



Committee of the Whole Report For the Meeting of November 25, 2021

To: Committee of the Whole **Date:** November 12, 2021
From: Philip Bellefontaine, Director, Engineering & Public Works
Subject: Inflow and Infiltration Mitigation on Private Properties

RECOMMENDATION

That Council:

1. Endorse the recommended strategy presented in this report to begin mitigating inflow and infiltration from private property sanitary sewer laterals.
2. Direct staff to bring forward a funding strategy and budget request as part of the 2023 Financial Planning process that includes resource and funding requirements to implement the recommended strategy.

EXECUTIVE SUMMARY

Sanitary sewers transport wastewater from homes and businesses to a centralized treatment plant. Along the way, some extraneous water may enter the system either from stormwater or groundwater, a problem commonly known as inflow and infiltration (I&I). I&I can cause sanitary sewer systems to exceed their capacity, especially during large or extended rain events, which are expected to continue to rise due to a changing climate. This may result in overflows into waterways and backflows of sewage into private property that pose public health and environmental concerns. In addition to increasing maintenance and treatment costs, excessive I&I can consume sewer capacity which would require expensive premature upgrades to the system.

Typically, more than half of the piped sewer system in any community is located on private property. Buildings are connected to the public system by way of *sewer laterals* which are small diameter pipes that run across private property from the building to the public sewer main. The property owner is responsible for maintaining the private laterals from their buildings out to the property line; but most private laterals tend to be neglected because they are “hidden” to the property owner and there is a lack of awareness of responsibility.

In the City of Victoria, common with many municipalities across the country, a large portion of I&I is understood to be generated from private-side portion of sewer laterals, estimated at 40% - 60% of the total flows. Most sewer utilities take an active role to reduce I&I but, while nearly half or more of the flows originate from private pipe issues, most public programs are almost exclusively dedicated to public-side reduction measures.

The regional core area wastewater system is governed by the CRD's Core Area Liquid Waste

Management Plan (CALWMP). The CALWMP outlines wastewater management strategies and initiatives to protect the region's water quality, including a focus on I&I mitigation. Under the plan, the CRD and participating municipalities are committed to reduce the maximum daily wet weather flows to less than four times the average dry weather flow by 2031.

Due to the old age of private building laterals and public sanitary sewers, several areas of the City are contributing I&I flows that are greater than the regional target of four times. Over the years, the City has implemented several programs to reduce I&I rates through planned asset management. The focus of I&I reduction however has been directed to the publicly owned portion of the sanitary sewer system.

To meet flow reductions to support climate resilience and regulatory requirements, the City will need to expand mitigation to include I&I originating from private properties. Staff have developed a long-term phased approach that includes property owner education-outreach, new regulatory requirements and new funding with incentives. The recommended strategy contained in this report is based on a review of existing regulations and municipal authorities. This included review of industry-wide examples of governing agencies from North America that have established a private-side I&I reduction program.

PURPOSE

The purpose of this report is to provide Council with options to mitigate inflow and infiltration to the sanitary sewer collection system from private property.

BACKGROUND

Throughout North America, many jurisdictions are concerned about the increased volumes of stormwater and groundwater that are entering sanitary sewer systems. This extraneous water, termed inflow and infiltration (I&I) can cause sanitary sewer systems to exceed their capacity, especially during large or extended rain events. A certain amount of I&I is unavoidable and is accounted for in routine sewer design. However, too much I&I can result in overflows into waterways and backflows of sewage into private property that pose public health and environmental concerns. In addition to increasing maintenance, treatment costs and wear and tear on public conveyance and treatment systems, excessive I&I can lead to the unnecessary construction of expensive oversized conveyance and treatment facilities.

Staff have previously briefed Council on the issues of I&I as part of financial plans. CRD, with regional responsibilities for management of wastewater services has also presented I&I updates to core area municipalities including emphasis on the I&I resulting from private properties. Council direction included addition of the following action in the strategic plan: *Begin to plan for mitigating the inflow and infiltration issue on private property.*

The City of Victoria operates separate utilities to handle stormwater and wastewater collection. The sanitary sewer is dedicated to handling wastewater and sanitary sewage, and the stormwater system is dedicated to collecting rainwater and safely returning it to the environment. At a basic level, inflow and infiltration occurs when water that should be destined for stormwater management is instead, captured by the sanitary system.

Inflow enters the sanitary sewer system through overland points such as manhole covers and more importantly through storm drains incorrectly connected (cross-connections) to the sanitary sewer including roof leaders or foundation drains. *Infiltration* is groundwater that seeps into sanitary sewer pipes through cracks and leaky pipe joints. Infiltration amounts vary by season and in response to

groundwater levels. Infiltration is typically more distributed than inflow and it occurs at lower individual rates, however, its cumulative effect can be severe. Sources of inflow and infiltration are shown in the illustration below – Figure 1.

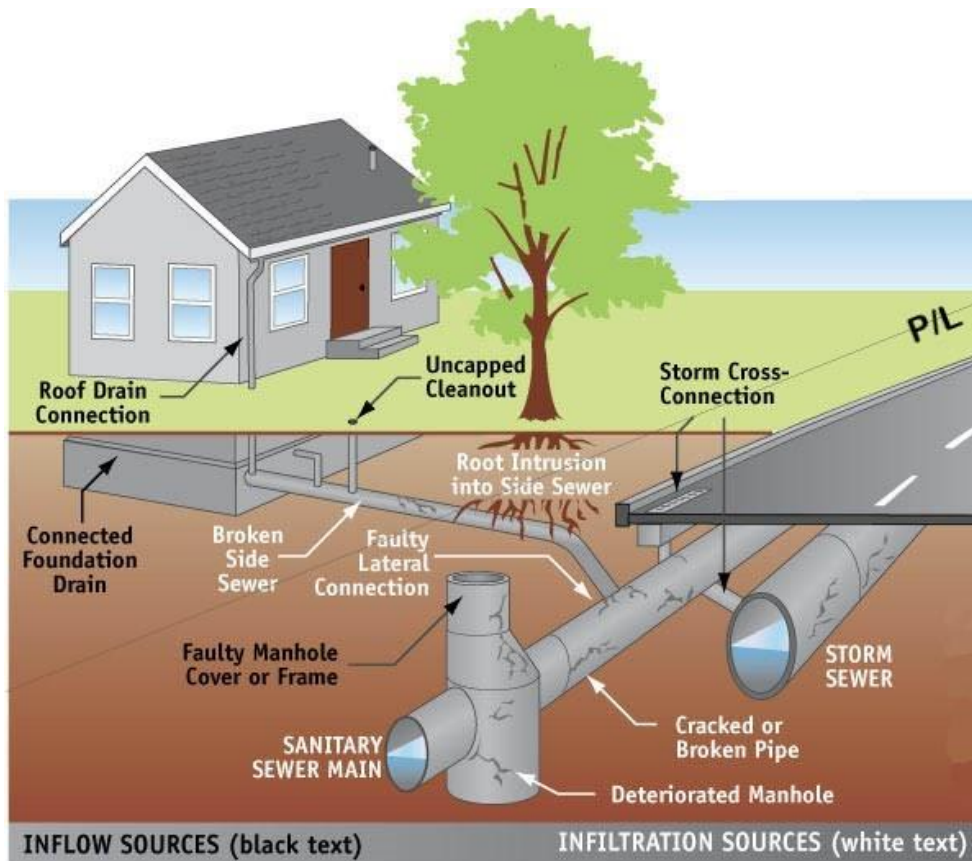


Figure 1 – Inflow and Infiltration Sources

The extent of I&I varies from community to community throughout the CRD; however, it is a particular issue for communities which have older sewer infrastructure, including the City of Victoria. In some areas of the City, due to the overall age of the system, the impacts of I&I can be significant during heavy rain events. I&I rates will be further impacted by climate change with increased frequency and severity of extreme rainfall events.

Typically, more than half of the piped sewer system in any community is located on private property. Buildings are connected to the public system by way of *sewer laterals* which are small diameter pipes that run across private property from the building to the public sewer main. The property owner is responsible for maintaining the private laterals from their buildings out to the property line; but most private laterals tend to be neglected because they are “hidden” to the property owner and there is a lack of awareness of responsibility.

In Victoria, common with many municipalities across the country, an estimated 40% - 60% of the total I&I flows is understood to be generated from the private-side portion of sewer laterals. Most sewer utilities take an active role to reduce I&I but, while nearly half or more of the flows originate from private pipe issues, most public programs are almost exclusively dedicated to public-side reduction measures.

Over the years, the City has been implementing several programs to reduce I&I rates, including flow monitoring, investigation and condition assessment, sanitary sewer master planning and

system rehabilitation. The focus to date has been directed to the publicly owned portion of the sanitary sewer system, including annual capital programs for rehabilitation and asset replacement.

The regional core area wastewater system is governed by the CRD's Core Area Liquid Waste Management Plan (CALWMP). The CALWMP outlines wastewater management strategies and initiatives to protect the region's water quality, including a focus on I&I. Under the plan, the CRD and participating municipalities are committed to reduce the maximum daily wet weather flows to less than four times the average dry weather flow by 2031.

To support climate resilience and meet regulatory flow requirements, the City will need to expand I&I mitigation to include I&I originating from private properties.

ISSUES & ANALYSIS

Victoria's sanitary sewer system is divided into catchments, or separated areas with various sewer pipes (connected to private laterals) which convey flows to a common terminus, often at the intersection with a regional CRD pipe. This branch-and-trunk type model is common in all major utilities and allows for area-specific planning, prioritization and solutions when presented with distributed and irregular problems such as I&I.

There are 20 catchments in the city, ranging in size from 25 ha to over 400 ha. Areas are typically defined by land that sits as a depression from the surrounding landscape and natural drainage patterns, but pumping systems are also used to connect isolated areas back to the broader utility.

Computer modelling with flow monitoring data has been used to analyse I&I impacts to City catchments. Flows from I&I vary among catchments during wet weather flows. While a number of the catchment areas are in compliance, improvements are needed in nearly 70% of the City catchments over the next decade to meet regulatory requirements.

All forms of I&I are not the same and the response to them varies depending on their causes.

Analysis of how quickly peak flows occur in the sanitary sewer system during a storm can be split into three response types:

1. *Fast* response, which denotes that there is a problem with inflow connections such as direct stormwater connections to the sanitary sewer.
2. *Medium* response, which denotes that there is a minor problem with inflow connections, but most flows originate on a cumulative basis via small flows distributed in many locations.
3. *Slow* response, where flows originate broadly and in small amounts in many locations that add up to create the overall I&I issue.

Nearly half of the catchments in the City are driven by fast response flows meaning that direct stormwater connections to the sanitary sewer system are an important focus area. While infiltration from aging laterals of all types is a concern, engineering analysis indicates that faulty inflow connections are triggering most of the capacity challenges.

Inflow issues typically occur when private-side stormwater drainage is directly connected to the sanitary sewer system. In some cases this occurs in older homes, constructed under now-obsolete sewer management practices, where connection of private-side stormwater drainage was permitted to be connected to the sanitary lateral (dual-sewer lateral) due to the cost and difficulty of managing stormwater in hilly, bedrock-prone areas.

Private Sanitary Sewer Laterals Inventory

There are approximately 14,500 private-side sanitary sewer laterals in the City. Table 1 provides a breakdown of sanitary sewer laterals into four main types and shows that residential laterals make up the majority.

Table 1 - Sanitary Sewer Lateral Profile Breakdown

Account Type	Count	Percentage
Commercial	1,450 +/- 10%	~10%
Government	500 +/- 10%	~3%
Industry	100 +/- 10%	~1%
Residential	12,450 +/- 10%	~86%
TOTAL	~14,500	

Private-side sanitary sewer laterals range in diameter, length, material, and configuration on any property. The size and surface treatment (e.g., landscaping or pavement) can greatly impact the cost of renewing or rehabilitating a lateral. Most laterals in Victoria date back to the property's original development over 100 years ago. Pipes deteriorate as they age which exacerbates the broad distribution challenge for flow reductions. These issues are key factors when considering private-side lateral programs.

Private-Side Lateral Programs

Experiences in various jurisdictions in BC suggest that while private-side laterals are a primary source of I&I, introduction of measures and programs to require property owners to repair them is complex and challenging. Common issues, barriers and difficulties related to private sewer lateral programs fall into three broad categories:

- 1) Property owner participation with private-side piping.
- 2) Technical challenges with renewing private-side laterals.
- 3) Authorities.

1. Property Owner Participation

- Public understanding and familiarity – Most residents are unaware of the problem and environmental impacts, question why the utility is interested in their property, nor appreciate how their lateral connection contributes to a cumulative, system-wide issue.
- Lack of public motivation – Private property owners rarely act on an issue that is buried-from-view until it directly impacts them, e.g., if I&I were to cause a flood.
- High costs of renewal – Renewing private-side laterals can be costly: for the property owner and for the municipality if they provide funding (rebates). Cost estimates can vary from property to property due to many unknowns (e.g., length of pipe, soil conditions, tree impacts, landscaping, subsurface conditions, among others). Most property owners do not budget for this.

- Enforcement difficulties – Municipalities have the legal authority to enforce private-side lateral bylaws, however, the buried laterals require on-site investigations to attest to their condition.
- Imposing oversight in new areas – There can be public concern toward new services or regulations especially where there are unknown outcomes, especially cost.
- Changes to regulations – decades ago, many private sanitary laterals were required to include storm-inflow connections directly to sanitary sewers since alternative storm sewer networks did not exist to collect foundation and roof drain flows.

2. Technical Challenges with Renewing Private-side Laterals

- Cross-connection location – Improper storm drain pipes connected to the sanitary sewer (cross-connections) may exist inside the building or may be difficult to locate during inspections, which makes lateral repairs difficult to resolve.
- Industry-wide technical capacity – Available staff and/or contractors may not have the knowledge or experience to assess the need to correct the lateral.
- Lack of accurate methods to assess program benefits – Some measures take time to prove out.

3. Authorities for Private-Side Laterals

- Meeting standards and requiring upgrades on the private-side can also be part of a mitigation plan when considering municipal authorities for laterals.
- The City of Victoria is primarily governed by the Local Government Act and Community Charter. These pieces of legislation provide the City with broad authority to own, operate, and manage a public sanitary sewer system.
- Requirements and regulations for owners to maintain a safe, working sanitary lateral are identified in the Sanitary Sewer and Stormwater Utilities Bylaw 14-071. This bylaw also includes testing requirements for any development or redevelopment for reuse of laterals, where the value of the building permit is more than \$100,000. Developments or permit values less than that amount are exempt from lateral inspections or repairs as part of the permitting process.

Plumbing Permit Thresholds for Lateral Investigation or Repair

The purpose of a value-threshold for investigating laterals during a renovation or development is to prevent a costly lateral repair from overburdening a minor private-side project. The current value-threshold is \$100,000 meaning any plumbing permit or building permit of this magnitude will trigger the requirement to investigate and, if necessary, to repair the lateral to meet the standards outlined in the bylaw. Any permit with a construction value less than \$100,000 is exempt from the investigation unless visual evidence of lateral failure is collected in the field. By lowering the value-threshold, more permits would be eligible for the inspection thereby creating a gradual method of private-side lateral renewal.

A cursory review of the building and plumbing permits issued between 2017 to 2019 suggest that about 150-175 eligible permits were issued per year with a value equal to or greater than \$100,000. If the value-threshold were lowered to \$25,000, for example, the number of eligible permits issued per year would increase to 300 to 350 eligible permits. A potentially significant private-side mitigation of I&I is available under this scenario, as upwards of 3,000 laterals would be included for investigation and repair over a 10-year period, equal to nearly 25% of all laterals in the City.

A drop in the value-threshold will impact property renovations. This approach would require outreach with stakeholders and would be considered with new incentives or rebates.

In summary, private-side I&I presents multiple challenges and any mitigation approach must consider the perspectives and concerns of property owners, technical challenges, financial impacts and authorities of the municipality while also advancing a program that leads to actual, significant reductions.

Industry-Wide Private-Side I&I Reduction Programs Review

To support staff in review and considerations of a private-side laterals program, Urban Systems was engaged to review industry-wide examples of governing agencies from North America that have established a private-side I&I reduction program. A summary of their findings is included in Attachment A and have been considered in the recommended strategy.

Reduction Priorities

Overall, there are a handful of priorities that guide the development of the I&I reduction program, namely:

- Build awareness of the property owner's responsibility for a clean, functional sewer lateral and develop effective communications coupled with effective investigation and repair-based incentives.
- Design initiatives that target both a) reducing the rapid inflows that come from cross-connections and dual-sewer laterals, and b) renewing private-side pipes to reduce infiltration sources.
- Continue with utility-led investments in the public right of way while dedicating new funds for private-side solutions.
- Secure long-term program resources including, financial, technical, and administrative.
- Refine bylaws and policies so that there is a clear, reasonable standard for all homeowners and developers to follow.
- Review plumbing permit thresholds for lateral inspections.

OPTIONS & IMPACTS

This report outlines opportunities to mitigate storm and groundwater flows from private property to the sanitary sewer system. Opportunities to expand are outlined below:

- Most homeowners are unaware of the responsibility, impacts and costs of failed laterals or inflow connections. Enhanced communications are both a precursor to expanding the private-side programs and a sustaining practice to report out on long-term reductions.
- Existing regulations are suitable for basic issues and solutions. There are some regulatory and operational gaps in fees, fines, enforcement, and permitting requirements. Addressing these gaps will help encourage more homeowners to take preventative action to repair their laterals, and later, will help to ensure that all pipes meet a minimum standard. A review of time of renovation or redevelopment requirements can potentially address a high volume of laterals. The current building permit value threshold is too high to trigger a meaningful level of inspection and renewal.

- Sanitary Sewer utility revenues appear adequate to cover a gradual implementation of initiatives. However, additional funding streams will be required to advance private-side programs including offering rebates.

Successful reduction of private-side I&I will redirect flows to the stormwater system. Managing these flows will require new capital works such as stormwater extensions and infrastructure capacity upgrades. These requirements will be reviewed and considered as part of the Stormwater Management Plan update with capital funding requirements included in future financial plans.

Option 1 – Phased Development of Private Property Laterals Program - Recommended

To begin addressing the complex issue of private property I&I reduction, staff recommend a phased multi-year approach that relies on public and stakeholder outreach/awareness, regulatory changes, new funding and rebates. It is envisioned that the plan would be delivered over ten years with a three-phase strategy as outlined below. Before proceeding with each phase, staff would report back to Council with detailed recommendations.

Phase 1 (2023)

1. Property Owner Awareness & Inspection Rebates

- Develop an education and awareness campaign for property owners including private lateral responsibilities, I&I impacts, flood risks and information on available rebates for inspections.
- Budget up to \$50,000 per year for two to three years for annual rebates for property owners looking to proactively inspect their sewer lateral (incentives/rebates for repair proposed for Phase 2).
- Explore City led initiative or joint opportunities with CRD (that also support Core Area needs), such as:
 - Partner with real estate firms, home inspection businesses, strata corporations and plumbers to encourage video of laterals and include results in property sale checklists.
 - Develop common plumber inspection forms for laterals and explore regional certification program for consistent assessments.
 - Consider options for development of a regional incentives or top-up rebates program for property owners who renew their lateral.

2. Regulations Planning and Development

- Review renovation or redevelopment requirements for inspection and repair of sanitary laterals. Review the implications of amending bylaws to lower permit value threshold, currently at \$100,000; proceed following progress with stakeholder communications and the establishment of funds for rebates.
- Review funding options including consideration of refining sewage frontage tax to expand cost-recovery for asset renewal and rebates for lateral repairs.

Phase 2 (Target 2024)

1. On-going Property Owner Awareness & Inspection Rebates

- Continue education and awareness campaign for property owners and maintain rebates for inspections.

2. Future Regulations Development

- Review fees and surcharges for non-compliant laterals including those with known issues that are not resolved and those with technically feasible means to eliminate dual-sewer laterals.

3. Gradual Pipe Renewal

- Implement lateral repair rebate for all properties that choose to (or must) upgrade their pipes; allocate annual utility funding for rebates.
- Review areas with high I&I rates without adequate stormwater infrastructure.
- Report on number of laterals renewed and achieved reduction of I&I flows.

Phase 3 – TBD Build upon outcomes of Phase 1 & 2 but may include:

1. On-going Property Owner Awareness & Inspection Rebates

- Maintain rebate program.

2. Future Regulations Development

- Review enforcement approaches and effectiveness and consider amendments as needed.
- Explore when to enter private property to complete the works and indebted the property owner e.g., a known failed lateral or non-compliance with removal of dual-sewer lateral.

3. Maintain Ongoing Pipe Renewal Program

- Continue reporting on number of laterals renewed and reduction of I&I flows.

In addition to program development, staff would also identify areas where storm drain service extensions are required to eliminate historic dual lateral service connections.

Option 2: Send back the Recommended Plan with revisions and report back to Council with amendments.

Council may choose to defer adoption of the plan, de-scope, or consider a different set of actions. Staff can review and reconsider the plan, as Council directs.

Accessibility Impact Statement

The recommendations in this report consider the City's objectives for access to affordable housing. As the detail of each phase of the strategy is developed, accessibility of the program to all homeowners will be considered.

2019 – 2022 Strategic Plan

This program is an action item under 2021 Strategic Plan objective #6. Climate Leadership and Environmental Stewardship.

Impacts to Financial Plan

Resources and costs for development and implementation of the recommended plan will be developed and included in future financial plans for Council consideration with funding from the Sanitary Sewer and Stormwater Utilities.

Official Community Plan Consistency Statement

Section 10 – Environment, Broad Objectives

10 (c) That freshwater and shoreline areas are protected and managed to best maintain hydrological functions.

Section 11 – Infrastructure, Goals

11 (c) Efficient and effective liquid waste management protects human health and the natural environment and makes use of resource potential.

Section 11 – Infrastructure, Broad Objectives

11 (e) That wastewater is managed to safeguard public health and to protect the marine environment.

Section 11 – Infrastructure, Wastewater Management

11.15 Continue to support the Capital Regional District in the regular update and implementation of the Core Liquid Waste Management Plan.

11.16 Continue to support the Capital Regional District and the health authority in monitoring and evaluating the effects of wastewater discharges on public health and the protection of the watershed and coastal marine environment.

CONCLUSIONS

I&I flows to the sanitary sewer are an ongoing concern for the City and will be further impacted by climate change impacts. While the City has been actively targeting I&I in the publicly owned portion of the sanitary sewer system, a major source of the issue is from laterals located on private property. A program to address private-side sanitary sewer deficiencies is required. A phased approach with education-outreach, new regulatory requirements and new funding with incentives is proposed.

Respectfully submitted,

Nina Sutic-Bata, P.Eng.
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Report accepted and recommended by the City Manager.

List of Attachments

Attachment A - Urban Systems Review of existing Private Side I&I Reduction Programs