Lower Costs, Lower Risks…
New Relief through Optimized Cleaning


Cleaning Optimization


CSO Monitoring & Reporting


I/I Reduction


Capacity Management


Accurate Billing

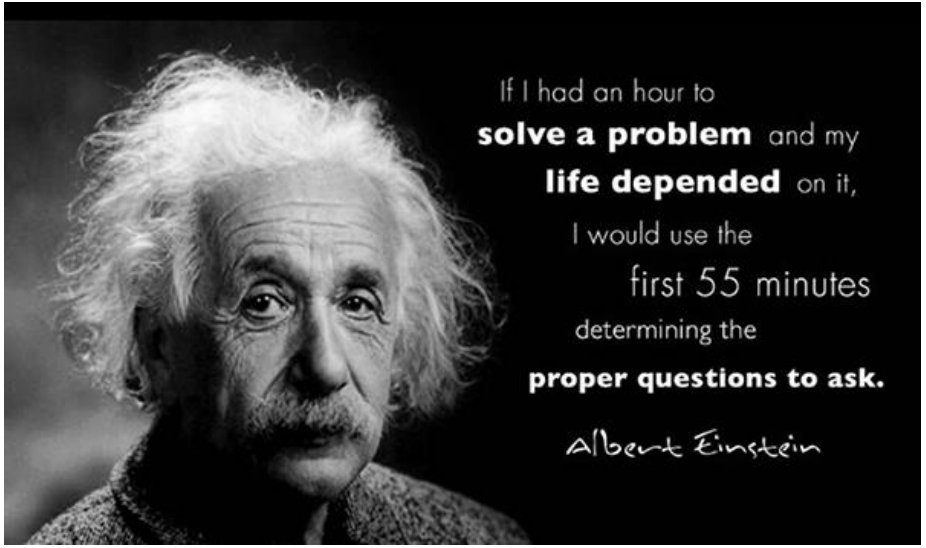

Hydraulic Model Calibration

Heather McPherson P.E.
Business Development Manager
ADS Environmental Services

AGENDA

- The History to *Best Practices* Today
- A Forward Path
- Three Case Studies
- Technology Supporting Solutions

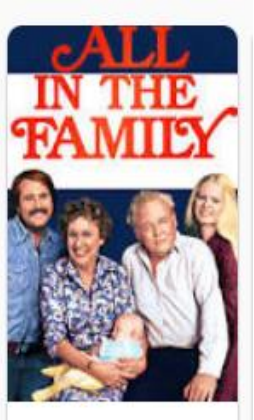
- Questions & Answers



Remembering *1972*

Biggest Hit Movie

Biggest Hit TV Show



Living in '72

- Average new house cost: $29,000
- Average Income/Year: $12,000
- Cost/Gallon of gas: $0.55

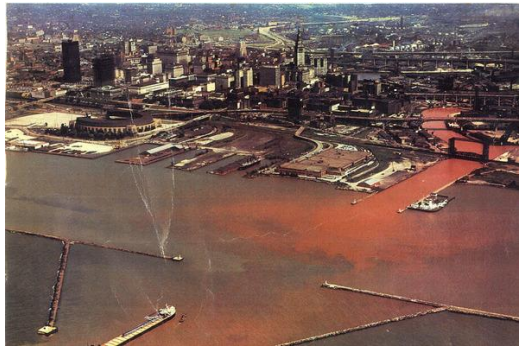
In the News in '72

- Dow Jones: 1st time above 1,000
- Apollo 16 & 17 last two Moon landings
- Watergate break-in

The Big News for Water

Two-thirds of US lakes, rivers and coastal waters deemed *unsafe* to swim or fish…

The Picture & the Response



EPA Created

Granted Authority to

- Implement pollution control programs
- Set water quality standards
- Prohibit or permit pollutant discharges
- Fund sewer treatment plant construction

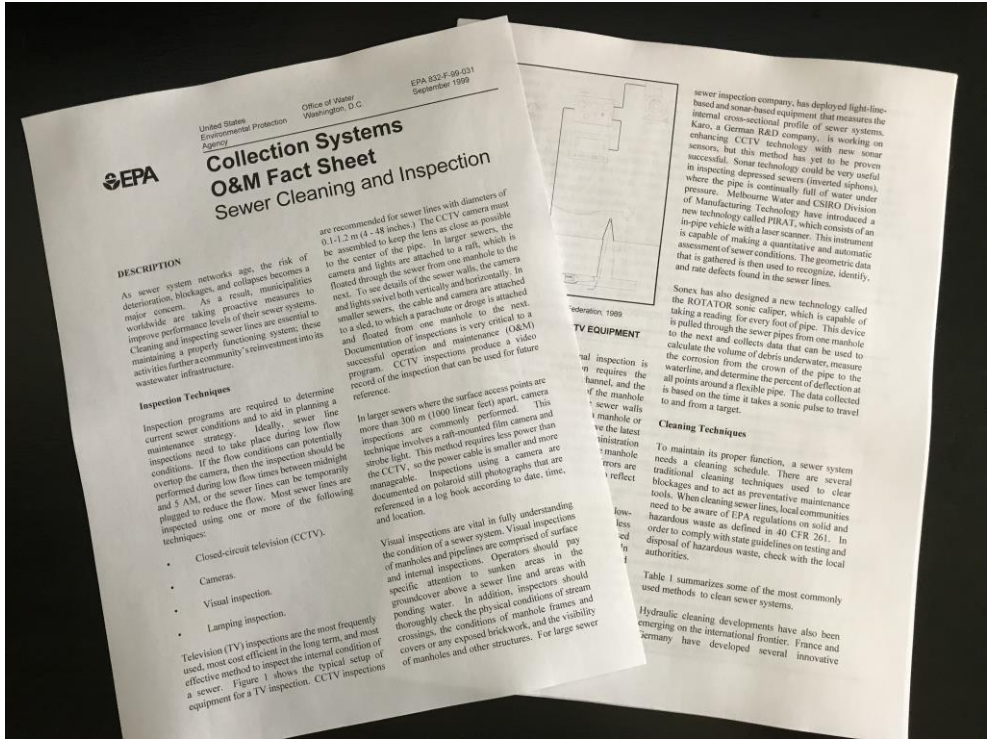
EPA's *Plan*

Problem to be solved:
Prevent SSOs

EPA provides guidance promoting "the *value of planning* for tackling critical issues."

CMOM forms and shapes the plan:
Capacity, Management Operations and Maintenance
Processes & *Best Practices*

Driving Principles & 'Best Practice':
***Clean* & Inspect**


United States Environmental Protection Agency
Office of Water Washington, D.C.
EPA 832-F-99-031 September 1999
EPA
Collection Systems O&M Fact Sheet
Sewer Cleaning and Inspection
DESCRIPTION
Inspection Techniques
Cleaning Techniques

EPA Guidance Document: 'Collection System O&M Fact Sheet'
***Sewer Cleaning and Inspection,* September, 1999**

Decades Old Cleaning 'Best Practice'

Approach

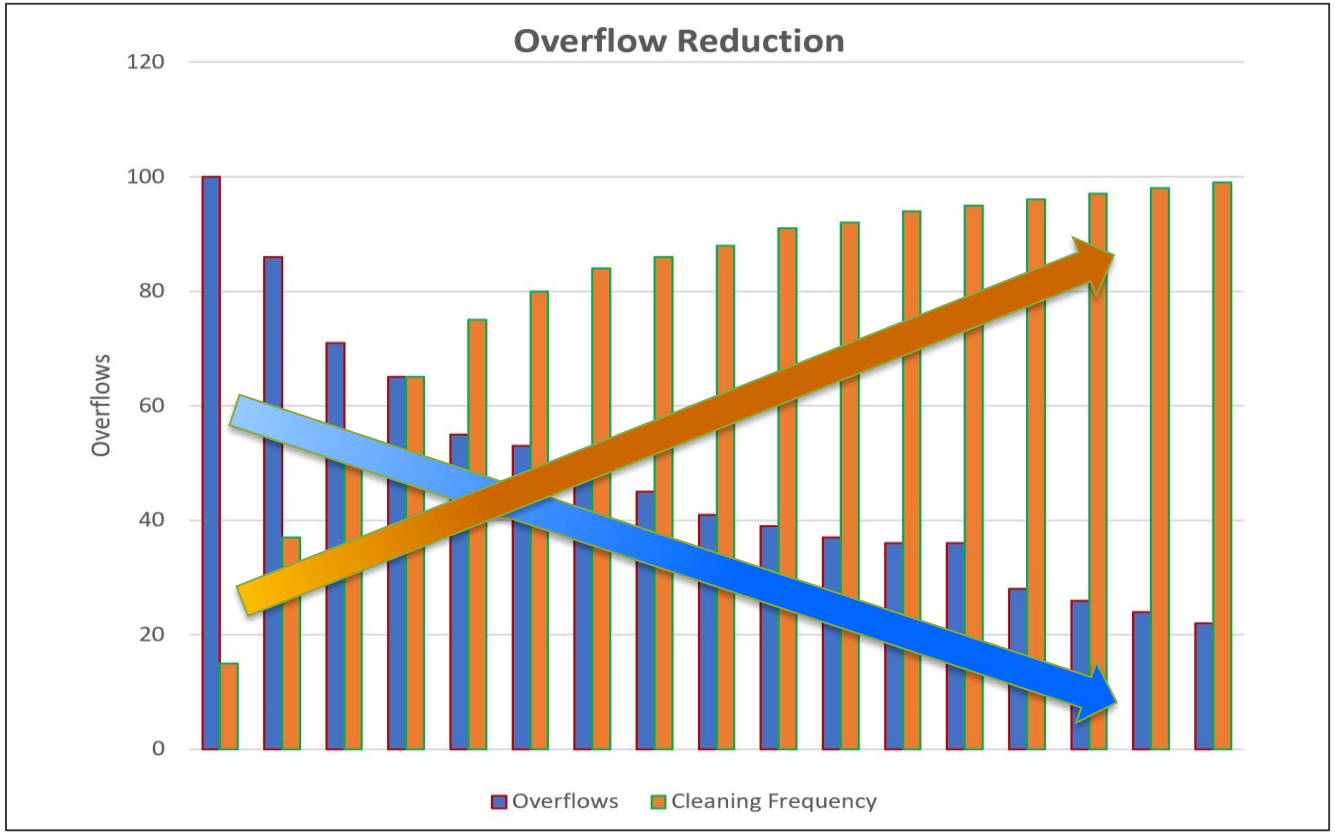
Overclean **and stay ahead of build-up**

Total System Cleaning
Single to multi-year cycles, collection system size dependent

"Hot Spot" Cleaning
High frequency segments cleaned weekly, monthly, quarterly.

Cleaning Frequency & SSOs

High Frequency Cleaning = *Overcleaning* = *SSO reductions*



Utility Challenges

Keeping up with the schedule

- Too much time devoted to HF sites
- Process requires CCTV
- Equipment & personnel availability

Aging infrastructure increases maintenance demands

- More to do often with no budget increase

SSO rate no longer improving (maybe worse)

- Blind to remote conditions
- Systemic changes e.g., aging pipes

Overcleaning: Truth & Consequence

Cleaning when site conditions don't require it is *overcleaning*.

Overcleaning Consequences

- Increased pressure on maintenance staff
- Escalation of maintenance costs
- Accelerated pipe wear
- Field staff spend more time in traffic
- No remote site visibility between cleanings

Ground Truth…

"We're busy so who wants to clean already clean pipes?"

"The schedule says to clean but it doesn't mean it needs it."

"When you can't see what's going on, you clean to be safe."

The core issue?

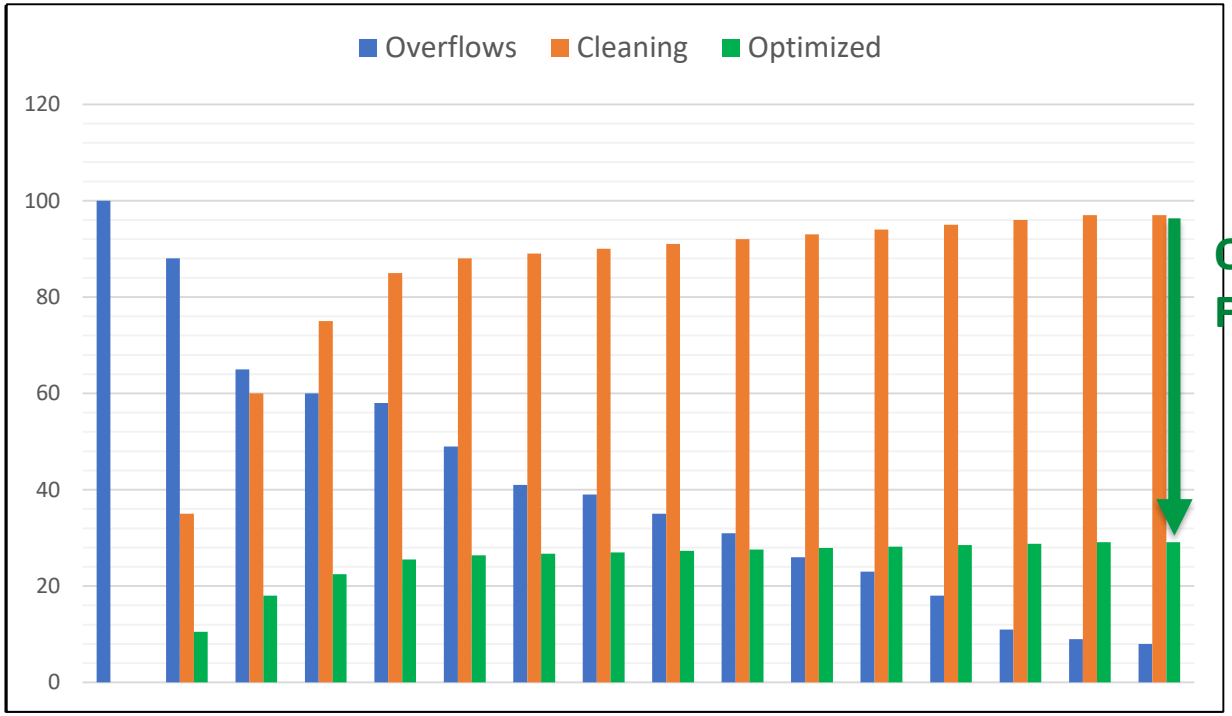
Lack remote site condition visibility


Forging Change
through
Optimization

What is Cleaning Optimization?

***Right-sized cleaning* frequency**

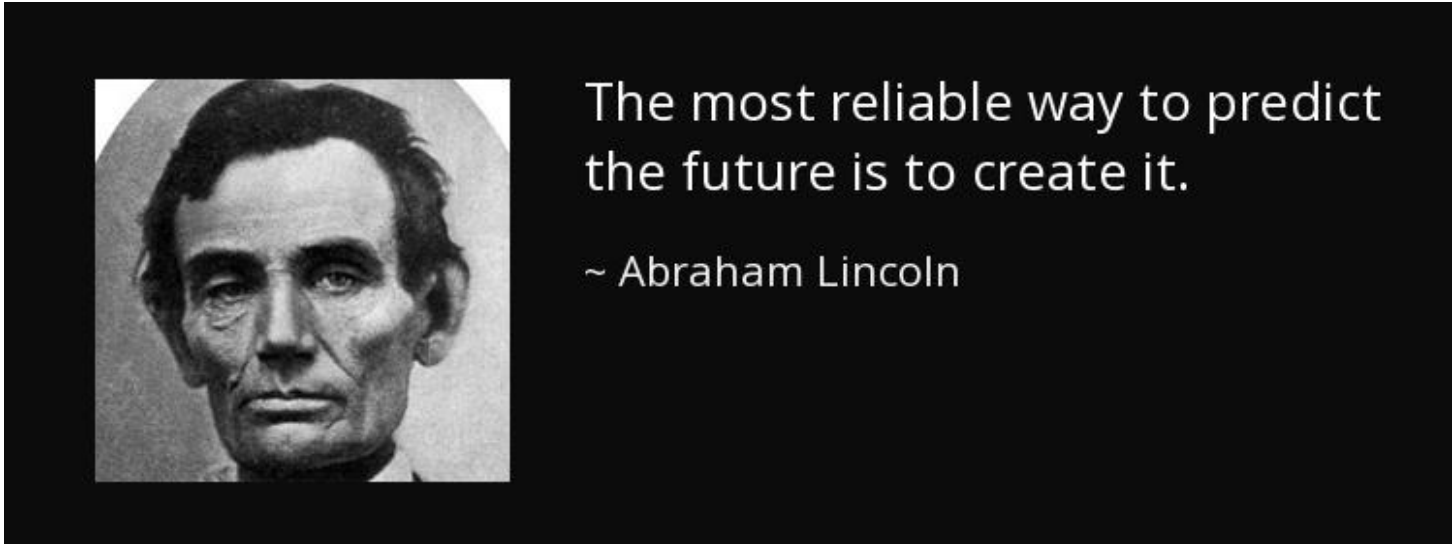
Driven by real-time, *remote site conditions*



Optimized Cleaning:

Lower Frequency *and* enhanced SSO prevention

Creating the Future



Creating the future: envision sustainable processes

The Sustainable Vision

Optimized Cleaning

Remote site conditions drive decision to clean

Sustainable performance & peace of mind

The Present		The *Future*
Schedule-driven cleaning	→	***Site condition-driven*** cleaning
Blind to remote site conditions	→	Site conditions ***always visible & known***
Observations experience dependent	→	Observations ***data-driven***, consistent performance measurement


Is it just data that we want?

Case Studies

La Mesa, CA Case Study

Situation

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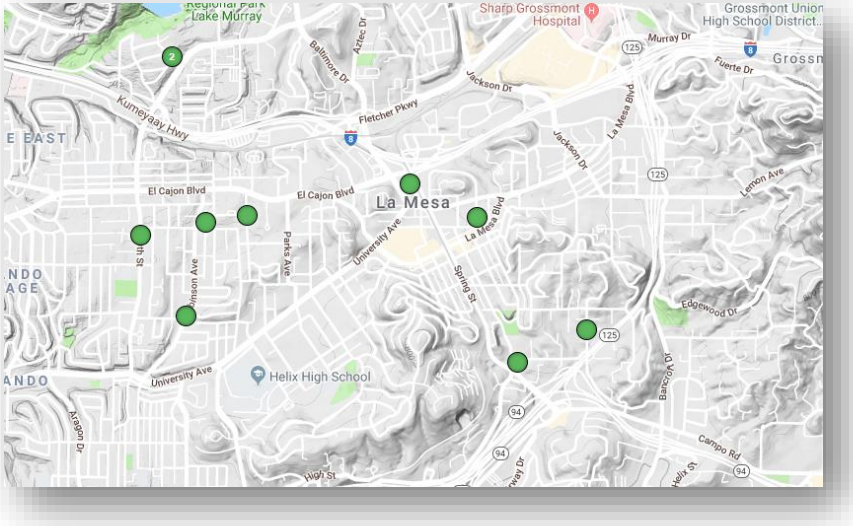
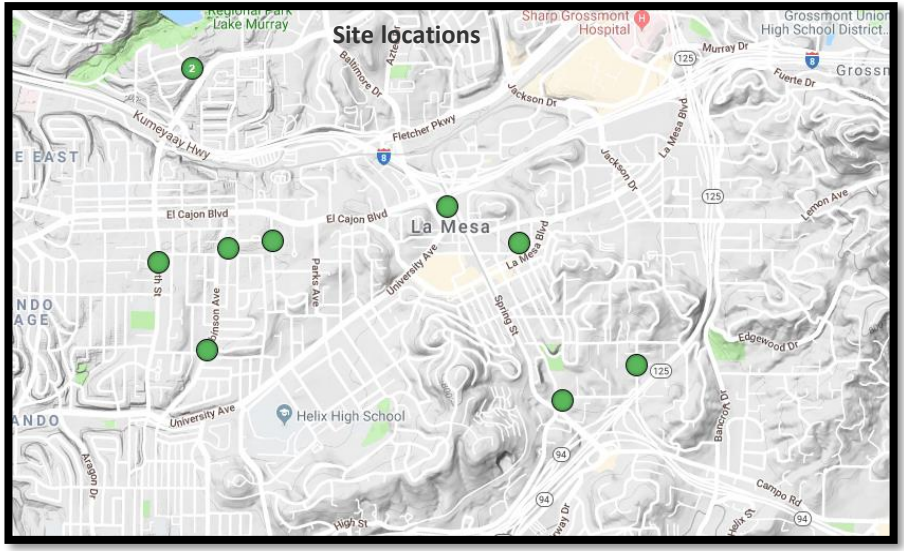
System	153 miles sewer, 53 miles storm
Process	Clean Total System Annually Clean 100 segments- monthly/quarterly
Challenges	80% maintenance time spent cleaning



La Mesa, CA – Optimized Cleaning Process Action Plan

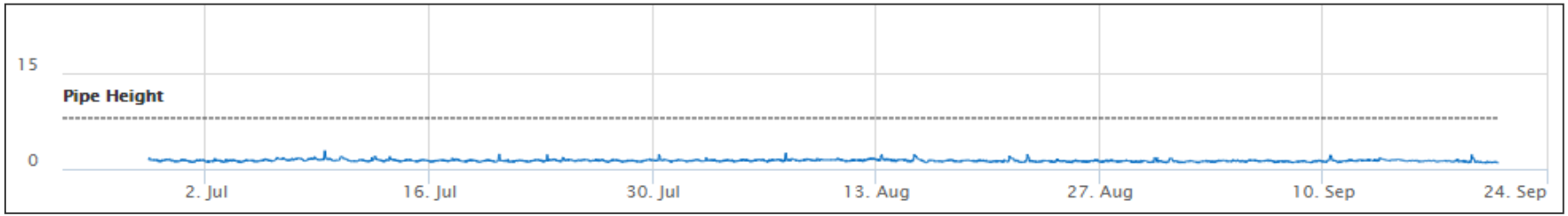
Study Approach

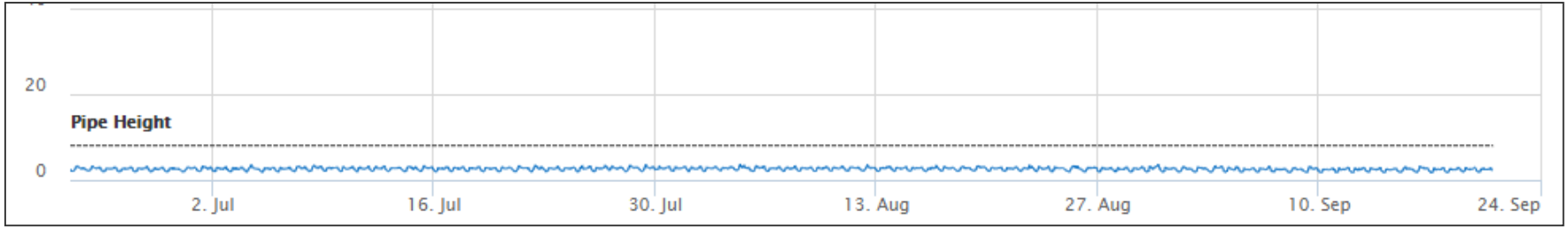
- Ten (10) sites being cleaned monthly selected
- Duration: 6 months
- Real-time level monitors installed
- Cleaning decision: *site conditions* communicated, software alerts and prioritizes
- Log cleaning instances: measure reductions

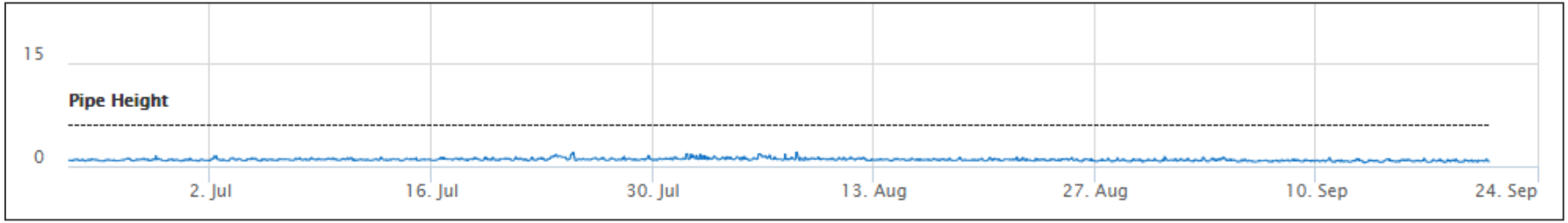


Stable depths for 4-months

Flow depth <50% of pipe diameter- all sites
Action? *Don't clean*

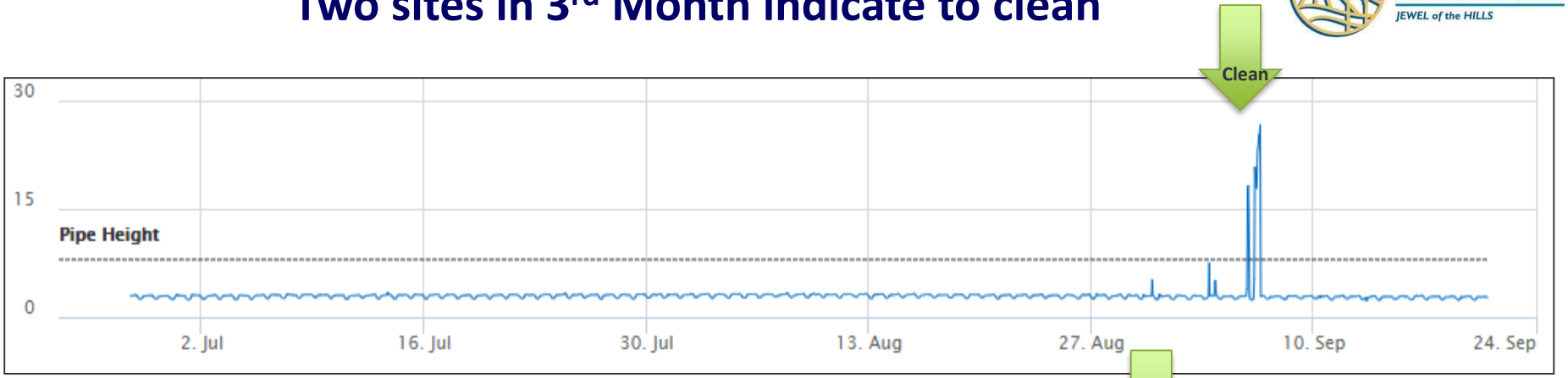


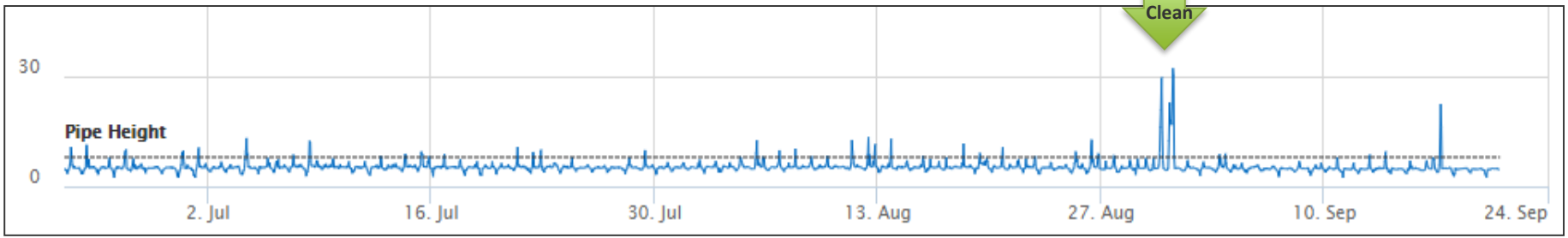




Hydrographs Show Changes

Two sites in 3rd Month indicate to clean





La Mesa, CA – Tabulated Results

Six-Months

Green = Not cleaned

Red = Cleaned

Site Location	Jul-18		Aug-18		Sep-18		Oct-18		Nov-18		Dec-18	
	Clean?	Type	Clean?	Type	Clean?	Type	Clean?	Type	Clean?	Type	Clean?	Type
70thSt	No		No		No		No		26-Nov		No	
Colorado	No		No		No		No		11/26/2019		No	
EchoDr	No		No		9/17/2018	Grease	No		11/26/2019		No	
HarbinsonAve	No		No		No		No		11/26/2019		No	
JessieAve	No		No		9/11/2018	Grease/Roots	No		11/26/2019		No	
JulliettePl	No		No		No		No		11/26/2019		No	
LakeMurray	No		No		No		No		11/26/2019		No	
NeboDr	No		No		No		No		11/26/2019		No	
PanormaDr	No		No		No		No		11/26/2019		No	
PineSt	No		No		No		No		11/26/2019		No	

Monthly Results

Month 1:	0 cleaned
Month 2:	0 cleaned
Month 3:	2 cleaned
Month 4:	0 cleaned
Month 5:	10 cleaned
Month 6:	0 cleaned
Total	12 cleaned

Summary for Six Months

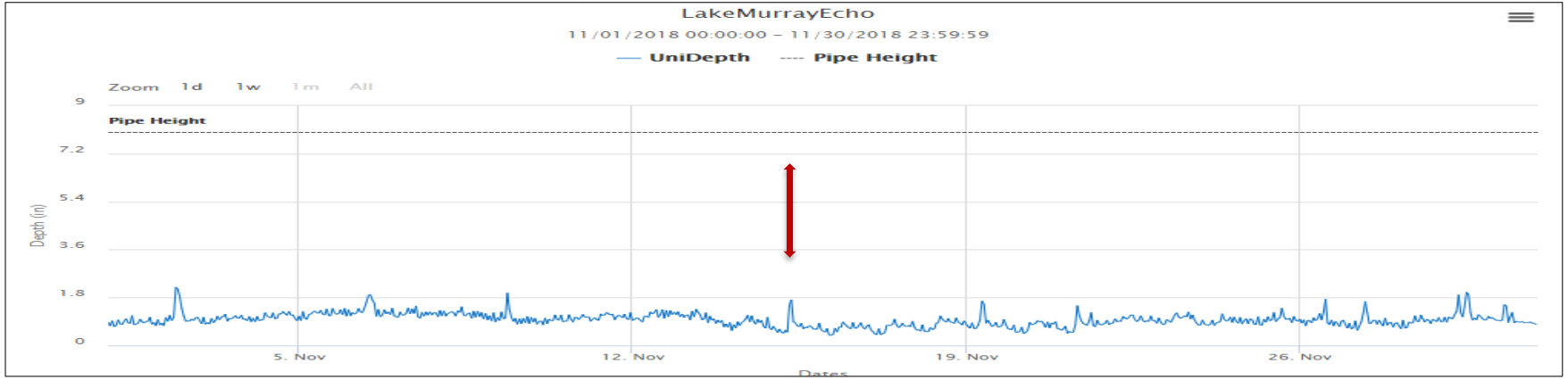
- Expected: Clean 60x (6 months x 10 sites)
- Actual: Clean 12x*
- Reduction: 48 cleanings (80%)

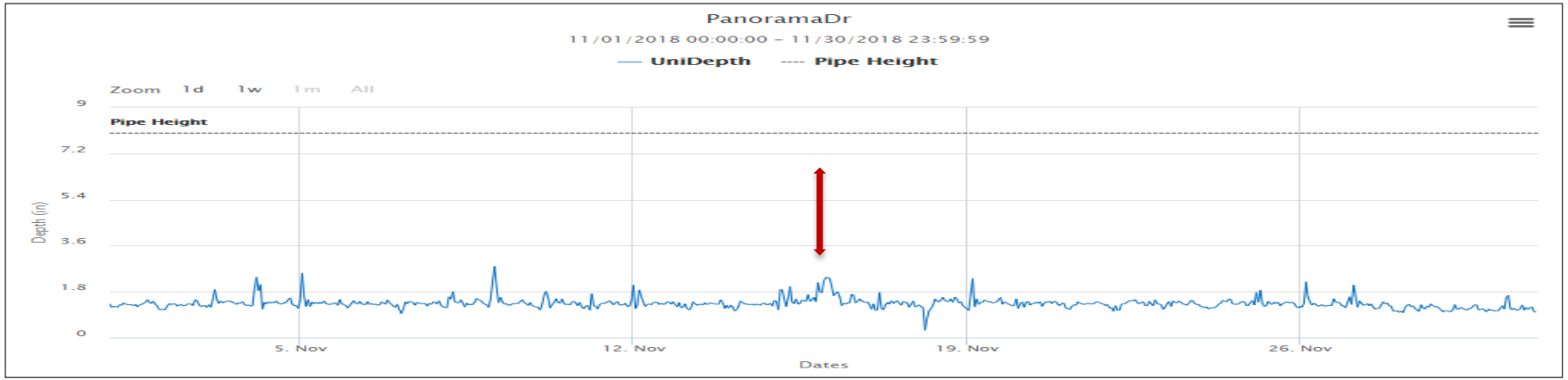
*Note: November all sites cleaned without necessity…

November Cleaning Required?

Month-5 Segments cleaned but *not* required.

Take away: it's *tough* to change old habits!





Results and Return

Frequency	Scheduled Cleaning (6-months)	Actual Cleaning	Change (Reduction %)	Cost/Segment	Total
Monthly	6	1	83%	$ 400	$ 2,000
Monthly	6	1	83%	$ 400	$ 2,000
Monthly	6	2	67%	$ 400	$ 1,600
Monthly	6	1	83%	$ 400	$ 2,000
Monthly	6	2	67%	$ 400	$ 1,600
Monthly	6	1	83%	$ 400	$ 2,000
Monthly	6	1	83%	$ 400	$ 2,000
Monthly	6	1	83%	$ 400	$ 2,000
Monthly	6	1	83%	$ 400	$ 2,000
Monthly	6	1	83%	$ 400	$ 2,000
6-Months	60	12	80%		$ 19,200
Annualized					$ 38,400

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JEWEL of the HILLS

Costs Overview

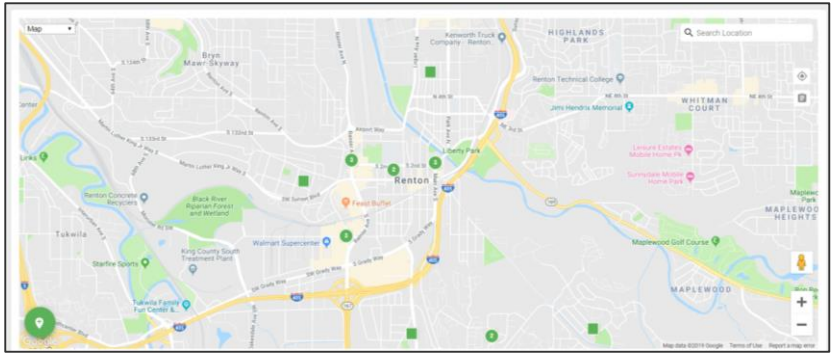
- Cost of truck
- Insurance
- Vehicle maintenance parts and labor
- Fuel
- Tools and materials
- Personnel labor and benefits

Productivity Savings

Renton, WA - Case Study

Situation

System	232 miles sewer
Process	High Frequency, Weekly & Monthly segments
Challenges	Unable to clean entire system
Study	4-month duration 20 segments: - 8 weekly - 12 monthly



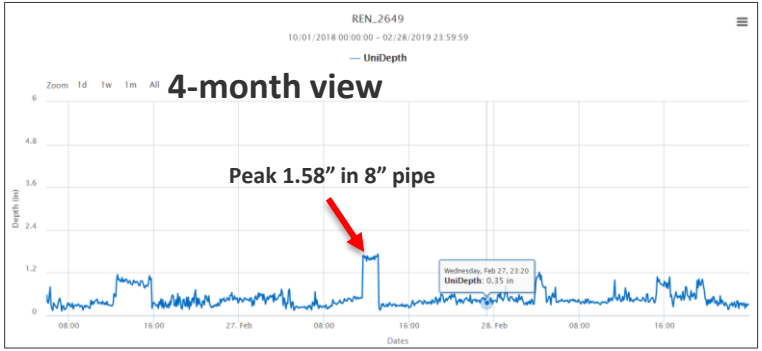
Renton, WA –Site Cleaned *Weekly*

Site

Pipe Diameter: 8”

Peak Height over 4-Months: 1.58”

No need to clean

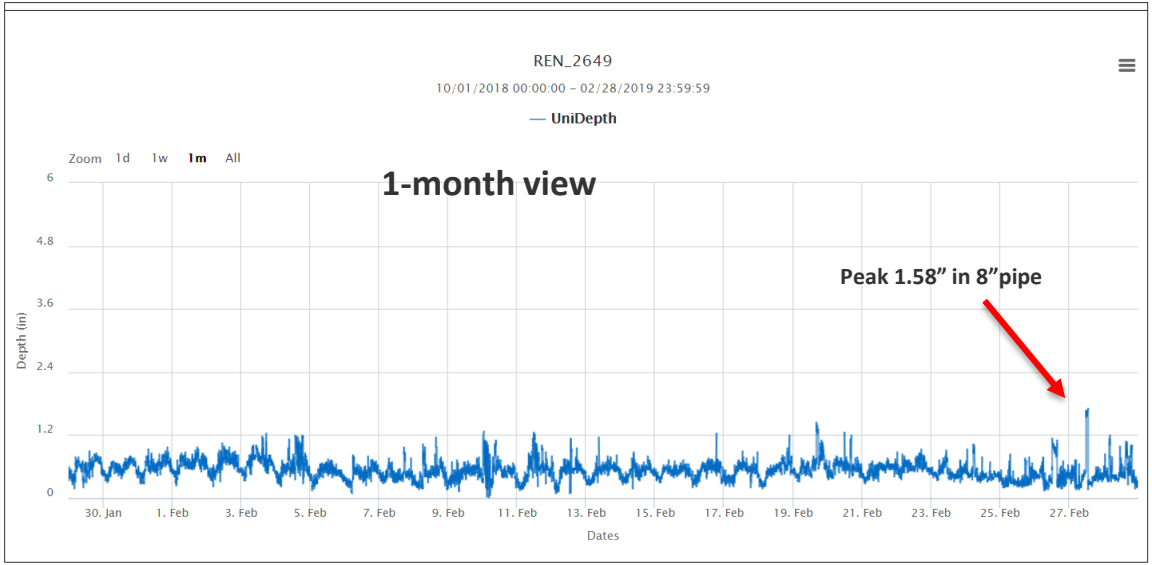


Cleaning Frequency Change

Schedule-driven: 19

Actual: 0

Cleaning Reduction: 100%



Renton, WA –Site Cleaned *Monthly*

Site

Pipe Diameter: 10”

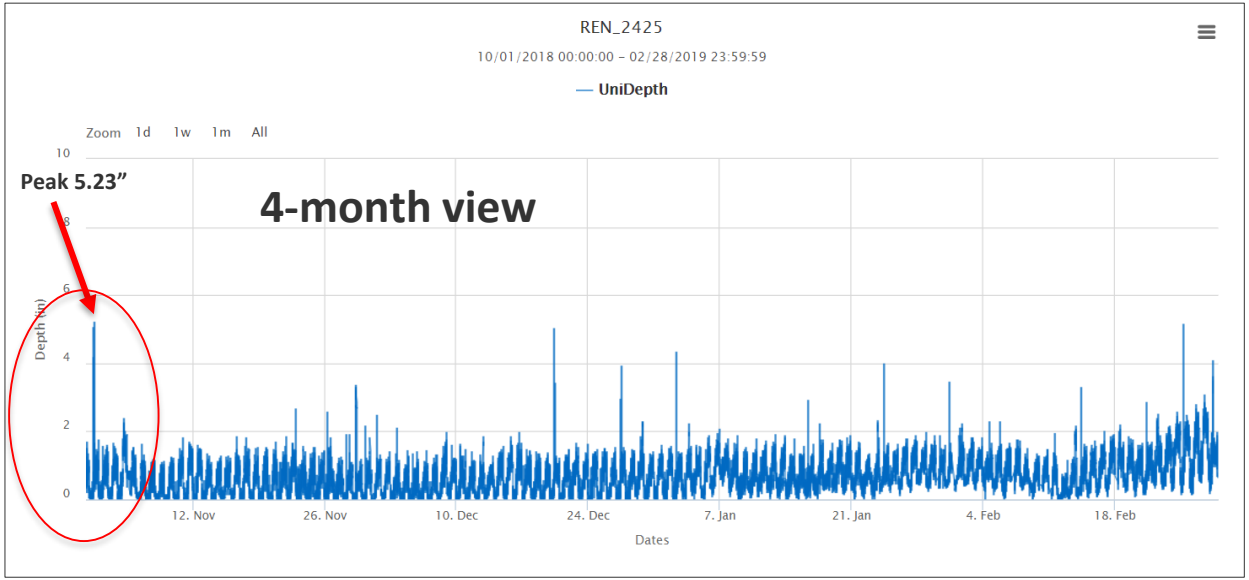
Peak Height: 5.23”

Cleaning Frequency

Schedule-driven: 4

Segment-Driven: 0

Reduction: 100%



Results and Return

Site Name	Pipe Size	Frequency	Scheduled 4-Months	Actual	% Change	Cost/Segment	Savings
1	8	Weekly	19	0	-100%	$ 400	$ 7,600
2	8	Weekly	19	1	-95%	$ 400	$ 7,200
3	8	Weekly	19	0	-100%	$ 400	$ 7,600
4	10	Weekly	19	0	-100%	$ 400	$ 7,600
5	8	Weekly	19	3	-84%	$ 400	$ 6,400
6	8	Weekly	19	2	-89%	$ 400	$ 6,800
7	8	Weekly	19	0	-100%	$ 400	$ 7,600
8	10	Weekly	19	0	-100%	$ 400	$ 7,600
			152	**6**	**-96%**		**$ 58,400**
9	8	Monthly	4	0	-100%	$ 400	$ 1,600
10	8	Monthly	4	0	-100%	$ 400	$ 1,600
11	8	Monthly	4	0	-100%	$ 400	$ 1,600
12	8	Monthly	4	0	-100%	$ 400	$ 1,600
13	8	Monthly	4	0	-100%	$ 400	$ 1,600
14	10	Monthly	4	0	-100%	$ 400	$ 1,600
15	8	Monthly	4	2	-89%	$ 400	$ 800
16	8	Monthly	4	0	-100%	$ 400	$ 1,600
17	8	Monthly	4	0	-100%	$ 400	$ 1,600
18	8	Monthly	4	1	-95%	$ 400	$ 1,200
19	8	3 Months	1	0	-100%	$ 400	$ 400
20	8	3 Months	1	0	-100%	$ 400	$ 400
			42	**3**	**-93%**		**$ 15,600**
Total			**194**	**9**	**95.4%**		**$ 74,000**

Productivity Savings

San Diego, CA

City of San Diego
PUBLIC UTILITIES
Water & Wastewater

System 3,100+ miles gravity sewer

Process Cleaning Frequencies:

- 1 per month
- 1 per 2-months
- 1 per 3-months
- 1 per 6-months

Challenges Labor availability

Program to date:

55 monthly sites installed
Beginning October 2019

Results and Return (Ongoing) – San Diego

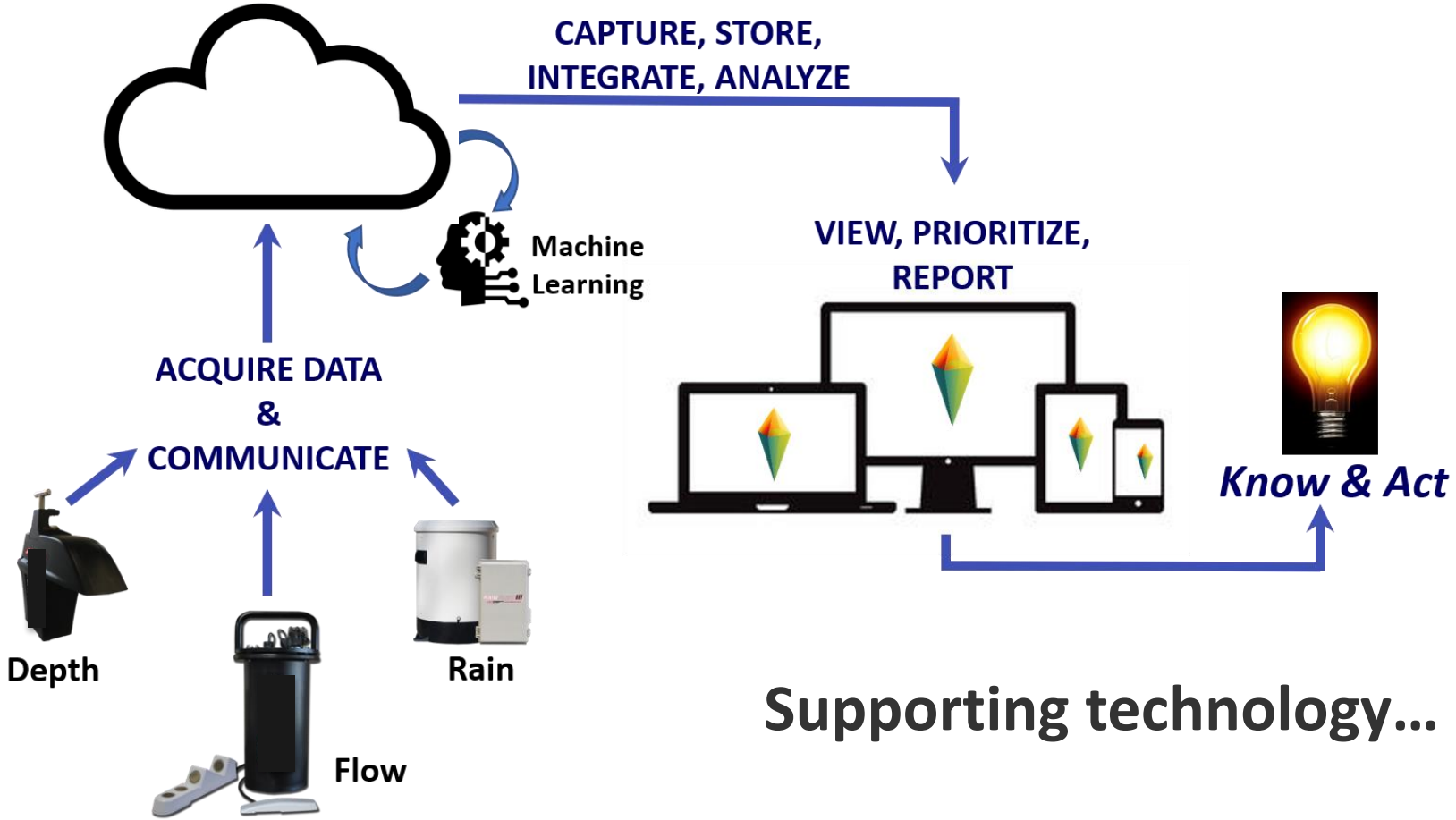
Manhole Name	Previous Frequency (Months)	Cleaning Since 1 Aug 2019	Last Cleaned Date	Months Not Cleaned	Reduction	Cost/Segment Cleane	Productivity Savings
B10S060	1	1	8/6/2019	12.0	92%	$ 600	$ 7,200
B13S271	1	1	8/13/2019	12.0	92%	$ 600	$ 7,200
B13S341	1	1	8/13/2019	12.0	92%	$ 600	$ 7,200
C16S006	1	1	4/2/2020	4.0	75%	$ 600	$ 2,400
F15S233	1	1	9/25/2019	11.0	91%	$ 600	$ 6,600
F15S233	1	0	6/4/2019	14.0	93%	$ 600	$ 8,400
F15S484	1	1	9/25/2019	11.0	91%	$ 600	$ 6,600
G03S230	1	1	2/28/2020	5.0	80%	$ 600	$ 3,000
G13S085	1	1	8/3/2019	12.0	92%	$ 600	$ 7,200
G16S223	1	1	9/25/2019	11.0	91%	$ 600	$ 6,600
G22S447	1	1	4/4/2020	4.0	75%	$ 600	$ 2,400
H02S074	1	1	9/3/2019	11.0	91%	$ 600	$ 6,600
H02S074	1	1	9/3/2019	11.0	91%	$ 600	$ 6,600
H02S146	1	1	9/24/2019	10.0	90%	$ 600	$ 6,000
H04S143	1	1	9/24/2019	10.0	90%	$ 600	$ 6,000
H23S008	1	1	4/6/2020	4.0	75%	$ 600	$ 2,400
I03S186	1	1	7/18/2020	0.0	0%	$ 600	$ -
J05S017	1	1	9/23/2019	11.0	91%	$ 600	$ 6,600
J05S017	1	2	1/8/2020	7.0	86%	$ 600	$ 4,200
J15S256	1	1	9/26/2019	10.0	90%	$ 600	$ 6,000
J21S187	1	1	4/6/2020	4.0	75%	$ 600	$ 2,400
J23S231	1	1	4/6/2020	4.0	75%	$ 600	$ 2,400
L22S035	1	2	7/6/2020	1.0	0%	$ 600	$ 600
L22S294	1	1	4/6/2020	4.0	75%	$ 600	$ 2,400
L34S218	1	1	9/5/2019	11.0	91%	$ 600	$ 6,600
L34S218	1	1	9/5/2019	11.0	91%	$ 600	$ 6,600
L35S180	1	1	9/5/2019	11.0	91%	$ 600	$ 6,600
L37S066	1	1	11/9/2019	9.0	89%	$ 600	$ 5,400
M25S15	1	1	4/7/2020	4.0	75%	$ 600	$ 2,400
L37S002	1	1	9/5/2019	11.0	91%	$ 600	$ 6,600
	30	**31**		**252**	**87.7%**		**$ 151,200**

Lessons Learned

1. Productivity savings enable maintenance resource reallocation.
2. Monitored segments gain 24/7 SSO protection.
3. Pipe-wear from high pressure sprays reduced.
4. Improved safety- less in-street activity
5. Water use lowered.
6. Ongoing data capture used for model calibration.

Technology that Enables Decisions

Internet of Things Connects Sites to People

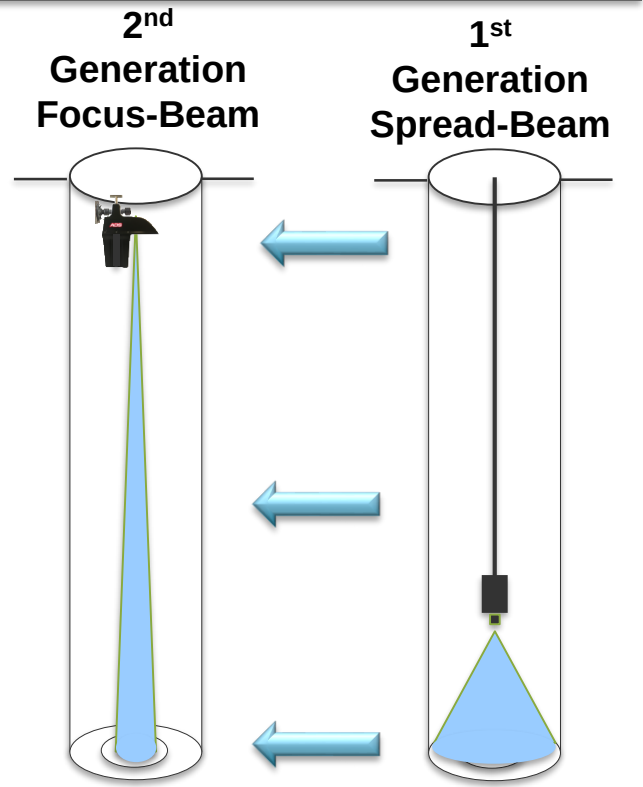


Supporting technology…

Remote Site Sensors & Communications

Level Monitors

Focus-Beam Ultrasonic Depth & Pressure Height Sensors in one System



Long Range 20 ft to 8” pipe

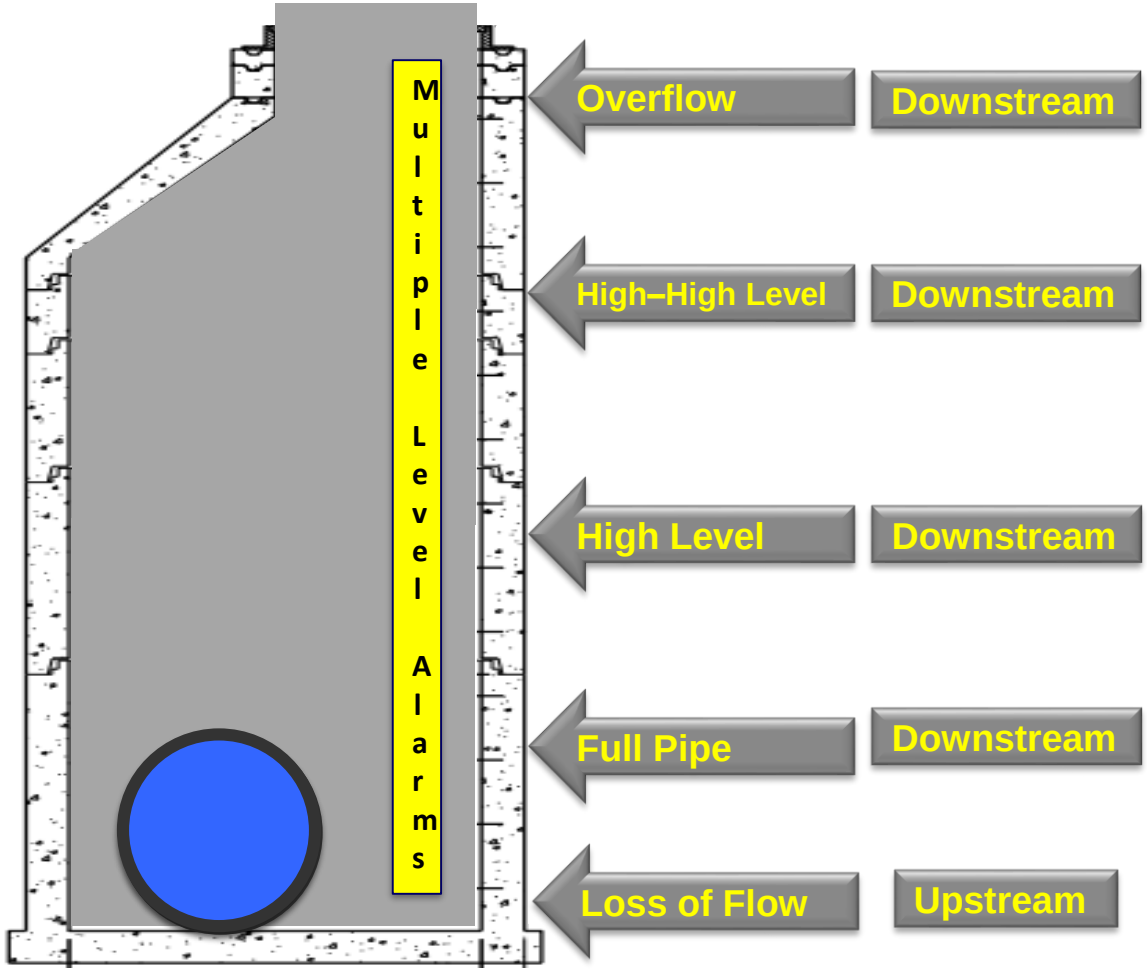
Limited Range 2 ft to 8” Pipe

2nd Generation Technologies & Notifications

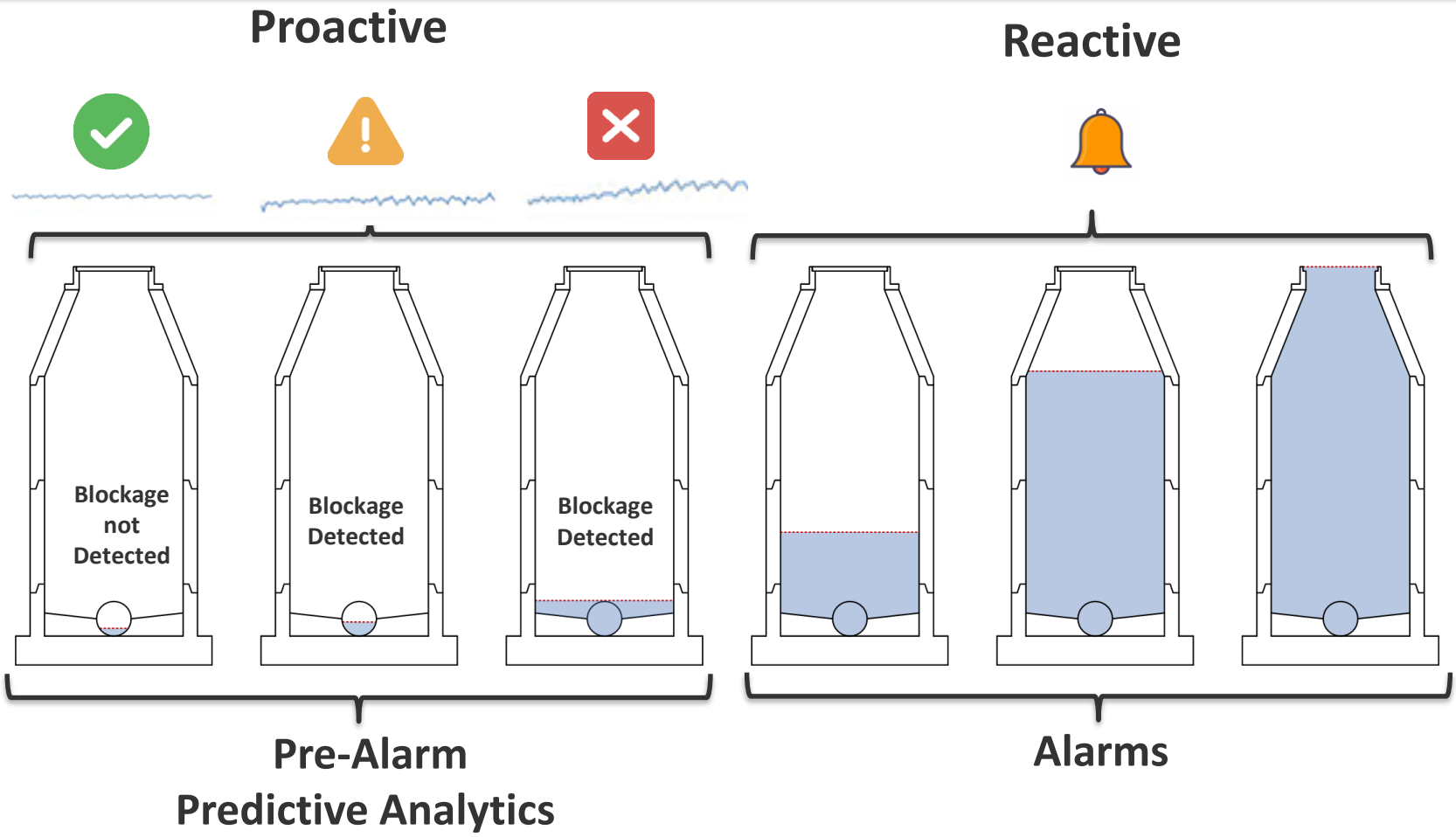
System Communication

2nd Generation:

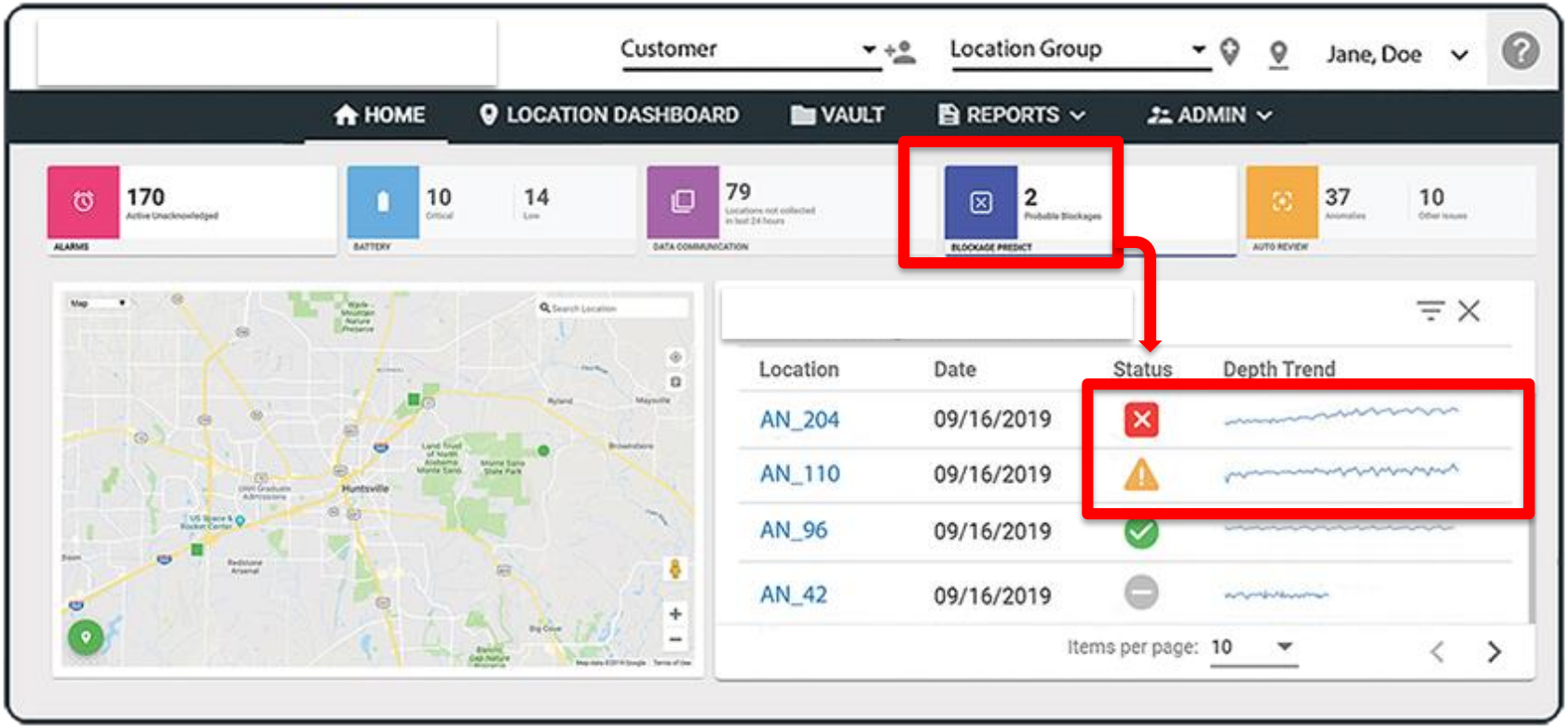
- Redundant Water Level Alarms
- Sensor Alignment Alarm
- System Status



The Blockage Continuum

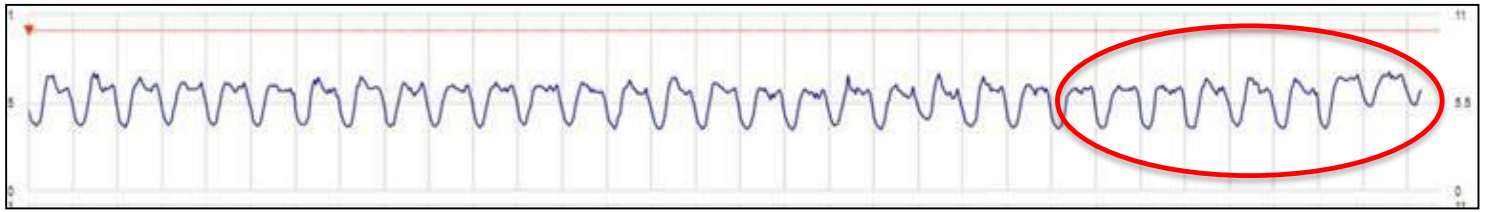


Predicting Blockages

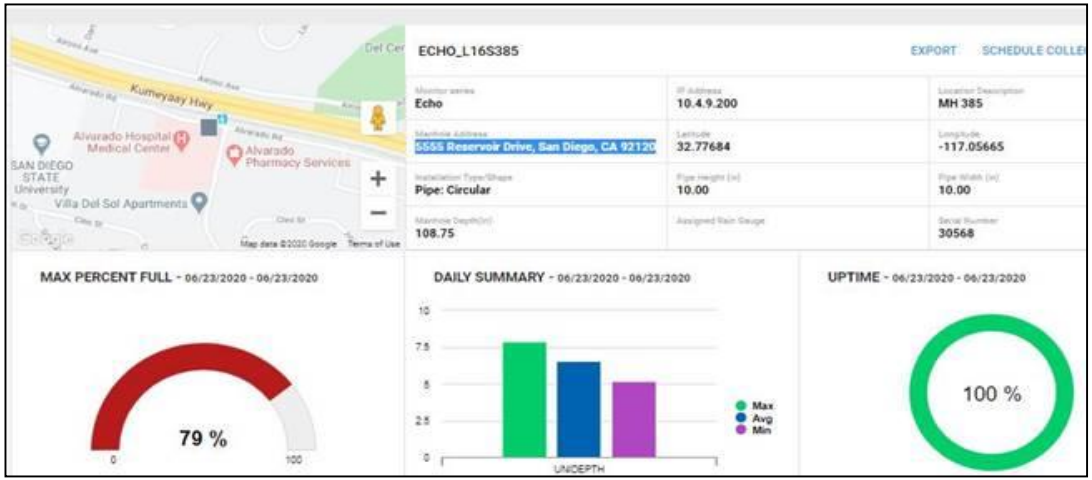


Predictive Analytics dashboards like above provide prioritized view

Site Hydrograph and Summary



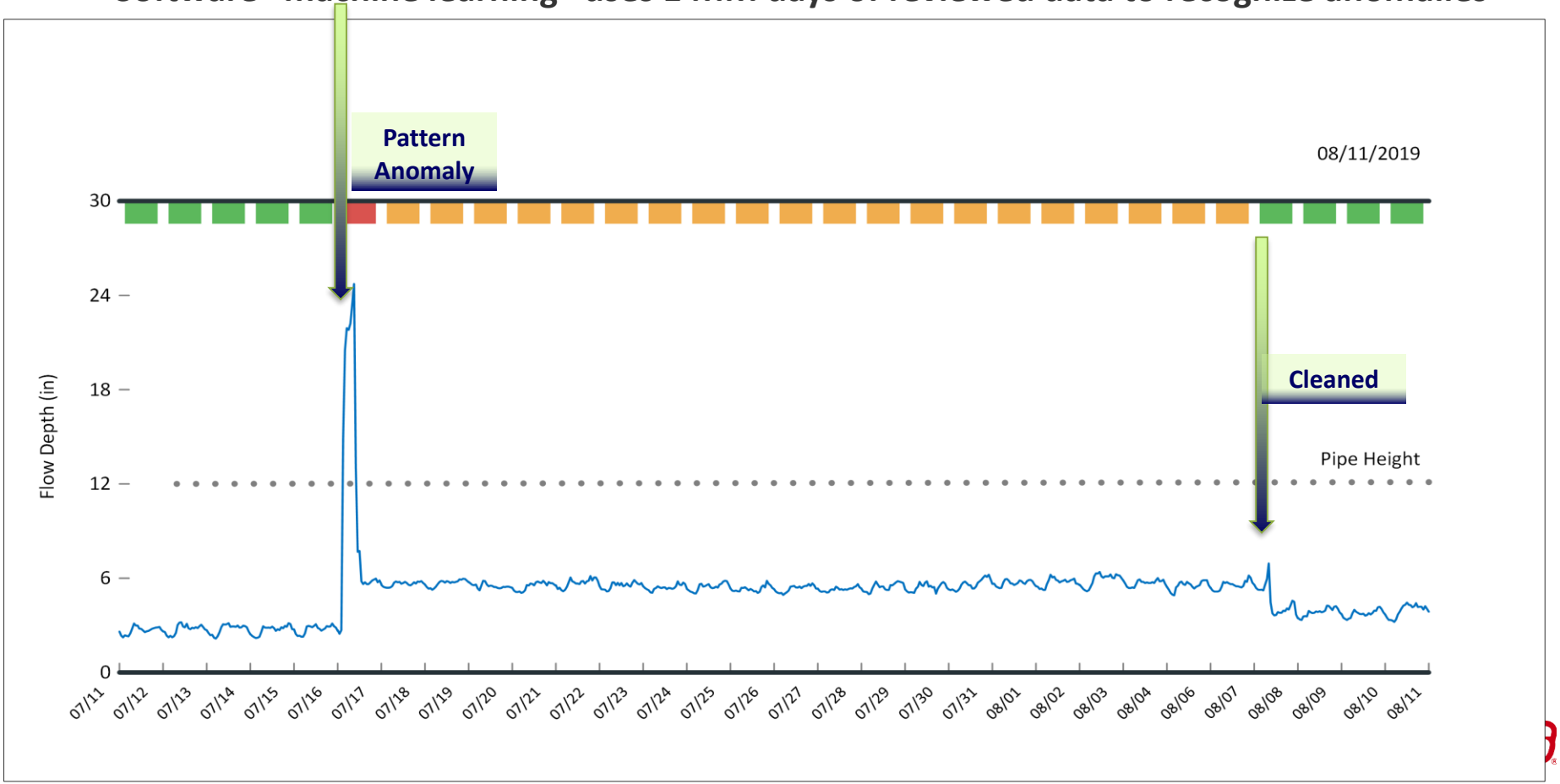
Change in hydrograph pattern



Summary of location and site details

Site Example 1

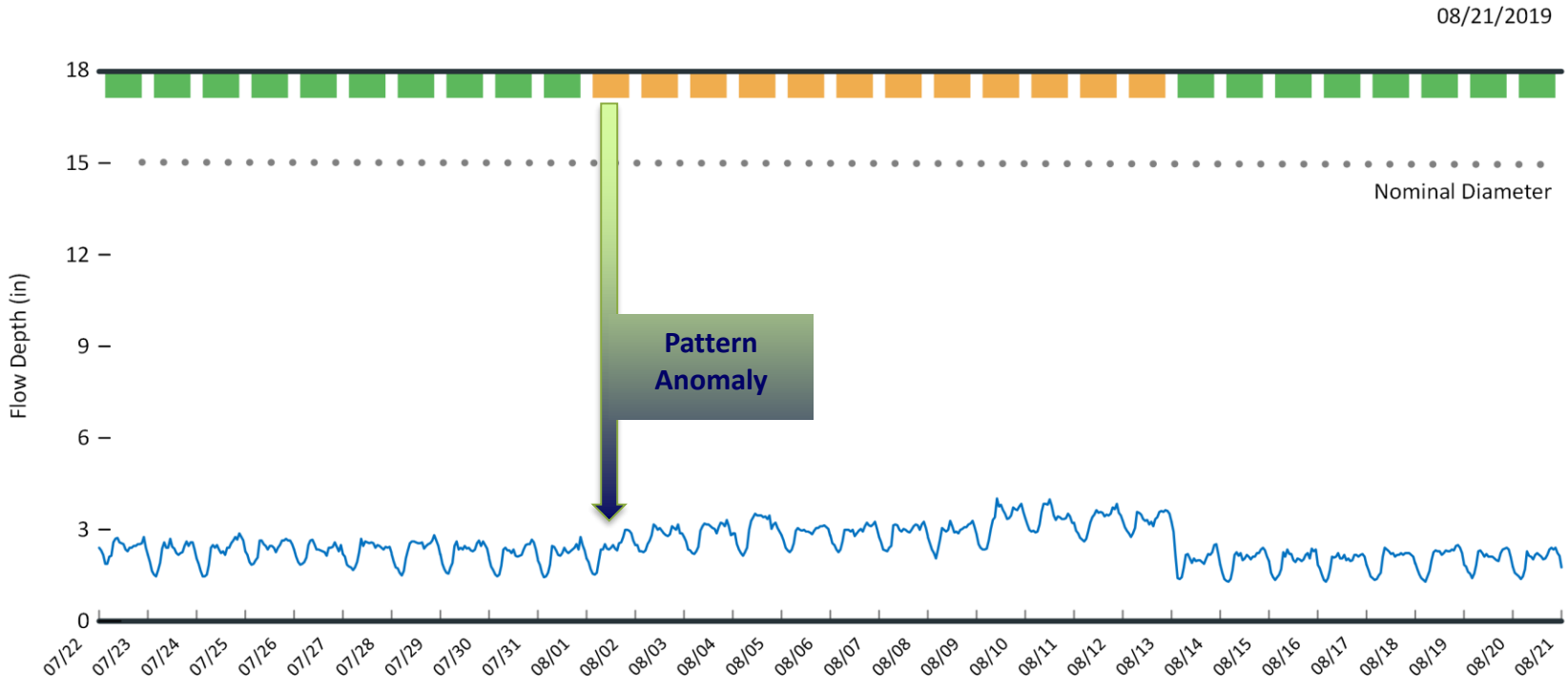
Software “machine learning” uses 1 MM days of reviewed data to recognize anomalies



Site Example 1 Site Findings

Gravel and Rocks Observed in Manhole Channel
Cleaning created the blockage pushing debris to next segment

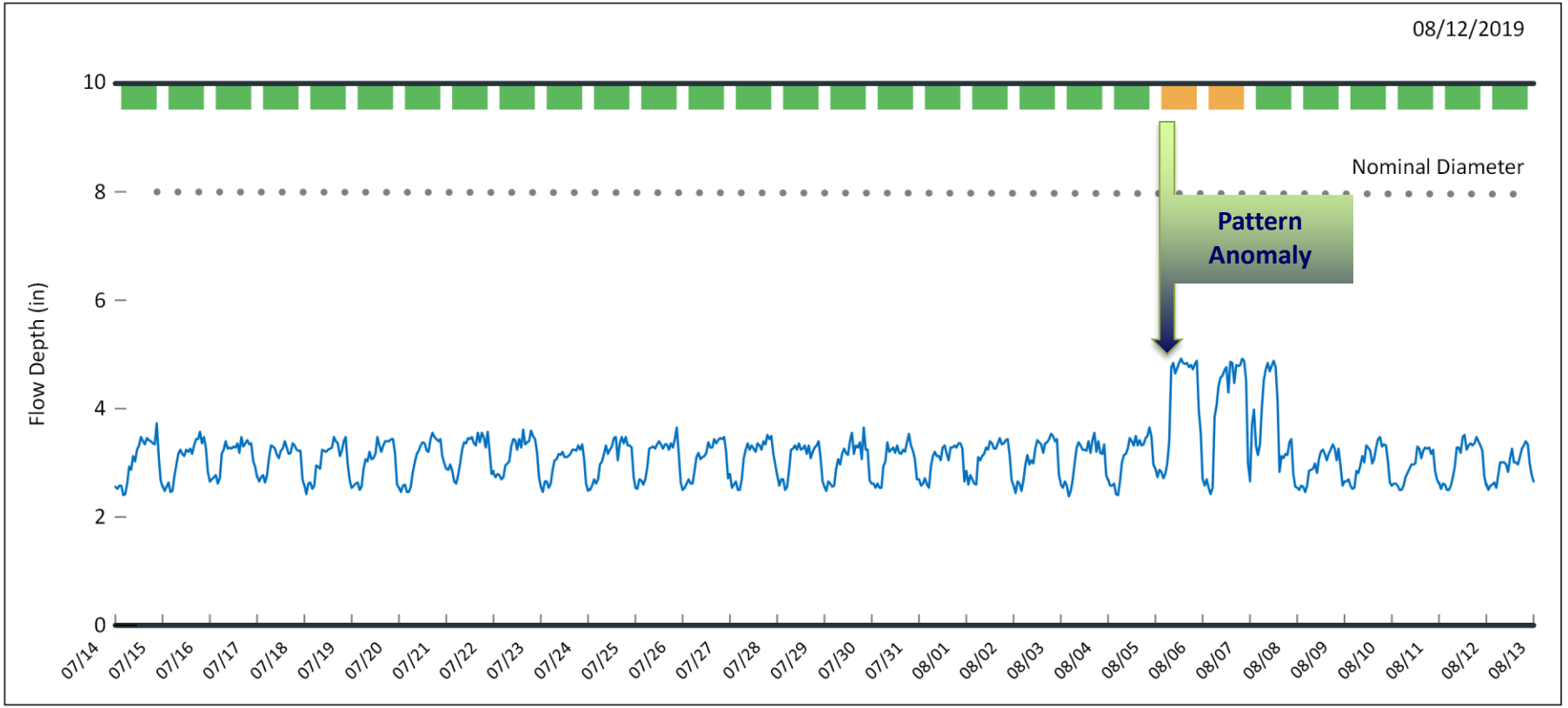
Site Example 2



Site Example 2 Site Findings

Stick catching debris
Small items can cause bigger problems

Site Example 3



Site Example 3

Confirmed channel grease obstruction dislodged upstream

Predicting Blockage & Identify Type

Machine learning- continuous technology development

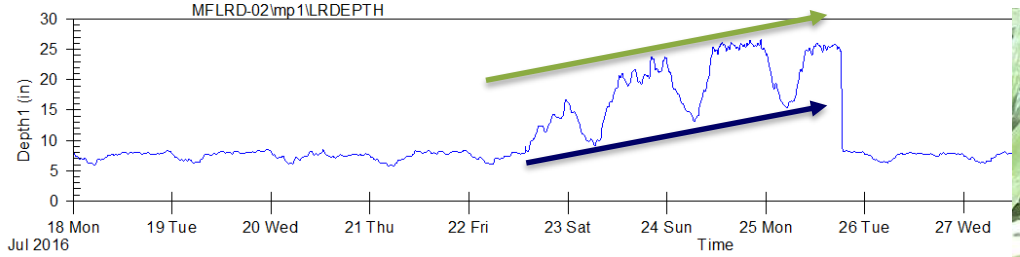
- Now: Predictively identify developing blockage
- Next: Identify blockage *type*

Grease

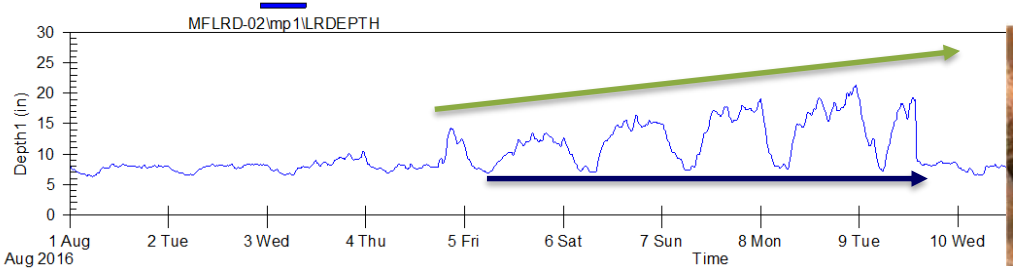
Roots

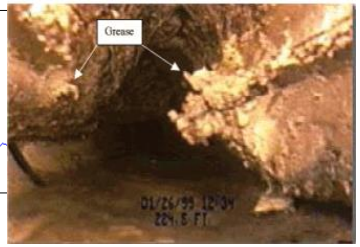
Collapse

Blockages Have Signatures

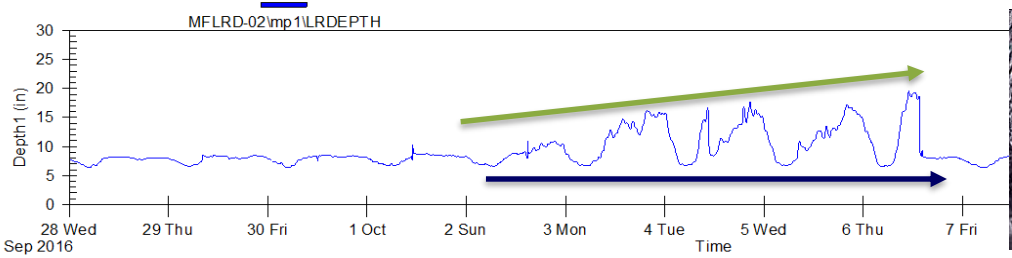


Debris Blockage Signature
Peak values increase
Low values increase





Grease Blockage Signature
Peak values increase
Low values remain relatively constant



Grease Blockage Signature
Peak values increase
Low values remain relatively constant

Summary

Optimizing Collection System health is like taking vitamins…

Vitamins: safe & healthful but..

- High Dosages create unnecessary costs
- Some unwanted side effects

High Frequency Cleaning side-effects…

- Over-stressed operations
- Excessive pipe wear
- No ongoing SSO protection

Technology Optimizes System Health

- Visibility & Predictability with fast pay-back
- Immediate performance improvement
- Peace of mind

Healthy balance is achieved!

About ADS

Depth of knowledge & expertise:
45 Years of Industry Collection System Experience

Comprehensive Solutions
Equipment & software
Analytical Apps
Analysis services
Field Service

STOP WASTING TIME

Monitoring system can determine how frequently you need to clean specific sections of your collections system

By Jay Boyd and Paul Fontbuteé

Cleaning
Optimization
MS&W Magazine
January 2019

FEATURE ▶ Smart Water

Busting Blockages

Predictive technology alerts operators to potential problems before catastrophe strikes

Kevin Enfinger

Cleaning
Optimization
MS&W Magazine
February 2020

Thank You!

Questions?

To Receive a Copy of Our Cleaning Optimization Paper
Please Send a Request to:
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