

Core Area Inflow & Infiltration Program 2020 Report

Capital Regional District | October 2020



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CORE AREA INFLOW & INFILTRATION PROGRAM 2020 REPORT

EXECUTIVE SUMMARY

The Core Area Liquid Waste Management Plan (LWMP) sets out goals and commitments for the municipalities, First Nations, and the Capital Regional District (CRD) to manage inflow and infiltration (I&I) through the Core Area I&I Management Plan. The Core Area I&I Program 2020 Report documents progress towards meeting these commitments for the period of 2019 to mid-2020.

In general, municipalities with aging sewer infrastructure are addressing areas with elevated I&I through sewer catchment analysis, investigations, rehabilitation and targeted sewer renewal. The municipalities with newer sewer infrastructure are focusing on I&I prevention. Overviews of municipal I&I actions, along with specific actions from this reporting period, are as follows:

Colwood diligently inspects its new underground infrastructure to manage and prevent I&I. It also continues its visual inspection program for manholes and cleanouts. In 2019, Colwood added 13 manholes, 780 m of sewer main, and 110 sewer connections. Colwood is currently updating its sewer master plan.

Esquimalt completed an extensive infrastructure investigation between 2004 and 2016, including camera inspection and smoke testing, relining of approximately half of its sewers, targeted repairs to manholes, and separation of its combined manholes. This work increased the sewer system performance and reduced I&I. In 2019/2020, Esquimalt modeled its sewer and stormwater systems, started development of a cost sharing strategy and bylaw for I&I, and worked with CRD Source Control to determine possible cross connections into the Gorge Waterway. In 2020, with funding from the I&I program, Esquimalt is having all of its I&I-related data (i.e. smoke testing and camera inspections) reviewed by a consultant who will provide the municipality with a prioritized list of I&I rehabilitation projects.

Langford has a rapidly expanding new sewer system. Langford diligently inspects new connections and is incentivized to monitor and repair the sewer system to preserve sewer capacity for future growth. In 2019/2020, Langford camera-inspected 4.2 km of sewer, inspected 45 manholes, repaired two manholes, rehabilitated 42 inspection chambers and fixed a cross-connection.

Oak Bay is working on the Uplands combined sewer separation project. In addition to that work, Oak Bay rehabilitated 3.6 km of sewer, separated two combined sewer laterals, separated two combined sewer manholes, camera-inspected 3.1 km of sewer, separated two cross-connections, and installed 104 inspection chambers. The CRD and Oak Bay are currently finishing work on a pilot program involving three small catchments with high I&I. Oak Bay is prepping for its sewer master plan update that is planned for 2021.

Saanich continues its sewer maintenance and repair program, including camera inspections, sewer relining, smoke testing to eliminate unused connections, and flow monitoring. In 2019/2020, Saanich relined or replaced 2,485 m of sanitary sewer. It also repaired 21 service connections, seven manholes, five sanitary sewer mains, and camera-inspected 2,230 m of sewer main. Saanich is currently updating its calibrated sewer model.

Victoria continues to manage its sewer repair and replacement work in its sewer master plan. In 2019/2020, Victoria replaced 6,104 m of sewer, 130 sanitary laterals and three manholes. Victoria replaced six catch basins that had been cross-connected to the sanitary sewer system, and inspected 529 manholes using an advanced 3D camera. The CRD I&I Program plans to fund a special I&I related project for Victoria (to be determined) in late 2020. Victoria collects sewer flow data from 12 open channel flow meters and its municipal pump stations, which is valuable for quantifying I&I reduction efforts over time.

View Royal continues its program related to sewer maintenance and repairs, camera inspections, sewer

flushing, and flow monitoring. In 2019/2020, View Royal camera-inspected 6,714 m of sewer pipe, repaired five sewer manholes, upgraded one pump station and replaced 50 m of gravity main.

Esquimalt Nation hired a consultant to inspect their sewer system and provide recommendations in 2018. In 2019/2020, they followed up by removing / capping unused laterals, grouting a leaky manhole, completing a mainline repair and renewing their pump station (in progress).

Songhees Nation continues its program related to sewer maintenance and repairs. In 2015, they hired a consultant to investigate their sewer system for I&I sources and to provide detailed design for remediation. The work is ready for tender and awaiting funding from Indigenous Services Canada.

The CRD, through the Core Area I&I Program, continues to work with its municipal and First Nations partners on I&I-related management and reduction efforts. This includes regional flow monitoring, standardizing I&I approaches, preparing management plans and annual reports, education programs and private property I&I initiatives. This work also involves coordination with municipalities and national organizations that are dealing with similar issues.

Key actions completed in 2019/2020 include:

- finalized an updated I&I brochure and banner that aligns with the new education approach
- successfully rolled out the updated education approach at an I&I focused booth at a Realtor conference in January. At the event, the CRD was invited to present at five Realtor offices and received indications that we would be welcome to present at most other offices. Also, Tony Joe invited the CRD to be on “The Whole Home Show with Tony Joe”, a radio show on CFAX 1070. Follow-up actions have been delayed due to the pandemic.
- Working under the lead of IWS, the I&I program helped develop the infrastructure for producing municipal monthly sewer reports for each of the core area Participant Areas with each area getting its own custom report. The reports quantify monthly sewer flows and compare it to previous years, and also quantify I&I rates, overflows, and periodically compare the flows to the CRD sewer allocations. The key audience for the reports are municipal engineering staff and First Nation’s administration.
- participating in a national expert stakeholder committee tasked with developing a national standard for addressing I&I in existing construction

The work described above will continue to support the regional effort to control and reduce municipal I&I flow rates. Continued and focused work is still needed to meet the LWMP commitment of reducing wet weather flows below four times average dry weather flow at Clover Point and the McLoughlin Point wastewater treatment plant by 2030. Municipalities with older sewers and inherently higher I&I will need to allocate additional resources and accelerate efforts to meet their respective I&I reduction targets.

1. BACKGROUND

1.1 Overview

The CRD completed a Core Area Liquid Waste Management Plan (LWMP) in July 2000 to serve the municipalities of Colwood, Esquimalt, Langford, Oak Bay, Saanich, Victoria, View Royal, Esquimalt Nation and Songhees Nation. The plan provides a strategy for managing liquid waste and was approved by the Ministry of Environment. Section 5 of the LWMP addresses the *Management of Infiltration and Inflow and Control of Wastewater Overflows* (see Appendix A).

Each year, the CRD's Core Area Liquid Waste Management Committee, comprised of core area representatives, submits a LWMP status report to the Province. In order to prepare this report, the Committee requires annual reports from the CRD departments that are involved in the implementation of the LWMP. This report provides the update for the Core Area I&I Program and includes data from 2019 to mid-2020. The report is divided as follows:

- Section 1 - Background
- Section 2 - Key Initiatives
- Section 3 - Overflows
- Section 4 – Private Property I&I
- Section 5 – Education
- Section 6 – I&I Rates for the Core Area
- Section 7 – Municipal and First Nation's I&I Initiatives
- Section 8 - Summary

1.2 Study Area

The CRD's core area is a partnership of seven local governments and two First Nation areas. These include Colwood, Esquimalt, Langford, Oak Bay, Saanich, Victoria, View Royal, the Esquimalt Nation and the Songhees Nation. The core area has a total land area of about 215 km² and a population of approximately 320,000 people.

In the core area, municipal sewer flows are discharged into CRD trunk sewers, which convey the flows to either the Clover or Macaulay point pump stations, where the flows are screened and pumped out through deep sea outfalls. A map of the core area sewers is located in Figure 1.1. A summary of sewer infrastructure in the core area is located in Table 1.1.

Figure 1.1: Map of the Capital Regional District Core Area

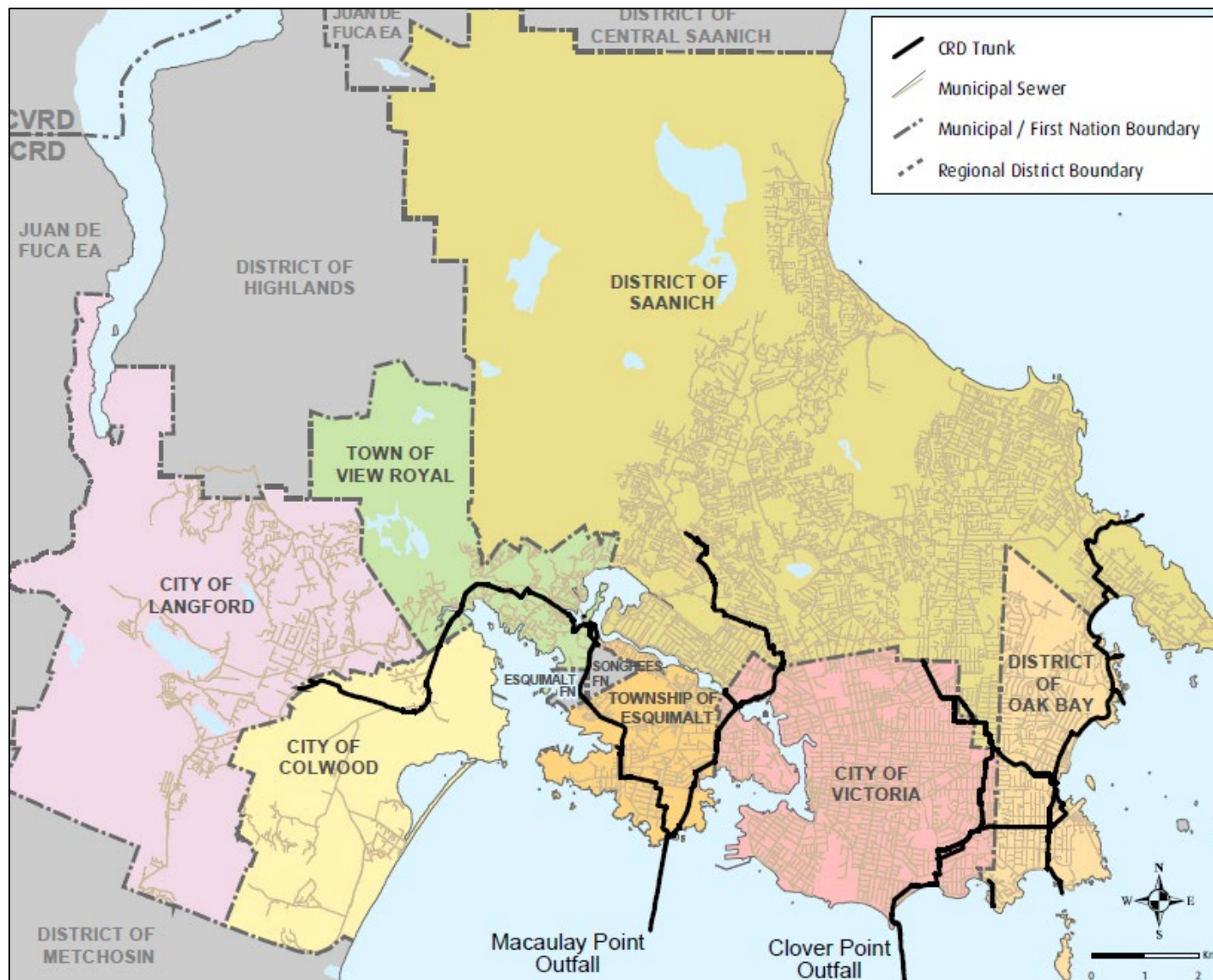


Table 1.1: Sewer Infrastructure in the CRD Core Area

* Excludes Hartland Landfill site, but includes Hartland Leachate Line

Jurisdiction		Gravity Sewers (km)	Force Mains (km)	Manholes	Pump Stations	Laterals**	Average Pipe Age *** (years)	% Developed Properties Connected to Sewer
Colwood	Municipal	40	7.8	516	10	1702	15	25%
	Private	5.2	3.7	120	12		15	
	Gov't of Canada	6.7	2.7	125	6		26	
Esquimalt	Municipal	54.8	3.9	820	12	4215	53	100%
	Private	0.2	0.0	4	0		81	
	Gov't of Canada	15.6	4.5	368	23		45	
Langford	Municipal	103.3	19.9	1512	14	6854	11	69%
	Private	9.0	0.9	144	8		10	
Oak Bay	Municipal	97.8	2.1	1280	7	6079	72	100%
	Private	2.3	0.0	32	2		56	
Saanich	Municipal	547.1	18.8	6173	43	29060	42	93%
	Private	11.7	1.4	181	0		13	
Victoria	Municipal	232.1	3.5	2754	11	17023	106	100%
View Royal	Municipal	43.0	6.5	765	23	3016	28	98%
	Private	1.4	0.2	21	1		13	
First Nations	Esquimalt	1.2	0.3	16	1	42	25	100%
	Songhees	N/A	N/A	N/A	N/A	233	N/A	100%
CRD Owned *		57.2	9.9	296	16	0	31	NA
Total		1222	85.8	15101	188	68165	51	91%

** Some estimated

*** Includes both gravity and force mains

1.3 Core Area I&I Program

The I&I program is guided by the Core Area I&I Subcommittee, which was established in the mid-1990s to work regionally to identify various methods of reducing and controlling I&I. The subcommittee comprises representatives from the CRD, Colwood, Esquimalt, Langford, Oak Bay, Saanich, Victoria and View Royal, and meets several times per year.

I&I program staff provide educational services to the public and technical support to municipalities to help promote reduction of the amount of rainwater and groundwater entering the sanitary sewer system to achieve the LWMP commitment of reducing wet weather flows below four times average dry weather flow at Clover Point and the McLoughlin Point wastewater treatment plant by 2030. The 2019 program budget was \$419,370.

The goals of the program are to:

- assist members with regulatory compliance
- coordinate and analyze regional flow monitoring and analysis
- promote the inspection and repair of private property laterals through education
- assist with prioritization of I&I reduction work required to reduce sewage overflows
- support sewer asset management programs
- support efforts to maintain sewer capacity needed for future growth, densification, and climate change

I&I program staff carry out a variety of routine tasks, including:

- preparing annual I&I reports, I&I Management Plans and Overflow Management Plan updates
- developing and analyzing flow meter data for I&I analyses
- assisting municipalities with tasks related to I&I reduction
- developing and executing private property I&I initiatives
- national leadership in I&I initiatives, such as private property initiatives and benchmarking

1.4 Past Reports

Since 2001, a regional effort of flow monitoring and analysis has been undertaken resulting in many regional initiatives. The results of this work are documented in reports summarized in Table 1.2. Of key interest are the I&I Management Plan and the Overflow Management Plan (executive summaries are located in Appendix B and C, respectively).

Table 1.2: Key Program Reports by Year

Year	Reports Completed
2005	<ul style="list-style-type: none"> • I&I Analyses Results Report: October 2001 to March 2004 • Biennial Report for the Ministry
2006	<ul style="list-style-type: none"> • I&I Analyses Results Report: October 2004 to April 2005
2007	<ul style="list-style-type: none"> • I&I Analyses Results Report: October 2005 to April 2006 • Biennial Report for the Ministry
2008	<ul style="list-style-type: none"> • Overflow Management Plan • I&I Analyses Results Report: October 2008 to March 2010
2009	<ul style="list-style-type: none"> • Biennial Report for the Ministry
2010	<ul style="list-style-type: none"> • I&I Analyses Results Report: October 2010 to March 2012
2011	<ul style="list-style-type: none"> • n/a
2012	<ul style="list-style-type: none"> • I&I Management Plan
2013	<ul style="list-style-type: none"> • Annual Reports for 2012
2014	<ul style="list-style-type: none"> • Overflow Management Plan: 5 Year Update • Annual Reports for 2013
2015	<ul style="list-style-type: none"> • Annual Reports for 2014
2016	<ul style="list-style-type: none"> • n/a
2017	<ul style="list-style-type: none"> • Annual Reports for 2016 • I&I Management Plan: 5 Year Update (included annual report for 2015)
2018	<ul style="list-style-type: none"> • Annual Reports for 2017
2019	<ul style="list-style-type: none"> • 2019 Annual Report (includes info for 2018 to mid-2019)

2. KEY INITIATIVES

2.1 Municipal Monthly Sewer Reports

The Capital Regional District (CRD) developed monthly wastewater flow reports for all Participant Areas connected to the core area sewer system where wastewater will be treated at the new McLoughlin Wastewater Treatment Plant; there is a separate report for each of the core area Participant Areas. The key audience for the reports are municipal engineering staff and First Nation's administration. The reports provide a summary of wastewater flow, include inflow and infiltration (I&I) statistics and comparisons to previously collected data. The flow data used to populate the reports comes from the core area cost sharing sewer flow meters, and is collected using the Core Area SCADA system.

The CRD's Integrated Water Services (IWS) department is leading this monthly reporting initiative. The core area I&I Program is working closely with IWS on this project and is providing technical assistance. The reports are important to the I&I Program because they effectively summarize I&I messaging to municipalities on a monthly basis. Consider this - if there was no I&I, each monthly report would be virtually the same. In essence, these reports act as monthly I&I reports!

Key actions carried out by the I&I Program include:

- worked with IWS to set up the conceptual design mockup for the reports. Of key importance to the I&I program were:
 - the inclusion of a graph containing hourly sewer flows and rainfall for the report month, which is the most intuitive way to see how sewer flows respond to rainfall. *(Using hourly data required much higher effort to set up.)*
 - tables comparing measured sewer flows to allocated flows for each municipal catchment discharging to the CRD system. The allocations come from CRD's Bylaw No. 4304 (2020) which aligns with the core area LWMP's commitments. Each catchment discharging to the CRD sewer system has allocations for both "average dry weather flow" and "peak 24 hour flow." The tables can be used to identify which of these catchments exceed their allocations and by how much, making them valuable for the I&I program. Currently these tables are only included in the monthly reports once per year.
 - summaries of overflows for the month. Overflow volumes are not quantified as part of monthly sewer volumes or I&I rates so they need to be listed to tell the whole story.
- building the reporting template in MS Excel. The template auto-populates when batches of new data are added. This simplifies the ongoing use of the template, eliminates most sources of error, and greatly increases the long-term viability of the overall project.
- updating and refining the reporting template as required.

2.2 FlowWorks.com for Vetting Sewer Flow Data

Sewer flow data collected using core area SCADA system is considered "raw" and should be vetted prior to use. Traditionally, this requires substantial effort and is only formally carried out once a year (i.e. when billing municipalities for their sewer flow into the CRD system). To provide reliable flow data for the monthly reports, a more efficient vetting approach was needed.

In early 2020, the CRD decided to push its core area sewer flow data to FlowWorks.com which contains tools for using, vetting and analyzing municipal wastewater flow data. Once the raw data was on FlowWorks, substantial site setup work was needed to make the data useful. The CRD's I&I program led this effort, which included:

- developing efficient data review tools and processes for vetting the data
- setting up processes and formulas for auto-correcting and manually correcting data
- building batch data export functions including batch exports that seamlessly insert into the Monthly Sewer Reports template
- building virtual sewer flow sites to reliably address data gaps
- building correlations for sites with known issues that can be in place until sites with issues can be corrected

2.3 Assessing the Accuracy of Municipal Pump Station Flow Data

I&I program staff collect and analyze sewer flow data for municipal pump stations using electronic data from wetwell levels, pump starts/stops, wetwell dimensions and flow monitor devices. The accuracy of the data varies widely between pump stations due to site-specific factors. It is important to determine how accurate the data is for each pump station, as the data may be used for sewer modeling, sewer master plans, development decisions, etc. For some pump stations, the SCADA data is not suitable for creating reliable flow data using typical methods. In 2019 and 2020, a few novel methods were developed to address this. Work is ongoing to apply these methods to these pump stations.

2.4 Committee Member: Guideline for I&I in Existing Construction

CRD I&I staff were hand-selected to be part of an expert stakeholder committee to address I&I in existing construction. The committee is made up of municipal engineers, inspectors, consultants, building industry representatives and regulators. The committee reviews draft documents and will meet online. The goal is to develop a national foundation document which is the first step for creating a new CSA national standard. This work is led by Norton Engineering, the Institute of Catastrophic Loss Reduction, and Engineers Canada.

2.5 Review of the Master Municipal Construction Document

The Master Municipal Construction Documents (MMCD) is the foundation for municipal infrastructure contracts in British Columbia. It contains standard specifications and standard detail drawings. The purpose of this project is to review the sections of the MMCD that relate to I&I and to propose improvements based on best practices and Canadian standards. The improvements can be implemented by the core area municipalities through their supplementary specifications. However, the long-term goal is to get the improvements implemented the MMCD. Norton Engineering is carrying out the work. They are acknowledged as the Canadian expert on the topic and are doing similar work in Ontario.

2.6 Esquimalt Project

Esquimalt has already collected I&I investigation data for the municipality including a calibrated sewer model, dense I&I data, municipal wide CCTV, smoke testing and manhole inspection data. In 2020, the core area I&I Program provided funding to Esquimalt to have this data reviewed by a consultant and turned into a prioritized list of I&I reduction actions. The results will be a valuable component of the I&I Management Plan update in 2021.

2.7 Education Approach and Materials

The key components of the education approach were finalized and implemented in late 2019. The stakeholder engagement portion is largely based on recommendations from the stakeholders themselves, based on interviews and a report completed in late 2018.

Education materials were also developed to support the updated education approach, including:

- an updated brochure and banner that aligns with the CRD's Generally Accepted Principles for Preventing Basement Flooding (Appendix D)

- updated website content to align with the new approach
- a slideshow for presenting at Realtor offices (draft)

2.8 Future Initiatives

Table 2.1: Anticipated Next Steps for Supporting I&I Reduction

Action	Description / Timeline
Finalize the Oak Bay Pilot Project (late 2020)	<ul style="list-style-type: none"> • The project involved sewer investigation work in three Oak Bay catchments with high I&I. The work included camera inspections, smoke testing and manhole inspections. The final step is to follow-up on the smoke testing results.
Special I&I Project for Victoria (2020/2021)	<ul style="list-style-type: none"> • To be determined. Will likely align with the I&I Management Plan Update for 2021.
Pump Station Flow Data for Colwood and Saanich	<ul style="list-style-type: none"> • Colwood and Saanich currently cannot collect sewer flow data from their pump stations. The CRD and its consultants will assess options for addressing this and may provide resources for implementation. • DND's Belmont pump station may be added to this list to support the needs of Colwood.
Interactive Display	<ul style="list-style-type: none"> • Finalize the interactive display for outreach events, etc.
Investigating sewer flows with a mainline sewer camera	<ul style="list-style-type: none"> • The I&I program purchased a portable mainline sewer camera in early 2020. The camera is unique in that it can be transported in most vehicles and can be used by a single staff member. It will be used to help investigate areas with high I&I.
Review Time of Sale and Sewer Billing Options (2020/2021)	<ul style="list-style-type: none"> • Determine potential options for incorporating sewer lateral education / actions into the real estate time of sale process. Consider sewer billing options. Include viability and pros and cons for each option.
Assisting with Municipal Programs (Ongoing)	<p>Assist the municipalities, upon request, with the following:</p> <ul style="list-style-type: none"> • incorporating the powers of the sample private property I&I model bylaw into their municipal bylaws, as appropriate • providing options for municipal-specific private property I&I programs to help address their unique needs and circumstances • assisting with municipal-specific private property I&I related educational materials (i.e., brochures to support municipal smoke testing or municipal installation of inspection chambers) • addressing public property laterals, smoke testing results (smoking guns), methods for collecting basement flooding statistics when home owners inform city.
Finalize Benchmarking Approach (2021)	<ul style="list-style-type: none"> • Continue leading the effort to develop I&I benchmarks for Canada.
Collaborations / Leadership (Ongoing)	<ul style="list-style-type: none"> • Continue working in collaboration with Metro Vancouver and the National Water and Wastewater Benchmarking Initiative's I&I Task Force to further private property I&I programs / options in Canada.

3. OVERFLOWS

3.1 Overview

Sanitary sewer overflows are releases of raw sewage into storm drains and/or local waterways. The majority of sewer overflows occur during heavy rainfall events as a result of I&I overwhelming the capacity of the sewer system. Overflows may also occur as a result of sewer blockage, pipe failure and pump station failures.

Sewer overflows can expose people, pets and the environment to sewage, harmful chemicals, infectious bacteria, viruses, parasites, etc. The risks associated with sewage releases are influenced by the following characteristics of the receiving environments:

- public use (e.g. shoreline access, kayaking, swimming, shellfish harvesting)
- habitat sensitivity (e.g. productive or endangered habitats such as shellfish areas, kelp beds and herring spawning sites)
- flushing characteristics (e.g. exposed coast line or in-land waters)

Reducing I&I will decrease the frequency, volume and duration of sewer overflows.

In 2014, the CRD submitted an update to the Province on the status of its commitments documented in the Core Area Overflow Management Plan (2008). A copy of the executive summary of the 2014 update is located in Appendix C.

3.2 Reported Overflows

CRD staff monitor regional overflow points with overflow sensors. The core area municipalities monitor their pump stations for overflows. When overflows occur, they are investigated, documented and reported to Emergency Management BC.

Figure 3.1 summarizes the overflows by year between 2005 and mid-2020. Note that discharges to high sensitivity receiving environments have been dramatically reduced since the Trent PS was commissioned in late 2008.

Figures 3.2 to 3.4 summarize the specific overflow events by year for 2018 to mid-2020. Note that the vast majority of overflow hours occur during very large storm events when conditions are saturated.

It is expected that there will be a reduction in locations with overflows and overflow hours as a result of conveyance system upgrades related to the core area treatment plant project, projected to be online by the end of 2020.

Figure 3.1: Graphical Comparison of Rainfall vs. Overflows

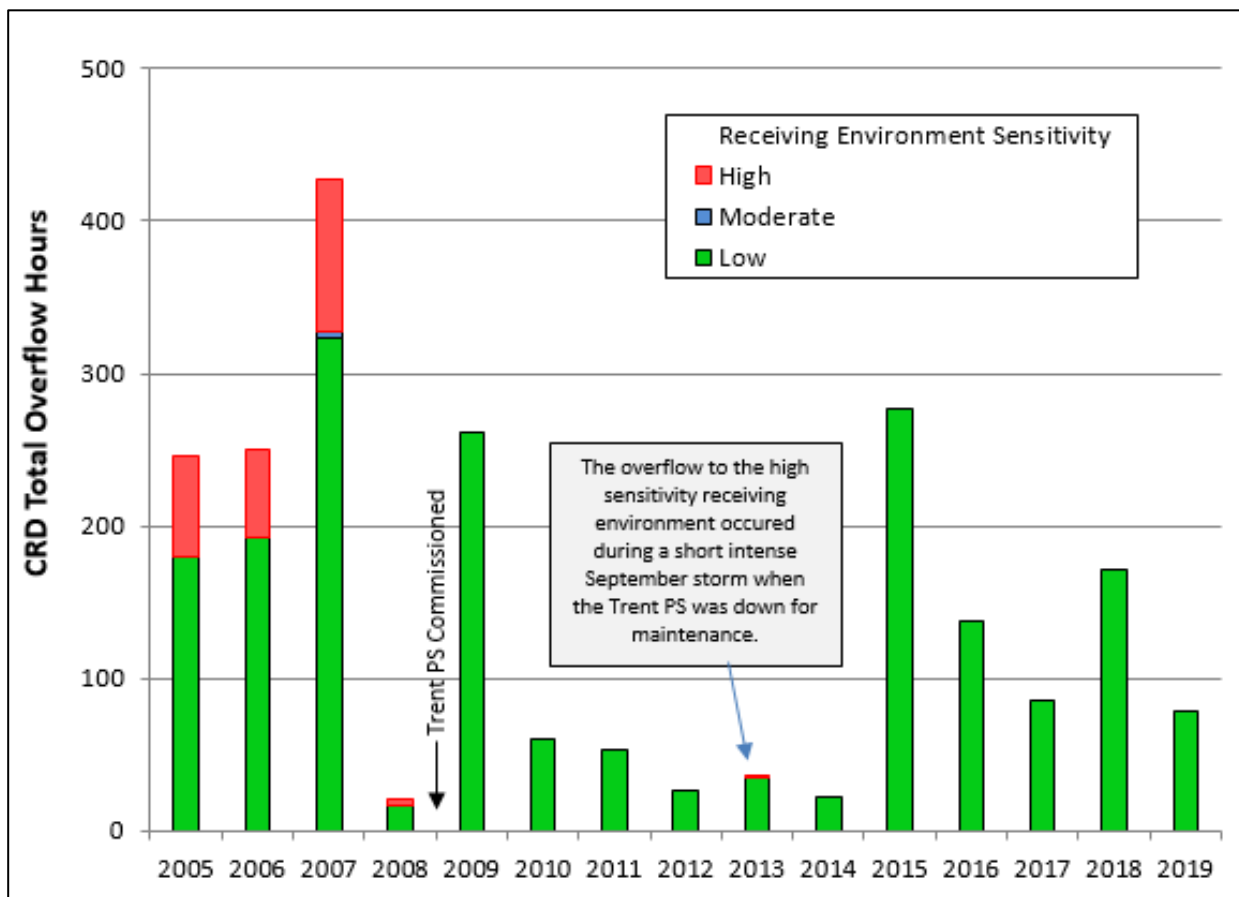


Figure 3.2: CRD Overflows from January to June 2020

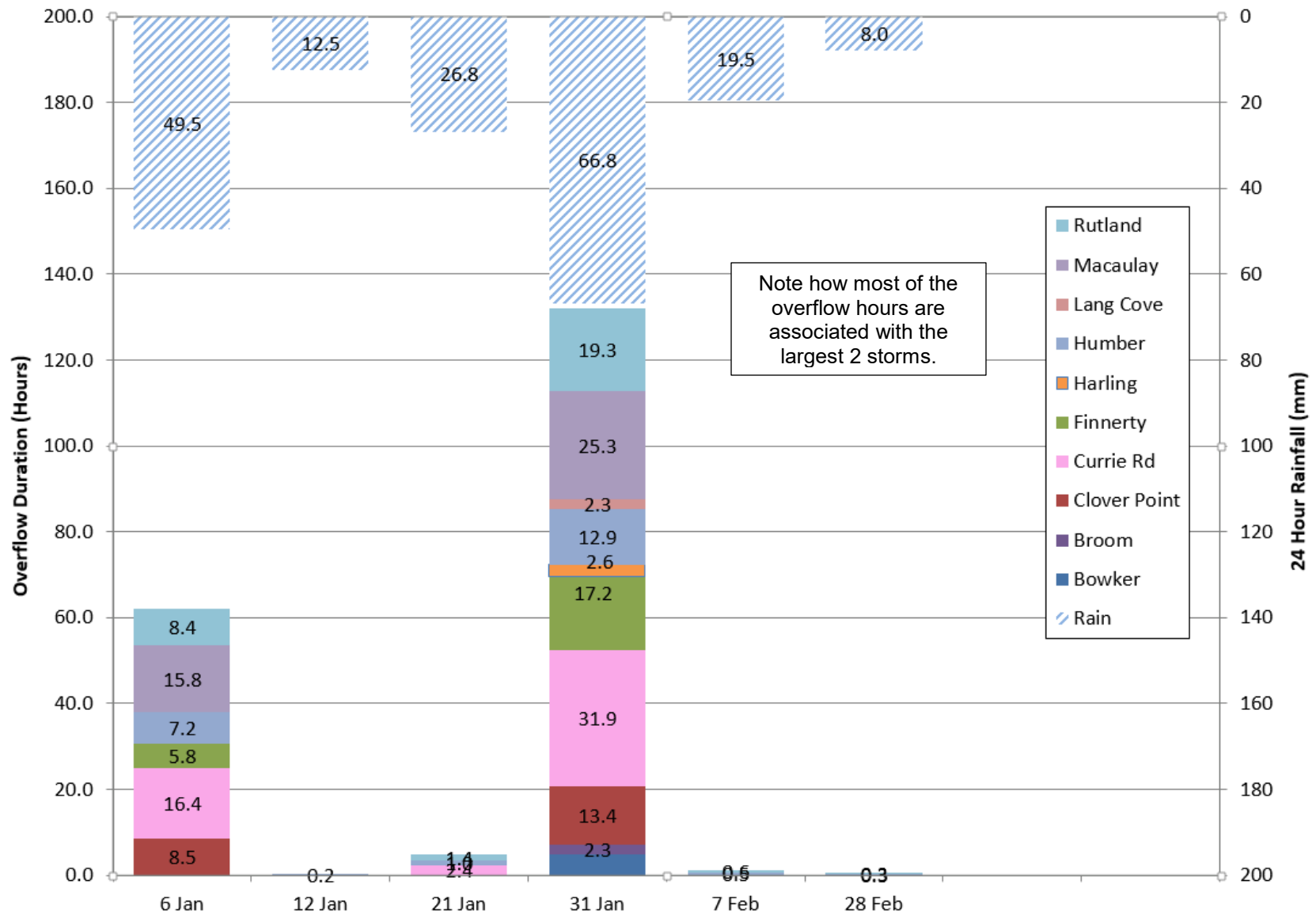


Figure 3.3: CRD Overflows from January to June 2019

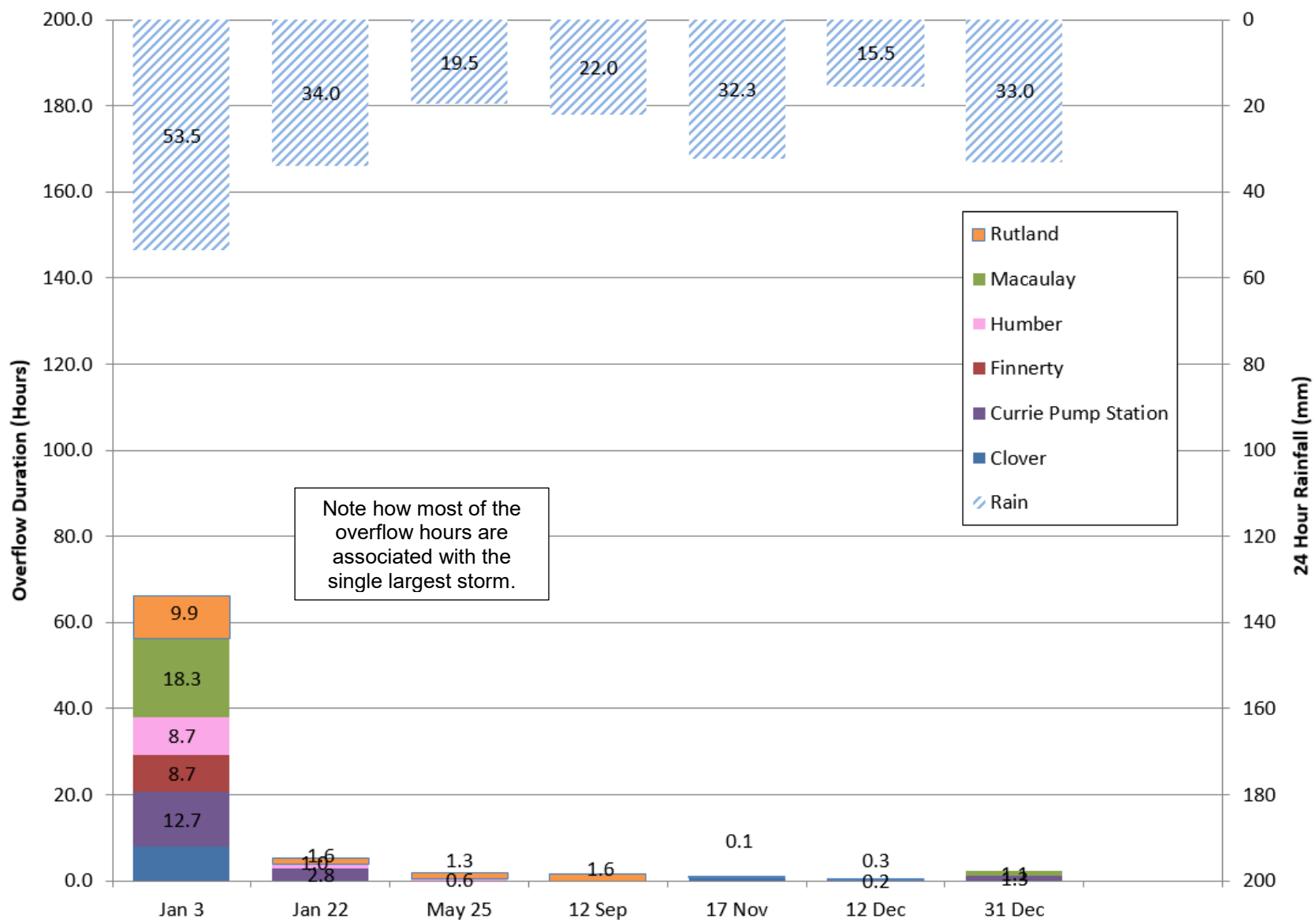
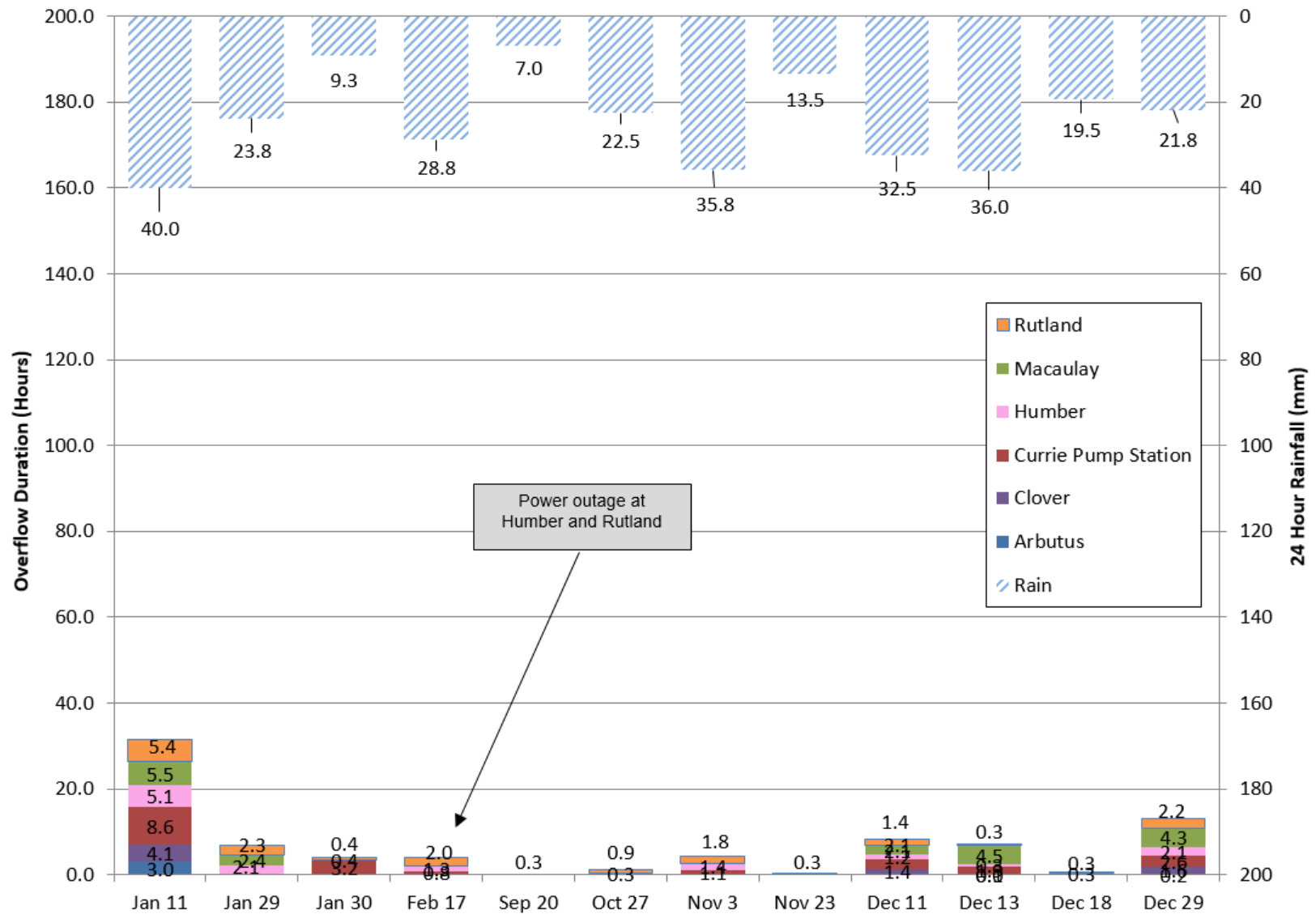


Figure 3.4: CRD Overflows in 2018



4. PRIVATE PROPERTY I&I

In North America, it is generally estimated that half of all I&I comes from private properties. As such, it is important that municipalities adopt strategies for addressing it; however, addressing private property I&I has proven difficult for the following reasons:

1. It's uncommon
 - The only municipalities with significant approaches for dealing with private property I&I are a small number of American municipalities that were required to address it to avoid substantial fines from regulators (i.e., the EPA).
2. It is expensive
 - Finding problems is expensive (e.g. \$250 for a camera inspection per property).
 - Addressing the problems can cost thousands of dollars.
 - Who pays, etc.?
3. Liability
 - Requiring or carrying out work on property brings potential liabilities to the municipality.

The CRD's I&I program staff continue to work towards workable private property I&I options for the core area. The goal is to provide the municipalities with tools/options that they can implement, as appropriate, to meet their LWMP commitments for I&I and overflows. Table 4.1 summarizes actions carried out to date.

Table 4.1: Private Property I&I Actions to Date

Timeline	Action
Ongoing	<ul style="list-style-type: none">• CRD:<ul style="list-style-type: none">- review case studies of jurisdictions taking steps to deal with private property I&I- meet with various experts and share information- work with and share information with Metro Vancouver, which is also working to establish programs to address private property I&I- are members of the National Water and Wastewater Benchmarking Initiatives I&I Task Force- provide I&I education to the public• Two municipalities within the core area (Oak Bay and Esquimalt) require that laterals be inspected and fixed if required, when applications are made for major building permits.• Each of the core area municipalities have sewer bylaws or council policies that relate to private property I&I.

Timeline	Action
2019 to mid-2020	<p>The CRD has developed the following items to support the updated I&I education approach:</p> <ul style="list-style-type: none"> • a brochure and banner that fully aligns with the GAP document (Appendix D) • updated website content to align with the new approach • a list of key regional events to interface with the public, including annual home show events, municipal events and key stakeholder events • a slideshow for presenting to realtors to Realtors <p>The CRD will be working with Metro Vancouver and the Institute of Catastrophic Loss Reduction on options that include lateral certifications.</p>
2018 to 2019	<p>The educational approach for addressing private property I&I was updated. The approach has the same desired outcomes as the existing approach: to promote the inspection and maintenance of sewer laterals. However, the approach focuses on preventing basement flooding which is more relevant to homeowners. The central document for the approach is the “Generally Accepted Principles” document, which:</p> <ul style="list-style-type: none"> • has full acceptance from the key stakeholder groups • aligns the various stakeholder groups on the topic • is designed to answer questions that the public may have on the issue in a clearly communicated fashion • establishes relationships with the various I&I related stakeholders • was developed in partnership with over 20 key stakeholder groups (local, provincial and national). Through consensus, the focus was extended to all private property underground pipes, including foundation drains and stormwater laterals. • can be used by stakeholder to educate the public <p>In late 2018, the CRD completed a report documenting how each of the key stakeholder groups preferred to be engaged on the I&I topic. The report also documented the level of outreach effort deemed appropriate for each of these groups.</p>
2017	<p>The following is a list of private property I&I work carried out in 2017 and the first half of 2018, details of which are located in Section 2:</p> <ul style="list-style-type: none"> • completed a background report to better understand I&I-related stakeholders • a report showing how to identify semi-combined sewers using GIS • collected additional private property I&I models bylaws from across Canada • Enforcement Approach for Addressing Cross Connections, as presented by the City of Burnaby to the Core Area I&I Subcommittee

Timeline	Action
2016	<ul style="list-style-type: none"> In general, the I&I Subcommittee agreed that the powers from the sample model bylaw should be incorporated into existing municipal sewer bylaws. To support this, the CRD retained consultants, Pinna Sustainability Inc., to compare the powers in the sample model bylaw to the powers in each municipality's existing sewer bylaws, and a gap analysis was completed. Based on the results, recommendations were made for updating each of the municipal sewer bylaws using language from the sample model bylaw. One municipality noted that they may include parts of the sample model bylaw as part of a new municipal bylaw. On February 11, 2016 the CRD presented to the National Water and Wastewater Benchmarking Initiatives I&I Task Force on the topic of "Implementation of a Private Property I&I Management Program". The CRD is considered a frontrunner in Canadian municipalities regarding private property I&I efforts, and staff shared the CRD's experiences and plans for moving forward.
2015	<ul style="list-style-type: none"> In late 2014, the Core Area Liquid Waste Management Committee (CALWMC) asked the CRD to prepare a sample model bylaw related to private property I&I. The sample bylaw was built using past I&I Subcommittee feedback and the best parts of existing bylaws from across Canada and the US, as documented in the report by Pinna in 2014. The draft bylaw was reviewed by a lawyer and by the I&I Subcommittee for general acceptability. The sample model bylaw was prepared and presented to the CALWMC on May 13, 2015. The committee recommended the sample bylaw be discussed with the I&I Subcommittee to determine how best to move it forward. The I&I Subcommittee decided it would be best to incorporate the powers from the sample model bylaw into the existing municipal sewer use bylaws. One municipality (Esquimalt) may customize the sample model bylaw into a stand-alone bylaw suitable for Esquimalt.
2014	<ul style="list-style-type: none"> On May 22, 2014, the I&I Subcommittee unanimously recommended that each municipality be able to customize their approach for meeting agreed-upon targets. This could involve a model bylaw that could be altered, as required, to meet the needs of individual municipalities. Overall, it was understood that municipalities with elevated I&I need a different approach than municipalities with low I&I. In 2014, the CRD commissioned a study by Pinna to prepare a memo entitled Update on Private Property I&I Programs. It contains supplementary research for the Stantec Report (2010). Notably it: <ul style="list-style-type: none"> - summarizes effective "drivers" for private property I&I programs - details private property I&I programs from across Canada by province - contains updates on private property I&I programs from the US - documents potential problems related to implementing private property I&I programs and includes North American examples - summarizes "good practices" that should apply to all private property I&I programs. For each "good practice" there is example bylaw language taken from existing Canadian sewer bylaws In late 2014, the CALWMC asked the I&I program staff to make a presentation to it in early 2015 and to include a working "draft" model bylaw in the presentation.

Timeline	Action
2013	<ul style="list-style-type: none"> • Staff shortlisted private property I&I options and refined the options. • The I&I Subcommittee reviewed the shortlist and provided feedback on multiple occasions. • Options were discussed with representatives from stakeholder groups (i.e., real estate, building association, building inspection and insurance industry, etc.)
2012	<ul style="list-style-type: none"> • Staff prepared private property I&I specific education materials related to the program options noted in the Stantec report, including: <ul style="list-style-type: none"> - handouts summarizing each of the program option categories - a detailed comparison table of the options - a reference guide covering frequently asked questions • In June 2012, CRD staff hosted a workshop focused on private property I&I for elected representatives. The purpose of the meeting was to present background information, options for moving forward, and to open dialogue on the topic. New ideas were discussed and those who were present endorsed the implementation of the consultation portion of the private property I&I plan. • On November 30, 2012, CRD staff put on a workshop for members of the Victoria Real Estate Board. The workshop was a collaborative effort between the CRD's I&I Program, Onsite Program (i.e., septic systems) and Cross Connection Program. The purpose of the workshop was to provide education and to promote the use of infrastructure inspection in the real estate industry.
2011	<ul style="list-style-type: none"> • CRD staff provided an overview of the 2010 Stantec report to elected representatives and recommended a full workshop in 2012. • CRD staff initiated an I&I-related educational program that included new educational materials and education outreach events including: an I&I brochure for residents, a comprehensive website, a survey used in 2012 to 2014, and educational videos. Public education regarding I&I will now be ongoing.
2010	<ul style="list-style-type: none"> • CRD staff commissioned a report, completed by Stantec Inc., showing potential management options for addressing private property I&I. The report included a summary of private property I&I programs used throughout North America, costs/effectiveness of these programs, and legal options for implementing programs in the region. A copy of this report is on the CRD website. • A workshop was held with municipal and regional staff to initiate discussion about options for implementing private property I&I programs, objectives, and potential barriers. It was agreed that the key objectives for a private property I&I program would be to: protect the environment, create system capacity, minimize costs, increase ownership responsibility and awareness, and minimize liability issues. A summary of this workshop is located in the Stantec report.

5. EDUCATION

CRD staff have taken steps to educate the public on the topic of I&I. The goals of this work are to:

- provide education showing where I&I comes from and the problems it creates so that when funding is required and/or rehabilitation work is proposed in local neighborhoods, the public have a better understanding of why the work is required
- encourage home owners to camera-inspect and maintain their underground sewer lateral, which will result in lower private property I&I

Table 5.1: CRD I&I Education Efforts to Date

Action	Description / Timeline
2019 and 2020	<p>Private Property I&I</p> <p>On January 23, the CRD had a booth at the 2020 Vision Victoria Real Estate Board conference and debuted the new I&I education approach to key stakeholders. The reception to the approach was exceptional. Of key significance:</p> <ul style="list-style-type: none"> • Many realtors visited the booth and were interested in both the brochures and the detailed Generally Accepted Principles document. In general, they noted that the materials were both useful and relevant to them. • Five realtor offices invited the CRD to present at their “Lunch n Learns” or “Coffee Talks”, which realtor offices typically have each month. It is believed that the CRD could schedule similar talks most real estate offices in the region as they are always looking for relevant content for these talks. • Tony Joe invited the CRD to have an extended interview related to the I&I education approach on “The Whole Home Show with Tony Joe”, a radio show on CFAX 1070 that focusses on real estate issues. It is a great sign that Tony Joe sees the value in the updated education approach because not only is he a realtor, he is a past president of the Victoria Real Estate Board and an Instructor for the British Columbia Real Estate Association. <p>As a result of COVID-19, a number of planned education actions had to be put on hold. To move things forward, efforts will be made to target the key stakeholder groups (i.e. plumbers, home inspectors, realtors) potentially through targeted video's, webinars, etc.</p>
	<p>Public Property I&I</p> <p>IWS and the core area I&I program worked together to develop monthly wastewater flow reports for the core area municipalities and First Nations. See Section 2.1 for details.</p>
2018 and 2019	<p>Developed an updated education approach making it more relevant to home owners and related stakeholders, as summarized in Section 2.2. The rollout of the updated approach was initiated in the fourth quarter of 2019.</p>

<p>2011 to Present</p>	<p>I&I was added to CRD outreach events where I&I materials were displayed along with those other CRD programs. In general, I&I was “featured” at four key events (e.g. home shows) per year and the materials made available upon request at an additional 10 events.</p> <p>From talking to CRD outreach staff, attending outreach events and talking to stakeholder groups, it is clear that I&I knowledge is low with the general public. Most people have little interest in the topic and say that they will deal with issues if they come up.</p>
<p>2010</p>	<p>The CRD I&I program, in collaboration with the core area municipalities, created a brochure, two sets of videos to help explain I&I, and developed an I&I website. This information is valuable when staff are providing notification to neighborhoods of upcoming video inspection, smoke testing, sewer rehabilitation or other work related to I&I management. The overall approach was consistent with other municipalities around North America.</p>

6. I&I RATES FOR THE CORE AREA

Regional I&I flow rates for the core area are generally analyzed every three years because there are not enough significant storm events to justify I&I analyses on an annual basis. In general, there are between 0-3 significant storm events per year. The most recent I&I results analysis was completed using data up to March 2019. The results are documented in this report.

The results of the I&I analyses are summarized as follows:

- A map of the entire core area displaying the most recent 5-year peak I&I rates for individual catchments is located in Figure 6.1.
- The individual I&I rates within each municipality have been converted into an overall weighted average for each municipality and compared with previous years' estimated I&I rates (see Table 6.1). This table is useful in providing a performance measure benchmark for each municipality to track overall I&I trends, but it must be interpreted with caution because it summarizes a vast amount of data into single municipal averages. For instance, a single very high I&I sub-area could skew the overall municipal average, or a single year of erratic weather and/or flow data could lead to misleading results. Therefore it is prudent to allow sufficient time to measure the full effect of any I&I reduction work in addition to gathering, compiling and analyzing weather patterns and I&I rates to track overall trends.
- I&I tends to predictably increase as sewers age due to the deterioration of sewer material, types of sewer material, the environment and the installation practices of the day.

Figure 6.1: I&I Rates Map for the CRD Core Area

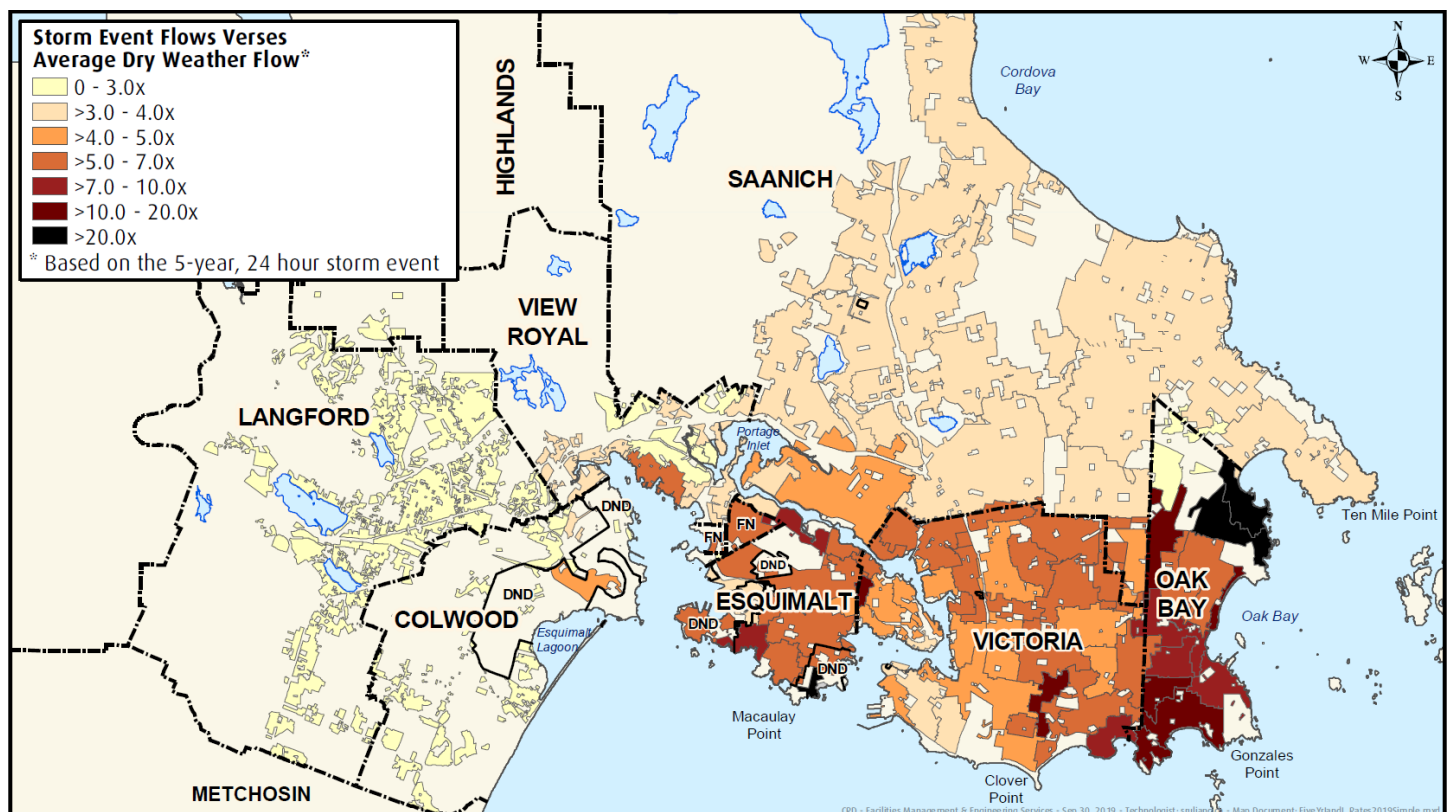


Table 6.1: Summary of CRD Core Area Municipal Peak 5-Year I&I Rates

Municipality	Ave. Age of Sewers	Estimated 5-Year I&I Rate ¹ (L/ha/day)					5-Year Peak Flows ¹ Compared to Average Dry Weather Flow
		2010	2012	2014	2016	2019	
Colwood	19	10,309	8,540	7,965	8,777	8,777	2.7 x ADWF
Esquimalt	92	52,412	52,599	48,727	51,471	48,786	6.3 x ADWF
Langford	16	11,023	9,364	9,222	10,606	8,587	1.9 x ADWF
Oak Bay ²	84	51,873	48,133	46,600	55,686	56,123	9.2 x ADWF
Saanich	43	15,514	13,613	15,427	15,223	14,369	3.7 x ADWF
Victoria	99	96,734	94,281	84,650	76,026	73,490	5.3 x ADWF
View Royal	31	12,322	12,294	13,216	14,525	11,541	2.9 x ADWF
First Nations	42	35,160	35,160	48,052	48,052	38,573	6.0x ADWF

¹ Based on peak 24 hour flows.

² Excludes the combined sewer in the Uplands which have I&I rates over 200,000 l/ha/day

Notes related to Table 6.1:

1. Most of the changes in flow rates over time were the result of more accurate sewer metering or more complete sewer meter coverage. Exceptions to this are in Langford and Colwood where rates went down due to the installation of new sewers, and Esquimalt where I&I went down after significant sewer upgrade work in the mid-2000's.
2. I&I rates are determined at each flow meter location and then interpolated into a weighted average over each particular municipality.
3. A 5-year storm event I&I flow rate is used, since the Municipal Sewage Regulation stipulates that a sewer system must be able to convey flow under this condition without an overflow.
4. In general, the rate of I&I tends to increase in proportion to the age of the system. Older systems usually need more work than newer systems. The primary goal of the I&I program is to reduce I&I to an optimum cost-benefit level. It is expensive to size wastewater facilities to accommodate vast amounts of I&I, but it can be equally expensive to rehabilitate or replace sewers to reduce I&I. Therefore, the optimal I&I level is the most cost-effective combination of I&I reduction and I&I accommodation.

7. MUNICIPAL & FIRST NATIONS INITIATIVES

Colwood

Colwood diligently inspects its new underground infrastructure to manage and prevent I&I. It also continues its visual inspection program for manholes and cleanouts.

In 2019, Colwood expanded its sewer system by adding 13 manholes, 780 m of sewer mains, and 110 sewer services. No asset information has been compiled for infrastructure installed to date in 2020.

Colwood is updating its Sewer Master Plan and is planning CCTV inspections of sanitary mains and flow monitoring in the fall of 2020.

Esquimalt

Esquimalt completed an extensive infrastructure investigation between 2004 and 2016, including camera inspection and smoke testing, relining of approximately half of its sewers, targeted repairs to manholes and separation of its combined manholes. This work increased the sewer system performance and reduced I&I.

In 2019 to mid-2020, Esquimalt carried out the following I&I related actions:

- started development of a cost sharing strategy and bylaw for I&I
- started development of a communication strategy for proposed I&I work and bylaw
- completed modelling of the stormwater and sanitary sewer collection systems
- installed or replaced 41 sewer laterals and 35 stormwater laterals
- replaced or installed four stormwater manholes and 6 catch basins
- developed a conceptual project scope for interpreting smoke testing results, etc.
- work on a plan for separation of combined manhole on Uganda Street
- continued with a project to camera inspect storm and sanitary mains (~33% complete)
- replacing various sections of storm drain/sanitary sewer mains with notable work on Esquimalt Road (sanitary sewer), Lampson Street (sanitary sewer), and Devonshire Road (storm drain)
- work on drain line modifications at the Public Works yard. The project will see oil/grit separators installed on service lines that discharge to the sanitary main and will improve water quality.
- made a grant application to Infrastructure Canada for end of pipe stormwater treatment structures for Gorge Creek and West Bay collection basins
- work with CRD Source Control to determine possible cross connection locations on Gosper Crescent

Langford

Langford has a rapidly expanding new sewer system, diligently inspects new connections, and is incentivized to monitor and repair the sewer system to preserve sewer capacity for future growth.

Since mid-2019, Langford carried out the following I&I related actions:

- inspected 45 sewer manholes for I&I
- rehabilitated 42 sewer inspection chambers
- camera-inspected 4,226 m of sewer main for infiltration purposes
- power-flushed and cleaned 1,061 m of sewer main
- rehabilitated and sealed two damaged manhole frame and covers from infiltration
- repaired a cross connection between the storm and sewer system for a property on Bear Mountain that was located during a routine CCTV of the storm system in the area

Oak Bay

Oak Bay is working on the Uplands combined sewer separation project, including an additional plan submission to the Province that was due on December 31, 2019. In addition to that work, Oak Bay carried out numerous I&I-related actions in 2019 and early 2020. The details are documented in Appendix E and are summarized as follows:

- replaced sections of sewer and storm mains; Central Avenue: replaced 86m of failed sewer plus one new sewer manhole. Heron St: removed and replaced 265 m of storm main plus seven 1050 manholes, replaced two storm laterals, replaced one sewer lateral and constructed one storm lateral (previously combined sewer)
- designed Kings Road storm drain project- abandon failed 200 mm storm drain and propose to install up to 232 m of 250 mm pipe. Propose to replace 27 storm laterals.
- sent out request for quotation (RFQ) for Runnymede Place survey. Data to be used for future design on new sewer and new storm mains. Currently, no storm main exists on a section of Runnymede Place. Proposed storm main will improve efforts to eliminate combined systems in the area.
- 2020: Preparing RFP for Sanitary Sewer Master Plan (SSMP.) Plan to do a SSMP in 2021.
- 2020: RFQ survey for proposed underground infrastructure work including storm main replacement on Armstrong Ave, Burdick Avenue, Lincoln Ave, Victoria Ave, Currie Rd.
- used trenchless technology (CIPP) to rehabilitate 3599.1 m of old vitrified sewer pipe and 434.3 m of old storm main pipe
- two combined sewer manholes were replaced
- three storm manholes were replaced
- separated two combined sewer laterals
- approved three storm water management systems/rain gardens
- installed 104 inspection chambers
- issued 67 permits to install / replace sewer or stormwater services
- carried out 79 dye tests resulting in 13 cross connections being found and two were separated
- Camera-inspected 3.1 km of sewer main in 2020. Majority of sewer in Oak Bay ROWs have been televised. Contractor now to focus on televising sewers in easements.
- Camera-inspected 10.5 km of storm sewer pipe
- received draft proposal on sewer model for Eastdowne sewer catchment area and storm model for Estevan storm catchment area
- completed sewer repairs on 31 sections of sewer
- contractor extended 46.2 m of new 200 mm sewer main on St. David Street, and eliminated a building's sewer and storm connection going to an old 200 mm private sewer main located at the rear property (no easement in place)
- working with CRD Source Control to determine possible cross connection locations at Willows Beach

CRD staff and Oak Bay are still working on a pilot program involving the collection of camera inspection, smoke testing and manhole inspection data in three small catchments with high I&I. The goal is to prioritize I&I reduction efforts in these catchments and provide a framework for similar work in the rest of the municipality. CRD staff are also working to develop reliable flow metering data from Oak Bay's pump stations.

Saanich

Saanich completed a number of replacements and renewals of sanitary sewer infrastructure through capital programs and through maintenance activities. This work included sanitary sewer and pump station upgrades and will continue to be implemented in future years.

Saanich completed the following capital and maintenance activities in 2019/2020:

- replacement and installation of 2,485 m of sanitary sewer, including 108 new sewer service connections and inspection chambers through capital projects
- repair of 21 sewer service connections including 13 full pipe replacements and 17 new inspection chambers
- repair of seven manholes, including two complete replacements
- repair of five sanitary sewer mains
- approximately 30 dye tests completed on sanitary sewer connections

In progress work started in 2019/2020 includes:

- CCTV and analysis of 2,230 m of sanitary sewer main, including 23 service connections
- planning for CIPP lining of 1,197 m of sanitary sewer main including lateral reinstatement, and lining of 81 sewer service connections
- development and calibration of updated sanitary sewer model, including a flow monitoring program for key locations
- smoke testing procedure and program development, with planned work in late 2020
- Brett Pump Station operational review including I/I potential for catchment area
- development of no-corrode sanitary sewer service connection inspection and replacement program

Victoria

Victoria continues to manage its sewer repair and replacement work in its sewer master plan, which was fully updated in 2018. Highlights of the I&I-related work carried out in 2019 to mid-2020 include:

In 2019:

- one flowmeter with a depth sensor was installed in a sanitary sewer manhole to monitor the sanitary sewer overflow channel to the storm drain manhole
- two cross-connection private property laterals were identified
- 14 linear meters of sanitary sewer mains were repaired by the City's crew
- 98 storm drain laterals and 75 sanitary sewer laterals were replaced by the Public Works staff in the City right of way. The storm drain laterals installed were in private properties by private owners during their Building Permit process.
- 28 sanitary sewer laterals were repaired and three sanitary sewer laterals were re-laid by the City crew
- 1,338 linear meters of sanitary sewer main were replaced by open trench excavation, ranging in size from 200 mm to 450 mm diameter.
- six catch basins were replaced because their laterals were cross-connected
- 105 sanitary sewer manholes were inspected by HD 3D Camera, for which MACP level 2 reports were generated.
- two sanitary sewer manholes were replaced
- 1,697 m of sanitary sewer main were relined
- one sanitary sewer vent and flush tank were replaced with the City standard terminal manhole
- 70,000 m of sanitary sewer main were cleaned by the Public Works staff
- 12,600 m of sanitary sewer mains were inspected with CCTV by the City
- ~6,000 m of sanitary sewer mains were inspected with CCTV by the contractor in 2019
- 1,023 m of sanitary sewer force main were constructed in 2019

In early 2020:

- The City has started developing a comprehensive I&I reduction plan which builds on the 2018 five-point strategy for I&I management from the Sanitary Sewer Master Plan and includes new elements that emphasize the role of private side flows.
- two FloDar flow meters with SVS sensors were purchased. The new meters have the capability to monitor peak flow, even when the monitoring manhole surcharges.
- 50 linear meters sanitary sewer mains were repaired by the City
- 410 linear meters sanitary sewer main were replaced by open trench excavation. 29 storm drain laterals and 26 sanitary sewer laterals were replaced by the Public Works staff in City right of way. The storm drain laterals installed in private properties were replaced by private owners during their Building Permit process.
- 16 sanitary sewer laterals were repaired
- Eight sanitary sewer laterals were re-laid by the City crew
- 424 sanitary sewer manholes were inspected by 3D Camera, for which MACP level 2 reports were generated
- one sanitary sewer manhole was replaced by the Public Works staff
- 2,246 m of sanitary sewer main was relined
- four sanitary sewer vents, and flush tanks were replaced with the City standard terminal manholes
- 22,900 m of sanitary sewer main was cleaned by Public Works staff
- 8,880 linear meters of sanitary sewer mains was inspected with CCTV by City Crew
- ~5,000 linear meters of sanitary sewer mains were inspected with CCTV by the contractor

Of key importance to the core area I&I Program, Victoria installed 12 open channel flow meters and three rain gauges in 2018. These meters produced high quality flow data and will be valuable for assessing future I&I reduction efforts.

View Royal

View Royal continues its program related to sewer maintenance and repairs, camera inspections, sewer flushing and flow monitoring. Since mid-2019, View Royal has completed the following sewer projects:

- repaired five sewer manholes
- repaired/replaced 50 meters of sewer gravity main
- completed the Price Bay Pump station upgrade
- awarded the Thetis Cove Pump station upgrade (2020-2021) with work starting shortly
- camera-inspected and flushed 6,714 m of sewer gravity main

Esquimalt First Nation

In 2018, the Esquimalt Nation hired a consultant to inspect their sewer system and prepare a report containing recommendations for maintenance, repairs, and I&I reduction. In 2019 and 2020, the following actions were taken:

- removal / capping of four unused sewer laterals that were noted as sources of I&I
- a mainline point repair
- grouting of a manhole to address I&I.
- renewal of the Nation's pump station (fall 2020)

Songhees First Nation

The Songhees Nation continues its program related to sewer maintenance and repairs. Initiated in late 2015, Songhees completed a study to investigate I&I sources along with a detailed design for remediation. Most of the recommended work has not been completed yet, however the work is ready for tender and awaiting funding from Indigenous Services Canada.

CRD

Section 2 of this report summarizes the key actions for the CRD's I&I program. In addition to this, CRD staff carried out the following I&I-related actions on the core area regional sewer system:

- assisted with the development of the sewer model for the core area
- conducted work supporting the building of the core area treatment plant and related conveyance system upgrades
- conducted ongoing camera inspection and manhole inspection work

8. SUMMARY

The purpose of this report is to provide an update on work related to I&I in the core area from 2019 to mid-2020. The work supports commitments located in Section 5 of the LWMP, which addresses the *Management of Infiltration and Inflow and Control of Wastewater Overflows*. The report included:

- summary of special projects carried out by the core area I&I program
- summary of overflow events from 2019 and mid-2020
- status of efforts to address I&I from private property
- I&I related updates from each of the core area municipalities

Appendix A:

LWMP Commitments Related to I&I

**CAPITAL REGIONAL DISTRICT
CORE AREA LIQUID WASTE MANAGEMENT PLAN**
(Consolidated Version incorporating all applicable amendments, February 2015)

**SECTION 5
MANAGEMENT OF INFILTRATION AND INFLOW AND
CONTROL OF WASTEWATER OVERFLOWS**

GOAL

Condition 17(1)(a) of Schedule 1 of the Municipal Sewage Regulation (MSR) requires that if infiltration and inflow (I&I) causes daily flows to be greater than 2 times the average dry weather flow (ADWF), the discharger must address "how I&I can be reduced as part of a Liquid Waste Management Plan" and condition 17(2) outlines the treatment and discharge requirements for such flows.

The goal of the I&I program is therefore to comply with this requirement of the MSR by developing and implementing a strategy aimed at reducing the amount of rainwater and groundwater entering the core area's sanitary sewer system from both the publicly owned and privately owned parts of the system in order to reduce and eventually eliminate overflows from the system.

How the Capital Regional District (CRD) proposes to substantially meet the requirements of Condition 17(2) is addressed in Sections 4 and 6 and in the draft operational certificate in Section 12.

COMMITMENTS

The CRD and the participating municipalities commit to the following actions to reduce I&I sufficiently to reduce maximum daily wet weather flows to less than four times the average dry weather flow by 2030:

1. Continue flow monitoring in each municipality to further refine priority areas for remediation.
2. Develop, by the end of 2011, and submit to the Ministry of Environment, comprehensive inflow and infiltration management plans for the core area that will:
 - a) Identify and evaluate options and opportunities that promote the minimization of groundwater and rainwater I&I into municipal sanitary sewer systems, including I&I originating from service laterals (private and public sections of sewer connections).
 - b) Identify needed changes to legislation and legal authority to enable options and strategies.
 - c) Identify opportunities for the inspection of private sewers connected to municipal sewers:
 - (i) as part of the municipal process in evaluating and issuing renovation and building permits for serviced properties; and/or
 - (ii) at the time of property transfer; and/or
 - (iii) targeted inspections.
 - d) Require the repair or replacement of private sewers that have cross-connections between storm sewers and sanitary sewer or are identified as being in poor condition.
3. Update, by the end of 2011, and enforce sewer use bylaws to prohibit the construction of rainwater and groundwater connections to sanitary sewers.
4. Implement the overflow reduction plans contained in the sanitary sewer overflow management plan, which was submitted to the Ministry of Environment in June 2008. These plans are summarized as follows:

Table 5.1
Prioritized Order of CRD Overflow Reduction Plan
(Updated based on current information)

Priority No.	O/F Name	Action Plan	Estimated Year of Completion	Estimated Cost (\$2008) to Complete
1.	Monterey Avenue MH0130	Complete and commission Trent pump station	2008 (Complete)	\$500,000
2.	Macaulay Point Pump Station	Complete installation of standby power	2008 (Complete)	\$800,000
3.	Harling Pump Station	Install a screen on the overflow pipe	2008 (Complete)	\$10,000
4.	Shoreline Drive MH0340	Commence with capacity deficiency study and identify upgrade options	2010	\$50,000
5.	Penrhyn Lift Station	Investigate pump and genset capacity	2010	\$600,000
6.	Humber Combined Sewers	Oak Bay plans to separate the sewers in the Uplands area	2015	To be determined (Oak Bay cost)
7.	Rutland Combined Sewers	Oak Bay plans to separate the sewers in the Uplands area	2015	To be determined (Oak Bay cost)
8.	Head Street MH0040	Twin the NWT from Macaulay Point to MH0055	2015	\$20,000,000
9.	Sea Terrace MH0055	Twin the NWT from Macaulay Point to MH0055	2015	as above
10.	Broom Road	Extend Trent forcemain down to Clover Point	2017	as above

Table 5.2
Prioritized Order of Colwood Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost (\$2008) to Complete
1.	SCADA Upgrade	Upgrade the SCADA system to collect flow data from all pump stations.	2008 (Complete)	\$10,000
2.	CCTV Inspection	Continue to inspect all new sewers that are installed to ensure they are well constructed	Annually	\$15,000
3.	Sewer System Maintenance	Continue to clean all mains and manholes, and repair as necessary.	Annually	\$50,000
4.	Lift Station Maintenance	Continue to maintain all lift station components to ensure that they run efficiently.	Annually	\$72,500

Table 5.3
Prioritized Order of Esquimalt Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost (\$2008) to Complete
1.	Sewer Relining	Relining and repairs to sewer mains rated poor and poorest	Completed	n/a
2.	Combination Manhole Separation	<ul style="list-style-type: none"> 148 manholes remain to be separated 29 manholes to be separated in 2008 Five manholes separated per year from 2009 to 2025 	2025	\$950,000
3.	Grafton Pump Station Upgrade	New electrical power supply, kiosk and controls	2008 (Complete)	\$38,000
4.	Grafton Pump Station Upgrade	Pump replacement	2012	\$40,000
5.	Sewer Main Replacement	Replacement of undersize sewer main on Craigflower Road between Tillicum Road and Lampson Street	2009 (Complete)	\$250,000
6.	Municipal Wide Smoke and Dye Testing	Smoke and dye testing underway to identify cross connections in attempts to reduce I&I in the future. The full scope of the project has not yet been determined.	2010	unknown

Table 5.4
Prioritized Order of Langford Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost (\$2008) to Complete
1.	Sewer Master Plan Upgrades	Continue with infrastructure upgrades as identified in the Sewer Master Plan.	Ongoing	\$0.2-0.5 Million
2.	CCTV Inspection	Continue to video inspect all new sewers that are installed to ensure that they are well constructed.	Annually	\$15,000
3.	Manhole Inspection	Continue to visually inspect manholes to ensure that they do not leak.	Annually	\$15,000
4.	Pump Station Maintenance	Continue to maintain all pump station components to ensure that they run efficiently.	Annually	\$200,000
5.	Sewer System Maintenance	Continue to keep the sewers clean and free from defects.	Annually	\$25,000

Table 5.5
Prioritized Order of Oak Bay Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost (\$2008) to Complete
1.	Uplands Sewer Separation	Complete the separation of combined sewers in Uplands.	2015	\$12,000,000 (est.)
2.	South Oak Bay I&I Rehab Project	Continue with the phased rehabilitation project in the Windsor catchment area.	2010	\$1,000,000 (est.)
3.	Hydraulic Model	Continue to complete a hydraulic model of the entire collection system.	2014	\$90,000 (est.)
4.	CCTV Inspection	Continue to video inspect sewer mains.	Annually	\$25,000
5.	Pump Station Maintenance	Continue to maintain all pump station components to ensure that they run efficiently.	Annually	\$30,000
6.	SCADA Upgrade	Upgrade the SCADA system to collect flow data from all pump stations. Typically one station per year is added to the Oak Bay SCADA system.	2016	\$180,000 (est.)
7.	Sewer System Maintenance	Continue to keep the sewers clean and free from defects.	Annually	\$237,000
8.	Manhole Inspection	Continue to visually inspect manholes to ensure that they do not leak.	Annually	\$15,000

Table 5.6
Prioritized Order of Saanich Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost (\$2008) to Complete
1.	Dysart Pump Station	Complete construction of the new Dysart pump station.	2008 (Complete)	\$2,500,000 (est.)
2.	The following pump stations will be upgraded: Vantreight Lift Station Murray #1 Pump Station Murray #2 Pump Station Arundel Pump Station Glenwood Pump Station Ashley Pump Station Dunkirk Pump Station Colquitz Pump Station Gorge Pump Station	Rebuild pump station and add a new standby generator.	2009-2015	\$500,000 Annually

Table 5.7
Prioritized Order of Victoria Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost (\$2008) to Complete
1.	James Bay I&I Pilot Project	Commence with the rehabilitation of sewer mains, laterals and manholes in James Bay.	2010	\$3,000,000
2.	Hydraulic Model	Continue to complete a hydraulic model of the City's entire sanitary sewer collection system.	2009	\$100,000
3.	Overflow Elimination	Investigate, monitor and abandon, if possible, existing known overflow locations.	2010	\$100,000
4.	Combined Manhole Separation	Investigate, monitor and initiate a program to separate combined manholes.	2015	\$400,000

Table 5.8
Prioritized Order of View Royal Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost (\$2008) to Complete
1.	Upgrade Pump Stations	Upgrade pump stations where required to improve pump performance, provide standby power and collect better data.	2017	\$140,000
2.	CCTV Inspection	Continue to video inspect all new sewers that are installed to ensure that they are well constructed.	Annually	\$20,000
3.	Manhole Inspection	Continue to visually inspect manholes to ensure that they do not leak.	Annually	\$5,000
4.	Pump Station Maintenance	Continue to maintain all pump station components to ensure that they run efficiently.	Annually	\$120,000
5.	Sewer System Maintenance	Continue to keep the sewers clean and free from defects.	Annually	\$40,000

APPENDIX C

Excerpt from the Capital Regional District Core Area Liquid Waste Management Plan – Sanitary Sewer Overflow Management Plan, June 2008.

Appendix B:

**EXCEUTIVE SUMMARY: CORE AREA I&I MANAGEMENT PLAN:
2017 UPDATE**

Capital Regional District

Core Area Inflow & Infiltration Management Plan 2017 Update

Executive Summary



KERR WOOD LEIDAL
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CORE AREA INFLOW & INFILTRATION MANAGEMENT PLAN

EXECUTIVE SUMMARY

Purpose

The purpose of the plan is to guide the Capital Regional District (CRD) and its municipal partners towards Inflow and Infiltration (I&I) reduction in a responsible, cost effective, integrated and well-planned manner. The primary objective of the plan is to reduce overflows and I&I to less than four times average dry weather flow (4xADWF), based on a five year return period, at Clover Point and the Core Area Wastewater Treatment Plant at McLoughlin Point by 2031.

Background

The core area municipalities are actively managing inflow and infiltration (I&I), a term that describes rainwater and groundwater that mistakenly gets into the sanitary sewer system. Inflow refers to rainwater that enters the sewer through plumbing cross connections and infiltration refers to groundwater that seeps into the sewer through cracks, faulty joints, etc. A certain amount of I&I is unavoidable and is accounted for in routine sewer design. However, too much I&I results in excessive sewer flows which can lead to:

- leaking sewers and overflows that can contaminate the environment and create public health concerns;
- backing up of sewage into buildings and homes that can destroy belongings and require expensive restoration;
- increasing operation and maintenance costs to convey and treat the increased flows; and
- consuming sewer capacity which could require expensive premature upgrades to the system.

The content of the Core Area I&I Management Plan is organized in the following sections: 1) Overview; 2) Overflows; 3) Asset Management; 4) Climate Change; 5) Public Property I&I; 6) Private Property I&I; 7 to 17) Municipal Plans; and 18) Monitoring & Verification.

Regulatory Context

The core area wastewater system is governed by the Core Area Liquid Waste Management Plan (LWMP). This plan was first approved by the Ministry of Environment in 2003. Since that time, there have been a number of amendments to the plan, the most recent being Amendment No. 11 (approved in 2016).

Section 5 of the plan relates to I&I and overflows and includes the following commitments:

The CRD and the participating municipalities commit to the following actions to reduce I&I sufficiently to reduce maximum daily wet weather flows to less than four times the average dry weather flow by 2030:

1. *Continue flow monitoring in each municipality to further refine priority areas for remediation.*
2. *Develop, by the end of 2011, and submit to the Ministry of Environment, comprehensive inflow and infiltration management plans for the core area that will:*
 - *Identify and evaluate options and opportunities that promote the minimization of groundwater and rainwater I&I into municipal sanitary sewers, including I&I originating from service laterals (private and public sections of sewer connections)*
 - *Identify needed changes to legislation and legal authority to enable options and strategies*
 - *Identify opportunities for the inspection of private sewers connected to municipal sewers:*
 - i. *as part of the municipal process in evaluating and issuing renovation and building permits for serviced properties; and/or*
 - ii. *at the time of property transfer, and/or*
 - iii. *targeted inspections*
 - *Require the repair or replacement of private sewers that have cross-connections between storm sewers and sanitary sewers or are identified as being in poor condition.*

3. *Update by the end of 2011, and enforce sewer use bylaws to prohibit the construction of rainwater and groundwater connections to sanitary sewers.*
4. *Implement the overflow reduction plans contained in the sanitary sewer overflow management plan, which was submitted to the Ministry of Environment in June 2008.*

Overflows

In 2014, the CRD submitted an updated core area overflow management plan to the Province. The plan documents the CRD's overflow related commitments and summarizes the significant work carried out related to overflows.

Asset Management

Asset management programs for sewer collection systems generally focus on the planned replacement of infrastructure based on remaining service life. Municipalities need to demonstrate that they are following the Asset Management BC Framework to qualify for federal gas tax funding.

Climate Change

Over the next five years, the CRD will carry out actions supporting a vulnerability assessment of CRD sewer infrastructure due to climate change. The actions include updating the core area sewer model, running the sewer model using climate change scenarios, and providing recommendations based on the results.

Public Property Inflow and Infiltration

I&I and overflow quantification helps municipalities to understand the condition and/or performance of their sewer systems. Quantified measurements can be compared to benchmarking standards and allow municipalities to track I&I performance. The most useful quantification methods are repeatable and follow a standardized approach. Examples of I&I quantification methods proposed in this plan include: statistical analysis of sewer flow data to calculate I&I rates, quantifying overflows based on given storm events, ranking structural integrity of sewer pipes based on closed circuit television (CCTV) inspections, counting cross-connections through smoke testing, documenting manhole condition and calibrating system performance using hydraulic models.

The public property I&I reduction plans are consistent with the systematic approach noted in the Infraguide for "Infiltration/Inflow Control/Reduction for Wastewater Collection Systems". Infraguide was a partnership between the Federation of Canadian Municipalities, the National Resource Council and Infrastructure Canada. It created best practice reports for municipal infrastructure. The guide proposes that I&I reduction programs be divided into the following three phases:

- Phase 1 - involves flow monitoring and data collection. The data is used to identify catchments that should be targeted for sewer investigation work.
- Phase 2 - involves sewer investigation work to identify specific sources of I&I. The data is used to create rehabilitation plans and to prioritize I&I rehabilitation work.
- Phase 3 - involves sewer rehabilitation work. The rehabilitation work is based on investigation data from Phase 2. If investigation data is not yet available, then archetype I&I rehabilitation programs should be used.

Archetype I&I rehabilitation programs were developed to provide a framework under which any given sewer catchment can be evaluated and related to an actionable plan to move forward with I&I assessments and sewer rehabilitation. These programs are to be used as planning tools. They should be interpreted from a strategic planning level and are suitable for establishing long-range budgets and for steering the development of targeted I&I reduction programs.

Private Property Inflow and Infiltration

The I&I Management Plan (2012) contained a five-year plan for implementing a common private property I&I approach for the core area. The plan was to consult with stakeholders and the public from 2012 to

2014, recommend an approach in 2015 and implement that approach in 2016. Significant effort was made to come up with a common approach. By 2014, it was clear that a common approach wasn't appropriate as the core area municipalities have different I&I rates, different issues and require different solutions. Three of the core area municipalities have older sewers and elevated I&I and they would benefit from strong programs to reduce I&I. The other four municipalities have newer sewers and have low I&I. These municipalities would prefer to focus on I&I prevention activities. The I&I Subcommittee agreed that each municipality should implement their own custom approach to suit their needs and should draw on the significant research and support that the CRD has provided.

In late 2014, the CRD Board directed that a sample model bylaw related to the inspection of private sewer laterals connected to municipal sewers be prepared. The sample bylaw was built using past I&I Subcommittee feedback and content from the Pinna Report (2014) which documented the best I&I related language from existing Canadian and American bylaws. It underwent legal review and I&I Subcommittee review for general acceptability. The sample model bylaw was presented to the Core Area Liquid Waste Management Committee on May 13, 2015. The Core Area Liquid Waste Management Committee recommended that the sample bylaw be discussed with the I&I Subcommittee to determine how best to move it forward. The I&I Subcommittee decided that it would be best to incorporate the powers from the sample model bylaw into the existing municipal sewer use bylaws. Subsequently, a gap analysis was carried out comparing the powers from existing municipal sewer bylaws to the draft sample model bylaw and presented to the member municipalities through the I&I Subcommittee.

The next steps for addressing private property I&I include:

- assisting municipalities with the further development of private property I&I reduction plans;
- supporting the implementation of the powers from the sample model bylaw for private property I&I into existing or new municipal sewer bylaws;
- developing common public education materials for use by key industry stakeholders (i.e. plumbers, realtors and home owners);
- updating the general education approach to focus on homeowner protection (i.e. basement flooding) and environmental protection and how I&I plays an integral role; and
- continued collaboration with Metro Vancouver and the National Water and Wastewater Benchmarking Initiative's I&I Task Force.

Municipal Inflow and Infiltration Plans

Each of the core area municipalities has participated in the development of their own individual municipal I&I plans. The municipal plans are organized into eight sections:

1. *Overview*
2. *Catchments* - A list and map of the long-term flow monitoring catchments that will form the basis for evaluation of I&I rates and I&I management planning
3. *Inflow & Infiltration Data* – Summary of historical data collected, current data collected, summary of I&I analyses results, and flow data analyses
4. *Sewer Infrastructure Maintenance & Capital Work* – summary of routine sewer work, notable work completed between 2012 and 2015, and notable work planned for 2016 to 2020
5. *Asset Management* – high level municipal tools, approaches, etc.
6. *Bylaws* – Contains a comparison of the key powers suggested by the CRD Private Property I&I Model Bylaw to those found in each of the municipality's existing sewer bylaws
7. *Budget* – Summary I&I budget related information
8. *Summary* - A high level summary and a graph showing projected peak wet-weather flow (PWWF) relative to 4xADWF for the entire municipality from 2011 to 2031

Monitoring and Verification

Monitoring and verification of I&I Management Plan objectives will be achieved by using the following metrics:

1. Comparison of peak wet weather flow (PWWF) with 4xADWF at Clover Point and the proposed wastewater treatment plant. This will include graphs comparing projected PWWF and ADWF verses actual rates recorded over time.

2. Flow monitoring of all catchments to track I&I rates paying extra attention to measuring flows before and after targeted I&I reduction work to verify results.
3. Tracking overflows by location, frequency, duration and receiving environment sensitivity rating to monitor trends and verify results.
4. Completion of detailed and specific I&I management strategies for each catchment to replace the archetype plans.
5. Reporting of efforts and costs applied towards I&I management on a regular basis.

The CRD will continue to provide annual reports on the I&I program to the Core Area Liquid Waste Management Committee. Every second year the I&I analyses results will be updated, as is the current practice, and an I&I benchmarking template will be filled out for each of the core municipalities. The benchmarking template is currently in development and will include a number of performance measure criteria to help gauge the level of effort each municipality is applying to I&I management.

Forecasted Inflow and Infiltration Reduction

Additional work will be needed to meet the LWMP commitment of reducing wet weather flows below 4xADWF at Clover Point and the McLoughlin Point Treatment Plant by 2031. However, the gap between 4xADWF and peak wet-weather flow (PWWF) is decreasing, which is significant as it takes a substantial investment of time and resources to reverse the natural trend of I&I increasing with sewer age.

Colwood, Langford, Saanich and View Royal already meet the 4xADWF performance target. This is largely due to having young sewers built with modern materials and good installation practices. These municipalities will need to focus on I&I prevention in order to continue to meet the performance target.

Esquimalt, Oak Bay, and Victoria have older sewers which tend to have elevated I&I rates. If we extrapolate out current I&I rates, it is evident that these municipalities will need to focus on I&I reduction to meet their commitments not to exceed the 4xADWF performance target. This will require increased focus and funding on I&I reduction to achieve their reduction targets. Financial support (i.e. grants) from senior government would help to accelerate the I&I reductions. It is worth noting that:

- Esquimalt rehabilitated all of its sewers and manholes that required structural repairs in the early 2000's. It has also separated almost all of its combined manholes. Esquimalt's next steps for addressing I&I will involve actions related to I&I from sewer laterals and stormwater sewer upgrades.
- Oak Bay's I&I reduction work focused on developing a plan for the separation of the combined sewers in the Uplands area. Oak Bay finalized the separation plan in 2017. This was Oak Bay's highest I&I related priority and was required as part of a LWMP commitment. Oak Bay also completed the significant task of collecting sewer flow data for each of its outstanding catchments using portable meters. Oak Bay's next steps for I&I reduction will be to implement the Uplands' separation project, to complete the collection of sewer camera inspection data for the municipality and to update its sewer master plan based on the results of the camera inspections.
- Victoria has collected sewer flow data for its outstanding catchments, and has also performed camera inspections and smoke testing throughout the entire municipality. The data will be analyzed and actions put into Victoria's sewer master plan. Updating a sewer master plan is a substantial project. Victoria had to delay the update of its sewer master plan until the location of the core area treatment plant was finalized because some of the locations considered for the plant would have resulted in dramatic changes to the plan. Work on the sewer master plan commenced in late 2016 after the regional treatment plant location was finalized.

The CRD is committed to assisting individual municipalities in the development of suitable private property I&I initiatives. Such initiatives could accelerate a municipality towards meeting its performance targets as it is estimated that 50% of I&I enters the sewer system on private property. Currently, there are no significant private property I&I initiatives in the core area; however, the research needed to develop such commitments is complete.

In addition, it is anticipated that significant progress will be made through the continuation and further development of I&I related education, stakeholder engagement, regulatory mechanisms, permit requirements, time of home sale options and through targeted pilot programs.

Key Future Actions

The next steps for addressing private property I&I include:

- supporting the implementation of the powers from the sample model bylaw for private property I&I into existing sewer municipal bylaws or into a new bylaw;
- assisting municipalities with the development and implementation of municipality specific private property I&I reduction plans;
- developing common public education materials for use by key industry stakeholders (i.e. plumbers, realtors and home owners);
- updating the general education approach to focus on homeowner protection (i.e. basement flooding) and environmental protection and how I&I plays an integral role; and
- continued collaboration with Metro Vancouver and the National Water and Wastewater Benchmarking Initiative's I&I Task Force.

The next steps for addressing public property I&I include:

- identifying "semi-combined" sewers in the core area and developing plans to address them;
- taking leadership on I&I benchmarking and taking action to introduce nationally;
- updating the core area sewer model, running the sewer model using climate change scenarios, and providing recommendations based on the results; and
- ongoing I&I metering, analyses and program development.

Conclusion

The Ministry of Environment reviewed and approved Amendment No. 11 of the Core Area LWMP. The LWMP included four commitments related to I&I and overflow management which are fulfilled by the I&I Management Plan.

The plan is purposeful and guided by a number of federal, provincial, regional and municipal regulatory documents and best practices. It provides the framework for how I&I can be quantified and establishes priority programs and approaches for each municipality and the CRD to follow. A strategy has been developed for moving the issue of private property I&I forward and the whole program will be monitored, verified and reported out using standard metrics and templates.

All core area municipalities assisted in the preparation of the plan and the specific actions and programs were developed based on current CRD and municipal funding levels for I&I and sewer service budgets. Modelling the results of implementing this plan show that the goal of reducing I&I to 4xADWF at Clover Point and the wastewater treatment plant is achievable but will require additional effort.

Appendix C:

EXCEUTIVE SUMMARY: SANITARY SEWER OVERFLOW MANAGEMENT PLAN: 2014 UPDATE

**CAPITAL REGIONAL DISTRICT
CORE AREA LIQUID WASTE MANAGEMENT PLAN**

**SANITARY SEWER OVERFLOW MANAGEMENT PLAN: 2014 UPDATE
EXECUTIVE SUMMARY**

On July 3, 2014, the Minister of Environment approved the Capital Regional District's Amendment No. 9 to the Core Area Liquid Waste Management Plan (LWMP) subject to four conditions being met by December 31, 2014. Condition No. 2 to the Minister's approval requires that the CRD submit a *Wet Weather Flow Management progress report that includes an update on the progress made to date in achieving the LWMP commitment to eliminate sanitary and combined sewer overflows*. This progress report was written to satisfy that requirement.

Section 5 of the LWMP entitled "*Management of Infiltration and Inflow and the Control of Wastewater Overflows*" includes the individual overflow reduction plans for the CRD and each of the core area municipalities.

Background

Rainwater and groundwater that mistakenly enters the sanitary sewer system is referred to as inflow and infiltration (I&I). Inflow refers to rainwater that enters the sewer system through improper plumbing connections such as cross-connections with storm drains. Infiltration refers to groundwater that seeps into the sanitary sewer through cracks or joints in the sewer pipe. A certain amount of I&I is unavoidable and is accounted for in routine sewer design. However, when I&I exceeds design allowances, sewer capacity is consumed, and may result in overflows, risks to health, damage to the environment, and increased conveyance costs.

In the core area, the overall length of the sewer system can be broken down as follows: 45% municipal sewers; 40% private property laterals; 10% public property laterals; 5% regional sewers. Municipalities and regional districts tend to proactively inspect and fix their sewers. Conversely, private property owners rarely inspect or perform maintenance on their sewer laterals unless they are adversely impacted by a problem.

Since 2001, the CRD has collected valuable sewer flow monitoring data for the core area. Initially, the monitoring was done with a small number of portable flow meters. The monitoring has since expanded to include over 90 permanent meters and 20 portable meters with the CRD analyzing the data collected. The results are documented in I&I analyses reports which are submitted to the Core Area Liquid Waste Management Committee annually. In addition, the CRD has prepared a number of reports for the Province as required by the LWMP including: biennial update reports (2005, 2007, and 2009), the Overflow Management Plan (2008) and the I&I Management Plan (2012).

The *Core Area Sanitary Sewer Overflow Management Plan* (2008) was developed by the CRD in collaboration with representatives from the core area municipalities engineering departments. The document includes the mapping of the known sewer overflow locations in the core area (including pump stations, combined manholes and sewer relief points), rating core area shorelines based their sensitivity to sewer overflows, summarizing overflows from 2000 to 2007, and documenting prioritized overflow management plans for the CRD and each of the core area municipalities.

The *Core Area Inflow and Infiltration Management Plan* documents an approach for addressing I&I in the core area to the year 2031. The plan was developed by the CRD in collaboration with representatives from the core area municipalities engineering departments. In the plan, the core area is divided into 108 long-term monitoring catchment areas. Each catchment area is flow monitored and the data is analyzed for I&I. Catchments that exceed the agreed upon I&I rate are investigated (i.e., camera inspections / smoke testing) and the data collected is used to determine what work needs to be completed. Finally, the rehabilitation work is prioritized and carried out based on available budget. The I&I Management Plan also contains a sub-plan for developing and implementing an approach to address private property I&I starting in 2016.

As of 2014:

- I&I rates have been collected for all 108 I&I Management Plan catchments.
- All of the catchments in Colwood, Langford, Saanich, or View Royal have relatively low I&I.
- Most catchments in Esquimalt, Oak Bay, and Victoria's catchments have elevated I&I. Many of these catchments have been or will be investigated. From 2005 to 2010, Esquimalt inspected its entire sewer system and repaired all of the sewers and manholes that were in poor condition.
- Work is still being carried out to implement a private property I&I approach by 2016.

Between 2008 and 2013, the following significant I&I related work items have taken place in the core area:

- Esquimalt completed a \$6.75 million upgrade of the sanitary collection system which included the relining of over 30% of Esquimalt's gravity sewers and separation of combined manholes.
- Victoria completed the James Bay I&I Reduction Pilot Study.
- The *Core Area Inflow and Infiltration Management Plan* was completed in 2012
- Methods were developed to generate sewer flow data from data already collected at municipal pump stations. This results in consistent, relatively inexpensive long-term flow monitoring data.
- I&I has been included at over 17 CRD outreach events per year since 2011. At these events the public was encouraged to complete a 4-question I&I related survey. I&I education material includes a brochure, two sets of videos to help explain I&I, and an I&I website.

Overflows (2008 – 2013)

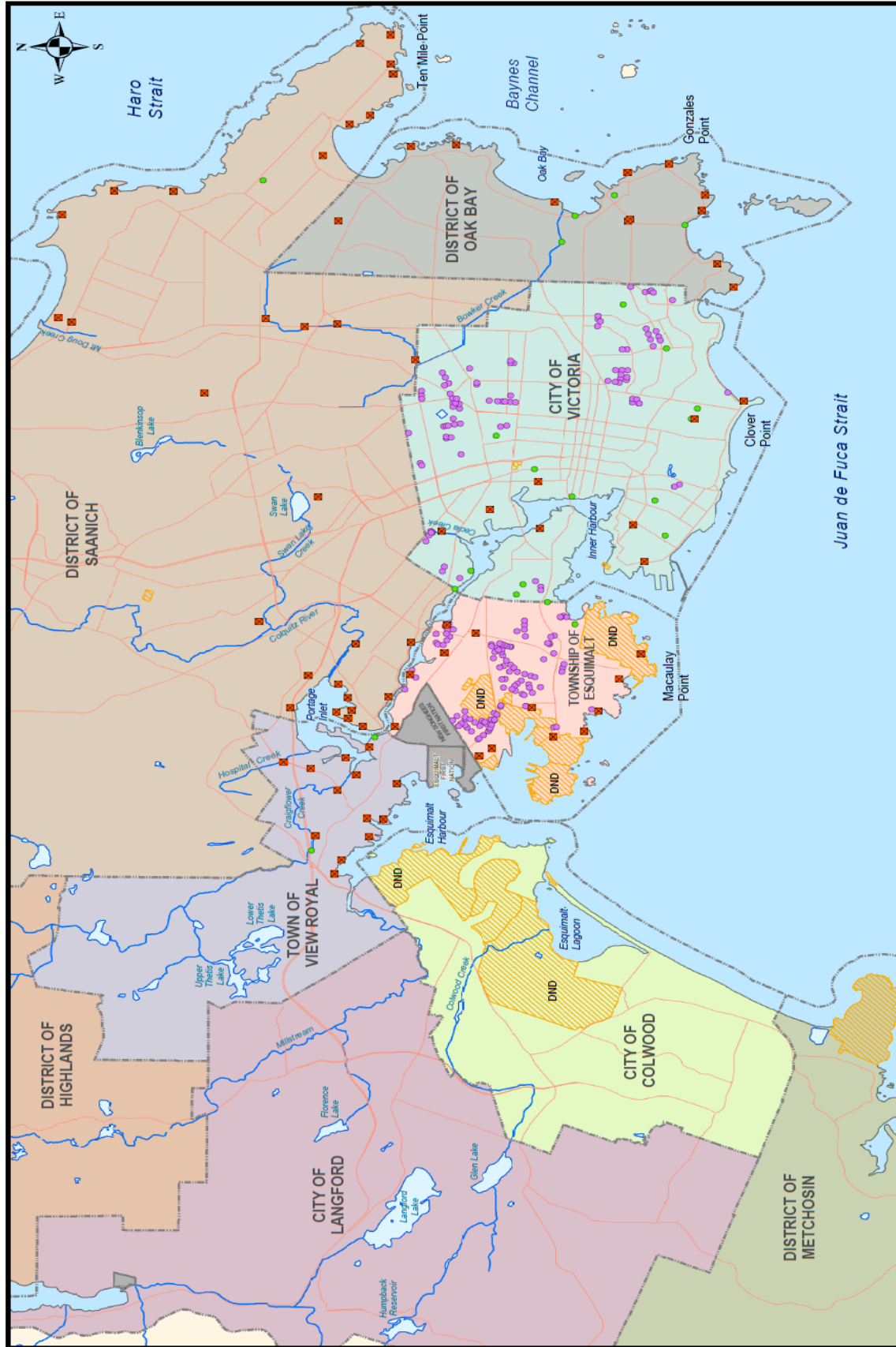
The CRD and core area municipalities have identified all of their known sewer overflow locations, which are summarized in Table ES-1 and Figure ES-1. It must be emphasized that, even though there are a large number of known overflow locations, the majority of them are never used or are infrequently used.

Table ES-1: Number of Known Potential Overflow Points

Jurisdiction	Pump Stations ¹	Relief Points ²	Combined Manholes ³	Total
CRD	14	8	0	22
Colwood	0	0	0	0
Esquimalt	11	0	~48	59
Langford	0	0	0	0
Oak Bay	6	0	Uplands is a combined collection system	6 plus Uplands
Saanich	28	0	0	28
Victoria	7	16	98	121
View Royal	12	0	0	12
Total	78	24	146	248

1. Sanitary pump station overflows are those that have a designed overflow point included within or just upstream of the pump station.
2. Relief point overflows include overflow pipes designed into the collection system that spill into storm drains or nearby waterways.
3. Combined manhole overflows are those where both sanitary and storm pipes are located within the same manhole but are separated by a concrete dividing wall. All of these manholes were installed as a cost-saving measure in the 1960-70s, as it was cheaper to install one manhole instead of two.

Most I&I related overflows take place in the regional sewer system during large storm events when operators monitoring the sewer flows selectively allow overflows to deep sea outfalls with low sensitivity receiving environments. This is done to preserve sewer capacity for areas that would otherwise overflow into high sensitivity receiving environments (creeks, basement flooding, etc.). The I&I that causes these overflows comes from the upstream municipal sewers and private property laterals. Table ES-2, summarizes the sewer overflows in the core area from 2008 to 2013.



Summary of Core Area Known Potential Overflow Points

Figure ES-1



June 10, 2007 - Technology: JPB - Map Document Core_OF - Combined Overview_March2008.mxd

Table ES-2: Frequency of Overflows Classified by Cause and Receiving Environment Sensitivity

Jurisdiction/Cause of Overflow		2008			2009			2010			2011			2012			2013		
Total Annual Rainfall (mm)		619			662.5			814			865			876			741		
		Receiving Environment Sensitivity of where Overflows were Discharged ¹																	
		Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Capital Regional District																			
Cause	1. Power outage				2						2						2		
	2. Pump station failure	1		1	1			7			3						1		
	3. Blocked pipe																		
	4. Storm event <5-yr.	7		2	32			17			16						8		1
	5. Storm event >5-yr.							7		1									
	6. Upland combined sewers	4			15			13			11						14		
TOTAL		15			50			45			32						26		
Colwood																			
Cause	1. Power outage																		
	2. Pump station failure																		
	3. Blocked pipe																		
	4. Storm event <5-yr.																		
	5. Storm event >5-yr.																		
	TOTAL	0			0			0			0			0			0		
Esquimalt																			
Cause	1. Power outage																		
	2. Pump station failure																		
	3. Blocked pipe																		
	4. Storm event <5-yr.																		
	5. Storm event >5-yr.																		
	TOTAL	0			0			0			0			0			0		
Langford																			
Cause	1. Power outage																		
	2. Pump station failure																		
	3. Blocked pipe										1						2		
	4. Storm event <5-yr.																		
	5. Storm event >5-yr.																		
	TOTAL										1						2		
Oak Bay																			
Cause	1. Power outage				3														
	2. Pump station failure																		
	3. Blocked pipe																		
	4. Storm event <5-yr.																		
	5. Storm event >5-yr.																		
	TOTAL	0			3			0			0			0			0		
Saanich																			
Cause	1. Power outage																		
	2. Pump station failure																		
	3. Blocked pipe																		
	4. Storm event <5-yr.																		
	5. Storm event >5-yr.																		
	TOTAL	0			0			0			0			0			0		
Victoria																			
Cause	1. Power outage																		
	2. Pump station failure																		
	3. Blocked pipe																1		
	4. Storm event <5-yr.																		
	5. Storm event >5-yr.																		
	TOTAL	0			0			0			0			0			1		
View Royal																			
Cause	1. Power outage																		
	2. Pump station failure																		
	3. Blocked pipe																		
	4. Storm event <5-yr.																		
	5. Storm event >5-yr.																		
	TOTAL	0			0			0			0			0			0		

Note: Low, Moderate, and High ratings of receiving environment sensitivity were determined by Seaconsult Marine Research Ltd.

Wet Weather Flow Management Progress Update

The CRD and core area municipalities are on track with their overflow management plans with the following highlights.

The CRD commissioned the Trent pump station in 2008 which eliminated overflows to Bowker Creek. Prior to commissioning, there were ~10 overflows per year into Bowker Creek.

Colwood programmed its Supervisory Control and Data Acquisition (SCADA) system to generate sewer flow data from its pump stations.

Esquimalt separated approximately 100 combined manholes (of 148), relined all poor and poorest condition sewer mains, and smoke tested the entire municipal sewer system.

Langford ensured that each of its pump station either has a backup generator or can be powered with Langford's portable standby generator.

Oak Bay added 7 of its 9 pump stations to SCADA and implemented policies that require the upgrade or replacement of sewer / stormwater laterals, when homeowners apply for major building permits, etc. or when cross connections are identified by the municipality. In the LWMP, Oak Bay has a commitment to separate its combined sewers by 2015. The timeline below describes Oak Bay's status and plan going forward.

- **Up to 2010:** Oak Bay had a plan in place that would have resulted in the Uplands combined sewers being separated by 2015. The approach was estimated to cost approximately \$7.5M (excluding private property works) and Oak Bay had successfully secured a \$5 million dollar grant toward this work. The work was anticipated to be complete by the end of 2015. However, many Uplands residents resisted this plan on account of each house needing to install a sewer sump pump to convey its sewage into the municipal low pressure sewer main. As a result, in 2010, Oak Bay Council decided to have staff investigate other alternative approaches for sewer separation in the Uplands.
- **2010 to 2014:** Oak Bay collected detailed data (municipal records, etc.) on the Uplands sewers and hired a land surveyor to collect additional information.
- **2014 to 2016:** Oak Bay plans to:
 1. Retain a consultant to prepare detailed plan options.
 2. Consult with the public on the options.
 3. Select a preferred option.
 4. Tender construction contracts to start the separation of the sewers.

Saanich upgraded 5 pump stations and is in the process upgrading 5 more.

Victoria completed the James Bay I&I Reduction Pilot Project, which compared the effectiveness between various types of sewer rehabilitation for reducing I&I and is in the process of camera inspecting and smoke testing the entire municipality by the end of 2016.

View Royal has been upgrading one pump station every two years including the addition of backup generators and is in the process of camera inspecting the municipalities' sewers.

Conclusions

On July 3, 2014, the Minister of Environment approved the Capital Regional District's Amendment No. 9 to the Core Area Liquid Waste Management Plan subject to four conditions being met by December 31, 2014. Condition No. 2 to the Minister's approval requires that the CRD submit a *Wet Weather Flow Management*

progress report that includes an update on the progress made to date in achieving the LWMP commitment to eliminate sanitary and combined sewer overflows. This progress report was written to satisfy that requirement.

During the period from 2008 to 2013, the municipal sewer collection systems experienced a total of seven overflows. These included three overflows resulting from pump station failures and four overflows attributed to blockages in sewer pipes related to new construction. The municipal sewer systems were able to convey all peak flows, including infiltration and inflows from storm events, into the regional trunk sewer system for discharge to the marine environment via deep sea outfalls.

During the same time period, CRD regional trunk sewers experienced a total of 193 sewer overflows, of which 100 were caused by I&I flows received from municipal sewers and another 70 overflows were directly attributed to combined sewer flows coming from the Oak Bay Uplands combined sewer systems during significant storm events. The remaining 23 overflows were the result of power outages, pump station failures, or pump station upgrades in the regional system.

All but one of the CRD regional system overflows were discharged through deep sea outfalls to marine environments of low sensitivity. The only overflow to a medium or high sensitivity receiving environment occurred during a summer storm when the Trent pump station was shut down for maintenance.

The LWMP (2010) Section 5 contains the overflow reduction plan commitments for the CRD and each of the core area municipalities. These individual plans identify specific infrastructure work items including inspections, studies and upgrades to regional and municipal pump stations and sewer systems.

The CRD and the participating municipalities have completed or initiated many of the overflow reduction tasks committed to in the LWMP. I&I must be further reduced by completing all tasks to limit maximum daily wet weather flows to less than four times the average dry weather flow by 2030.

Oak Bay's commitment to separate its combined sewers in the Uplands, which collect and convey both sewage and storm water to the CRD regional pump stations at Humber and Rutland, remains outstanding.

The CRD will continue to monitor the status of the overflow reduction plans for CRD and the participating municipalities of Colwood, Esquimalt, Langford, Oak Bay, Saanich, Victoria, and View Royal. These plans will be evaluated and updated as required.

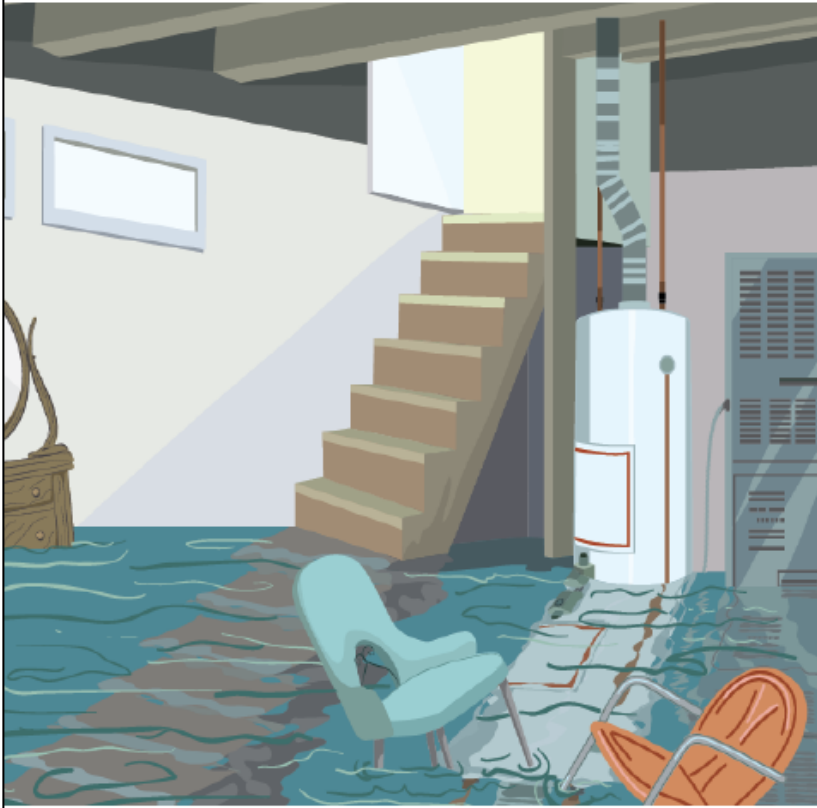
The core area treatment plant project includes infrastructure upgrades that should further reduce the frequency I&I related overflows in the core area.

APPENDIX D

Updated Education Materials (Banner / Brochure)



Making a difference...together



**Banner used for
outreach events.**

What you don't know can cost you

Underground pipes deteriorate over time. Maintenance is needed to prevent basement flooding and protect the environment.

www.crd.bc.ca/pipes

Tips to Prevent Flooding

- ☐ Have your pipes camera inspected by a plumber or drainage specialist at least every 10 years; ideally by someone who can also auger or flush your pipes if the camera is impeded by a blockage
- ☐ Fix issues identified by a camera inspection (roots in pipes from nearby trees, cracked pipes, misaligned pipe joints, grease buildup, etc.)
- ☐ Keep your inspection chambers accessible so they can be easily used for maintenance or emergency work; don't hide or bury them

- ☐ Avoid planting water-loving trees over your pipes (e.x., willows, maples, figs)
- ☐ Avoid putting fats, oils and grease down drains
- ☐ Avoid flushing wipes, napkins or paper towels down toilets or drains
- ☐ Ask your plumber if your home would benefit from a backwater valve (if you already have one, ensure it still seals properly and is free of obstructions)

if your basement floods:

- ☐ Stop all water use and toilet flushing
- ☐ Call a licensed plumber
- ☐ Call your insurance broker if you need to make a claim
- ☐ Protect yourself with gloves and boots
- ☐ Take photos before starting clean up

If you experience a sewer backup, notify your municipality if a plumber confirms that the source of the issue comes from municipally-owned pipes.



Protect the Environment

Underground pipes can contaminate the environment and lead to beach closures.

- Leaky sewer pipes allow sewage to seep out of the pipe, contaminating soil, groundwater and nearby creeks
- Sewer pipes erroneously connected to storm drains can contaminate downstream waterways
- Stormwater pipes erroneously connected to sewers can cause sewer overflows during large rainfall events

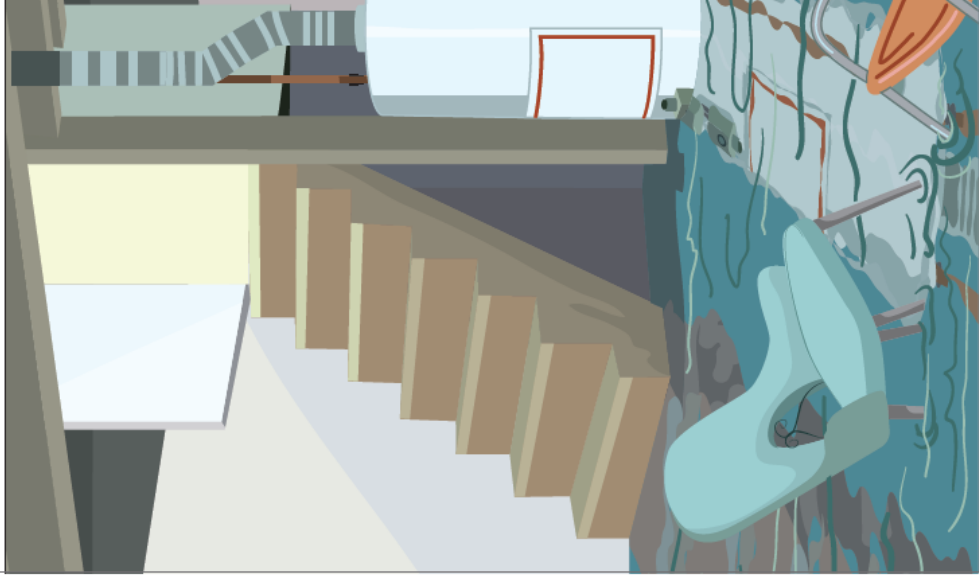
We all need to do our part to prevent overflows

Municipalities routinely inspect and maintain their sewers. Homeowners can do their part by inspecting and maintaining their underground pipes and ensuring that they are properly connected.



Capital Regional District
Environmental Services
625 Fisgard Street, Victoria, BC V8W 1R7
www.crd.bc.ca/pipes

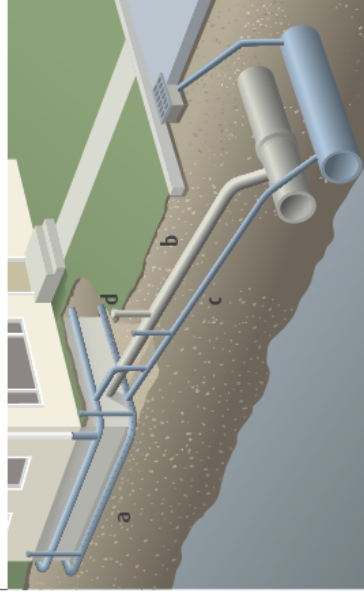
Maintaining Your Underground Pipes to Prevent Basement Flooding



Pipes Need Maintenance

Underground pipes deteriorate over time. They require periodic maintenance and eventually need to be replaced.

In general, homeowners own and are responsible for maintaining the pipes between the house and the property line. In Oak Bay, however, this ownership extends all the way to the municipal sewer main and stormwater drainage system.



Modern building code

Underground Pipes

- a. Foundation drain:** drains water away from the house's foundation and prevents wet basements and flooding
- b. Sewer lateral:** carries water from sinks, showers, toilets and laundry to the municipal sewer system or a septic system
- c. Stormwater lateral:** carries rainwater and groundwater from foundation drains and roof (through gutters and downspouts) to the municipal stormwater system
- d. Inspection Chamber:** used for inspections and maintenance (required by code since the 1990s)

Signs of Possible Pipe Failure

Here are signs to watch for that could indicate a problem with your pipes:

- Wet, warped or stained walls and floors
- Musty odours
- Slow drains or sewer odours
- Ground above pipes is very lush or sunken

Risk of Pipe Failure & Basement Flooding

Age is the key risk factor for pipe failure. Generally, pipes are the same age as the house, unless they have already been replaced. Most pipes installed before the 1980s have already exceeded their expected lifespan.

Pipe Material and Risk Level

ERA OF HOME	PIPE MATERIALS	PIPE LIFESPAN	RISK LEVEL
Pre-1930s	Wood Stave (laterals)	75	High
Pre-1940s	Asbestos Cement	75	Elevated
Pre-1960s	Clay	75	Elevated
1950-1980	Concrete	50	Moderate
1960-1980	Tarpaper (laterals)	50	High
Pre-1990s	Big "O" Corrugated (foundation drains)	75	Moderate
1980s & newer	Plastic Pipes (PVC/ABS)	75	Low

RISK LEVEL			
High	Elevated	Moderate	Low



In-camera pipe inspection

Camera Inspections

- Have your pipes camera inspected by a plumber or drainage specialist; ideally someone who can also auger or flush your pipes if the camera is impeded by a blockage
- Request a copy of the video, inspection notes and/or site sketch for your records
- Get more than one quote if significant repairs are needed

Know what your insurance covers

Many basic insurance policies provide little to no coverage for basement flooding so read your policy carefully:

- Is damage from sewer and/or stormwater backups or overland flooding covered?
- What is the deductible?
- What is the maximum dollar value of the coverage?
- Are costs for accessing/repairing the pipe included (digging up the yard, landscaping, etc.)?

APPENDIX E

Oak Bay Inflow & Infiltration Work: 2019 to Mid-2020

Oak Bay Summary of I & I for 2019/2020 (end of June)

Sanitary Sewer

Capital Projects

- In 2019, used trenchless technology on a total of **3599 m** of old sewer and, as part of the contract, two combined sewer manholes were replaced. 2019 Lining work carried over into 2020:
 - 146m of 200mm sewer Lincoln Road
 - 64m of 200mm sewer Lincoln Road
 - 82.5m of 200mm sewer Lincoln Road
 - 109.3m of 200mm sewer Lincoln Road
 - 107m of 200mm sewer Island Road
 - 100.7m of 200mm sewer St Ann Street
 - 42.5m of 200mm sewer Westdowne Road
 - 92.7m of 200mm sewer Westdowne Road
 - 110m of 200mm sewer Heron Street
 - 125m of 200mm sewer Byng Street
 - 73m of 200mm sewer Cookman Street
 - 37.6m of 200mm sewer Westdowne Road
 - 146.1m of 200mm sewer Hampshire Road
 - 84m of 200mm sewer Byng Street & Linkleas Ave.
 - 94.3m of 200mm sewer Beach Drive
 - 90.1m of 200mm combined sewer Cotswold Road
 - 43m of 150mm combined sewer Cotswold Road
 - 76m of 300mm combined sewer Exeter Road Easement
 - 89m of 300mm combined sewer Exeter Road Easement
 - 137m of 300mm combined sewer Exeter Road Easement
 - 82m of 300mm combined sewer Exeter Road
 - 60m of 200mm combined sewer Exeter Road
 - 131m of 200mm combined sewer Exeter Road
 - 46.3m of 250mm combined sewer Exeter Road
 - 46.2m of 200mm combined sewer Lansdowne Road
 - 84m of 200mm combined sewer Lansdowne Road
 - 107m of 200mm sewer Island Road
 - 25.4m of 200mm combined sewer Lansdowne Road
 - 60m of 200mm combined sewer Lansdowne Road
 - 55m of 200mm combined sewer Lansdowne Road
 - 127.2m of 200mm combined sewer Lansdowne Road
 - 59.5m of 250mm combined sewer Lansdowne Road
 - 86m of 250mm combined sewer Lansdowne Road
 - 91m of 200mm combined sewer Weald Road
 - 53m of 200mm combined sewer Weald Road
 - 59.3m of 200mm combined sewer Weald Road
 - 112.3m of 200mm combine sewer Beach Drive
 - 81.6m of 200mm combined sewer Ripon Road
 - 72m of 200mm combined sewer Lansdowne Road
 - 94.7m of 200mm sewer Lincoln Road
 - 94.7m of 200mm sewer Heron Street & Lincoln Road
 - 94.7m of 200mm sewer Lincoln Road

- 17.3m of 200mm sewer Lincoln Road
- 1 new combined Sewer Manhole Exeter Road
- 1 new combined Sewer manhole Ripon Road
- Conventional Sewer main replacement on Central. Removed and replaced 86m of failing sanitary sewer main with 250mm PVC SDR 35 pipe. Removed and replaced one 1050mm sewer manhole.
- 2020: Sent out Request for proposal: Cadboro Bay Road /Thompson Avenue Intersection. Upgrade 45m of 200mm sewer main.
- 2020: RFQ for surveying Runnymede Place for future design on new 200mm Sewer on ROW(eliminate sewer in easement) and install new storm main thus reducing combined systems in the area.
- 2020: Preparing RFP for Sanitary Sewer Master Plan (SSMP.) Plan to do a SSMP in 2021.
- 2019: RFQ survey for 2020 proposed Underground replacement work to include
 - Currie Road: 200m road, storm, sewer and water

Subdivisions/Large Development- Contractor's work

- 1416 St David Triplex development. Extended 46.2m of 200mm new PVC sewer pipe on St David. Terminal cleanout installed for future extension by Municipality. Existing building had a combined system but with conversion to triplex the building now has new separate sewer and storm connections.

• Ongoing Programs

- 2020: CCTV program (years 4 & 5 of a 5 year sewer program).
 - Contractor flushed/cleaned 3.1 km of sanitary sewer mains
 - Contractor televised 3.1 km of sanitary sewer mains.
- With most of the sewers in Oak Bay's ROW's televised, CCTV contractor now to televise sewer mains in all Oak Bay easements.
- Public Works: Annual and 6 month flushing program.
- Working with CRD Source Control to determine possible cross connection locations at Willows Beach.

General Service applications/dye testing policy

- Ongoing policy to cap old sewer services at the main when new house relocates sewer service.
- Ongoing policy to dye test storm drains before most plumbing/building permits issued.
- 2019 (end of June to end of Dec 2019): 17 storm dye tests completed by Public Works and 2 cross connections discovered.
- Of the 2 cross connections, 1 house separated with new storm and sewer laterals via replacements of existing system or new storm lateral installations.
- Jan 2020-end of June 2020: 62 storm dye tests completed by Public Works, 11 cross connections discovered and 5 storm systems non-existent.
- End of June 2019-end of June 2020 sewer permits: Services installed or yet to be installed:
 - New houses with new sewer & storm services installed: 26
 - Buildings with combined sewer replaced with separate sewer & storm laterals: 2
 - Buildings that replaced sewer and storm laterals: 9
 - Buildings that replaced the sewer lateral: 8
 - Buildings that replaced the storm lateral: 22
 - Inspection chambers: 104

Studies/Investigations

- Undertaking partial analysis of Oak Bay's sewer system with new large developments or subdivisions. Oak Bay is researching and working towards acquiring a sewer master plan and sewer model.
- A developer has televised the 200mm sewer main on Island Road as part of a proposed subdivision development. Pipe condition assessments undertaken.
- 2020: Victoria Drains (CCTV contractor) televised sewer and storm mains in easements between Sandowne Road and Neil St for proposed capital projects. CCTV to assist in determining method of replacement i.e. pipe bursting or pipe lining.
- Received draft proposal from McElhanney on the sewer model for Eastdowne sewer catchment.
- 2019/2020 Investigating/surveying/ recording Sewer Manholes as part of our Asset Management program.

Repairs/Maintenance

- July 2019: 1003 Amphion St. (located in Victoria) sewer lateral had fallen off the main. Oak Bay repaired lateral in easement.
- August 2019: 2041 Granite Street sewer lateral had fallen off main. Old wye broke and Public Works repaired sewer at the main.
- October 2019: 2723 Foul Bay Road sink hole. Found asbestos concrete sewer lateral into Saanich sewer main. Previous trench was in sand.
- Dec 2019: 2183 McNeil sewer lateral had sunk in the CRD's trunk line trench. Public Works cut out damaged section and installed new sewer lateral.
- Heron Sewer main flushed and cut due to roots and to prep for lining work.
- Public Works repaired cracked sewer main on Lincoln due to #2620 Lincoln's sewer connection. Replaced 1.6m of main with PVC. Reconnected 2620 Lincoln lateral approximately 2m south of north property line.
- Gravel in Sewer main on Lincoln. Public Works flushed and cleaned prior to lining.
- Feb 2020: At 2695 Lansdowne large sink hole appeared in the ROW due to large boulder on Sewer Main. Bell pipe broken. PW repaired.
- 2020: 3042 Westdowne Road -sewer spot repair; pipe section was oval shape. Replaced 1.3m of old pipe with PVC.
- Jan 2020: At 2080 Chaucer, Public Works repaired a section of 100mm sewer lateral. Pipe failure due to root blockage.
- Feb 3 2020: 2445 Cotswold - Plugged Main caused lateral to back-up. Replaced lateral connection and 2m of sewer main.
- Jan 2020: 2695 Topp Avenue- Section of sewer lateral repaired (sewer goes to Thompson).

Storm

Capital Projects

- In 2019, used trenchless technology on a total 434 m of old storm mains, and, as part of the contract, three storm manholes were replaced. 2019 Lining work carried over into 2020:
 - 87m of 200mm storm Lincoln Road
 - 26m of 150mm storm Lincoln Road
 - 8.3m of 200mm storm Lincoln Road
 - 72m of 200mm storm Lincoln Road
 - 75m of 200mm storm Dover Road
 - 83m of 460mm storm Lincoln Road
 - 56m of 460mm storm Lincoln Road

- 27m of 250mm storm Lincoln Road
- 3 storm manholes replaced on Lincoln Road.
- Feb 2020: Conventional storm drain replacement on Heron St. Removed and replaced 265m of 250mm storm drain with PVC SDR 35 pipe. Removed and replaced 7 1050mm storm manholes. Replaced 2 storm drain laterals. Replaced 1 sewer lateral and constructed 1 storm drain lateral (previously combined).
- 2019- June 2020: Designed Kings Road storm drain project. Plan is to abandon 390 m of failed 200mm storm drain and install 232 m of 250mm PVC SDR 35 pipe. Propose to construct/replace up to 27 storm laterals.
- 2020: Sent out Request for proposal: Cadboro Bay Road/Thompson Avenue Intersection. Upgrade 81m of 200mm storm main in vicinity.
- 2020: RFQ for surveying Runnymede Place for future design on new 200mm Storm on ROW where currently no storm exists.
- 2019: RFQ survey for 2020 proposed Underground replacement work to include:
 - Armstrong Ave : 160m (approx. road length), Storm/water.
 - Burdick Avenue: 385m road, storm main, water.
 - Lincoln Road: 330m road, storm, water.
 - Victoria Ave: 380m road, storm, water.

Subdivision/Development work done by Contractors or Public Works

- 1416 St David Triplex development. New Rain garden installed with storm overflow into storm main on St David Street. Property was previously on a combined system.

Ongoing Programs

- 2019: CCTV program(year 5 of a 10 year storm program; decided to fast track the program and extended the CCTV contract)
 - Contractor flushed/cleaned 10.54 km of storm mains.
 - Contractor televised 10.54 km of storm mains.
- 2020: CCTV program
 - Contractor flushed/cleaned 13.22 km of storm mains.
 - Contractor televised 13.22 km of storm mains.
- Public Works: Annual and 6 month flushing program.

General Service applications/dye testing policy

- See Sewer section for shared information.

Studies/Investigation

- 2019: Partial storm modelling for 77 Beach Drive Subdivision. Existing 150mm Storm main was undersized and storm main upgrade required if subdivision is approved.
- 2019: Partial storm modelling for 237 King George Terrace subdivision. Storm main was upgraded to 250mm PVC pipe. Pipe also televised.
- Nov 2019: Victoria Drains televised sewer and storm mains in easement behind properties on Mount Joy. Smoke testing showed cross connections. Crews investigated. Potential capital project for lining or pipe bursting.
- 2020: Partial storm modelling for Dover Road storm main (between Nottingham Rd & Devon Rd) to ensure capacity adequate prior to lining. Storm main was adequate.
- May 2020: 2180 Pentland Road storm main in easement- Crews attempt to clean and flush due to significant tree roots in the easement. Potential for pipe bursting.

- Received draft proposal and will review Mcelhanney's report on a storm model for the North & South Estevan Storm Catchment.
- 2019 Investigating/surveying/recording Storm Manholes as part of our Asset Management program.
- 2020 Investigating/surveying/recording Storm Manholes as part of our Asset Management program.

Storm Water Management Systems

- 2019: 1564 Prospect. Voluntary rain garden. Overflows into approved storm main.
- 2020: 1416 St David. Engineered rock pit with overflow into storm main on St David.
- 2020: 2302 Windsor. Storm Water Management System with overflow into storm main.

Repairs/Maintenance

- Nov 2019: Replaced section of collapsed storm pipe on Anscomb Plc.
- Oct 2019: Public Works replaced about 30m of 200mm pipe with 250mm PVC pipe on Beach Drive between Estevan and Anscomb Plc.
- Oct 2019: Replace catch basin at 3070 Larkdowne Avenue.
- Nov 2019: Replace section of collapsed 200mm storm pipe on Linkleas near #662 Linkleas Avenue.
- Aug 2019: Repair broken section of Storm main on Meadow Place.
- Sept 2019: Installed new Storm Manhole, replaced 9.1m of 150mm pipe with PVC pipe on St Louis.
- Aug 2019: Replaced catch basin lead near 787 Transit.
- Jan 2020: New catch basin installed at 1880 Beach Drive.
- June 2020: Hole in 250mm storm main repaired on Theatre Lane.
- Feb 2020: On Heron, replaced 2.8m of 200mm storm main due to roots blocking main near 2752 Heron.
- Feb 2020: On Burdick Avenue, top of storm main missing. Public works replaced about 3m of pipe.
- March 2020: Enlarged rock pit for a Hydro vault's storm lateral. P/W also installed an Inspection chamber.
- Confirmed abandoned storm main on Hampshire just north of Cranmore on the west side.
- Jan 2020: Replaced catch basin lead at Avondale/Cardiff NW corner. Replaced 6m of old pipe with 100mm PVC pipe.
- June 2020: Gas company replaced section of 460mm storm pipe that had a gas service running through it. Gas service in front of 1073 Newport.
- June 2020: Storm main on Theatre Lane between Wilmot Place & Hampshire Rd flushed and cut due to roots.
- Jan 2020: On Thompson Ave, 15 feet of collapsed 200mm pipe was replaced with PVC pipe and #2695 Thompson's sewer lateral was replaced at the same time.
- Jan 2020: On Thompson Avenue, Public Works repaired a section of storm pipe that had a hole in it.
- Jan 2020: at 2995 Westdowne Road, Public Works replaced a failed catch basin.