

# Infiltration and Inflow

Greater Lawrence Sanitary District's nine miles of large gravity interceptors convey an average daily wastewater flow of 30 million gallons per day (mgd) from the sewer systems owned and operated by six communities: Lawrence, Methuen, Andover, North Andover, and Dracut, Massachusetts, and Salem, New Hampshire, to the regional wastewater treatment facility (WWTF) located in North Andover. On an annual basis, a large percentage of the flow from the communities is extraneous rain and ground water leaking into the sewer system. During large storms the extraneous water can overburden the WWTF.

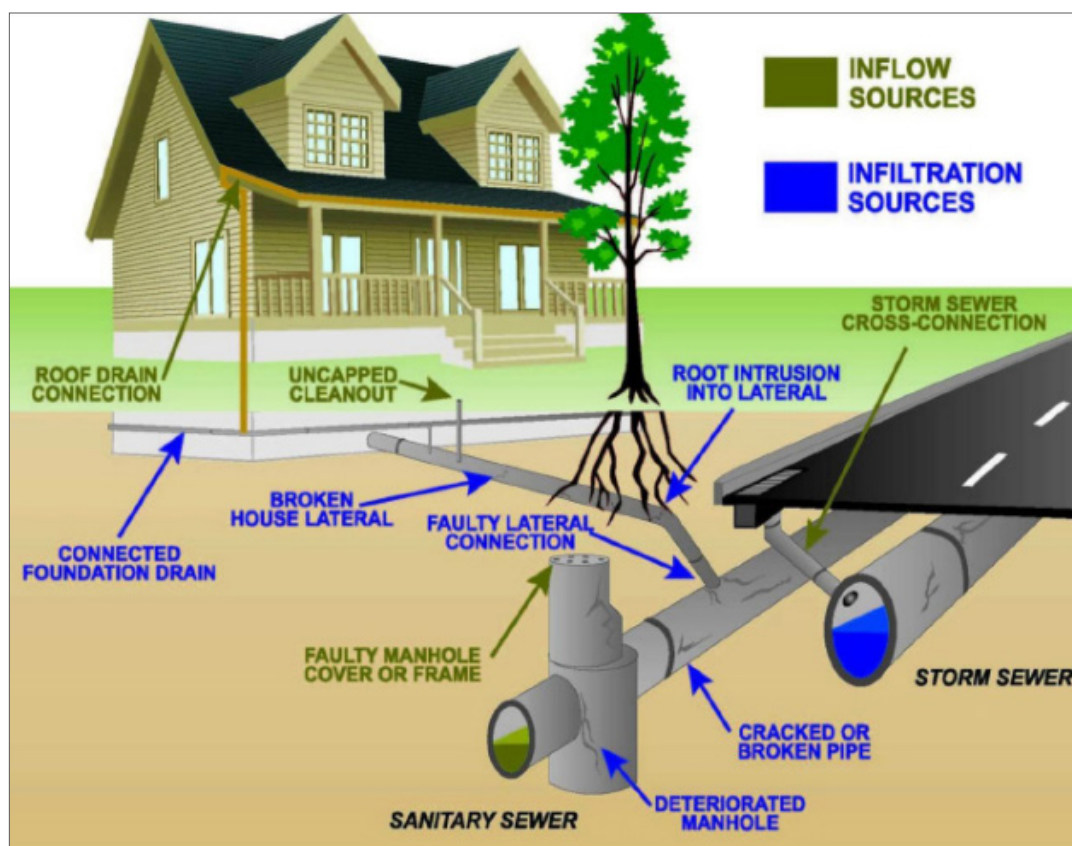
## What is infiltration/inflow (I/I)?

Excess water that flows into sewer pipes from groundwater and stormwater is called infiltration and inflow or I/I. Groundwater infiltration seeps into sewer pipes through holes, cracks, joint failures, and faulty connections. Stormwater inflow rapidly flows into sewers via roof drain downspouts, foundation

drains, storm drain cross-connections, combined sewers, and through holes in manhole covers. Most I/I is caused by aging infrastructure that needs rehabilitation or replacement.

## Infiltration

Infiltration is groundwater that enters sewer pipes (interceptors, collectors, 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 observed following significant storm events or following prolonged periods of precipitation. Since infiltration is related to the total amount of piping and appurtenances in the ground and not to any specified water use component, it is usually expressed in terms of the total land area being served, or in terms of gallons per day per inch-mile of pipe (i.e. gpd/in-mile).



*Infiltration/Inflow (I/I) Diagram*

## Inflow

Inflow is surface water (rain) that enters the wastewater system from combined sewers, yard, roof and footing drains, from cross-connections with storm drains, downspouts, and through holes in manhole covers. Inflow occurs as a result of storm events such as rainfall, springs or snow melt that contribute to excessive sewer flows. Peak inflow can occur during heavy storm events when storm sewer systems are surcharged, potentially resulting in hydraulic backups, local ponding, and Combined Sewer Overflows (CSOs).

## Why is I/I a problem?

Additional water in the sewer system is a problem because:

- It takes up capacity in the sewer pipes and ends up at the wastewater treatment plant where it must be treated like sewage, resulting in higher overall treatment costs. These costs are then transferred to you, the user.
- It may require new and larger wastewater facilities to convey and treat larger volumes of flow, resulting in higher capital expenditures.
- I/I flows contribute to sewer system overflows into local homes and the area waterways, negatively impacting public health and the environment.



*GLSD Wastewater Treatment Facility*

## What is GLSD doing to reduce or eliminate Inflow and Infiltration (I/I)?

While it is virtually impossible to eliminate all I/I from any sewer system, the Greater Lawrence Sanitary District has completed a comprehensive investigation of its interceptor sewer system to identify sources of I/I. Additionally, it has implemented I/I removal capital projects. The rehabilitation of the existing system will reduce the amount of clean water entering the sewer system, improve system reliability, and help to reduce the costs that residents and businesses pay.

## How do we locate Inflow and Infiltration (I/I)?

The primary method used to locate infiltration is by closed circuit television inspection (CCTV). During this process, a small robotic camera is placed inside the sewer main on a self-propelled crawler. The camera displays the internal condition of the sewer pipe to the camera operator, who records any defects observed. The report and digital video of the inspection are then reviewed to determine the appropriate repair needed for a given defect or defects present in the pipe.

Additional methods used to locate I/I include manhole inspection, smoke testing, dyed water tracing, and internal building inspections.

## How do we remove Inflow and Infiltration (I/I)?

There are many methods and technologies available to remove and reduce I/I. Modern techniques allow for the sewer lines to be inspected, cleaned, and even replaced or rehabilitated without traditional open-cut excavation. These “trenchless technologies” allow for rehabilitation and repair of sewers without the expense and interruption of conventional open-cut excavation. Not only is it more convenient to employ trenchless technologies to rehabilitate the sewer system, but it is also extremely cost effective when compared to open-cut methods.

## What can you do?

As a homeowner, there are things you can do to reduce I/I from your property:

- Do not plant trees and shrubs over sewers as root systems can damage pipes
- Keep caps on drain cleanouts to prevent debris from entering
- Check that basement drains and sump pumps are not connected to the sanitary sewer; this can help prevent sanitary sewer overflows and CSOs
- Replace any known broken or problematic sections of sewer pipe on your property
- Ensure gutters and outdoor drains are not connected to sewers transporting sewage