

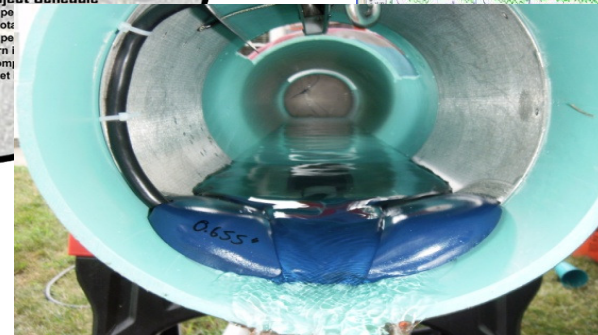
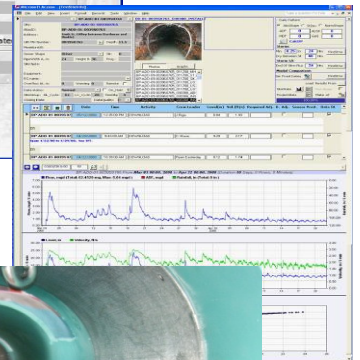
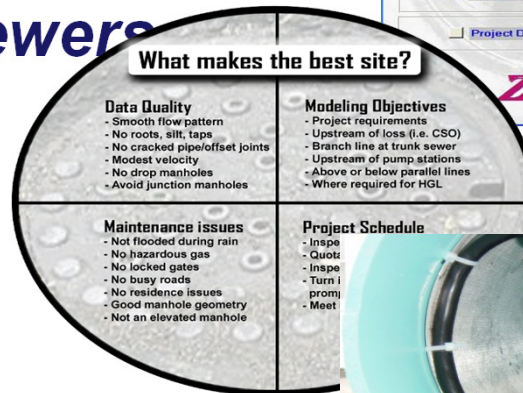
Micro-Monitoring:

An innovation in monitoring
low flows in sanitary sewers

Gerard J. Fernandes, PE

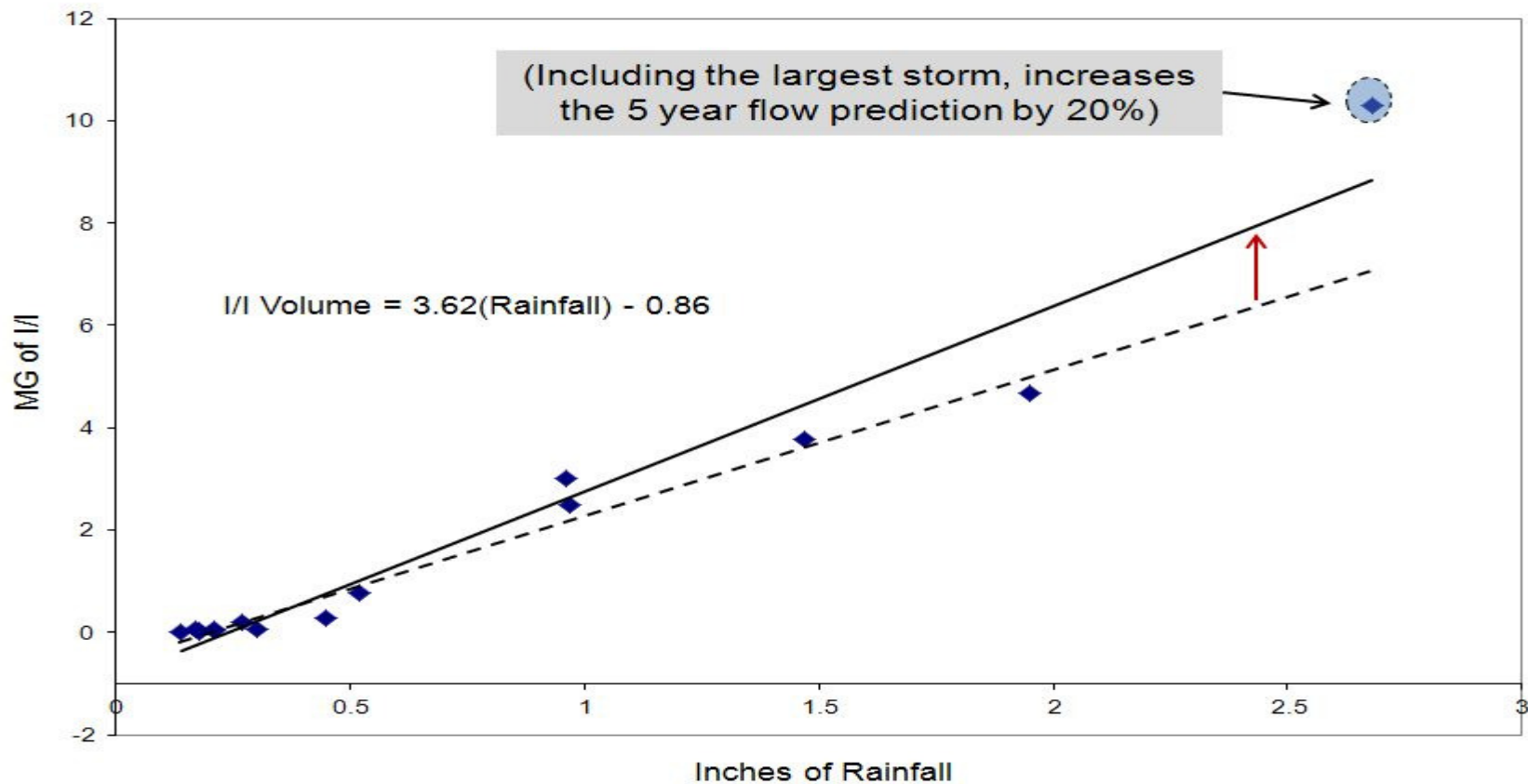
Eileen M. Nelson, PE

Stantec Consulting Services, Inc.

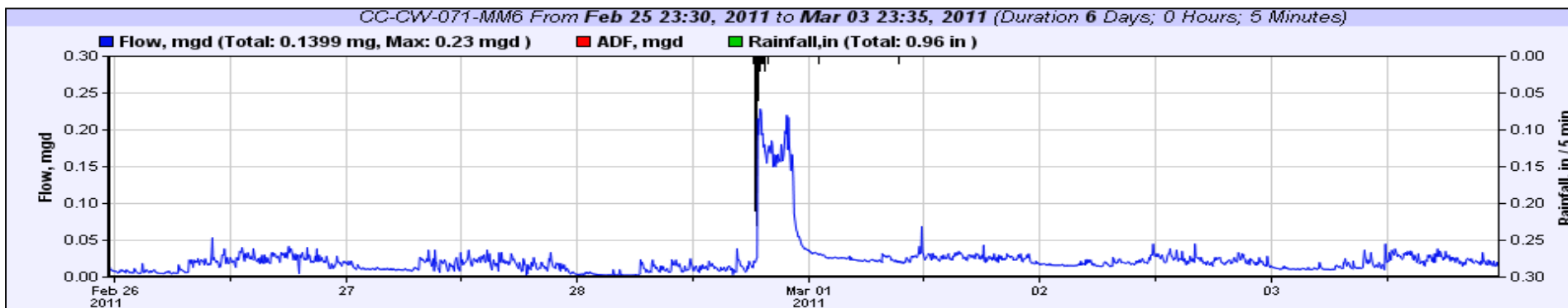
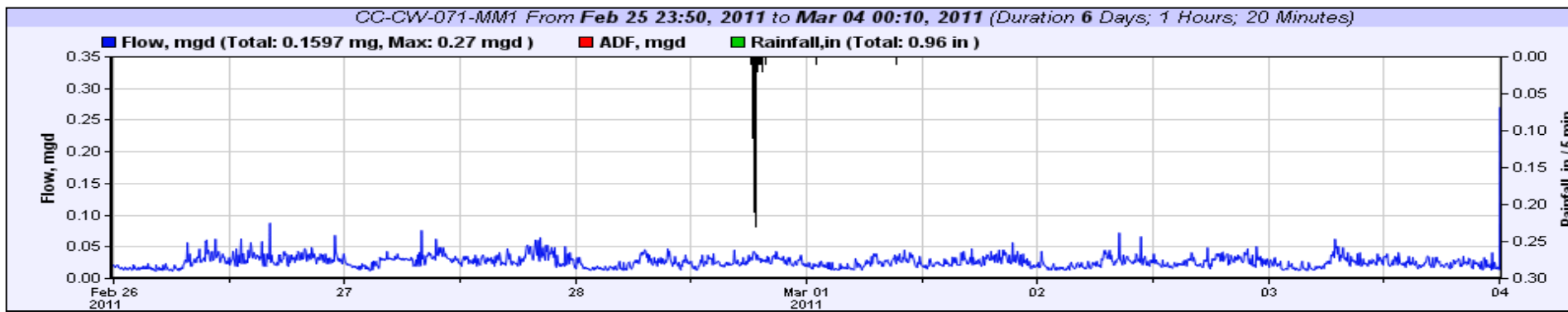


How Many Storms Do You Need to Quantify I/I?

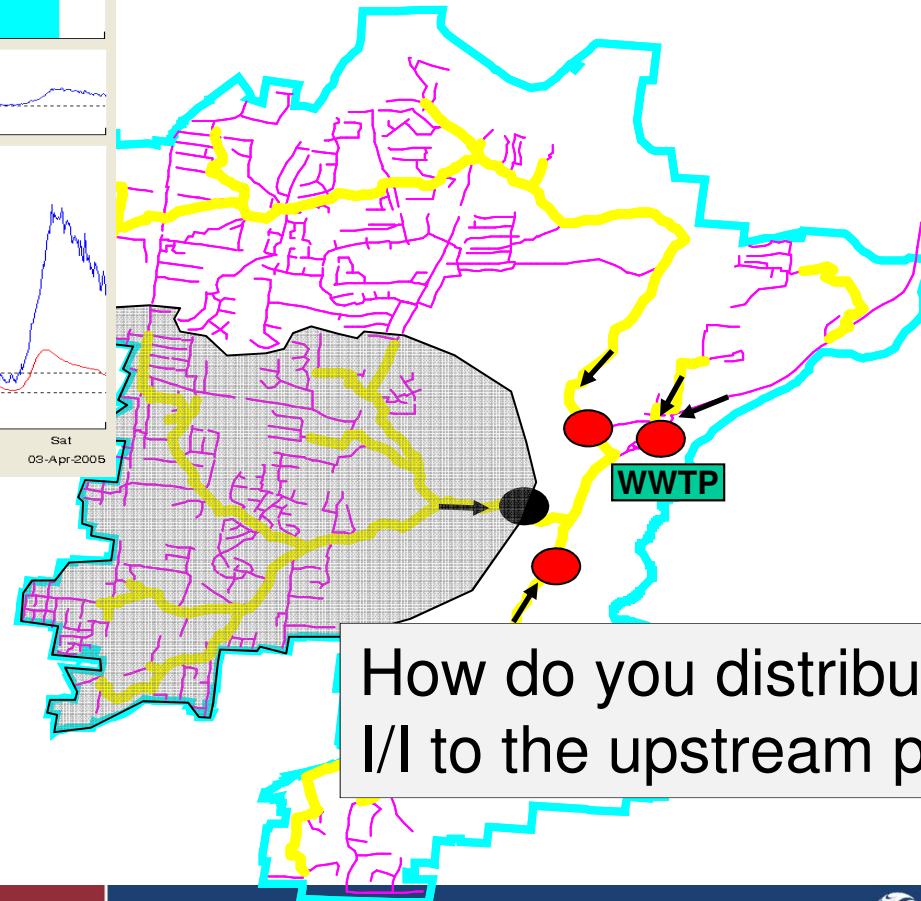
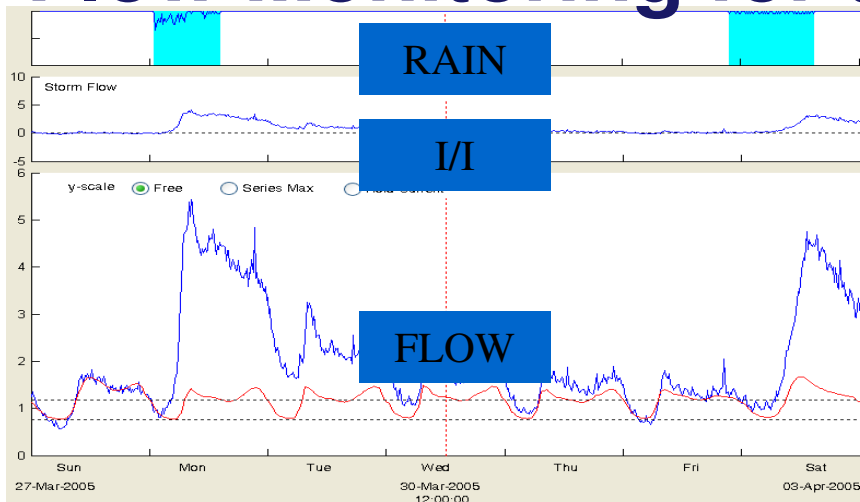
For the Modeler?



For the I/I guy?



Flow Monitoring for the Modeler

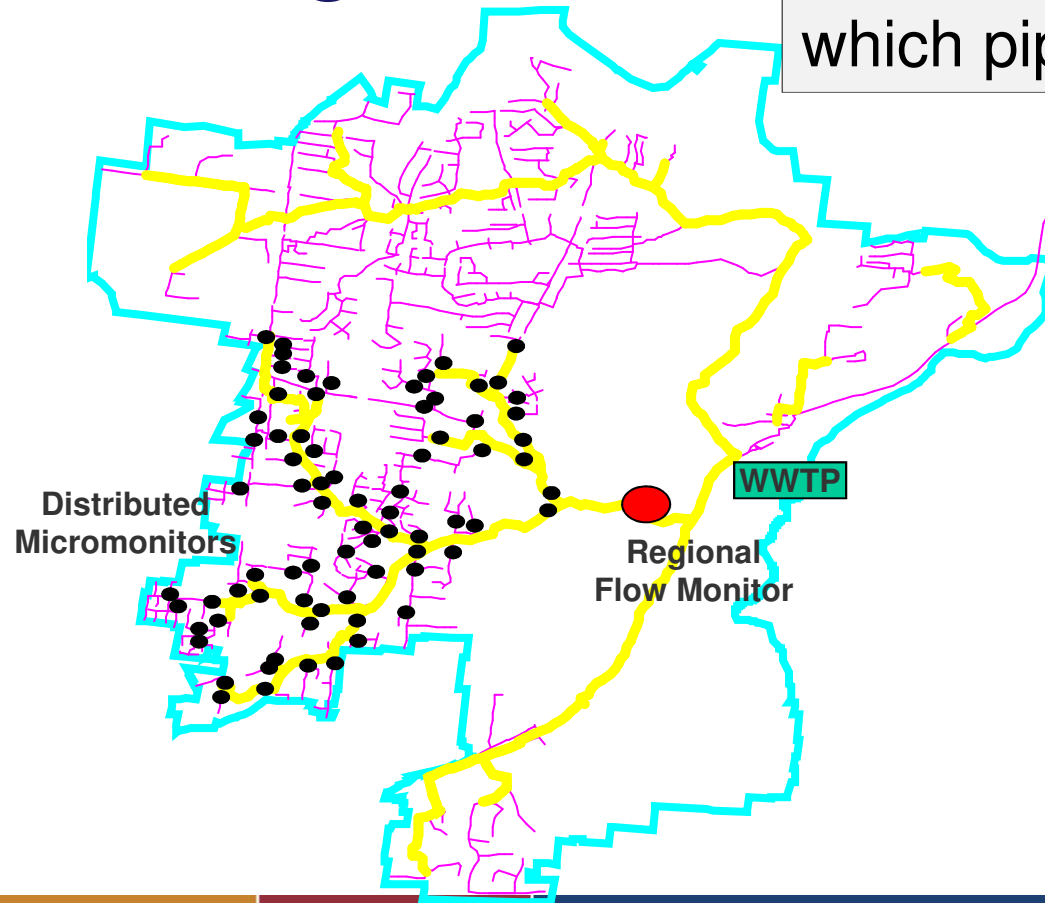


Regional Monitors
(1 per 6 miles of pipe)

How do you distribute the I/I to the upstream pipes?

Flow Monitoring for I/I

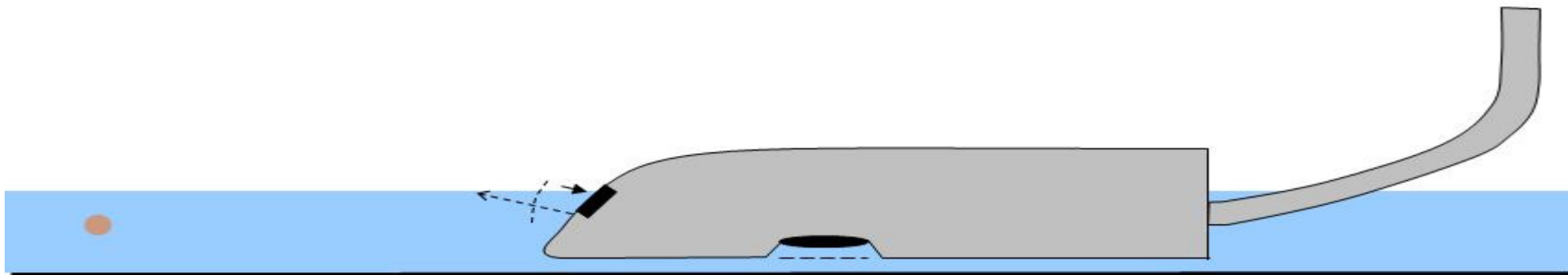
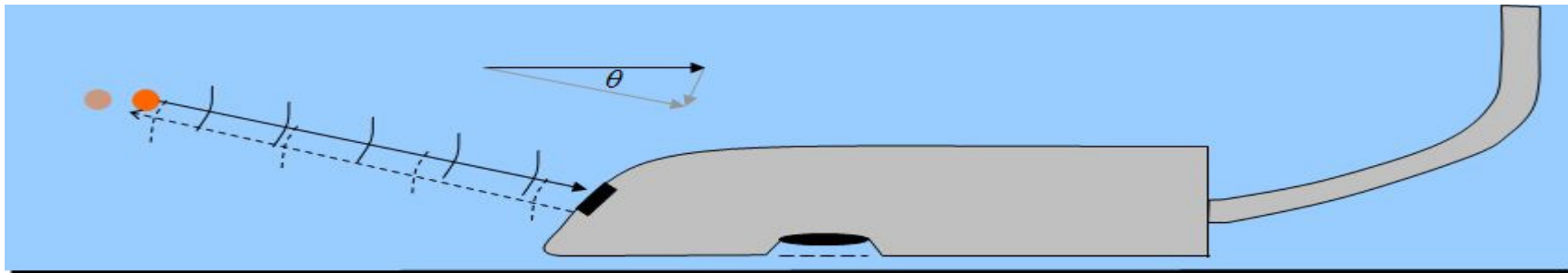
We'd really like to know which pipe it comes from?



What is the Problem with Low Flow?



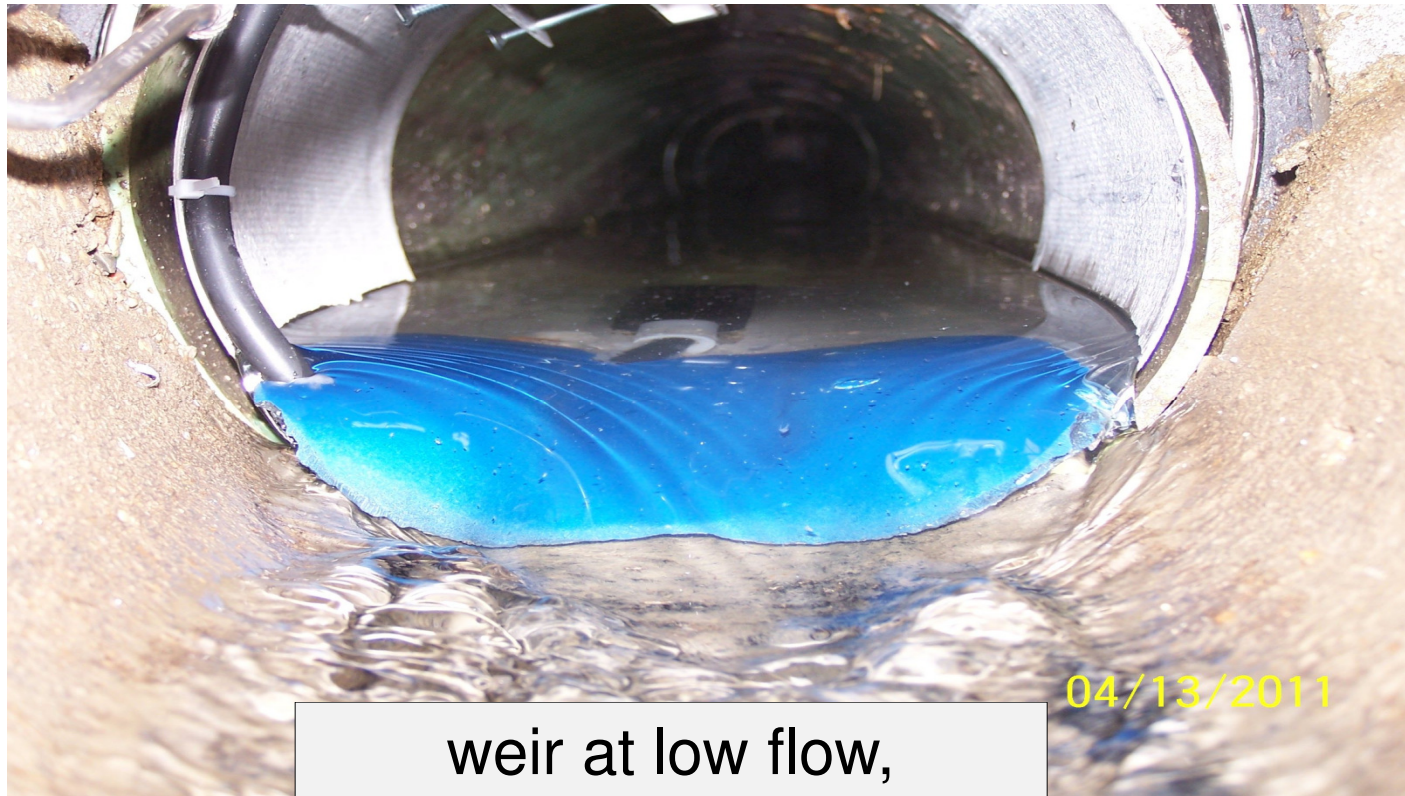
Velocity Readings



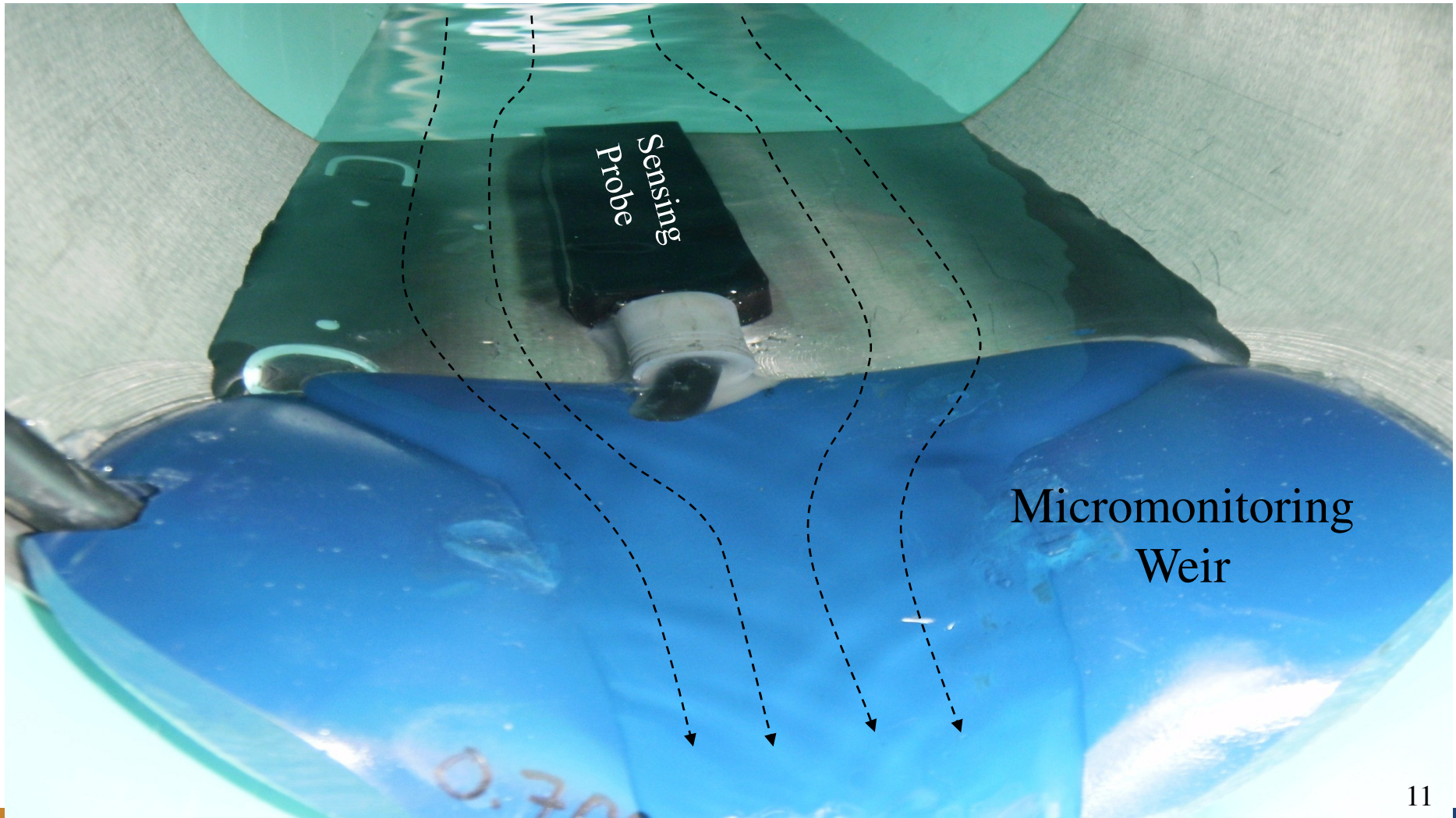
Debris



What is a Micromonitor?



weir at low flow,
area-velocity at high flow



Micromonitors do
sometimes catch
sand or debris.



Micromonitoring – Case Study

Clayton County Georgia:

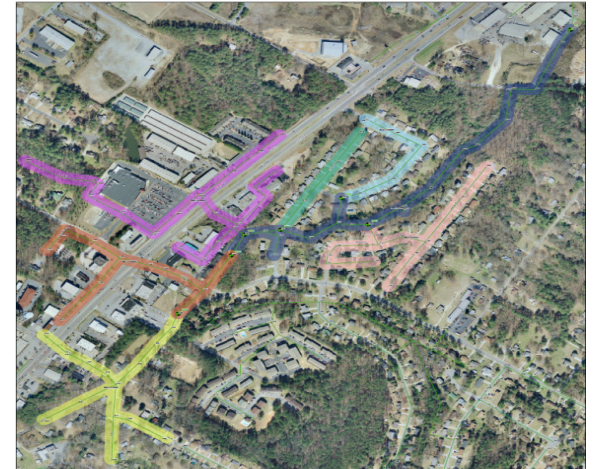
Reduce SSES costs!

Monitored 118 sites in Spring 2010

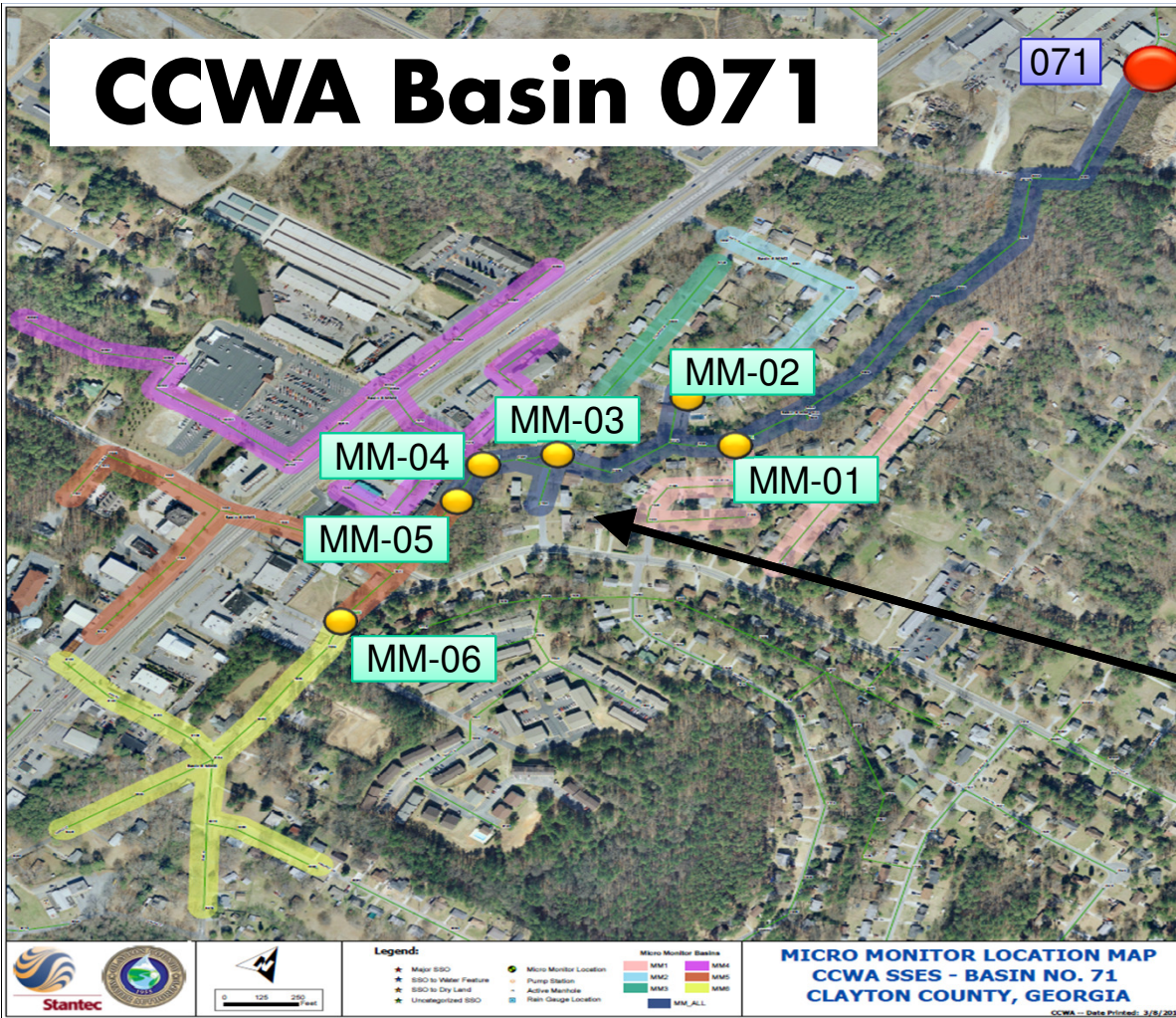
Several high I/I basins were identified

SSES Spring 2011 (Smoke, Dye, CCTV, MH Insp.)

Micromonitors Proposed for **Basin 071**



CCWA Basin 071

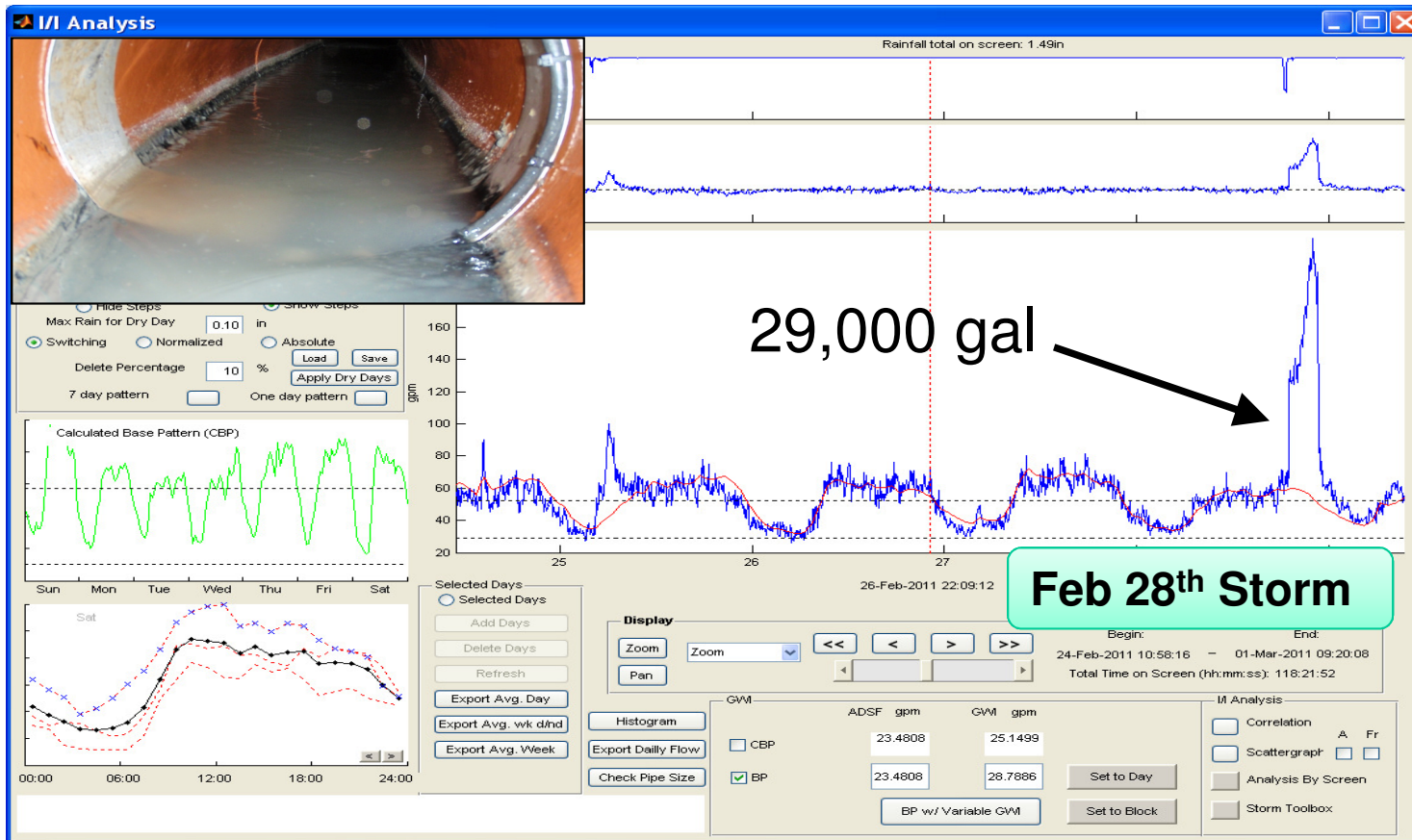


Regional Monitor

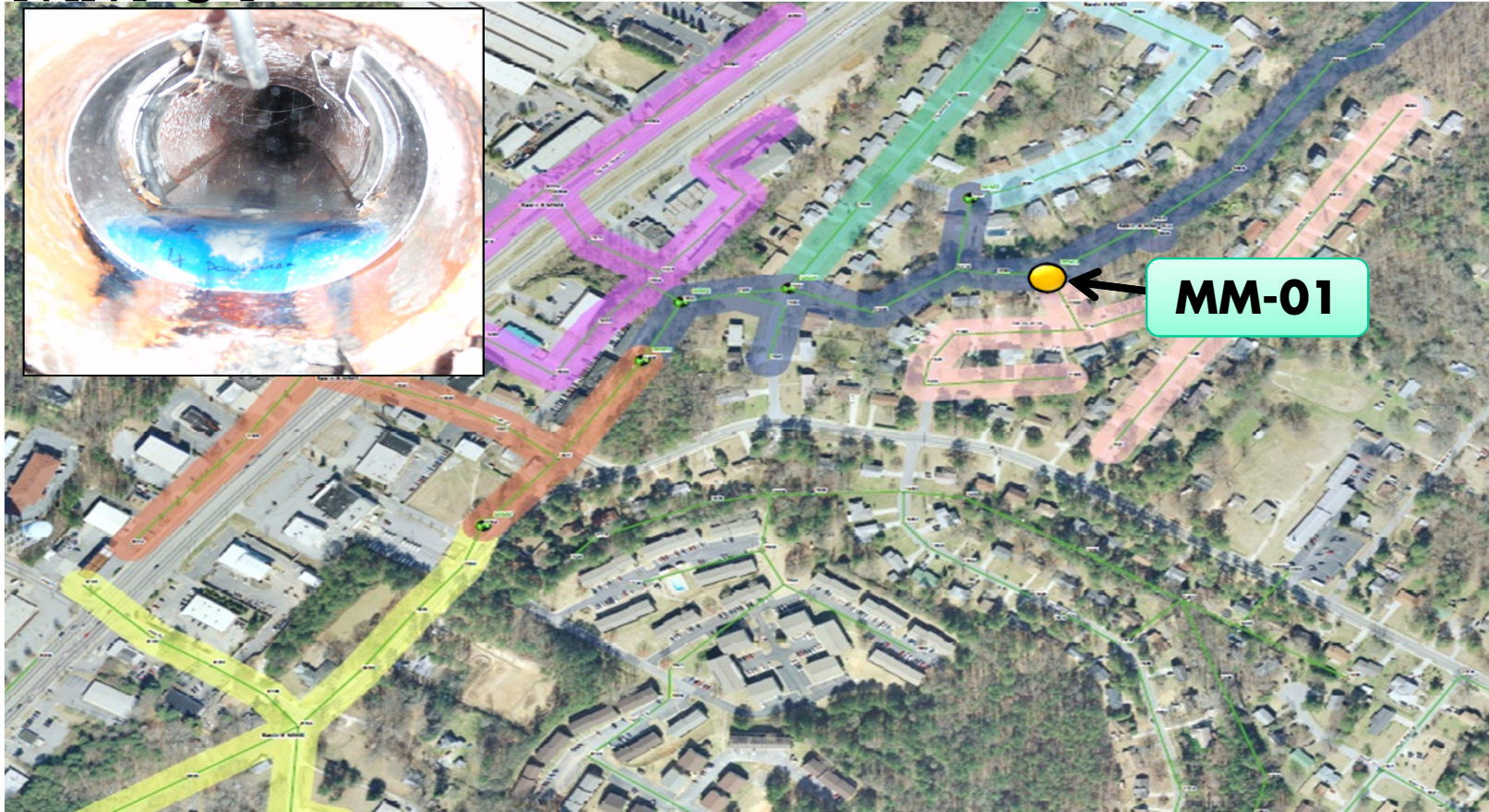


Micromonitors

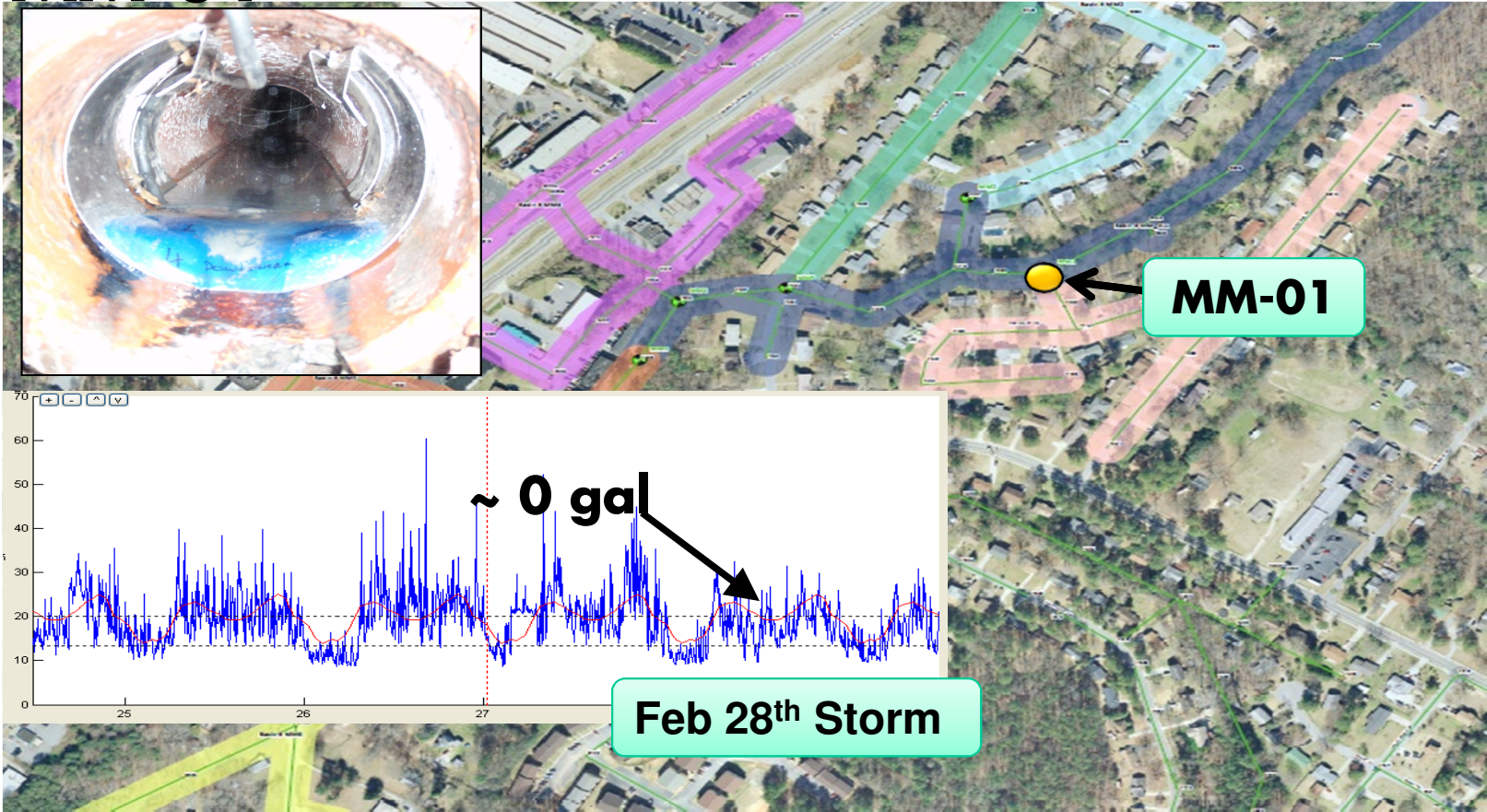
Regional Monitor 071



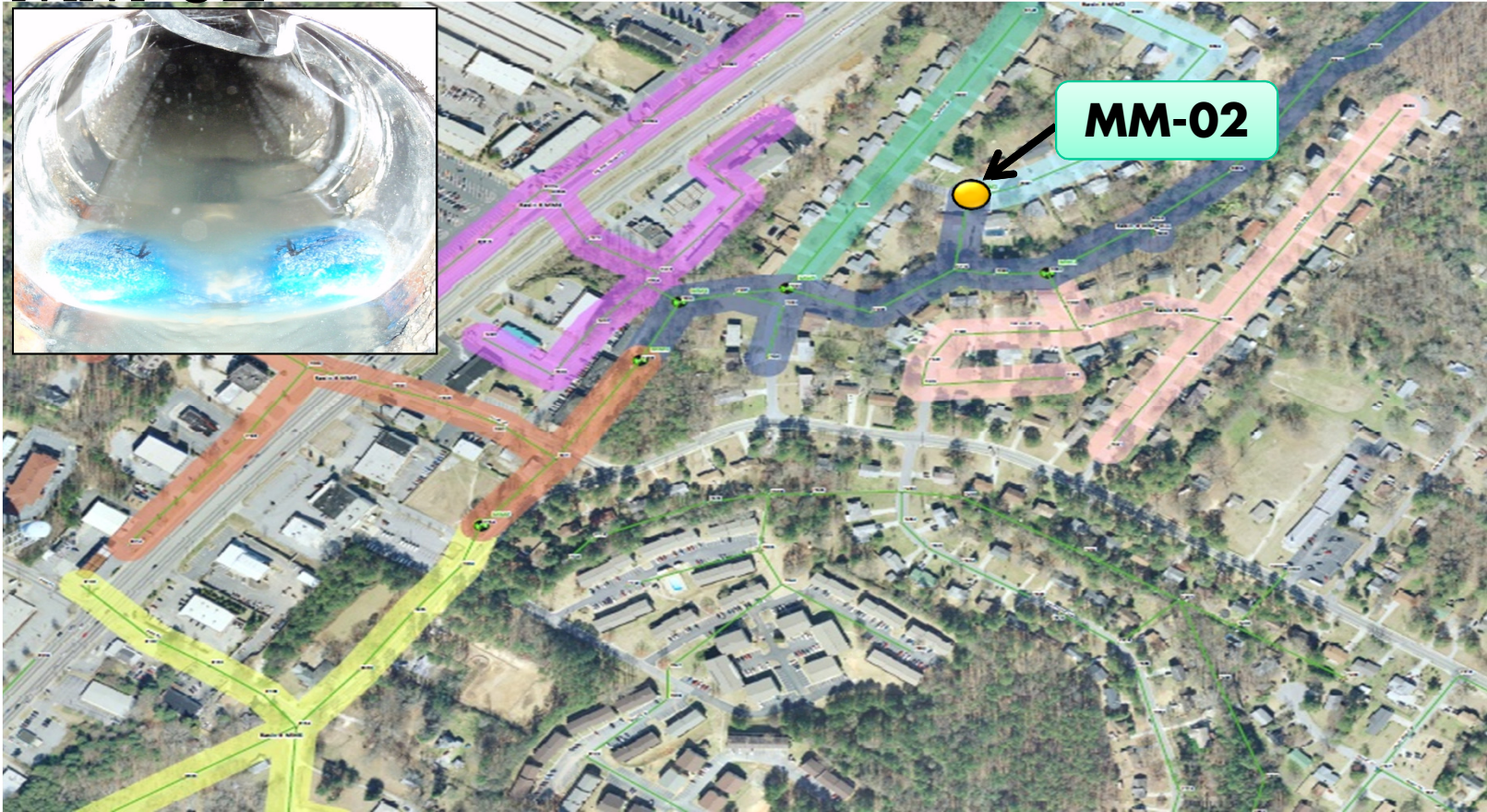
MM-01



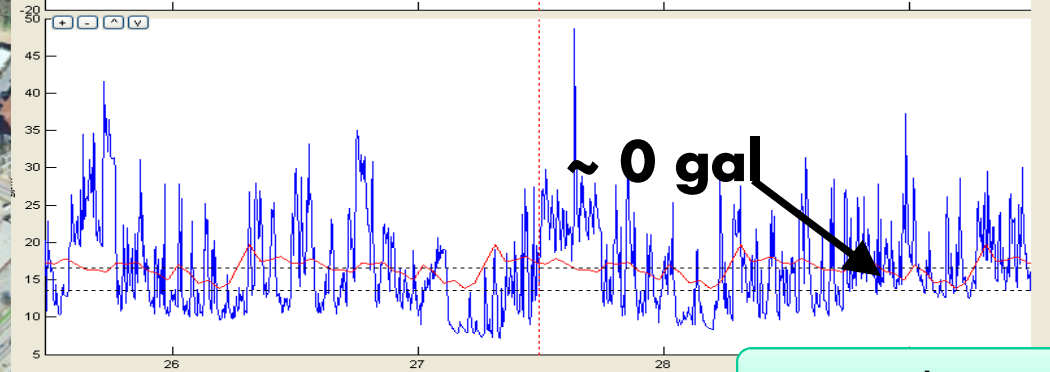
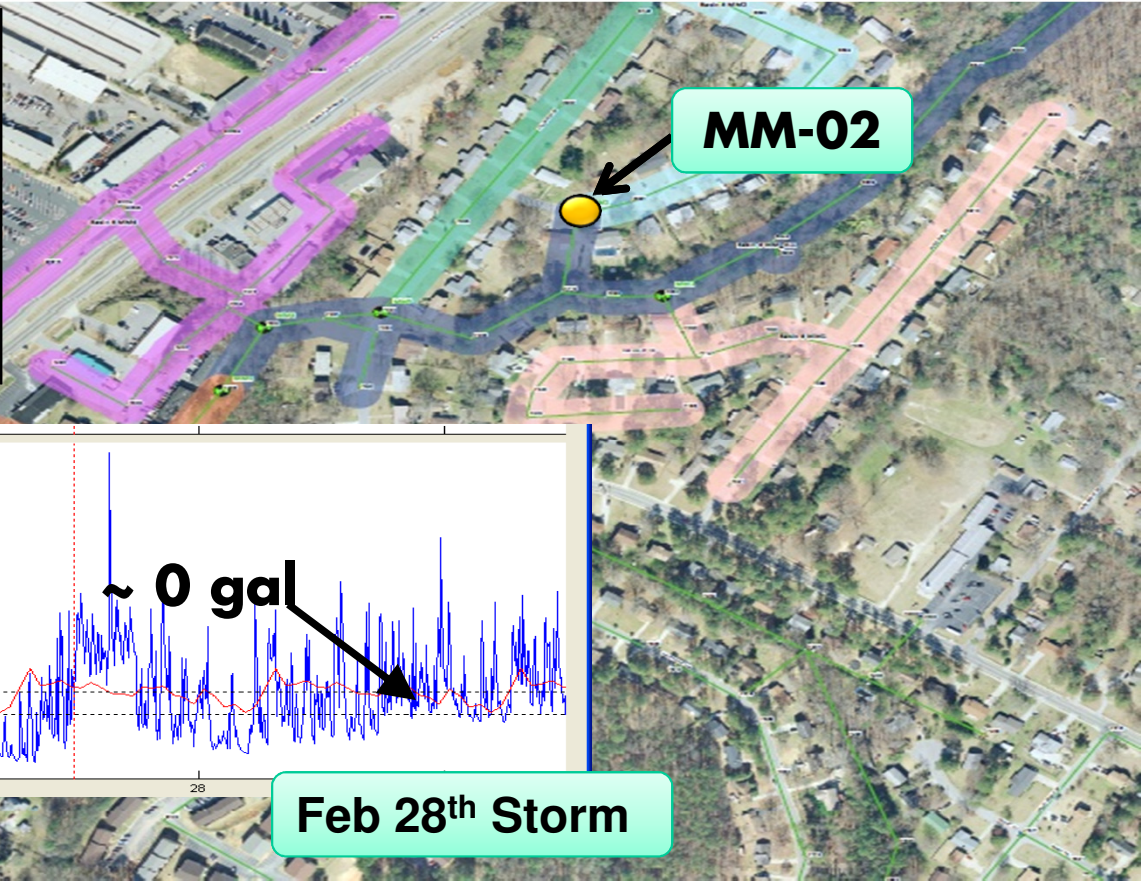
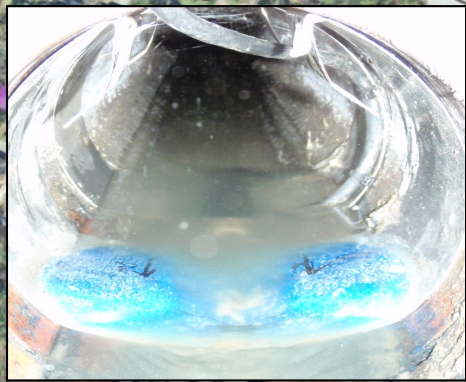
MM-01



MM-02

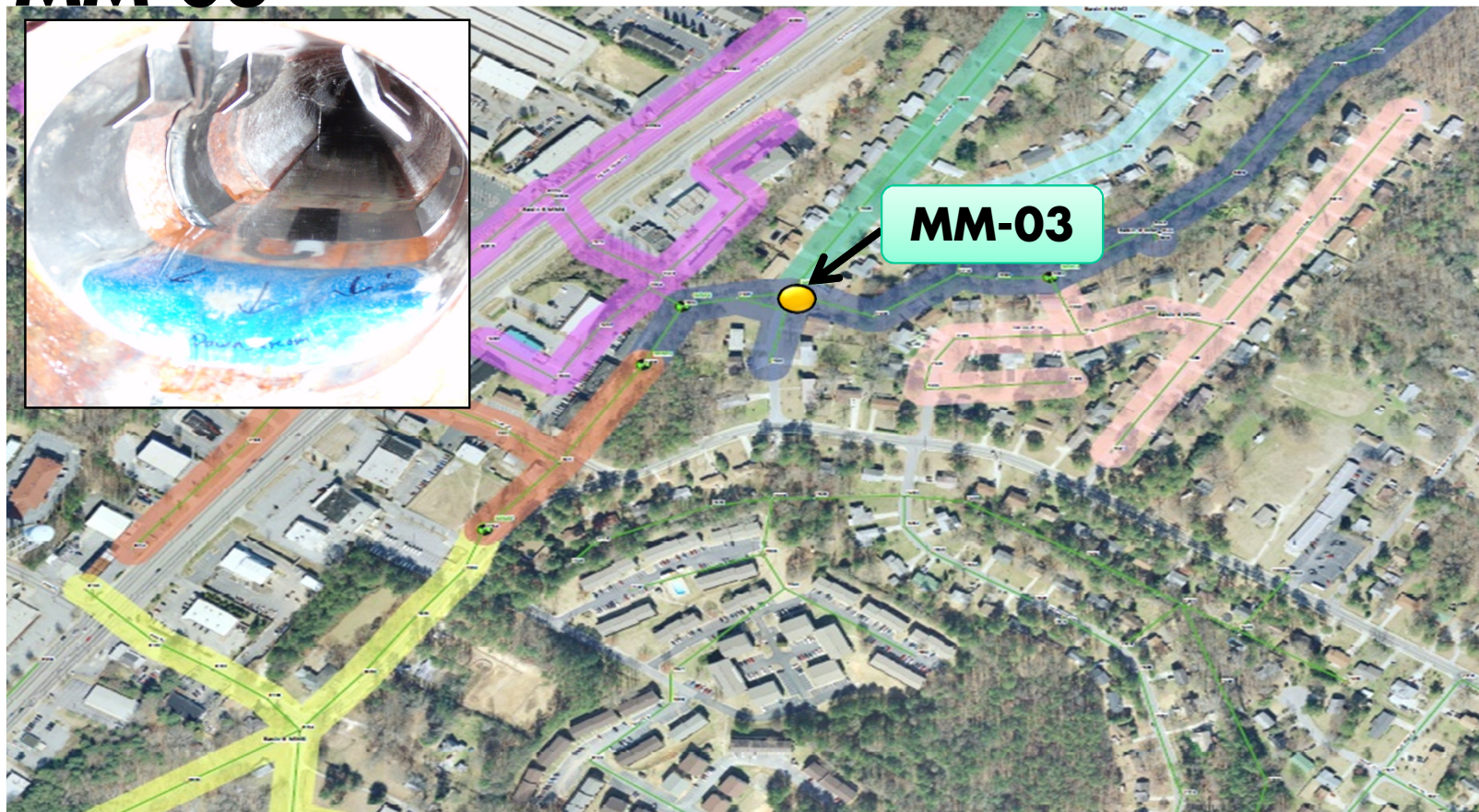


MM-02

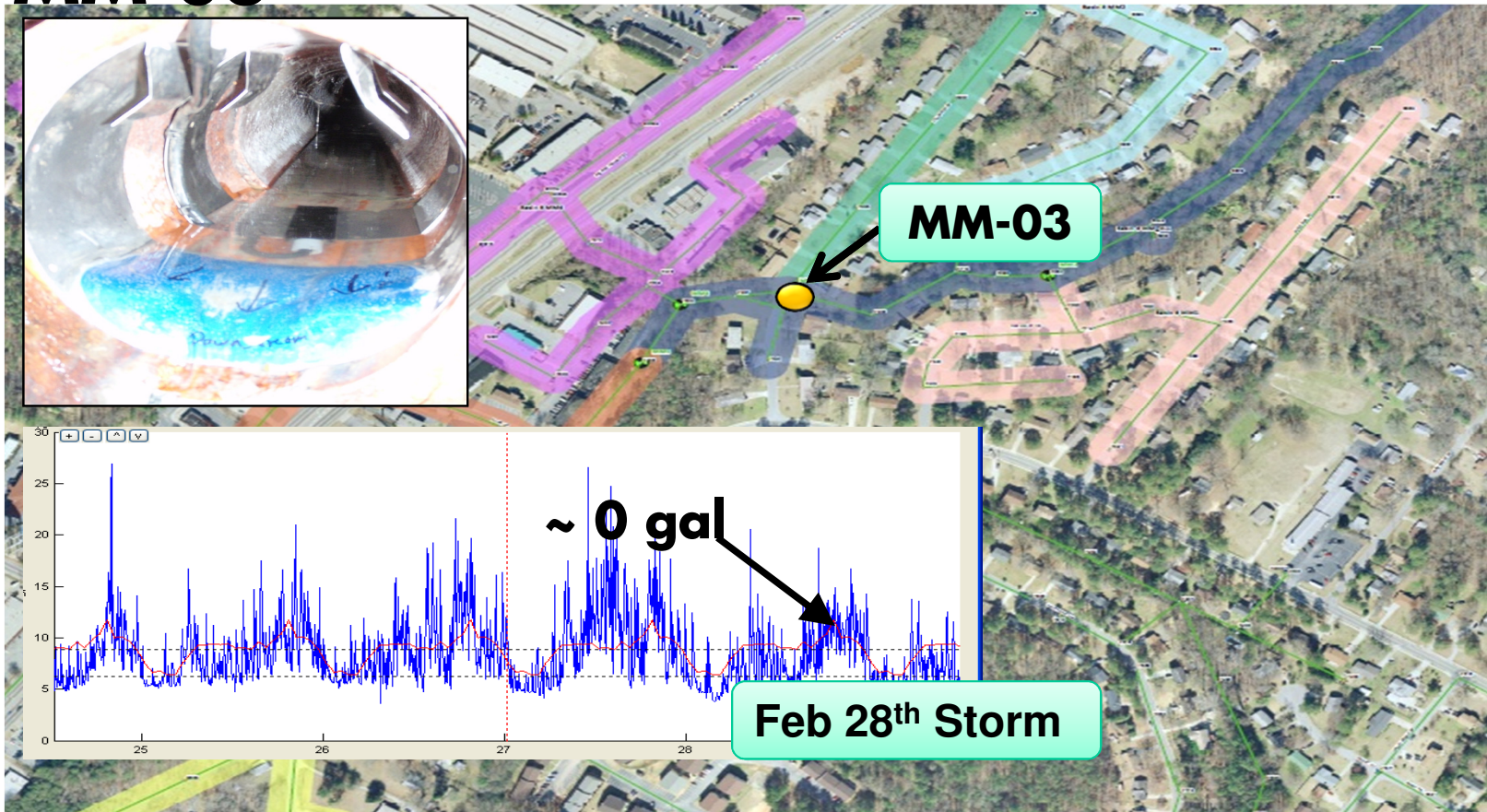


Feb 28th Storm

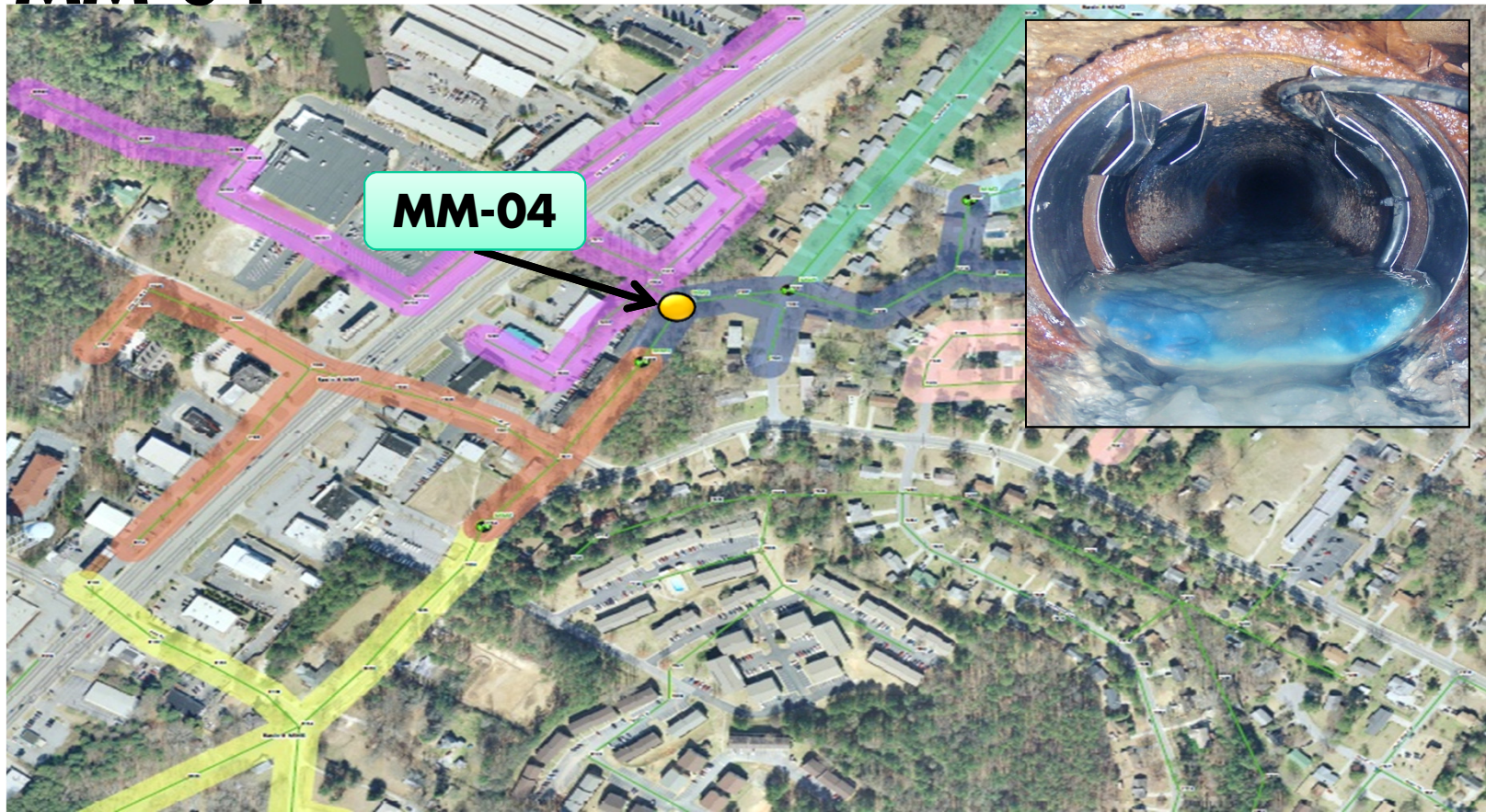
MM-03



MM-03



MM-04

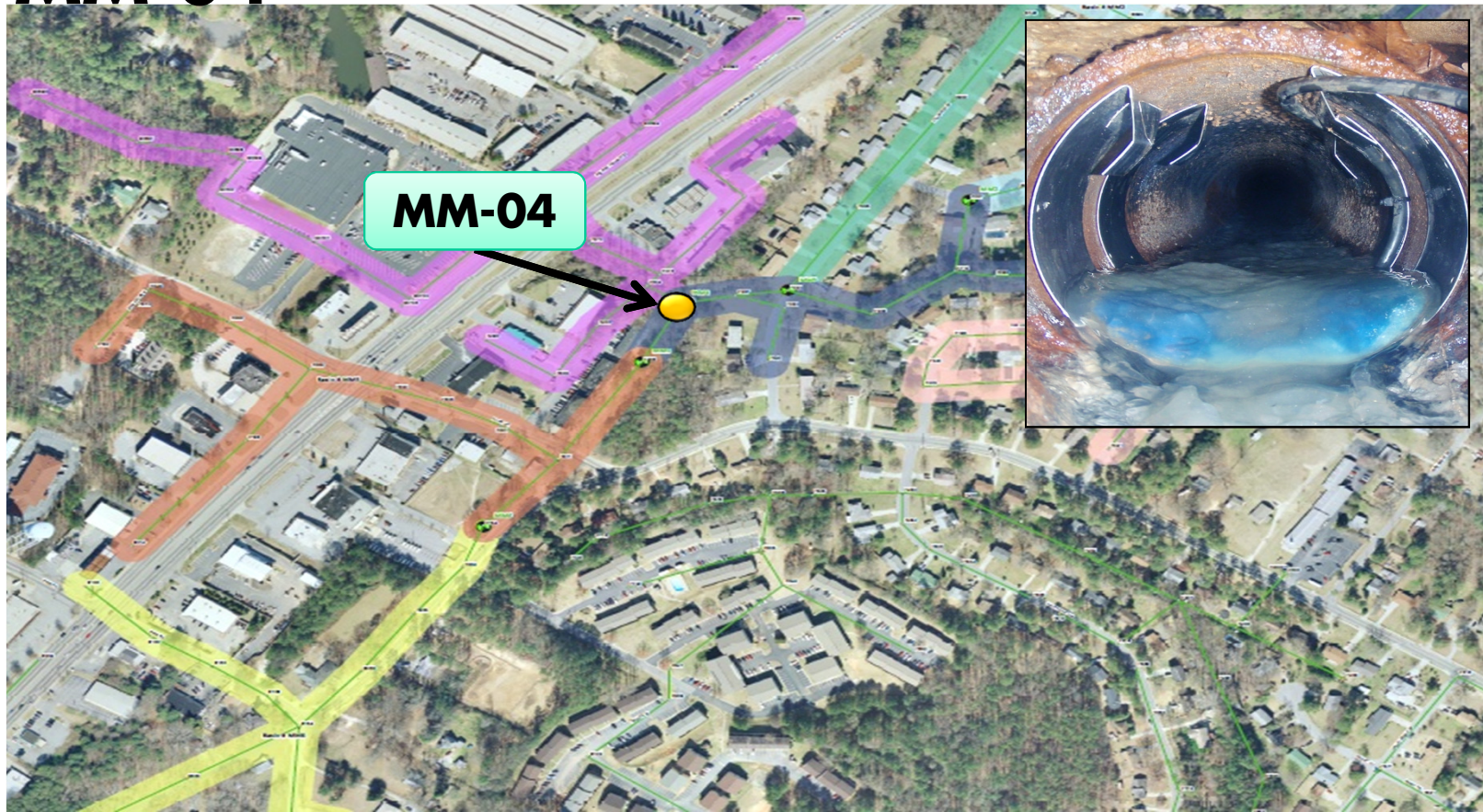


MM-04

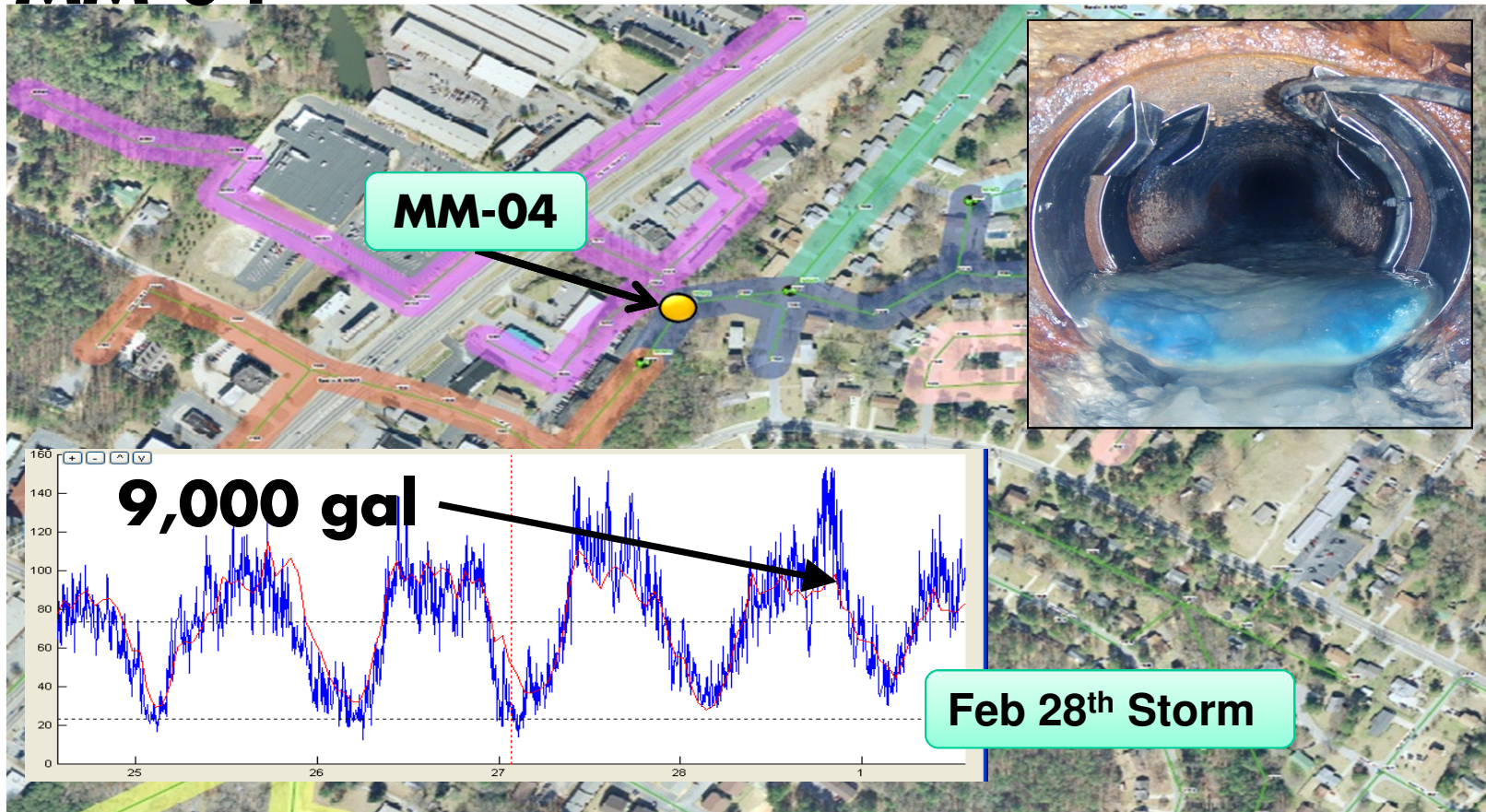
MM4 Upstream Area is one of the only areas in the project area below the stream level, and it is all sand.



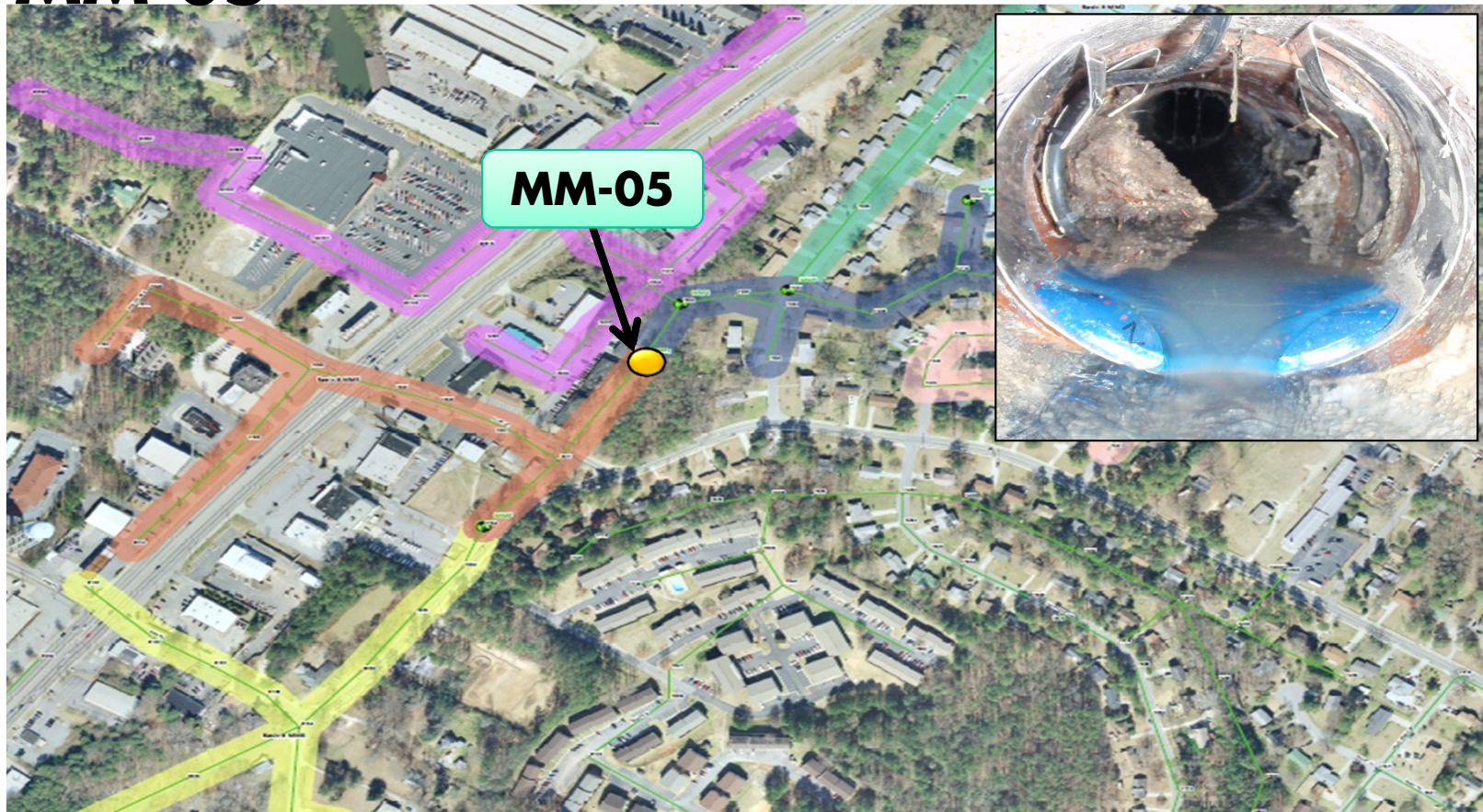
MM-04



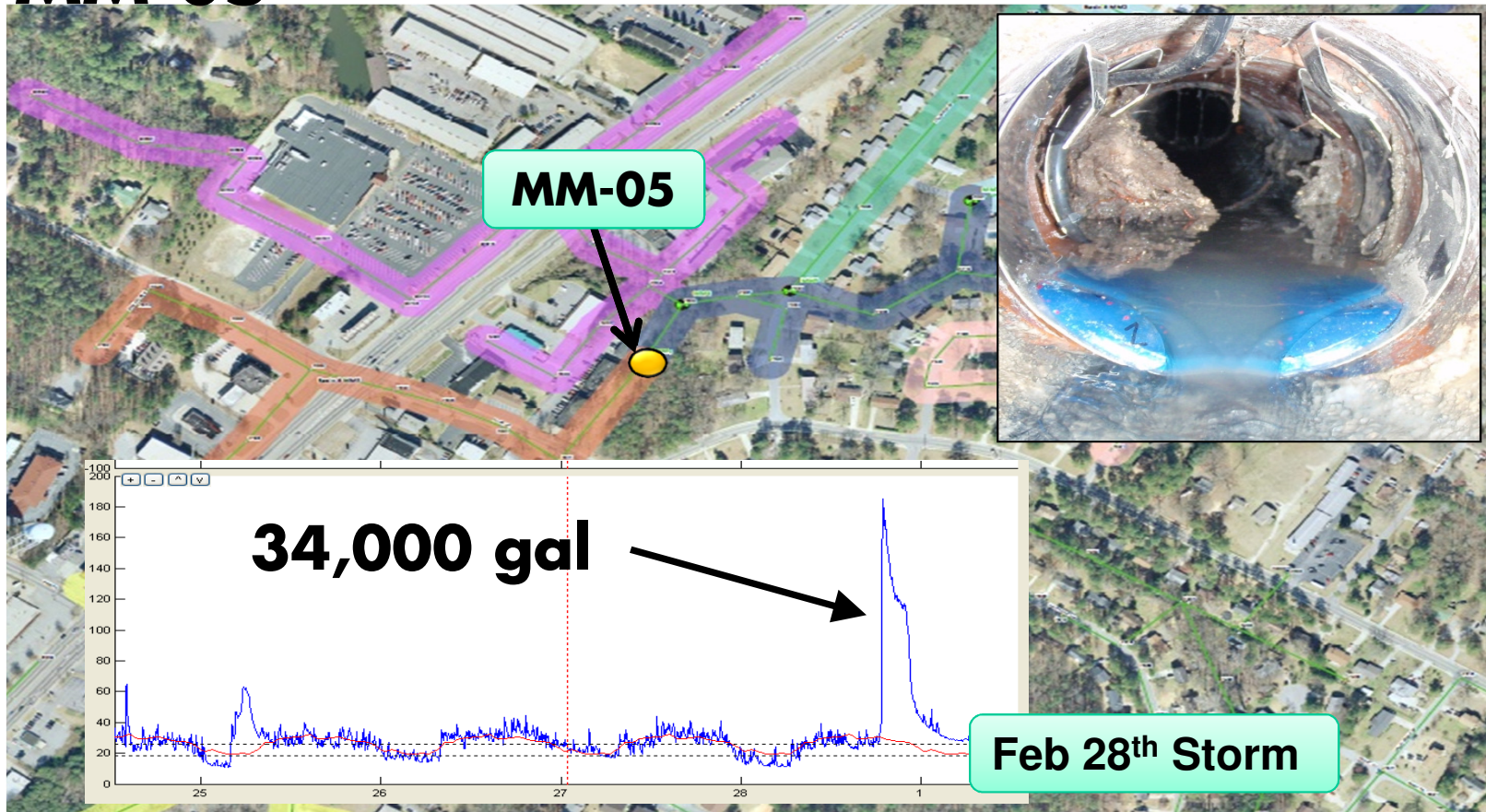
MM-04



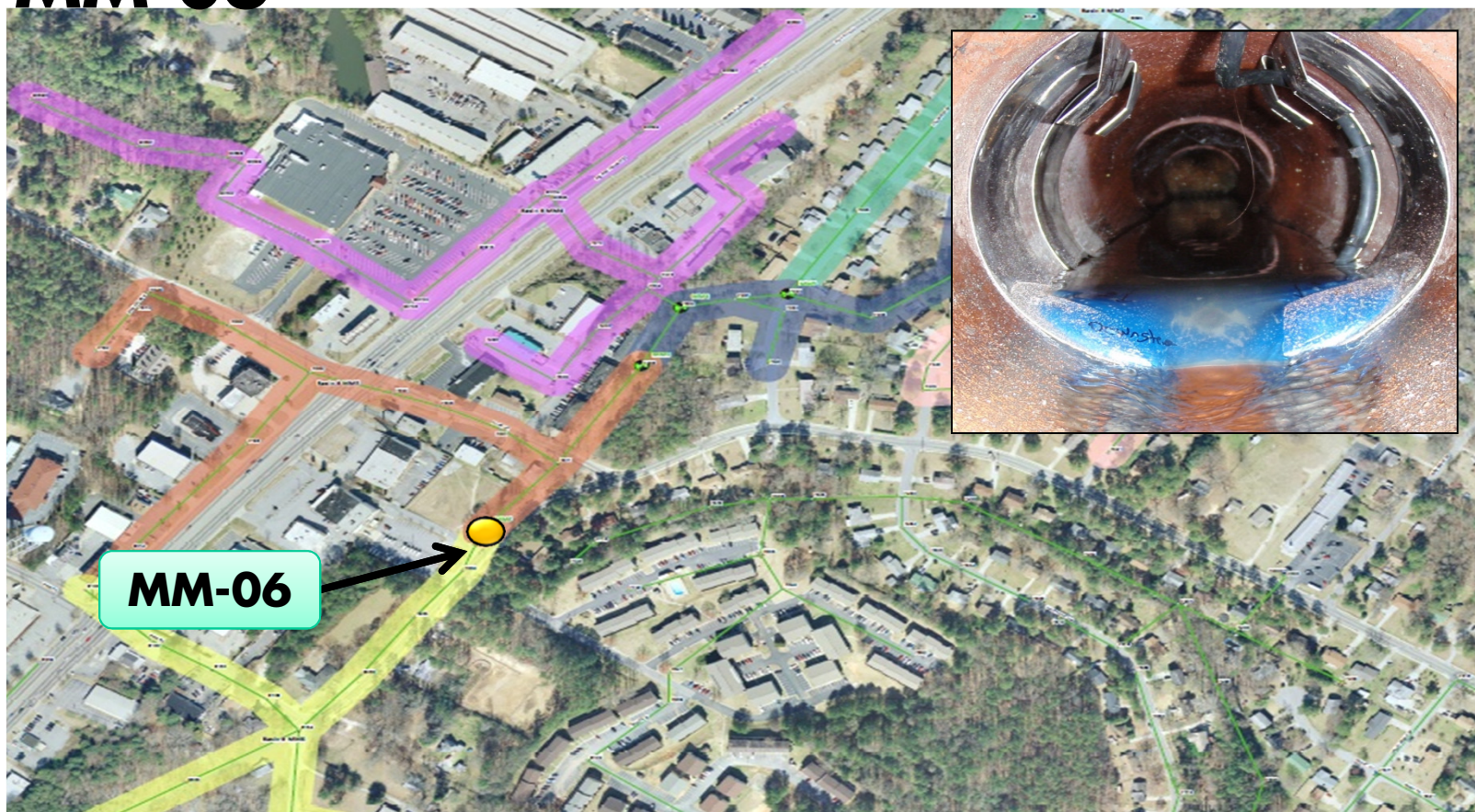
MM-05



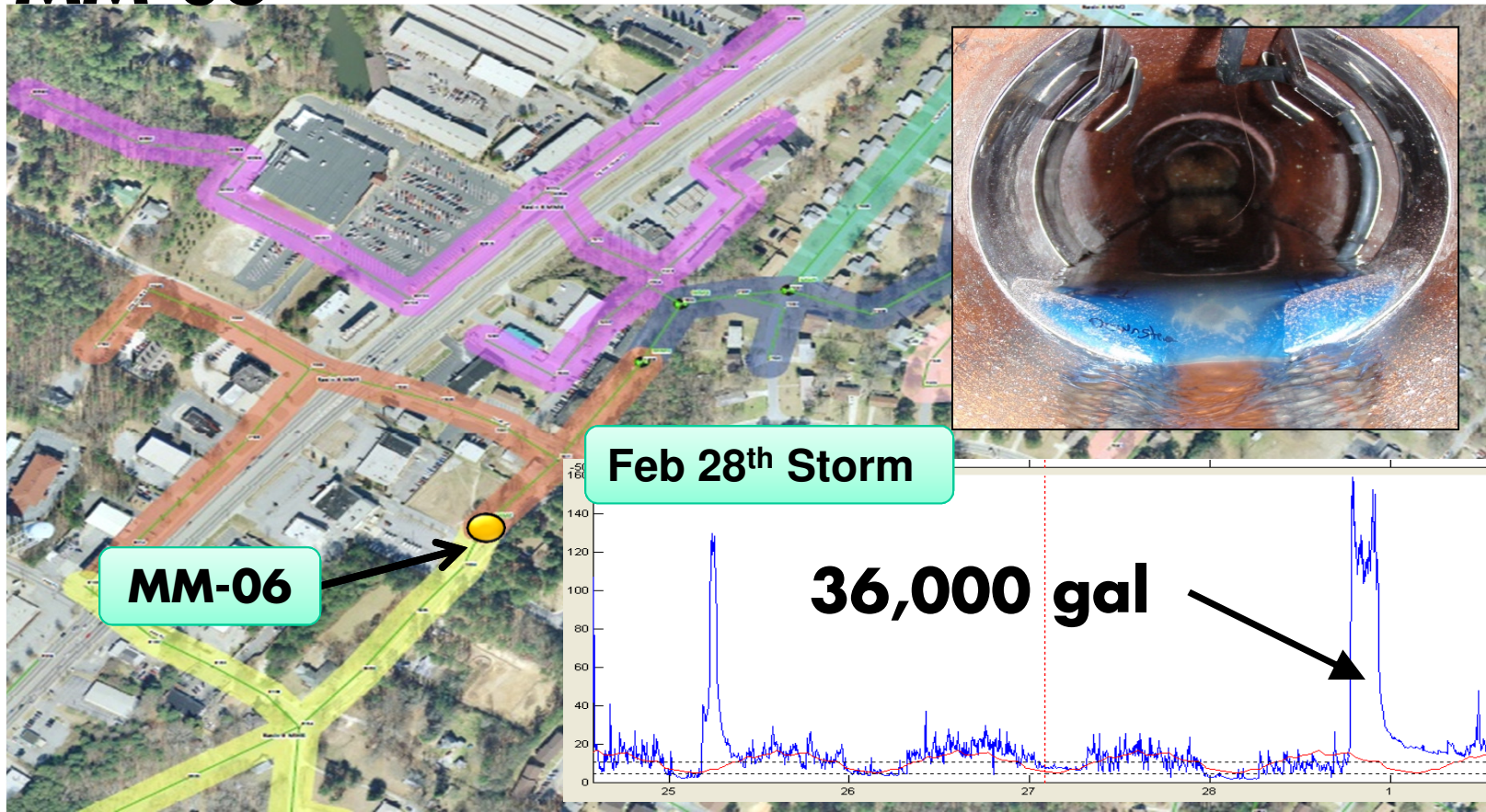
MM-05



MM-06

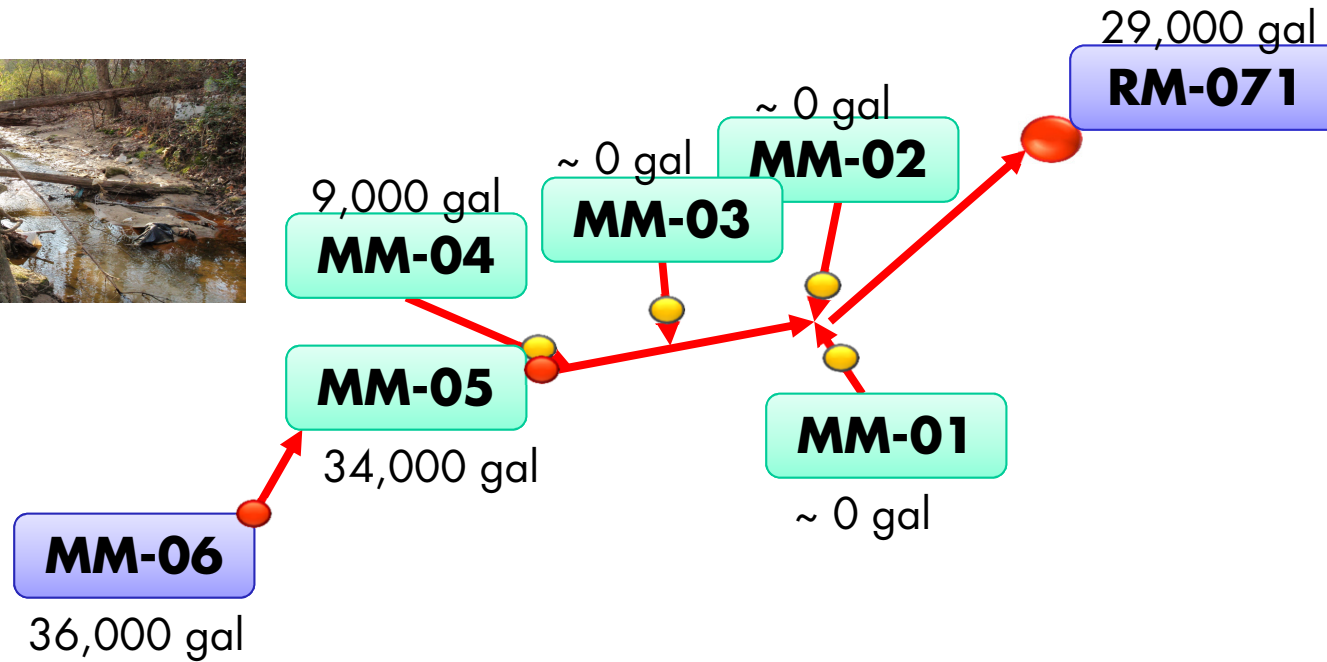


MM-06



CCWA Flow Schematic

and Micromonitoring flows for the February 28th Storm



MM-06 goes through MM-05 and RM-071, so the I/I generated at MM-06 is seen in all three graphs!

Possible Source?

Possible Source?

Posted: 11:50 PM Apr 7, 2011

Riverdale neighborhood normal after gas-line repair

Residents forced to leave homes for several hours

Riverdale police evacuated 50-60 residents in the Camp Creek neighborhood, Thursday afternoon, after workers nicked a 2-inch natural gas main inside a Clayton County sewer line.



f

By Kathy Jefcoats
kjefcoats@news-daily.com

Riverdale police evacuated 50-60 residents in the Camp Creek neighborhood, Thursday afternoon, after workers nicked a 2-inch natural gas main inside a Clayton County sewer line.

The evacuation, which lasted more than four hours, affected 154 homes, a laundromat, gift shop and church, said Riverdale Police Chief Samuel F. Patterson. The Waffle House on Ga. 85, near the neighborhood, closed voluntarily, as a precaution, he said. <

Clayton County Water Authority Spokeswoman Suzanne Brown said a consultant was televising inside the sewer lines about 2:10 p.m., when a root ball interfered with the project. A worker clearing the root ball nicked an Atlanta Gas Light line that had bored into the sewer line, said Brown. i

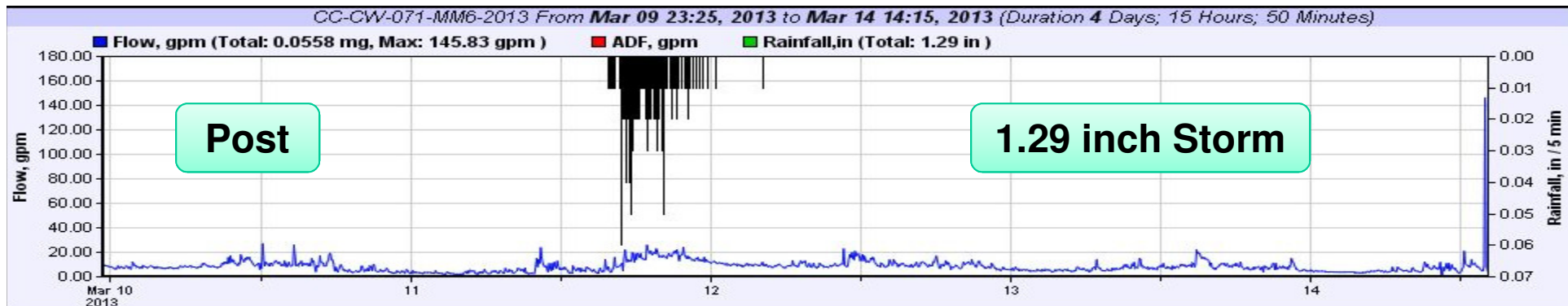
Possible Source?

The screenshot shows the homepage of 'Natural Gas Watch .org'. The navigation bar includes links for Home, About, Advertise Here, Fracking, Friday Funnies, Natural Gas Explosions, Natural Gas Leaks, NYC Natural Gas Infrastructure, and Regulation. The main content area features a video player titled 'Amazing Video Pipeline May B...' with a play button overlay. The video shows a massive fireball rising from a street in Minneapolis. Below the video, a caption reads: 'A fireball nearly three stories high rages in Minneapolis after a massive natural gas explosion. This screenshot is from video footage taken by Robert Stephens'. To the right of the video, there is a text block that begins with 'There's no word yet on what cause the explosion, but given that the NTSB has already said it's got collective hands full investigating the circumstances behind the Sept. 8, 2010 San Bruno natural gas explosion that killed eight people and the December 2010 Detroit natural gas explosion that killed two, we probably shouldn't hold our breath waiting for details on this one, either.' Below this, another line of text starts with 'Indeed, there's a great story in the Minneapolis Star Tribune this morning'. The right sidebar contains various article teasers, including one about 'Aging' and another about 'Law for a'.

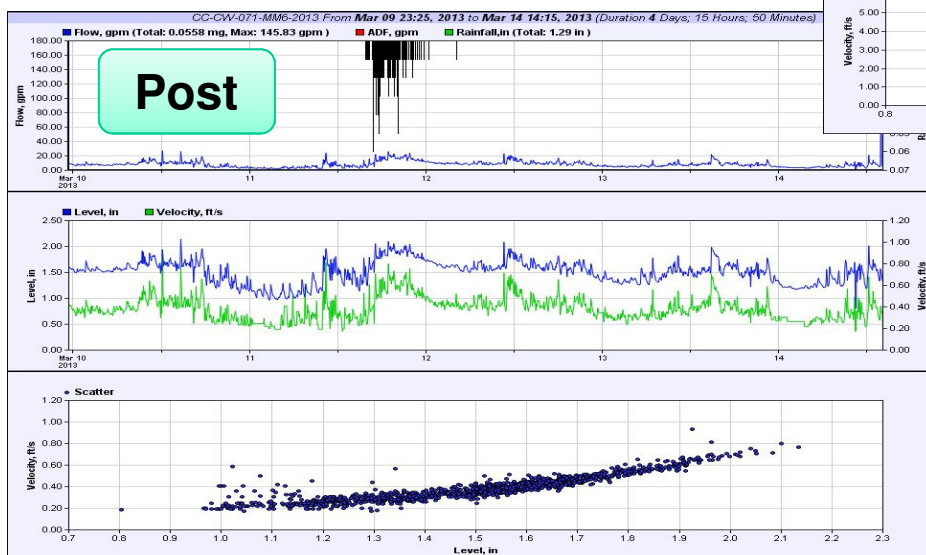
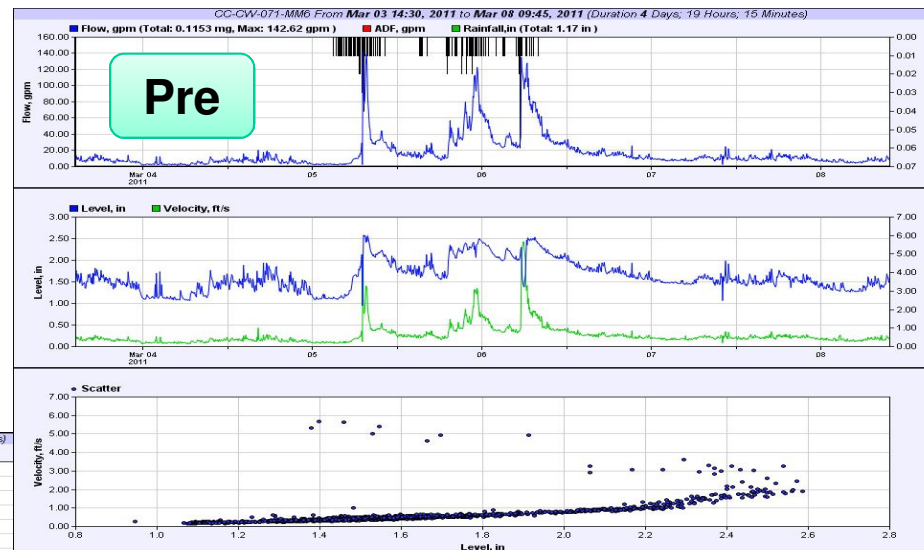
Possible Source: Gas Line



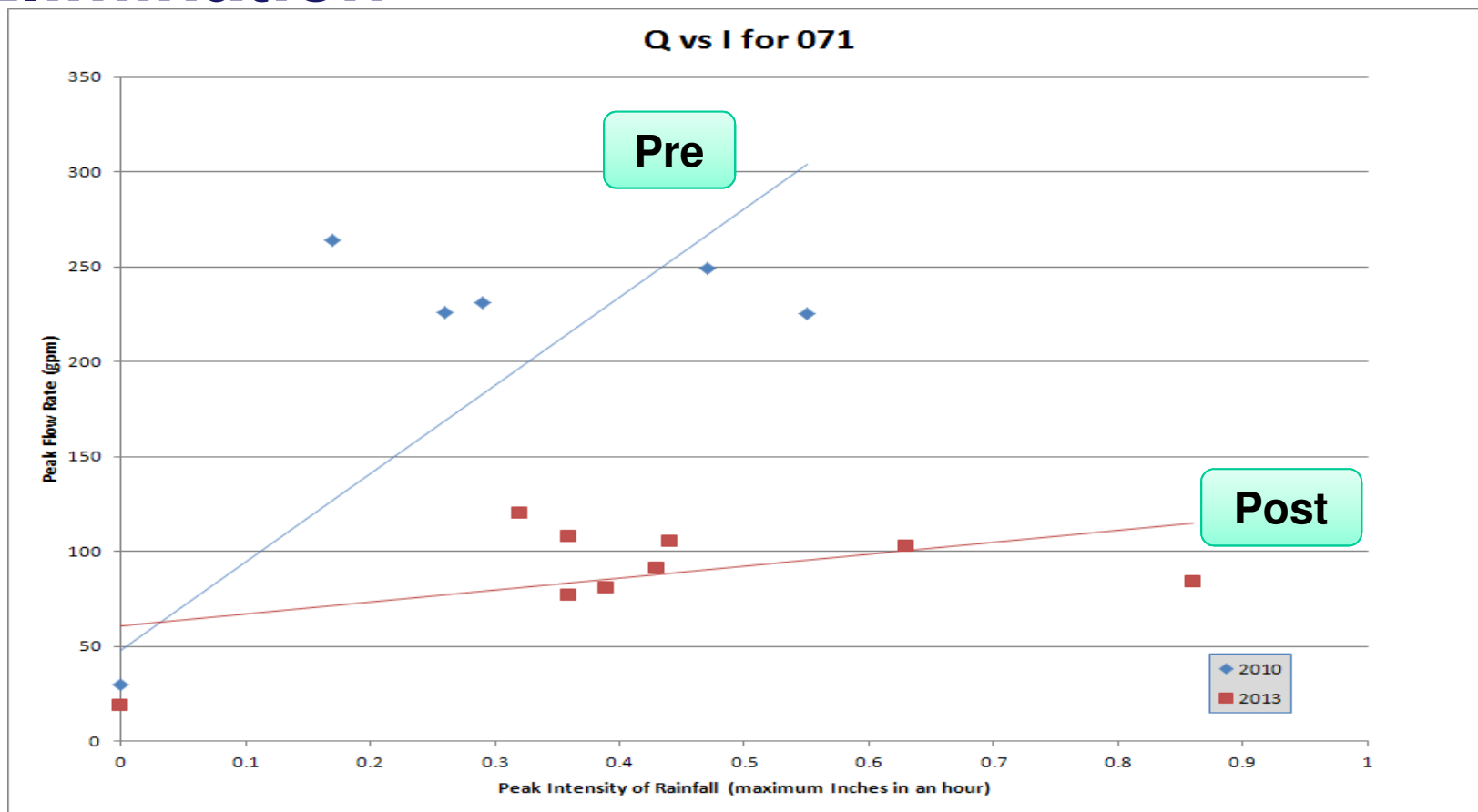
I- Elimination



I-I Elimination



I-I Elimination



CCWA Case Study - Summary

INFLOW: In the intense Feb 28th Storm, almost all of the inflow recorded at the downstream monitor **071**) originated in **Sub-basin 6**.

18% of the Basin

All remaining sub-basins show no

measurable direct inflow

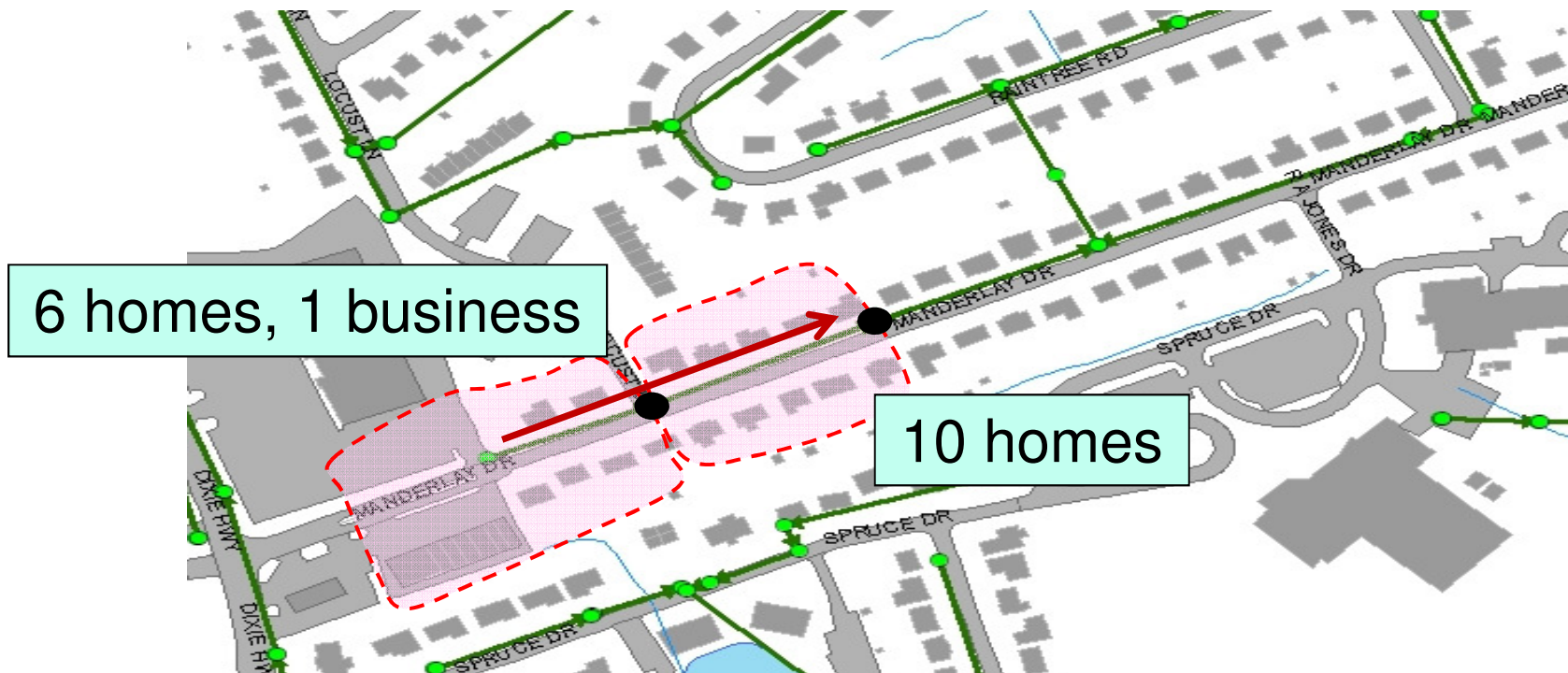


Micromonitoring: Nightly Flows Florence, KY

28 Sites in Florence Micromonitored

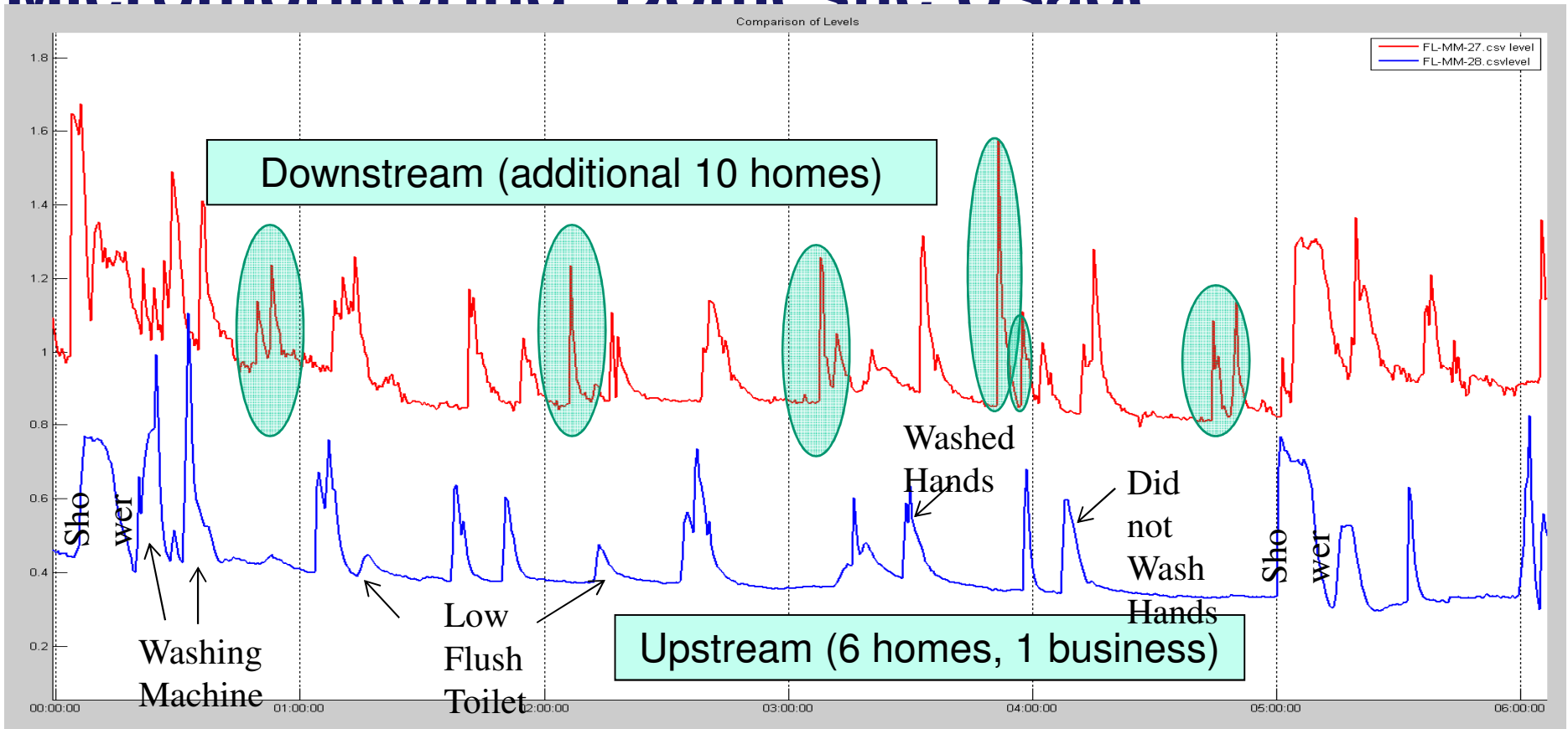
Let's just look at the nightly flows from two adjacent MM

Micromonitoring: Florence Sites



30 second data, Adjacent manholes.

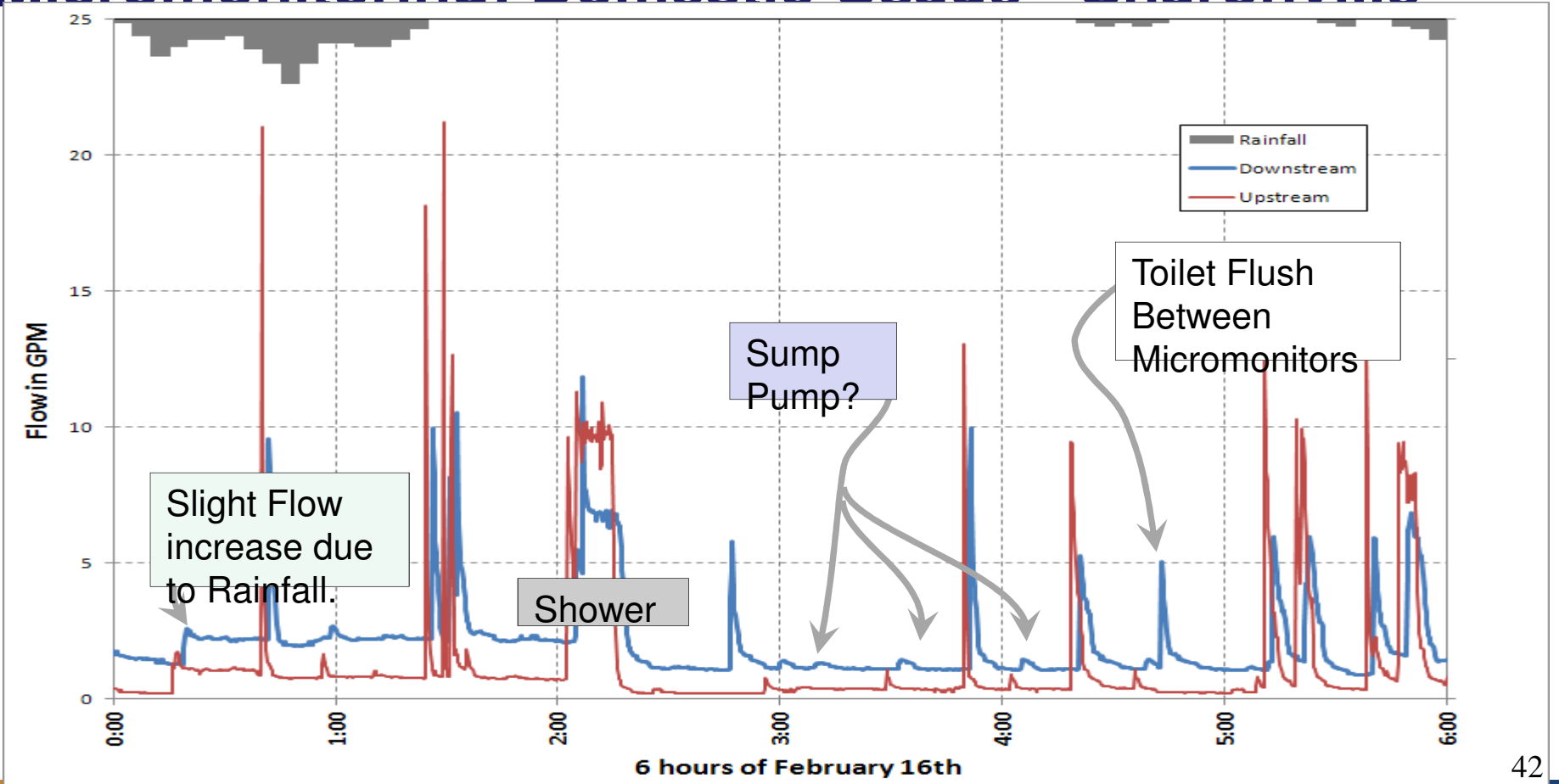
Micromonitoring - Domestic Usage



30 second level data, Adjacent manholes.

B5

Micromonitoring: Domestic Usage - Sharonville



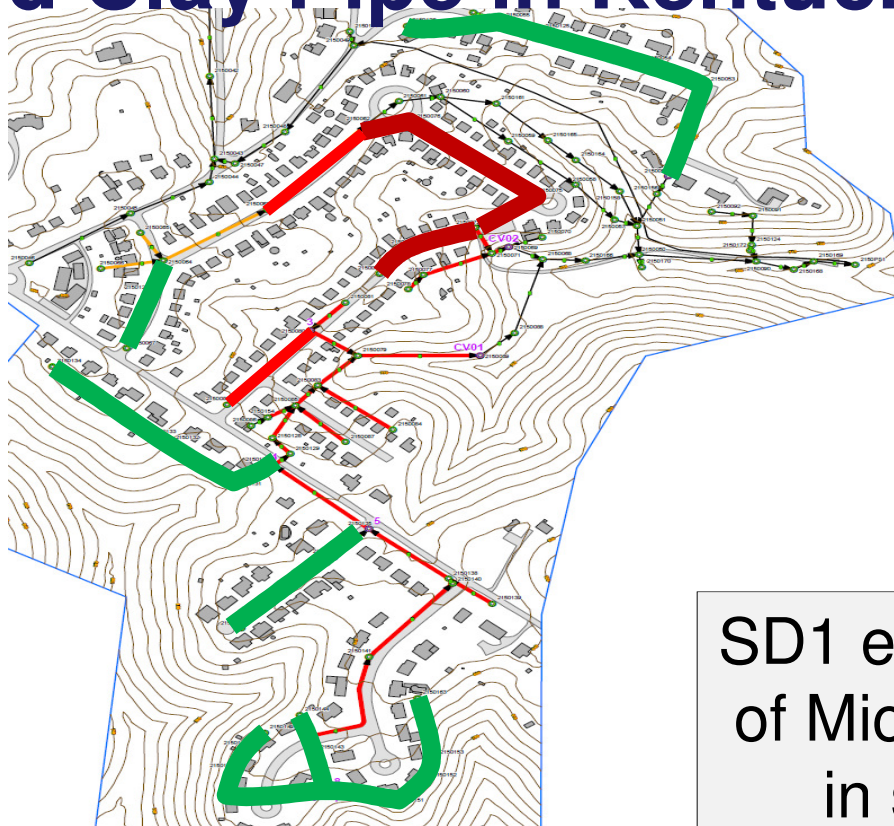
Slide 42

B5

Show pictures for each point in animation

Bhuvana, 4/29/2011

Old Clay Pipe in Kentucky

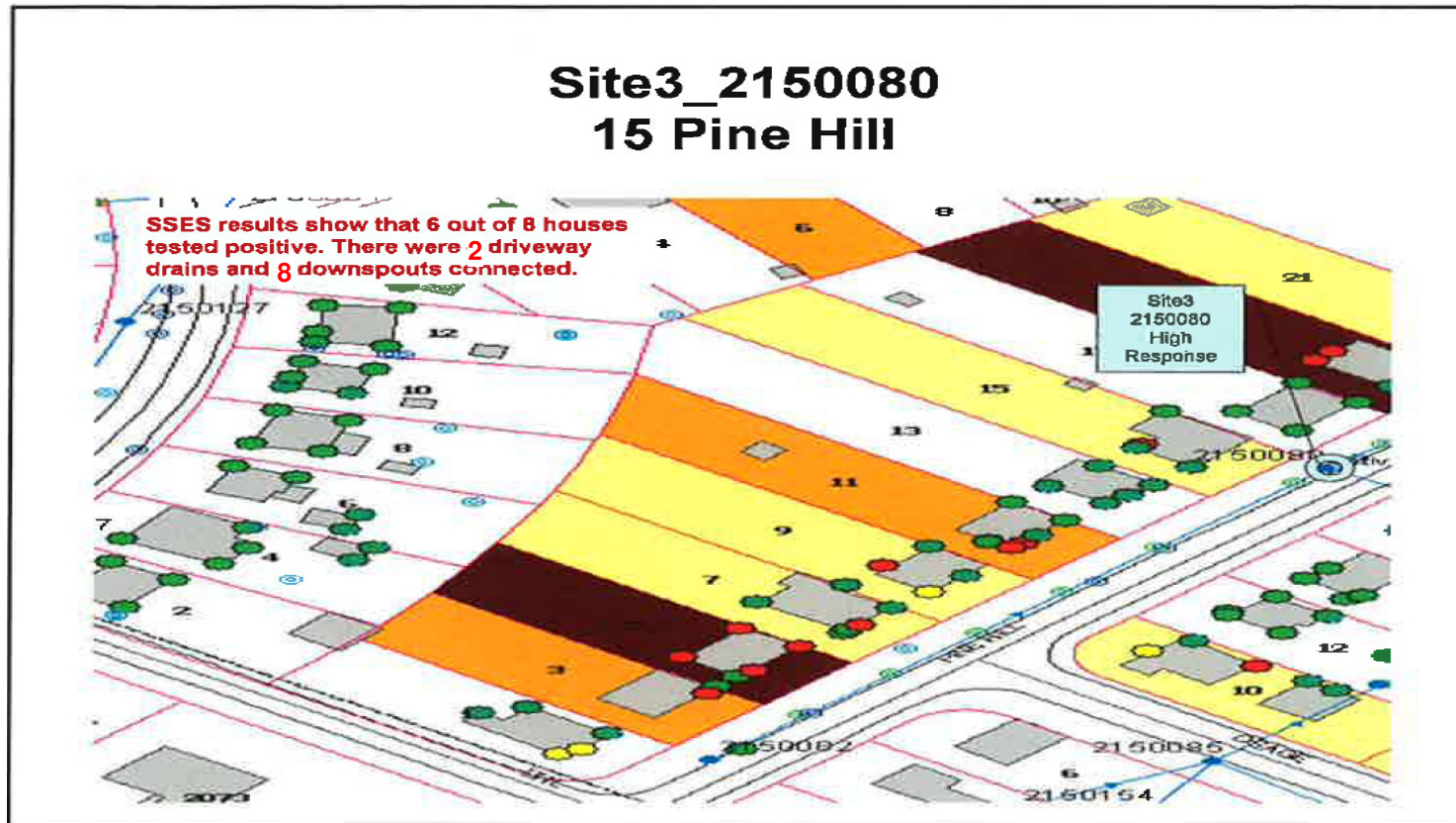


Sim_Lines
Effective Value
NOT MONITORED
0 - 0.25
0.25 - 0.75
0.75 +

 No Rehab Required

SD1 estimates that the first round of Micromonitoring saved \$250K in scheduled rehabilitation

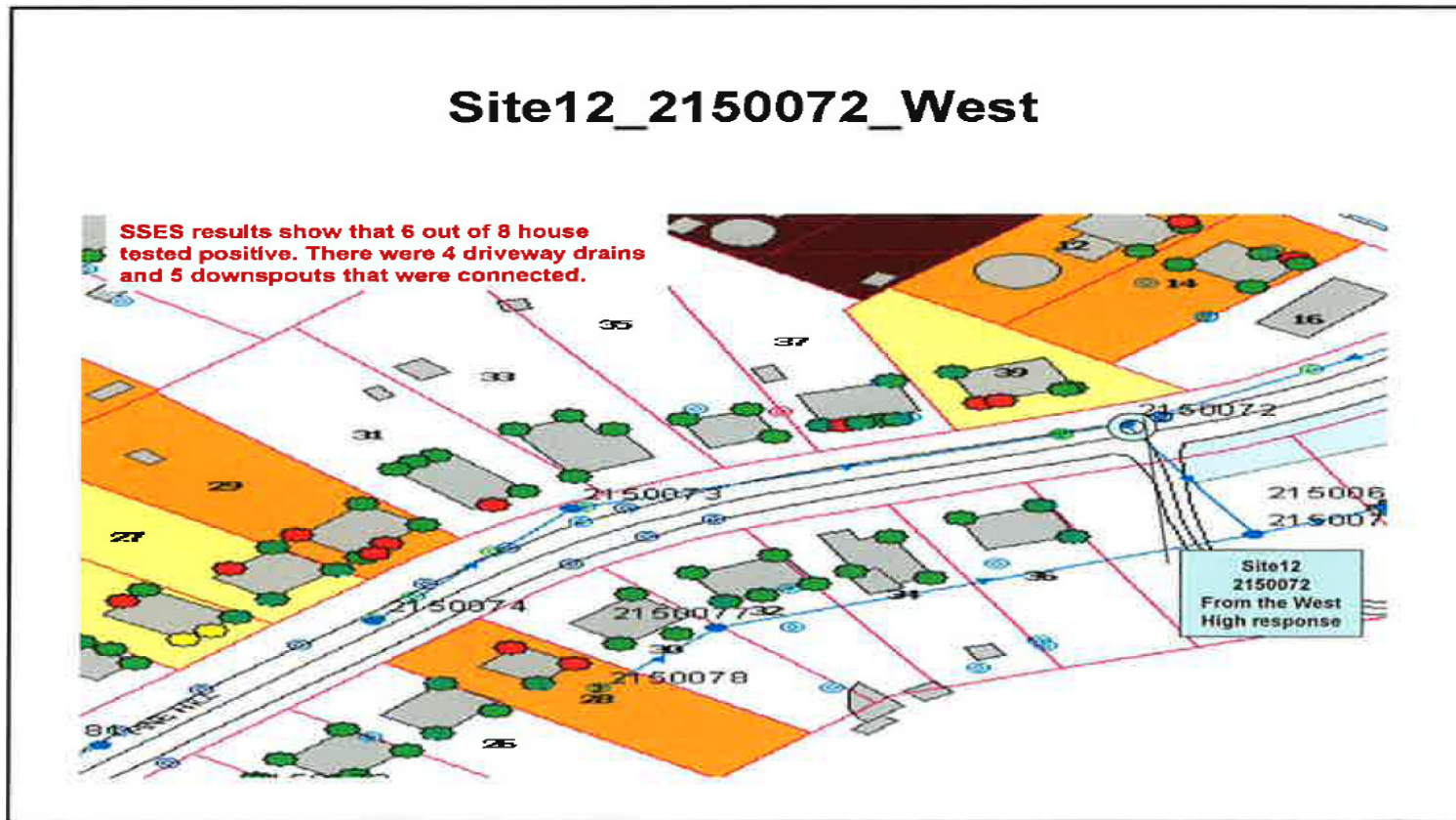
Old Clay Pipe in Kentucky



Micromonitoring results from the Cold Spring area of SD1 in Northern, KY

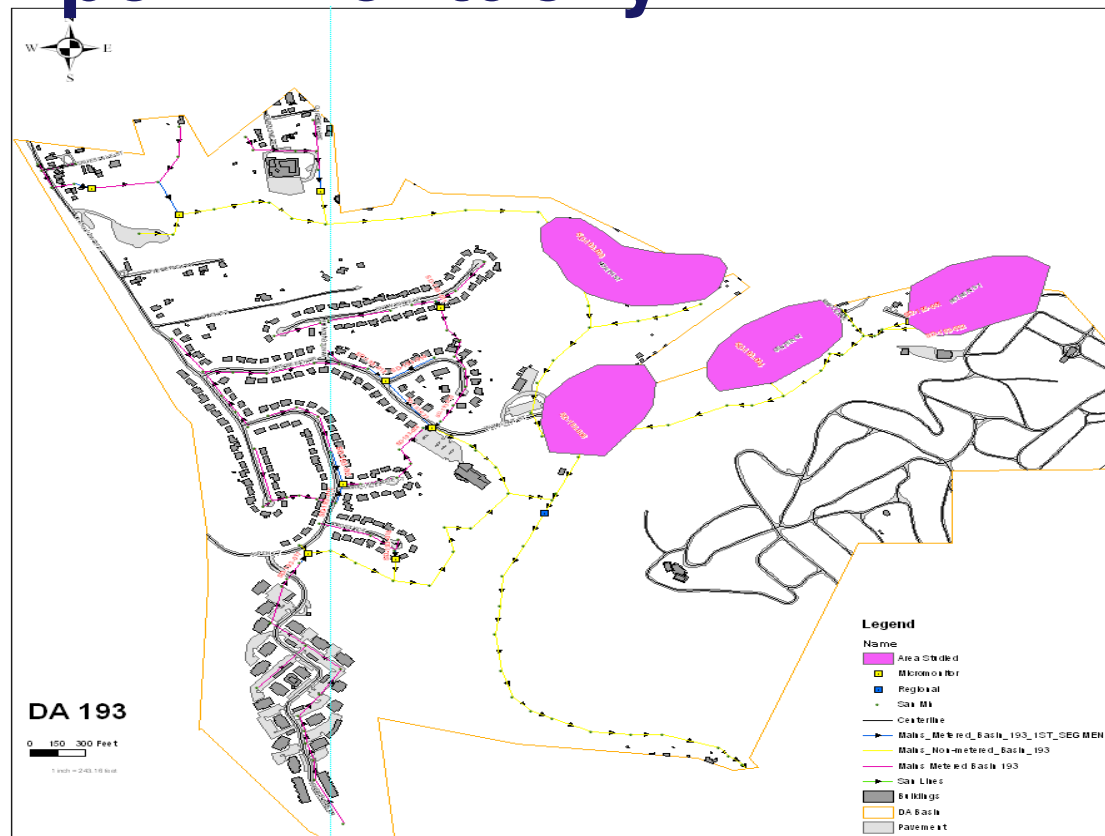
44

Old Clay Pipe in Kentucky



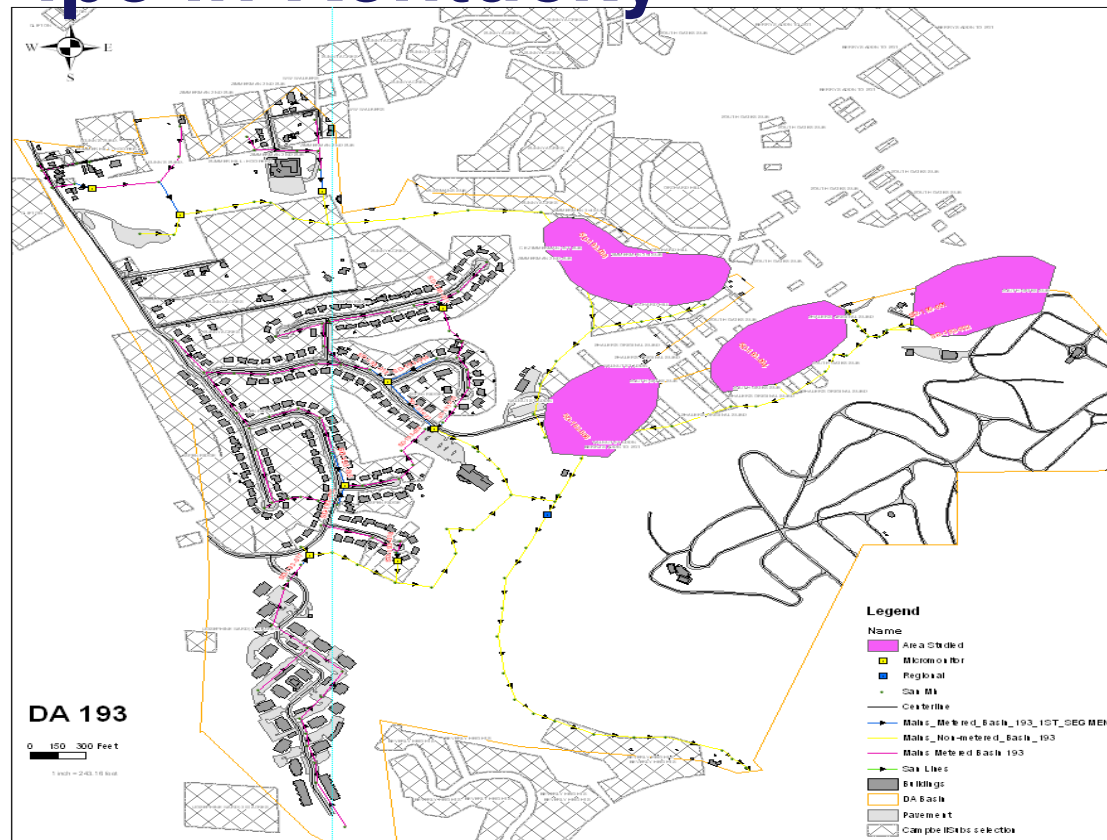
Micromonitoring results from the Cold Spring area of SD1 in Northern, KY

Old Clay Pipe in Kentucky



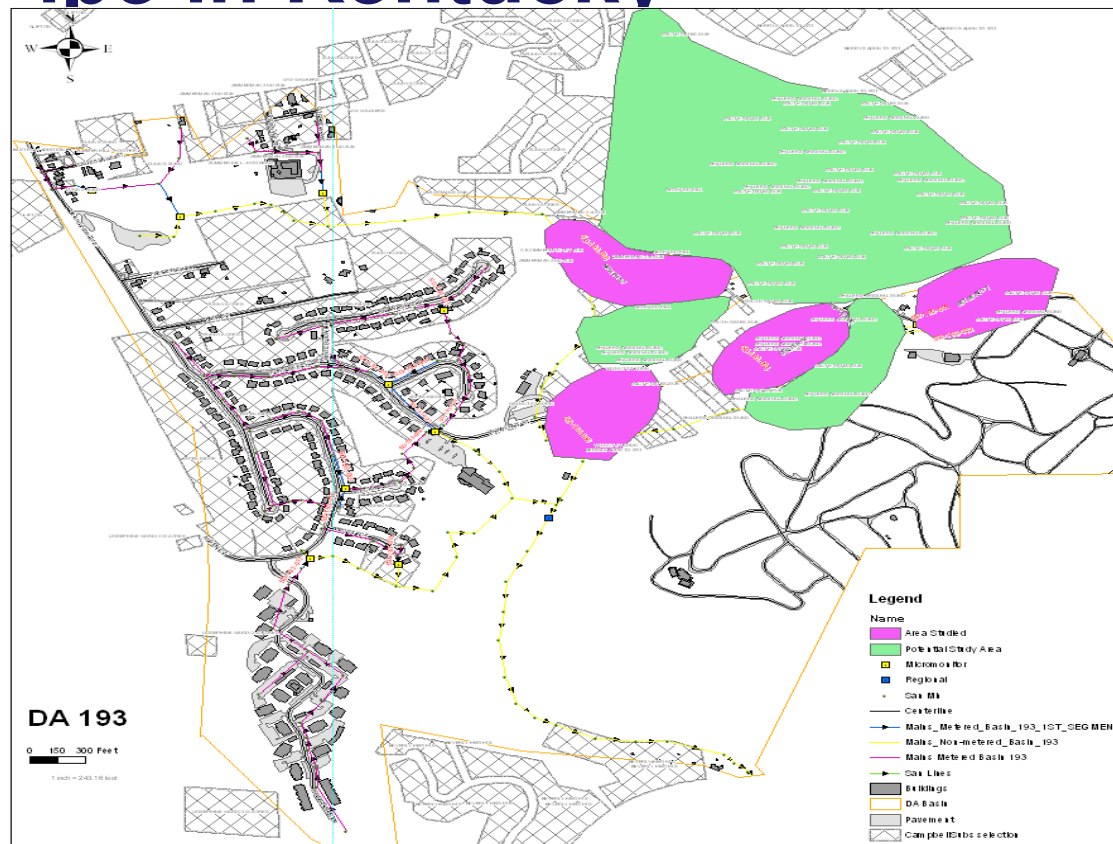
Neighborhoods to Investigate

Old Clay Pipe in Kentucky



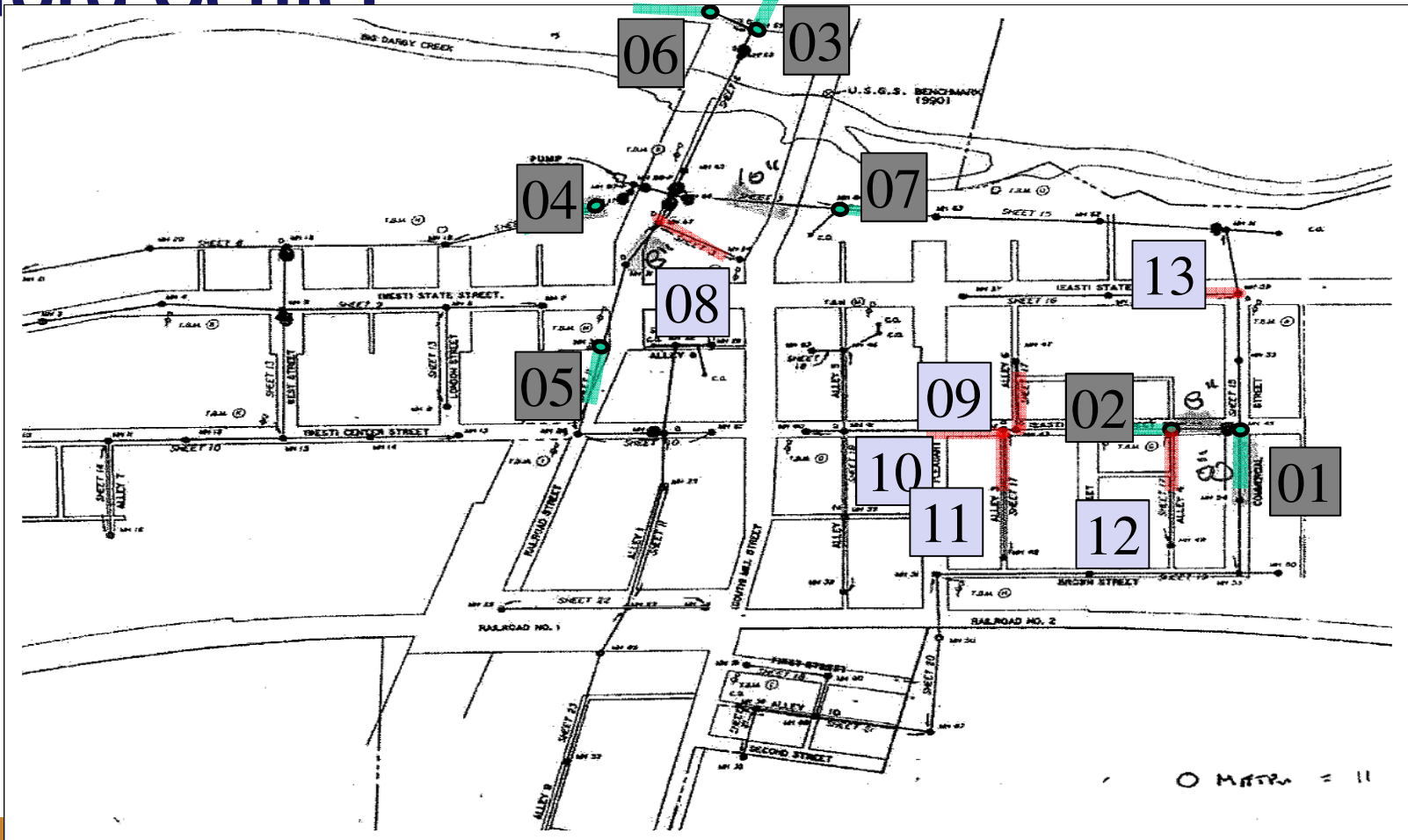
Neighborhoods to Investigate

Old Clay Pipe in Kentucky

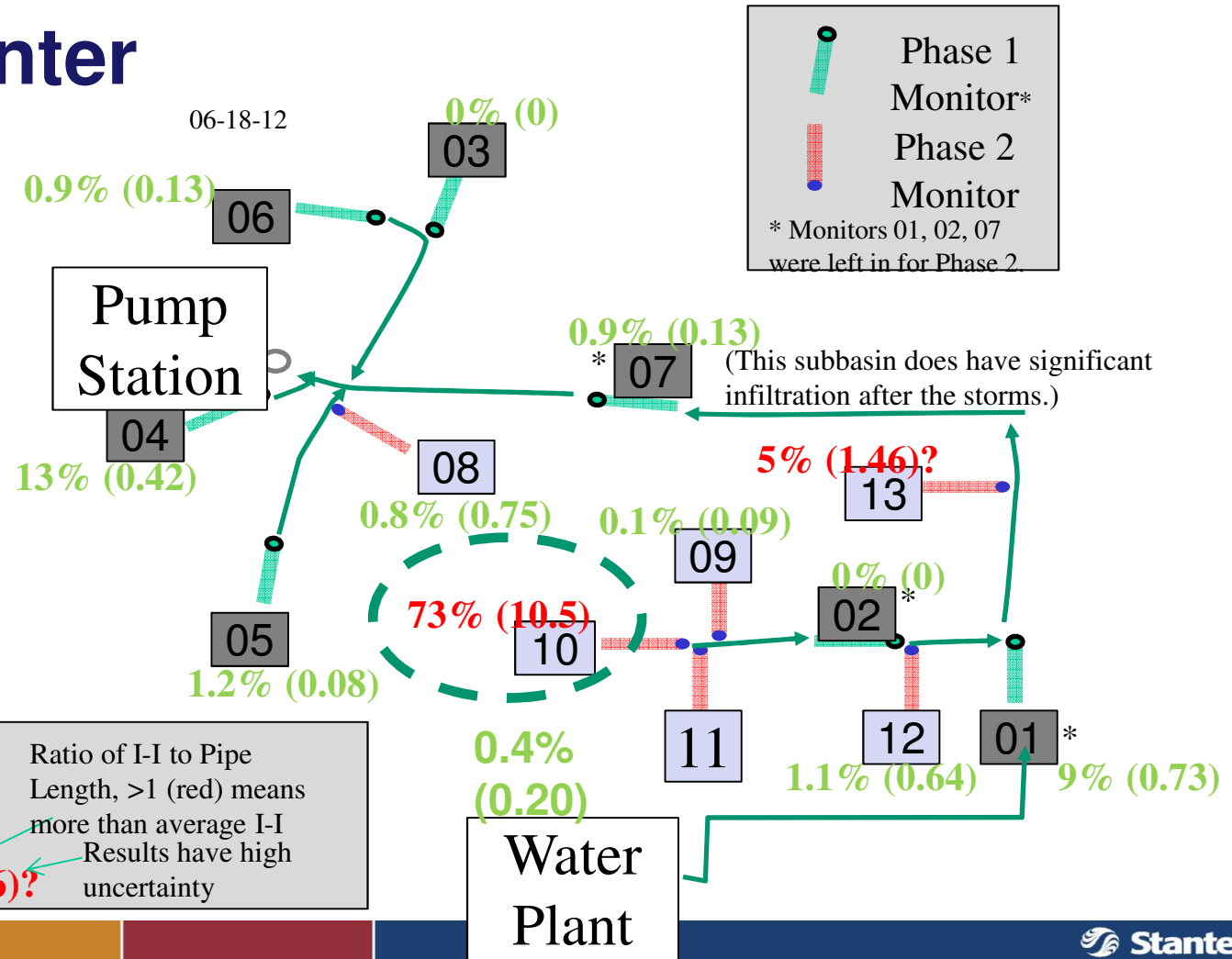


Neighborhoods to Investigate

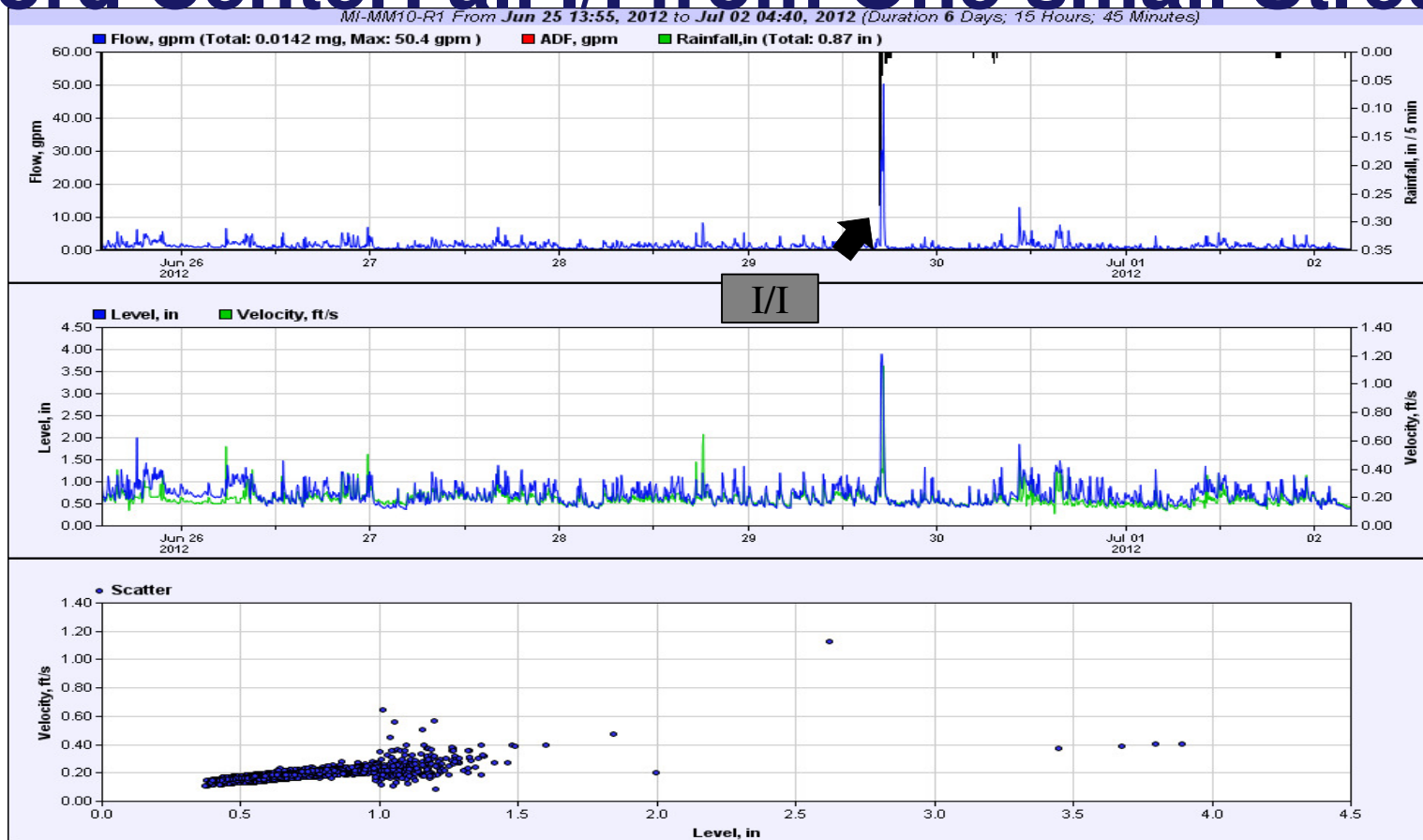
Milford Center



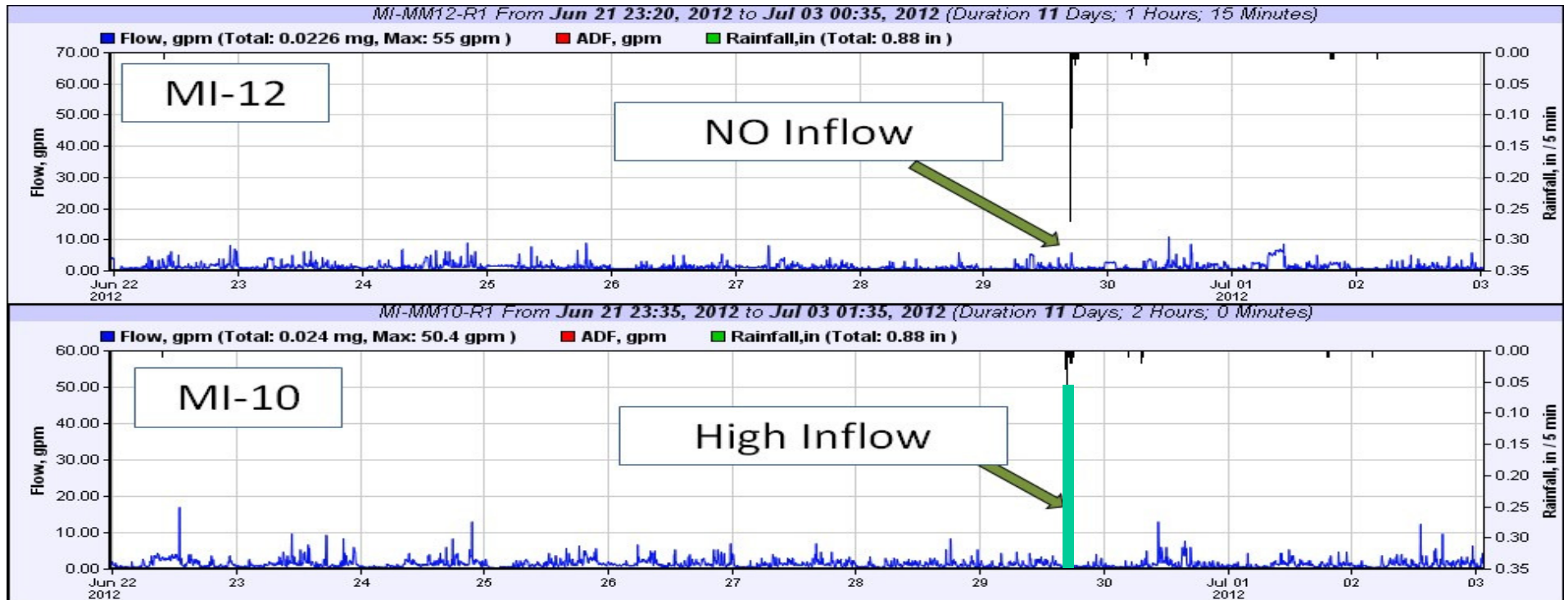
Milford Center



Milford Center: all I/I from One small Street



Milford Center: all I/I from One small Street



SWDCMA Micromonitoring in Aston

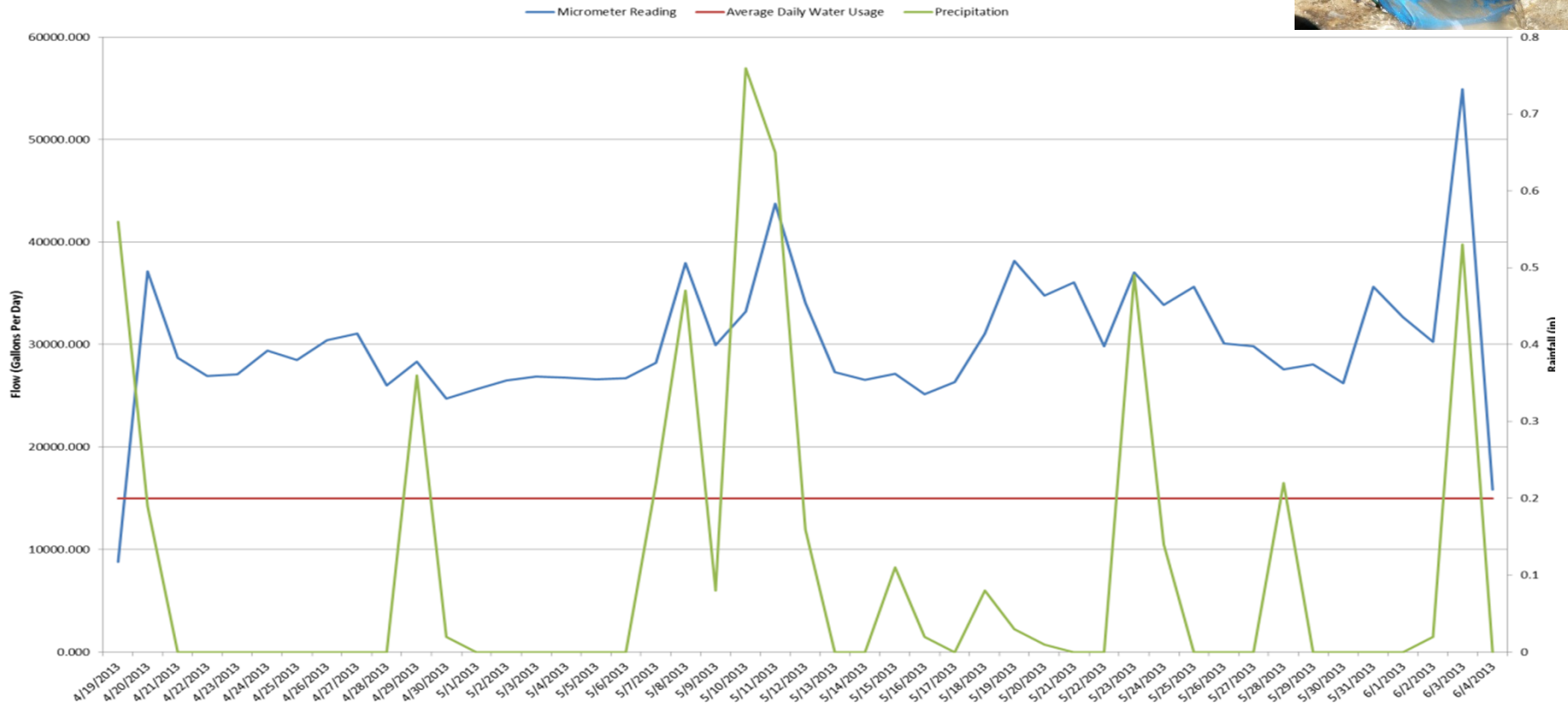
I/I volume during June 13, 2012 storm,
0.15 inch storm



	Length of Upstream Pipe (LF)	Percentage of Total Pipe in Basin	Volume I/I in Largest Storm (gal)	Volume I/I per LF of Pipe (gal/ft)
RM (total)	5,909	100%	4,047 *	0.68*
Subbasin flow	2,800	47%	Net negative	Net Negative
Williams Drive	1,306	22%	2,811	2.2
Anvil Road	1,803	31%	2,440	1.3

* Appears to be underestimated. Stantec did not operate this meter

SWDCMA Micromonitoring in Aston



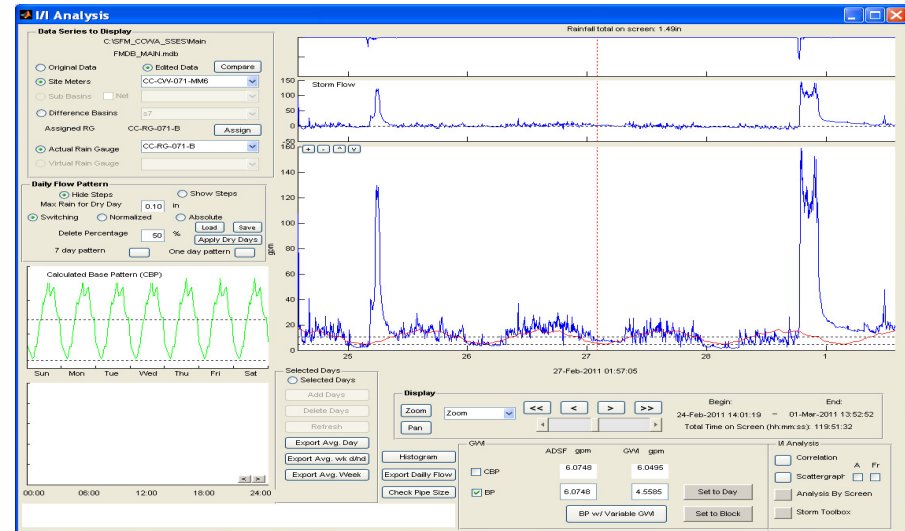
B2

Micromonitoring: Limitations

Current sizes are 6, 7, 8 and 10" pipes

Overestimates during surcharge and steep pipes

Difficult to install with curved fillet



Slide 55

B2

Show pictures for each point in animation

Bhuvana, 4/29/2011

B1

Micromonitoring: Advantages

Significant I/I sources (the cost effective ones)

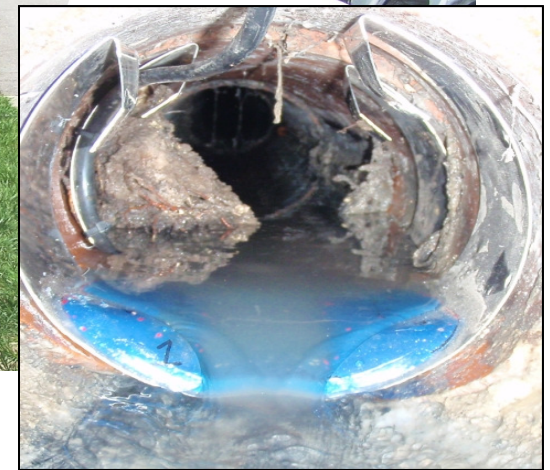
Low flow

No CSE (one-man crew)

Non-Invasive

Used at Poor Quality sites

LOWER COST!!



Slide 56

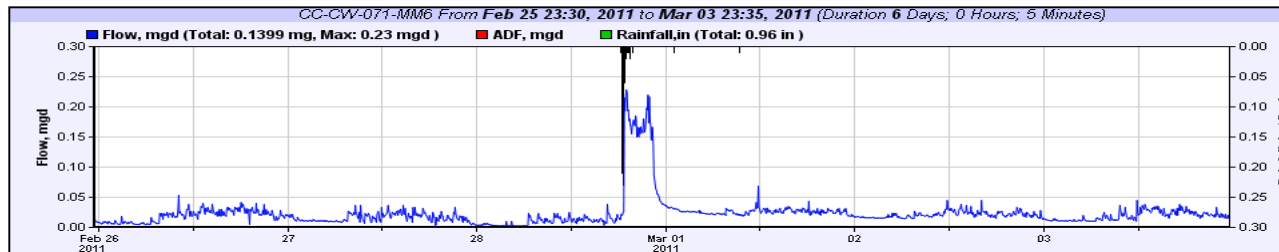
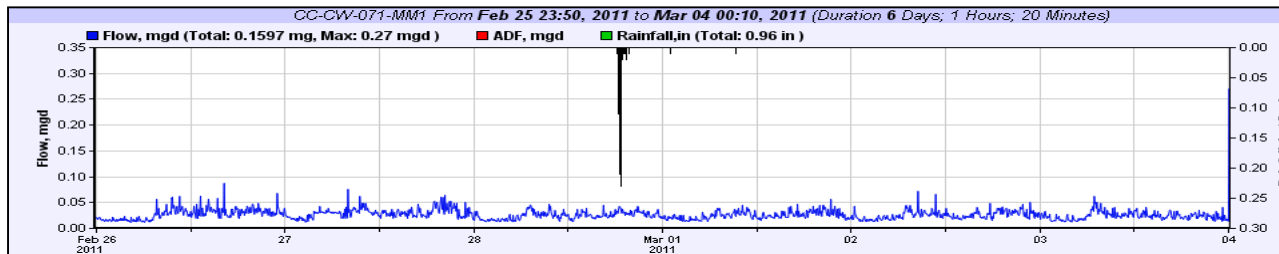
B1

Show pictures in animation for each point

Bhuvana, 4/29/2011

B4

What Contributes Most to the Low Cost?



The One Storm Answer!!

Slide 57

B4

Show pictures in animation for each point

Bhuvana, 4/29/2011

Micromonitoring: Questions?

