Core Area Inflow & Infiltration Program 2019 Report

Capital Regional District October 2019



Table of Contents

EXECUT	IVE SUMMARY	iii
1. Bac	kground	1
1.1	Overview	1
1.2	Study Area	1
1.3	Core Area I&I Program	3
1.4	Past Reports	4
2. Key	Initiatives	5
2.1	Committee for new subdivisions	5
2.2	Sewer Modeling Support	5
2.3	Oak Bay Pilot	5
2.4	Assessing the Accuracy of Municipal Pump Station Flow Data	5
2.5	Updated I&I Analyses / Flow Rates	6
2.6	Finalized the Private Property Education Approach	6
2.7	Future Initiatives	6
3. Ove	rflows	8
3.1	Overview	8
3.2	Beach Closures	8
3.3	Reported Overflows	8
4. Priv	ate property I&I	13
5. Edu	cation	17
6. I&I F	Rates for the Core Area	18
7. Colv	wood	20
7.1	I&I Related Work (2018 to mid-2019)	20
7.2	2019 Analyses	20
7.3	Discussion	20
8. Esq	uimalt	23
8.1	I&I Related Work (2018 to mid-2019)	23
8.2	2019 Analyses	23
8.3	Discussion	24
9. Lan	gford	27
9.1	I&I Related Work (2018 to mid-2019)	27
9.2	2019 Analyses	27
9.3	Discussion	28
10. C	ak Bay	31
10.1	I&I Related Work (2018 to mid-2019)	31
10.2	2019 Analyses	31

List of Appendices

 Appendix A: LWMP Commitments Related to I&I Appendix B: Executive Summary: Core Area I&I Management Plan (2017 Update) Appendix C: Executive Summary: Sanitary Sewer Overflow Management Plan (2014 Up Appendix D: Generally Accepted Principles: Basement Flooding Prevention Appendix E: Maps and Flow Charts: Catchments Analyzed in 2019 Appendix F: Additional Key Statistics: 2019 Analyses Appendix G: Oak Bay Inflow & Infiltration Work: 2018 to Mid-2019
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CORE AREA INFLOW & INFILTRATION PROGRAM 2019 REPORT

EXECUTIVE SUMMARY

The Core Area Liquid Waste Management Plan (LWMP) sets out goals and commitments for the municipalities, First Nations and 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 2019 Report documents progress towards meeting these commitments for the period of 2018 to mid-2019.

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 2018, Colwood updated its pump station SCADA system. I&I program staff will work with Colwood to establish sewer flow meter data for Colwood pump stations using the new SCADA system.

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 2018 and 2019, 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 late 2019, in conjunction with the I&I program, Esquimalt will have 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 2018 and 2019, Langford camera-inspected 7 km of sewer, inspected 203 manholes, repaired 3 manholes and rehabilitated 71 inspection chambers.

Oak Bay is working on the Uplands combined sewer separation project, including an additional plan submission to the Province, due by December 31, 2019. In addition to that work, Oak Bay rehabilitated 1,725 m of sewer, separated 8 combined sewer laterals, camera-inspected 13.8 km of sewer (year 3 of a 5-year program) and installed 116 inspection chambers. The CRD and Oak Bay are currently working on a pilot program involving the collection of camera inspection, smoke testing and manhole inspection data in 3 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. I&I program staff are also working to develop reliable flow metering data from Oak Bay's pump stations.

Saanich continues its sewer maintenance and repair program, including camera inspections, sewer relining, smoke testing to eliminate unused connections and flow monitoring. Saanich is near completion of a SCADA system upgrade. In 2018, Saanich relined or replaced 3,500 m of sanitary sewer.

Victoria continues to manage its sewer repair and replacement work in its sewer master plan, which was fully updated in 2018. Victoria installed 12 open channel flow meters and 3 rain gauges in 2018. These meters produced high quality flow data and will be valuable for assessing future I&I reduction efforts. Victoria also relined 3.3 km of sanitary sewer, camera-inspected 20 km of sewer, replaced 700 m of sewer, eliminated cross connections from 6 catch basins and carried out significant work to eliminate a number of combined manholes. CRD staff plan to work with Victoria on an I&I-focused project in 2020.

View Royal continues its program related to sewer maintenance and repairs, camera inspections, sewer flushing and flow monitoring. In 2018, View Royal completed a sewer master plan, camera inspected 4,208 m of sewer pipe, repaired 4 sewer manholes and carried out operational maintenance (i.e., flushing) based on camera inspection results.

Esquimalt Nation had a consultant inspect their sewer system and prepare a report containing recommendations for maintenance, repairs and I&I reduction, etc. They are currently looking at funding options for this work.

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.

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 also involves coordination with municipalities and national organizations that are dealing with similar issues. Key actions completed in 2018 and early 2019 include:

- Updated I&I analyses for 62 catchments in the Core Area. In general, the I&I rates were similar to those from the last analyses in 2016; however, the new analyses included a detailed breakdown of sewer flow components, which can be used to better understand the root cause of the I&I in each catchment. The 2020 report will include additional analyses for catchments that didn't have suitable or available flow data in 2019.
- Initiated a pilot project (in progress) in 3 small catchments in Oak Bay.
- Participated on a national expert stakeholder committee tasked with developing a national standard for addressing I&I in new construction.
- Assisted consultants developing both the CRD's and Esquimalt's sewer models.
- Carried out a project to confirm flow data accuracy from municipal pump stations.
- Key components of the education approach were finalized with the new approach to be implemented in late 2019. The stakeholder engagement portion will be based on recommendations from the stakeholders themselves, based on interviews and a report completed in 2018.

The work described above will continue to support the regional effort to control and reduce municipal I&I flow rates; however, continued and focused work is still needed to meet the LWMP commitment of reducing wet weather flows below 4 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 2018 to mid-2019. The report is divided into the following sections:

- Background (Section 1)
- Key Initiatives (Section 2)
- Overflows (Section 3)
- Public Property I&I (Section 4)
- Private Property I&I (Section 5)
- Education (Section 6)
- Future Initiatives (Section 7)
- Summary (Section 8)

1.2 Study Area

The CRD's core area is a partnership of 7 local governments and 2 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
	Municipal	40	7.8	516	10		15	
Colwood	Private	5.2	3.7	120	12	1702	15	25%
	Gov't of Canada	6.7	2.7	125	6		26	
	Municipal	54.8	3.9	820	12		53	100%
Esquimalt	Private	0.2	0.0	4	0	4215	81	
	Gov't of Canada	15.6	4.5	368	23		45	
Longford	Municipal	103.3	19.9	1512	14	0054	11	69%
Langford	Private	9.0	0.9	144	8	0804	10	
Oak Bay	Municipal	97.8	2.1	1280	7	6070	72	100%
Uak Bay	Private	2.3	0.0	32	2	0079	56	
Securich	Municipal	547.1	18.8	6173	43	20000	42	0.00/
Sadilicii	Private	11.7	1.4	181	0	29060	13 93%	93%
Victoria	Municipal	232.1	3.5	2754	11	17023	106	100%
	Municipal	43.0	6.5	765	23	2010	28	0.00/
view Royai	Private	1.4	0.2	21	1	3016	13	90%
First	Esquimalt	1.2	0.3	16	1	42	25	100%
Nations	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 the 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 2018 program budget was \$404,818. 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).

Year	Reports Completed			
2005	 I&I Analyses Results Report: October 2001 to March 2004 Biennial Report for the Ministry 			
2006	I&I Analyses Results Report: October 2004 to April 2005			
2007	 I&I Analyses Results Report: October 2005 to April 2006 Biennial Report for the Ministry 			
2008	 Overflow Management Plan I&I Analyses Results Report: October 2008 to March 2010 			
2009	Biennial Report for the Ministry			
2010	I&I Analyses Results Report: October 2010 to March 2012			
2011	• n/a			
2012	I&I Management Plan			
2013	Annual Reports for 2012			
2014	 Overflow Management Plan: 5 Year Update Annual Reports for 2013 			
2015	Annual Reports for 2014			
2017	 Annual Reports for 2016 I&I Management Plan: 5 Year Update (included annual report for 2015) 			
2018	Annual Reports for 2017			
2019	Annual Report for 2018			

Table 1.2:	Kev	Program	Reports	bv	Year
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2. KEY INITIATIVES

2.1 Committee for New Subdivisions

CRD I&I staff were hand-selected to be part of an expert stakeholder committee to address I&I from new construction. The committee was made up of 21 experts, including municipal engineers, inspectors, consultants, building industry and regulators. The committee met in person and online to develop a national foundation document, which is the first step for creating a new CSA national standard document.

The title of the foundation document is "Reducing the Risk of Inflow and Infiltration in New Sewer Construction." It was led by Norton Engineering, the Institute of Catastrophic Loss Reduction and Engineers Canada. The document will be submitted to the Standards Council of Canada with recommendations for follow-up.

2.2 Sewer Modelling Support

I&I program staff provided the sewer flow data needed to create sewer models for the CRD's core area and Esquimalt. The work benefited from previous I&I program efforts to create data from pump SCADA data and to quantify the accuracy of the source data. CRD staff were able to streamline the data collection for the modelling by working with existing I&I program files.

The core area model was urgently needed to answer major infrastructure questions related to the treatment plant project. The modelling consultants estimated that it would have taken 4 times longer, up to 6 months, to build the model without the CRD data. It also would have cost substantially more and impacted the treatment plant project timelines.

2.3 Oak Bay Pilot

Under the I&I program, staff initiated a pilot project (in progress) in 3 small catchments in Oak Bay with high I&I. The project includes smoke testing, manhole inspections, CCTV inspections (by Oak Bay), and a drainage system. A key part of the project involves testing a new method for cost effectively confirming cross-connection sources.

2.4 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 resulting data is used for I&I analyses and clearly shows how sewer flows are impacted by I&I. The accuracy of the data varies widely between pump stations due to site-specific factors. Establishing the accuracy is critical for municipalities, as this data identifies deficiencies and guides rehabilitation. The purpose of this project was to:

- assess the flow data from each pump station for accuracy using existing tools on FlowWorks.com.
- engage municipal technical staff with the results to conduct technical review of the data.
- conduct engineering review of respective flow characteristics.
- make recommendations for improvements / next steps, as appropriate.

In 2018 and 2019, a flow data assessment was carried out (currently in draft) on municipal pump stations from Langford, Esquimalt, Oak Bay, Victoria and View Royal.

Colwood and Saanich were not included as their pump stations don't currently collect flow data. The CRD plans to help with this.

2.5 Updated I&I Analyses / Flow Rates

I&I program staff analyzed sewer flow data for 62 catchments in the core area. In general, the I&I rates were similar to those from the last analyses in 2016; however, the new analyses included a detailed breakdown of sewer flow components, which can be used to better understand the root cause of the I&I in each catchment. The results are summarized in the municipal sections of this report.

2.6 Finalized the Private Property Education Approach

The key components of the education approach were finalized with the new approach set to be implemented in late 2019. The stakeholder engagement portion will be largely based on recommendations from the stakeholders themselves, based on interviews and a report completed in late 2018. See Section 5 for additional details.

2.7 Future Initiatives

Action	Description / Timeline			
Developing a prioritized list of rehabilitation projects for Esquimalt (late 2019)	 Esquimalt already has full I&I related data. This includes: a calibrated sewer model; dense I&I data; and municipal wide CCTV, smoke testing and manhole inspection data. Esquimalt wants to turn this data into a list of prioritized I&I reduction actions. However, they lack the resources to do this in-house. The CRD has already put aside funds for an I&I-specific project for Esquimalt for 2019. Esquimalt's preference is that this money to be used to make that prioritized I&I reduction list. The general outline for the work included is: Compare Esquimalt's current flows to CRD trunk sewer allocations. Quantify the components of the I&I using Esquimalt's sewer model and CRD analyses data. Based on the results of step 2, review the CCTV, smoke testing data, etc., as appropriate. Investigate, interview, etc. Create a work plan containing specific projects with costs, expected I&I reductions, and cost/L I&I reduction Prioritize and schedule based on budget. The results will be a valuable component of the next I&I Management Plan update. 			
Finalize the Oak Bay Pilot Project	 See section 2.3 for info. The manhole inspections and smoke testing are complete. In late 2019, Oak Bay will be CCTV'ing the main and the CRD will be following up on the smoke testing results. The results will then be summarized in report format and will include a list of prioritized I&I reduction projects. 			
Special I&I Project for Victoria (2020)	To be determined			

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

Pump Station Flow Data for Colwood and Saanich	 Colwood and Saanich currently cannot collect sewer flow data from their pump stations. The CRD and its consultants will assess potential options (2020). The CRD may provide resources to help implement the recommended solutions (2021). Considering options for the DND Belmont PS, which discharges into Colwood's sewer system. 	
Comparing Current Sewer Flows to the Updated Sewer Flow Allocations	• The CRD is updating its sewer allocation bylaw in 2019. Once complete, actual flows can be compared to what is allocated.	
Finalize Benchmarking Approach (2020)	Continue leading the effort to develop I&I benchmarks for Canada.	
Collaborations / Leadership (Ongoing)	• 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.	
Assisting with Municipal Programs (Ongoing)	 Assist the municipalities, upon request, with the following: 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. 	
Review Time of Sale Options (2019/2020)	• Determine potential options for incorporating sewer lateral education / actions into the real estate time of sale process. Include viability and pros and cons of the options.	

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 Beach Closures

In 2014, CRD staff began testing water quality at selected public beaches and, in conjunction with Island Health, developed a notification and sampling protocol for overflow events. In the protocol, the public is notified of overflow-related beach closures with signs on the beaches and notifications on Island Health's website, the CRD website and through CRD social media. CRD staff sample the beaches following an overflow to determine when the signs can be removed. When stormwater is a source of elevated bacteria, staff continue to work with the appropriate jurisdiction to identify and eliminate the source of contamination.

3.3 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-2019. Note that discharges to high sensitivity receiving environments have decreased substantially over that time.

Figures 3.2 to 3.4 summarize the specific overflow events by year for 2017 to mid-2019. Note that most overflow hours occur during very large storm events when conditions are saturated.

Previous reports had noted overflows at Broom Road. Upon investigation, it was found that these did not overflow to the environment but rather to an adjacent sewer trunk. As a result, these overflows were removed.



Figure 3.1: Graphical Comparison of Rainfall vs. Overflows

Figure 3.2: CRD Overflows from January to June 2019



Figure 3.3: 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 <u>significant</u> approaches for dealing with private property I&I are a small number of American municipalities that were required to address to 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 data.

Table 4.1: Private Property I&I Actions to Date

Timeline		Action
Ongoing	•	 CRD: 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
2018 to mid-2019	 Efforts continued on a supplementary educational approach for addressing private property I&I. This 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 (Appendix D). This document was completed in 2019 and contains signoff and full acceptance from the key stakeholder groups. This document: 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 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 appropriate for each of these groups. As of mid-2019, the CRD has developed the following education materials in draft. These materials will be further developed and finalized in 2019 once the outreach approach is formally approved. a brochure that aligns with the GAP document. an interactive public display, designed to be deployed on its own at outreach events updated website content (ready to go live). a list of key regional events to interface with the public, including annual home show events, municipal events and key stakeholder events.
	The following is a list of private property I&I work carried out in 2017 and the first half of 2018. Details of this work are located in Section 2.
2017	• completed a background report to better understand I&I-related stakeholders.
	 report showing how to identify semi-combined sewers using GIS.
	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	• 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	• 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 that 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.
	 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.
2014	 In 2014, the CKD commissioned a study by Prima to prepare a memo entitled opdate of Private Property I&I Programs. It contains supplementary research for the Stantec Report (2010). Notably it: 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
	Staff shortlisted private property I&I options and refined the options.
2013	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.)
	 Staff prepared private property I&I specific education materials related to the program options noted in the Stantec report, including: handouts summarizing each of the program option categories; a detailed comparison table of the options; and a reference guide covering frequently asked questions.
2012	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.
	• CRD staff provided an overview of the 2010 Stantec report to elected representatives and recommended a full workshop in 2012.
2011	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	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.

Action	Description / Timeline
2018 and 2019	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.
2011 to Present	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 4 key events (i.e., home shows) per year and the materials are available, upon request, at an additional 10 events.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.
2010	The CRD I&I program, in collaboration with the core area municipalities, created a brochure, 2 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 brochure and videos can be found on the CRD website at: <u>http://www.crd.bc.ca/wastewater/ii/index.htm</u>

Table 5.1: CRD I&I Education Efforts to Date

6. I&I RATES FOR THE CORE AREA

Regional I&I flow rates for the core area are generally analyzed every 3 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 analysis results 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

Municipality	Ave. Age of Sewers		Estimated (I	l 5-Year I& _/ha/day)	I Rate ¹		5-Year Peak Flows ¹ Compared to Average Dry
		2010	2012	2014	2016	2019	weather Flow
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

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

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-2000s.
- 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. COLWOOD

7.1 I&I-Related Work (2018 to mid-2019)

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 2018, Colwood updated its pump station SCADA system.

In 2018, Colwood expanded its sewer system by adding: 6 manholes, 332 m of sewer mains, 85 m of force mains and 74 sewer services. No asset information has been compiled for 2019.

7.2 2019 Analyses

Colwood's I&I analyses will be done as part of the 2020 report. The main reason for the delay is that Colwood updated its SCADA system and flow data is currently not available for its pump stations. In addition, the CRD's Aldeane flume was clogged for a number of the key storm events, making it not worth analyzing at this time.

Figure 7.1 shows Colwood's long-term I&I Management Plan catchments. Figure 7.2 classifies each of these catchments into archetypes based on average sewer age and current I&I rates, using the same classification system that is used in the Core Area I&I Management Plan.

- Colwood has relatively young sewers and low I&I.
- I&I analyses could not be carried out for Colwood's pump stations because Colwood's new SCADA system isn't collecting flow data.
- CRD staff plan to review options for collecting flow data from Colwood's pump stations in 2019/2020 and help with the implementation. Once this is complete, it will be possible to carry out full I&I analyses on the data.





Figure 7.2: Classification of Colwood Sewer Catchments in Archetypes

8. ESQUIMALT

8.1 I&I-Related Work (2018 to mid-2019)

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 2018 to mid-2019, 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 4 stormwater manholes and 6 catch basins
- Developed a conceptual project scope for interpreting smoke testing results, etc.
- Working 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).
- Working 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.
- Working with CRD Source Control to determine possible cross connection locations on Gosper Crescent

8.2 2019 Analyses

In 2019, 14 Esquimalt catchments were analyzed for I&I, including 11 pump stations and the CRD's Meaford flume, which measures the total flow for Langford. The key results are summarized in Table 8.1. Maps and flows charts are located in Appendix E. Additional statistics related to the analyses are located in Appendix F.

Figure 8.1 shows Esquimalt's long-term I&I Management Plan catchments. Figure 8.2 classifies each of these catchments into archetypes based on average sewer age and current I&I rates, using the same classification system that is used in the Core Area I&I Management Plan.

			Poak	1-br flow	Peak 24-hr Flow				
Catchment	Size	Ave.	Feak		2012	2016		2019	
Name	(ha)	(yrs.)	I&I (I/ha/day)	vs ADWF	I&I (I/ha/day)	I&I (I/ha/day)	I&I (I/ha/day)	vs ADWF	
Devonshire (ES14)	144	74	94,068	10.2 x ADWF	n/a	60,229	61,812	6.5 x ADWF	
Esquimalt Panhandle (ES15)	17	44	31,460	5.2 x ADWF	23,138	21,765	20,698	3.7 x ADWF	
Head (ES16)	124	77	76,339	9.9 x ADWF	45,246	47,565	47,649	6.2 x ADWF	
Kinver (ES17)	39	75	74,082	8.7 x ADWF	45,225	48,205	53,129	6.3 x ADWF	
Lang Cove Esquimalt (ES9)	56	75	41,981	8.1 x ADWF	27,372	31,375	30,142	6.1 x ADWF	
Dockyard (ES19)	72	65	72,288	9.3 x ADWF	n/a	48,750	48,620	6.5 x ADWF	
Wilson (ES20)	19	78	106,681	8.4 x ADWF	54,440	62,000	62,045	5.0 x ADWF	
Sea Haven (ES28)	6	83	12,096	2.0 x ADWF	n/a	8,500	6,936	1.5 x ADWF	
Luscombe (ES32)	2.6	n/a	24,766	3.2 x ADWF	n/a	10,385	12,561	2.0 x ADWF	
Garthland (ES31)	6.6	n/a	105,881	12.3 x ADWF	n/a	37,576	46,461	5.8 x ADWF	
Grafton (ES25)	17	43	82,741	20.2 x ADWF	39,282	60,118	43,908	10.4 x ADWF	
Foreshaw (ES24)	34	61	79,259	11.4 x ADWF	50,227	59,794	59,090	8.4 x ADWF	
Canteen (ES29)	0.6	n/a	1,605,879	66.5 x ADWF	n/a	n/a	533,384	21.4 x ADWF	
Constance (ES30)	1.3	n/a	82,478	11.6 x ADWF	n/a	170,000	56,007	7.7 x ADWF	
Uganda (ES26)	18	83	123,408	12.1 x ADWF	57,986	59,444	69,186	6.6 x ADWF	

Table 8.1: Key I&I Stats for Esquimalt Catchments Analyzed in 2019

- Esquimalt has relatively old sewers and higher I&I.
- There is an issue at Kinver has too much groundwater. The Peak 24-hr I&I increased due to changes in the analyses method. Not a valve issue.
 - Briefly fixed around March 2016 but bad by mid October 2016.
 - Not backflow. Checked against the CRD mag with consultant.
- Anson (DND) is high yet very small. Could be worth a partnership.
- Anson has serious issue. CCTV?
- Lang Cove DND is industrial. The new rate looks good.
- Wilson has a groundwater issue or an offset issue.
- CRD working with Esquimalt to prioritize I&I reduction





Figure 8.2: Classification of Esquimalt Sewer Catchments in Archetypes

9. LANGFORD

9.1 I&I-Related Work (2018 to mid-2019)

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 2018, Langford carried out the following I&I related actions:

- inspected 76 sewer manholes I&I
- rehabilitated 40 sewer inspection chambers
- camera-inspected 4.5 km of sewer main for infiltration issues
- power-flushed and cleaned approximately 400 m of sewer main
- rehabilitated and sealed 3 manholes from infiltration
- repaired a private sewer line off Millstream Road, which was later discovered to be servicing the Stellar Court strata
- completed a CCTV video investigation of an undocumented backyard sewer main servicing the Cottier Place area

To mid-2019, Langford carried out the following:

- inspected 127 sewer manholes for inflow and infiltration
- camera-inspected 3 km of sewer main for infiltration issues, with more CCTV work scheduled for the fall of 2019
- rehabilitated 31 sewer inspection chambers

9.2 2019 Analyses

In 2019, 12 Langford catchments were analyzed for I&I, including 11 pump stations and the CRD's Meaford flume, which measures the total flow for Langford. The key results are summarized in Table 9.1. Maps and flows charts are located in Appendix E. Additional statistics related to the analyses are located in Appendix F.

Figure 9.1 shows Langford's long-term I&I Management Plan catchments. Figure 9.2 classifies each of these catchments into archetypes based on average sewer age and current I&I rates, using the same classification system that is used in the Core Area I&I Management Plan.

		A.v.o	Peak	1-hr flow	Peak 24 hr Flow				
Catchment Name	Size	Ave. Age (yrs.)	Teak		2012	2016	20	019	
	(ha)		I&I (I/ha/day)	vs ADWF	I&I (l/ha/day)	I&I (I/ha/day)	I&I (I/ha/day)	vs ADWF	
Country (LG4)	12	19	16,128	2.5 x ADWF	11,080	11,250	5,985	1.5 x ADWF	
Florence (LG12)	37	12	7,589	2.2 x ADWF	4,580	8,676	5,941	2.0 x ADWF	
Goldie (LG5)	67	14	20,775	3.6 x ADWF	16,154	16,376	12,996	2.7 x ADWF	
Goldstream (LG13)	LG13	55	6,519	2.0 x ADWF	5,111	2,618	3,376	1.6 x ADWF	
Happy Valley (LG6)	82	13	9,788	2.1 x ADWF	4,924	11,488	8,178	2.1 x ADWF	
Jeanine (LG7)	29	16	11,023	3.5 x ADWF	7,501	9,000	9,099	2.7 x ADWF	
Langford Parkway	18	9			No measu	reable I&I			
Leigh (LG16)				Lo	w flows with	no visible I&I			
Meaford (LGALL)	714	14	13,757	2.7 x ADWF	n/a	9,703	9,834	1.9 x ADWF	
Millstream (LG17)	8	12	31,860	5.3 x ADWF	n/a	8,289	15,520	2.7 x ADWF	
Selwyn (LG8)	208	14	16,387	2.8 x ADWF	n/a	16,113	14,433	2.5 x ADWF	
Wild Ridge (LG9)	20	12	8,424	2.7 x ADWF	n/a	4,439	6,296	2.0 x ADWF	

Table 9.1: Key I&I Stats for Langford Catchments Analyzed in 2019

- Langford has relatively young sewers and some of the lowest I&I in the region.
- Langford pump station data was only available for storm events after 2018. This was sufficient due to the number of significant storm events after this date and the fact that Langford's sewer system continues to grow/change.
- It appears that Millstream's I&I has increased since the last analyses. In the 2016 analyses, flows barely changed as a result of rainfall. The current flows increase quite noticeably and predictably to it. Having said this, Millstream's I&I is still relatively low compared to the rest of the CRD.





Figure 9.2: Classification of Langford Sewer Catchments in Archetypes

10. OAK BAY

10.1 I&I-Related Work (2018 to mid-2019)

Oak Bay is working on the Uplands combined sewer separation project, including an additional plan submission to the Province, due by December 31, 2019. In addition to that work, Oak Bay carried out a number of I&I-related actions in 2018 and early 2019. The details are documented in Appendix G and are summarized, as follows:

- substantial effort related to the Uplands combined sewer separation project
- used trenchless technology (CIPP) to rehabilitate 1,649 m of old vitrified sewer
- separated 8 combined sewer laterals
- installed 116 inspection chambers
- issued 67 permits to install replace sewer or stormwater services
- capped 8 old sanitary service connections to the stormwater system
- carried out 110 dye tests resulting in 27 cross connections being found and 8 were separated
- camera-inspected 13.8 km of sewer main in 2018 (year 3 of a 5 year program to CCTV the entire municipal sewer system). Consultants then assessed the data and prioritized rehabilitation work based on the results.
- developed a hydraulic computer model for the Windsor sanitary sewer catchment
- smoke-tested the McNeill, Bowker and Harling sewer catchments, in collaboration with the CRD
- investigated/surveyed/recorded sewer manholes as part of Oak Bay's Asset Management program
- completed sewer repairs on 6 sections of sewer
- contractors lined 166 m of sewer, replaced 1 manhole and 1 pipe burst in a private sewer easement

CRD staff and Oak Bay are currently working on a pilot program involving the collection of camera inspection, smoke testing and manhole inspection data in 3 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.

10.2 2019 Analyses

In 2019, 3 Oak Bay catchments were analyzed for I&I. These catchments are monitored by CRD staff using 2 pump stations and a FloDar site. The key results are summarized in Table 10.1. Maps and flows charts are located in Appendix E. Additional statistics related to the analyses are located in Appendix F.

Oak Bay has no temporary meters installed at this time. Efforts were made to create sewer flow data from Oak Bay's pump station SCADA data but additional technical details will be need to be overcome before the data can be considered reliable enough to use.

Figure 10.1 shows Oak Bay's long-term I&I Management Plan catchments. Figure 10.2 classifies each of these catchments into archetypes based on average sewer age and current I&I rates, using the same classification system that is used in the Core Area I&I Management Plan.

Catchment Name	Sino	Ave.	Peak 1-hr flow (5 yr. storm)		Peak 24 Hour Flows (5-yr storm)			
	(ha)	Age (yrs.)			2012	2016	20	019
			l/s	vs ADWF	m3/day	m3/day	m3/day	vs ADWF
Currie Minor (OB26)	184	~90	136,108	20.4 x ADWF	n/a	55,707	85,298	12.4 x ADWF
Harling (OB14)	26	75	106,870	32.2 x ADWF	67,486	65,441	72,082	21.9 x ADWF
Windsor Flodar (OB15)	324	65	65,731	11.8 x ADWF	n/a	60,278	48,706	8.7 x ADWF

Table 10.1: Key I&I Stats for Oak Bay Catchments Analyzed in 2019

- Oak Bay's sewer system is relatively old with elevated I&I. The current analyses shows that this is still the case. The analyses from 2016 show the relative differences in I&I rates throughout the municipality.
- It's important that Oak Bay carries out investigation work to assess the state of its sewer infrastructure and I&I-related defects. Oak Bay is on track with the CCTV portion of this, in that 2019 is year 4 of Oak Bay's 5-year program to CCTV its sewer system. Oak Bay is encouraged to broadly smoke-test its sewer system to find further defects.
- In 2018, CRD staff conducted smoke testing in the McNeill, Bowker and Harling catchments as part of a pilot project. Staff will try to pinpoint the cross-connections identified through the smoke testing. Soon, Oak Bay will be camera-inspecting the sewers in these catchments. The data will then be analyzed and a prioritized list of I&I reduction actions will be developed for each catchment. It's hoped that the process will provide a framework for future I&I projects in Oak Bay.
- In 2019/2020, CRD staff will complete the work needed to generate sewer flow data for Oak Bay's sewer pump stations.



Core Area Innow & Innitration Program 2019 Report



Figure 10.2: Classification of Oak Bay Sewer Catchments in Archetypes

11. SAANICH

11.1 I&I-Related Work (2018 to mid-2019)

Saanich continues its sewer maintenance and repair program, including camera inspections, sewer relining and smoke testing to eliminate unused connections and flow monitoring. In 2018, Saanich relined or replaced 3,500 m of sanitary sewer.

Saanich is near completion of a SCADA system upgrade. This includes both hardware and software improvements to bolster the system. Saanich continues to leverage its lift station SCADA to collect and monitor sewer flows.

11.2 2019 Analyses

In 2019, 9 Saanich catchments were analyzed for I&I. Each of these was a permanent CRD flow metering location. The key results are summarized in Table 11.1. Maps and flows charts are located in Appendix E. Additional statistics related to the analyses are located in Appendix F.

Figure 11.1 shows Saanich's long-term I&I Management Plan catchments. Figure 11.2 classifies each of these catchments into archetypes based on average sewer age and current I&I rates, using the same classification system that is used in the Core Area I&I Management Plan.

	Avo		Peak 1-hr flow		Peak 24 hr Flow				
Catchment Name	Size	Ave. Aae	i cui		2012	2016		2019	
	(na)	(yrs.)	I&I (l/ha/day)	vs ADWF	l&l (l/ha/day)	l&l (l/ha/day)	l&l (l/ha/day)	vs ADWF	
Boundary (SA15)	575	54	22,270	5.4 x ADWF	16,378	14,191	14,220	3.6 x ADWF	
Colquitz (SA4)	439	32	29,085	6.0 x ADWF	23,518	23,518	18,150	4.0 x ADWF	
Haro (SA23)	29	37		No measurable I&I ~1.2 x A					
Harriet (SA17)	297	57	43,084	7.2 x ADWF	35,867	26,337	26,213	4.7 x ADWF	
Haultain (SA22)	50	52	33,523	6.5 x ADWF	19,355	19,300	19,327	4.1 x ADWF	
Marigold (SA18)	1850	33	18,315	4.3 x ADWF	n/a	14,456	14,453	3.5 x ADWF	
Penrhyn (SA19)	246	38	11,362	4.5 x ADWF	n/a	7,943	8,815	3.6 x ADWF	
Swan Lake (SA20)	411	40	23,727	4.5 x ADWF	17,971	16,742	14,728	3.0 x ADWF	
Townley (SA21)		Data too inconsistent to produce reliable updated I&I data							

 Table 11.1: Key I&I Stats for Saanich Catchments Analyzed in 2019

- Saanich's sewers are relatively middle aged with low I&I.
- The data for the Townley flume was inconsistent. For a long period of time the flows appeared relatively normal and believable, then they shifted to a "new normal". The site will need to be reviewed to confirm which data is more correct.
- Efforts will be made to work with Saanich to get sewer flow data from Saanich pump stations in the near future. The data will be then analyzed for I&I.





Figure 11.2: Classification of Saanich Sewer Catchments in Archetypes

12. VICTORIA

12.1 I&I-Related Work (2018 to mid-2019)

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 2018 to mid-2019 include:

<u>2018</u>

- installed 160 m of storm drain mains to collect cross-connected laterals from private properties
- Contractors installed or replaced 313 m of sanitary sewer mains, 472 m of storm drain mains, 5 sanitary manholes, 9 storm drain manholes, 21 sanitary sewer laterals and 43 storm drain laterals, to eliminate a number of combined manholes.
- replaced 62 storm drain laterals and 53 sanitary sewer laterals as part of the Building Permit process
- relined 3,321 m of sanitary sewer mains
- Public Works staff replaced 49 m of sanitary sewer main. Contractors replaced an additional 634 m of sanitary sewer main.
- replaced 6 catch basins to correct lateral cross-connected to the sanitary sewer system
- replaced 2 sanitary sewer manholes
- Contractors camera-inspected 3,312.5 m of sanitary sewer mains. City staff camera-inspected an additional 9,222 m of sanitary sewer mains.

2019 (to July)

- 2 cross-connection private property laterals were confirmed to the sanitary sewer system. The city installed SS lateral on City Right of Way; the property owners are to connect the service to it.
- replaced 36 m sanitary sewer mains
- replaced 55 storm drain laterals and 48 sanitary sewer laterals as part of the Building Permit process
- replaced 2 sanitary sewer manholes
- Contractors camera-inspected 555 m of sanitary sewer mains. City staff camera-inspected an additional 7,400 m of sanitary sewer mains.

Of key importance to the core area I&I Program, Victoria installed 12 open channel flow meters and 3 rain gauges in 2018. These meters produced high quality flow data and will be valuable for assessing future I&I reduction efforts.

12.2 2019 Analyses

In 2019, 19 Victoria catchments were analyzed for I&I; 5 of these are permanent CRD flow metering sites; 6 are Victoria pump stations and 8 are Flodars installed by Victoria. The key results are summarized in Table 12.1. Maps and flows charts are located in Appendix F. Additional statistics related to the analyses are located in Appendix G.

Figure 12.1 shows Victoria's long-term I&I Management Plan catchments. Figure 12.2 classifies each of these catchments into archetypes based on average sewer age and current I&I rates, using the same classification system that is used in the Core Area I&I Management Plan.

	A.v.a		Peak 1-br flow		Peak 24 hr Flow			
Catchment Name	Size	Ave. Age	rear		2012	2016	:	2019
	(ha)	(yrs.)	l&l (l/ha/day)	vs ADWF	I&I (I/ha/day)	I&I (l/ha/day)	l&l (l/ha/day)	vs ADWF
Flodars								
Belleville (S0323)	405	n/a	87,040	4.1 x ADWF	n/a	n/a	50,989	2.8 x ADWF
Doncaster (VIC49)	101	n/a	112,252	11.0 x ADWF	101,414	57,465	60,770	5.9 x ADWF
Fort (VIC51)	82.8	n/a	109,190	5.9 x ADWF	82,414	60,362	75,953	4.4 x ADWF
Government @ Belleville (VIC61)	325	n/a	126,577	7.0 x ADWF	n/a	n/a	63,522	4.0 x ADWF
Gonzales (VIC3)	41.2	n/a	49,659	5.6 x ADWF	109,261	38,180	31,392	4.0 x ADWF
Kings (VIC41)	83.9	n/a	139,332	5.7 x ADWF	82,655	80,981	99,800	4.2 x ADWF
Mid-Cook East (VIC44)	92.2	n/a	103,539	7.4 x ADWF	82,655	90,515	44,770	3.9 x ADWF
Mid Cook West (VIC45)	65.5	n/a	116,963	3.9 x ADWF	82,655	62,809	70,854	2.7 x ADWF
Moss (VIC46)	36.6	n/a	195,746	22.4 x ADWF	82,655	107,131	114,128	13.0 x ADWF
Victoria PS's								
Cecelia PS (VIC35)	92.6	113	110,286	7.8 x ADWF	n/a	59,190	65,638	5.1 x ADWF
Dockside PS (VIC42)	25.3	85	74,789	6.8 x ADWF	92,852	54,585	46,511	4.1 x ADWF
Garbally (VIC37)	30.7	107	58,623	7.3 x ADWF	45,912	34,528	31,574	4.1 x ADWF
Government (VIC38)	14.2	108	231,090	15.8 x ADWF	140,319	62,887	67,104	5.2 x ADWF
Niagara (VIC39)	24	97	63,720	8.6 x ADWF	62,029	64,458	38,021	5.0 x ADWF
Superior (VIC40)	87.5	93	132,108	5.3 x ADWF	n/a	80,766	80,847	3.7 x ADWF
CRD Meters								
Cecelia Flume (VIC31)	179	96	102,758	8.7 x ADWF	n/a	57,844	57,164	5.1 x ADWF
Hereward (VIC32)	75.7	101	133,789	6.3 x ADWF	n/a	72,061	80,298	4.0 x ADWF
Langford Flume (VIC33)	11.3	116	197,420	28.4 x ADWF	157,651	85,752	98,155	14.4 x ADWF
Trent PS (VIC11)	446	91	106,119	9.1 x ADWF	n/a	72,886	71,909	6.5 x ADWF
Hollywood (VIC55)	67.3	0	154,570	21.8 x ADWF	n/a	98,074	98,492	14.1 x ADWF

Table 12.1: Key I&I Stats for Victoria Catchments Analyzed in 2019

- Victoria has old sewers with elevated I&I. Many catchments have high I&I rates. However, because of Victoria's high population density, base sanitary flows are high, resulting in relatively moderate ratios of peak flow to average dry weather flow.
- Victoria has CCTV data and smoke testing data for most of the municipality. This will be valuable for future I&I studies. CRD staff plan to work with Victoria on an I&I-focused project in 2020. Details will be determined in late 2019.
- The Victoria Flodar data is highly valuable as it allows I&I to be assessed at a proper level of detail. Without this, a large proportion of Victoria's sewer flow would not be monitored and it would be difficult to identify problem I&I areas. Most of the Flodar data is only available since 2018. Some of the sites didn't have enough flow data available for analyses. More data is needed from each of the Flodar sites to confirm and refine the I&I rates for their catchments.
- The Flodar data is generally excellent; however, it's recommended that a field verification be done to confirm the levels and velocities to provide assurance of the flow rates.





Figure 12.2: Classification of Victoria Sewer Catchments in Archetypes

13. VIEW ROYAL

13.1 I&I-Related Work (2018 to mid-2019)

View Royal continues its program related to sewer maintenance and repairs, camera inspections, sewer flushing and flow monitoring. In 2018, View Royal completed a sewer master plan, camera-inspected 4,208 m of sewer pipe, repaired 4 sewer manholes and carried out operational maintenance (i.e., flushing) based on camera inspection results.

13.2 2019 Analyses

View Royal's I&I analyses will be done as part of the 2020 report. The delay is the result of a recent project looking at flow data quality from View Royal's pump stations identified improvements to be made to make the data more reliable. The recommendations will be implemented in 2019 so the analyses can be completed in 2020.

Figure 13.1 shows View Royal's long-term I&I Management Plan catchments. Figure 7.2 classifies each of these catchments into archetypes based on average sewer age and current I&I rates, using the same classification system that is used in the Core Area I&I Management Plan.

- View Royal has young sewers and low I&I.
- I&I analyses for View Royal's pump stations has been delayed so that data quality improvements can be made prior to the analyses.
- View Royal is diligent about camera-inspecting its sewer system and carrying out maintenance, as appropriate.





Figure 13.2: Classification of View Royal Sewer Catchments in Archetypes

14. ESQUIMALT FIRST NATION

The Esquimalt Nation had a consultant inspect their sewer system and prepare a report containing recommendations for maintenance, repairs and I&I reduction, etc. They are currently looking at funding options for this work.

Reliable flow data is currently not collected for the Esquimalt Nation property; however, the CRD is considering options for adding flow metering for cost sharing purposes.

15. 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.

In 2019, 2 Songhees First Nation catchments were analyzed for I&I. Each of these was a permanent CRD flow metering location. The key results are summarized in Table 15.1. Maps and flows charts are located in Appendix E. Additional statistics related to the analyses are located in Appendix F.

Table 15 1. Key	v I&I Stats for Sono	hees First Nation	Catchments Anal	0100 in 2019
Table 15.1. Reg	y 101 31813 101 30110	JILEES FILST NATION	Calchinents Anal	yzeu III zuig

Catchmont	0:	Ave.	Peak 1-hr flow (5 yr. storm)		Peak 24 Hour Flows (5-yr storm)				
Name	(ha)	Age			2012	2016	2019		
		(yrs.)	l/s	vs ADWF	m3/day	m3/day	m3/day	vs ADWF	
Songhees (SFI1)	50	~40	80,594	10.3 x ADWF	41,600	41,600	41,511	6.0 x ADWF	
Maplebank (SFN2)	3		This is a new catchment. Its flows are very small and highly varied. There is no noticeable I&I at this time.					ighly	

16. DND

In 2019, 2 DND-exclusive catchments were analyzed for I&I. Each of these was a permanent CRD flow metering location. The key results are summarized in Table 16.1. Maps and flows charts are located in Appendix E. Additional statistics related to the analyses are located in Appendix F.

		Ava	Peak 1	-hr flow	Peak 24 hr Flow			
Catchment Name	Size (ha)	Ave. Age (yrs.)			2012	2016	20	019
			I&I (l/ha/day)	vs ADWF	I&I (I/ha/day)	I&I (l/ha/day)	I&I (l/ha/day)	vs ADWF
Anson (ES13)	10	46	89,156	41.9 x ADWF	n/a	52,000	61,163	29.4 x ADWF
Lang Cove DND (ES18)	33	42	48,148	6.8 x ADWF	24,976	34,000	24,517	3.9 x ADWF

 Table 16.1: Key I&I Stats for DND Catchments Analyzed in 2019

17. 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:

- completed a 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

18. SUMMARY

The purpose of this report is to provide an update on work related to I&I in the core area in 2018 and the first half of 2019. 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 2018 and mid-2019
- status of efforts to address I&I from private property
- I&I related updates from each of the core area municipalities
- Updated I&I analyses for the core area, except for two municipalities whose analyses will be included in the 2020 report after improvements are made to pump station flow data quality.