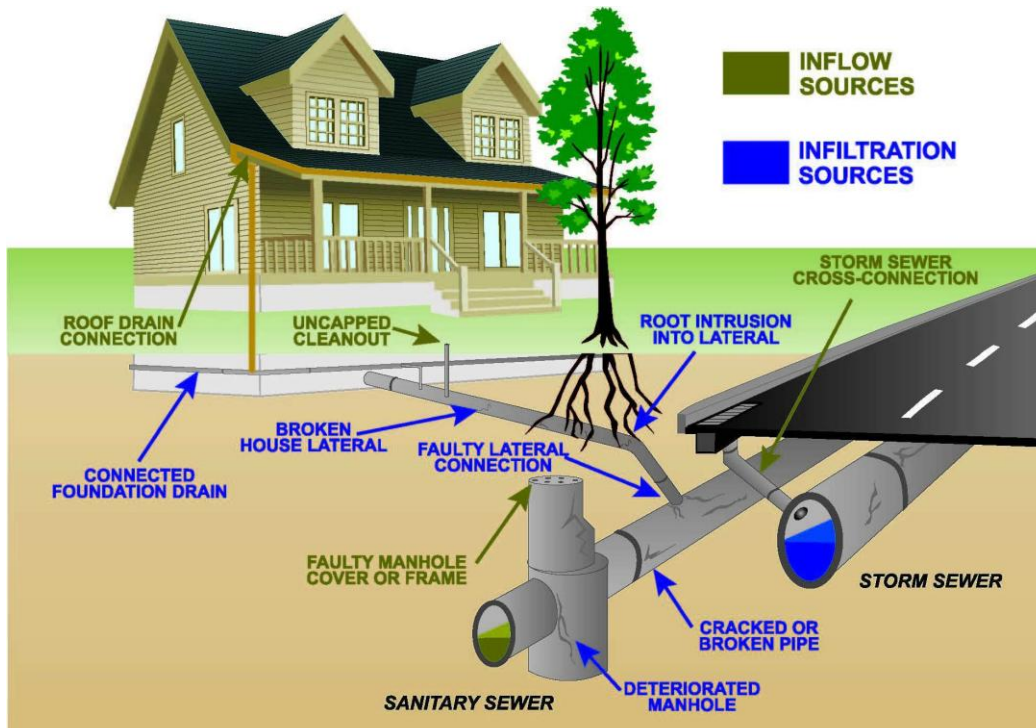


September 10, 2014

Inflow & Infiltration Reduction Program for the City of Diamond
Years 2014 to 2019



Objective

Remove storm water sources from the sanitary sewer system, keep wastewater treatment costs and sanitary sewer rates low, and protect the environment.

Program Overview

The term I/I is an abbreviation for **Inflow/Infiltration** and is used to describe the sources of storm water (rain and groundwater) that enter into the dedicated sanitary sewer system. Sanitary sewers are pipes located under the street, or City right-of-way, and are strictly designed to transport wastewater from sanitary plumbing fixtures, such as toilets, sinks, bathtubs, showers, and lavatories. The I/I Reduction Program has been implemented to identify and remove I/I sources from the

sanitary sewer system. These sources can overload the sanitary sewer system and cause sanitary sewer backups into homes and businesses, as well as sanitary sewer overflows (SSOs) to a nearby wet weather creek, which flows into Carver Branch.

Inflow sources are those that flow directly into the sanitary sewer via a defined route (pipe, etc.)

Infiltration sources are those that inadvertently enter into the sanitary sewer via cracks, holes, faulty connections, or other openings. Inflow sources within the public right-of-way can include sanitary manhole covers and storm water catch basins that are inadvertently tied into the sanitary sewer.

Private land areas (outside of public right-of-way) inflow sources include roof downspout connections, yard and driveway drains, broken or missing sanitary lateral cleanout caps, and sump pump connections to the sanitary sewer system. These connections are illegal and can add thousands of gallons of storm water into the sanitary sewer system per household during large rain events. Inflow sources are usually the easiest to remediate.

Infiltration sources within the City right-of-way can include broken or cracked sanitary pipes, deteriorated manholes, and misaligned or faulty pipe joints. Private infiltration sources can include broken lateral sewers, faulty lateral connections, tree root penetration, and broken cleanouts. Infiltration sources can be more difficult to deal with due to the fact that the sources occur underground.

Treatment Costs and Wastewater Treatment Plant (WWTP) Expansion

During a rain event, a large amount of storm water (I/I) enters into the sanitary sewer system and is treated as if it is wastewater. Typically, rain water is clean and does not need any type of treatment. The unnecessary wastewater treatment of storm water **costs** the City, and ultimately **all sewer users, extra money** in wastewater treatment. Sewer use rates may need to increase once again if I/I is not reduced to combat the costs associated with treating excess storm water.

What is the City 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 City of Diamond has begun a program to rehabilitate the existing system in an effort to reduce the amount of clean water entering the sewer system in an effort to improve system reliability and reduce any future additional costs which residents and businesses will pay.

What are the plans for the next five years to reduce I/I?

The City of Diamond Wastewater Treatment Facility will be undergoing extensive rehabilitation on its lagoons during the month of November 2014; however this will not alleviate the Inflow and Infiltration issue that we continually experience during periods of wet weather. In years past, we have suffered emergency discharging mainly during the winter months when land application windows are limited.

In an effort to limit the amount of I/I we receive into our system, the following plans are being made to repair as much of the issue as we can with limited budget numbers to work within. So far in 2014, we have had the benefit of having assistance from Missouri Rural Water Association on two

separate occasions in utilizing a camera to take a closer look at our sewer mains throughout a large portion of the City of Diamond. We have also utilized smoke testing, water dye in stormwater, and visual manhole inspections to determine the best route to take in assuring that we repair the issues we are experiencing in our infrastructure.

The biggest issue we have found to date is in our manholes. Several manholes have been found to have substantial decay in mortar and sidewalls within the structure which is allowing infiltration of ground water into our system. If the City of Diamond receives more than an inch of precipitation, our influent amounts coming in at the lift station quadruples which inundates our lagoon system and causes the potential for discharging to occur. So the plan over the next five years will be to remediate the worst 25 manholes we find at a minimum. We have already made repairs to two manholes (#13.3 and #9.6-1) which had significant decay and were allowing substantial amounts of ground water to infiltrate our system.

The next biggest issue we have found to date is roots in our sewer mains in several locations. Our plan to remediate this issue is to utilize the information gathered from the lines when they were looked at with a sewer camera and replace the clay section where the roots have caused blockage with 8-inch PVC lines. We will be replacing the worst 20 sections in town over the next five years at a minimum. This will only equate to replacing 210 feet of line within the City of Diamond, but it will be at the most extreme areas all over town.

We have also determined from smoke testing the lines some areas that require a riser to be placed in order to limit the amount of ground water that is entering the system through low lying manholes. We have already placed risers on four locations which were allowing significant amounts of inflow to enter our system (#8, #9.4-2.2, #9A, and #10). The plan over the next five years is to assure that we have located and placed risers on any manhole within the City of Diamond that is in a low lying area to assure that we limit the I/I issue.

Depending upon the severity of the berm in Cell #2 at the West lagoons for the City of Diamond, the potential will be to have a substantial amount of funding for more I/I remediation once the determination is made whether a cofferdam has to be placed or not. If funding is available, the potential exists to have some inline grouting done on some of the clay pipe that has severe cracks in them to remediate them as well.

For the most part, the clay tile in our system is in remarkably good shape for being roughly 60+ years old. We have several locations allowing ground water to enter our system, but the majority of the issues we are discovering can be resolved without extensive ground disturbance.

In an effort to continue to determine problem areas within our system, the City of Diamond is also hoping to purchase a push rod color camera system with 200' of cable for usage in determining weak points. This along with our smoke machine and three different colors of water dye will allow us to pinpoint areas that need immediate attention before they become a major issue. The camera should be able to be purchased at a cost of less than \$1000.

Smoke testing will be performed in late spring each year to determine if customer sewer or gutter connections are causing an issue for our system as we found approximately one dozen this past

spring that were missing cleanout caps and three to four buildings that had gutters running into our sewer system.

It is my goal as the Wastewater Superintendent for the City of Diamond to at the very least cut the amount of I/I coming into our lift station during periods of wet weather by 50% within the next five years with the repairs we have planned.

Submitted Respectfully by,

Gerald S Ezell, Wastewater Superintendent
City of Diamond