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CET Engineering Services
Newsletter

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INFILTRATION AND INFLOW

Background and Stuff to Think About

How much infiltration and inflow (I/I) do you have in your system? Do you experience overflows or bypasses during extreme wet weather conditions? Now, it's a fair statement to say that every system has some I/I, and it's also a fact that just about every system constructed prior to the '70's has **excessive quantities** of I/I. What's also interesting is that some systems that experience overflows or bypasses during wet weather events would probably have overflows even if everyone were away on vacation and no wastewater was being discharged into the system! I/I in the worst cases is that bad!

Most systems have an I/I removal program. The lucky ones found a spring or two, or a break under a stream crossing and made a cost-effective correction. Or, some addressed the problem by building larger conveyance facilities and larger treatment facilities, in most cases, a very cost effective and practical way of dealing with infiltration.

However, for those of you that are among the unlucky ones, you have probably tried almost every rehab method available. But, what are you doing about the I/I that enters the laterals? Based on our studies, most municipalities do nothing and only 5% offer financial assistance with removing private source I/I. As many have experienced, while every section of public main and manhole can be rehabilitated, when nothing is done to **fix the pipe from the sewer main to the house**, there is often little or no reduction in I/I under extreme wet weather conditions! Understandably so, since many building sewers installed before the mid 1970s are clay, transite, orangeburg, or some combination of the above. In addition, the footage of lateral pipe may be as great as that of mainline in many systems! Think about it - even if every manhole and every foot of mainline in a drainage area were replaced, there may be little reduction in flow if the groundwater simply moves (migrates) to those old, defective laterals that allow I/I to enter the system. How frustrating that would be! It is our experience that a real key to removing I/I is addressing the private sources. Without doing so, your program **may** be doomed from the beginning.

So, how many connections do you have in your system? If they leak, just how much additional water might there be? Well, just imagine if from every lateral and/or building sewer there was an average 1 gallon per minute leak (1,440 gallons per day) of peak hourly I/I. (For those of you that have watched VHS tapes or performed TV work during heavy rainstorms, this is not difficult to imagine.) So let's say you have 1,000 connections, this means that you would have 1.4 mgd (1,000 gpm) of peak flow. Let's say you have 5,000 connections; this means that you would have 7.4 mgd (5,000 gpm) of peak flow. How many interceptors, pumping stations, or treatment units were originally designed for that large a peak hydraulic loading? Now, add in a factor for leaks from manholes and mainline!

Over the next five years, respondents will spend an average of $800,000 on their I/I programs.

Just What Are Municipalities Doing?

In a recent survey by CET, respondents indicated they will spend an average of $800,000 on I/I during the next 5 years. One municipality will reportedly spend nearly $20 million over the next 5 years to address I/I. While this municipality has a population of 45,000, this still is a lot of money.

Most owners report that they attempt to remove I/I only in mains and manholes; in the mains by either excavation or repair or by grouting; and in manholes by grouting, cement coating or replacement. However, our research also found that 80% of the owners recognize that private laterals are a significant source of I/I, but little or nothing is being done about it. This is understandable given the political and financial implications.

Our research also shows that almost all facilities are finding and removing I/I based on televising performed during wet weather or high groundwater conditions. Very few are actually focusing on smaller drainage areas called minibasins through a comprehensive flow monitoring effort, prioritizing the minibasins (usually less than 20,000 linear feet of mainline or 300 connections in suburban communities), and then rehabilitating the worst basins first. Based

on flow monitoring data we have seen, however, addressing mini-basins as opposed to larger basins has proved to be extremely valuable. This type of metering can provide a 'snap shot' of your system during an extreme event and can provide priceless information. The following are some of the comprehensive metering results from two different PA municipalities during 1999 and 2000. However, the names of the basins have been changed to protect the innocent:

Drainage Area	EDU's	Peak hourly flow	Peak hourly flow per EDU
A	90	1.4 mgd	15,000
B	93	0.6 mgd	7,000
C	180	1.0 mgd	5,000
D	77	1.8 mgd	20,000
E	12	1.0 mgd	80,000

Of course, not all of the drainage basins had results this high. Based on the metering projects, the average peak hourly flow was between 3,000 to 5,000 gallons per day per EDU, but that is not the point. The point is that if your boss says to you 'Hey, you have $100,000 this year to spend on removing I/I', where would you spend it? Would you go out and address leaks anywhere in your system or would pick one of the above mini-basins and address every mainline joint and manhole and, dare we suggest, laterals? A comprehensive metering effort, although expensive for some, can yield tremendous results. Besides, once comprehensive metering is available from an extreme wet weather event, the data will be good for quite some time since leaks obviously don't go away on their own. It has to be an extreme event, though. Extreme event comprehensive metering can also identify control basins that can be used to measure the effectiveness of I/I rehabilitation efforts.

Should I/I Be Treated?

As noted before, I/I can occupy valuable capacity in sewers and plants. When that happens, or when agreements for treatment are based on a cost per gallon of flow without consideration to the organic component of the treatment cost, it usually makes sense to look hard at removing I/I. However, there are times when leaving it in and treating it makes more sense.

The costs of treatment, once facilities are constructed, fall into three or four significant categories: 1) labor and overhead, 2) electricity, 3) maintenance and repairs, and 4) administration and billing. None of these large blocks of cost are substantially affected by the presence or absence of clear water. Personnel are not laid off when flows go down during a dry period. Aerators are not turned off if the organic loading stays the same. The cost of insuring buildings and equipment do not vary with flow. Bills need to be sent out no matter what the flows are. Treatment of I/I **when there is capacity readily available**, can make sense.

This is not a theory. We compared the 1996 and 1997 costs for a Central PA facility with the following results:

	1996	1997
Precipitation, inches	61.3	39.3
Plant Flow, MGD	8.510	6.500
BOD lbs./day	8,200	8,100
Treatment Costs	**1996**	**1997**
Personnel Services	$232,700	$248,700
Supplies	$166,700	$182,500
Services & Charges	$308,000	$308,000
Cost	**$707,400**	**$739,200**

In this facility, the cost of treatment was the almost the same in 1996 and 1997, even though there was 2 MGD additional flow in 1996. The organic loading was the same. The 720 MG of clear water made no difference in their cost of operation. They had the tankage available to accommodate the extra flow.

Did You Know...

DEP has reorganized their regional permitting by watersheds, instead of by county.

So what are we saying? If you have no sanitary sewer overflows, and if you charge for services on the basis of flow **and loading** (especially to your large bulk customers), and if you have the existing plant capacity available for use, consider treating the I/I for the time being. If you have these luxuries, it may not make sense to spend hundreds of thousands of dollars per year on I/I removal at this time. Your engineer should be able to provide valuable advice on this issue.

There are many good repair methods for improving the integrity of old sewer systems and reducing the infiltration of groundwater into systems. Have your engineer explain them and their advantages and expected costs. Consider the importance of laterals and their contribution to infiltration. Educate the public. Be creative and proactive to help them understand how their infrastructure may be part of the problem. Don't give up and don't get in a rut that bears few, if any, improvements.

This newsletter represents some of what we have experienced in more than 20 years of working on projects that include I/I removal as well as our recent survey on the subject. We invite you to email us (info@cet-inc.com) or write and share your experiences that may be in agreement or contrary to ours.

Any Day Now...

The Independent Regulatory Review Commission has approved amendments to the existing water quality management regulations as submitted to them on August 1, 2000 by the Environmental Quality Board. These amendments were first published in the *Pennsylvania Bulletin* on August 29, 1998. The amendments affect the following 25 Pa. Code Chapters:

92 - NPDES
93 - Water Quality Standards
95 - Wastewater Treatment Requirements
97 - Industrial Wastes

Also, a new Chapter 96 was added. ***Chapter 96, Water Quality Standards Implementation***, consolidates requirements from the existing regulations and incorporates Total Maximum Daily Loads into the regulations.

These amendments will be effective upon publication in the *Pennsylvania Bulletin* as final rulemaking.

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