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# Ways of Reducing I&I During Hard Economic Times

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**ABSTRACT:** The upkeep of aging infrastructure can be a costly capital expenditure. Inflow and infiltration (I&I) in a sewer system can cost owners up to hundreds of thousands of dollars in unnecessary treatment costs, reduced capacity at a treatment plant, and ultimately become a hindrance to economic development by limiting new development and new connections. In this economy, the question becomes for a municipality or town: “What can we do to reduce I&I without spending a significant amount of the rate payers’ money?”

Township of Falls Authority (TOFA) in Bucks County, Pennsylvania faced this issue. An I&I Study was conducted in 2006 which outlined the areas of I&I in the township. TOFA conveys a portion of its sanitary flow to Bucks County Water and Sewer Authority (BCWSA) which conveys its sewage to the City of Philadelphia for treatment. To eliminate surcharges from BCWSA, TOFA looked for ways to reduce I&I and reduce costs for treatment. In 2008 the first phase of the I&I program began. The first phase included an inspection and grouting contract. In the first year of the program, approximately 6000 linear feet of 8” vitrified clay pipe and approximately 7000 linear feet of 10” vitrified clay pipe was inspected. All joints were pressured tested and leaking joints were grouted. Some pipes required point repairs, root intrusion was addressed, and a few manholes were rehabilitated. The result of this first phase was a reduction of flow by approximately 200,000 gallons per day and an approximate savings of \$280,000.00 per year in wastewater treatment costs. The contract award cost of the project was \$90,000.00. This project resulted in a 10% reduction in I&I tributary to BCWSA. Dry weather flows were reduced from 1.897 MGD to 1.708 MGD<sup>1</sup>. Peak weather flows were reduced from 2.219 MGD to 1.998 MGD<sup>2</sup>.

An inspection and grouting contract can be a beneficial combination for asset management in that you are verifying the condition of your system and reducing I&I at the same time.

## Background

The Township of Falls Authority (TOFA) is a water and sanitary sewer utility located in Fairless Hills, Bucks County, Pennsylvania. TOFA provides collection and conveyance of sanitary wastewater for Falls Township, Lower Makefield Township, and Bristol Township. TOFA’s system has approximately 308,900 linear feet of gravity sanitary sewer mains and interceptors in sizes from 8-inches to 36-inches. TOFA has a staff of approximately 10 people and serves approximately 23,000 customers. TOFA does not own a wastewater treatment facility and conveys its sewage to the City of Philadelphia (via Bucks County Water and Sewer Authority), Morrisville Municipal Authority, and Lower Bucks County Joint Municipal Authority facilities for treatment. In the early 2000’s, TOFA was under a moratorium by the City of Philadelphia and Bucks County Water and Sewer (BCWSA) for new connections as a result of high inflow and infiltration in its system. TOFA conveys approximately 2 MGD to Philadelphia for treatment. This represents 2/3 of TOFA’s flow. When the moratorium

was lifted, TOFA as well as other authorities that convey to BCWSA and Philadelphia for treatment committed to reduce I&I in their systems. In 2006, BCM Engineers conducted an Inflow and Infiltration Study for TOFA and wrote a report called "Inflow and Infiltration Removal Plan"<sup>3</sup>. The plan outlined all the locations in TOFA's service area that exhibited high infiltration rates and high peaking rates. This report became the basis of TOFA's I&I program as it became the guide to strategically address I&I removal. TOFA was assessed surcharges from Bucks County Water and Sewer for high BOD and TSS concentrations as well. Surcharges in 2008 were over \$200,000.00.

During these hard economic times, TOFA was faced with how to address I&I and eliminate surcharges in a cost effective manner without increasing rates for the ratepayers. If these issues were not addressed, eventually the costs would have to be passed on to the ratepayers. The condition of the sewers in these areas of I&I were not known and the Authority was concerned that major repairs may also be required. TOFA has a small staff and does not own equipment or have the capability to inspect its system. In 2008, the TOFA Board budgeted \$250,000.00 towards I&I removal. Remington, Vernick and Beach (RVB) recommended that TOFA focus first on the areas tributary to BCWSA to reduce I&I with the hopes the BOD and TSS concentrations would also be reduced and eliminate surcharges. This effort would show BCWSA and Philadelphia that TOFA was committed to reducing I&I and prevent any moratoriums in the future.

### **Project Details and Scope**

RVB recommended the first phase of the I&I program be an inspection and grouting contract that focused on the areas tributary to BCWSA that exhibited high infiltration rates. The locations were in the southeast section of Falls Township. The contract would include cleaning and televising the sanitary sewers, pressure testing the joints, and sealing the joints with grout if required. The majority of TOFA's system is vitrified clay pipe. Over time the joints would misalign and allow water to come into the sewer via root intrusion, cracked pipe, or through voids in manholes. Joint sealing is a start to I&I removal. The inspection portion would allow TOFA to obtain the knowledge of the condition of its system and if any further action is necessary. The contract specifications stated that all contractors had to be NASSCO certified and trained. In October 2008, TOFA bid its first I&I removal project that included:

- Cleaning and Inspection of 6,970 linear feet of 8-inch VCP sewer at \$2.00 per linear foot;
- Cleaning and Inspection of 7,250 linear feet of 10-inch VCP sewer at 22.00 per linear foot;
- Pressure Testing and Grouting of 2,323 8-inch joints at \$12,00 per joint;
- Pressure Testing and Grouting of 2,417 10-inch joints at \$14.00 per joint.

The Contract time was 90 calendar days to allow for any delays due to weather or any unforeseen conditions. Six contractors bid on the project and the lowest bidder was Tri-State Grouting, Inc., from Delaware. Their bid was \$90,154.00. TOFA budgeted \$250,000.00 for the project, so there was approximately \$160,000.00 available to perform work on another section or take further action if required. Additional work included:

- 3-foot long CIPP point repairs at \$1,800.00 per repair;
- Manhole saddle lining at \$2,700.00 per manhole;
- CIPP repairs over 3-feet in length at \$200 per linear foot

The cleaning and inspection portion of the contract showed evidence of root intrusion (Figure 1), multiple fractures (Figure 2), misaligned or open joints (Figure 3), protruding laterals, and infiltration at manholes. The inspection also showed that certain sections of pipe were in danger of collapsing and required replacement (Figure 4). The scope of work was expanded to include point repairs using 3-foot CIPP lining and manhole rehabilitation. The contractor also encountered tuberculated cast iron pipe during the project that required heavy mechanical cleaning.



Figure 1 Root Ball in Pipe Segment MH 180 – MH 298  
(Courtesy of the Township of Falls Authority)

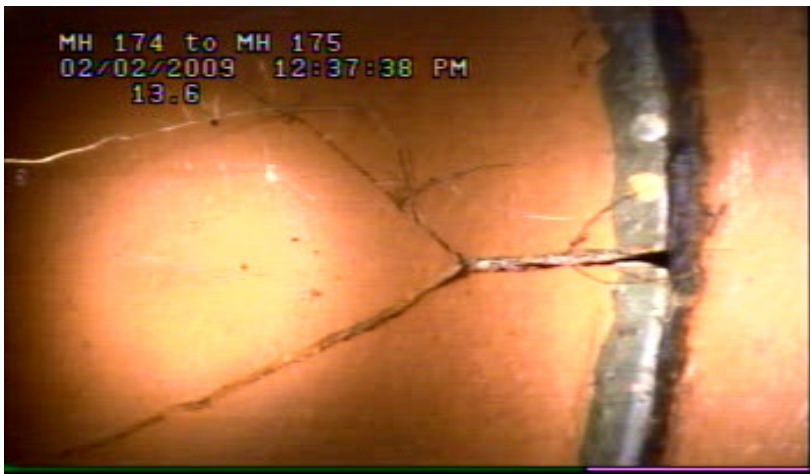


Figure 2 – Multiple Fracture in Pipe Segment MH174 to MH175  
(Courtesy of Township of Falls Authority)



Figure 3 – Open Joint / Joint Offset  
(Courtesy of Township of Falls Authority)



Figure 4 – Broken Pipe  
(Courtesy of Township of Falls Authority)

Upon the closing of the contract, the final scope of work included:

- 20,313 linear feet of 8-inch VCP was cleaned and televised
- 1,338 linear feet of 10-inch VCP was cleaned and televised
- 573 linear feet of 12-inch cast iron pipe was cleaned and televised
- 2,406 8-inch joints were pressure tested
- 540 10-inch joints were pressure tested
- 158 12-inch joints were pressure tested

- 961 8-inch joints were grouted
- 76 10-inch joints were grouted
- 158 12-inch joints were grouted
- 10 lateral protrusions were cut
- 1 pipe relining
- 8 Short CIPP repairs (3-foot lengths)
- 7 CIPP repairs (over 3-feet in length)
- 1 Saddle Liner



Figure 5 – CIPP Liner Point Repair, 3-foot length  
(Courtesy of Township of Falls Authority)

The final cost of the job was \$156,703.00. This work included the addition of a completely different section of Falls Township that had severe I&I problems. TOFA saved over \$93,000 of their allotted budget on this project. More savings were realized when TOFA's 2009 Chapter 94 Municipal Wasteload Management Report (Chapter 94 Report) was written the following year. After this project was completed, the flow tributary to Bucks County Water and Sewer decreased significantly. Data from flow meter stations M15 and M16 recorded showed flows from the year 2008 to 2009 dropped approximately 200,000 gallons per day (monthly average)<sup>4</sup>. The treatment cost savings in 2009 totaled approximately \$280,000.00 based on TOFA paying \$3.83/1000 gallons to BCWSA for treatment. BCWSA did not assess TOFA any surcharges in 2009 for BOD and TSS concentrations. Precipitation data for both 2008 and 2009 are similar in that the wettest months of the year were May through September. In 2008, September 9<sup>th</sup> had the most rainfall of 1.58 inches and in 2009, August 12<sup>th</sup> had the most rainfall of 1.64 inches. Total precipitation for 2008 and 2009 was 43.27inches and 35.46 inches respectively.<sup>5</sup>

<b>Table 1</b> <b>Flow to Bucks County Water and Sewer Authority 2004 - 2014</b> <b>(Based on Meter Readings at Meter Station M15 and M16, with Projections)</b>				
<b>Year</b>	<b>Average Flow (MGD)</b>	<b>Peak Flow (MGD)</b>	<b>Average Loading (lbs. BOD5/Day)</b>	<b>Peak Loading (lbs. BOD5/Day)</b>
2004	2.520	3.398	4,284	5,777
2005	2.059	3.866	3,500	6,572
2006	2.186	2.644	3,716	4,495
2007	1.897	2.219	3,752	4,389
2008	1.897	2.219	3,750	4,387
2009	1.708	1.998	4,250	5,000
2010	1.505	1.761	4,248	4,998
2011	1.505	1.761	4,246	4,996
2012	1.505	1.761	4,245	4,994
2013	1.302	1.523	4,243	4,992
2014	1.302	1.523	4,243	4,992

Table 1 - Excerpt from 2009 Annual Chapter 94 Wasteload Management Report  
(Courtesy of Township of Falls Authority)

### Conclusion

The Township of Falls Authority determined this project a success and moving forward will complete an I&I project every year until all areas listed in the Inflow and Infiltration Removal Plan are addressed. As a result of this project, surcharges were not addressed and treatment costs were reduced. This project was successful because TOFA did not have to raise rates as a result of this project, saved money to fund other capital programs, and improved the system by restoring capacity in sewers that were once restricted.

For small municipalities and authorities who do not have the staff or equipment to inspect their system, a cleaning and televising contract is beneficial in gaining knowledge on the condition of their system. TOFA used the information gathered from the inspections to create a capital program for their sewer system. If I&I is present, combining this work with a chemical grouting contract is a start in reducing I&I as well. Joints are problematic in systems that have vitrified clay pipe. Joints become a weak spot and allow water to infiltrate or exfiltrate the pipe. No municipality or authority wants to pay for treating stormwater. In TOFA's case, a large savings was realized after the first phase that paved the way to fund future projects. Chemical grouting may not be a long term solution to reducing I&I but it can be a cost effective method used by municipalities who need to realize results quickly without spending a lot of money.

## REFERENCES

<sup>3</sup>BCM Engineers, Inc. (2006). Inflow & Infiltration Removal Plan, Township of Falls Authority, Fairless Hills, PA.

<sup>1,2,4</sup>Remington, Vernick & Beach Engineers. (2009). Annual Chapter 94 Wasteload Management Report, Township of Falls Authority, Fairless Hills, PA.

<sup>5</sup>Precipitation data provided by Weather Underground ([www.wunderground.com](http://www.wunderground.com))