Prescriptive Cleaning May be a Bitter Pill to Swallow but Some Municipalities are Finding a New Tech-Cure

Cleaning Optimization

CSO Monitoring & Reporting

I/I Reduction

Capacity Management

Accurate Billing

Hydraulic Model Calibration

ADS ENVIRONMENTAL SERVICES®

Jay Boyd
Director of Market Development

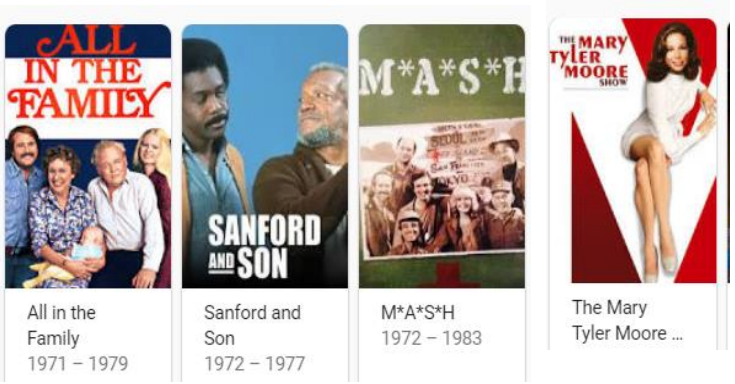
Cleaning Optimization Agenda

- How We Got Here- Wastewater History
- ‘Best’ Practices: Yesterday and Today
- Case Studies
- The Technology that Supports the Solution
- Q & A

Remembering the Seventies' *1972*

Movies

TV



Living in '72

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

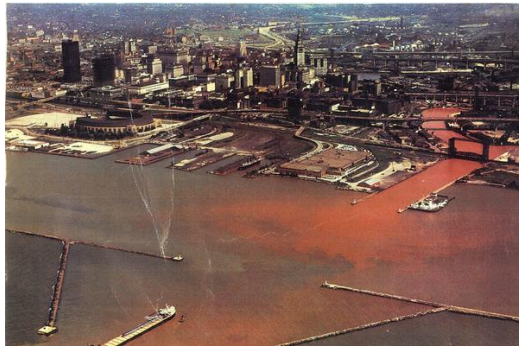
In the News in '72

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

1972 Big News for Water

Two-thirds (2/3) of US lakes, rivers and coastal waters *not safe* to swim or fish so…

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

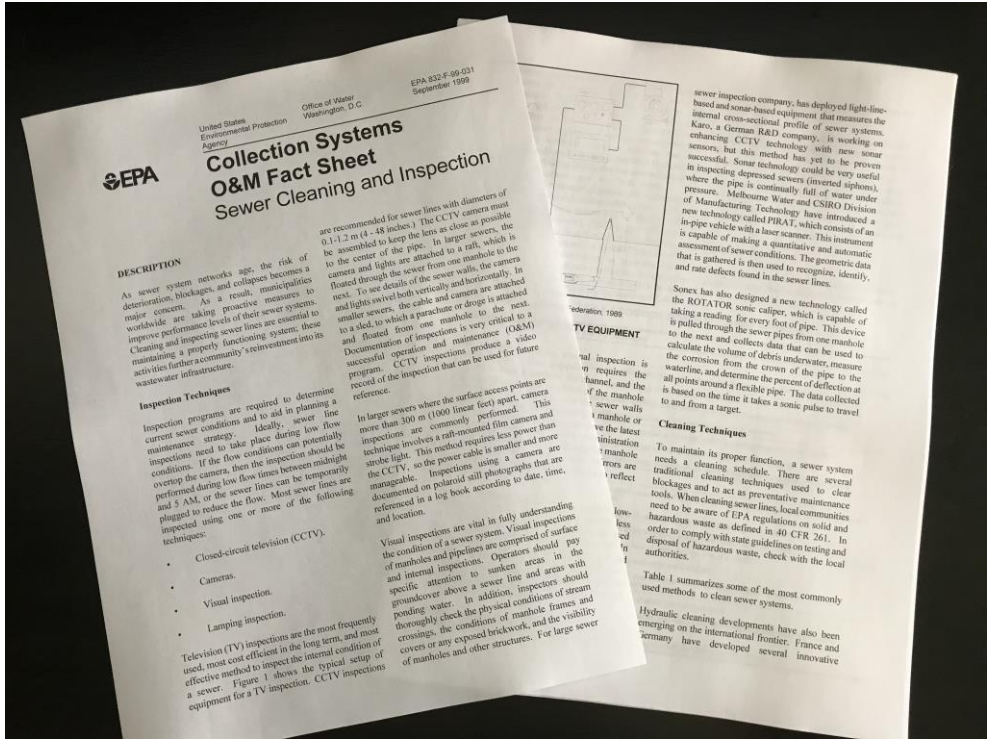
EPA and the Plan

EPA quickly recognized
“the value of planning for tackling critical issues.”

Most Critical Issue:
Prevent sanitary sewer overflows “SSOs”.

The Plan:
Establish *Capacity, Management Operations and Maintenance* (CMOM) Processes & Practices

At the Heart….
Aggressive Cleaning & Inspection



September 1999 EPA ‘Collection System O&M Fact Sheet’
Sewer Cleaning and Inspection

20-Year-Old ‘Best Practice’ is Aging

Cleaning Best Practice summarized as:

- Clean entire collection system using multi-year cycles i.e., every 5-years
- Clean “hot spots” at high frequencies e.g., weekly, monthly, quarterly, etc.

Q. What *usually* determines the frequency?

A. History

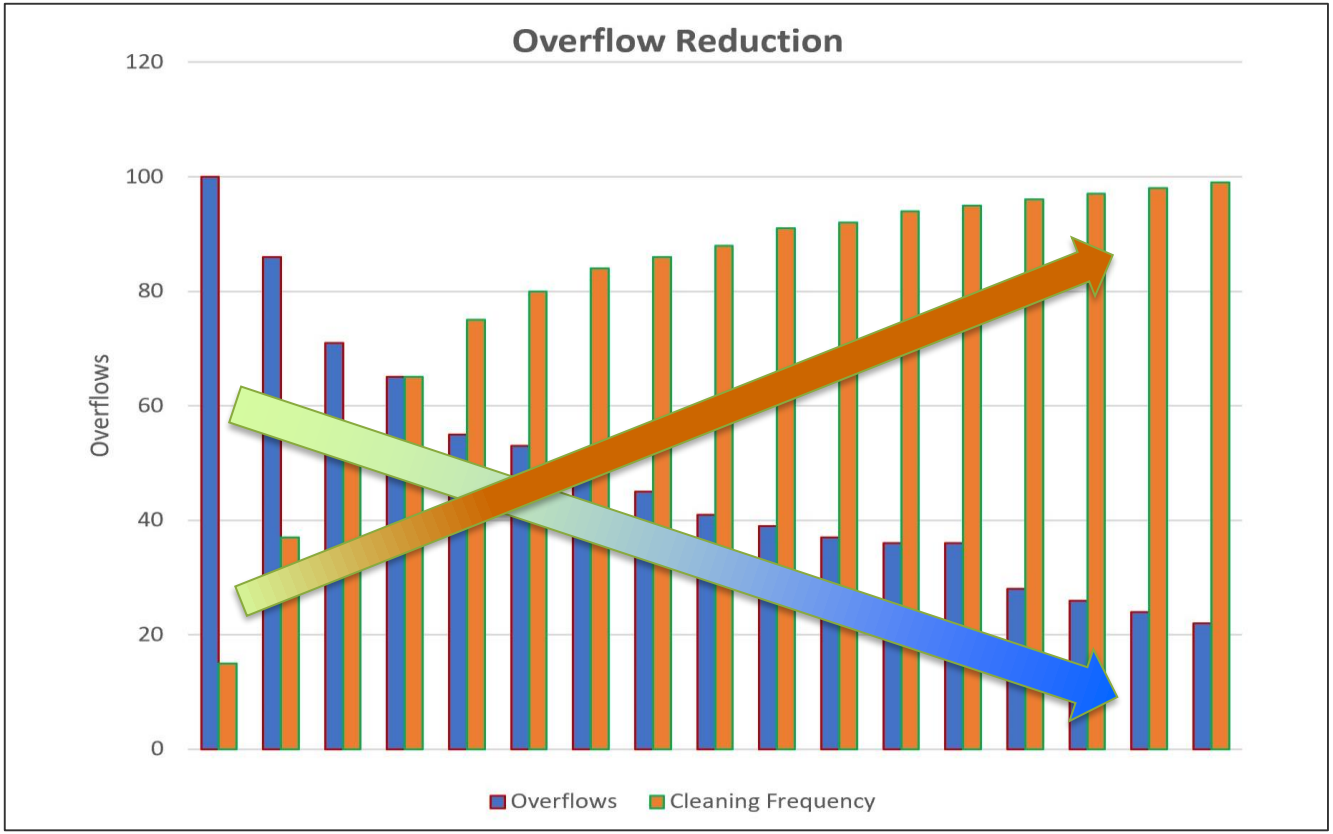
Q. How are frequency adjustments made?

A. CCTV or visual inspection


Cleaning
Optimization
The Tech-Cure

Cleaning Frequency & SSOs

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



But there's a cost…

Industry Talks about *Overcleaning*

City of San Diego…*we don't like cleaning clean pipes…*

City of Tulsa… *scheduled cleaning makes no sense when it's not needed…*

City of La Mesa… *staff can't keep up, neither can the budget…*

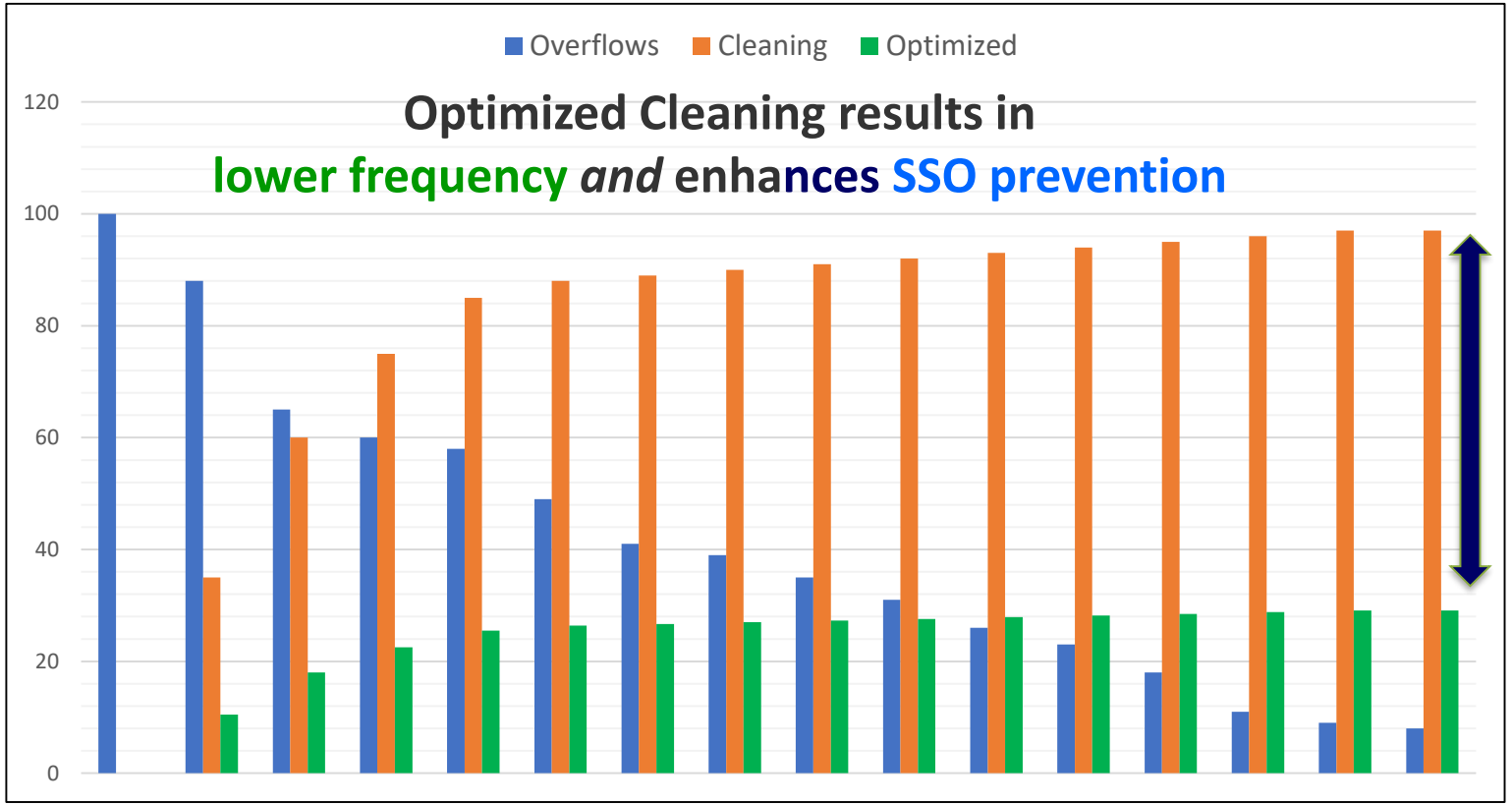
Consequences of Overcleaning

- Significantly increased pressure on operations staff
- Continuous escalation of maintenance costs
- Accelerated pipe wear
- More time in traffic
- No remote site visibility between cleanings

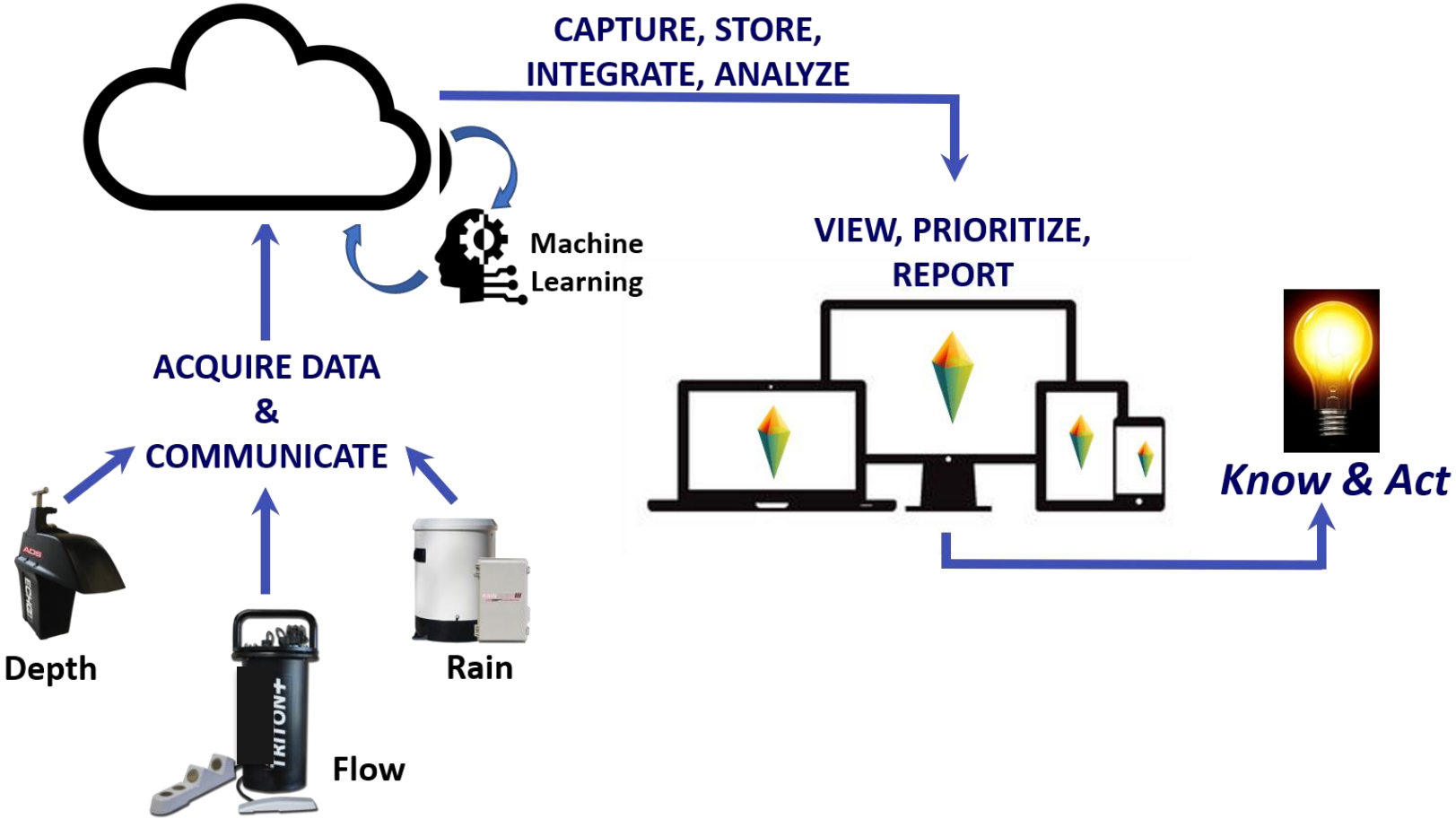
Overcleaning: the bitter pill to swallow but there's a new way…

What is Cleaning Optimization?

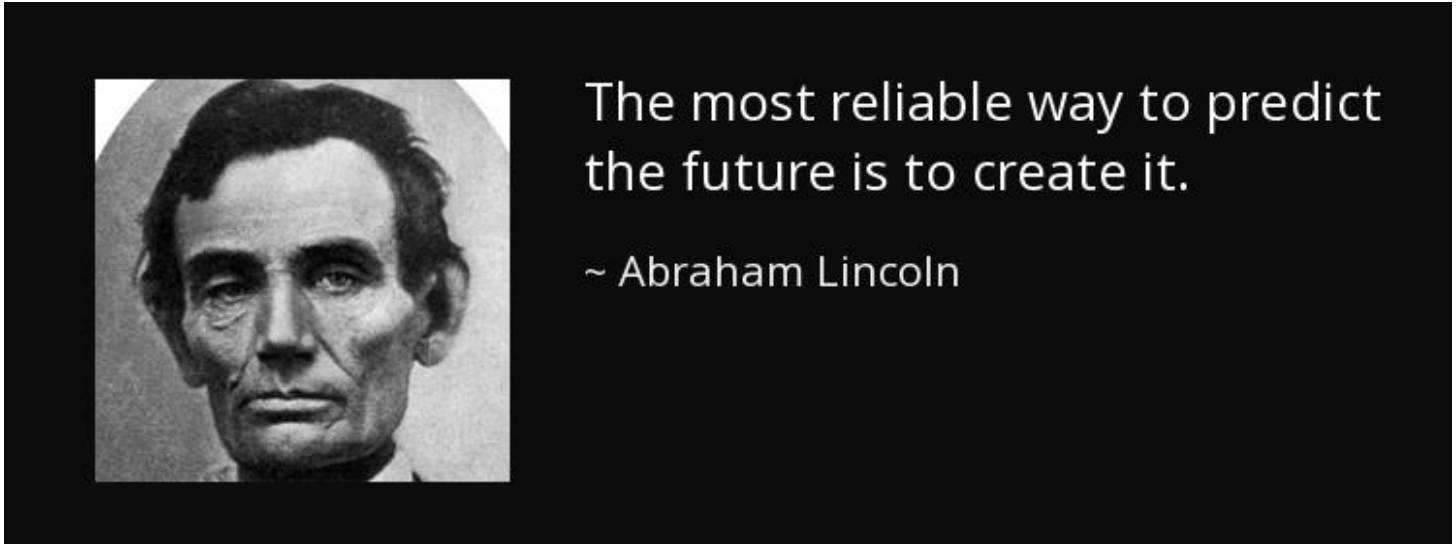
Cleaning Optimization: *right-sized* frequency driven by real-time, *remote site conditions*



Smart Technology Creates the Connection



What It Takes from Us



Creating the future means to ask…

Are our current processes sustainable ?

Are we embracing continuous process improvement?

Are we looking comprehensively at costs?

Creating the Future

The Past

Schedule-driven cleaning → **The New Best Practice Vision**: ***Site condition-driven*** cleaning

Blind to remote site conditions → Site conditions ***always visible & known***

Observations experience dependent → Observations ***data-driven***, consistent performance measurement

Optimized Cleaning Vision

Continuous remote site condition drives decision to clean

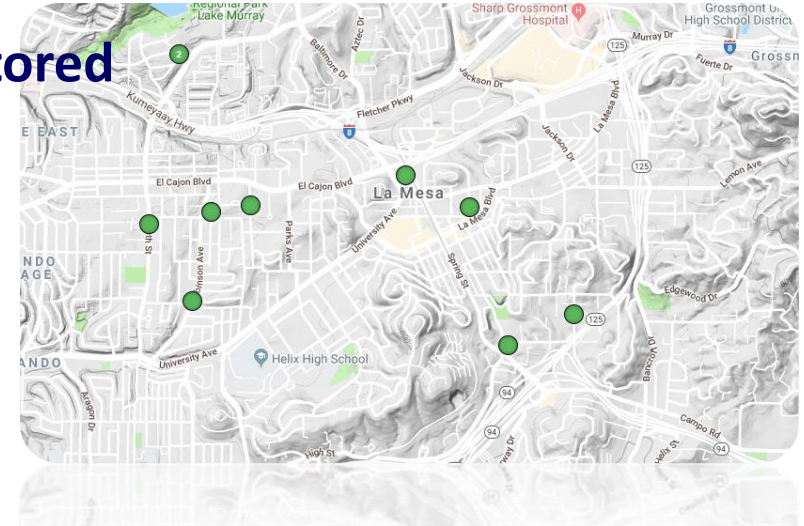
Improved performance & peace of mind

Case Studies

La Mesa, CA Case Study

Situation

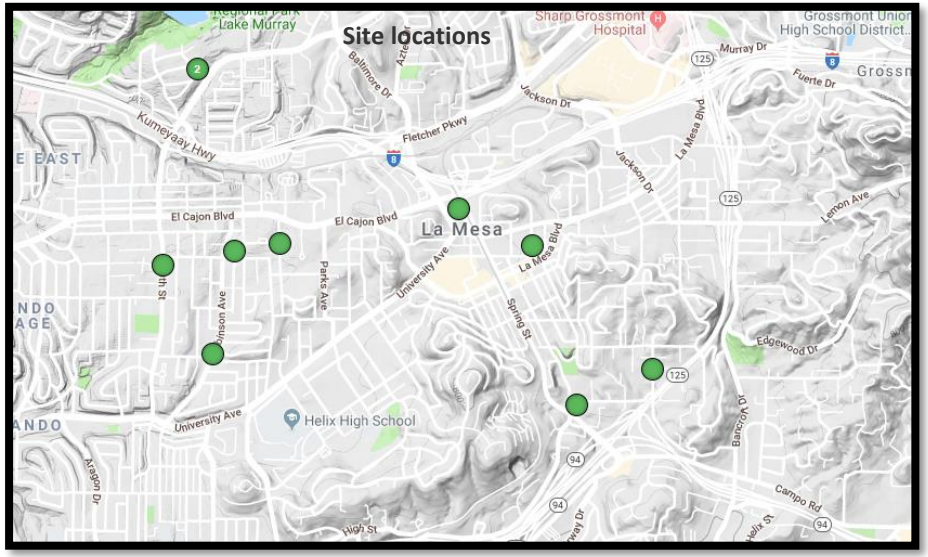
System	153 miles sewer, 53 miles storm
Process	Clean Total System Annually Clean 100 segments- monthly/quarterly
Challenges	80% maintenance time spent cleaning
Study	10 monthly segments monitored 6-month duration



La Mesa, CA - Action Plan

Approach

- Use remote site monitoring for real-time, site condition feedback
- Sites: 10 depth-only monitors installed at monthly cleaning sites
- Duration: 6 months
- Cleaning decision: as *site conditions* dictate and notified through software
- Log cleaning instances: measure reductions



La Mesa, CA - Results

Six-Month Tabulated Results

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

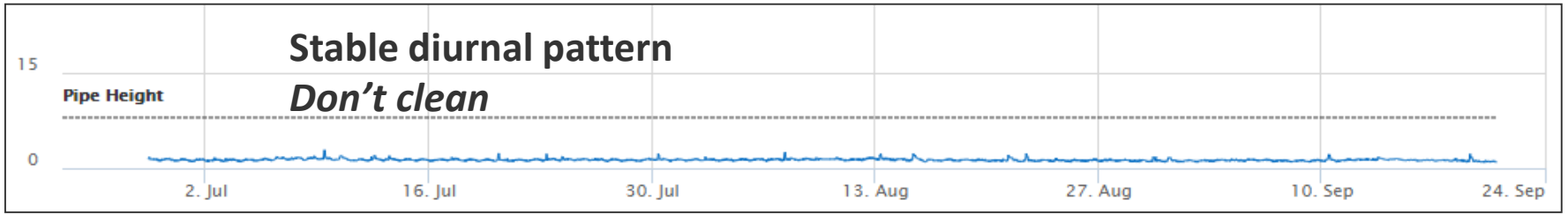
Summary for Six Months

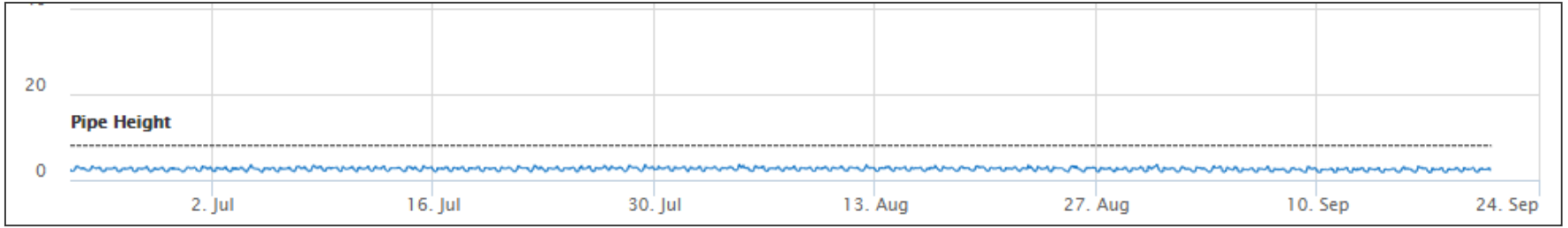
- Expected: **60** Cleaning Opportunities
- Actual: **12*** Cleanings
- Reduction: **48** cleanings (**80%**)

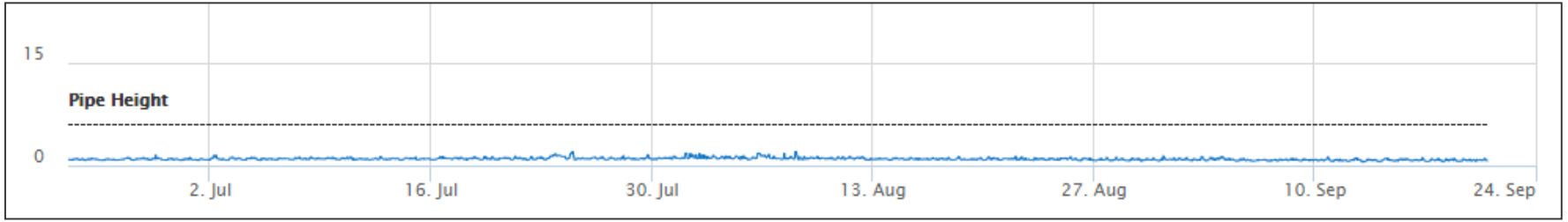
*Note: November all sites cleaned without necessity…

Three Sample, Stable Segments, 4-months

Remote segments: feedback confirms “no clean” decision

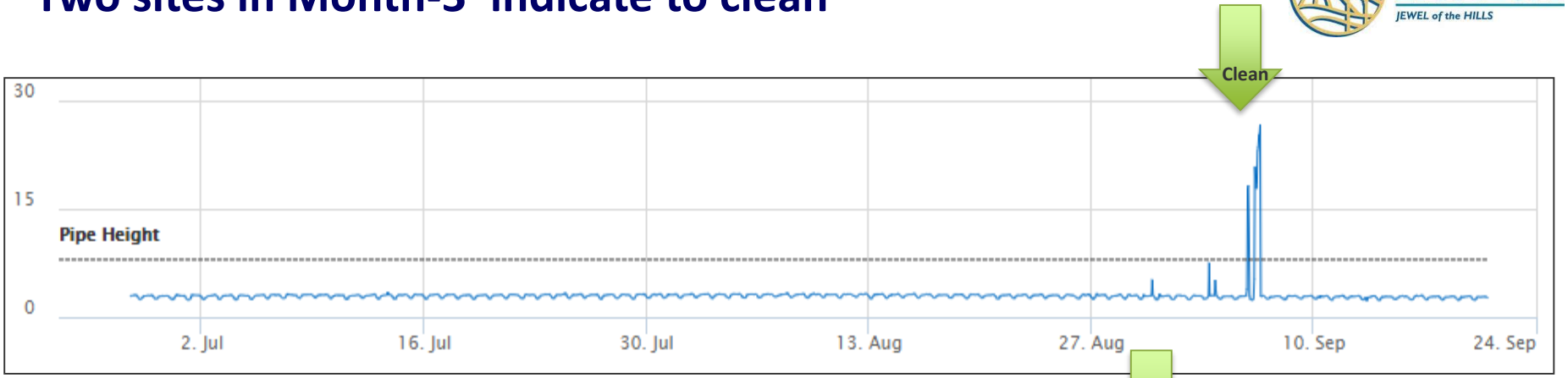


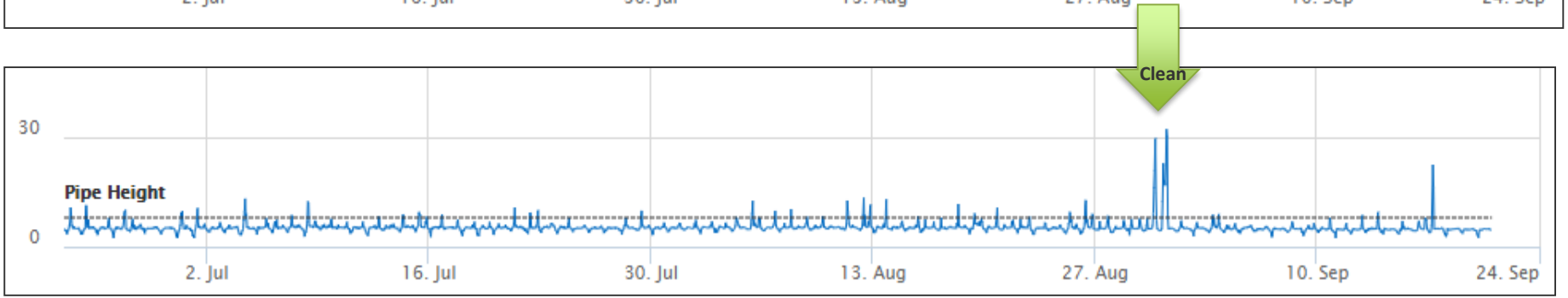




La Mesa, CA- Data

Two sites in Month-3 indicate to clean

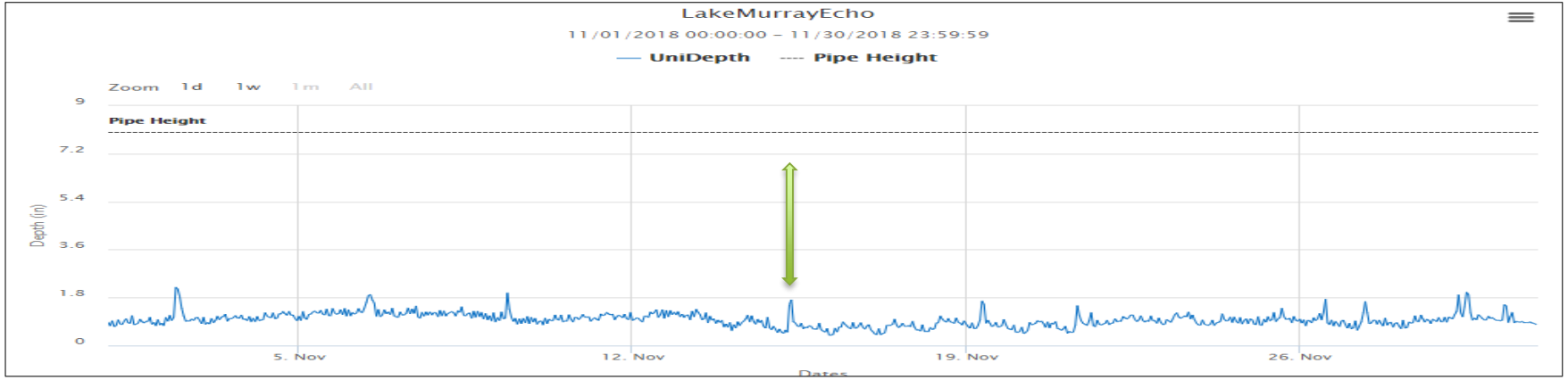


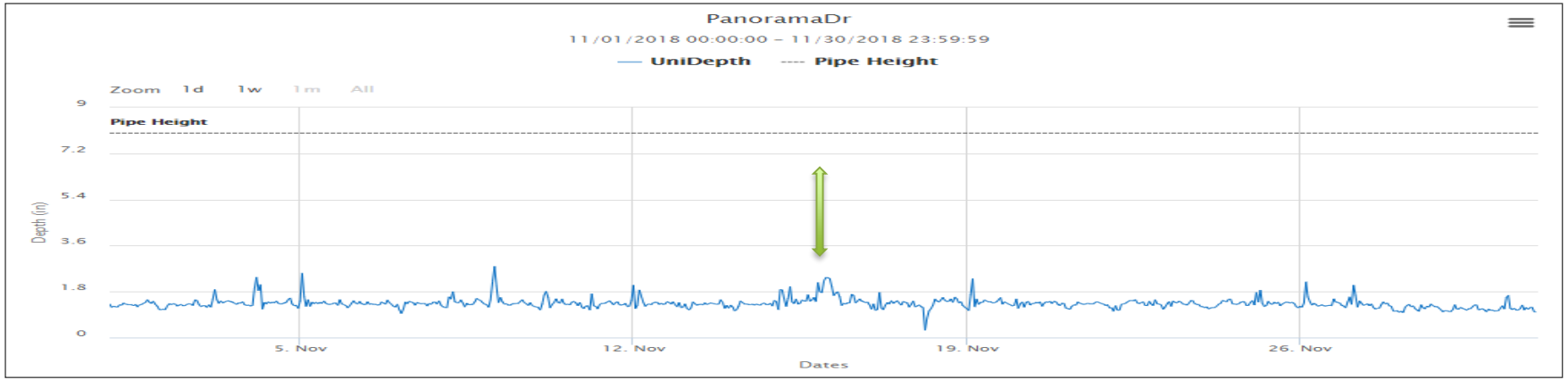


La Mesa, CA- Data

Month-5 Segments cleaned but *not* required.

It's tough to change old habits!





Results and To-Date Return – La Mesa, CA

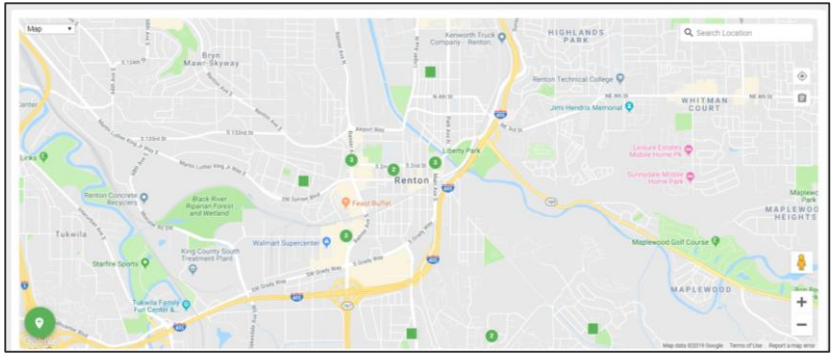
Frequency	Scheduled	Actual	% Change	Cost/Segment	Total
Monthly	6	1	83%	$ 400	$ 2,000
Monthly	6	1	83%	$ 400	$ 2,000
Monthly	6	2	67%	$ 400	$ 1,600
Monthly	6	1	83%	$ 400	$ 2,000
Monthly	6	2	67%	$ 400	$ 1,600
Monthly	6	1	83%	$ 400	$ 2,000
Monthly	6	1	83%	$ 400	$ 2,000
Monthly	6	1	83%	$ 400	$ 2,000
Monthly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

Productivity Gain

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

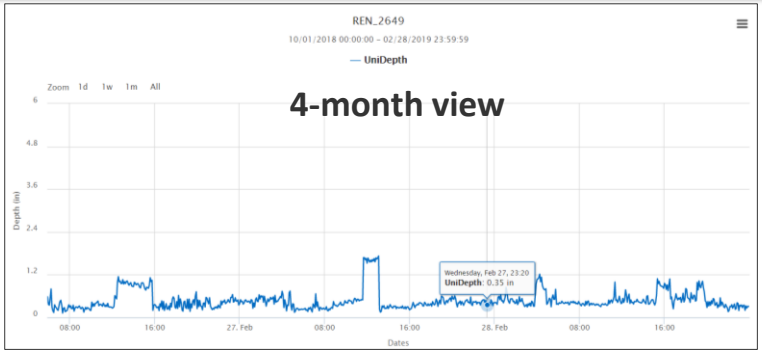


Renton, WA –*Weekly* Site

Site

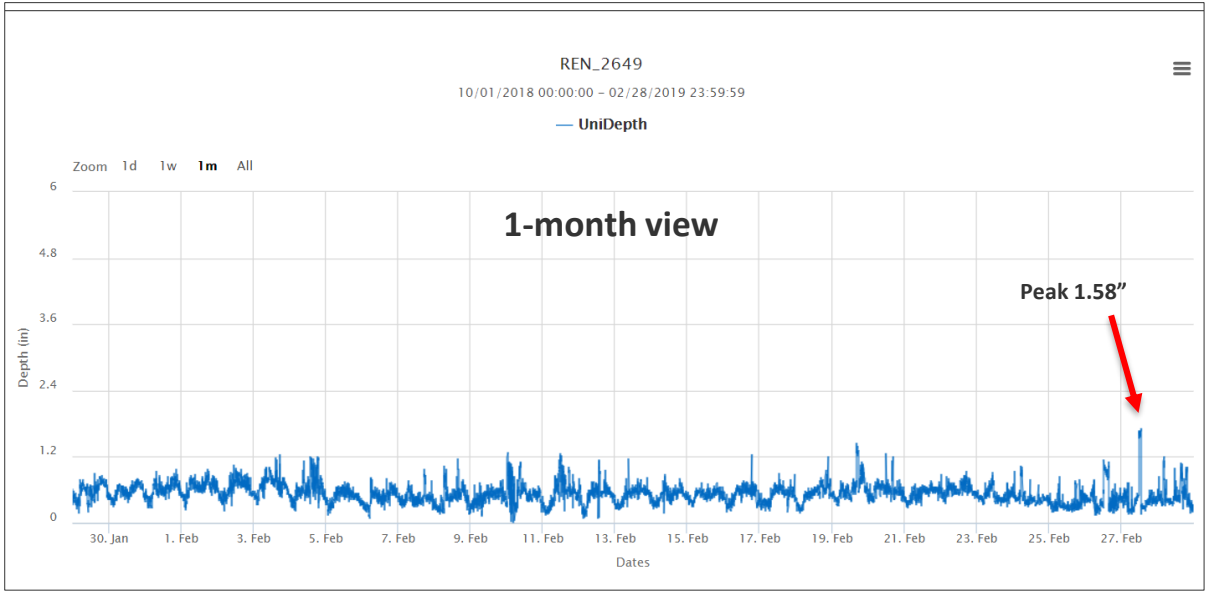
Pipe Diameter: 8”

Peak Height: 1.58”



Cleaning Frequency

Schedule-driven:	**19**
Segment-Driven:	**0**
Cleaning Reduction:	**19**



Renton, WA –*Monthly* Site

Site

Pipe Diameter: 10”

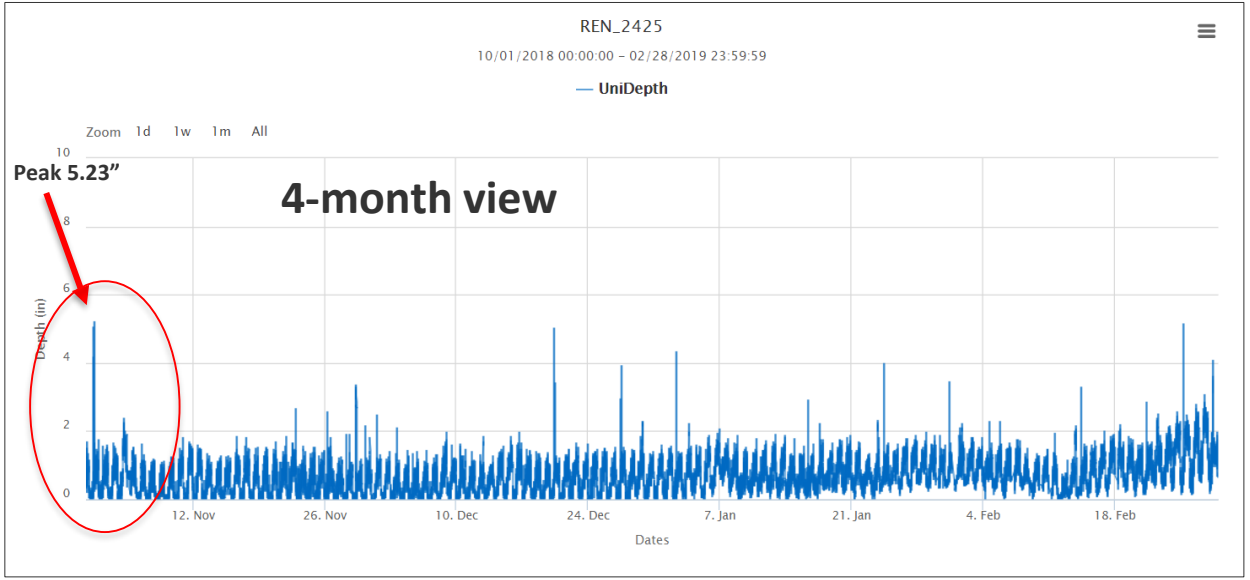
Peak Height: 5.23”

Cleaning Frequency

Schedule-driven: 4

Segment-Driven: 0

Reduction: 4



Results and To-Date Return - Renton

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 Gain

San Diego, CA

City of San Diego
PUBLIC UTILITIES
Water & Wastewater

System 3,800+ miles gravity sewer

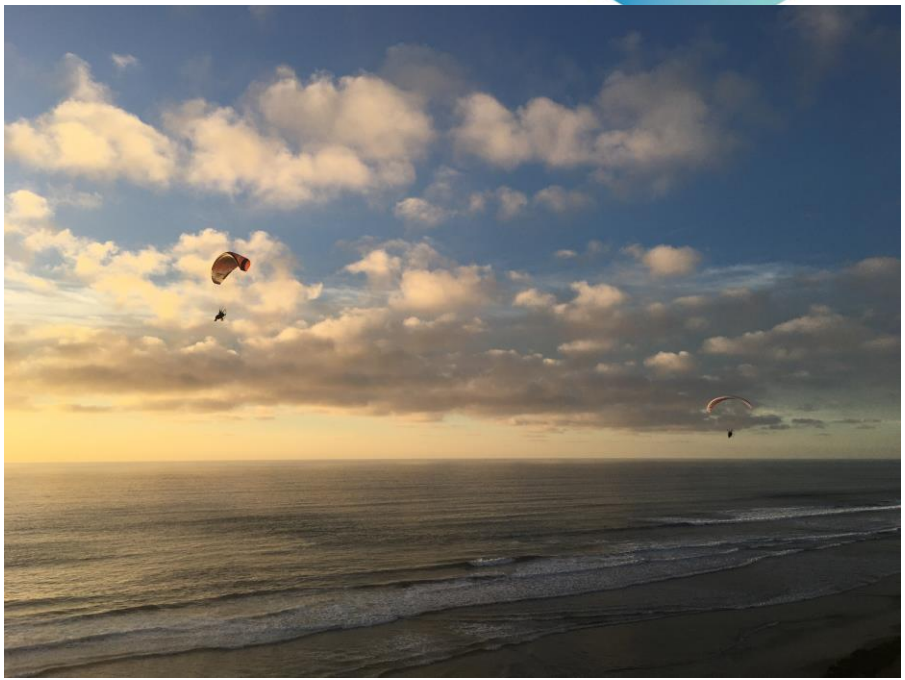
Process Cleaning Frequencies:

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

Challenges Labor availability

Program to date:

55 monthly sites selected
Beginning October 2019



Results and Return (Ongoing) – San Diego

Location	Last Cleaned Date	Scheduled Expected Since Last	Reduction	Cost Per Segment	Savings to Date
2610	8/6/2019	6	83%	$ 600	$ 3,600
3832	8/13/2019	6	83%	$ 600	$ 3,600
3889	8/13/2019	6	83%	$ 600	$ 3,600
4405	9/6/2019	5	80%	$ 600	$ 3,000
22344	9/25/2019	4	75%	$ 600	$ 2,400
22362	9/25/2019	4	75%	$ 600	$ 2,400
22364	6/4/2019	8	88%	$ 600	$ 4,800
24697	12/11/2019	2	50%	$ 600	$ 1,200
24698	6/3/2019	8	88%	$ 600	$ 4,800
24699	12/11/2019	2	50%	$ 600	$ 1,200
25415	9/19/2019	4	75%	$ 600	$ 2,400
26692	9/26/2019	4	75%	$ 600	$ 2,400
27620	9/25/2019	4	75%	$ 600	$ 2,400
30793	9/3/2019	5	80%	$ 600	$ 3,000
30794	9/3/2019	5	80%	$ 600	$ 3,000
30868	9/24/2019	4	75%	$ 600	$ 2,400
31776	9/24/2019	4	75%	$ 600	$ 2,400
33400	11/22/2019	2	50%	$ 600	$ 1,200
42013	9/23/2019	4	75%	$ 600	$ 2,400
42014	11/2/2019	3	67%	$ 600	$ 1,800
43395	9/26/2019	4	75%	$ 600	$ 2,400
59931	9/4/2019	5	80%	$ 600	$ 3,000
61519	9/7/2019	5	80%	$ 600	$ 3,000
61522	9/7/2019	5	80%	$ 600	$ 3,000
61782	9/5/2019	5	80%	$ 600	$ 3,000
62170	11/9/2019	3	67%	$ 600	$ 1,800
62222	9/5/2019	5	80%	$ 600	$ 3,000
		122	**78%**		**$ 73,200**

City of San Diego
PUBLIC UTILITIES
Water & Wastewater

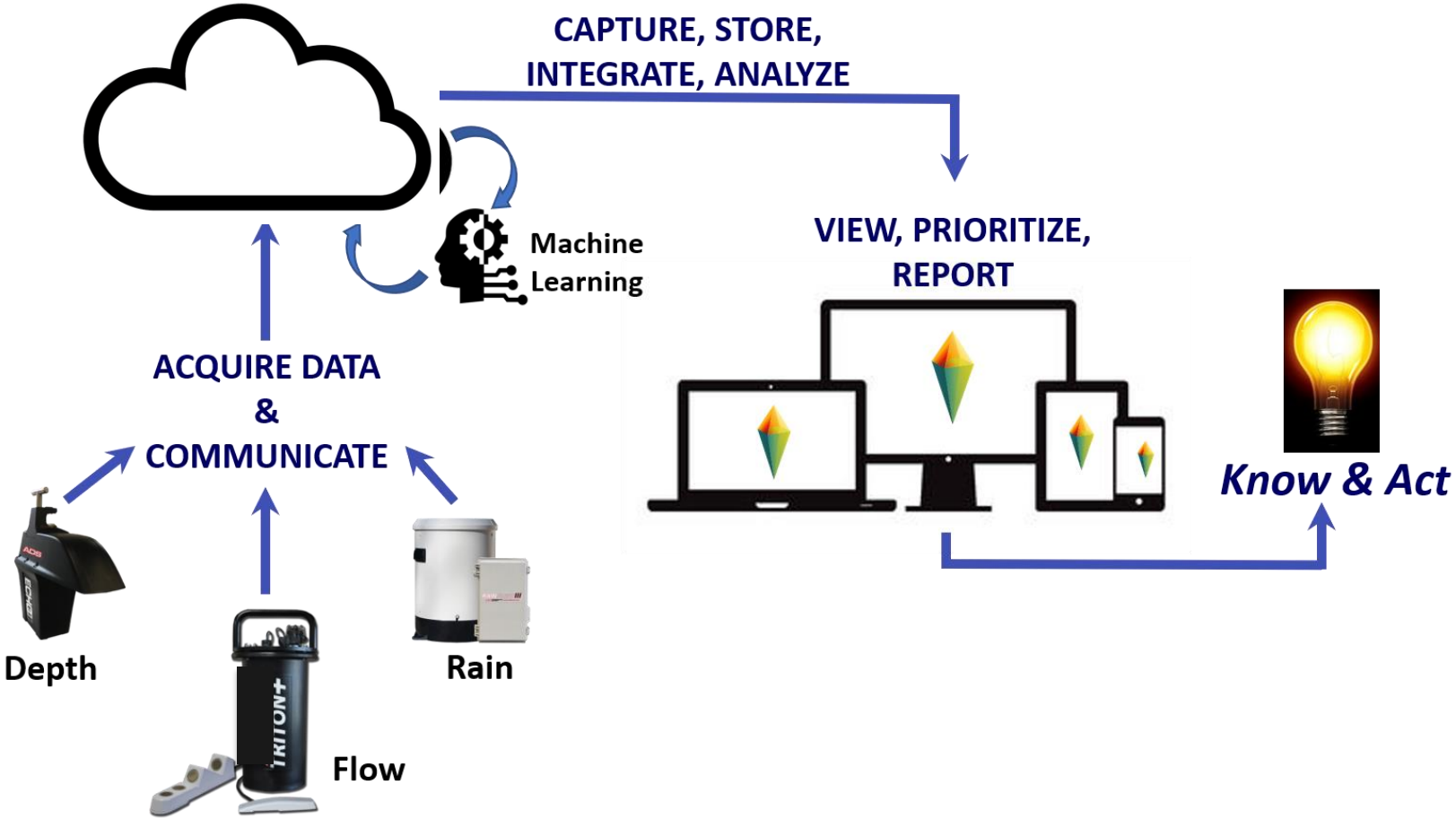
Monthly Sites

Reduced Cleaning Frequency Realized Benefits

1. Productivity gains enable maintenance resource reallocation.
2. Monitored segments have 24/7 SSO protection.
3. Pipe-wear from high pressure sprays reduced.
4. Safety- less in-street activity.
5. Water use is lowered.
6. Ongoing data capture can be leveraged for other applications i.e., model calibration.

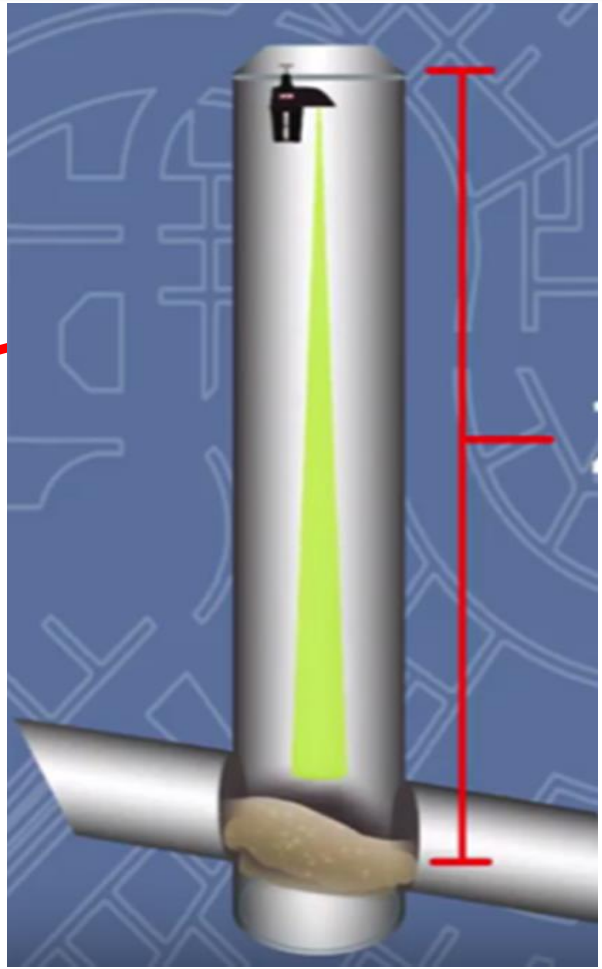
Enabling Technology

Smart Technology: Creating the Connection



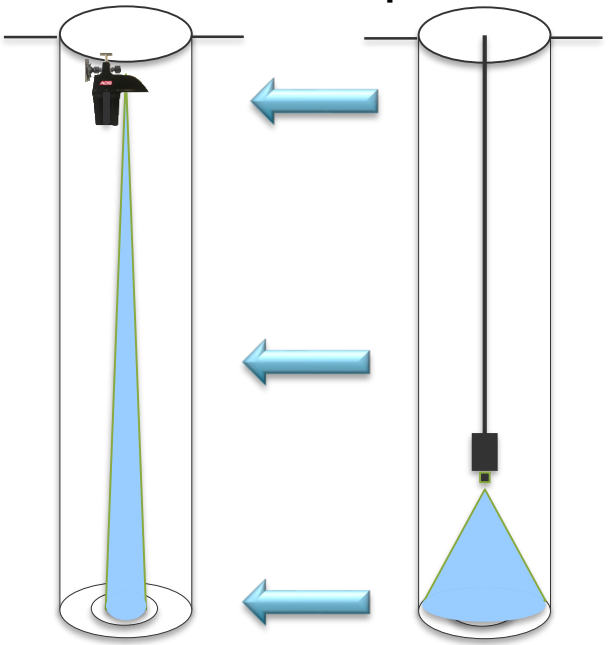
Remote Site Sensing & Communications

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



2nd Generation Focus-Beam

1st Generation Spread-Beam



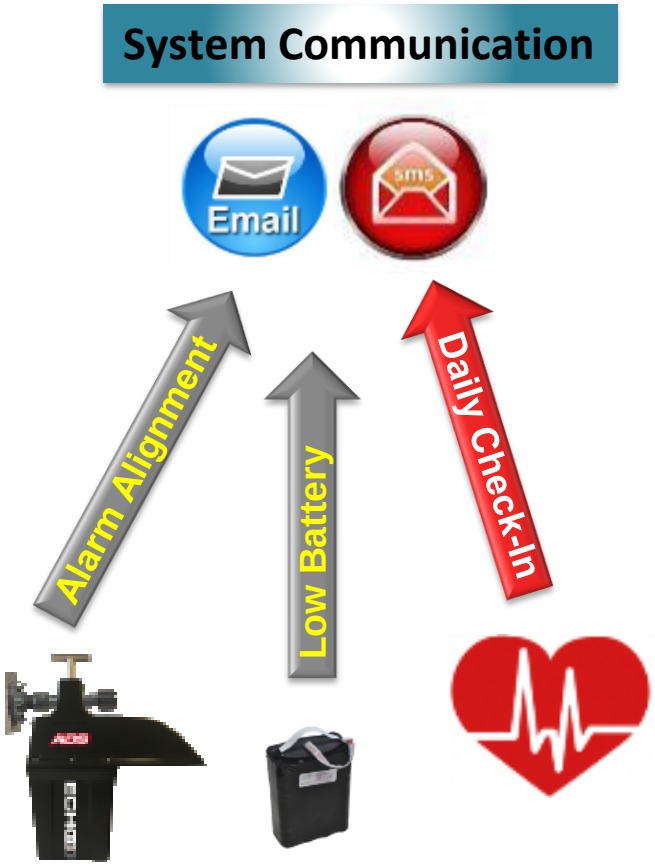
4 °

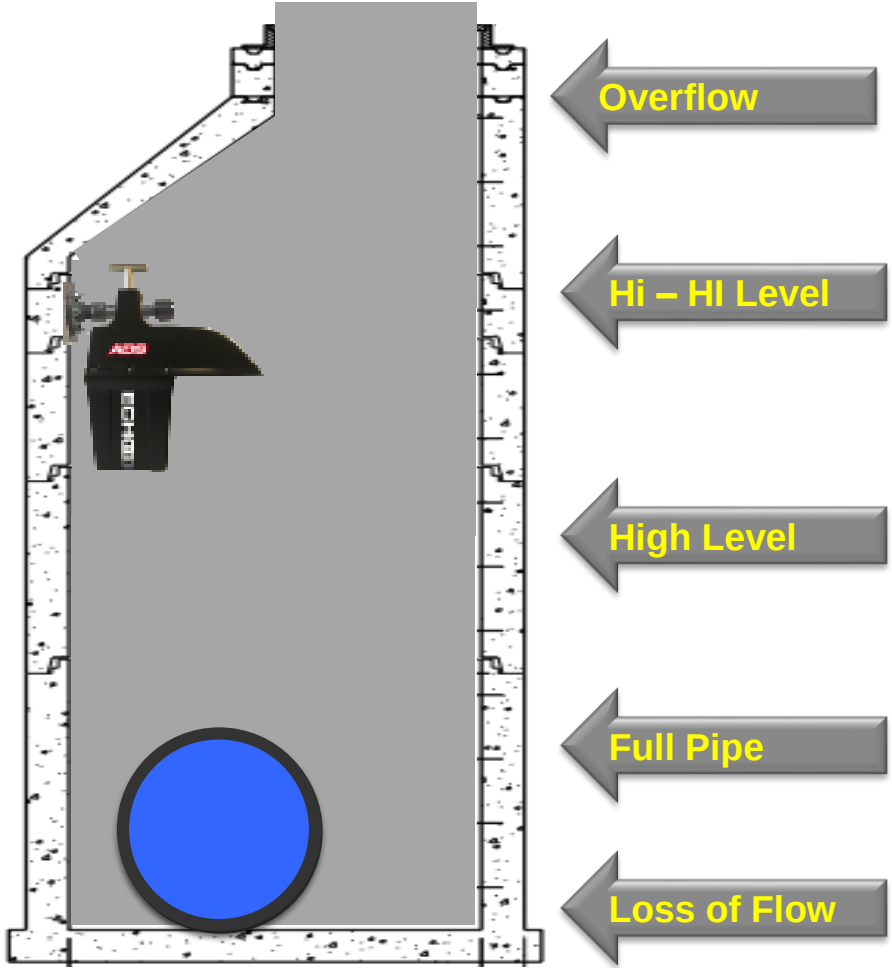
16 ° to 18°

Complete Range 20 ft to 8” pipe

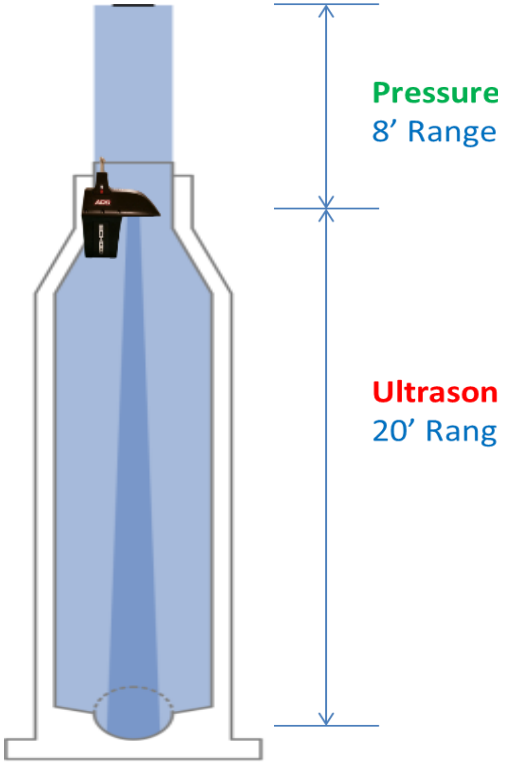
Limited Range 2 ft to 8” Pipe

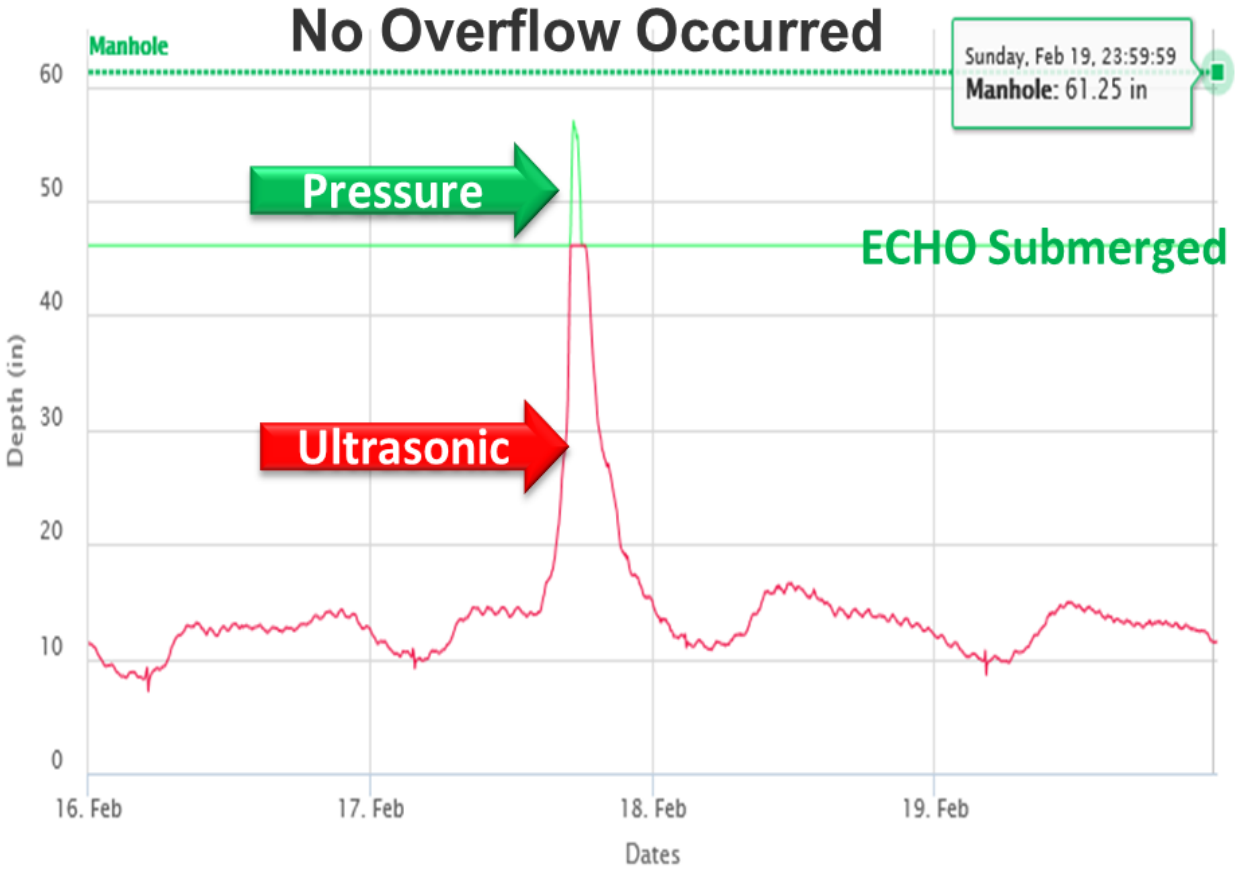
2nd Generation Monitoring Technology Advancements



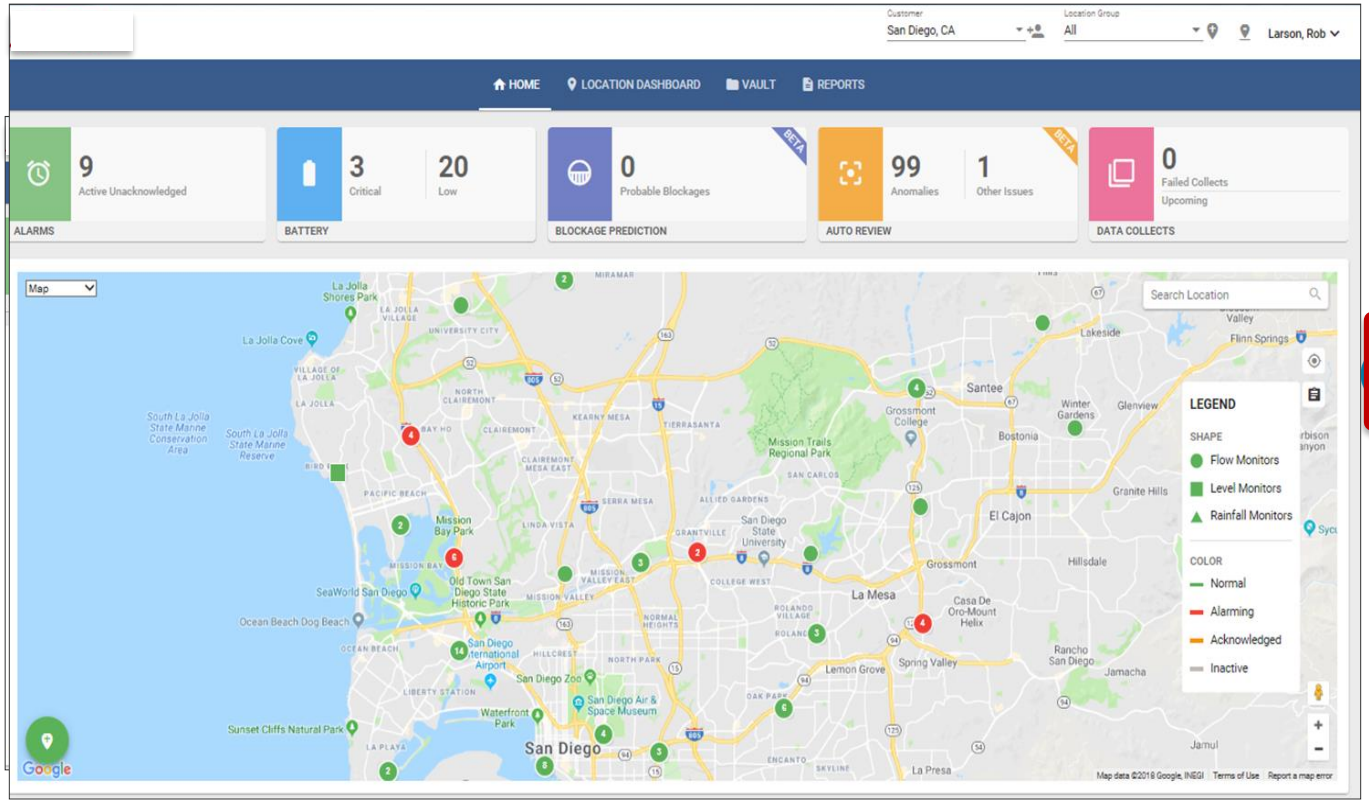


Remote Site Depth (Level) Monitor





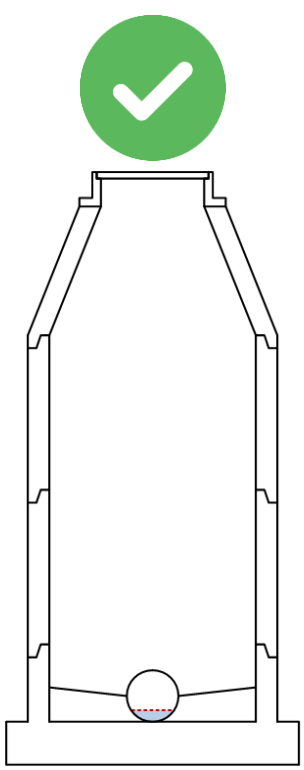
Software Advancing with Machine Learning



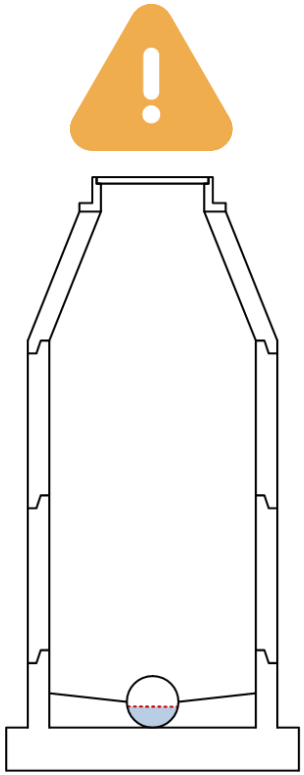
Apps

- Auto Detect / Auto Correct
- Blockage Prediction
- Wet Weather Analytics
- Data Editing
- IoT Hub

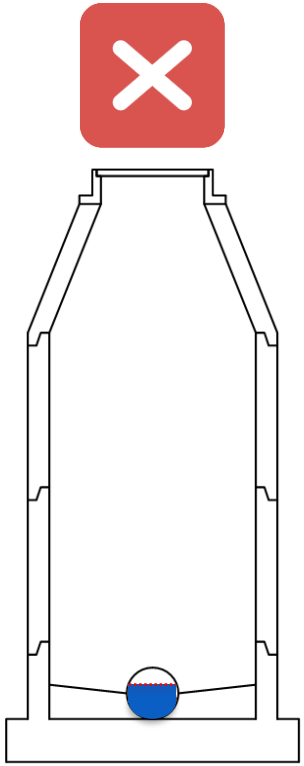
Blockage Prediction Status



Blockage not detected

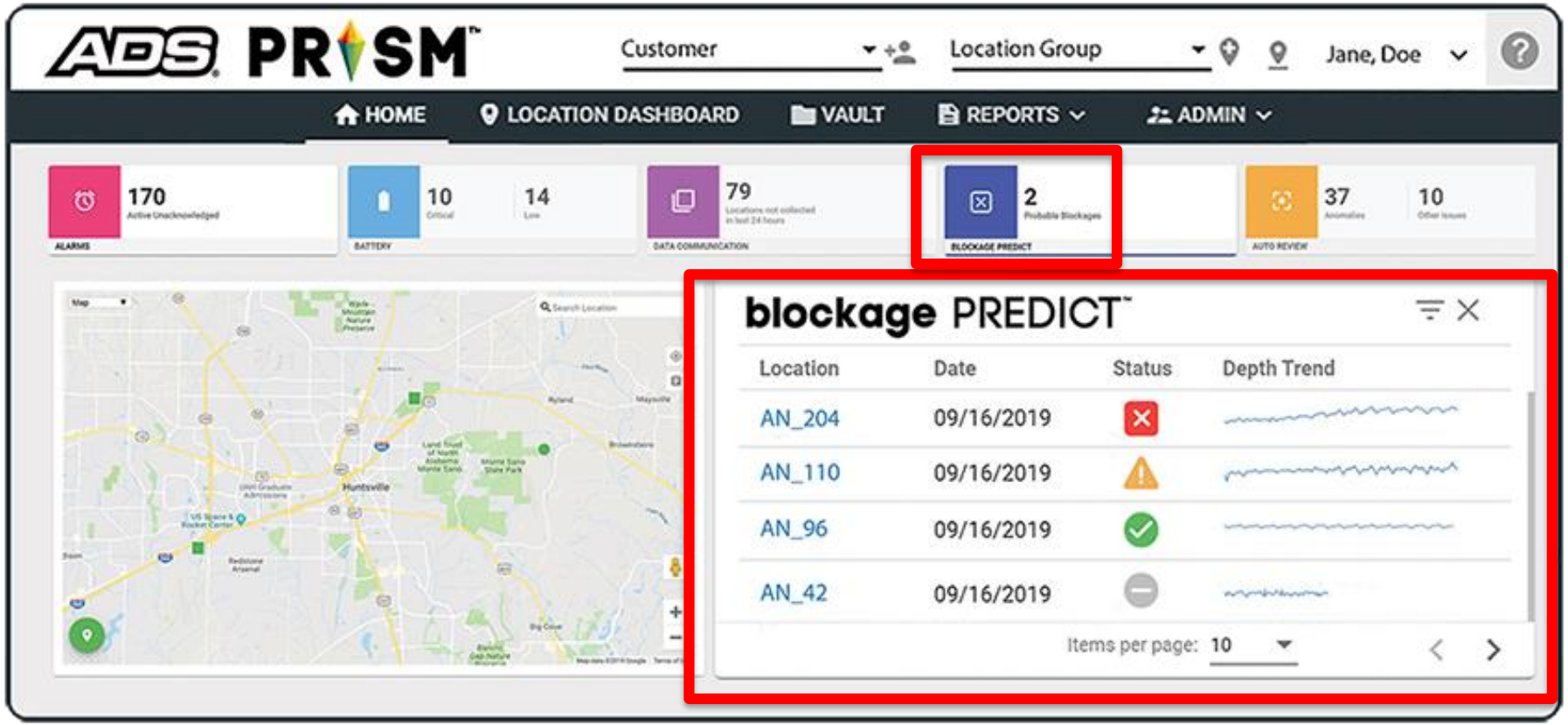


Blockage is detected

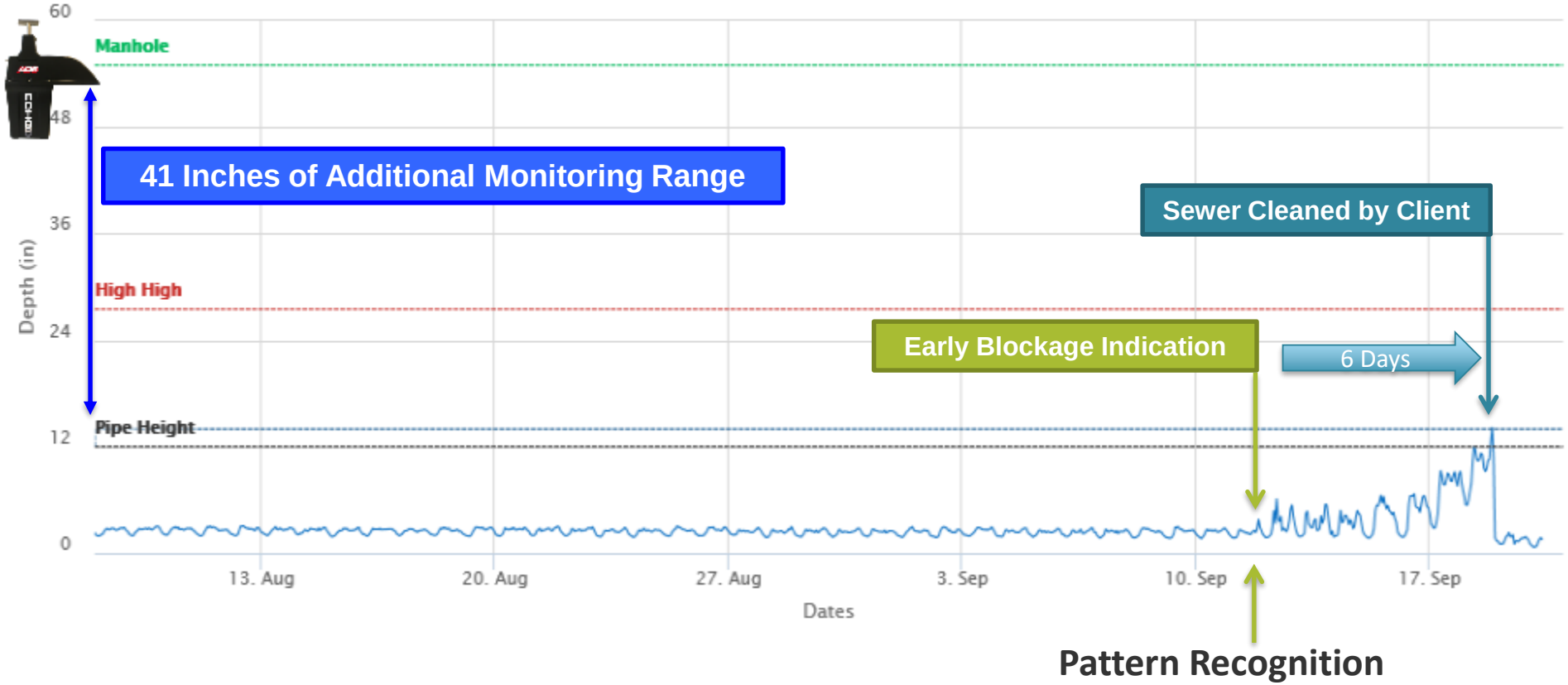


Blockage is detected

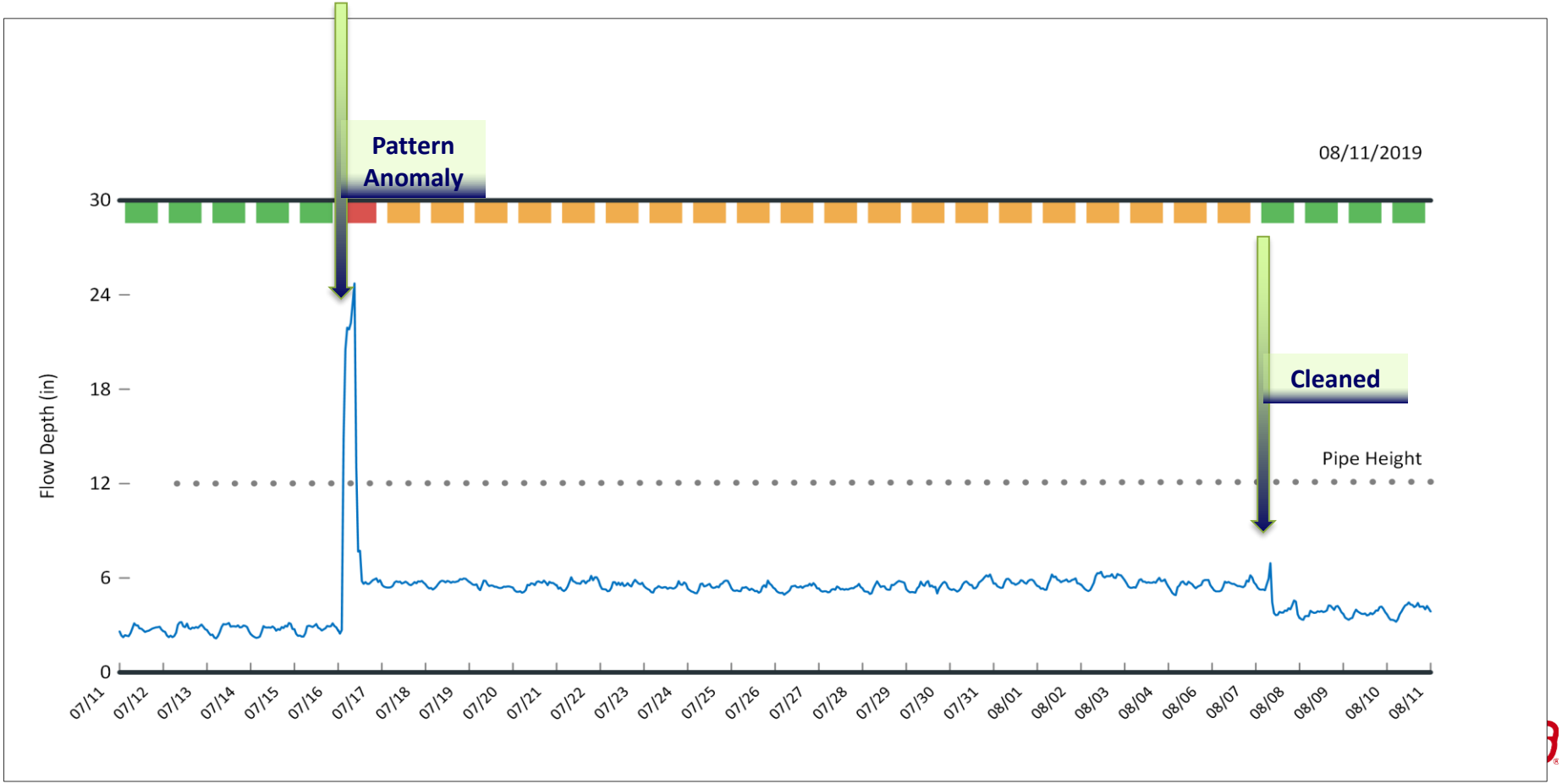
Predicting Blockages



Example of Weekly Cleaning Site



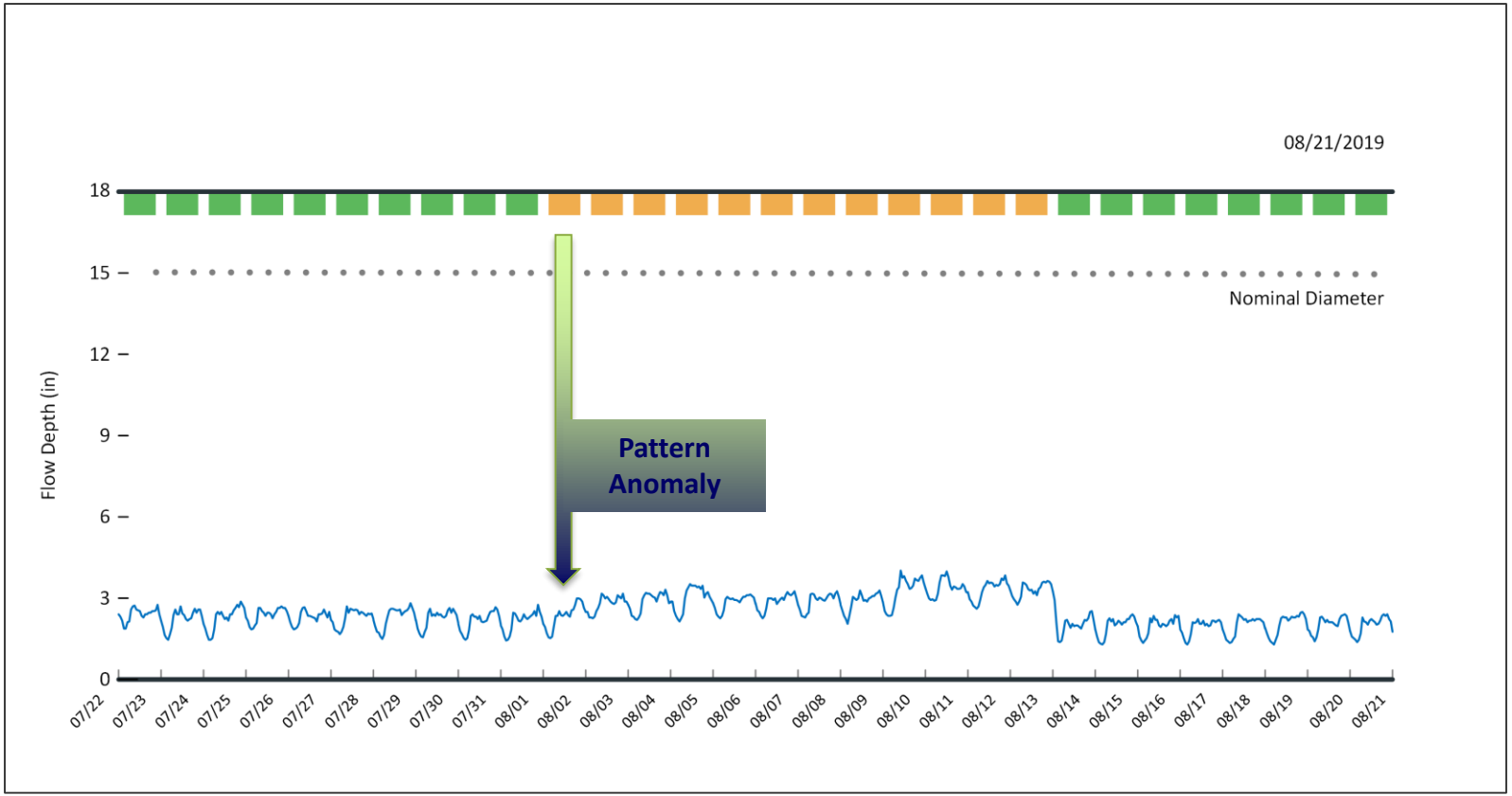
Pattern Anomoly 1: Sediment



Findings Site 1

Gravel and Rocks Observed in Manhole Channel

Pattern Anomaly 2: Obstruction



Abstraction

Stick Blocking Outlet Pipe Resulting in Ragging

Predicting Blockage & Identify Type

Machine learning- continuous technology development

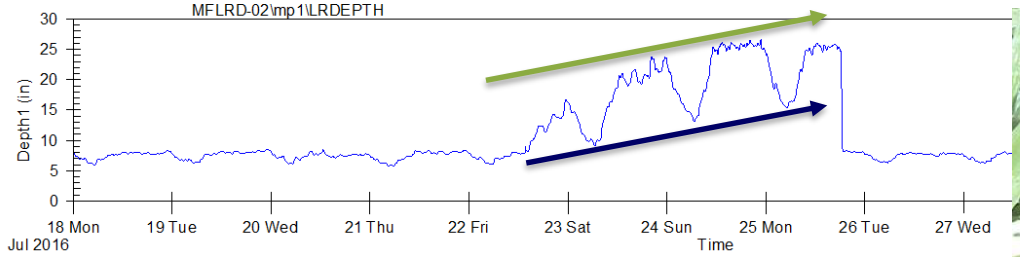
- Now: Predictively identify developing blockage
- Next: Identify blockage *type*

Grease

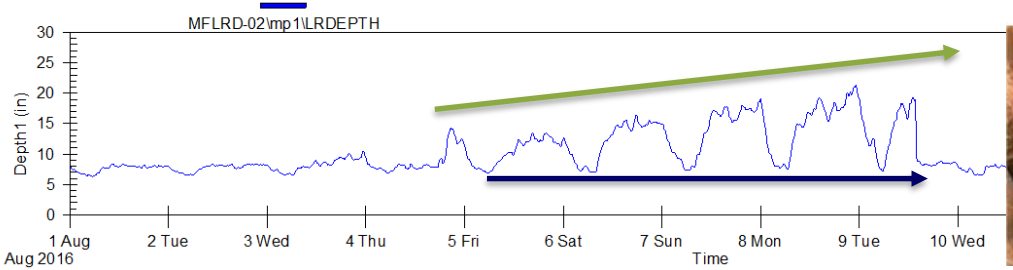
Roots

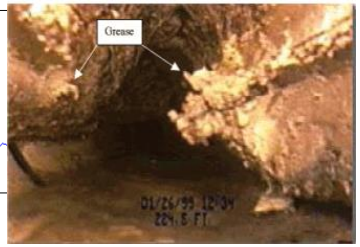
Collapse

Blockages Have Signatures

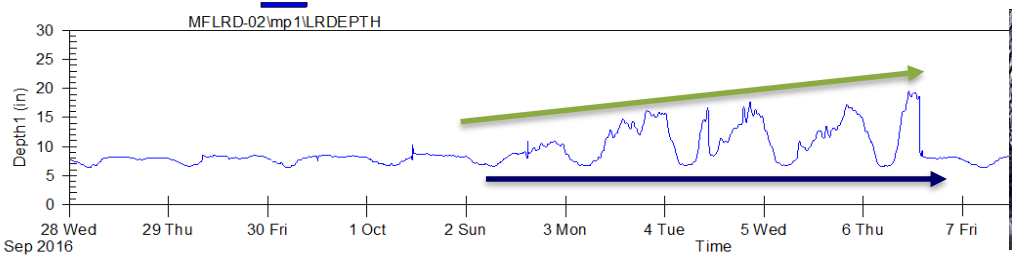


Debris Blockage Signature
Peak values increase
Low values increase





Grease Blockage Signature
Peak values increase
Low values remain relatively constant



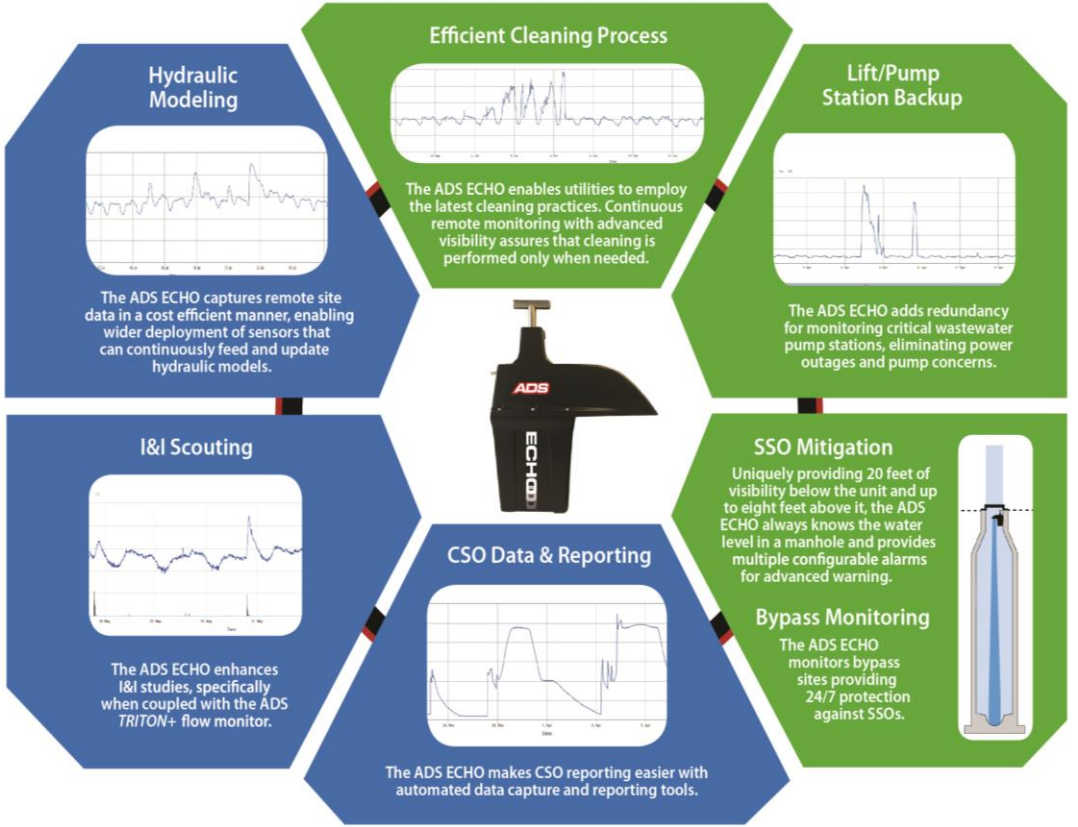
Grease Blockage Signature
Peak values increase
Low values remain relatively constant

A Little About ADS

- **44-Years of Experience with Collection System Flows**
- **End-to-end Approach**
  - Equipment, Software,
  - Analytics & Applications Services
  - 29 Field Service Offices

Solutions-Focused…

ADS, when expertise matters



Summary

Optimizing Collection System health is like taking vitamins…

Vitamins are safe & healthful but high dosages can bring

- Unwanted side effects
- Unnecessary costs

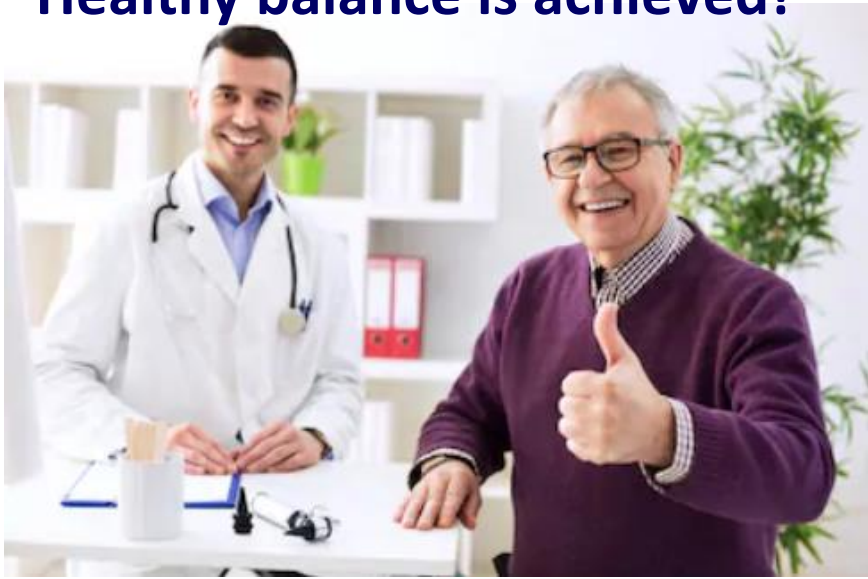
High Frequency Cleaning is similar with side-effects…

- 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!



Questions?

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