

Long Term Plan to Reduce I/I

The Mansfield, MA, sewers were originally built in the early 1940s. The system currently consists of 312,000 ft (60 miles) of clay, cast iron, concrete, and PVC sewer mains ranging from 6 to 42 in. in diameter. The system also includes 1,500 manholes, five pump stations, a 3.14-mgd capacity wastewater treatment plant, and 3,300 sewer users. Like most older systems, Mansfield's was afflicted with inflow/infiltration (I/I) and the town was determined to correct the situation.

I/I is groundwater or stormwater that flows into the sanitary sewer system due to leaky sewer lines or manholes or from situations where stormwater can flow into the sanitary sewer system through direct connections, such as catch basins, roof drain connections, or sump pump connections. I/I affects the quantity of wastewater that needs to be treated, the capacity of Mansfield's sewer pipes, pump stations, wastewater treatment plant, and ultimately, the rate businesses and residents pay to operate and maintain them. I/I takes up valuable capacity in treatment plants and has the potential to limit future sewer connections.

The objectives of Mansfield's program were to:

- Reduce the quantity of I/I in the sanitary sewer system.
- Maintain compliance with state discharge permits during wet weather flows.
- Reduce treatment costs and free up capacity at the wastewater treatment plant.
- Improve reliability in the sewer system by eliminating surcharges and backups caused by excessive flows.

Identifying I/I

To determine the location of I/I in

the system, Mansfield elected to use sewer camera inspection. Sewer camera inspection is accomplished by sending a small self-propelled closed circuit color TV camera through the sewer lines to record and document the conditions observed. Defects such as water infiltration, broken or cracked pipes, and root intrusion can be found.

Manholes were inspected visually. Inspectors noted the condition and presence or evidence of I/I from the cover, cone, walls, joints, lift holes, pipe connections, steps, bench, and trough.

Simple house-to-house inspections were conducted of the exterior and interior of a properties and residences. Inspectors checked for illegally connected roof, yard, driveway, basement, and foundation drains, as well as sump pumps. Home inspections usually took less than ten minutes.

Smoke testing was also used to find I/I. A non-toxic, odorless smoke was blown through the sewer lines to find defects. Defects were identified where smoke was seen exiting the ground or other connection, such as roof leader or yard drain. Improperly connected plumbing or drains inside of a home were also identified through smoke testing.

Removing I/I

There are many methods and technologies that are available to remove and reduce I/I. Modern techniques allow for sewer lines to be inspected, cleaned, and even replaced without traditional open cut excavation. By utilizing trenchless technologies, sewer rehabilitation and repair can often be performed without interruption of sewer service or traffic disruption.

I/I can also be removed by a variety of techniques, some of which require a direct disconnection of the sanitary

sewer system from the inflow source. For example:

- Disconnect roof leaders, sump pumps, foundation drains, or other illegal or improper connections from the sanitary sewer system.
- Encourage the removal of private inflow sources through enforcement of state and local regulations or incentive programs.
- Raise manhole covers that are located in low areas where stormwater may pond and/or divert stormwater that flows to manhole covers.

Mansfield's Engineering Department went out to bid and purchased a portable closed circuit sewer television inspection system in 1998. The highway division and motor pool mounted the inspection system and constructed a permanent sewer camera inspection unit utilizing a retired water department vehicle. The engineering department worked closely with the highway division to train personnel and continues to manage and supervise the operation of the sewer camera inspection vehicle.

Using its own personnel and its own camera, as well as contracting out camera inspections of large diameter sewer lines, as of the end of 2006, the town completed inspections of 328,977 linear ft, which included re-inspection of some of its 320,375 linear ft of sewers. This leaves about 23,046 linear ft of sewer remaining to be inspected in 2007 and 2008. The average cost for the town to inspect sewer lines including all capital costs of the camera and truck (over ten years), maintenance, labor, and police details is about \$0.30/ft., compared to the industry standard of \$2.12/ft. This represents a tremendous savings to the town and provides a valuable tool to assess and inspect the sewer system for many years to come.

The town has also completed the inspection of 1,286 of the approximately 1,500 manholes located in Mansfield, of which 354 were found to be leaking. The average cost to inspect a manhole using town personnel was \$6.37/manhole. The industry standard cost is \$20.00/manhole. The town intends to inspect the remaining manholes, as it can. Most of these remaining manholes are currently paved over or located in cross-country sewer easements.

In the spring 2001, the town contracted Weston & Sampson, Inc. (www.westonandsampson.com) to review inspection data from its television and manhole inspections, specify repair methods, and prepare contract documents utilizing town-developed sewer plans for bids.

The contract was bid and subsequently awarded to the low bidder, NEPCCO (www.eheitkamp.com), in April 2001 for \$183,000. This contract was completed in June 2001, and included the rehabilitation and repair of 145 manholes and the cleaning and television inspection of 65,000 linear ft of large diameter sewer lines. Based on department of environmental protection guidelines, 129,780 gpd of I/I was eliminated by this repair work.

After the Mansfield Engineering Department reviewed and identified additional possible sources of I/I in both the spring and fall 2002, an additional contract was awarded to Weston & Sampson to provide the repair specifications for bidding this repair work. The contract was bid and awarded to Pipelining Products, Inc. for about \$559,000. Extensive repairs of an additional 60 manholes and the relining of 11,500 linear ft of defective sewer lines were subsequently accomplished in the spring, summer, and fall 2002. Based on department of environmental protection guidelines, an additional 171,540 gpd of I/I was removed by this repair work.

House-to-house (HTH) inspections were then conducted in fall 2003 and spring 2004 with the purpose of identifying illicit connections to the sewer system, and eliminating extraneous flow of unnecessary groundwater or stormwater

to the system. The HTH program included public outreach and notices concerning the times of inspections and the reason for them. The house-to-house program was formalized and adopted by Mansfield's Selectmen in September 2003. Inspections of the over 3,000 sewer users were performed by engineering and department of public works personnel in the fall 2003 and the spring 2004. The inspections were completed by April 2004 due to the cooperation of residents and business owners. The inspections identified 60 sump pumps, which could have contributed over 300,000 gpd of unnecessary water to the sanitary sewer system. This is equivalent to over 900 three-bedroom homes.

The HTH program has successfully resulted in the disconnection of all inflow sources from the inspected properties. As a highlight of the program, one property that was disconnected had 11 pumps



Ingenuity and planning combined in Mansfield, MA, to produce a cost-effective program for eliminating I/I.


connected to the system, which had metered flows during dry periods (July to October) of up to 22,000 gpd. The town estimated, based on its wastewater plant flow data, that this one property may have contributed over 60,000 gpd in wet weather periods. As of July 2007, only one property has not complied with the HTH program, and is being billed a "Private Inflow Penalty" of \$50/month on their sewer bill. The town does not suspect an illegal sewer tie-in, but this older gentlemen will not allow access for inspection, and is paying the monthly fee. The town expects that an inspection will be allowed upon future transfer of this property.

New England Pipe Cleaning Company, under the direction of Weston & Sampson Engineers and the Mansfield Engineering Department, was awarded an I/I repair contract in 2005 for approximately \$570,000. During this contract, 13 manholes were rehabilitated, one manhole was replaced, 9,817 pipe joints were tested and 1,455 sealed, three open-cut repairs were performed, 13,008 linear ft of sewer received root treatment, 573 linear ft of short liners were installed, 119 services were sealed, and 3,809 ft of cured in place pipe was installed. As a result of this repair work, approximately 172,160 gpd of observed I/I were eliminated. Based on DEP guidelines of using half of the observed amount, 86,080 gpd of I/I were removed.

During 2007 and 2008, the department of public works expects to obtain a recently approved new sewer camera truck and will continue to perform television inspections on the approximately 23,046 linear ft of remaining town sewer lines.

The short-term goal of inspecting and repairing the major defects found within the entire system is near completion. As part of the long-term I/I program, an annual maintenance budget has been implemented for the department of public works to continue with the prioritized inspection, repair, and replacement of components of the sewer system. The department of public works became an Enterprise Account on

July 1, 2006, which allows it to operate more as a business entity for budget and planning purposes. Based on Mansfield's history of repair costs and expected maintenance, an annual budget of \$100,000 has been included for continued I/I work in fiscal years 2007 and 2008.

As demonstrated by the above progress, the engineering department and the department of public works worked closely together to implement the I/I reduction program and to plan future sewer use and maintenance within the town of Mansfield. 

The preceding is courtesy of Mansfield, MA.