodatabase has been put together to house all the climate/hydrometric stations for ease of access to information for long term planning or to monitor flood risk / intense rain events.

<p>iv. Continue to implement the seven programs detailed in the DWWP Action Plan including integrated watershed management planning</p>	<ul style="list-style-type: none"> • In 2018, the DWWP Action Plan implementation from the first 10 years was reviewed by third-party analysts and a report on progress was presented to the Board. See “DWWP Action Plan – 10 Year Implementation Review” • In 2019, the DWWP Action Plan will be updated, incorporating the findings from the 10-year review and from engagement sessions with key stakeholders and the public. This will include overlapping commitments in RDN LWMP for rainwater management.
<p>v. Implement the Water Conservation Plan</p>	<ul style="list-style-type: none"> • Graphical billing was piloted in 2014 and 2015. • The Watershed Friendly Yard campaign started in 2014 and continued in 2015 and 2016, using attractive yard signs and a draw for a rain barrel to encourage and highlight water efficient landscape practices in the community. • A WaterSmart Garden Rebate program for efficient irrigation and soil improvements was piloted in all RDN Water Service Areas in 2016 and ran region-wide in 2017 and 2018. • In 2018, the RDN Water Systems’ progress against the targets laid out in the 2013 Water Conservation Plan was reviewed – found that RDN Water Systems are on track to meet targets across all service areas (observed 31% decrease in water use per connection since 2004). See Water Conservation Evaluation – RDN Water Service Areas 2018 • In 2019, the RDN Water Conservation Plan is due to be updated and have new targets set.
<p>vi. Refine the Water Budget Study to assist in land use and development decisions</p>	<ul style="list-style-type: none"> • A refined Water Budget for Nanoose is planned for 2019 and for French Creek in 2020
<p>vii. Continue to provide water education, incentive programs and watershed monitoring partnerships</p>	<p>ONGOING: Team WaterSmart provides these programs and partnerships through:</p> <ul style="list-style-type: none"> • Team WaterSmart educational workshops • Team WaterSmart community booths • School presentations and field trips • Rainwater harvesting incentive program • Rural Water Quality Protection incentive program (for well water testing, wellhead construction upgrades, well closure) • WaterSmart Garden Rebate Program offers incentives for homeowners to upgrade to efficient irrigation hardware / controls and to augment their soil/mulch

4.7 Volume Reduction

The Volume Reduction Program promotes potable water conservation, results in less water entering public wastewater systems, lowers the cost to treat wastewater, and reduces the potential for overflows.

The Volume Reduction Program objective is to reduce wastewater production by promoting water conservation measures. Progress towards the LWMP commitments is summarized in Table 8.

Table 8. Volume Reduction Program Commitments

Target: Promote a reduction in per capita water consumption	
Commitment	Progress
i. Promote water conservation incentives like low-flow toilet rebates	The RDN offered a low-flow toilet rebate from 2009 to 2013. This program is now complete. Over 1,500 toilets were replaced under this program, for a total of over 50 million litres of water saved each year, from here forward. Other RDN rebates are advertised at www.rdnrebates.ca .
ii. Work with provincial regulators to provide public with information around opportunities for greywater reuse, as supported by the BC Building code and provincial regulations	The BC Ministry of Health published the Manual of Composting Toilet and Greywater Practice in 2016.
iii. Educate the public through free workshops and online information	<ul style="list-style-type: none"> • ONGOING. From March 10 to April 21, 2018, RDN Team WaterSmart hosted events and activities for “Water to Earth month”. This included workshops on topics related to water conservation and watershed protection, field trips and steam walks. Community partners co-hosted many of the events alongside RDN Team WaterSmart. • Since 2010, Team WaterSmart staff performed hundreds of residential irrigation check-ups. The program has effectively caught leaks, lowered excessive watering times & advised on water-saving techniques. 65% of participants reduce their summer water use after taking part in the program. In 2018, Team WaterSmart performed 12 residential irrigation check-ups to help residents reduce outdoor water use. • WaterSmart’s website includes an interactive map showing the watering restrictions in effect in each water service area, municipality and improvement district within the region. • See dwwp.ca and teamwatersmart.ca

<p>iv. Hold semi-annual meetings with the City of Nanaimo, District of Lantzville, City of Parksville, and Town of Qualicum Beach to develop a regional volume reduction strategy</p>	<p>W3C meetings were held on:</p> <ul style="list-style-type: none"> • April 15 and October 16, 2014 • March 12 and September 25, 2015 • March 4 and September 30, 2016 • April 21 and September 22, 2017 • March 2 and September 14, 2018.
<p>v. Continue to develop and implement water conservation measures through the DWWP service, with a target of reducing per capita water consumption by 25% between 2009 and 2030</p>	<p>In 2018, the RDN Water Systems' progress against the targets laid out in the 2013 Water Conservation Plan was reviewed and found that RDN Water Systems are on track to meet targets across all service areas</p> <ul style="list-style-type: none"> • observed 31% decrease in water use per connection since 2004 • observed that maximum month water production stayed well below the reference threshold of 2004 production levels, between 2011- 2017 <p>See Water Conservation Evaluation – RDN Water Service Areas 2018</p>

Target: Reduce water consumption in RDN buildings and wastewater treatment operations

Commitment	Progress
<p>i. Install low-flow or dual flush toilets and other water-saving devices in RDN buildings</p>	<p>Ongoing with new construction according to the Corporate Climate Change Plan</p>
<p>ii. Consider water efficient technology when designing infrastructure upgrades and expansion</p>	<p>Ongoing according to the Green Building Policy</p>
<p>iii. Promote the use of reclaimed water when practicable</p>	<p>FCPCC uses treated effluent during operation as process and wash water in place of potable water. GNPCC uses treated effluent during operation as process water in place of potable water</p>

Target: Eliminate sanitary sewer overflows

Commitment	Progress
<p>iv. Identify potential sources of sanitary sewer overflows and develop a strategy to eliminate</p>	<p>In 2017 the Nanaimo Interceptor Hydraulic Modeling Study was completed. The steady state simulation did not predict any overflows within the study area (the interceptor south of the Departure Bay Pump Station)</p>

4.8 Inflow and Infiltration

Inflow refers to rainwater or snowmelt that enters the sanitary sewer system from a direct stormwater connection (e.g. roof leaders, basement sump pumps, or foundation drains). Homes built before the 1970s can be major sources of inflow since building permits at the time allowed property drainage to connect to the sewer system.

Infiltration refers to groundwater (marine or freshwater) that enters the sewer system. Infiltration can occur via pipeline cracks, leaky joints or deteriorated manholes. I&I is a term to collectively describe inflow and infiltration.

I&I are regulated under the Municipal Wastewater Regulation and are measured in reference to the average dry weather flow (ADWF), the daily municipal flow to a wastewater facility after an extended period of dry weather such that I&I is minimized to the greatest extent practicable.

Inflow & Infiltration Program objectives are:

- 1) to reduce inflow and infiltration entering the wastewater collection and treatment system and
- 2) to meet Municipal Wastewater Regulation standards for I&I.

Progress towards the LWMP commitments is summarized in Table 9.

Table 9. Inflow & Infiltration Program Commitments

Target: Monitor I&I entering RDN infrastructure	
Commitment	Progress
i. Set up an I&I monitoring function for GNPCC and FCPC in FlowWorks (flow monitoring system)	FlowWorks data are reviewed regularly. Catchments with high flows are further investigated as needed by staff of member municipalities (i.e. Harewood)
ii. Evaluate flow data to understand system reaction to rainfall and high flow events	Still to come
iii. Use CCTV to inspect GNPCC and FCPC interceptors on a 5-year cycle	<ul style="list-style-type: none"> • Sections of the GNPCC interceptor are CCTV monitored annually. In 2018 the RDN CCTV monitored three siphon lines at Maffeo Sutton Park. • FCPC interceptor is CCTV monitored every 5 years. In 2018, 3.7 km of inspected by CCTV (manholes 40-24 in Qualicum Beach; manholes 36-29 in Parksville)
iv. Maintain and install flow meters and rainfall gauges as needed	<ul style="list-style-type: none"> • Environment Canada and member municipalities operate rain gauges • Installed influent flow meter at FCPC in 2015. • In 2016, new wireless modems installed on all flow meters. Level sensors in flow meters are tested monthly for accuracy. • The Ocean Place Flow meter was repaired in 2017 and replaced in 2018. • Wiring was repaired on the Lantzville flow meter in 2018. • In January 2018, the laser flow meter at GNPCC was replaced by a Parshall Flume to improve the accuracy of flow measurement. • Replaced the influent meter at FCPC with one that is intrinsically safe.

Target: Reduce I&I directly entering RDN owned infrastructure	
Commitment	Progress
i. Repair manholes as needed; perform regular maintenance of interceptors	<ul style="list-style-type: none"> In 2015, the RDN completed the Qualicum Beach Interceptor Pipeline Protection study. In 2016, an erosion protection project was completed on the Qualicum Interceptor between manholes 16 and 17. Performed routine inspections of manholes and interceptors In 2017, repairs were made to FCPCC manholes 39, 36, 30 and 12 to enable access for CCTV inspection Planning to repair the GNPCC northslope manholes was underway in 2018
ii. Investigate grant funding opportunities (e.g. Gas Tax Fund) for infrastructure rehabilitation	Ongoing. Grant funding for other infrastructure rehabilitation is listed in the Pollution Control Centres Program
Target: Provide secondary treatment for flows up to 2 times ADWF and at least primary treatment for flows beyond 2 times ADWF during storm or snowmelt events with less than a 5-year return period	
Commitment	Progress
i. Design upgrades to RDN infrastructure so flows up to 2 times ADWF will receive secondary treatment and all flows in excess of this amount will receive primary treatment	GNPCC detailed design completed in 2016 provides secondary treatment for 2xADWF and primary treatment for all flows beyond 2xADWF
Target: Develop a regional strategy on I&I management	
Commitment	Progress
i. Hold semi-annual meetings with the municipalities to develop regional monitoring and reduction targets for inflow and infiltration	<p>W3C meetings were held on:</p> <ul style="list-style-type: none"> April 15 and October 16, 2014 March 12 and September 25, 2015 March 4 and September 30, 2016 April 21 and September 22, 2017 March 2 and September 14, 2018.
ii. Share flow and rainfall data with municipalities	Flow monitoring data is shared at the W3C meetings
iii. Consider requiring replacement or disconnection of private laterals when granting demolition permits	Still to come
iv. Consider providing municipal or regional staff to witness or perform service connections	Still to come

<p>v. Work with the member municipalities to continue to reduce flows due to I&I and to eliminate sewer overflows</p>	<ul style="list-style-type: none"> • I&I was discussed at the biannual W3C meetings. • The City of Nanaimo continues to grout manholes to reduce I&I. • The City of Nanaimo completed an Inflow and Infiltration Reduction Strategy in 2018. • The City of Nanaimo Public Works crews continued to remove the Harewood wyes, a significant source of I&I, in 2018.
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Target: Encourage I&I reduction on private land through public education

Commitment	Progress
<p>i. Enhance the source control program to encourage landowners to check gutters and outside drains for connection to the sewer system, avoid planting trees and shrubs over sewer laterals, ensure basement drains and sump pumps are not connected to the sanitary sewer, and replace broken or leaky pipes located on private property</p>	<p>Still to come</p>
<p>ii. Consider providing incentives to enable residents to reduce private property I&I</p>	<p>Strategies to reduce private property I&I have been discussed at W3C meetings. To date, the priority has been on addressing I&I on owned infrastructure.</p>

4.9 Pollution Control Centres

The Pollution Control Centres Program objective is to meet Municipal Wastewater Regulation standards and sustainably manage wastewater treatment at GNPCC, FCPCC, NBPCC, DPPCC, and associated facilities. Progress towards the LWMP commitments is summarized in Table 10.

Table 10. Pollution Control Centres Program Commitments

Target: Comply with permit or operational certificate	
Commitment	Progress
<p>i. Manage wastewater collection and treatment using the RDN's Environmental Management System (EMS) to meet permit requirements</p>	<p>RDN Wastewater Services has been ISO 14001 Certified since 2005 and has been part of the National Water and Wastewater Benchmarking Initiative since 2001 with the goal of continually improving service and environmental performance</p>
<p>ii. Work with MOE staff to establish reasonable timelines and scope of any required receiving environment monitoring programs</p>	<p>A Receiving Environment Program was developed in December 2016. 2017 & 2018 monitoring program results are summarized in separate documents.</p>

Target: Manage assets to maintain the quality and integrity of existing infrastructure	
Commitment	Progress
i. Update and evaluate asset management and preventative maintenance plans	<ul style="list-style-type: none"> An integrated Asset Management strategy was prepared in 2014 to guide Asset Management development with a consistent organization-wide approach. The Board approved an Asset Management Policy in 2016 (provided in 2016 annual report) and created a new department responsible for organization-wide asset management activities. The 2019 Asset Management Review and Implementation Report was underway in 2018 and completed in 2019.
ii. Systematically inspect, detect, and correct incipient failures	Wastewater Services has a Computer Maintenance Management System used for preventative, corrective, urgent, and emergency maintenance
iii. Replace the GNPCC effluent outfall line	Replacement of the outfall began in 2014 and was complete in 2016
iv. Prepare an Environmental Impact Study for the GNPCC outfall	The EIS for the land portion of the outfall was complete in May 2014. The EIS for the marine portion of the outfall was completed in October 2015
v. Monitor the condition of the Departure Bay forcemain	Performed monthly visual inspections and routine annual air/vacuum relief valve inspections in 2016. In 2017 a condition assessment of the Departure Bay Force Main was completed using “Pipe Diver” and “Smart Ball” electromagnetic sensing tools. The assessment provided suitable condition data for about 80% of the total length of the forcemain from the Departure Bay Pump Station. The assessment determined that the pipe appears to be in better condition than originally believed, further condition assessments are planned for 2019
vi. Improve the odour management system at the NBPCC outfall manhole	Complete in 2013
Target: Expand and provide secondary treatment at GNPCC by 2018	
Commitment	Progress
i. Commission a third digester	Complete in 2013
ii. Construct a fourth primary sedimentation tank	Complete in 2013

<p>iii. Upgrade the facility to provide secondary treatment by 2018</p>	<ul style="list-style-type: none"> • Preliminary site preparation began in 2015 • Environmental Impact Study was complete in 2015 • Geotechnical study was complete in 2015 and shows that an extra six months of ground improvements is necessary to account for liquefiable soils on site • Engineering design was complete in 2016 • Construction of the GNPCC Secondary Treatment Upgrade Project began in May 2017 and continued through 2018 (see photos below). Commissioning is scheduled for 2019
<p>iv. Explore federal and provincial grant options to fund secondary treatment</p>	<p>RDN made the following requests for financial assistance:</p> <ul style="list-style-type: none"> • September 2013 request to the Province at the UBCM Convention to help fund GNPCC secondary treatment upgrade • April 2015 application to the Strategic Priorities Fund • November 2016 application to the Clean Water and Wastewater Fund • Spring 2017 application to the Strategic Priorities Fund <p>In March 2018 the RDN was awarded \$6 million in Federal Gas Tax Funds to assist with the \$82 million GNPCC Secondary Treatment Upgrade Project</p>

Target: Provide secondary treatment at NBPCC by 2023

Commitment	Progress
<p>i. Upgrade the facility to provide secondary treatment by 2023</p>	<p>Conceptual design of secondary treatment upgrade is planned for 2019</p>
<p>ii. Explore federal and provincial grant options to fund secondary treatment</p>	<p>The RDN requested financial assistance from the Province to help fund the secondary treatment upgrade projects at GNPCC and NBPCC at the September 2013 UBCM Convention</p>

Target: Expand capacity in wastewater infrastructure to respond to demands created by an increasing population

Commitment	Progress
<p>i. Expand FCPC treatment plant capacity</p>	<p>Detailed design of the FCPC expansion began in 2018. Commissioning is scheduled for 2022.</p>

Target: Develop a sewer servicing strategy for the Nanoose Bay Peninsula

Commitment	Progress
i. Coordinate with Development Services through the OCP review process to identify property owners in growth containment boundaries who are interested in establishing public wastewater services	The Last Electoral Area E OCP was completed in 2015. An Area E OCP review has not proceeded since then.
ii. Consider resource recovery, visual, and olfactory buffers and the number of pump stations required	Still to come
iii. Review and update the Fairwinds sewer servicing agreement and DCC bylaw for the Nanoose Bay area	Still to come

Target: Develop a DCC bylaw to allow new connections to use existing capacity at DPPCC

Commitment	Progress
i. Develop a DCC bylaw to allow properties in the growth containment area to purchase capacity at DPPCC	The Cedar Village Sewer Servicing Study reviewed the potential for properties in the growth containment area to purchase capacity at DPPCC. DCCs were considered in the DPPCC Cost and Capacity Review which began in August 2015 and completed in 2017 (revised from 2016)

Target: Review DCC plan every year and revise bylaws where necessary to fund anticipated projects

Commitment	Progress
i. Revise DCC bylaws at GNPCC, NBPCC, and FCPC.	A review and update of the Southern (GNPCC) and Northern (FCPC) Communities' Wastewater Development Cost Charges was started in 2015. DCC Amendment Bylaws Nos. 1547.01 and 1442.03 were adopted on June 27, 2017. Revised 2015-2017 (from 2015-2016)

Construction photographs of the GNPCC Secondary Treatment Upgrade Project are provided below.



Photo left: Secondary treatment area – bioreactors and clarifiers



Photo right: Primary treatment and solids handling area

4.10 Resource Recovery

The Resource Recovery Program objective is to economically recover and utilize resources in wastewater. Progress towards the LWMP commitments is summarized in Table 11.

Table 11. Resource Recovery Program Commitments

Target: Reduce resource consumption at wastewater treatment facilities	
Commitment	Progress
i. Complete a study to review resource recovery opportunities at RDN wastewater facilities	Resource recovery is integrated into GNPCC Secondary Treatment design (2016 completion). The final design includes a water system to reuse effluent as operational wash water in place of potable water, an increase in the production of biogas, and an increase in the use of biogas as an energy source for the boilers. The heat will be transferred through the hydronic system to heat the occupied spaces and the treatment process
ii. Evaluate wastewater treatment operations which require energy, water, chemicals or fuel and identify activities that can be run more efficiently, if any	Energy, water, chemical and resource consumption are reviewed annually. As part of the National Water and Wastewater Benchmarking Initiative, Wastewater Services compares its data to other facilities across Canada of similar size to monitor performance and identify areas to improve efficiency
Target: Recover resources from wastewater	
Commitment	Progress
i. Commission a cogeneration facility for biogas recovery and energy generation at GNPCC	Complete 2012
ii. Continue to beneficially use biosolids according to the Biosolids Program	<ul style="list-style-type: none"> Since 1999, RDN biosolids have been beneficially used in agriculture, landfill closures, mine reclamation and forestry applications. In 2018, the RDN produced and beneficially used 4,945 tonnes of biosolids
iii. Reclaim water for use onsite in compliance with MOE guidelines (MOELP 2001)	FCPCC uses treated effluent as process and wash water in place of potable water. GNPCC uses treated effluent as process water in place of potable water
iv. Discuss future opportunities for reclaimed water use with Morningstar Golf Course	Until 2014, reclaimed water was sent to Morningstar Golf Course in the summer months for irrigation.
v. Consider potential resource recovery options for new projects, particularly through process selection	Integrated into GNPCC Secondary Treatment design (2016 completion) (see comment above regarding the resource recovery study)

<p>vi. Examine opportunities for a district heating project at Hammond Bay Elementary using the GNPCC outfall</p>	<p>In 2014 the RDN installed two stubs into the new effluent outfall line to facilitate easy connection for the proposed School District 68 district heating project. The outfall replacement project was completed in 2016. In 2017, School District 68 received funding from the Carbon Neutral Action Program and School Enhancement Program for the project.</p>
<p>vii. Examine opportunities for using reclaimed water for the Fairwinds Golf Course.</p>	<p>Still to come</p>

4.11 Biosolids

Biosolids are stabilized municipal sewage sludge resulting from a municipal wastewater or septage treatment process or septage that meets quality criteria for beneficial use under the Organic Matter Recycling Regulation.

GNPCC treats sludge from its operations as well as sludge trucked from the DPPCC that has undergone secondary treatment. Likewise, FCPCCC treats sludge from its operations as well as sludge trucked from NBPCCC that has undergone primary treatment. In 2018, the RDN produced and beneficially reused a total of 4,945 tonnes of biosolids. This includes the 3,658 tonnes produced at GNPCC and 1,287 tonnes produced at FCPCCC.

Since 1999, RDN biosolids have been beneficially used in agriculture, landfill closures, mine reclamation and forestry applications. Biosolids provide an alternative to chemical fertilizers as a means to improve soil fertility where nutrients are limited.



Photo: trees receiving biosolids applications have longer and greener (healthier) needles (photo credit SYLVIS Environmental).



Photo: trees receiving biosolids applications grow much faster than controls that have not had biosolids treatments (photo credit Vancouver Island University).

Since 2003, RDN biosolids have been used in a Forest Fertilization Program on land privately owned by TimberWest (leased to Vancouver Island University until May 2017). Biosolids are managed and applied according to a Land Application Plan prepared annually by SYLVIS Environmental in adherence to the British Columbia Organic Matter Recycling Regulation (OMRR). Through this program, RDN biosolids are diverted from the landfill and applied to the forest lands to improve tree growth.

This program demonstrates modern practices in forest ecology and stand management. Applications combine the initial fertilization benefits of biosolids with long-term benefit through soil conditioning, as the surface-applied biosolids become incorporated into the surface organic matter (humus) that develops over time. Biosolids provide improved productivity through nutrient input, improved water holding capacity, and increased organic matter through application to the forest.

Industry best practice recommends a biosolids management program have a biosolids contingency site. Previously, the Regional Landfill was used as the contingency site when the forest lands were not accessible due to winter conditions. In 2017, the RDN established a contingency biosolids management site at the Harmac mill so biosolids can continue to be beneficially used during times where the TimberWest lands is inaccessible (i.e. winter road conditions). At the Harmac site, RDN biosolids, Harmac wood waste, and mineral soil are used to fabricate soil for cover material for the Harmac landfill during is landfill closure activities. The Harmac site has capacity as a contingency site for 10-20 years.

The 2018 Biosolids Management Summary is prepared by SYLVIS Environmental as a separate report.

The LWMP Biosolids Program objective is to continue producing and beneficially using biosolids. Progress towards the LWMP commitments is summarized in Table 12.

Table 12. Biosolids Program Commitments

Target: Produce, at minimum, Class B biosolids	
Commitment	Progress
i. Develop a Biosolids Management Plan to assess options for the beneficial use of RDN biosolids, including land application, energy generation, and other possible resource recovery strategies	A Biosolids Management Plan was completed in 2011. A Biosolids Options Study was completed in 2016 and appended to the 2016 LWMP Annual Report. A Site Optimization Study was completed in 2018.
ii. Improve the quality of biosolids through upgrades to wastewater treatment infrastructure and innovative technologies and techniques (i.e. decrease volatile solids content and pathogen concentrations)	Biosolids quality will improve with the secondary treatment upgrades at GNPCC (2018-2019) and NBPCC (2023)
iii. Monitor and report biosolids quality according to operational certificate/discharge permit and OMRR	RDN Biosolids met OMRR requirements in 2018. The 2018 Biosolids Management Summary is prepared by SYLVIS Environmental as a separate report.
iv. Establish a contingency plan for temporary storage or application of biosolids if the VIU site is not useable	Previously, the Regional Landfill was used as the contingency site when the forest lands were not accessible due to winter conditions. In 2017, the RDN established a contingency site at the Harmac mill where RDN biosolids, Harmac wood waste, and mineral soil are used to fabricate soil for cover material that will be used during the closure of the Harmac landfill
Target: Enhance the biosolids-based education and outreach program	
Commitment	Progress

- | | |
|---|--|
| i. Develop and distribute information on source control in order to improve biosolids quality | • In 2003 and 2012 , the RDN completed groundwater impact assessments that concluded that past and proposed future application of biosolids within the Biosolids Application Area will not impact groundwater quality in any of the wells located in the region |
| ii. Develop material to increase awareness of precautions taken to ensure the storage and application of biosolids do not negatively impact groundwater | |
| iii. Continue working with local user groups to communicate plans for biosolids application areas | • The RDN's website www.rdn.bc.ca/biosolids posts material to increase awareness of the application area, regulations, monitoring and research including surface water quality monitoring reports and groundwater studies |
| iv. Provide educational material and outreach at open houses and other events. | <ul style="list-style-type: none"> • In 2015, the RDN developed a brochure on Biosolids • Biosolids open houses for the Nanaimo Mountain Bike Club were held in August 2014, October 2015, and April 2018 • Biosolids educational materials were available at the FCPC open house on <ul style="list-style-type: none"> ○ May 9, 2015 ○ April 30, 2016 ○ June 2, 2018 • Biosolids educational materials were available at the GNPCC open house on <ul style="list-style-type: none"> ○ April 30, 2014 ○ February 10 & 11, and July 8, 2015 ○ June 11, 2016 ○ There was no open house at in 2017 or 2018 due to heavy construction |

5) Emerging Issues

The LWMP recognizes that new issues may emerge from innovations in water quality monitoring and from an evolving regulatory environment. The LWMP commits to keeping informed on the emerging issues listed below.

- Shellfish Harvesting Areas
- Contaminants of Emerging Concern
- Heritage Resources
- Climate Change
- Non-point Sources of Pollution

5.1 Shellfish Harvesting Areas

The Canadian Shellfish Sanitation Program (CSSP) is a federal food safety program, jointly administered by the Canadian Food Inspection Agency, Environment Canada, and Fisheries and Oceans Canada (DFO). The purpose of the program is to provide assurance that bivalve molluscan shellfish (e.g. mussels, oysters, and clams) meet food safety and quality standards for both domestic and international markets, thereby protecting the public from the health risks of consuming contaminated shellfish.

Under the CSSP, Conditional Management Plans may be developed to allow shellfish harvesting in areas in proximity to wastewater infrastructure. These areas meet the standards for safe harvest of bivalve molluscan shellfish (i.e. mussels, oysters, and clams), except in times where a temporary source of pollution exists. As long as the pollution source is not present, the Conditional Management Plan allows the shellfish harvesting area to remain open.

The RDN currently operates with a Conditional Management Plan for two pump stations that have bypasses. The bypasses are designed to allow untreated wastewater to discharge to the marine environment if the volume of wastewater entering the interceptor exceeds the capacity of the pump station. Bypasses prevent damage to infrastructure and reduce the risk of flooding private residences. These bypasses have been in place since the system was built in the 1970's and during this time there has been no reported need to bypass the flow. Furthermore, pump redundancy, back-up power, and a Supervisory Control and Data Acquisition System make it unlikely that an overflow would occur at these locations. RDN's Conditional Management Plan clearly outlines the roles and responsibilities of each partner, as well as immediate actions to be taken to close these conditionally classified areas should a discharge of untreated wastewater occur from the pump station bypasses. These plans clearly identify what events will trigger a temporary closure of the area and what response protocol would follow if a trigger event was to occur.

The RDN's Conditional Management Plan came into effect in 2015 and was renewed in 2016 and 2019.

5.2 Contaminants of Emerging Concern

Contaminants of emerging concern, sometime called emerging contaminants, refer to an array of pharmaceuticals, personal care products, and industrial contaminants (CCME 2009). Once standards are established by higher levels of government for the identification, testing, and measurement of contaminants, the RDN will develop a strategy to mitigate their impact on the wastewater stream. Recognizing that most of the contaminants entering the wastewater stream originate from private residences and businesses, the RDN will continue to work to improve the quality of effluent through the Source Control Program, the Sewer Use Regulatory Bylaw, and through strategic investments in critical infrastructure.

In 2018, the RDN commissioned advisory memorandum on Emerging Substances of Concern (ESOCs) and microplastics, attached in Appendix B.

5.3 Heritage Resources

The Province protects heritage sites through the *Heritage Conservation Act*. This protection applies to both private and Crown land and a provincial heritage permit is required before altering or developing a heritage site. In 2018, the RDN applied for a Blanket Archaeological Permit from the Archaeology Branch. A Blanket Permits is a Heritage Inspection Permit that covers a broad geographic area for

multiple assessments. The RDN’s Blanket permit was granted May 6, 2019 and expires December 30, 2020.

5.4 Climate Change

Sea level rise is driven by a global increase in average temperature which is causing glacier and ice caps to melt, and the expansion of ocean waters. At the regional and local scale, sea level rise will differ and change in response to these global effects. For the east coast of Vancouver Island, the mean sea level rise is estimated to increase by least 0.8 m by the year 2100³. Potential impacts associated with these changes include:

- More frequent and extreme high water levels in coastal areas
- Increased erosion and flooding
- Increased risk to coastal infrastructure, as well as increased maintenance and repair costs
- Loss of property due to erosion
- Loss of habitat and reduced biodiversity
- Saltwater intrusion into coastal aquifers
- Loss of cultural and historical sites.

The RDN is preparing for sea level rise through the Sea Level Rise Adaptation Program, initiated in 2018. This multi-year Program is designed to be executed with the collaboration of relevant RDN departments and member municipalities and divided into four phases:

- Pre-planning (2016)
- Research (2017-2019)
- Engagement (2019-2020)
- Implementation (2021)

The RDN is currently in the research phase which includes undertaking a coastal analysis to develop coastal hazard maps. Due to the size of our coastline (188 km), the mapping study will take place in two phases. Phase 1, Study Area 1 & 2, will be completed in the spring 2019 and Phase 2, Study Area 3, is anticipated to be initiated in the fall 2019.

When completed, the flood hazard mapping information will be used to further update the Floodplain Management Bylaw, and to inform future decisions relating to land use, servicing and emergency preparedness planning, and infrastructure planning and adaptation. More information is available at: <https://www.rdn.bc.ca/sea-level-rise-adaptation-program> or <https://www.getinvolved.rdn.ca/>.

³ BC Ministry of Environment. 2011 *Climate Change Adaption Guidelines for Sea Dikes and Coastal Flood Hazard Land Use - Guidelines for Management of Coastal Flood Hazard Land Use*. By Ausenco Sandwell. Accessed June 17, 2019 from http://www.env.gov.bc.ca/wsd/public_safety/flood/pdfs_word/coastal_flooded_land_guidelines.pdf.

5.5 Non-Point Sources of Pollution

Non-point sources of pollution come from sources other than an outfall pipe. Some examples of non-point pollution include agricultural and stormwater runoff, onsite sewage systems, and discharges from vessels.

- The LWMP Private Onsite Systems Program addresses pollution from onsite sewage systems.
- The RDN also has agreements with BC Ferries to establish a pump ashore program at GNPCC and DPPCC to accommodate the wastewater produced on BC Ferries and Seaspan vessels.

6) Revisions and Adjustments

Minor revisions to non-capital LWMP deliverables are identified in Table 1. Timelines for Major Wastewater Capital Projects are revised as indicated in Table 2. Table 2 identifies a revised timeline for completion of GNPCC secondary treatment and upgrades associated with that project. The GNPCC Secondary Treatment Upgrade Project has been underway since 2015 when the Environmental Impact Study was complete and site preparation began. The geotechnical study that was also complete in 2015 showed that an extra six months of ground improvements was necessary to account for liquefiable soils on site. Construction of the GNPCC Secondary Treatment Upgrade Project continued from 2017 through 2018 and into 2019. Commissioning of Secondary Treatment is scheduled for 2019.

Appendix A – W3C Meeting Minutes



W3C: WASTEWATER & WATER COLLABORATIVE MEETING

Friday, March 2, 2018; 9:00 am – 1:00 pm
6300 Hammond Bay Road – RDN Committee Room

MINUTES

ATTENDEES:

Adrian Limpus – RDN
Bob Weir – Qualicum Beach
Dean Mousseau – Nanaimo
Deanna McGillivray – RDN
Doris Fournier – Nanaimo
Gerald St. Pierre – RDN

Ian Lundman – RDN
James Haddou – RDN
Julie Pisani – RDN
Lorena Mueller – RDN
Mike Squire – RDN
Randy Alexander – RDN

Rob Lawrance – Nanaimo
Sean De Pol – RDN
Shelley Norum – RDN
Vaughn Figueira – Parksville

ADOPT MINUTES

Minutes from the September 22, 2017 meeting were adopted.

ROUNDTABLE UPDATE

(1) RDN Wastewater Services:

J. Haddou provided an update on the GNPCC Secondary Treatment Project:

- RDN is working with NAC and AECOM, as well as a number of subcontractors on this project.
- Blasting is nearly complete. The first phase was finished in Oct 2017, and the second phase started in January 2018, following the installation of the primary effluent bypass line.
- The primary effluent bypass line, one of the project's milestones, was commissioned in January 2018. Its installation allows for project activities in the area previously occupied by the old line to proceed.
- Site excavation is nearing completion. Currently, the contractor is about to finish the excavations for the No. 3 clarifier and bioreactor.
- The new screening Building is under construction, and the slab has been poured for the aeration and thickening building.
- All critical path items for the project are on schedule.

D. McGillivray provided an update on the Bowser Village Centre Wastewater Project:

- In March 2017, the project received \$7.6 million in provincial/federal grant funding through the Clean Water & Wastewater Fund to build a collection system, secondary treatment and disposal system. The total project budget is \$10.6 million. A petition process in August 2017 determined that service area property owners were willing to contribute their portion of the project costs (approximately

\$500,000). The remaining \$2.6 million will be collected as DCCs through a Development Cost Charges Front-End Agreement.

- RDN staff provided a project update at two public open houses in October 2017. Approximately 150 people total attended the two events.
- In December 2017, the RDN adopted bylaws to establish the Bowser Village Sanitary Sewer Service Area.
- Staff are working with consultant Stantec to update the design of the previously completed collection system and treatment plant design. The Provincial and Federal permitting and approvals process is also underway.
- Staff are working with consultant Great Pacific to review the proposed outfall location. Detailed design will start when the location has been confirmed.

M. Squire provided an update on the following capital projects:

- Bay Ave Pump Station Upgrade: The project has a budget of \$2.5 million and includes an expansion to increase well and pump capacity, and other upgrades to address access and operational challenges. A peer review of the engineering for the project is underway, with a consultant taking a detailed look at the design.
- Chase River Force Main & Pump Station Upgrades: The project has a budget of \$2.1 million. The RFP for the work closes on March 8, with construction anticipated for summer 2019. The forcemain was twinned in 1998; the original forcemain was installed in 1979. We're currently running both forcemains at the same time, but the older one is at the end of its life and needs to be replaced. Some upgrades to the septage receiving site facility at the pump station are planned as part of the project. A request for proposals is open now.
- FCPCC Upgrade & Expansion: The project has a budget of \$32.9 Million. Odour control is a part of expansion/upgrade. Activated sludge secondary treatment. New outfall and headworks may be delayed as not currently needed. RFQ for detailed design closes March 15. Construction is anticipated to take place in 2020 - 2021.

S. De Pol provided an update on RDN Wastewater Services' activities:

- Manhole Repairs and CCTV: Manhole repairs and CCTV inspections are planned for 2018 on Qualicum Beach and North Slope interceptor lines.
 - B. Weir suggested that RDN Wastewater Services and Town of Qualicum Beach could look at partnering on CCTV work.
- Departure Bay Forcemain: An assessment of the Departure Bay Forcemain has been completed, using smart ball sensor technology to read pipe wall thickness. RDN and City of Nanaimo staff will meet in the next few months to discuss plans for infrastructure replacement on Hammond Bay Rd, as timing on the water main replacement for Hammond Bay Rd near the Departure Bay bin wall is starting to move up the queue for the City.

S. Norum provided an update on the following programs:

- Liquid Waste Management Plan: The LWMP Annual Report is being prepared and will be presented to the LWMP Monitoring Committee in May; before the submission deadline in June.
- SepticSmart Workshops: There are four upcoming SepticSmart workshops scheduled for Spring 2018:
 - April 5, 2018 – Gabriola Agi Hall
 - April 12, 2018 – Lantzville Legion
 - April 26, 2018 – Nanoose Place

- May 2, 2018 – Qualicum Beach Civic Centre.

A newsletter recently went out via Canada Post with the workshop dates and summary of rebates.

- Septic Maintenance Rebate Program: This year we are offering the following rebates as well as a bonus of up to \$100 for workshop participants:
 - Up to \$200 for installing or replacing a distribution box (new in 2018)
 - Up to \$300 for installing risers
 - Up to \$100 for installing an effluent filter
 - \$600 towards replacing a malfunctioning system.
- Changes to Septage Receiving Rates: Trucked Liquid Waste Bylaw No. 1732 was amended in February to update septage rates to address increasing costs of treating septage. On March 1, the rate increased from \$0.23 per gallon to \$0.24 per gallon, with an increase of \$0.01 per gallon each year going forward. Prior to this amendment, septage revenue had not increased in over 10 years. These changes make our Septage Receiving Program a completely user paid service.

(2) City of Parksville:

Vaughn Figueira provided an update on the City of Parksville’s activities:

- Parksville Water Modelling: A new model will be run when the treatment plant comes online to inform operations going forward.
- Water Treatment Plant and Intake: Construction of the new water treatment plant and Englishman River water intake is well underway. Concrete work is nearly complete, and will be followed by construction of the steel superstructure. Commissioning is scheduled for summer 2019, with water being delivered to customers in the fall. The forcemain to top bridge is also completed. On the whole, the project is going well.
- Craig Bay and Martindale Rd Pump stations: The pump stations do not need major changes, but some alterations to pump configuration and horsepower will be done to improve operation.
- Standards and Specifications Update: The City’s Standards and Specifications update was supported by Council. The update included consideration of the effects of climate change and shorter, higher intensity storms. Storm system capacity will be oversized to take into consideration climate change effects. For new development, 80% pipe capacity will be considered a full pipe in order to provide a “safety factor”. The 80% recommendation was sourced from best practices from other communities, as well as predictions regarding future effects. A similar approach was taken for the sanitary system, to accommodate inflow and infiltration. Changes to the development requirements regarding trees were proposed, but were not accepted by council.

(4) Town of Qualicum Beach:

B. Weir provided an update from the Town of Qualicum Beach:

- FOG: An investigation to determine the origins of FOG in the sanitary system is underway.
- Sewer Main Replacement: The Town is replacing a sewer main along the old Island Highway; the possibility of incorporating potential for future heat recovery project is being investigated.
- Stormwater Modelling: The town is currently modelling recent severe storms, and requirements for new sanitary and storm pipes will be upsized according to the model results.
- New Rain Garden: The intersection of Crescent Rd. and Memorial Ave. was recently reconfigured to redirect all runoff from downtown into a new rain garden before it flows into the storm system.

(5) City of Nanaimo:

R. Lawrence provided an update on City of Nanaimo’s activities:

- Natural Asset Management: The City is investigating an asset management strategy for its natural assets, as part of a pilot project with five other municipalities organized by David Suzuki Foundation. The current focus is on Buttertubs Marsh. One part of the project is an investigation the marsh’s function as a stormwater asset, how it fits within the larger stormwater system from an engineering perspective, and what that means for its valuation as an asset. Concerns regarding liability and ownership are also being reviewed. Hydraulic modelling has been completed for the marsh, taking into account climate change. A case study about the project is being drafted and City of Nanaimo staff will share with the W3C group when complete.

Dean Mousseau provided an update on City of Nanaimo’s activities:

- Stormwater Standards: The City’s stormwater standards have been updated to account for climate change and more intense storm events.
- Tree Protection Bylaw: The City requires developers to plant one tree per lot, using a covenant on each property to enforce. The City of Nanaimo [Tree Protection Bylaw](#) and [Urban Forestry Strategy](#) can be found on the City’s [website](#).
- Infrastructure Requirements for Higher Density: There has been an increased interest in high rise developments. In response, the City is investigating infrastructure upgrades required to service such developments and what the impacts of higher density developments on the city’s water, sanitary and storm water systems might be. “As and When” evaluations are conducted for water on each development application, and the City is looking to set up a similar system for sanitary sewer.
- Soils Bylaw: The City is planning to develop a comprehensive soils bylaw for new development later this year, to cover erosion and sediment controls, blasting, and watershed management.

D. Fournier provided an update on City of Nanaimo’s activities:

- 7th Street Pump Station: Design for the 7th Street pump station (formerly known as the City of Nanaimo’s Chase River pump station) is complete. Tendering is anticipated for this summer.
- “As and When” Sanitary Sewer Modelling: The City will be engaging consultants for a 5 year “as and when” sanitary sewer modelling program. The plan is to start by looking at 5 year storm events first. A representative from the RDN may be invited to the kickoff meeting for that project.
- DCC Updates: Adoption of updated DCC Bylaw is anticipated for late March 2018.
- Cross Connection Control Bylaw: A new Cross Connection Control Bylaw is set to go forward to council next week.

(6) RDN Water Services:

J. Pisani provided an update on the Drinking Water and Watershed Protection Program (DWWP):

- DWWP:
 - An RFP will go out in the next couple of weeks for a surface water quality trend analysis project. It will be based on Community Watershed Monitoring Network data collected by volunteers over the past seven years. The report will hopefully be complete in July.
 - The DWWP Action Plan will be updated in 2018 – 2019, as the original plan is nearing its 10 year horizon.

- The RDN is involved in a pilot program to become a provincial third party data source for groundwater data, by sharing the data from the Volunteer Observation Well Program.
- DWWP staff are investigating the possibility of using WaterTrax software to manage a large groundwater quality datasets shared through an opt-in reporting function in the Well Water Quality Testing Rebate Program, with the goal of moving to a data management solution with spatial and query functionality.
- A 10 year review of the Team WaterSmart Irrigation Check-Up Program is being conducted. Preliminary results from consultant indicate that about 64% of participants reduced their water use after a visit from Team WaterSmart.
- Water Conservation Plan: The Water Conservation Plan for the RDN’s Water Service Areas will be updated in 2018.

G. St. Pierre provided an update on RDN Water Services activities:

- San Pareil Water Service UV Disinfection Project: The treatment plant building for the UV disinfection project is constructed. Work on piping and controls has begun.
- Nanoose Water Main Replacement: A tender is out now for a water main replacement in the Nanoose system.
- Nanoose Bulk Water Pump Station: A new pump station is planned to supply the Nanoose system with bulk water from the Englishman River Water Service. 30% engineering drawings will be sent to Parksville engineering staff shortly for review and comment.
- SCADA Master Plan: An RFP for a SCADA Master Plan for all RDN water systems closes next Thursday.
- Condition Assessments and Capital Plan: An RFP for condition assessments and capital planning for all RDN water systems is planned for later this year.
- Cross Connection Control Bylaw: Water Services staff are planning to bring a draft Cross Connection Control Bylaw to the Board later this year.

FLOW MONITORING

A. Limpus provided a flow monitoring billing update from August 2017 to end of January 2018:

- The flow metering packages will be sent in the coming weeks and will include flow monitoring data for February 2018.
- In January 2018, the new partial flume for GNPCC was commissioned. It replaced the old laser meter. One month of data from the flume is included in this update.
- A leak in was discovered in the Lantzville meter’s weir. The leak has been fixed and the flow data has been adjusted accordingly.
- The Ocean Place meter has not been sending data since December. As such, a flow estimate has been used based on French Creek flows. There is good data to base this estimate on from both the French Creek and Johnstone Rd. meters between November and January.

WET WEATHER EVENT JANUARY 28-29, 2018

L. Mueller provided an update on the wet weather event on January 28-29, 2018:

- There was a major rain event at end of January, which caused overflows along the interceptor line at the Brechin Overflow and the Millstone Siphon.
- Operations staff noticed increasing levels in Departure Bay Pup Station (DBPS) wet well at about 4:40 pm on the 28th and started the 4th pump. Then, at 8:20 pm there was a high level alarm at DBPS and overflows occurred at the Brechin Overflow and the Millstone Siphon. The peak flow of the event

corresponded with low tide. The overflow at Brechin stopped on January 29th at 4:40 am. The overflow at the Millstone stopped on January 29th at 11:50 am.

- RDN staff have notified Ministry of Environment, the Shellfish Sanitation Program, the First Nations Health Authority, and Island Health about the event.
- Staff completed an incident investigation on February 6th and identified corrective actions which include a CCTV inspection of the siphon, level sensors, etc.
- RDN Water Services is certified to the ISO14001 EMS standard. There is a detailed investigation procedure to be followed when incidents such as this one happen.

SOURCE CONTROL

S. Norum provided an update on Source Control initiatives:

- Pollution Prevention Website: At the last W3C, the RDN previewed the “Unflushables” videos shared by Metro Vancouver. The videos were added to an updated source control webpage at www.rdn.bc.ca/pollution-prevention.
- Emerging Substances of Concern (ESOCs): Urban Systems has produced an advisory support memo on ESOCs and Microplastics. The purpose of the memo was to provide a current overview of the topic as it relates to our systems. There are not yet any regulations around ESOCs. The memo identifies some main responses to ESOCs including, source control and education, wastewater treatment, sampling and monitoring, and regulatory change.
 - R. Lawrence suggested that we look at available effluent quality data and target some messaging according to the findings of the data review.

INFLOW AND INFILTRATION

D. Fournier provided an update on Inflow and Infiltration (I & I) initiatives:

- Townsite Stormwater Master Plan: Urban Systems has completed an I & I study for the Townsite Stormwater Master Plan, and hosted a workshop for city staff to inform an I & I strategy for the City. A draft report has been reviewed by staff, and the report is anticipated to be completed in the coming months. When complete, the City will share the I & I strategy with the W3C, so that other municipalities can use it as a starting point to prepare something that works for their systems.

CLOSE AND PROPOSE NEXT MEETING

The next W3C meeting is tentatively scheduled for September 14, 2018.

W3C: WASTEWATER & WATER COLLABORATIVE MEETING

Friday, September 14, 2018; 9:00 am – 1:00 pm
6300 Hammond Bay Road – RDN Committee Room

MINUTES

ATTENDEES:

Adrian Limpus – RDN
Doris Fournier – Nanaimo
Ian Lundman – RDN
James Haddou – RDN
John Elliot – Nanaimo

Julie Pisani – RDN
Lorena Mueller – RDN
Mike Squire – RDN
Murray Walters – RDN
Poul Rosen – Nanaimo

Randy Alexander – RDN
Rob Lawrance – Nanaimo
Sean De Pol – RDN
Shelley Norum – RDN

1. ROUNDTABLE UPDATE

RDN Wastewater Services:

- J. Haddou provided an update on the GNPCC Secondary Treatment Project.
- S. De Pol provided an update on the [Bowser Village Centre Wastewater Project](#). S. De Pol also provided an update on the Chase River Forcemain project.
- M. Squire provided an update on the following capital projects:
 - Bay Ave Pump Station Upgrade
 - Chase River Forcemain & Pump Station Upgrades
 - FCPCCC Upgrade & Expansion.
- S. Norum provided an update on the Liquid Waste Management Plan and SepticSmart program.

RDN Water Services and Drinking Water and Watershed Protection Program (DWWP):

- J. Pisani provided an update on the DWWP:
 - Surface Water Quality Trend Analysis Report
 - DWWP Action Plan update
 - Watershed mailouts for Walley Creek and Beck Creek
 - Watershed field trips for elementary school classes
 - [Rebates](#)
 - Water Restrictions.
- M. Walters provided an update on the Nanoose Pumphouse and the acquisition of EPCOR water services.

City of Nanaimo:

- J. Elliot provided an update on City of Nanaimo’s activities:
 - Summer staff activities
 - Source Control Response Maps
 - I&I (Operations) activities
 - Water Services
 - Garbage and Recycling
- D. Fournier provided an update on City of Nanaimo’s activities:
 - 7th Street Pump Station
 - “As and When” Sanitary Sewer Modelling
 - DCC Bylaw
 - Cross Connection Control
 - Water Condition Assessment Program
 - Wetland Construction
 - Sea Level Rise Study
- P. Rosen provided an update on City of Nanaimo’s activities:
 - City of Nanaimo’s Capital Works Program
 - Project Management Framework
 - Colliery Dam

2. FLOW MONITORING

A. Limpus provided a flow monitoring billing update for the Southern Communities.

3. OVERFLOW AND SIPHON

I. Lundman provided an update on the wet weather event on January 28-29, 2018 which caused an overflow at the Brechin Overflow and Millstone Siphon.

4. INFLOW AND INFILTRATION

D. Fournier provided an update on the City of Nanaimo I&I Reduction Strategy.

5. RAINWATER MANAGEMENT: BUTTERTUBS MARSH NATURAL ASSET STUDY

R. Lawrance provided an overview of the Municipal Natural Assets Initiative.

6. REGIONAL REFERRALS PROCESS

L. Mueller provided an update on the referrals process for projects affecting RDN Wastewater Services.

7. SOURCE CONTROL

J. Elliot provided an update on the colour-coded response map in his roundtable update.

8. CLOSE AND PROPOSE NEXT MEETING

The next W3C meeting is scheduled for March 2019. Discussions will be held in the upcoming months to consider expanding the scope of the meetings to include operations staff.

Appendix B – ESOCs and Microplastics Memorandum



MEMORANDUM

Date: January 24, 2018
To: Shelley Norum; Regional District of Nanaimo
From: Ehren Lee, Urban Systems
File: 1984.0017.01
Subject: ESOCs and Microplastics Advisory Support

1. Memo Overview: Issue, Drivers and Study Framing

The Regional District Nanaimo (RDN) administers four wastewater services and occasionally receives inquiries in regards to the current level of treatment and the effectiveness of the system with regards to effluent water quality. Within these exchanges, there is some misinformation and or elevated concerns about Emerging Substances of Concern (ESOCs). Each of the RDN's four treatment facilities operates under either a permit or Operational Certificate as issued by the Ministry of Environment, and most facilities are undergoing upgrades to improve treatment capacities.

Overall, there are *apparent gaps* between the level of service provided by the facilities and the water quality expectations of select stakeholders. There are no known receiving environment issues at this time yet there are occasional concerns regarding greater treatment levels and a perception that additional proactive efforts are required to prevent significant ecological disruptions.

Our topical review and advisory summary will support the RDN to evaluate various options for responding to these concerns in particular through the following study focus objectives:

- Research and summarize discussion papers from North American water works associations for insights on emerging trends in treatment, environmental risks and overall programming to safeguard community values for ESOCs;
- Review the water quality context based on treatment levels for the existing facilities to appreciate topics and issues that may warrant future technical reviews for the RDN;
- Consider multiple responses to the stakeholder concerns that are specific to a regional district including program options such as source control methods, additional monitoring, among others; and,
- Identify options and compare impact-effort for each option so as to create a basic plan for building a program to respond to ESOCs.

Overall, there is a growing sentiment for higher wastewater treatment and changes to levels of service which causes the RDN to evaluate near-term responses to the issues.

2. Memo Background: Definitions, Context and Technical Themes

The RDN administers four sanitary sewer services each including treatment and disposal¹. All services provide at least primary treatment and following upgrades to two of the four services (pending in the next 5+ years), there will be secondary treatment for all systems.

¹ A fifth service is proposed for the community of Bowser where the RDN will potentially manage collection, treatment and disposal.

TECHNICAL MEMORANDUM

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The Municipal Wastewater Regulation (MWR; provincial) and Wastewater Systems Effluent Regulations (federal) requires secondary treatment at all facilities serving a minimum number of customers who discharge to a surface water environment. Effluent quality requirements for federal regulations often stipulate finished concentrations for coliforms, nitrogen, phosphorus, toxicity, biological oxygen demand, total suspended solids and levels of disinfection, as needed. A parameter not yet addressed by provincial regulations, but is still topical with scientists and engineers, elected officials and various stakeholders is that of emerging substances of concern (ESOCs) including microplastics.

ESOCs include pesticides, pharmaceuticals and personal care products, fragrances, plasticizers, hormones, flame retardants, nanoparticles, perfluoroalkyl compounds, chlorinated paraffins, siloxanes, algal toxins, various trace elements including rare earths and radionuclides; certain metals, including lead, arsenic, silver, selenium, and mercury, have also been classified as ESOCs. The effects and risks of ESOCs encompass a range of factors, including:

- ESOCs are not fully understood which is partly why they are concerning;
- the variability of the contaminant, the impacted species, and the effluent characteristics makes it difficult to define the effects of ESOCs;
- there has been research showing irregular health and reproduction characteristics in fish due to ESOCs;
- many ESOCs are resistant to natural degradation and they reside in the natural environment for long periods of time with the potential to cause adverse effects;
- ESOCs are not regularly monitored but have the potential to impact the environment and/or human health; and,
- ESOCs will continue to be a moving target because new chemical compounds are always being produced.

Microplastics are pieces of plastics that are between 0.33mm and 5mm and are potentially harmful to aquatic life and the environment. Microplastics are primarily made up of micro fragments, microbeads, and microfibres: micro-fragments are from larger pieces of plastic that have degraded; microbeads are usually from personal care products; and microfibres are from synthetic clothing. The primary issue with microplastics is that aquatic and aerial species can accidentally ingest them and or mistake them for food. Once ingested, microplastics can cause gut blockage, physical injury, changes to oxygen levels in cells in the body, altered feeding behaviour and reduced energy levels, which impacts growth and reproduction. In addition, microplastics have the ability to absorb and carry or contain other harmful chemicals in the environment which can be released once ingested by aquatic life.

A sub-topic to ESOCs which has experienced a longer course of public and scientific debate is the broader term *endocrine disrupting substances*. In the mid-1990's, concerns were first raised regarding the impact of certain substances on the normal functioning of endocrine (hormone) systems. The endocrine system consists of complex mechanisms which are responsible for the co-ordination and regulation of the internal communication among cells. Endocrine systems release hormones which act as chemical messengers, interacting with cells to control normal biological functions such as growth, embryonic

TECHNICAL MEMORANDUM

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development and reproduction. These processes are complex. Examples of endocrine-related problems include:

- Exposure to industrial chemicals and certain insecticides has been associated with deformities and embryo mortality in birds and fish;
- Effluents from pulp and paper mills have impaired reproduction and development in fish;
- Exposure to anti-fouling substances used in the ship industry has resulted in abnormal reproduction in snails; and,
- Reports have indicated a higher incidence of fish feminisation near municipal effluent outlets.

It is thought that the principal cause of feminised responses in wild fish populations worldwide is related to the presence of endocrine disrupting substances in sewage effluents (Filby et al., 2010). It is understandable that with the wide variety of sources and substances which are potentially able to disrupt the endocrine system, and the low concentrations which may be present, the subject of endocrine disrupting substances is a challenge to environmental managers in industry and government worldwide. As such, there is a global aspect to the whole subject of endocrine disrupting substances, their impact and the development of management criteria.

The aforementioned background and definitions of ESOCs is only a snapshot into the broad and in-depth information available and we suggest that much greater research is required prior to undertaking scientific efforts to assess risk and developing engineering responses to them. Given the primary purpose of this memo is to position the RDN for evaluating near-term responses to the issues, the memo transitions to a broad scan of government-led initiatives into reviewing, assessing, regulating and responding to the broad issues of ESOCs. And, while the research (throughout the scientific community) into ESOCs evolves, there is adequate rationale to research the gap between the incidence of contaminants and the removal of said contaminants, and to identify preliminary tactics to manage risk to environment, health, public confidence and service sustainability.

3. Executive Scan: ESOCs Mitigation Practices

Waste water treatment plants (WWTPs) are typically proficient in completing the task that they were designed for which is to renovate water to meet applicable standards so as to compliantly return the water to the environment; however, most WWTPs were not designed to specifically remove most ESOCs or microplastics. Yet, some treatment processes are much better than others in removing ESOCs partly by design and partly as a result of their methods to remove other compounds that share similar characteristics. And, while many treatment processes can remove ESOCs, these compounds can still remain in the sewage sludge. Overall, while some mitigation of ESOCs is present today even in historic (non-emerging) treatment practices, there are important questions in regards to the effectiveness of removal rates and a strong interest in understanding the range of mitigation practices.

A number of institutions and governments across North America have reviewed the incidences, probabilities, available research, potential outcomes, and possible pathways to mitigate the known risks for ESOCs. Overall, our experience is that there is a lack of consistent themes in terms of responses by

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governments; however, the range of experiences by many institutions can be observed for advisory purposes. While there is a broad range and extent of practices, most of the institutional responses fall under a few categories, namely:

- *Source control*, which tackles potential sources of pollution at their source;
- *Education and information*, which is typically premised on allaying the perceived fears related to the risks of ESOCs or focuses on programming enhancements such as funding and source control;
- *Treatment*, which enhances current processes to target removal of a particular suite of contaminants
- *Sampling and monitoring*, which intends to uncover the effectiveness of existing or future treatment processes, and, examining receiving environments including biota so as to determine the incidence of ESOCs in the environment; and,
- *Regulatory change*, which typically centers on source control or advocacy towards increasing treatment requirements to further remove ESOCs from the treated effluent.

Each type of response is explored below through select findings, messages and scientific outcomes from a range of studies and programs available within the literature.

Source Control, Education and Information

- Source control methods may involve the restriction, substitution or reduced usage of certain ESOCs or products containing ESOCs, or the separation and/or pre-treatment of wastes that contain ESOCs or products containing ESOCs, which are destined for the sewer.
- Source control of pharmaceutical compounds may be accomplished to some extent through pharmaceutical take-back programs and education of the public that they should not flush unused medications via toilets to the sanitary sewer system. For those pharmaceuticals that are excreted in urine, use of toilets equipped with urine traps may help to remove the compounds from entering the wastewater stream.
 - CRD's Regional Source Control Program includes an extensive range of parameters and applies specific controls depending on the type of permit for the given building or land use; one element of the program helps promote the *Medications Return Program* (RDN has a similar initiative) which promotes the proper disposal of unused and expired medications, thereby reducing their release to the environment. Note: In our experience, the CRD's Regional Source Control Program is the most comprehensive and enforced suite of practices in the province. Their practices have not been evaluated as part of this study but suggest that further review may occur while the RDN evolves its own program. <https://www.crd.bc.ca/about/what-we-do/stormwater-wastewater-septic/regional-source-control>
 - Metro Vancouver recently expanded its source control outreach program which includes an *Unflushables* campaign launched in 2017; much of the information available to Metro Vancouver and CRD is well known to RDN staff.
 - RDN's Liquid Waste Management Plan includes ongoing improvements to its Source Control Program through improved outreach and public education programs. Outreach continues to target residents, businesses and medical facilities to address pharmaceuticals, personal care products, organics, fat, oil, grease and inflow and infiltration (I&I). One element of the program includes the RDN's participation in a *source control network*, which involves select municipal governments

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across BC who discuss source control issues and strategies. We understand that the topic of ESOCs is likely to become part of the network's priorities in the near future.

- Source control is typically found to be the most effective and least expensive pollution prevention option, and may be the primary tool applied to reduce microplastic pollution. The federal ban (USA, Food and Drug Administration) on plastic microbeads in rinse-off personal care products is one example of microplastic-specific source control that will soon take effect. However, the sources of microplastics are diverse, and different sources or particle types may be more amenable to source control than others. This phenomenon triggers a range of source control methods, including better management of:
 - larger plastic trash items that ultimately fragment into microplastics;
 - industrial microplastic materials that may be blown or washed off surfaces into creeks and storm drains that discharge to surface waters (e.g., nurdles, abrasive-blasting materials);
 - laundering practices such as implementation of microplastic filters on laundry machines to reduce the release of fibers to wastewater; and,
 - voluntary measures that consumers, businesses, and government agencies can take to reduce use of plastic (particularly single-use plastic items) and or including eco-labelling on products
- Sewer use by-laws can be used as a tool to control the release of ESOCs from industrial, commercial, and institutional facilities. Enforcement of the bylaw can be difficult and requires resources such as staff, laboratory capabilities, and funding.
- Most education and information programs that seek to engage with multiple stakeholders with an emphasis toward the role of source control and the ways that various types of wastewater customers can do their part to minimize negative effects on the environment. Throughout the course of this study and similar exercises for other utilities, we've come across multiple studies and memos that communicate to elected officials of various governments that ESOCs already undergo some level of removal and that there is not yet sufficient information or case studies to cost-effectively select enhanced, practical treatment upgrades for ESOCs.
- In summary, source control can be an effective means to eliminate or reduce the incidence of select ESOCs from wastewater. However, the extent of resources required to prevent most if not all ESOCs from entering wastewater is extraordinary and seemingly implausible; this leaves a gap in assurance of the occurrence of ESOCs in effluent and warrants the need to review other responses such as treatment and monitoring.

Wastewater Treatment

- Primary treatment plants must be upgraded to secondary treatment plants or lagoons however both levels of treatment still provide up to high removal rates for select ESOCs, including removal of pharmaceuticals and personal care products.
 - There have been significant studies on the ability of secondary biological sewage treatment processes to remove ESOCs (**see 'Table 7' enclosed**; excerpt from conference proceedings at Water Environment Association of Ontario, 2010).
- Treatment technologies that generally perform well with respect to the reduction of ESOCs and associated toxicity include activated carbon, ozonation, advanced oxidation, and reverse osmosis (Note: We are not aware of any treatment facilities in BC with similar technology). These

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technologies work as part of a treatment train that includes at least a secondary level of upstream treatment.

- Sorption is the attachment of a substance to the solids or sludge and includes hydrophobic substances moving from the liquid to the solid phase during sewage treatment through physical means. Sorption does decrease the concentration of some endocrine disrupting compounds in the liquid effluent which is discharged to the receiving environment.
 - Activated carbon is used as a standard process for the treatment of drinking water. Organics, such as endocrine disrupting substances, can be removed from water through the attachment to the activated carbon media by sorption. Although there have been many studies with respect to the use of activated carbon for the treatment of drinking water, the studies relating to sewage effluents are limited, and are largely extrapolated from the understanding of the drinking water studies. From the research which has been conducted on sewage effluents, activated carbon has the potential to be an effective treatment process for endocrine disrupting substances.
 - Activated sludge plants remove the bulk of organic compounds which enter the sewage treatment plant, however, early research indicated that while removal can occur, this did not necessarily relate to complete biodegradation.
 - Some typical modifications to the standard activated sludge process include nitrification, biological nutrient removal and the membrane bioreactor.
 - The activated sludge process is considered to provide up to 99% removal of endocrine disrupting substances (Johnson and Sumpter, 2001), although this will vary depending on the type of substance which is present (Lishman et al., 2006; Oulton et al., 2010).
- Biodegradation is a biological process of breaking down a substance into carbon dioxide and water (aerobic biodegradation) or CO₂, H₂O, and methane (anaerobic degradation). Factors for effectiveness include age, temperature, biomass diversity, the fraction of active biomass which is present, floc size, the structure of the chemical to be degraded, the hydraulic retention time and biomass concentration.
 - Chemical oxidation is the use of highly active chemicals to breakdown compounds through a simple chemical reaction.
 - Ultra-violet (UV) light results in the photolytic decay of organic compounds. There is some information on the potential to use UV light for the treatment of endocrine disrupting substances in drinking water, but it is assumed that the complex organic nature of a sewage effluent would result in less removal of ESOCs due to the higher concentrations of organic matter present and the potential for other light scattering or light absorbing constituents (Oulton et al., 2010).
 - Volatilization includes rapid aeration and its effects on removal of ESOCs needs further research.
 - There are instances where an ESOC may actually increase in concentration as it moves through a sewage treatment plant. Although this could be due to the evaporation of water in warm climates or sampling constraints, the increase in the concentration may also be due to the release of ESOCs which are attached to particulate faecal material or the conversion of substances which have been transformed by metabolism in the human body back to the parent compound (Onesios et al., 2009).
 - The complex nature of ESOCs causes difficulties in the ability to predict the biodegradation pathways and the nature of the intermediate by-products which form during biodegradation. There

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is also the risk of incorrectly extrapolating data and information gained from the laboratory into the real world (Onesios et al., 2009).

- Of the tertiary and advanced treatment technologies, reverse osmosis and activated carbon performed the best overall for the reduction of whole effluent toxicity.
- There are still significant knowledge gaps on the treatment or removal of ESOCs during the wastewater treatment process. Caution is needed when considering the outcomes of laboratory and pilot-scale studies, as these outcomes may not necessarily be translated directly to full-scale sewage treatment plant operations.
- Table 1 provides a brief review of the RDN wastewater services including a summary correlation of the proposed level of treatment and their impacts on ESOCs.

Table 1: RDN Wastewater Service Area Review – ESOC Management Context

RDN Service	Level of Treatment and Outfall Conditions	ESOC and Microplastic Considerations	
		Pros	Cons
Greater Nanaimo Pollution Control Centre	<ul style="list-style-type: none"> o Chemically-enhanced primary treatment o Secondary treatment (2019*) – <i>conventional activated sludge</i> and expansion to accommodate growth o Outfall: discharged into the Strait of Georgia at a depth of 70m, 2,000 m offshore 	<ul style="list-style-type: none"> - Secondary treatment enhances the removal of ESOCs and micro-plastics - Activated sludge is known for removing large quantities of organic compounds and non-conventional contaminants - Solid retention time can increase removal 	<ul style="list-style-type: none"> - <i>Would requires further treatment to increase the removal of ESOCs</i>
French Creek Pollution Control Centre	<ul style="list-style-type: none"> o Secondary treatment – Tricking Filter / solids contact o Expansion using <i>conventional activated sludge</i> process (2021) * o Outfall: discharged into the Strait of Georgia at a depth of 61 m, 2,000 m offshore.” 	<ul style="list-style-type: none"> - Secondary treatment enhances the removal of ESOCs and micro-plastics - Activated sludge is known for removing large quantities of organic compounds and non-conventional contaminants - Solid retention time can increase removal 	<ul style="list-style-type: none"> - <i>Trickling filters are mainly designed for BOD removal; removal of ESOCs is substance dependant and there remains debate on effectiveness</i>
Nanoose Bay Pollution Control Centre	<ul style="list-style-type: none"> o Chemically-enhanced primary treatment o Secondary treatment – process not selected (2023) * o Outfall: discharged via an outfall into the Strait of Georgia 450 m offshore at a depth of 39 m 	<ul style="list-style-type: none"> - Focus on removal of BOD and TSS 	<ul style="list-style-type: none"> - <i>Would requires further treatment to increase the removal of ESOCs</i>
Duke Point Pollution Control Centre	<ul style="list-style-type: none"> o Secondary treatment with UV disinfection – Sequencing Batch Reactor o Outfall: discharged into the Strait of Georgia 242 m off shore at a depth of 43 m.” 	<ul style="list-style-type: none"> - Decays organic compounds - Effective for bacteria and viruses - Environmentally friendly method and cost-effective 	<ul style="list-style-type: none"> - <i>UV light not well known to eliminate most ESOCs; turbidity and suspended solids can harm effectiveness</i> - <i>Does not filter/remove microplastcis and ESOCs (inorganic materials)</i>
Proposed Bowser Village Centre Treatment Plant	<ul style="list-style-type: none"> o Secondary treatment with UV disinfection – <i>Sequencing Batch Reactor</i> (2019) * o Outfall: Proposed marine effluent disposal as ground disposal was deemed not feasible 	<ul style="list-style-type: none"> - Decays organic compounds - Effective for bacteria and viruses - Environmentally friendly method and cost-effective 	<ul style="list-style-type: none"> - <i>UV light not well known to eliminate most ESOCs; turbidity and suspended solids can harm effectiveness</i> - <i>Does not filter/remove microplastcis and ESOCs (inorganic materials)</i>

*Proposed upgrades (target upgrade year)

- Composting of sludges (aerobic treatment) generally resulted in the highest removal efficiencies of most ESOC, including pharmaceutical and fragrance compounds. Anaerobic digestion was less successful in overall removal of ESOCs than the composting process.

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- There are insufficient data reported in the literature to determine the effectiveness of the different biosolids treatment processes for reductions of many ESOCs.
- In summary, standard sewage treatment processes such as those employed by RDN are known to remove ESOCs, although the level to which this is achieved will vary due to a number of factors, including the complexity of each substance. While a high treatment rate can be achieved for select parameters, this is not necessarily the case for all substances. In addition, given the very low concentrations which can cause endocrine disrupting effects, it is possible that a high level of treatment may not be sufficient to guarantee that an effect will not be seen.

Sampling and Monitoring

- Methods to extract, isolate and identify microplastics exist, but the practice to enumerate and identify these very small particles should be standardized.
- Standardized whole effluent toxicity tests are not available for ESOCs.
- The acute and/or chronic toxicity associated with traditional toxicants in municipal wastewater effluent such as chlorine, ammonia, metals, and legacy contaminants may mask the toxicity of ESOCs, and as such, samples may need modification to exclude such toxicity prior to the measurement and evaluation of ESOC-related toxicity.
- There is a need to define criteria for what is an adequate database for characterization of contaminants in sludges and biosolids, then to apply the criteria to the compiled data. Where there are insufficient data, the availability of adequate analytical protocols for the ESOCs of interest needs to be determined by qualified analytical personnel.
- The impact of these compounds on the ecosystem and ultimately on human health is unknown, and there are few tools available that are relatively simple and rapid, yet sensitive enough to detect biological responses to trace levels of these contaminants. In addition, it is not yet known how rapidly aquatic organisms return to baseline conditions once exposure ceases.
- Sampling and monitoring does provide a precautionary response to ESOCs however there are significant complexities in the effectiveness of any enhanced monitoring, such as:
 - the cost of the analyses
 - limitation of testing associated with effluent samples, due to the presence of solids and organic matter;
 - the inability to test for all parameters which may have a disrupting effect which includes the vast number of unknown by-products which can be produced during degradation,
 - the limitations with respect to the analytical detection limits and the potential for effects to occur below these detection limits,
 - the issues of increased effects as a result of interactions between the different types of ESOCs, and
 - concerns with the ability to translate measured concentration into risks associated with biological effects.
- In summary, sampling and monitoring already provide critical information to the RDN and regulators in regards to effluent quality as a method for maintaining healthy receiving waters. However, it is currently very challenging to effectively sample and test for many ESOCs in part due to gaps in the

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accuracy of laboratory equipment and largely due to the near undetectable concentration of many ESOCs in effluent or the environment. As a result, determining the appropriate engineering response or enhanced treatment process is similarly challenging. With further advancements to the standards and accuracy of testing processes and equipment, there is a correlated greater potential for the development of better and more numerous treatment options for ESOCs.

Regulatory Change

- The complexity associated with this subject has resulted in little demonstrable progress with respect to Federal and Provincial regulations. It is generally known that before regulatory changes occur that much needs to be understood with respect to the level of treatment which can be achieved, the extent of the effects in a receiving environment and the resulting capital and operational costs which may need to be borne to achieve required effluent concentrations of these substances.
- In July 2012, the publication of the new Federal wastewater regulation contained no requirement for ESOCs. Similarly, at the provincial level, the focus for the MWR was the standard parameters associated with sewage effluents, although in this case, the parameters were extended to include additional nitrogen parameters, phosphorus and faecal coliforms. There are no effluent quality requirements for ESOCs.
- In British Columbia, land application of municipal biosolids is regulated by the Ministry of Environment through the Organic Matter Recycling Regulation (OMRR). The OMRR was enacted in 2002 to replace a system of permits and authorizations, and falls under the authority of the Environmental Management Act and the Public Health Act, with minor amendments carried out in 2007 by the Ministry of the Environment. Recently, BC released an updated water quality guidelines document which identifies maximum concentrations (as a guideline) for a range of parameters including some ESOCs which should be further reviewed for best practice compliance.
- In summary, there are no known regulations that require the RDN to increase treatment levels to further remove ESOCs from treated effluent. However, there is some potential for the RDN to advocate to senior government to investigate the issue further and to ultimately have senior government provide guidelines or targets as it is their responsibility.

The technical factors affecting the incidence, risks and removal of ESOCs, including microplastics are broad and complex. The proceeding section frames the range of concerns and existing programs to provide additional context in regards to options for the RDN to improve engagement with stakeholders, identify management options and safeguard the environment.

4. Strategic Framing and Advisory Support for Next Steps

ESOCs including microplastics continue to increase in importance and prevalence among all levels of government, the scientific community and the public. While there are multiple technical, environmental, practical and financial barriers toward taking action on this range of issues, there is still an expectation from many stakeholders of an impactful response by service providers and regulators. The concerns that elicit a government response are varied and include:

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- Fears of ecological degradation or contamination to surface water habitats including food sources (e.g. commercial fishing, aquaculture) and the gap in information to allay those fears
- Lack of action and or vigilance by service providers to an issue that is in contrast garnering a lot of attention
- Perceptions that government is unprepared or unwilling to address the issues
- Apparent gaps in messaging, information-sharing or position-taking by wastewater officials

ESOCs represent a broad, complex issue. Select stakeholders regularly communicate their concerns for effluent water quality and push for additional responses by government to increase assurances for the health of receiving environments. Considerations for the RDN to respond to this issue encompass a range of choices not limited to scientific study. Instead, the list of concerns noted above involve emotions, further engagement, potential strategy development, information gathering and sharing, as well as further technical analysis. Overall, inaction by any government could exacerbate the issues and ultimately trigger more effort for service providers into the future. There are various options available to the RDN to demonstrate that it has taken precautionary steps to respond to the issues of ESOCs and that it is working with various partners to enhance service delivery and protect the environment. Options to this effect include:

1. Signal the need to discuss the issue with the Board with the aim of developing a resolution to deliver a suite of purposeful responses. *It is fundamental for staff to have clear direction for challenging topics related to levels of service.*
2. Update the RDNs Source Control Program in conjunction with participating municipalities with a particular emphasis towards greater management of ESOCs in part by evaluating and applying learned lessons and best practices by CRD and other leading jurisdictions in this regard. *The RDN as an organization did not create ESOCs and it's important to further mitigate the issue by reducing the occurrence of ESOCs at the source and also to evoke greater compassion by stakeholders that they too contribute to the issue and their removal.*
3. Canvass educational institutions or non-governmental organizations to formally partner in regular sampling and monitoring of select ESOCs including of the influent, effluent and receiving environment (e.g. around the outfall). *This initiative should take time to develop (e.g. ~5 years) because there is significant research still required to effectively design a reliable data collection program; yet, getting started immediately and communicating this step will demonstrate vigilance. Make it clear in communications that this response is not required, that it exceeds the regulations and that it's being proposed out of concern and abundant precaution. Further, communicate the intention of the RDN to increase the measures to better manage ESOCs, including additional treatment as needed, once the proper information is available.*
4. Engage with provincial and federal regulators by means of formal communications and conveying local sentiments so as to advocate to senior government that those with greater resources and authority must step-in to address the lack of standards or targets. *Transmitting local concerns to the regulators can uncover additional resources to investigate alternative measures and can also help to assign responsibility to others who ought to shoulder part of the effort to respond. Furthermore, in*

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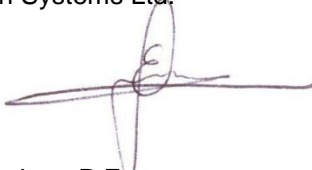
many instances, the decision to increase treatment levels should be dictated by senior government and advocating to regulators is a helpful pathway to resolving this difficult topic.

5. Message-out and communicate to stakeholders on a regulator basis in regards to the initiation and progress of these responses. *The programs and actions undertaken by the RDN to manage ESOCs can be communicated to various stakeholders to demonstrate government leadership on a difficult topic.*

By engaging in this exercise, the RDN is seeking to identify potential responses to increase service levels and organizational understanding of issues relating to ESOCs and microplastics. The list of responses above provides potential mitigation actions to a complex topic that requires many more resources than are available to the RDN or indeed any one Wastewater Service Provider. We suggest further discussion and refinement of the responses outlined above and agree that one of the early next steps in 2018 is to further engage with participating municipalities. Please contact the undersigned to continue with program development.

Sincerely,

Urban Systems Ltd.



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**Information Resources for Further Review in Subsequent Assignments**

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3938815/>
https://wrrc.arizona.edu/sites/wrrc.arizona.edu/files/Arroyo2013LR_0.pdf
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3938815/>
http://www.ccme.ca/files/Resources/waste/biosolids/pn_1440_contam_invt_rvw.pdf
<https://www.wqa.org/whats-in-your-water/emerging-contaminants>
<https://oceanservice.noaa.gov/facts/microplastics.html>
<https://www.marinelittersolutions.com/about-marine-litter/what-are-microplastics/>
<https://danimerscientific.com/the-macro-problem-of-microplastics/>
<https://eic.rsc.org/feature/the-massive-problem-of-microplastics/2000127.article>
<https://www.greenfacts.org/en/marine-litter/l-3/5-impact-environment.htm>
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**TABLE 7
SUMMARY COMPARISON OF FREQUENTLY CITED NCC GROUPS AND THEIR REMOVALS BY MUNICIPAL SEWAGE TREATMENT TECHNOLOGIES**

Level of Treatment:	Primary	Secondary ^b			Equivalent to Secondary	Tertiary and Advanced ^c			
Treatment Technology:	Primary Clarification	Non-Nitrifying Activated Sludge	Activated Sludge (SRT 10-15 d), BNR, MBR, Extended Aeration	Trickling Filters ^h	Lagoons	Tertiary Filtration (GMF, MF, orUF)	Granular Activated Carbon	Ozone, Advanced Oxidation	Reverse Osmosis
Legacy compounds (including pesticides & PAHs)	Low	High	High	N/A ^f	High	Low	High	High	Moderate to High
Metals	Low to Moderate	Low to Moderate	Low to Moderate	Low	Low to Moderate	Low	High	Low	High
Surfactants	Low	Moderate to High	Moderate to High	Low	High	Low to Moderate	High	Low to Moderate	High
Hormones (Natural & Synthetic) and Estrogenic Activity	Low	Moderate to High	Moderate to High	Low	Moderate to High	Low	High	High	High
Pharmaceuticals	Low	Moderate	Moderate	Low to Moderate	High	Low	Low to High	High	High
Personal Care Products ^d	Low	Moderate to High	Moderate to High	High	High	Low to Moderate	Low to High	High	High
Iodinated X-Ray Contrast Media	N/A ^f	Low	Low	N/A ^f	High	N/A ^f	Low	Low	High
Whole Effluent Toxicity ^e	Low	Moderate	Moderate	Low to Moderate	Moderate	Low	High	Low to High ^g	High

Notes:

^a Moderate removal means approximately 30-70% removal by the technology for a significant portion of the compounds in the category.

^b Typically employs primary treatment prior to secondary treatment.

^c Assumes secondary level of treatment prior to tertiary or advanced treatment.

^d PCPs includes fragrances, anti-microbials, sunscreens, and pest repellants.



^e Excludes toxicity due to ammonia and chlorine.

^f N/A indicates no data available to determine efficacy.

^g Some chronic toxicity tests have shown an increase in toxicity after ozonation.

^h Insufficient data available to assess other attached-growth technologies.



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