



Infiltration and Inflow: What Is It and Why Should We Care?

Infiltration and inflow (I/I) can be a major cause of sanitary sewer overflows (SSOs) in some communities. Prevention and correction of I/I requires a long-term commitment to sewer pipe maintenance, repair and replacement. Consistently working to address I/I is an effective way to help prevent SSOs.

What is infiltration/inflow (I/I)?

Infiltration and inflow are terms that refer primarily to the groundwater and rainwater that get into sanitary sewer pipes which are intended to only carry wastewater. Specifically, infiltration refers to water that enters the sewer pipes through leaks in pipe joints and connections, broken or cracked sewer pipes and leaky manhole walls. Inflow refers to water that enters the sewer system through direct connections, including (illegal) roof drains, foundation drains, catch basins, area drains, manhole covers and defective sewer service lateral cleanouts.



Water can "infiltrate" water pipes through leaks in pipe joints and connections or through breaks and cracks.

Even new, properly constructed sewer systems may experience some small amounts of groundwater leakage through pipe joints (typically provided for in system design). Over time however, ground subsidence, construction

activities, leaky house connections, illegal connections and normal wear and tear take a toll on the integrity of the wastewater collection system. Consequently, I/I rates generally increase over time, even in well-maintained systems. To put it in perspective, some Bay Area communities rely on sewer system segments that were built over 100 years ago. Why is it important to address I/I? I/I is a concern because the capacity of the sewers can be overwhelmed by this additional rainwater or groundwater, causing localized or downstream release of wastewater flow from the sewer pipes into the environment. If the sewer pipes are able to carry the additional flow to the treatment plant, there is the potential for operational difficulties, as flows may be too high for the biological process (involving natural living micro-organisms) that is essential for water treatment. The additional flow created by I/I results in additional energy and chemical and labor costs for treating these higher flows. Costs and operational difficulties can and are managed by the public clean water agencies. However, I/I-induced overflows from the sewer pipes are the greater concern.

Concern about I/I mainly applies to "separate" sanitary sewer systems, in comparison to "combined" sewer systems that are specifically designed to collect and transport a combination of storm water runoff and wastewater. Many older U.S. cities have combined sewers. In the Bay Area, only San Francisco has a combined sewer system.

What effect does I/I have on the environment?

There is no direct impact on the environment when sewer pipes and wastewater treatment plants are able to carry and treat the I/I. The impact occurs when the volume of I/I flow into the system of sewer pipes, sometimes across a large area, causes or contributes to SSOs or affects operations at

Continued on page 2

the wastewater treatment plant. The overflow of untreated wastewater from sewer pipes into the environment can impact public health if there is contact with the untreated wastewater, and it also can impact our water environment if it reaches our creeks or the Bay.

What can be done about I/I?

Most municipalities/public clean water utilities have programs that are focused on maintenance and repair of the wastewater collection system, which includes pipes and pump stations. To find existing and potential areas where I/I can enter a wastewater collection system, public clean water agencies frequently use underground video equipment to inspect sewer pipes. Generally, when problems are found, repair and replacement is the next step. Although funding generated from sewer fees and sometimes property taxes are used for necessary repair and replacement of sewer pipes, it is expensive to either dig up the street or tunnel under the street to repair the pipes. Often more immediate problems take precedence over slower-to-develop I/I conditions. Although addressing I/I early can help save money (and headaches), it requires a robust budget and dedicated staff and equipment to detect and correct I/I. For public clean water agencies with hundreds of miles of public sewer pipes and thousands of private sewer service laterals that connect to the public sewers, the task of maintaining these systems is constant and complex.

There are more than 14,500 miles of sanitary sewers across the Bay Area. How many miles of pipes are in your city's sewer system? Here are some examples.

San Jose	2,500*
Oakland:	1,000*
Concord:	685*
Palo Alto	205*
Novato	200*

*Estimated number of miles

If I/I can't be completely eliminated, how is its impact minimized?

I/I can be reduced and managed in three ways:

- Reduce flows at the source through routine and emergency inspection/removal of illegal stormwater connections to the sewer pipes.
- Encourage or require private property owners to regularly inspect and repair private sewer laterals, which are estimated to contribute up to 50 percent of the I/I in a typical system.
- Size pipes and treatment facilities to accept and treat additional flows.

Public clean water agencies also can conduct engineering studies on the impacts of I/I to their collection and treatment systems and determine the best combination of activities and programs to maximize effectiveness and minimize costs to ratepayers.

About BACWA

BACWA is a public joint powers authority whose members include public utilities that collect and treat municipal wastewater in the nine counties that surround the San Francisco Bay. BACWA is dedicated to working with our member agencies, the state and federal governments, as well as non-governmental organizations to deliver useful information about the water quality of the San Francisco Bay. BACWA works to ensure that water quality information is fully utilized to determine the health and needed protection of the San Francisco Bay. BACWA supports its public utility members, the public clean water agencies of the San Francisco Bay region, to promote understanding of the water quality needs and requirements of the region and to make water quality protection and enhancement a priority in our communities. For more information, visit www.bacwa.org.



NOTE: The information used in this document was adapted by the City of Mountain View from BACWA materials.