

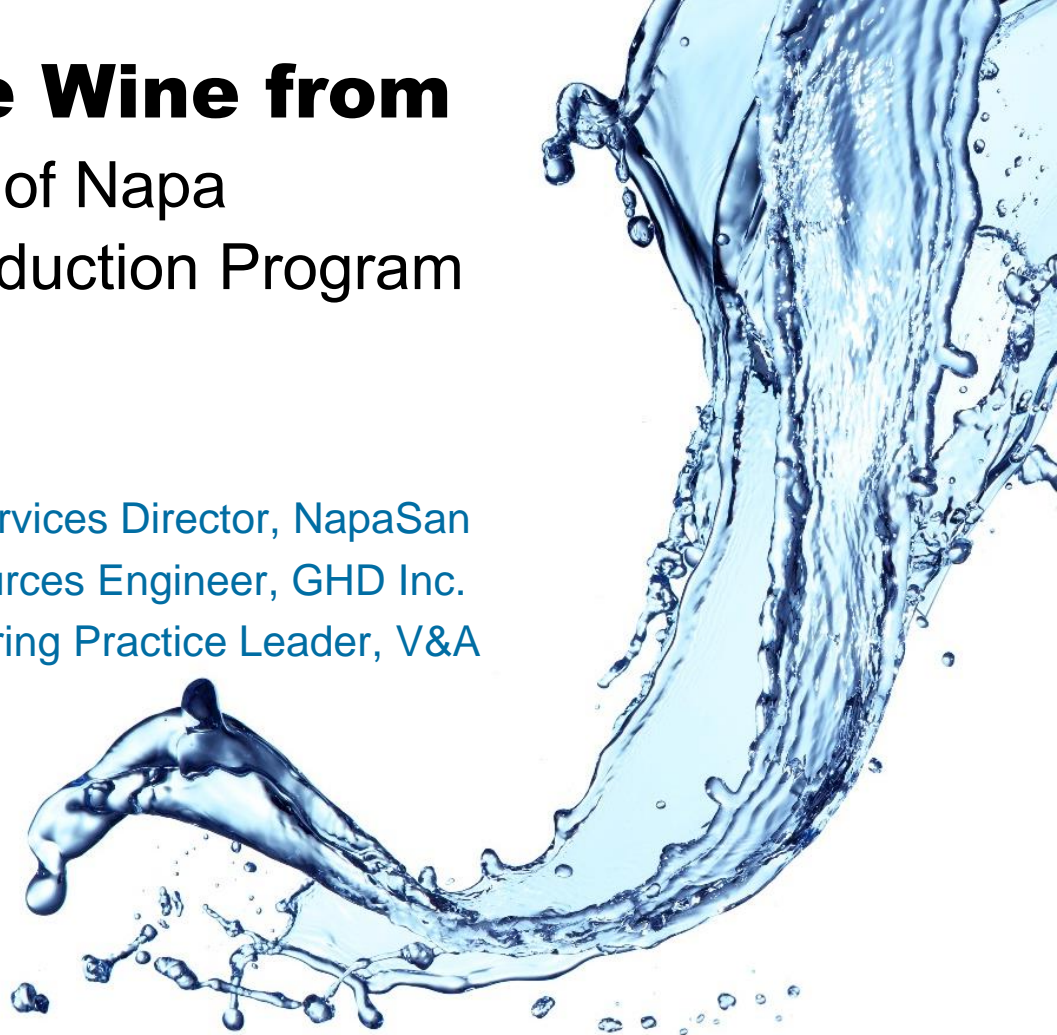
You Can't Squeeze Wine from a Stone: The Success of Napa Sanitation District's I&I Reduction Program

WEFTEC 2017

Andrew Damron, PE | Technical Services Director, NapaSan

Matt Winkelman, PE | Water Resources Engineer, GHD Inc.

Kevin Krajewski, PE | Flow Monitoring Practice Leader, V&A



Agenda

- Overview and Owner's perspective
- I&I planning
- Field work and I&I analysis
- Q&A

NapaSan

- Founded in 1945
- Wastewater
 - 6.0 mgd dry weather
 - 55 mgd peak flow (wet weather)
 - 90 mgd (model = unattenuated flow)
- Discharge in the winter to the Napa River
- Recycled water to irrigation customers in the summer

NapaSan I&I Program Overview

- Collection System Master Plan (2007)
 - \$120 million in capacity expansion projects
 - Recommend 5-year pilot program
 - Delayed analysis due to California drought
- Six completed projects with measured flow reductions

NapaSan I&I Program Results (2010 – 2016)

Project Name	Project Year	Pre- Project Peak Flow Rate (mgd)	Post- Project Peak Flow Rate (mgd)	Peak Flow Rate Reduction (mgd)	Percent Peak Flow Rate Reduction	Cost to Reduce 1.0 mgd Peak Flow Rate (\$M) ¹
Project Type: Sewer mains, manholes, and lower laterals ²						
Upper Alphabet / Stonecrest ³	2011	4.10	2.58	1.52	37%	0.6
		2.54	0.51	2.03	80%	
Basin L#1	2012	4.08	2.68	1.40	34%	1.2
Basin L#2	2013	1.03	0.92	0.11	11%	27.6
Basin L#3	2014	5.63	4.18	1.45	26%	2.2
Basin L#4	2015	5.30	3.12	2.18	41%	2.0
Basin L#5	2016	1.75	0.55	1.20	69%	1.7
TOTAL		24.43	14.54	9.89	40%	1.6

Notes:

1. Costs (\$million) in 2017 dollars
2. Percentage of basin assets included in each project varied
3. Upper Alphabet and Stonecrest areas were combined into one project

NapaSan I&I Program Results (2010 – 2016)

Project Name	Project Year	Pre- Project Peak Flow Rate (mgd)	Post- Project Peak Flow Rate (mgd)	Peak Flow Rate Reduction (mgd)	Percent Peak Flow Rate Reduction	Cost to Reduce 1.0 mgd Peak Flow Rate (\$M) ¹
Project Type: Miscellaneous improvements, including upper laterals						
Nipak State Streets – Ph 1	2011	6.43	5.35	1.08	17%	0.04
Nipak State Streets – Ph 2	2016	5.35	4.45	0.90	17%	0.10
Upper Laterals – Basin L	2015	0.18	0.07	0.11	61%	0.9
Upper Laterals – Spring St.	2010	0.19	0.13	0.06	32%	2.0

Notes:

1. Costs (\$million) in 2017 dollars

I&I Program Methodology

- System rehabilitation – infiltration reduction
 - Mains
 - Manholes
 - Laterals (public/private)
- Illicit connections – inflow reduction
 - Smoke testing
 - Public and private projects



Collection System Rehabilitation Benefits

- I&I reduction
- Repair of failing sewers
 - Decrease O&M costs
 - Avoid unexpected failures
- In advance of paving projects (City/County)

Rehabilitation Methods

Asset Type	Existing Material	Rehabilitation Method	Notes
Manhole	Brick	Coating	Mortar and epoxy (spray)
	Concrete	Grout Injection, Coating	As-needed based on condition (corrosion and infiltration)
Main	Asbestos Cement (ACP)	CIPP ¹	
	Clay (VCP)	Pipe bursting	HDPE (fused)
	PVC	N/A	No rehabilitation performed
Public Lateral	Asbestos Cement (ACP)	CIPP ²	
	Clay (VCP)	Pipe bursting ³	HDPE (fused)
	PVC	N/A	No rehabilitation performed
Private Lateral	Various	CIPP	Pilot projects only (limited scale)
Flush hole	Asbestos Cement (ACP)	CIPP	
	Clay (VCP)	Open cut	HDPE (fused)
	PVC	N/A	No rehabilitation performed

I&I planning



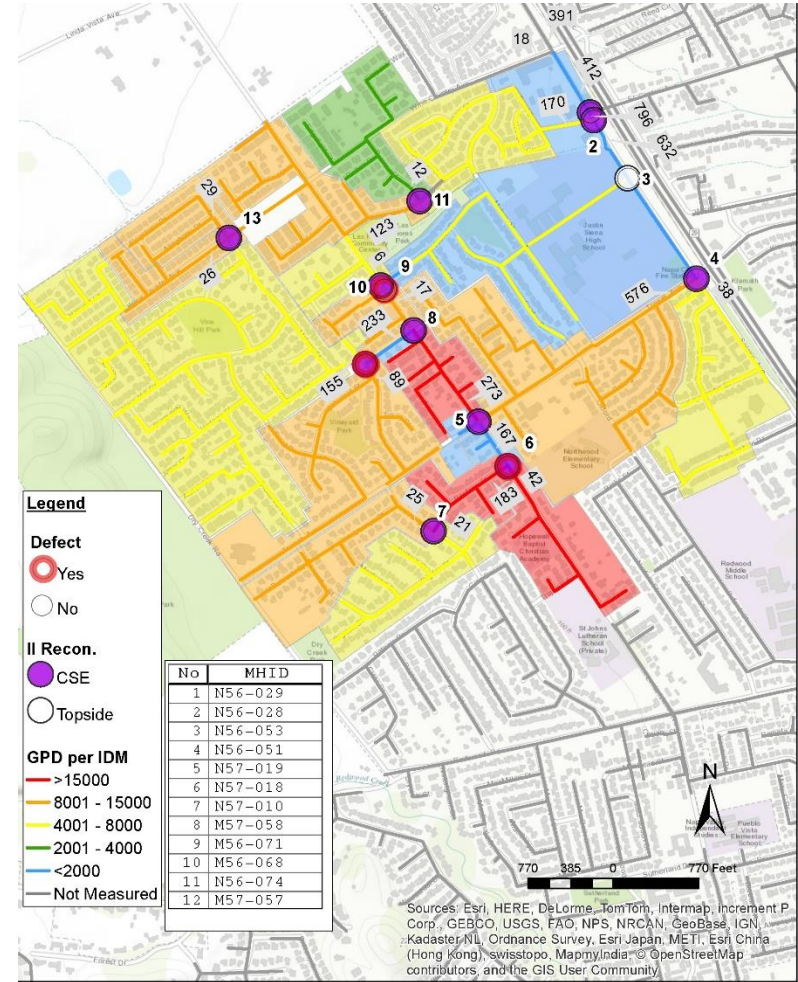
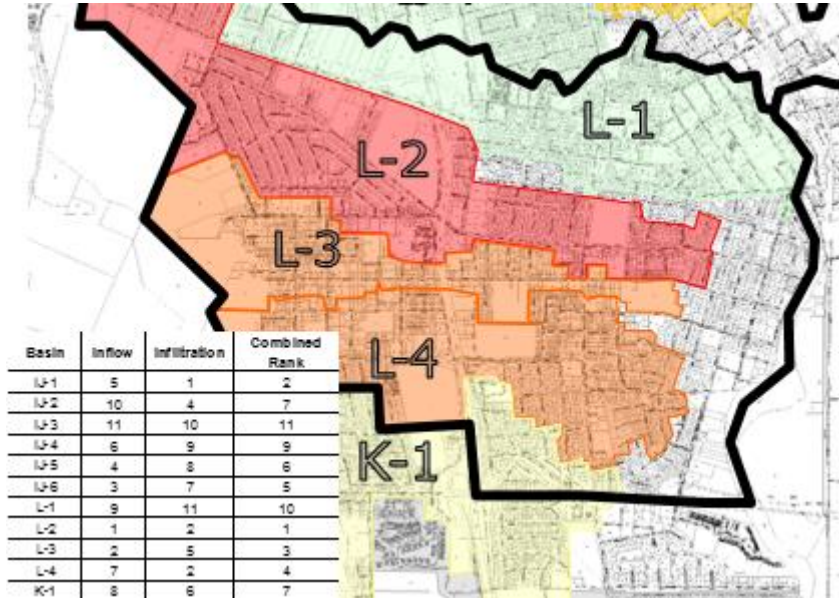
Evolving approach focused on improved results

- Dry weather vs. wet weather field inspections

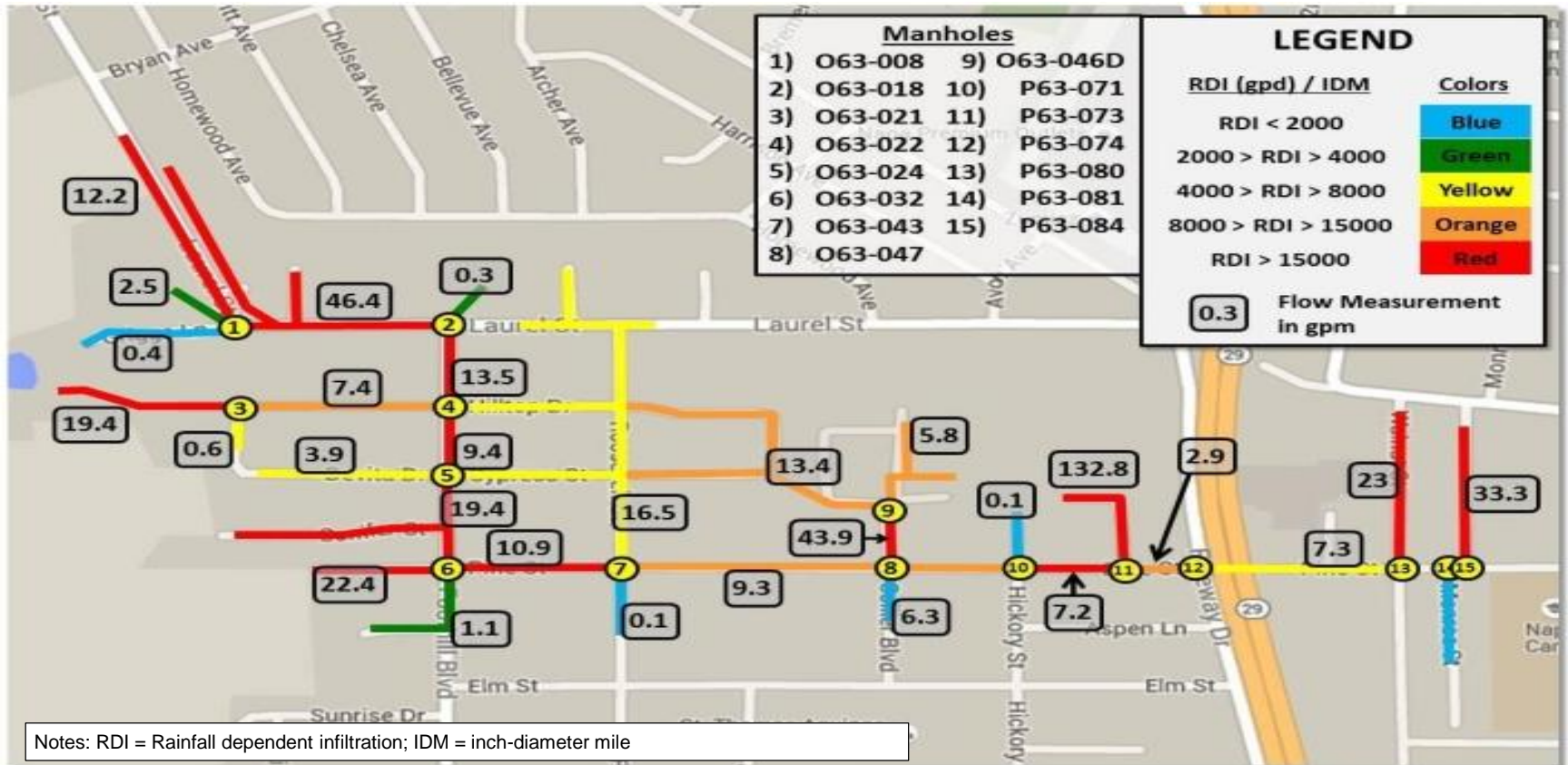


Evolving approach focused on improved results

- Increased research for assets contributing higher levels of I&I



Evolving approach focused on improved results



Evolving approach focused on improved results

Additional changes in the program

- Review of age and pipe material data
- Enhanced coordination with the City and County on paving project schedules
- Pre-project flow monitoring – multiple phases
- CCTV inspection – targeted areas only
- Post-project flow monitoring

Field work and I&I analysis



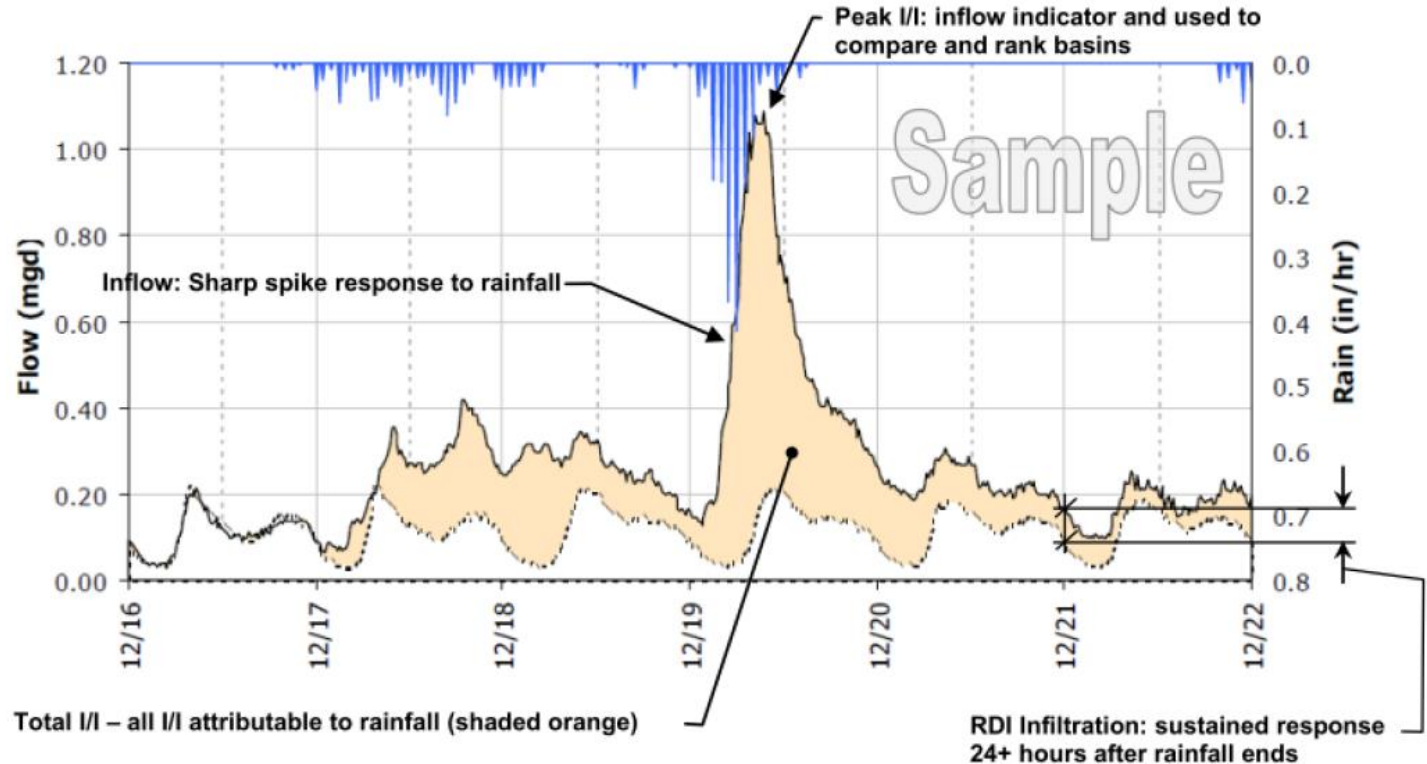
Field work

- Pre-project flow monitoring
- Nighttime I&I reconnaissance
- CCTV inspection
- Inspection of project areas to search for sources of inflow
- Post-project flow monitoring



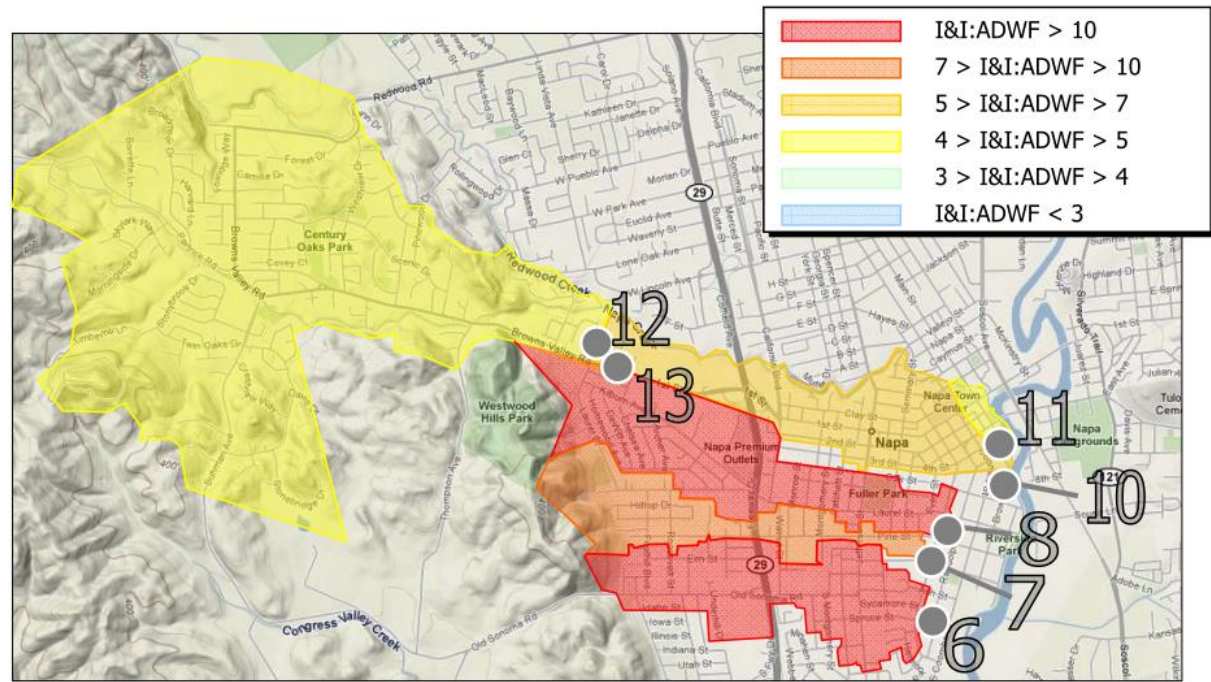
Field work: pre-project flow monitoring (I&I identification)

- Inflow vs. infiltration



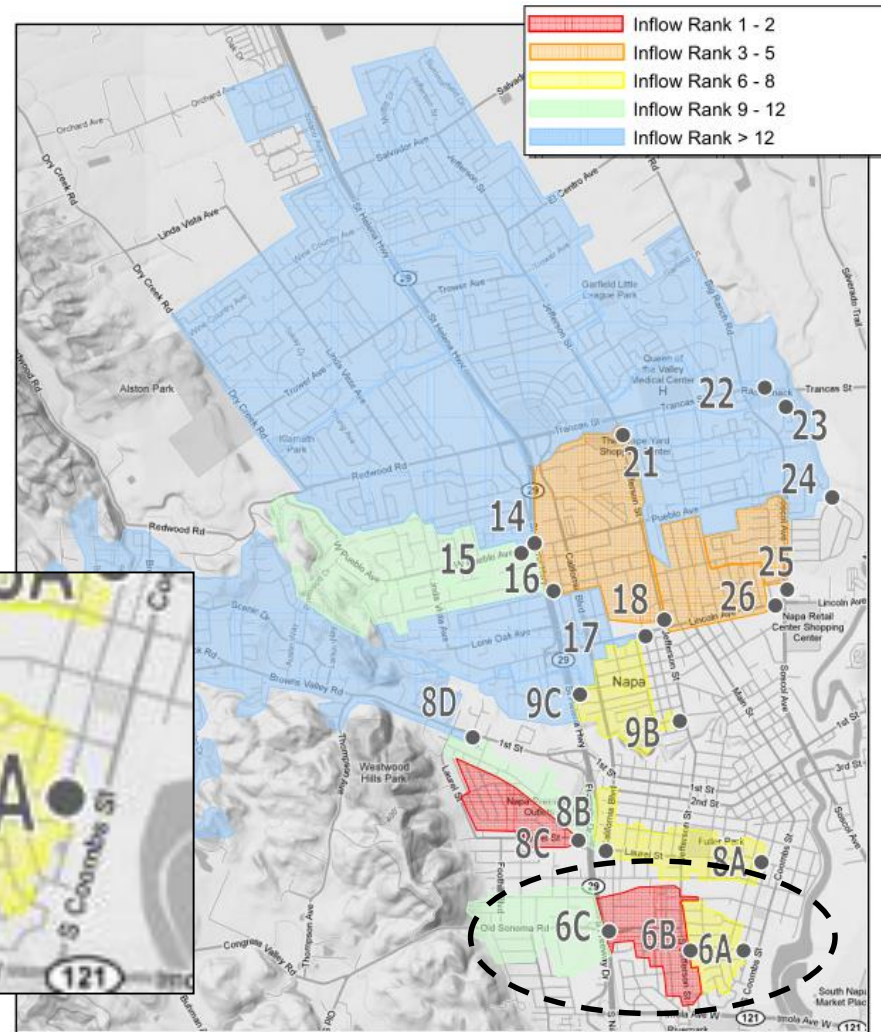
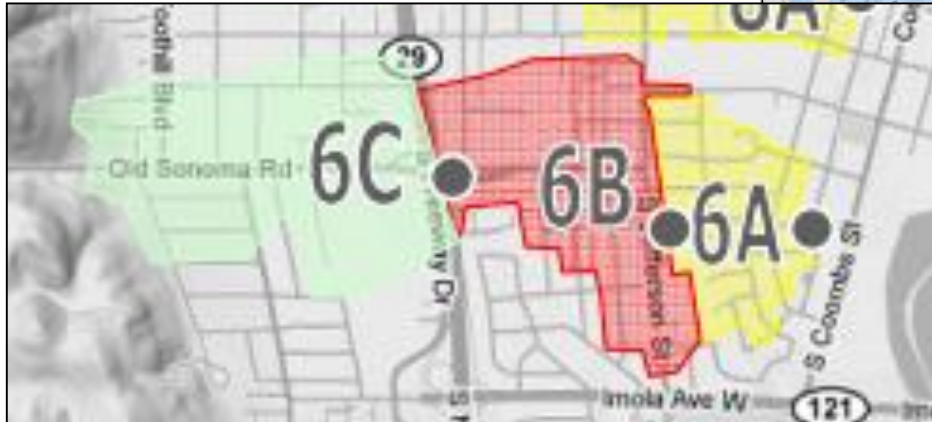
Field work: pre-project flow monitoring (course)

- Full collection system: basin by basin analysis



Field work: pre-project flow monitoring (finer)

- Sub-basin I&I analysis



Field work: pre-project flow monitoring (finest)

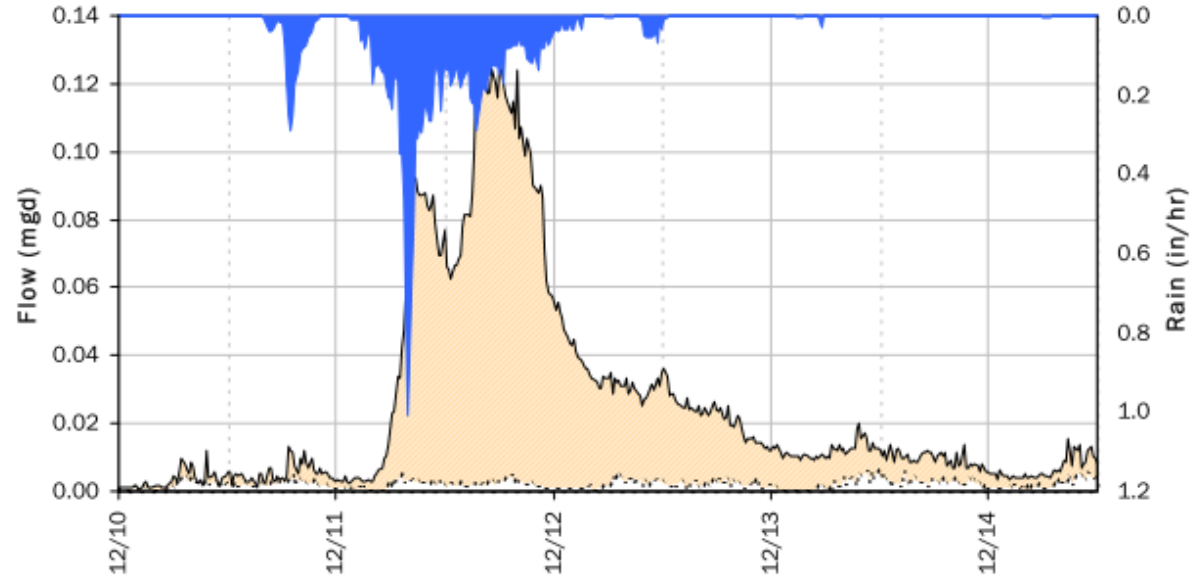
- Construction areas identified
- Example: Basin L Upper Lateral #1



Field work: pre-project flow monitoring (finest)

- Pre-project flow monitoring conducted (Basin L Upper Lateral #1)

Event 1 Detail Graph



Storm Event I/I Analysis (Rain = 4.62 Inches)

Capacity

Peak Flow: 0.13 mgd

PF: 58.25

Inflow / Infiltration

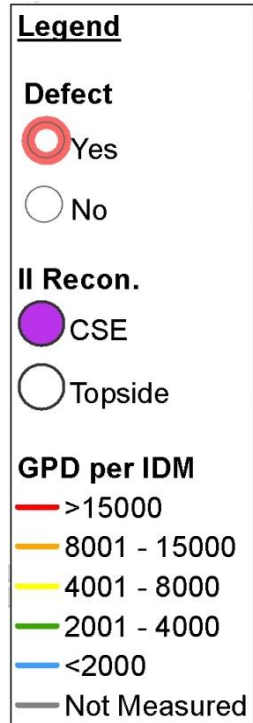
Peak I/I Rate: 0.12 mgd

Total I/I: 104,000 gallons

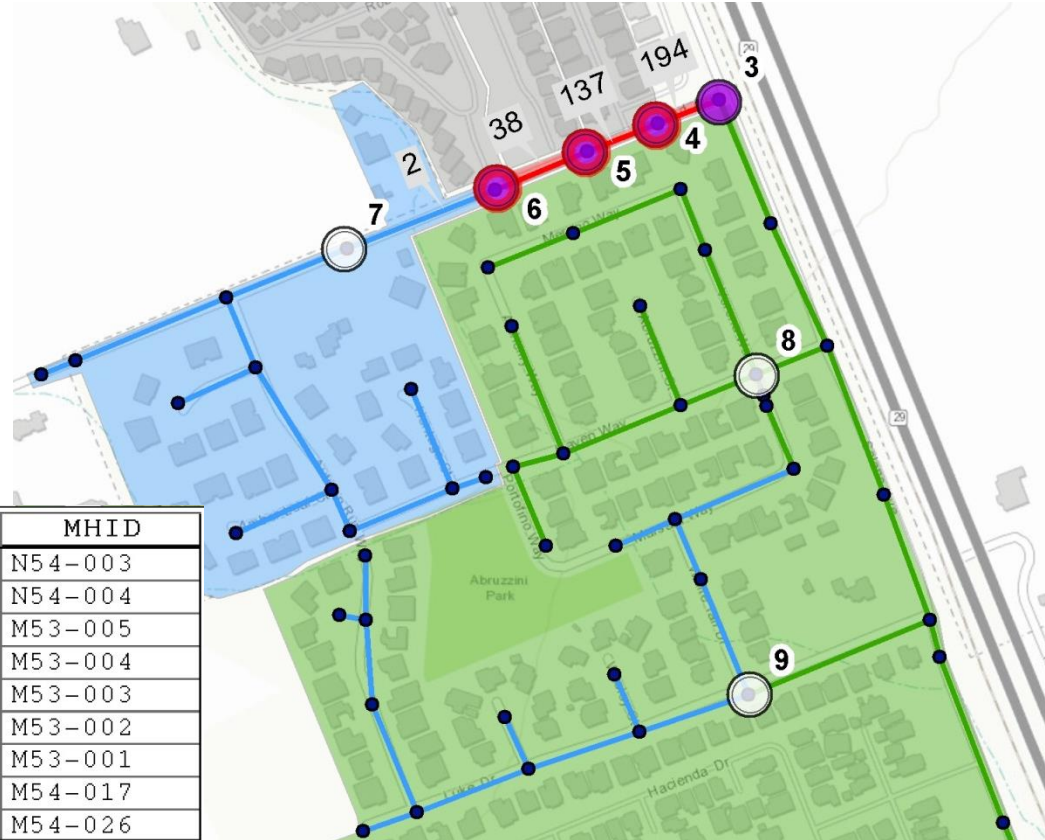
Field work: nighttime I&I reconnaissance

- Work conducted between 12 midnight and 4:30 am
- Investigative: follow the clear water
- Take spot measurements to produce a “hot-spot” temperature map
- Videos and photos as required

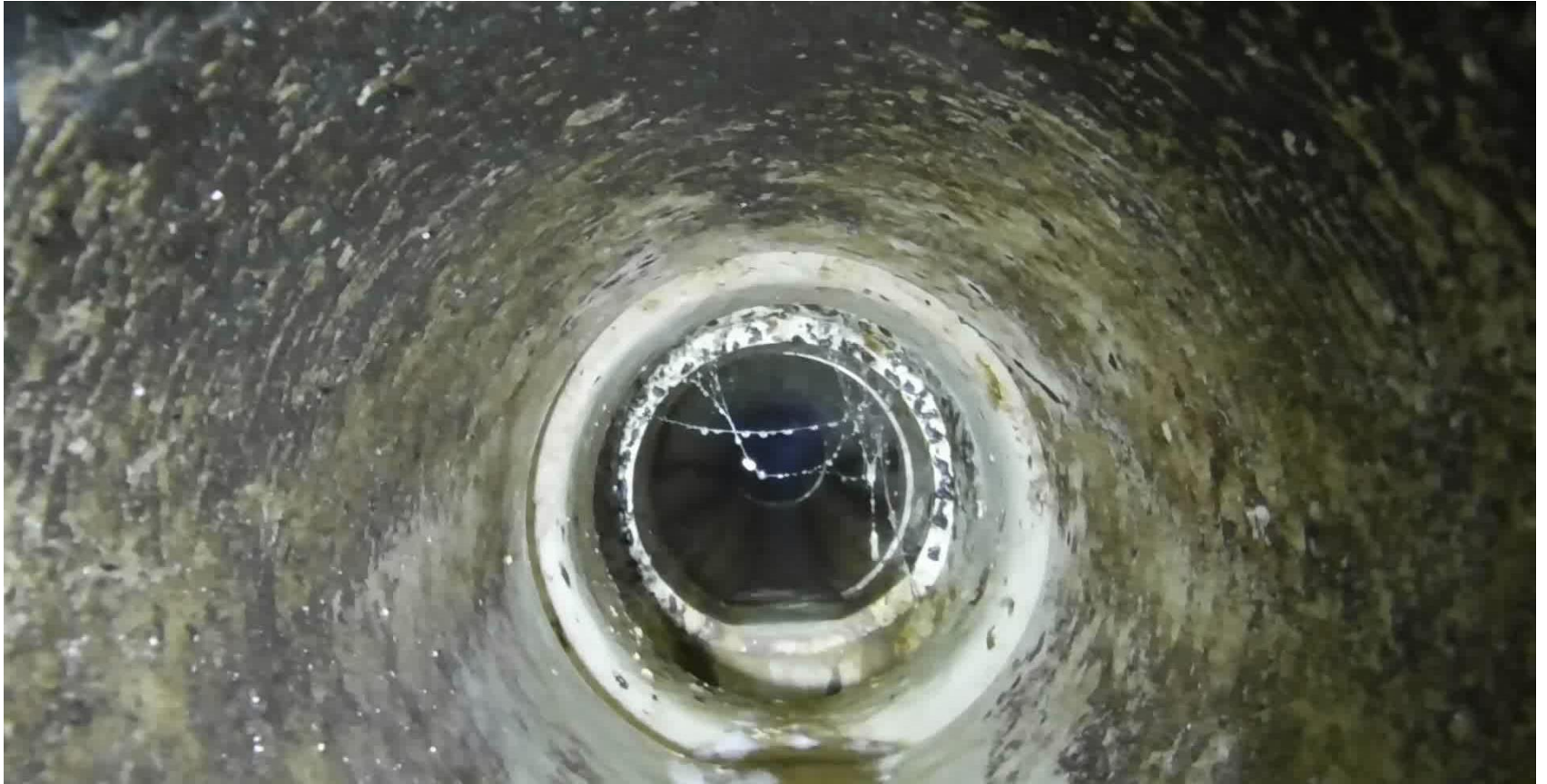
Field work: nighttime I&I reconnaissance



No	MHID
1	N54-003
2	N54-004
3	M53-005
4	M53-004
5	M53-003
6	M53-002
7	M53-001
8	M54-017
9	M54-026

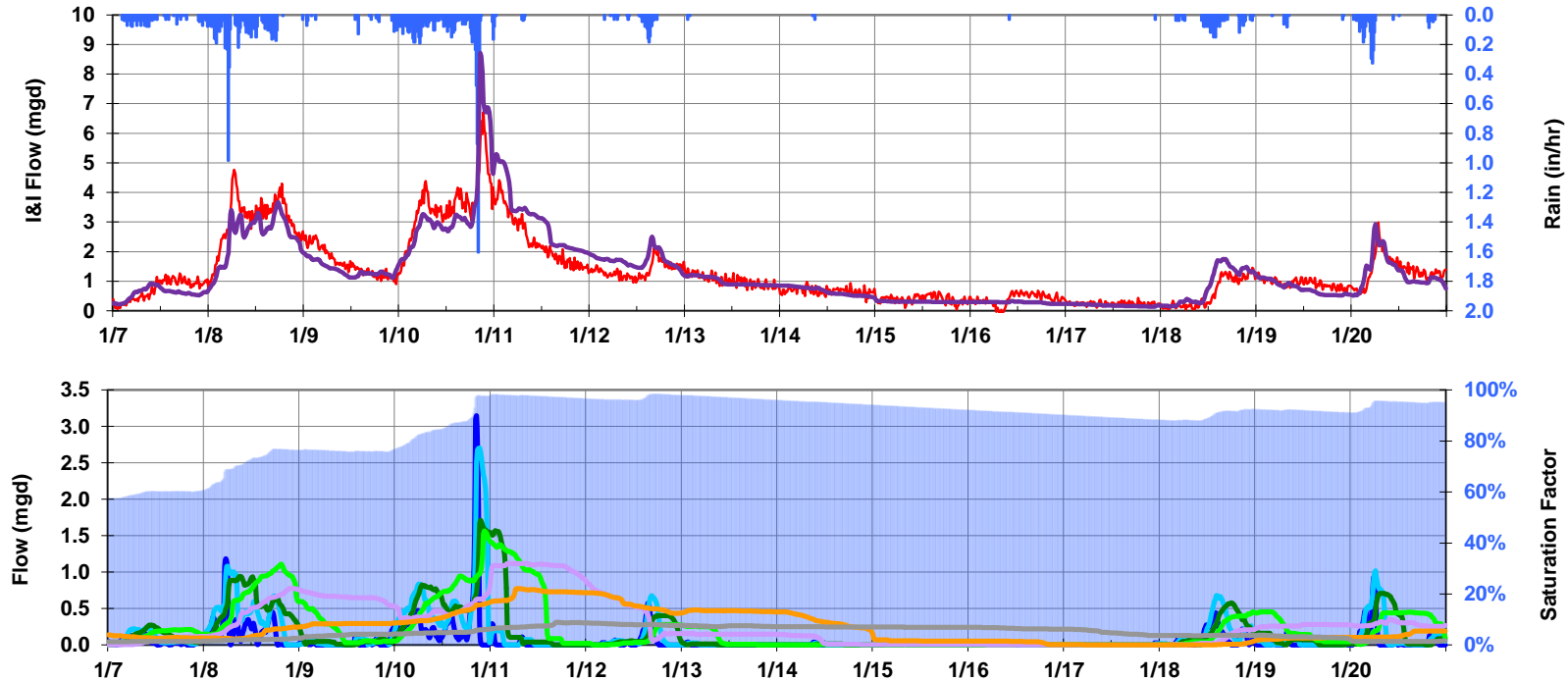


Field work: nighttime I&I reconnaissance

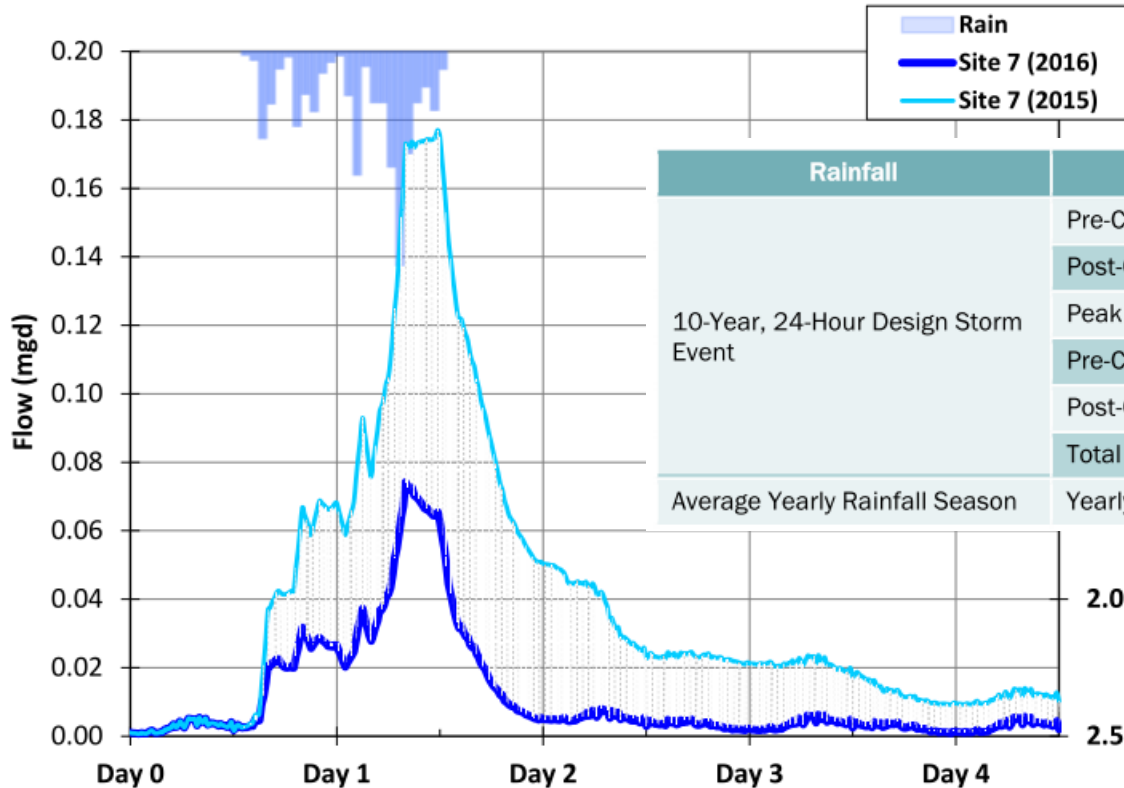


Field work: post-project flow monitoring

- Synthetic I&I hydrograph modeling and comparison



Field work: pre- and post-project I&I response comparison



Rainfall	Item	Result
10-Year, 24-Hour Design Storm Event	Pre-Construction Peak Design Flow:	0.18 mgd
	Post-Construction Peak Design Flow:	0.07 mgd
	Peak Flow Reduction:	0.10 mgd (58%)
	Pre-Construction Total I/I Contribution:	169,000 Gallons
	Post-Construction Total I/I Contribution:	42,000 Gallons
	Total I/I Reduction:	127,000 Gallons (75%)
Average Yearly Rainfall Season	Yearly I/I Reduction:	1,000,000 Gallons

Conclusions and looking forward

- Private lateral pilot projects
- Refine what is “good enough”
- I&I Program funding
- Work smarter and not harder
- Future collection system planning

Thank You

WEFTEC 2017

