REGION OF YORK & CITY OF VAUGHAN

INFLOW & INFILTRATION REDUCTION PROGRAM

SMOKE TESTING SEWER LINES

The City of Vaughan, in conjunction with The Regional Municipality of York, is conducting smoke testing in specific areas of the City.

A "SMOKE TEST" survey assists our inspection crews in locating breaks, defects and potentially inappropriate connections in the sewer system. The smoke that you see coming from the vent stacks on houses or holes in the ground is:

- **NON-TOXIC**
- **NON-STAINING**
- **HAS NO ODOUR**
- **WHITE TO GRAY IN COLOUR**
- **CREATES NO FIRE HAZARD**

The smoke should not enter your home unless you have defective plumbing or dry drain traps. Prior to the test it is advisable to run taps for a short time and pour two to three cups of water into all drains (don't forget your basement floor drains).

What should I do if smoke gets into the house?

Do not become alarmed. Open windows, turn on exhaust fans and note the location of the smoke. The smoke will dissipate in a few minutes. Contact the City of Vaughan at 905-832-8562 and speak to staff.

IMPORTANT! If there is any individual in your home or business who has respiratory problems and is immobile, please notify us at 905-832-8562, press #4, prior to testing.

Residents in the study areas will be notified by a door hanger prior to testing.

For more information and a list of affected streets,
please visit the City's website at
www.city.vaughan.on.ca/vaughan/departments/public_works/index.cfm
or contact the Public Works Department at 905-832-8562, press #4.

York Region

City of Vaughan
The City Above Toronto

York Region & Municipal 2010 Flow Monitoring Program

Streets being Smoke Tested

THORNHILL
Street
Franklin Avenue
Maimonides Court
Hefhill Court
Regency Gate
Braemar Court
Markwood Lane
Thornridge Drive (west of Brooke Street)
Raymond Drive
Calvin Chambers Road
Clarke Haven Street

WOODBRIDGE
Street
Pine Valley Crescent
Club House Road
Golf Avenue (from Pine Valley Drive to Meadowland Court)
Fenyrose Crescent
Abell Avenue
Cheltenham Avenue
Burwick Avenue
Lansdowne Avenue
McKenzie Street
Hawman Avenue
Coles Avenue
Rainbow Drive
Ellerby Square
Villagewood Court
Kipling Avenue (from Abell Avenue to Hawman Avenue)

KLEINBURG
Street
Sevilla Boulevard
Donhill Crescent
Camlaren Crescent
Donbay Drive
Rushworth Crescent
Cardish Street
Art Drive

York Region and Municipal Inflow and Infiltration Reduction Program

What is Inflow and Infiltration?

Sewage from the majority of York Region's communities is collected through local and regional sewer systems. This collection system is extensive and varies in age and condition.

Sewer System Statistics

- Length of public wastewater mains - 3300 km
- Estimated length of private mains including service laterals and mains on private property - 1600 km
- Manholes – 43 700
- Average Age – Approx. 40 years

As these systems age, there is a higher chance that inflow and infiltration (I&I) will enter the sewers. Inflow and Infiltration (I&I) is a technical term for rainwater and/or groundwater that enters the sewage system and adds clean water flow to the regular sanitary sewage flows.

In some cases, older construction practices allowed for direct connections of the household storm water drainage system to the sanitary system. For example, some residential areas constructed in the 1960s and 1970s allowed rain water downspouts from houses to connect to the sanitary system.

Inflow: Inflow is water from rainfall, snowfall or snow melt that enters the sewage system from yard, roof and footing drains, from cross-connections with storm drains, downspouts, and through holes in manhole covers. Peak inflow usually occurs during heavy storm events, which can result in sewer backups or system overflows.

Infiltration: Infiltration is groundwater that enters sewer pipes and manholes through holes, breaks, joint failures, connection failures and other openings. Infiltration quantities often exhibit seasonal variation in response to groundwater levels. Storm events can trigger a rise in groundwater levels and increase infiltration flows. The highest infiltration flows are seen after large storm events or after long periods of precipitation.

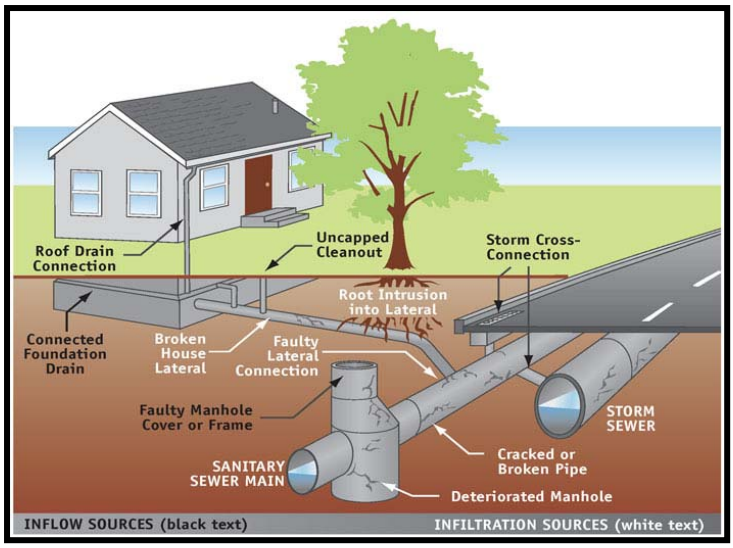


Image Source: King County, WA Department of Natural Resources and Parks, Wastewater Treatment Division. (2008).

York Region and the municipalities are working together to identify the sources of inflow and infiltration and repair and/or disconnect reduce flows.

What are we doing about inflow and infiltration reduction?

York Region and the local municipalities are committed to I&I reduction and have initiated a large-scale program to identify strategies that will benefit the local and regional sewer systems.

The work plan for this program consists of the following main components:

1. Flow Monitoring Program - including the development of standards for monitoring and assessing inflow and infiltration in all areas of the Region.

- This component of the program started in February 2008 and is currently underway through the largest temporary flow monitoring project in Canadian history. The results of the monitoring will determine the amount of inflow and infiltration currently entering the system at key locations. Approximately 40 per cent of the entire wastewater system is being monitored through 120 flow monitoring locations.

2. Implementation of inflow and infiltration reduction pilot projects using various technologies in selected areas, including follow-up flow monitoring to determine the effectiveness of the pilot project..

- Once high inflow and infiltration flow areas are identified, rehabilitation and mitigation projects will be identified and implemented. If successful, these pilot projects could then be rolled out across the system where warranted.

3. Cost/benefit analysis to determine best applications of rehabilitation and replacement for I&I reduction.

- Results from the pilot projects in conjunction with a thorough understanding of deficient areas will form the basis for cost analysis to determine the extent and expected benefits of expanding the pilot projects to full scale rehabilitation projects.

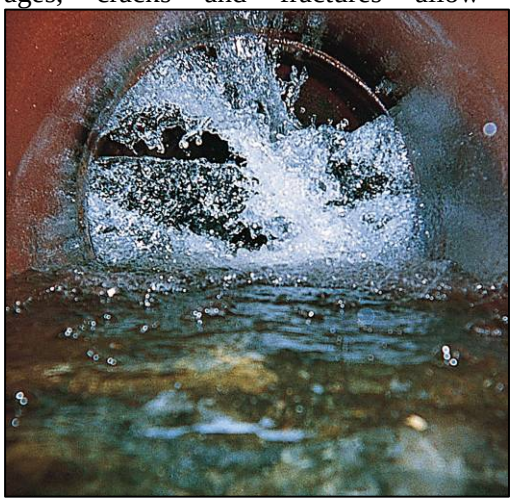
4. Project recommendations and cost sharing methodology for further inflow and infiltration reduction projects.

- Once the analysis is completed, the scope of the full implementation will be defined and cost sharing approaches between the Region and the area municipalities will be defined prior to full-scale implementation. The full implementation of works will be clarified after analyzing the monitored data collected upon completion of the pilot projects.

Images of Active I&I

Pipes

Wastewater mains are designed to accommodate small amounts of I&I,, however, as the system ages, cracks and fractures allow additional clear water to enter the system.



Manholes

Manholes are designed as an access point for our wastewater mains and can also be a source of I&I. Surface water can enter through manhole covers that are subject to ponding/flooding or in sag conditions. Groundwater can potentially enter inside the manhole through cracks or faulty joints.

Sump pumps

Sump pumps are designed to capture surface or ground water that enters basements or crawl spaces and pump it away from the house. Sump pumps should not be connected to the sanitary sewer. Preferably, sump pumps should drain onto the ground or into the storm sewer system.

Downspouts

Roof drains and downspouts direct storm water from roof gutters to the ground or storm sewer through pipes and downspouts. Roof drains should never be connected to the sanitary sewer.

Illegal/Un-authorized Connections

Unauthorized connections from any source other than sanitary system may result in additional flow that the system was not designed to accommodate.

Why should we reduce I&I?

In York Region, all domestic sewage is treated either at municipal treatment plants or in private septic systems. An overflow of a sanitary sewer is viewed as a significant breakdown in the environmental control of our water resources.

All sanitary sewer systems are designed to accommodate a maximum amount of flow. When inflow and infiltration exceeds these design allowances, sewer capacity is used and could result in overflows, risks to health, damage to the environment and increased costs in conveying sewage to the treatment plant and the treatment itself.

Environmental Concerns:

- Sewage overflows damage sensitive ecosystems and the environment.
- Sewage overflows can affect groundwater, local ecosystems, water quality in lakes, streams and rivers

Potential Health Risks:

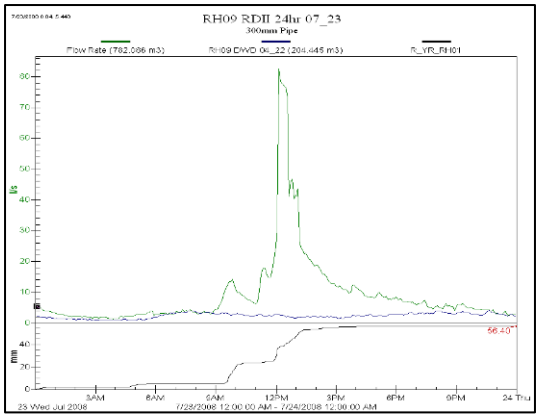
- Sewage overflows present a public health risk. While exposure to bacteria, such as those of fecal coli form origin (ie: *E. coli*), *giardiasis* or *cryptosporidiosis*, are not considered fatal for a healthy adult, they can be deadly for those with weaker immune systems, the elderly and small children.

Exceeding Sewer Capacity:

- Excess I&I takes up sewer capacity needed for existing residents and future growth. The extra volume of water can overload the sewage collection system pipes causing back-ups. Raw sewage can overflow at hundreds of locations (including residential basements) before it reaches the treatment plant.

How do we find the sources of inflow and infiltration?

- **Flow Monitoring** – sewage flow rates are monitored at various locations within the municipal sewage collection system through permanent and temporary monitoring. Along with rainfall data, the flow data is analyzed to determine if there is excessive I&I within the study area.



- **Smoke Testing** – a non-toxic, stainless, odourless, vegetable-based “smoke” is pressure injected into a sanitary sewer manhole. If smoke escapes from a source not connected to the sanitary sewer system, this would indicate a sewer I&I cross-connection.

- **Dye Testing** – non-toxic dye is added to an upstream freshwater source believed to be contributing to I&I. The downstream sanitary sewer is then monitored for traces of the dye to confirm the existence of a sewer cross-connection.

- **Closed Circuit Television/Sonar Inspections** – a video camera is sent through a sewer line to record the condition of the sewer. The video footage is analyzed for cracks, intrusions and active leaks of water entering the sewer.

- **Inspections** – Building inspectors and trained maintenance personnel visually inspect and assess the condition of the sewer system to determine any defects or conditions that may be sources of inflow and infiltration to the sanitary system. Visual inspections are performed on the sewer system manholes at a higher frequency than internal inspections because of the relative ease of performance. This type of inspection can give a good indication as to the condition and proper functioning of the collection system.

I & I Reduction – Mitigating Measures.

Municipalities around the world are exploring ways to reduce the impact of I&I. The following are examples of tools and techniques being used for inflow and infiltration reduction and control:

1. Replacing or rehabilitating the defective sewer pipe, lateral and/or manhole
2. Pipe grouting/sealing – using a cement-based or other material to fill a hole or crack in a pipe or manhole
3. Pipe relining – inserting a flexible liner into a defective sewer pipe or sewer service lateral which hardens into an impervious surface
4. Disconnecting known inflow sources, such as cross-connected catch basin drains, footing drains or downspouts,
5. Installing drainage systems that will allow cross-connected sewers to be separated
6. Backflow valve (or other plumbing upgrade) installation
7. Storage tanks for capture of peak wet weather flows

Once identified, the sources are incorporated into long-term maintenance and capital projects plans. This allows for the reduction of I&I and the elimination of sewer overflows in a cost-effective manner.

Some I&I reduction programs that have been proven to be most cost effective are described further below.

Disconnecting Downspouts

Downspouts of many older buildings are connected directly to the wastewater system. In these cases, roof runoff is a significant source of inflow into the system. Disconnecting downspouts can dramatically reduce the volume of water entering the system and can help to minimize peak flows. Where possible, downspouts should be redirected to a stormwater system or disconnected and allowed to discharge to the ground or some type of storage device such as a rain barrel.

The disconnected downspout should direct water away from the building foundation such that there is no property damage or flooding. A splash block or similar feature is generally installed to prevent erosion. After disconnection, the portion of the downspout drain that remains below grade and connected to the sewer lateral should be suitably plugged to avoid subsequent infiltration.

Disconnecting Sump Pumps

Sump pumps used to drain basements are another common source of inflow into sanitary sewer systems. Sump pumps can be disconnected from the sanitary sewer system and redirected to a storm drainage system, the backyard or garden. Consideration should be given such that discharges are redirected properly in a manner that prevents property damage, erosion or recirculation of the water.

Uncapped Cleanouts

Cleanouts installed on sewer laterals which have become uncapped, have loose or broken covers or are improperly installed can allow storm water into the sewer system. Installing properly sealed covers can remove this source of inflow. This activity can easily be completed by homeowners.

Additional I&I Mitigation/Reduction Programs

Rain Barrels

Rain barrels (or cisterns) are above ground water storage vessels that capture the runoff from home and building roofs. Flows collected in roof gutters are conveyed through the downspout into the rain barrels. Water stored in the rain barrels can be used at a later time to irrigate gardens, lawns or other landscaping. Rain barrels reduce runoff, increase natural infiltration and reduce direct flows into the sewer system. Rain barrels are limited in that they can only store small amounts of water and might not be adequate to store runoff volumes from heavy storms or from prolonged or closely spaced rain events.

Green Roofs

A green roof replaces traditional roofing with a living environment of plants and soil. Among the many benefits they offer, green roofs remove pollutants from stormwater and reduce the amount of water that flows into sewer systems. The plants store excess carbon from the atmosphere, reduce radiant heat in the summer and create habitats for local wildlife. Additionally, green roofs provide extra insulation to buildings. They are designed to intercept rainfall, delay runoff peaks, and reduce runoff discharge rates and volume. Existing buildings can be retrofitted with green roofs and new buildings can be designed to incorporate green roofs. Green roofs have been commonly installed on flat and low pitched roofs on institutional, commercial and industrial buildings; however residential applications are gaining wide acceptance.

Constraints associated with green roofs include the fact that they are limited to use in buildings and roofs which have the structural capacity to support the additional loads.

Pervious Pavements

Pervious concrete pavement is a unique and effective means to address storm water runoff issues. By capturing stormwater and allowing it to infiltrate into the ground, porous concrete promotes groundwater recharge and stormwater runoff reduction. This pavement technology creates more efficient land use by reducing the need for retention ponds, swales, and other stormwater management devices.

Pervious pavement is designed to allow percolation and infiltration of rainfall and snowmelt to the soil underneath it, thereby reducing runoff.

Infiltration Swales

Infiltration swales (also referred to as grass swales) are engineered landscape features that increase storm water infiltration into the native soil structure below. They are typically constructed as linear, shallow open channel areas with flood tolerant, erosion resistant plants. They are designed to convey storm water runoff at fairly slow velocities and at a controlled rate, thereby allowing infiltration to occur. Infiltration swales are commonly used in controlling runoff from highways, roadways, parking lots, at property boundaries. Infiltration swales can be used in place or in combination with traditional curb and gutter. They present an environmentally friendly and aesthetically pleasing solution for controlling storm water runoff.

Rain Gardens

Rain gardens are typically used in controlling runoff from houses and small buildings. These are specially designed gardens containing plants and grasses that can survive in soil soaked with water from rain storms. In addition to collecting and slowing storm water runoff and increasing

infiltration, they provide a low maintenance, attractive addition to properties. They can help in reducing basement flooding and eliminate wet spots or standing water in yards and landscaped areas.

Rain gardens are limited in that they are appropriate only for small drainage areas. Plants and grasses for the rain garden have to be carefully chosen to withstand soaked conditions.

Underground Storm Water Storage

Underground storm water storage systems capture and store storm water runoff from surrounding impervious areas. Stored water is released from storage back into wastewater system at a controlled rate, thereby, delaying runoff peaks and reducing discharge rates. Underground storage systems are often used in high density urban areas with limited space or where land is expensive and other surface storage runoff control methods are not feasible.

Frequently Asked Questions

What is the difference between sanitary water and storm water?

Sanitary water is the water discharged from all household uses, or other non-industrial operations, including from toilets, showers, and laundry facilities. Storm water is the water runoff from buildings and land surfaces into the ground.

Why can't the sanitary sewer system accept storm water?

The sanitary sewer system is designed to carry household sewage or wastewater from homes to the treatment facilities. While the pipes are sized adequately to handle sanitary flows plus an allowance for some inflow and infiltration, excessive storm water entering the sanitary system during severe rainstorms could easily overload it.

Why can't you make the sewers bigger to handle high volumes of storm water?

Retrofitting the existing infrastructure to receive storm flows would be far too expensive and extremely difficult from an engineering perspective.

What are the different types of improper connections?

Improper connections to the sanitary sewer system include:

- Connections of rain water leaders and downspouts.
- Sump pumps connected to sanitary systems.
- Foundation drains (weeping tiles).
- Drains from driveways.
- Illegal connections of any main carrying storm water.

What should I do if my basement floods?

If your basement floods and you suspect it is sanitary water, call **your municipality immediately**. Staff will inspect the problem, assess the flooding, attempt to determine the source and advise you of what actions you may take.

Each of the municipalities provides 24 hours a day, 7 days a week service to homeowners who have experienced flooded basements.