

Stantec

Gary D. Silcott, Jr, PE presents:

Micromonitoring:
A Cost Effective
Approach for
Locating I&I in
Sanitary Sewers

MH 340
3/25/2014

TO
CITY OF LOGAN

MH 35
12:5

Agenda

1. Background and History
2. Milford Center, Ohio
Micromonitoring Program
3. Logan, Ohio Micromonitoring
Program
4. Jackson, Ohio Micromonitoring
program
5. Summary/Q&A

215'01

Safety Moment

Remember when entering manholes to use all of the SWP protocols including gas detection and confined space requirements.



Background and History

Micromonitoring was developed by Stantec, to provide a way to quickly and efficiently identify upstream small diameter sewers containing sources of Inflow and Infiltration (I/I) where traditional flow monitoring methods are ineffective.

Stantec has completed several Micromonitoring projects in the past few years; here we will highlight three successful projects for rural communities in Ohio.

What is a Micromonitor?

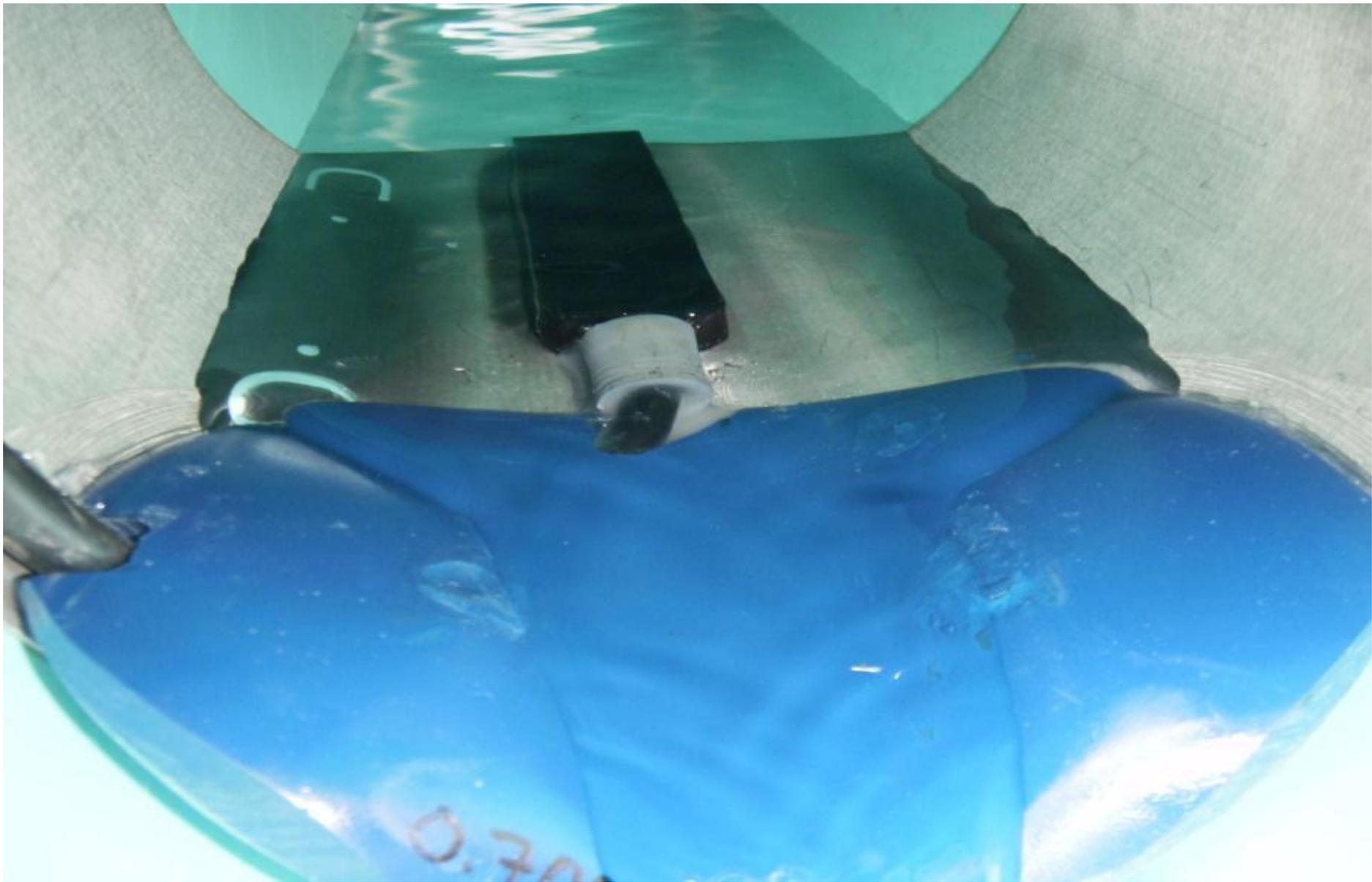


$Q = AV$ at high flow

**ISCO 2150 Flow Monitor
with a Customized Weir**



$Q =$ weir curve at low flow



A smooth weir

Micromonitoring Advantages



Identify significant I/I sources in small sewers

Suitable for low flow conditions

No CSE (one-man crew)

Works where traditional monitors do not

Allows for focused SSES

Quickly deployed, moved, and removed

LOWER OVERALL COST!

Low Flow Problems



Accuracy

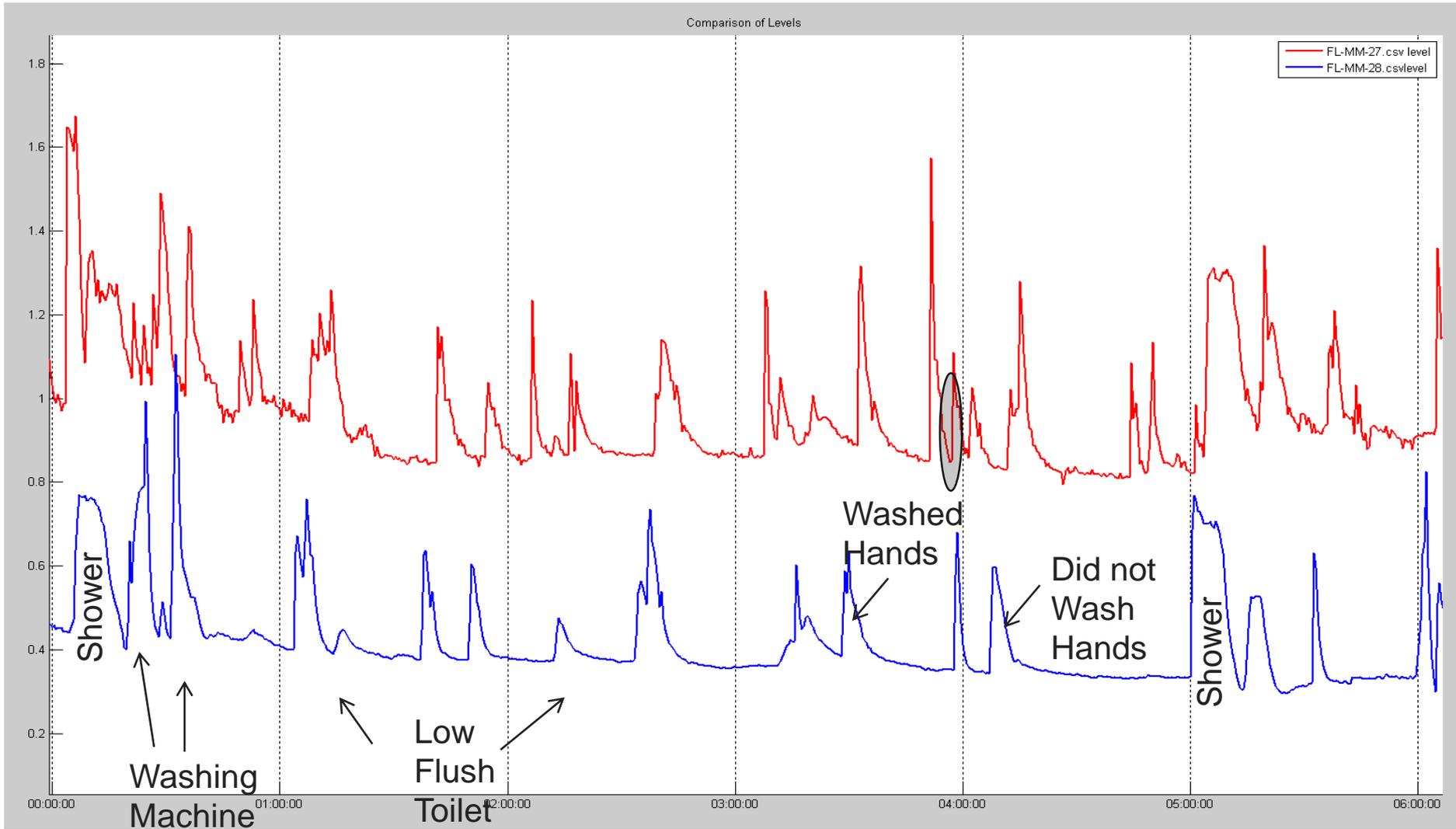


Debris



No problem

Domestic Usage Identified

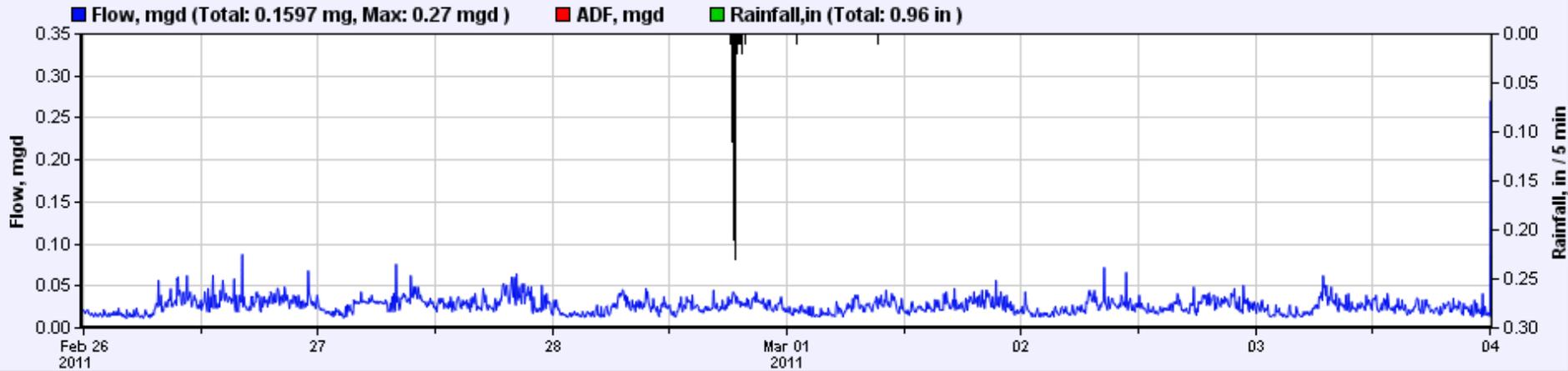


Midnight

6:00AM

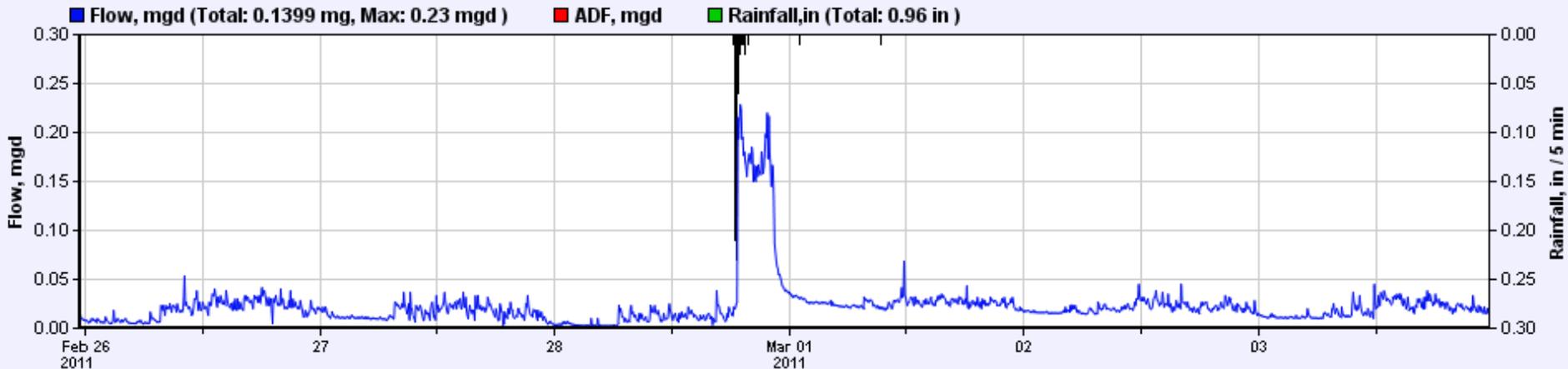
Where is the I/I Problem Here?

CC-CW-071-MM1 From Feb 25 23:50, 2011 to Mar 04 00:10, 2011 (Duration 6 Days; 1 Hours; 20 Minutes)

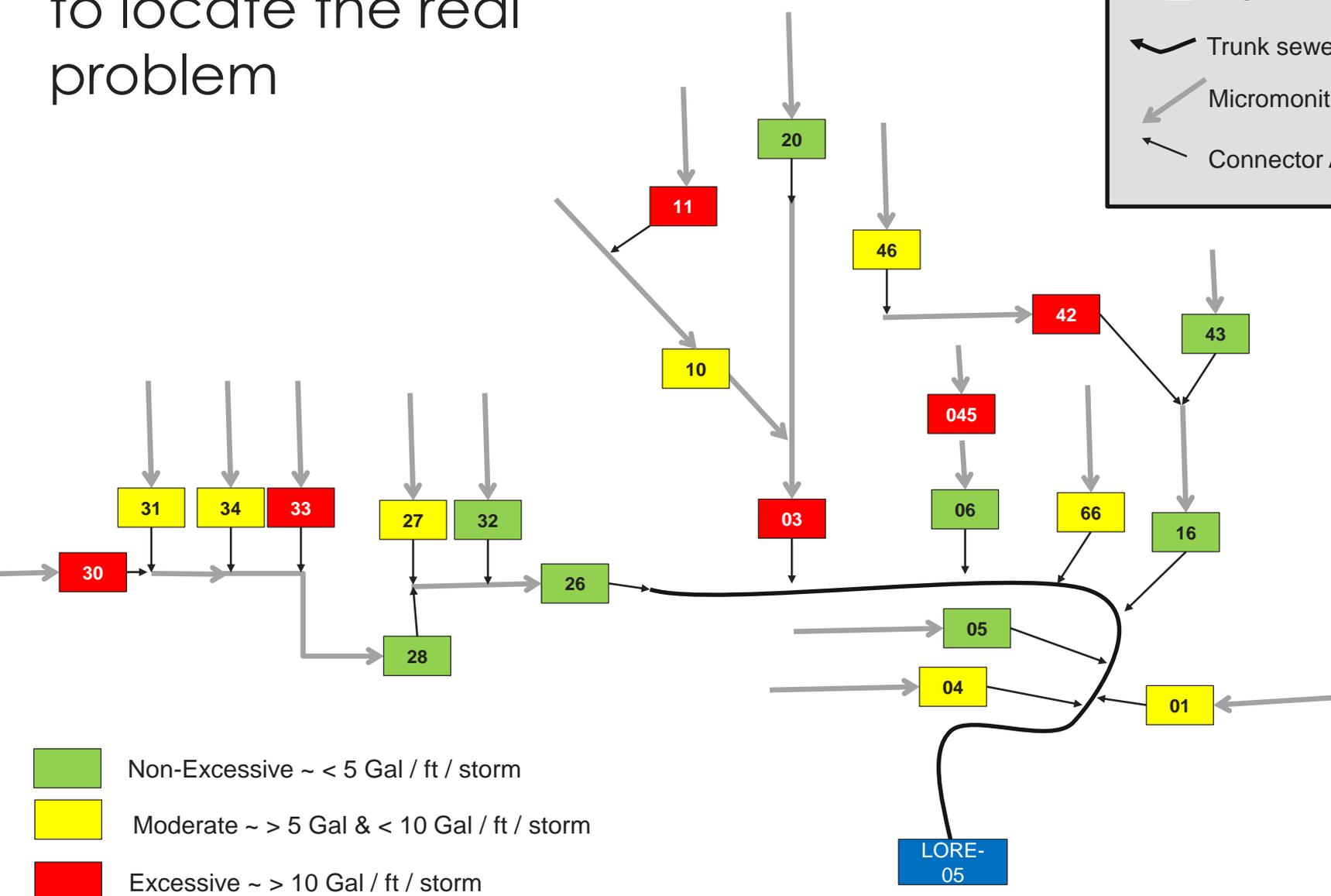
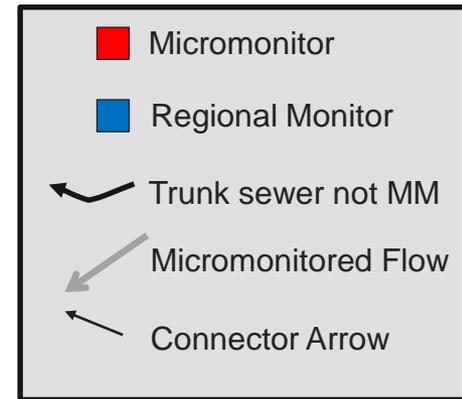


All you need is ONE storm!!!

CC-CW-071-MM6 From Feb 25 23:30, 2011 to Mar 03 23:35, 2011 (Duration 6 Days; 0 Hours; 5 Minutes)



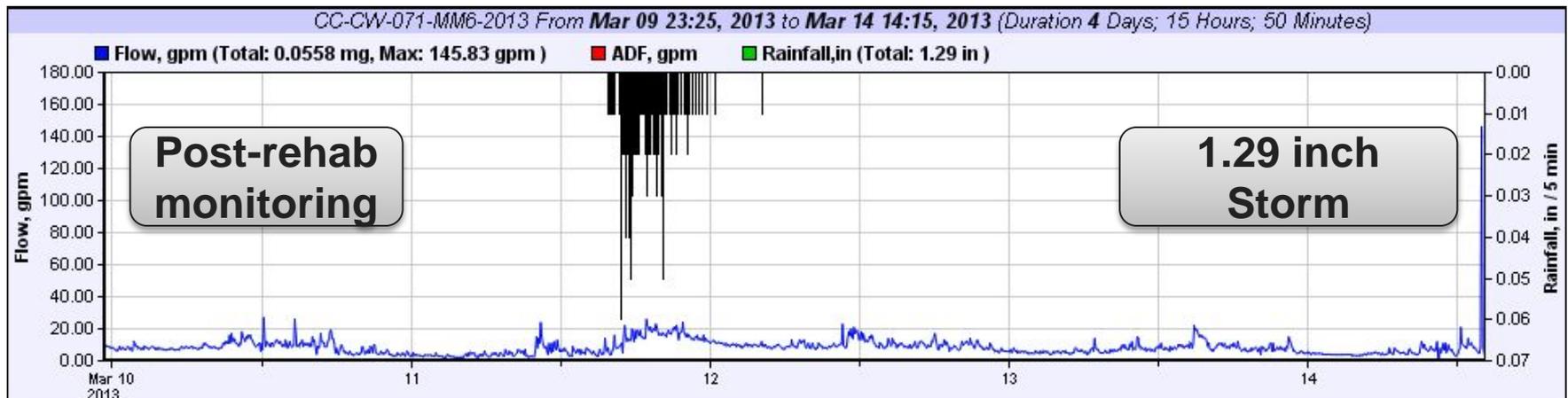
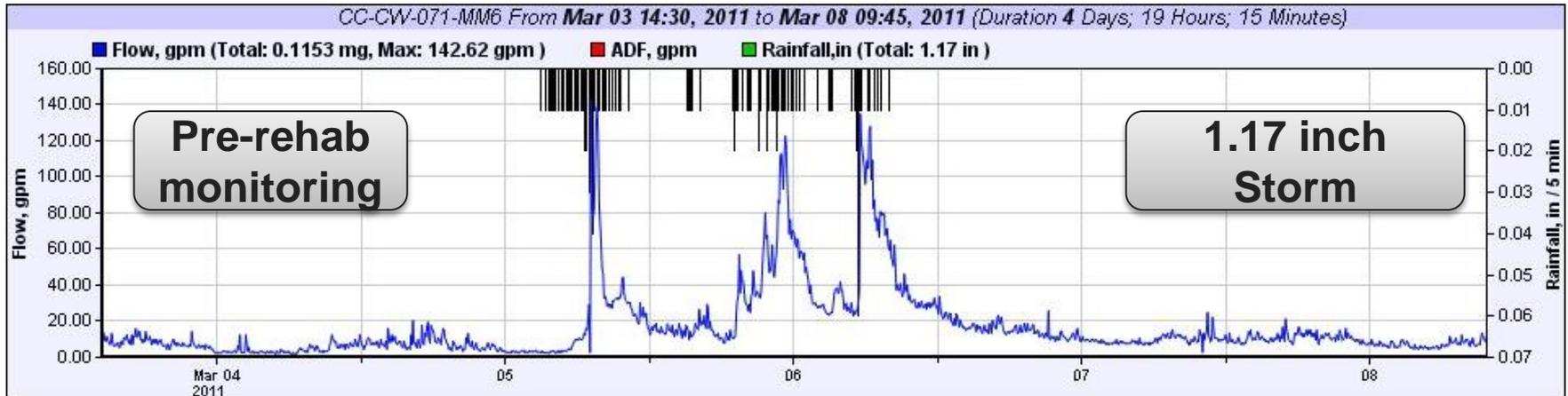
Monitor numerous sites to locate the real problem



- Non-Excessive ~ < 5 Gal / ft / storm
- Moderate ~ > 5 Gal & < 10 Gal / ft / storm
- Excessive ~ > 10 Gal / ft / storm

Results!

A gas line bored through the sewer line was found, which was removed during the monitoring period below.



Normal Tap



This is what a tap look like in Dry Weather.

MH7-6



Would have been missed using just CCTV!

Infiltration Tap

+0102.0ft

IG(Infil Gusher)
Counter: 101.8

From: 12 To:
Remarks: tap



This is looking into the Infiltration.

I&I Can be elusive!



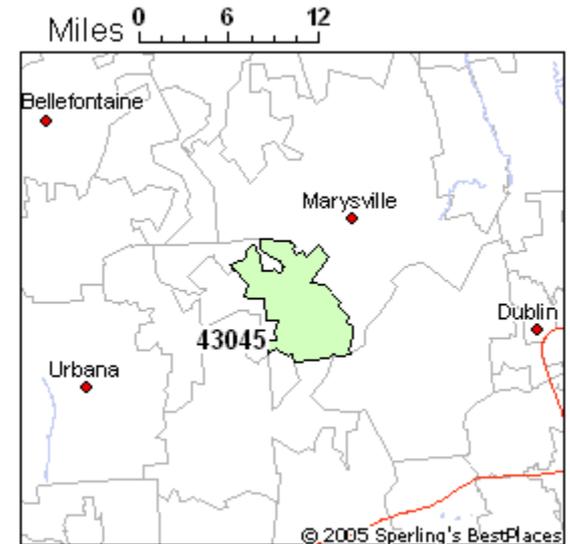
Main Line and Manholes replaced but laterals remained.

Village of Milford Center

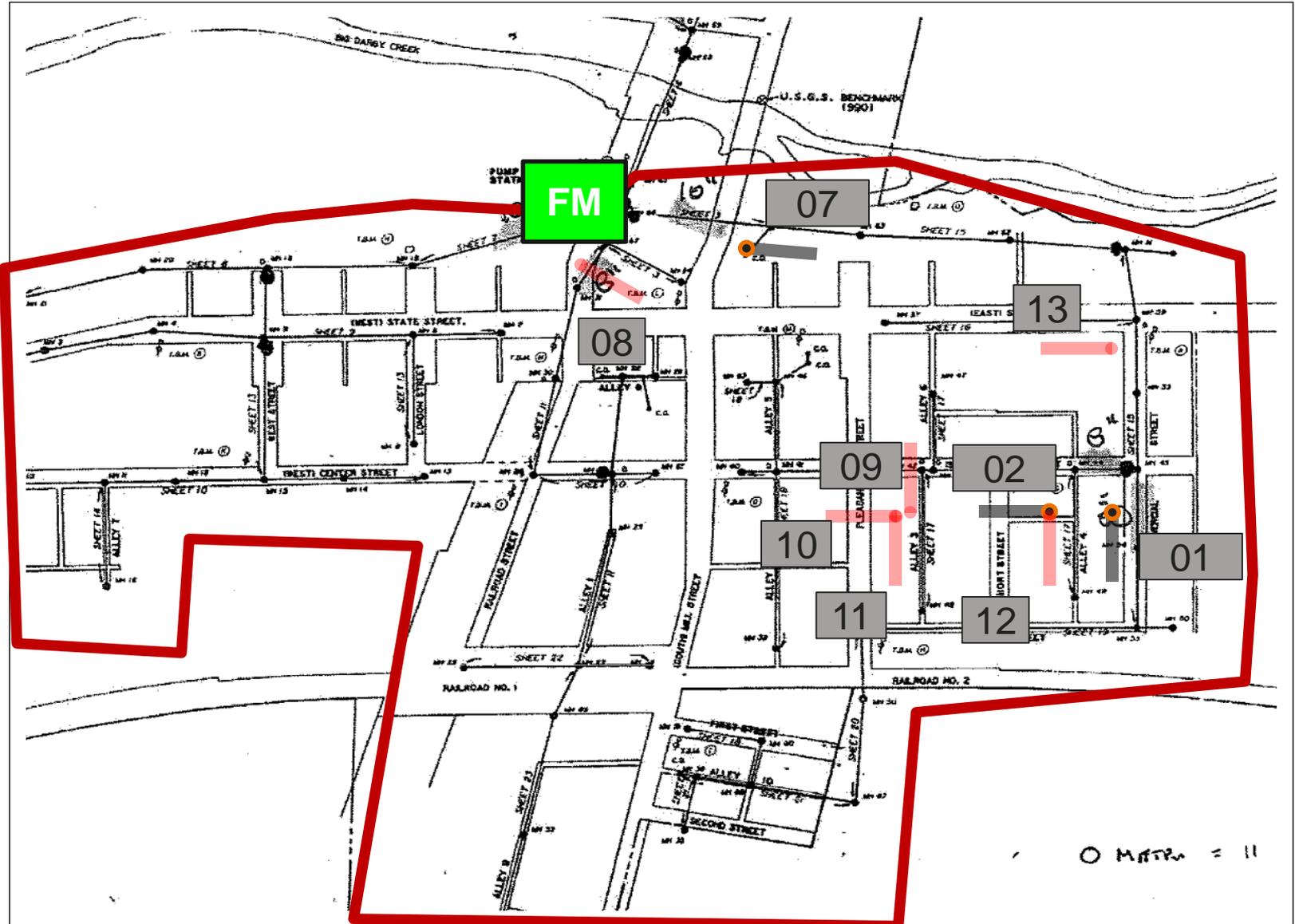
2012 Micromonitoring Program

Village of Milford Center

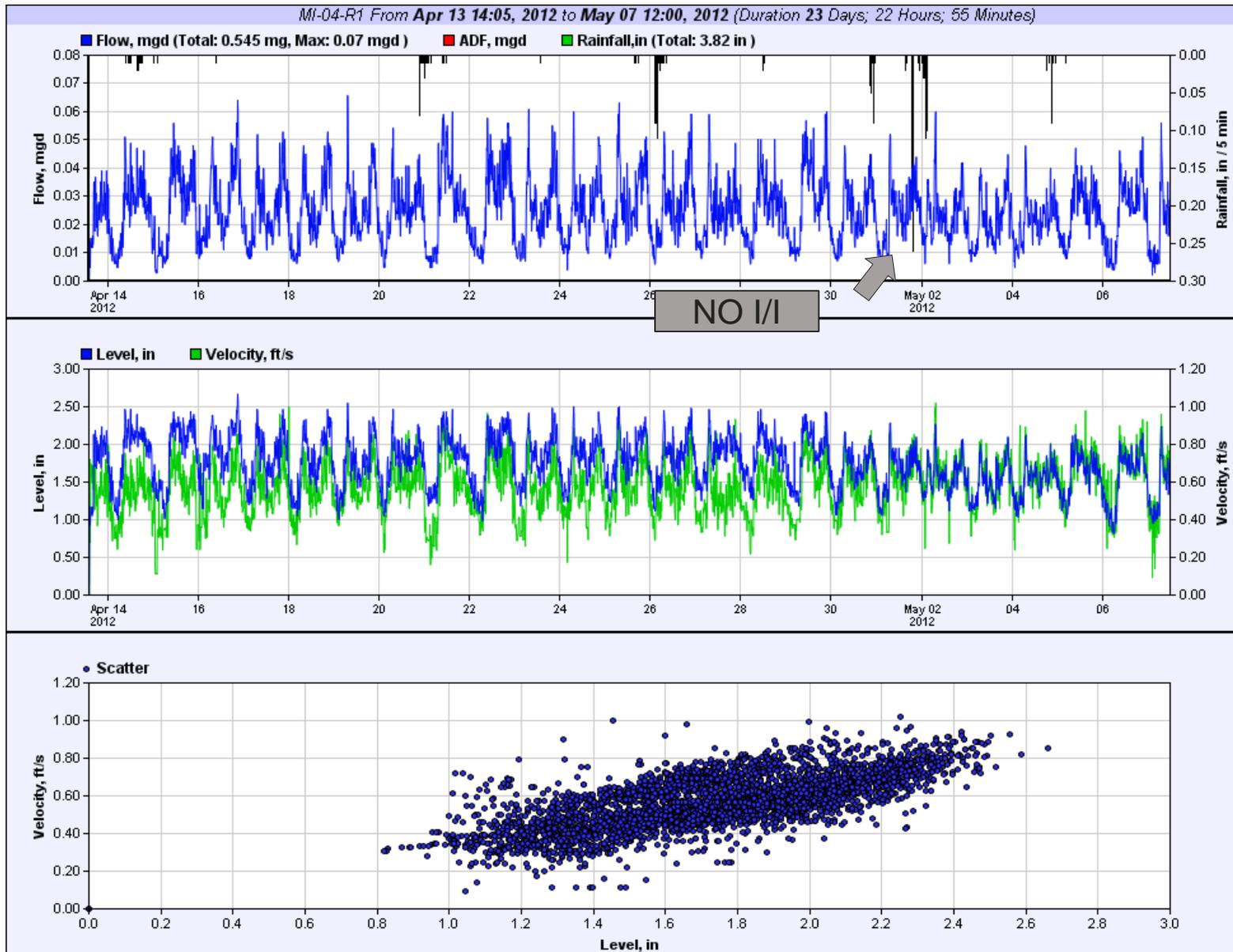
- Union County, OH
- Sewage treated by City of Marysville
- I/I in sanitary sewer, which is relatively new and is comprised of PVC pipe and precast manholes
- Cost to treat flow increased 3x during wet season
- 364 customers
- Smoke testing and manhole inspections conducted during rain events did not find I/I
- Choice between CCTV and Micromonitoring
- Micromonitoring was chosen to pin-point problems



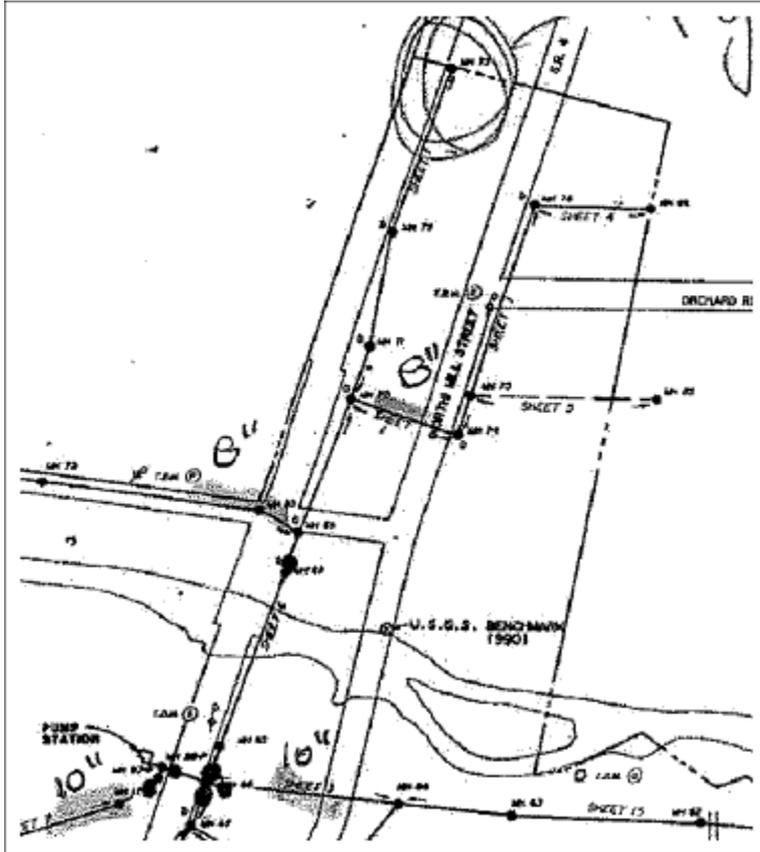
Micromonitor Locations



Monitoring Location 4

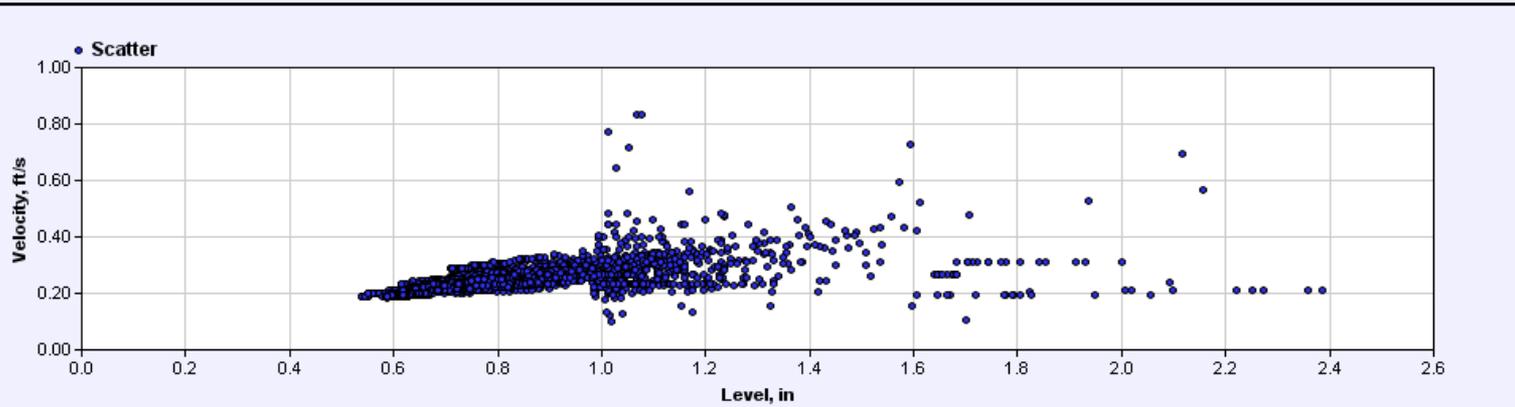
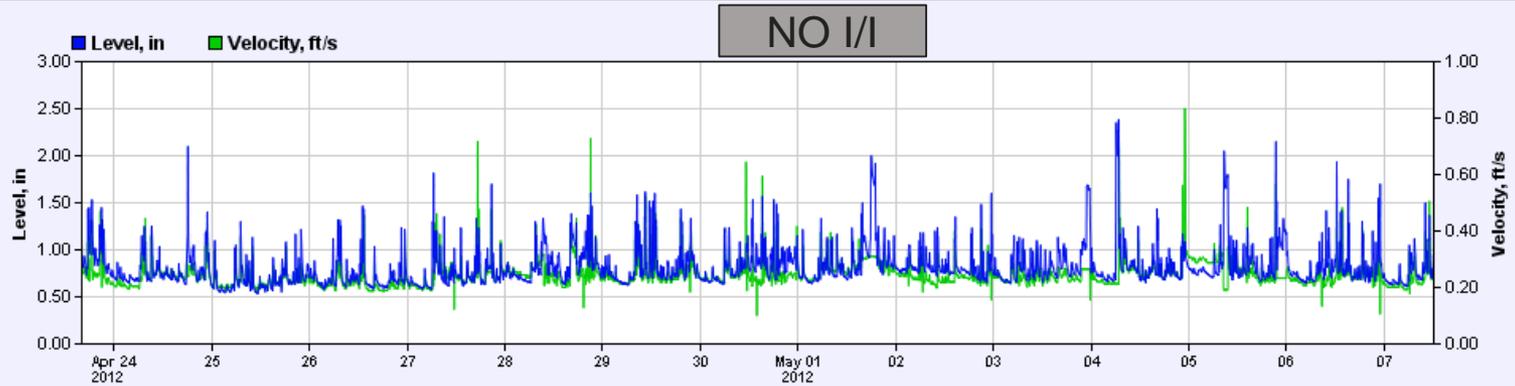
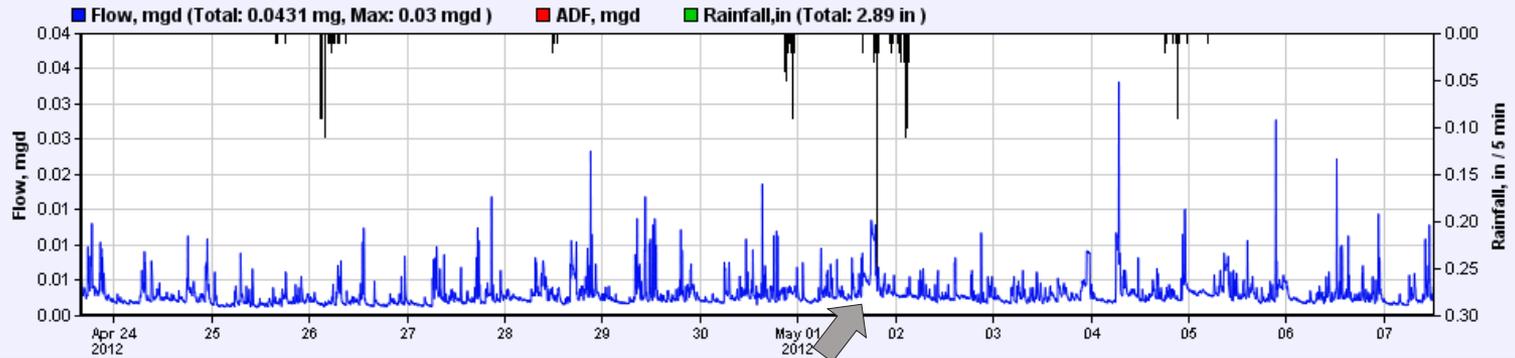


Monitoring Location 6

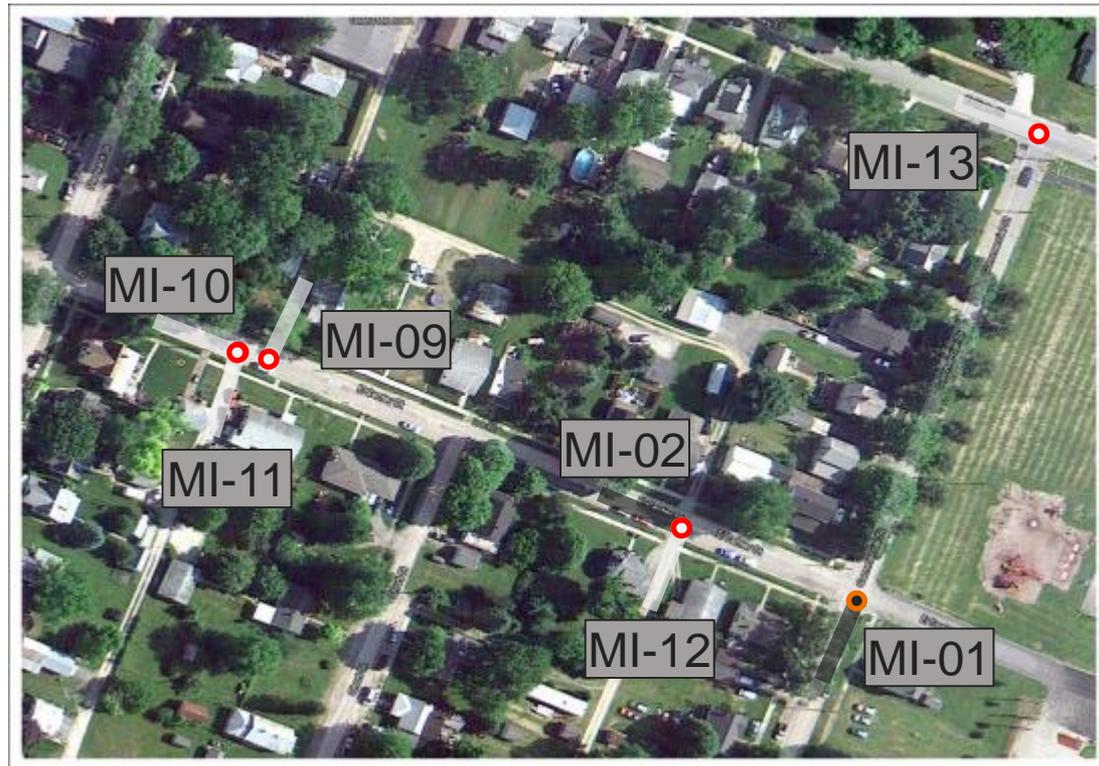
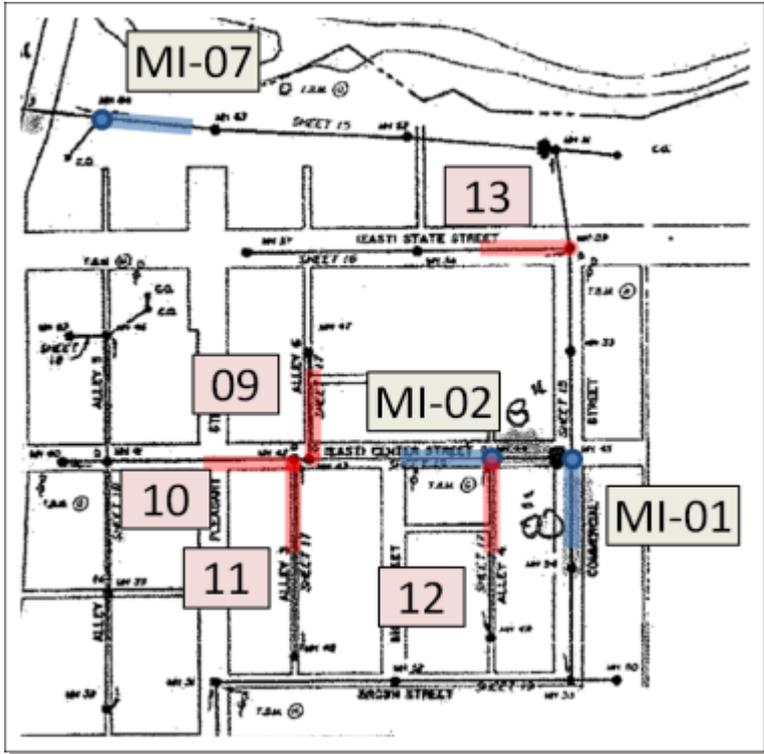


Monitoring Location 6

MI-MM06-U1 From Apr 23 16:05, 2012 to May 07 12:10, 2012 (Duration 13 Days, 20 Hours, 5 Minutes)

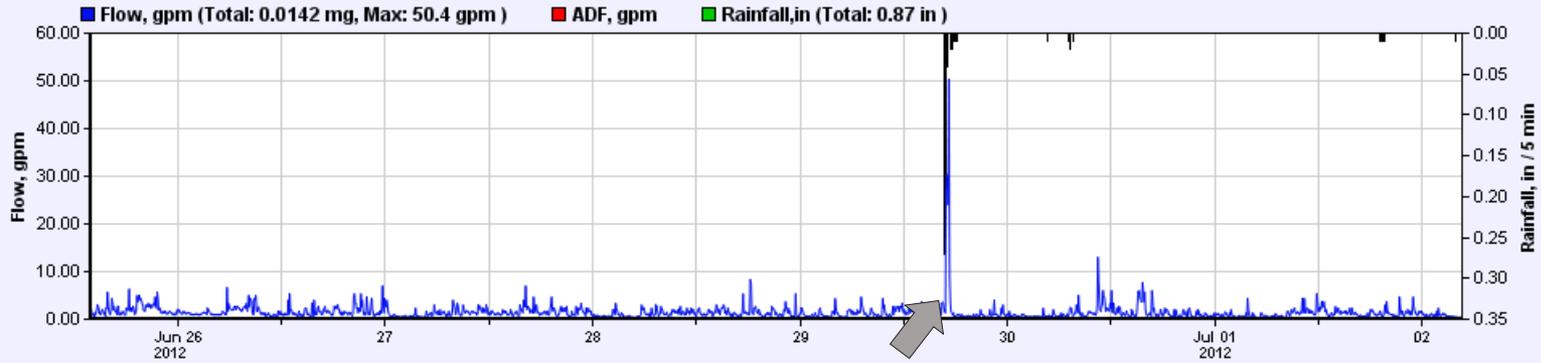


Monitoring Location 10

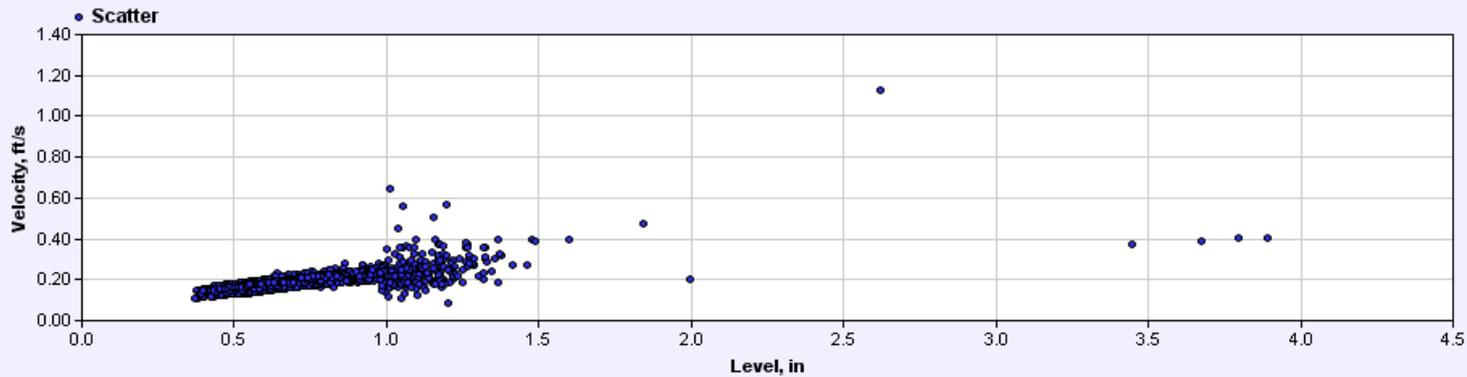
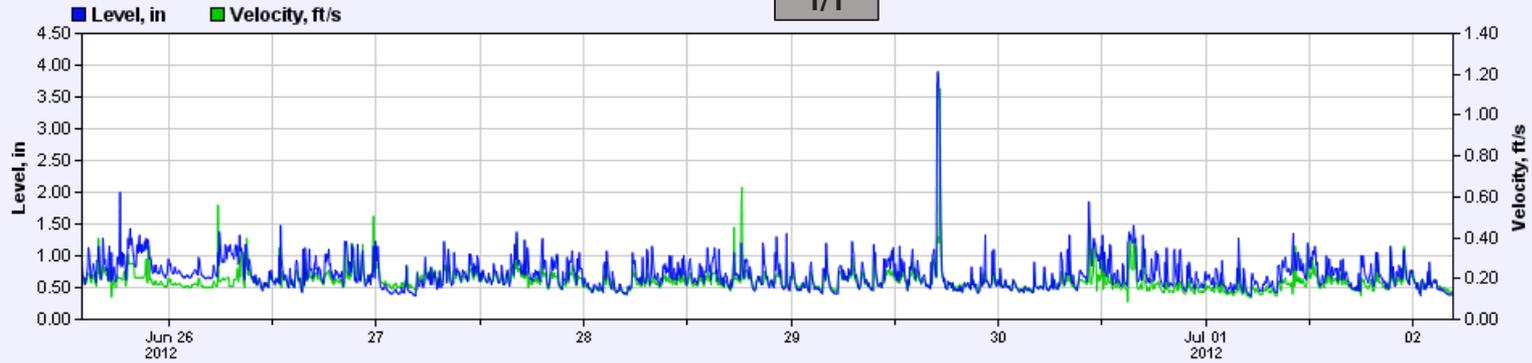


Monitoring Location 10

MI-MM10-R1 From Jun 25 13:55, 2012 to Jul 02 04:40, 2012 (Duration 6 Days; 15 Hours; 45 Minutes)

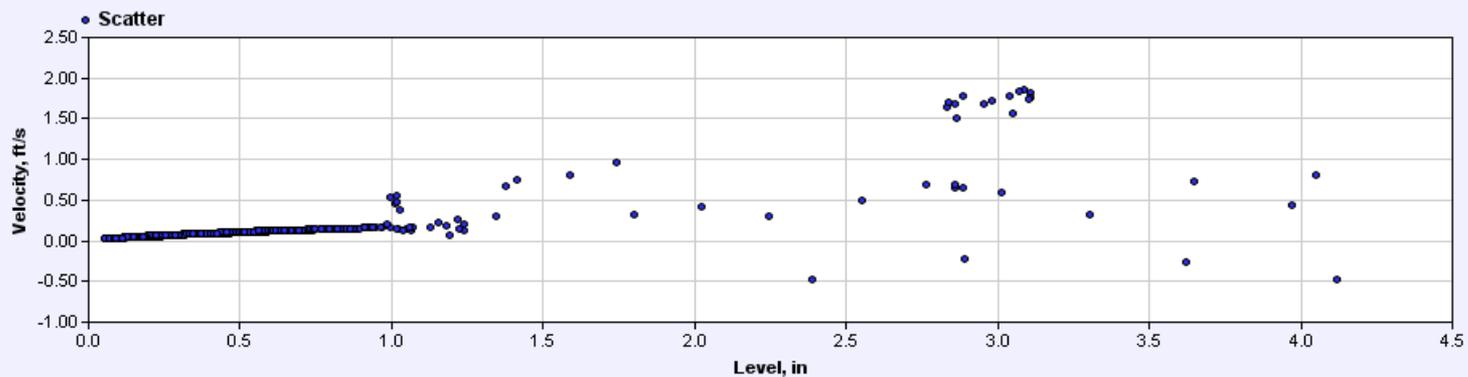
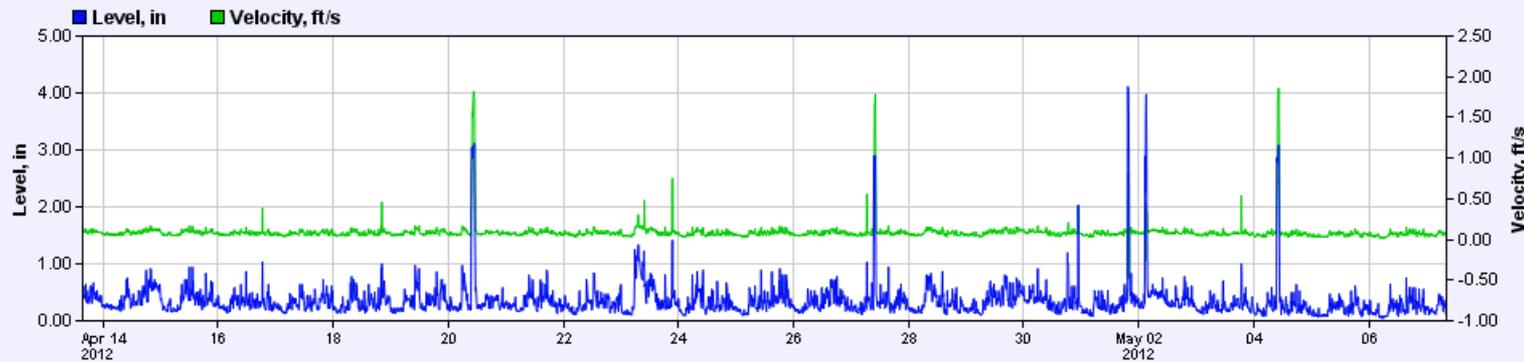
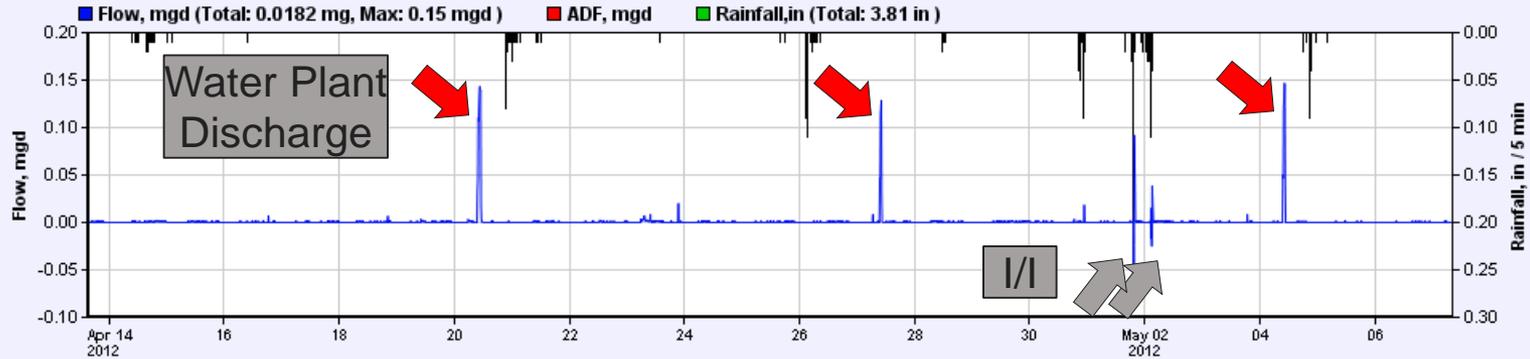


I/I



Monitoring Location 01

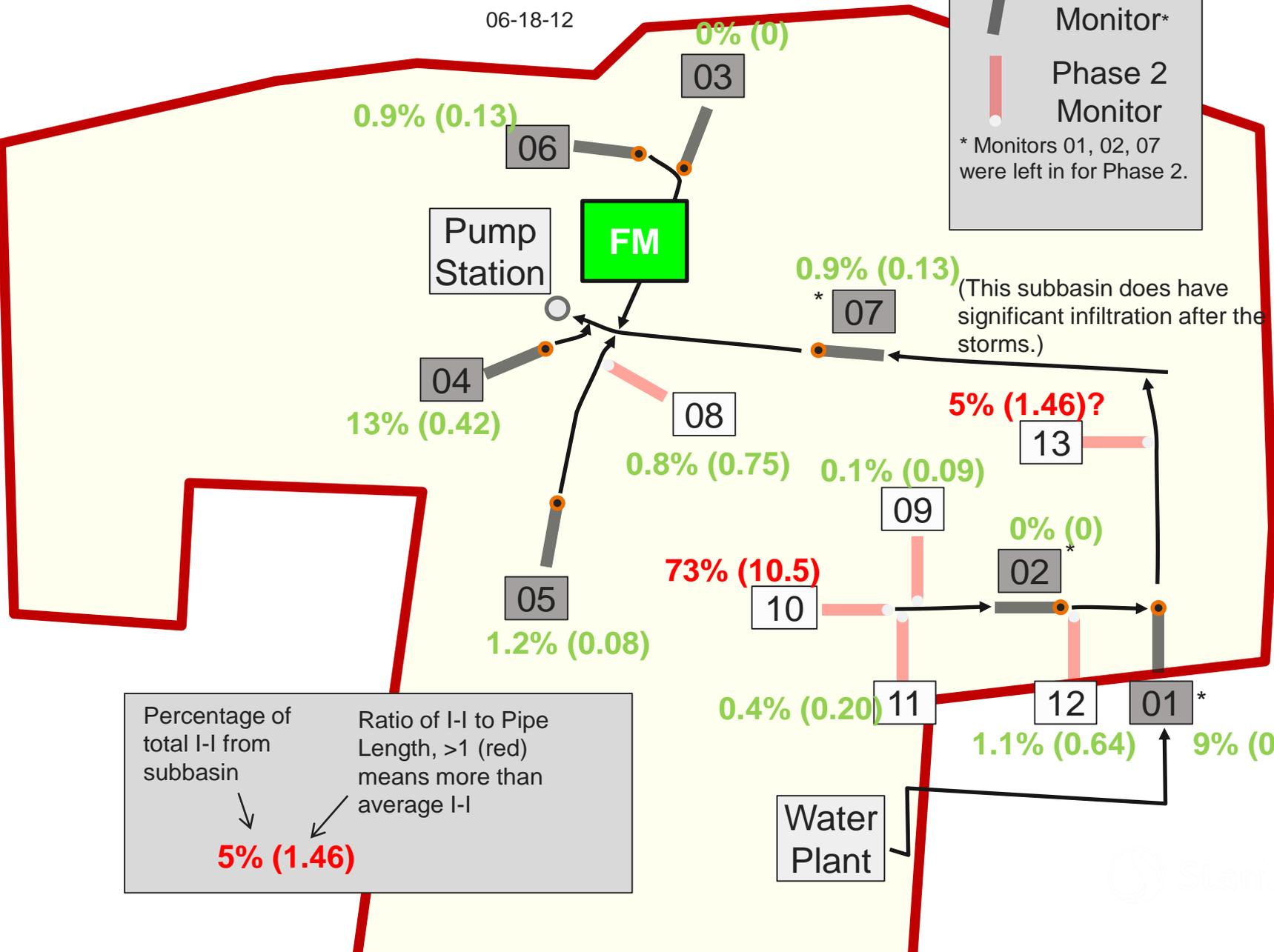
MI-MMO1-R1 From Apr 13 15:30, 2012 to May 07 08:25, 2012 (Duration 23 Days; 17 Hours; 55 Minutes)



Milford Center Schematic

06-18-12

 Phase 1 Monitor*
 Phase 2 Monitor
 * Monitors 01, 02, 07 were left in for Phase 2.



0.9% (0.13)

0% (0)

03

06

Pump Station
FM

0.9% (0.13)

* 07

(This subbasin does have significant infiltration after the storms.)

04

13% (0.42)

08

0.8% (0.75)

0.1% (0.09)

13

5% (1.46)?



05

1.2% (0.08)

73% (10.5)

10

09

0% (0)

02*

0.4% (0.20)

11

12

1.1% (0.64)

01*

9% (0.73)

Water Plant

Percentage of total I-I from subbasin
 Ratio of I-I to Pipe Length, >1 (red) means more than average I-I
5% (1.46)

Results

- Isolated Inflow sources to three sewer pipes in alley between South Mill St. and Pleasant St.
- Isolated infiltration sources to three sewer pipes along the creek
- In all, the sources were isolated to 1,900' of sewer out of the ~30,000' that make up the Village's system

City of Logan

2013 Micromonitoring Program

Current Situation

Inflow / Infiltration (I/I) in the Collection System

- I/I in City's sanitary sewer system contributes to basement flooding, overflows, and inflated operating costs.
- Outdated collection system of nearly 100% vitrified clay pipe (VCP) surcharges in several locations during heavy rains.
- System lacks capacity to convey all wet weather flow to the newly expanded WWTP.
- Last system survey was nearly 30 years ago.

Purpose

Goals

- Remove as much I/I from the system as possible without exhausting all resources
- Eliminate basement flooding / overflows / future compliance possibilities
- Identify bottlenecks and other deficiencies in collection system
- Update system mapping to reflect actual field conditions
- Get sewage to new WWTP
- Project must be affordable!

A customized approach to
meet the City's needs

Approaches

Traditional Approach

- Identify I/I Related Problems
- Regional Flow Monitoring / Basin Selection
- Detailed SSES
- Remediation Recommendations

Customized Approach

- Identify I/I Related Problems
- Regional Flow Monitoring / Basin Selection
- ❖ **Focused SSES**
 - ❖ **Micromonitoring**
 - ❖ **CCTV**
 - ❖ **Smoke and dye testing and other SSES activities as needed**
- Remediation Recommendations

Step 2

Micromonitoring

- Initiated in the basins which regional flow monitoring/City staff consultations determined were worst contributors of I/I
- 67 sites monitored in 3 months (10-15 actual MM's w/ 2 staff)
- Of the 132,043' of sewer monitored:
 - 19,047' of sewer isolated as excessive I/I sources
 - 26,706' isolated as moderate I/I sources
 - Detailed SSES work will be focused in these areas



$$(19,047+26,706) / 132,043 = 35\%$$

“The early payoff for the City is not in the sewers found to contribute excessive I/I, but rather in the sewers that do not contribute excessive I/I that are eliminated from consideration for additional SSES work”

Step 3

Closed Circuit Television (CCTV) Inspection

- Completed in two rounds within sewers found to contribute excessive or moderate I/I
- A variety of defects discovered
 - Structural
 - I/I

MH 126
3/18/2014

TO
CITY OF LEAN

MH 125
16:15

342'11"

Hole in Pipe

TO
CITY OF LOGAN

MH 125
16:15

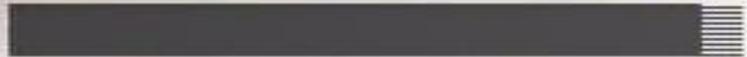
407' 00"

Hammer Tap

MH 288
3/19/2014

TO
CITY OF LOGAN

MH 285
13:48



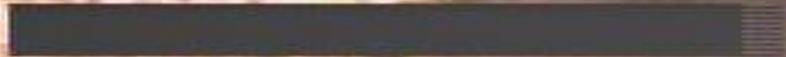
94' 10"

Fractured Pipe &
Hammer Tap

MH 277C
3/21/2014

TO
CITY OF LOGAN

MH 277B
10:15



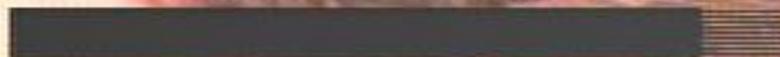
219'02"

Deposits w/ Infiltration

MH 340
3/25/2014

TO
CITY OF LOGAN

MH 351
12:52

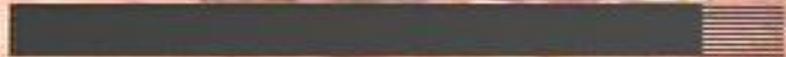


96' 00"

MH 340
3/25/2014

TO
CITY OF LOGAN

MH 351
12:52



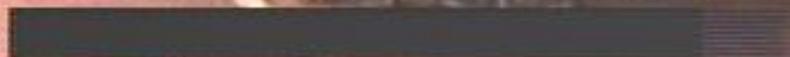
215'01"

Infiltration Gusher

MH 356
3/25/2014

TD
CITY OF LOGAN

MH 353
10:28



11'01"

Root Intrusion

MH 550
3/26/2014

TO
CITY OF LOGAN

MH 551
12:55

30' 11"

Hole w/ soil pouring in

Analysis

System Analysis

- Analysis included other typical I/I investigation work:
 - System mapping and verification
 - Lift station run time analysis
 - Comparison of water use records with flow monitoring and micromonitoring data
 - Interviews with City staff to gain historical knowledge of problem areas
- Info used in conjunction with field work to formulate various remediation recommendations

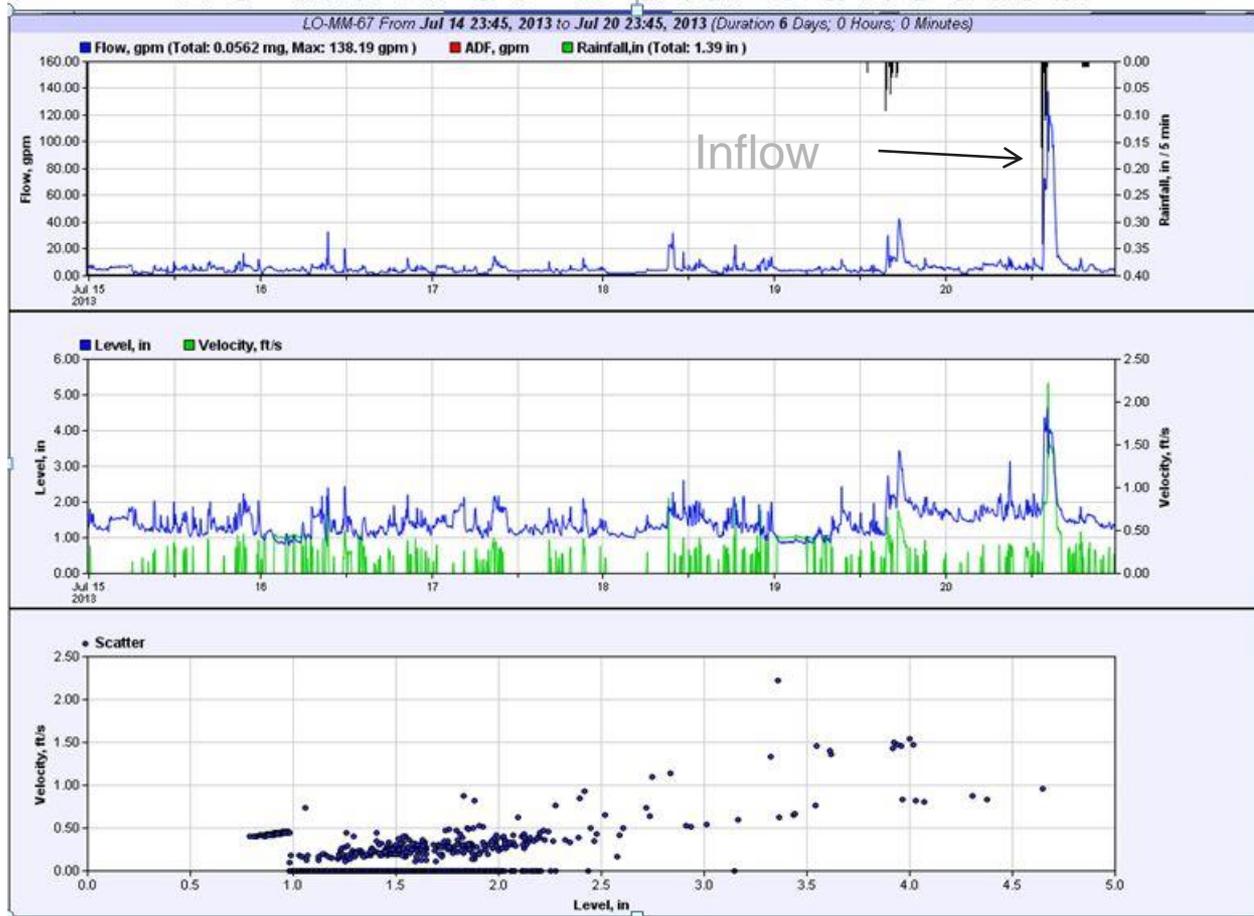
Preliminary Results

SSES Report

- Draft Focused SSES report presented to City in November 2013 contained:
 - Flow monitoring results
 - Micromonitoring results
 - CCTV Round 1 results
 - Additional observations
 - Rehabilitation recommendations
 - Recommendations for focused SSES work in specific areas based on micromonitoring data
 - Project financing recommendations
- Report was updated as SSES investigations continued

Data Analysis

LO MM 67 Data Collected



Inflow vs. Infiltration

Micromonitoring data analysis can be used to direct specific focused SSES work

Other SSES Activities

Focused SSES

- Smoke testing in isolated areas in 2014
- Additional SSES activities will be scheduled as necessary based on the success of rehabilitation work. This may include:
 - Dye testing
 - Plumbing inspections
 - Service lateral inspections

I/I Remediation

Rehabilitation

- Two phases of pipe and manhole rehabilitation were developed from the first round of CCTV work completed in 2013
 - Total project cost estimate ~\$2.15M
 - Includes:
 - Manhole rehabilitation
 - Main line CIPP
 - Main line replacement
 - Point repairs
 - Spot liners
 - Grout sealing
 - Lateral replacement

I/I Remediation

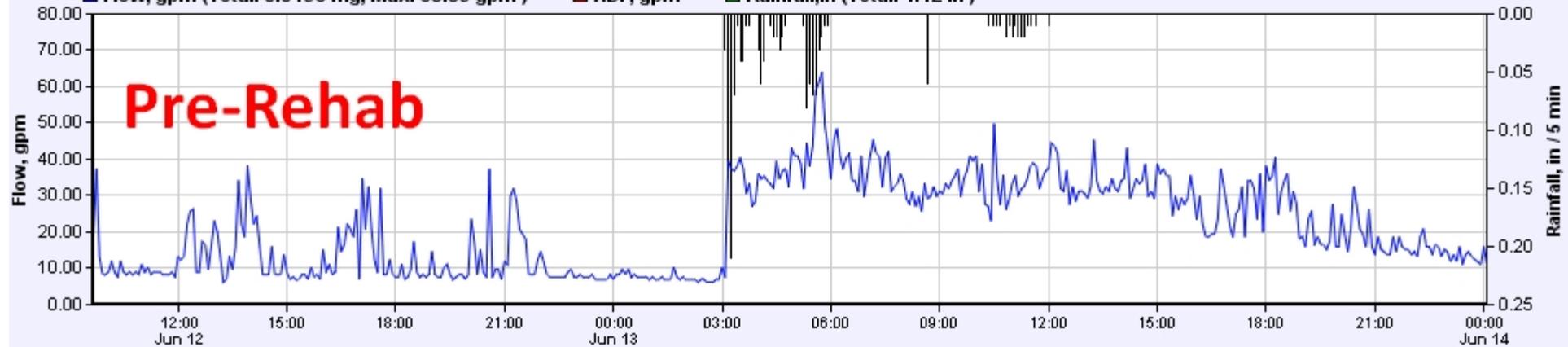
Rehabilitation

- Additional rehabilitation projects are currently being developed from the second round of CCTV work completed in March 2014
- The City secured grants and low interest loans to finance the projects
 - Phase 1 was funded through the Ohio Public Works Commission. The Phase I improvements resulted in a 95% reduction in I&I in the project area.

Phase I Rehab Results

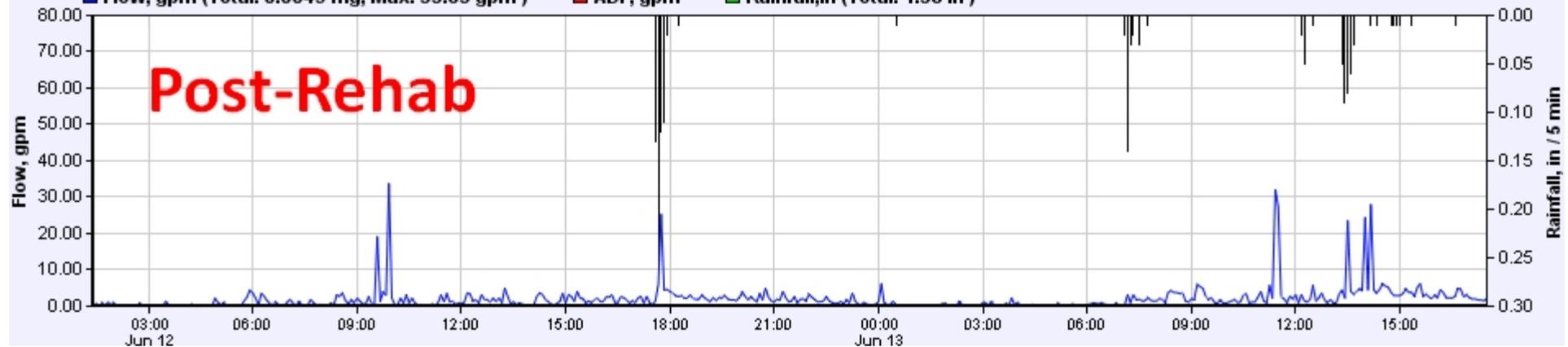
LO-MM-30 From Jun 12 09:40, 2013 to Jun 14 00:05, 2013 (Duration 1 Days; 15 Hours; 25 Minutes)

■ Flow, gpm (Total: 0.0496 mg, Max: 63.89 gpm) ■ ADF, gpm ■ Rainfall, in (Total: 1.42 in)



LO-MM-GLENWOOD From Jun 12 01:25, 2015 to Jun 13 17:30, 2015 (Duration 1 Days; 16 Hours; 5 Minutes)

■ Flow, gpm (Total: 0.0049 mg, Max: 33.65 gpm) ■ ADF, gpm ■ Rainfall, in (Total: 1.38 in)



Capacity Assurance

Maintenance/Capital Improvements

- Several sewer mains were found to contain substantial accumulations of debris, which will be thoroughly cleaned to increase capacity
- Potential bottlenecks discovered will be further evaluated once lines are cleaned and I/I remediation is complete

Results

- ✓ Total footage excluded by regional flow monitoring = 45,700
- ✓ Total footage excluded by micromonitoring = 86,290
- ✓ Remediation efforts focused in areas found to contribute moderate or excessive I/I = greatly increased odds of successful I/I reduction

City of Jackson

2013 & 2014 Micromonitoring Program

Current Situation

I/I in the Collection System

- Currently the City's sanitary sewer system is inundated with I/I that contributes to SSO's and inflated operating costs.
- Very old collection system comprised of nearly 90% vitrified clay pipe (VCP) surcharges in several locations during heavy rains.
- The City entered a consent decree with the EPA that requires continued work to eliminate SSO as well as expansion of WWTP to handle wet weather flows.
- A significant amount of older sewer lines were relined using CIPP within the last decade, but this did not reduce I/I.
- The City has conducted flow monitoring in the past with limited success.

Purpose

Goals

- Test a new technology since traditional methods have been unsuccessful; a small project was conducted in specific areas where SSO's are present
- Locate and reduce I/I in these areas to eliminate SSO occurrences and the associated penalties
- Identify bottlenecks and other deficiencies in the collection system
- Identify potential funding sources for investigation / remediation work
- The project must be affordable!

Phase 1

- Commenced in 2013
- Included 19 MM sites
- Was completed within 2 months
- Results!
 - Isolated Excessive I/I to 12,875 feet of sewer ~ 36 % of study area
 - Isolated Moderate I/I to 2,067 feet of sewer ~ 6 % of study area
 - Excluded 20,875 feet of sewer ~ 58 % of study area from further investigation

Funding

Local Government Innovation Fund (LGIF)

- The City was awarded a \$100,000 grant and was able to use the Phase 1 project as their local match obligation for the LGIF funding program through the Ohio Development Services Agency
- This valuable resource allowed the City to move forward with a City-wide micromonitoring program

Phase 2

- Commenced in 2014
- Included 65 MM sites
- Was completed within 4 months
- Results!
 - Isolated Excessive I/I to 42,619 feet of sewer ~ 32 % of study area
 - Isolated Moderate I/I to 23,540 feet of sewer ~ 17 % of study area
 - Excluded 69,596 feet of sewer ~ 51 % of study area from further investigation

Jackson Project Approach

Another customized approach.....

- The Jackson utilities department owns and maintains cleaning and CCTV equipment, which allows them to inspect sewers in-house
- City has completed a variety of investigation and rehabilitation projects but realized very little I/I reduction
- Micromonitoring throughout the entire collection system in the upstream sewers was therefore chosen as the best way to provide the City with a prioritized approach for further investigation

Summary

- ✓ Micromonitoring is very flexible – it can be implemented as a stand alone process or as a compliment to a larger project.
- ✓ Micromonitoring can benefit any size community that maintains a gravity collection system, from the largest cities to the smallest villages.
- ✓ Micromonitoring enables the community to quickly identify the sewers contributing the greatest amounts of I/I, which greatly reduces overall program cost while significantly increasing the likelihood of successful remediation work.
- ✓ Micromonitoring is a tool that compliments the Focused SSES Approach where through the use of the micromonitor you can narrow down the sources of I&I, investigate and repair defects in an economical manner that gets results.

Questions?

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