Environmental and Financial Benefits of Inflow and Infiltration Control

ISC Services – Dennis Bentink

Contents

Tel: 02 9790 2024 | Fax: 02 9790 2030 | Mobile: 0411 961 630 | Email: dennis@iscservices.com.au
Address: Po Box 489 Bexley NSW 2207 Australia | ABN: 38 608 629 983

1. Background

Inflow and Infiltration (also referred to as I/I or I&I) is unwanted ground water or stormwater entering sewerage collection networks.

When sewerage networks are overloaded due to excessive I/I or blocked due to soil ingress, root intrusion or other restrictions, sewage overflows from structures and pipes into the environment resulting in contamination, increased risks to public health and the need for clean-ups, testing and environmental reporting.

Not only are there environmental impacts, interruption to public amenity and negative public perceptions, but the costs of managing these overflows can also be quite significant.

As communities grow, new developments are introduced and urban infill increases, the load on the existing infrastructure continues to increase and all the while, existing assets continue to age with small issues growing and becoming more critical. In order to maintain a sustainable operational capacity, it is necessary to either implement measures to reduce the unnecessary burden due to I/I or to invest in capital works to upsize assets to cope with the increased loads.

I/I from even small rain events can result in increased pump operations with increased power consumption and treatment required that have negative environmental impacts even if the I/I doesn't result in an overflow.

Tel: 02 9790 2024 | Fax: 02 9790 2030 | Mobile: 0411 961 630 | Email: dennis@iscservices.com.au
Address: Po Box 489 Bexley NSW 2207 Australia | ABN: 38 608 629 983

2. Unsustainable I/I

Sewage flows typically increase by 3 to 4 times Average Dry Weather Flow (ADWF) even in small rain events with increases of over 10 times ADWF reported.

Without directly addressing inflow and infiltration the problem does not get any better and will continue to grow in a network to unsustainable levels with a myriad of problems developing right from the first I/I event.

i. Delayed and demobilised works

I/I can result in increased flows that result in critical inspections, traverses and works in collection systems being delayed or abandoned resulting in wasted time, energy and money for labour, equipment, traffic control and specialists.

Maintenance activities at wastewater treatment plants, pump stations and pits may need to be demobilised for the duration of increased flows because of rain, resulting in lost time, wasted money and resources due to demobilisation and remobilisation.

ii. Increased treatment costs

Treating wastewater costs money. Increased flows due to I/I result in increased operational costs and cause excessive chemical consumption.

Increased flows result in increased pump station and treatment plant operations which means unnecessarily increased power consumption and associated greenhouse gas emissions.

iii. Sewerage overflows

I/I steals capacity of the network in terms of flow as well as storage capacity meaning there is an increased risk of overflows and both health and environmental impacts. If there is a leak, sewage may also flow out (exfiltration) of a joint contaminating the area.

iv. Capital expense

The design and construction of structures to cope with rain water that has entered the sewerage network and to prevent potential overflows is capital intensive and adds another item that requires ongoing cost of operation and maintenance to store and then slowly release for treatment the captured rainwater.

v. Damage to infrastructure

When water flows in through a leaking joint in a pipe or maintenance hole, or through a crack in a pipe or wall, soil and embedment surrounding the pipe, MH or pump station can be washed into the network, creating a void that causes the pipe or MH to move. This in turn exacerbates the leak causing further loss of supporting material. In the worst cases, pipes collapse and voids are formed that can damage other underground infrastructure as well as any surface structures such as roads, footpaths and even buildings.

Tel: 02 9790 2024 | Fax: 02 9790 2030 | Mobile: 0411 961 630 | Email: dennis@iscservices.com.au
Address: Po Box 489 Bexley NSW 2207 Australia | ABN: 38 608 629 983

3. Benefits of I/I control

The benefits of controlling I/I are many and varied with the weighting for the benefit dependent upon the specific issues and circumstances of each asset owner.

Having said that, key benefits include:

1. Reducing power consumption and hence greenhouse gas emissions
2. Reduced operational costs (particularly when considered over the longer term)
3. Increased life of assets (reduced wear as well as less potential for soil washout damaging infrastructure such as pipes, MH's roads and surface structures.)
4. Fewer overflows and negative environmental impacts
5. Fewer reactive callouts during rain events and less need to have vacuum trucks to pump out struggling pump stations
6. Improved public perception

4. I/I Control

While it is not practical to totally eliminate all I/I, it is possible to adopt processes and smart construction techniques to prevent early onset of I/I in new assets as well as to utilise systems that address I/I sources to allow a manageable and sustainable level of I/I control to be achieved resulting in environmental and financial benefits for water authorities and communities who ultimately pay the price for inflow and infiltration.

There are a lot of opportunities to prevent the development of I/I and to repair leaks in maintenance holes, pump stations and pipes. While some information is provided below on preventing and repairing common I/I sources and causes, the list is not exhaustive and it is worthwhile discussing the specific issues with those experienced in I/I prevention and control.

Preventing the development of I/I is the simplest and best approach for new structures being constructed and includes the use of quality, well proven components, appropriate design and good installation techniques. Simple innovative approaches such as a flexible high-quality external wrap for precast joints to ensure that movement of joints does not result in failure will help cost effectively prevent early development of leaks.

For the multitude of structures and pipes already in the ground, the repair approach will depend on the severity of the leak, criticality of the asset, general condition of the asset, accessibility as well as various external factors such as ground type, depth below ground, size and geometry of the structure and pipes and practicality and risks associated with the repair (confined space, nearby structures and contributors to flow/ air quality etc).

Where leaks are at joints of pipes and maintenance holes, internal mechanical seals may be installed quickly and without the need for major surface preparation or drying out of the structures, however if an overall pipe condition is poor or severely degraded, it may be necessary to utilize a structural liner. Similar mechanical seals are also available for sealing the neck or chimney section of a MH.

Where a high rate leak is occurring at a pipe or maintenance hole joint or crack, this can be quickly stopped through use of a made for purpose fast acting polyurethane foam.

Foams can also be used for curtain grouting which is essentially surrounding the entire structure with a polyurethane foam, a good approach if there are a lot of fine cracks in the shaft.

Concrete risers on maintenance holes are often subject to failure of the joints as well as concrete rings cracking or breaking. Sometimes they may even have been packed to achieve a slope by using shims or packers and the resultant gap filled with mortar. The mortar can quickly fail resulting in an I/I point even during small rain events so using made for purpose Pro-Ring™ grade adjustment rings that are designed to provide a watertight and gas tight seal while meeting grade and slope is a better long term approach.

Tel: 02 9790 2024 | Fax: 02 9790 2030 | Mobile: 0411 961 630 | Email: dennis@iscservices.com.au
Address: Po Box 489 Bexley NSW 2207 Australia | ABN: 38 608 629 983

MH Insert/ inflow dishes are a simple and easy method to prevent rainwater flowing in through lids and frames during rain events.

5. Frequently Asked Questions

Q. Is it sustainable to completely stop I/I?

A. In short, no. The sheer quantity of sewerage networks (maintenance holes, pump stations & pipes) already installed and operating and the myriad of different paths allowing ground water and stormwater into sewerage networks make it impossible to completely eliminate all I/I. It is also not sustainable to try and attempt to completely eliminate I/I as the costs to try and stop all I/I would far outweigh the cost of treating a small amount of I/I. Water authorities need to consider their own individual circumstances, budgets and risks in developing an overall I/I reduction and management plan however long term reductions in operation and maintenance can be achieved with simple I/I reduction strategies.

Q. What are the environmental benefits of controlling I/I ?

A. Minimizing wasted electricity required to pump and treat water that has entered the sewer; reduced chemical consumption in treatment plants; reduced risk of sewage contaminating the environment.

Q.What is the most common cause of I/I?

A. While there are a number of causes of I/I, typically the most common is failed joints in both new and old assets. This can be in maintenance holes (particularly the chimney or neck where there are often multiple joints close together and near the surface) as well as pump stations, pits and pipes.

Q.Why do joints fail?

A. Joints can fail due to expansion and contraction (due to wetting and drying of soils as well as temperature variations), movement from settling and ground vibration, failed jointing materials and mortar and poor construction.

Tel: 02 9790 2024 | Fax: 02 9790 2030 | Mobile: 0411 961 630 | Email: dennis@iscservices.com.au
Address: Po Box 489 Bexley NSW 2207 Australia | ABN: 38 608 629 983