

Lower Costs, Lower Risks...

New Relief through Optimized Cleaning



Cleaning Optimization



CSO Monitoring
& Reporting



I/I Reduction



Capacity Management



Accurate Billing



Hydraulic Model Calibration

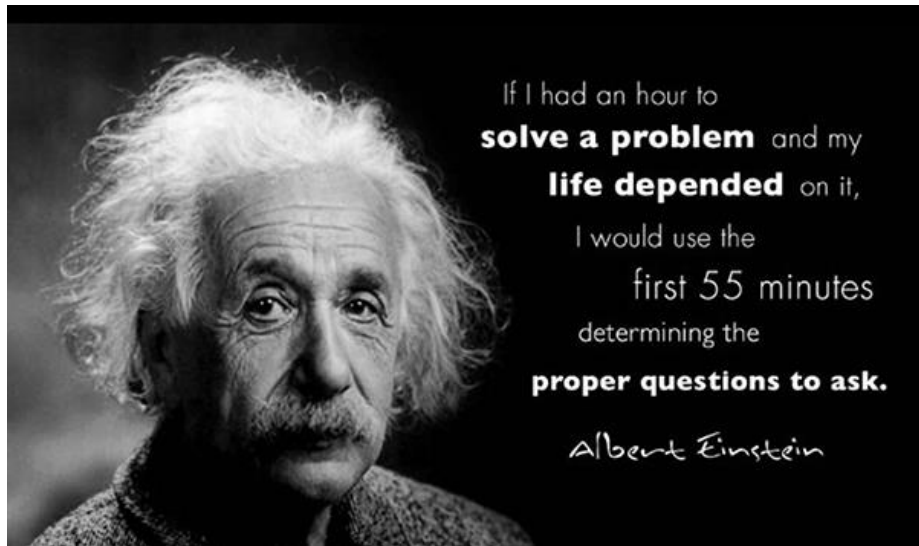


Heather McPherson P.E.
Business Development Manager
ADS Environmental Services

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

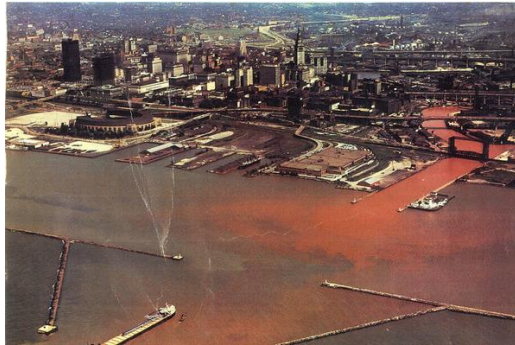
In the News in '72

- 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**



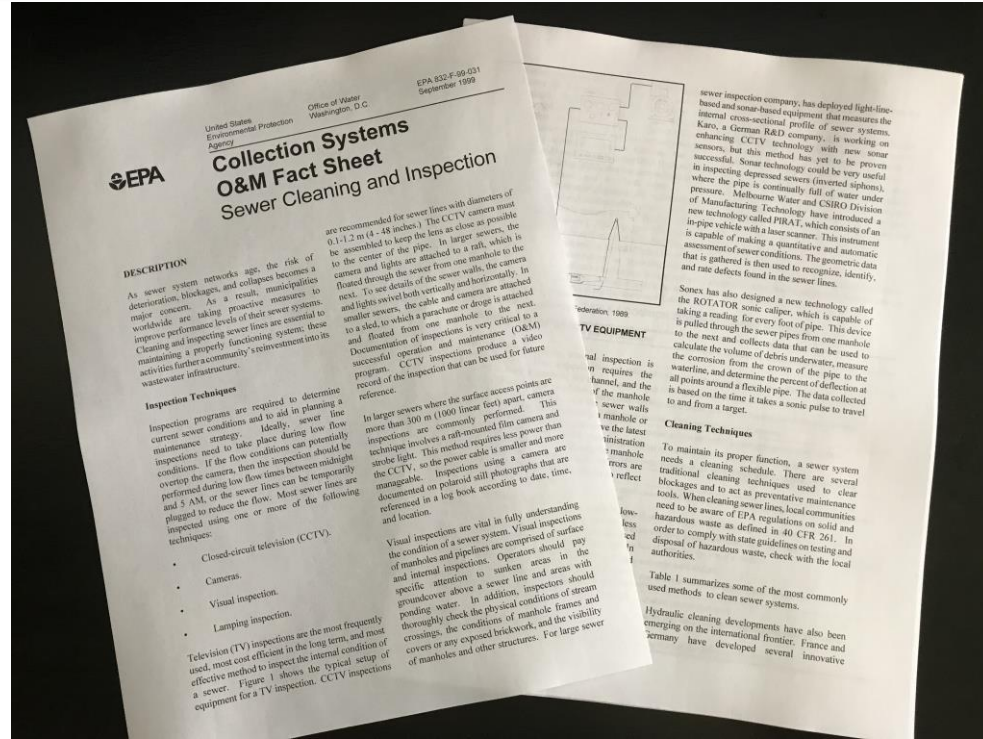
EPA's Plan

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



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

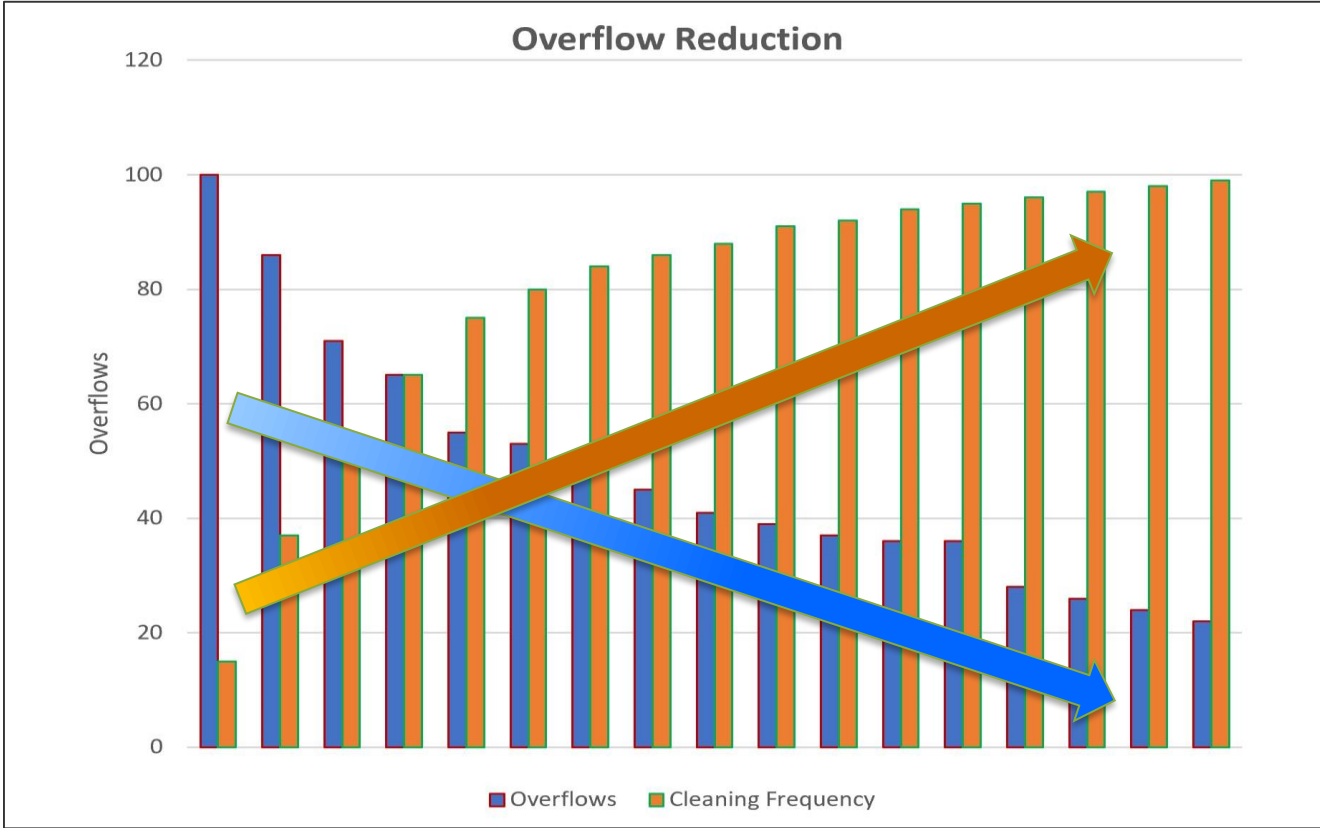
“Hot Spot” Cleaning

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?

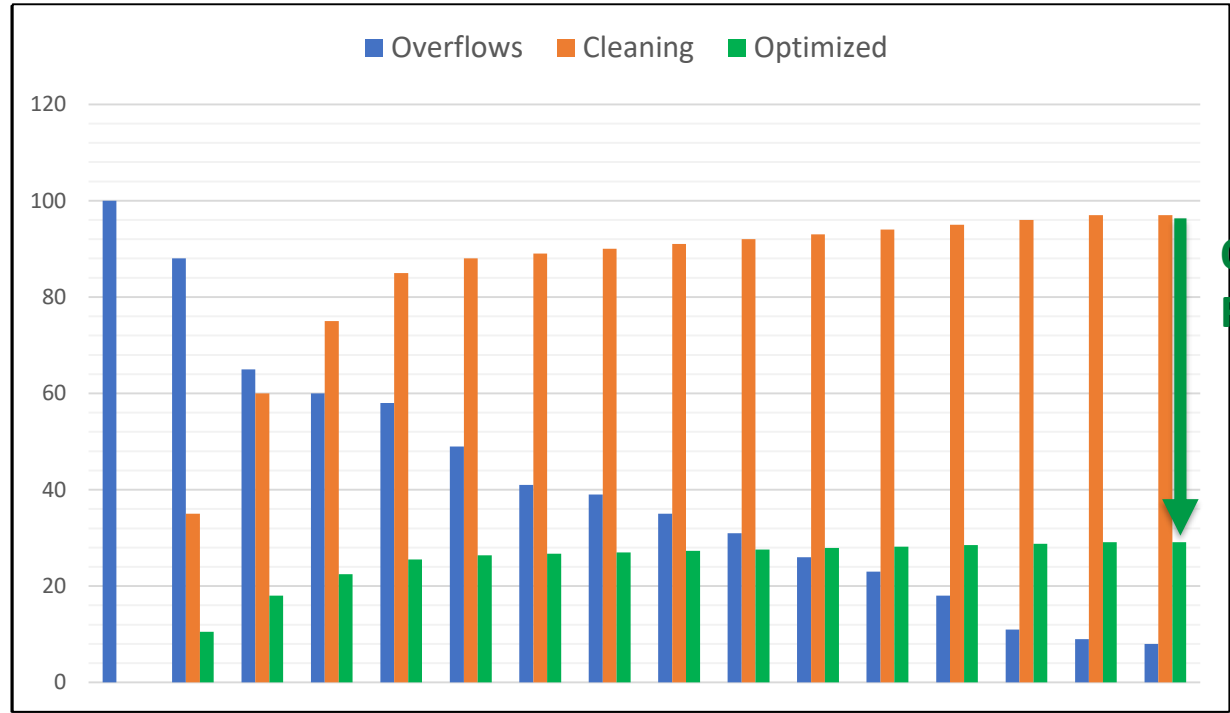
Lack remote site condition visibility



**Forging Change
through
Optimization**

What is Cleaning Optimization?

Right-sized cleaning frequency
Driven by real-time, *remote site conditions*



Optimized Frequency

Optimized Cleaning:
Lower Frequency and enhanced SSO prevention

Creating the Future



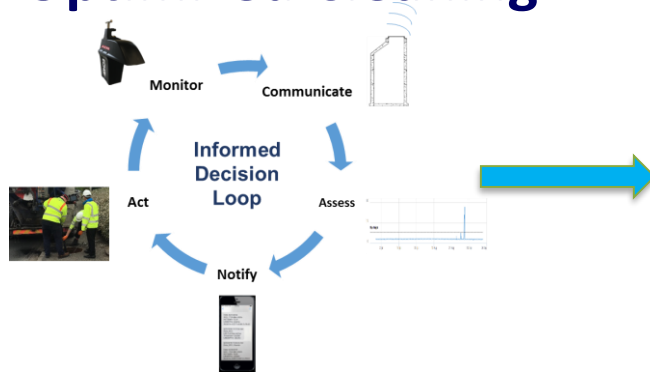
The most reliable way to predict
the future is to create it.

~ Abraham Lincoln

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

Schedule-driven cleaning



The Future

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

System

153 miles sewer, 53 miles storm

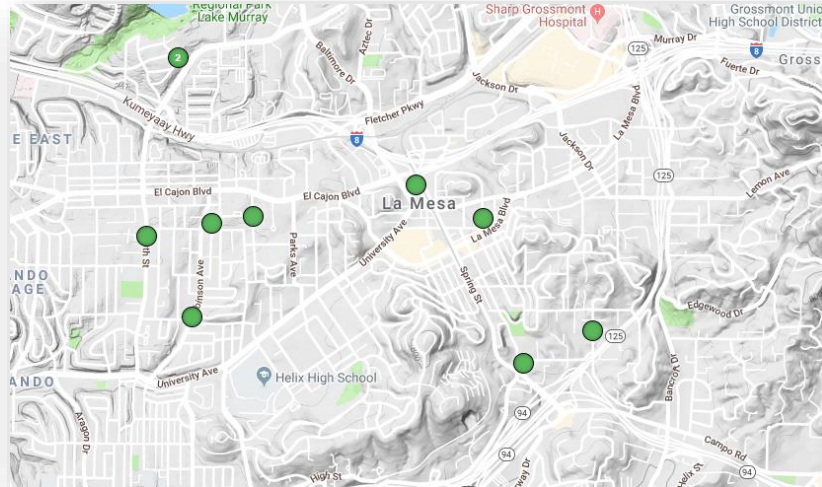
Process

Clean Total System Annually

Clean 100 segments- monthly/quarterly

Challenges

80% maintenance time spent cleaning

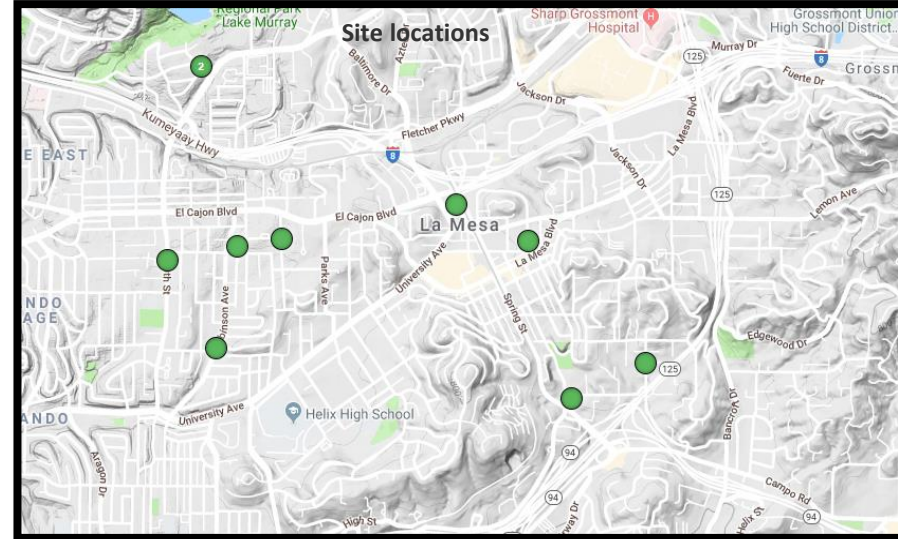


La Mesa, CA – Optimized Cleaning Process Action Plan



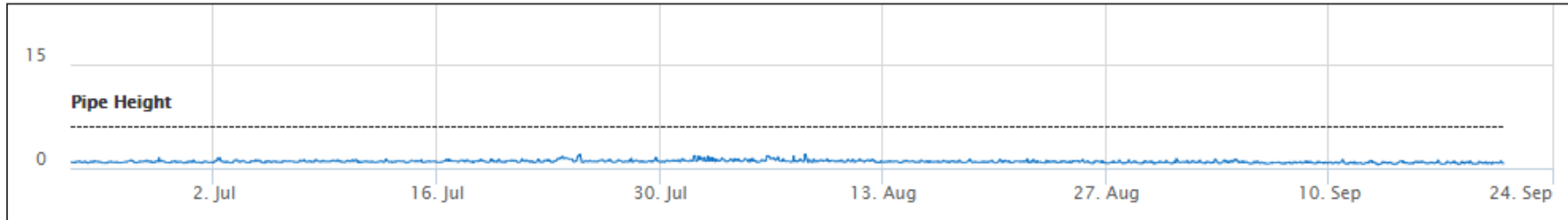
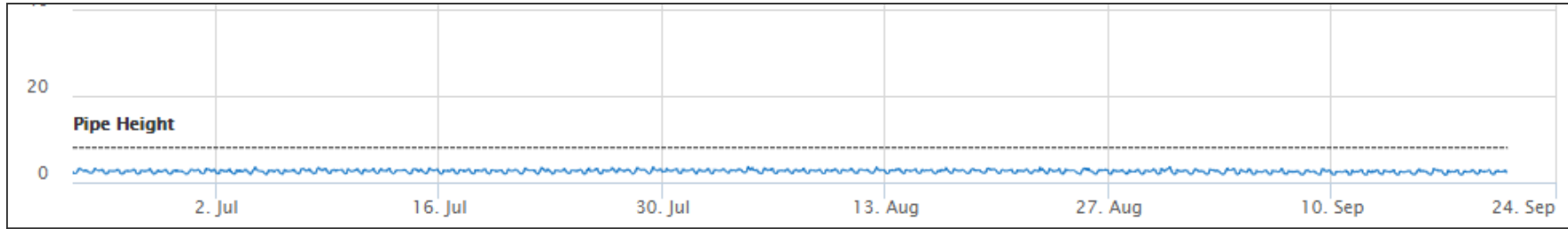
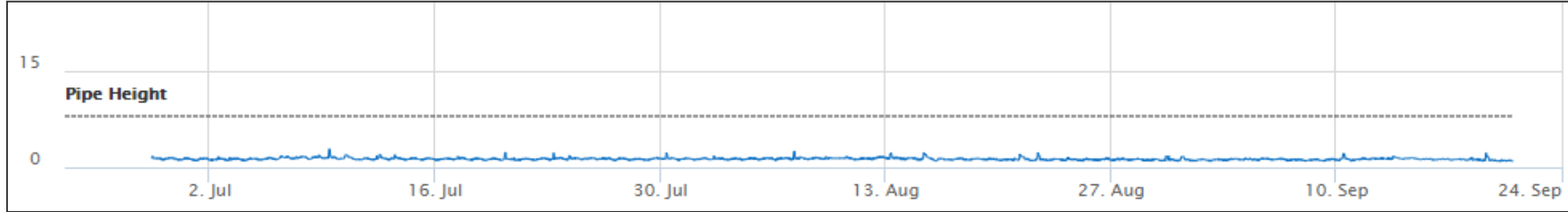
Study Approach

- 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



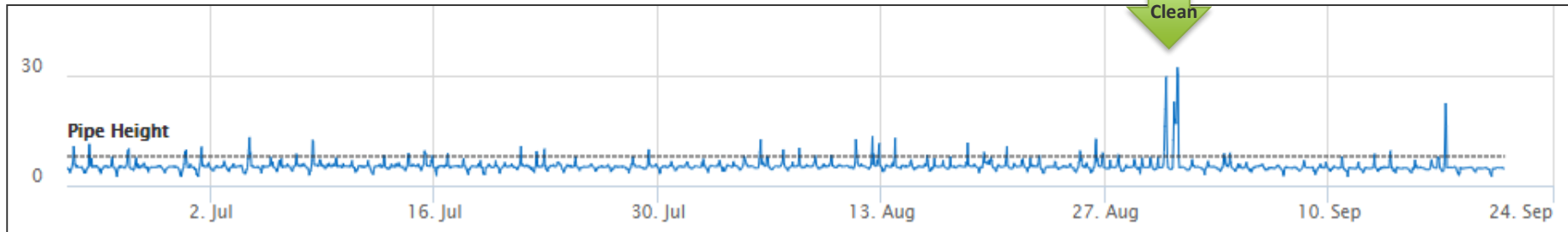
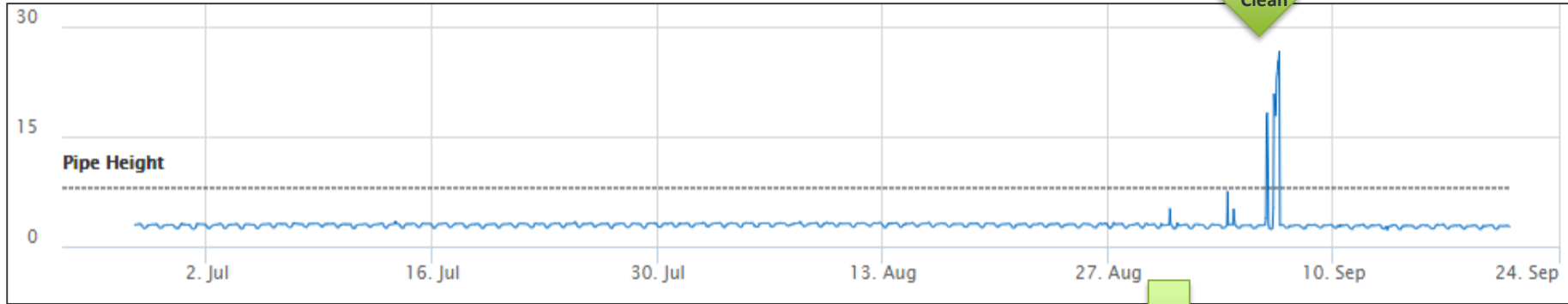
Stable depths for 4-months

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

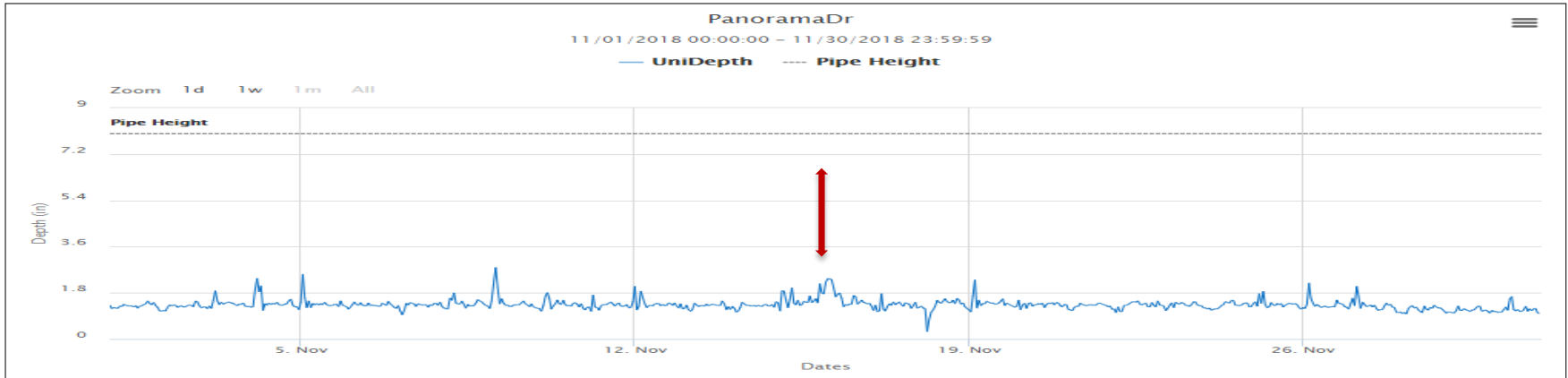
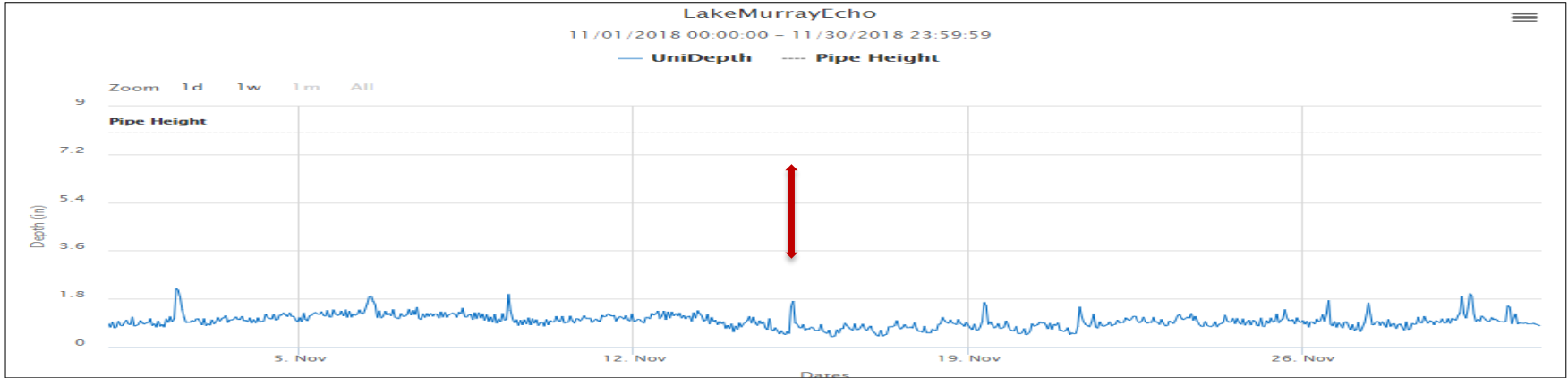
- Expected: Clean 60x (6 months x 10 sites)
- Actual: Clean **12x***
- Reduction: **48** cleanings (**80%**)

*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



Costs Overview

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

Productivity Savings

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%	\$ 400	\$ 19,200
Annualized					\$ 38,400

Renton, WA - Case Study

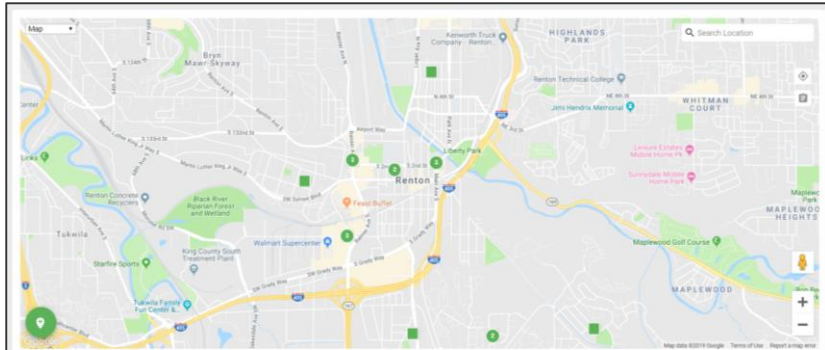
Situation

System 232 miles sewer

Process High Frequency, Weekly & Monthly segments

Challenges Unable to clean entire system

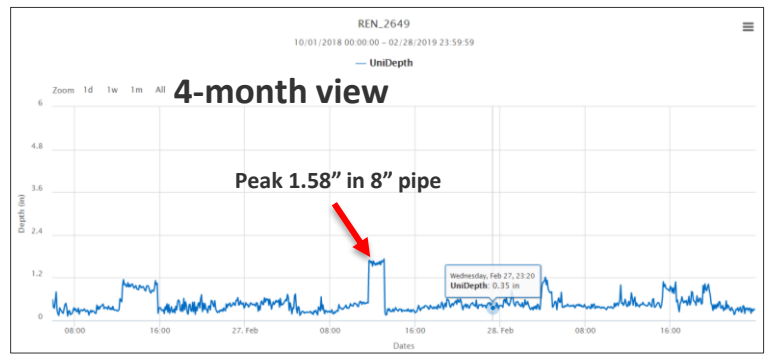
Study 4-month duration
20 segments:
- 8 weekly
- 12 monthly



Renton, WA –Site Cleaned Weekly

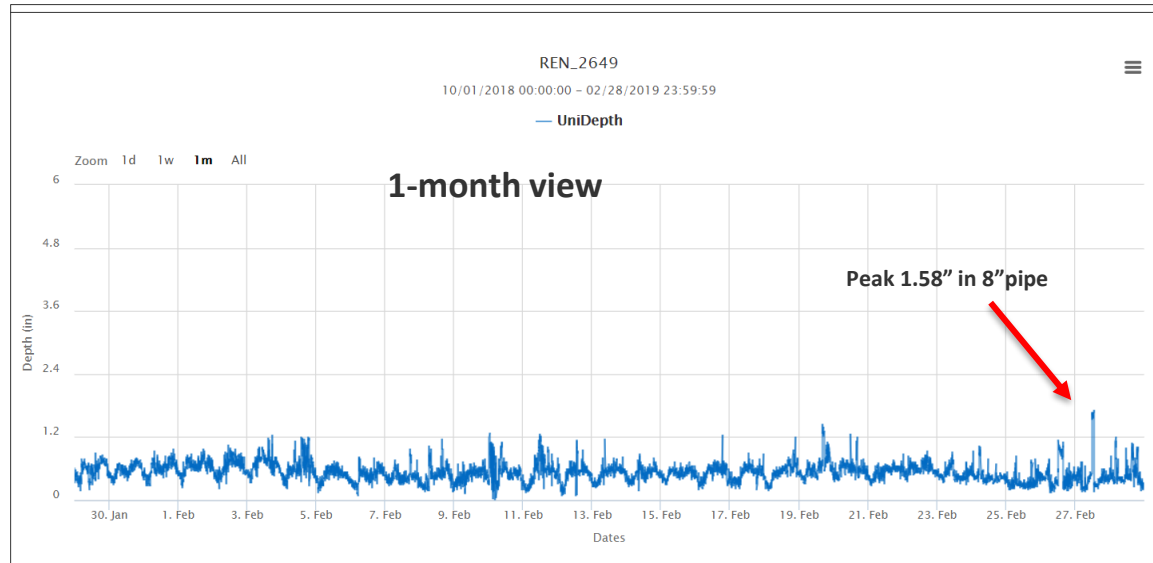
Site

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%





Site

Pipe Diameter: 10"

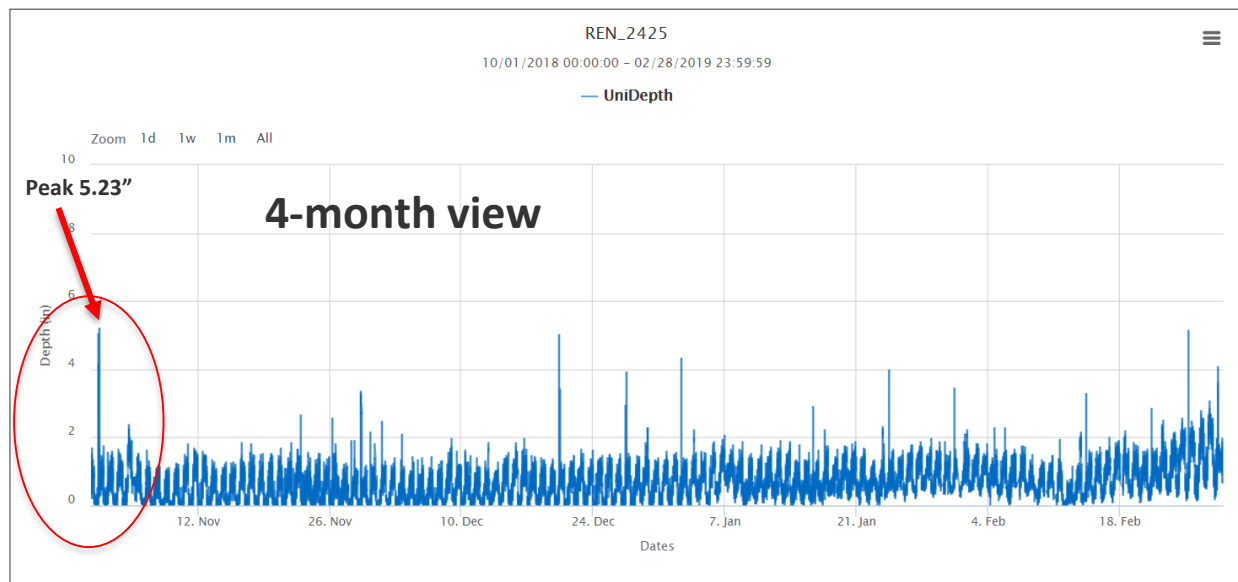
Peak Height: 5.23"

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



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 Cleaned	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

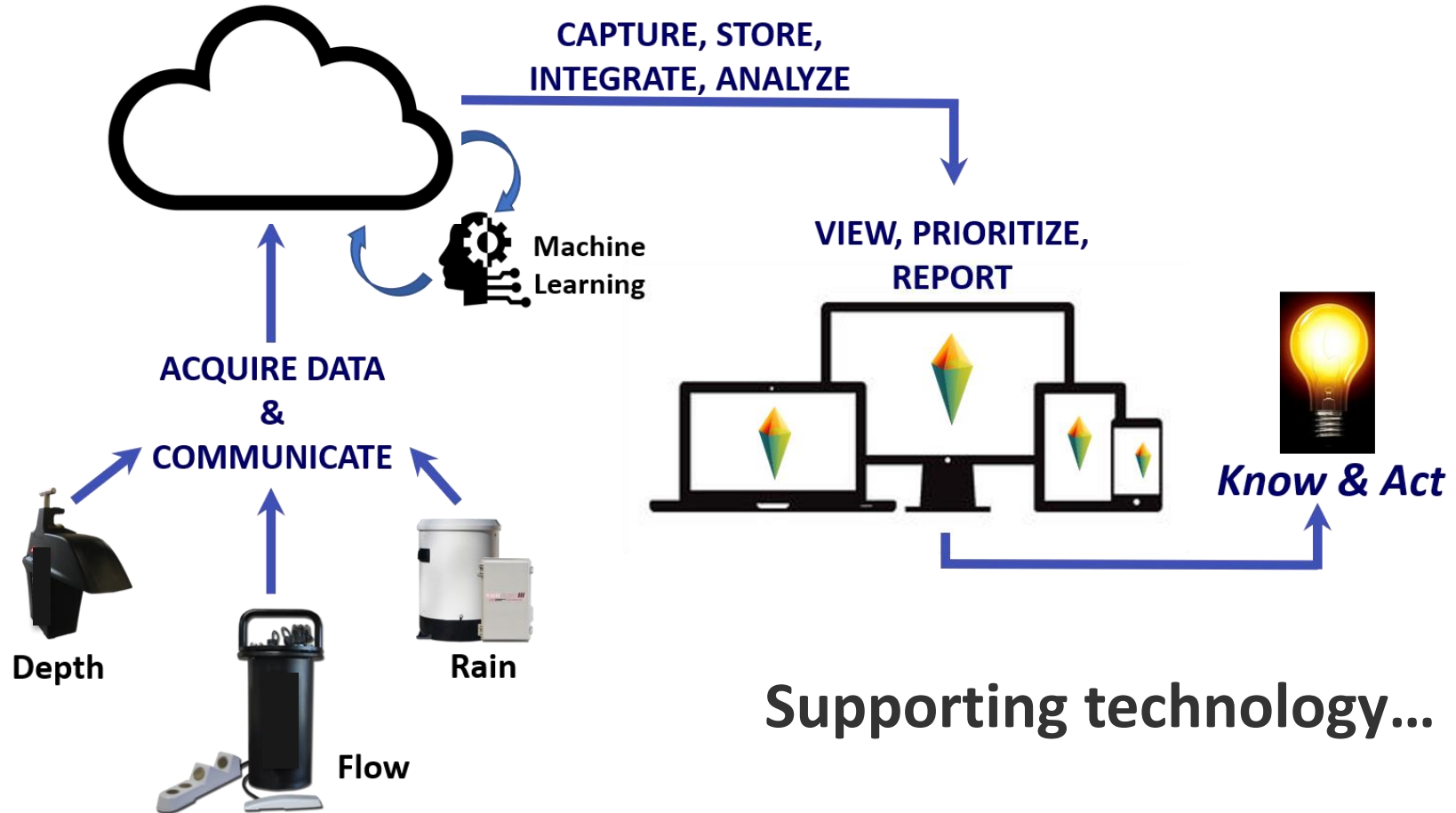
1. Productivity savings enable maintenance resource reallocation.
2. Monitored segments gain 24/7 SSO protection.
3. Pipe-wear from high pressure sprays reduced.
4. Improved safety- less in-street activity
5. Water use lowered.
6. Ongoing data capture used for model calibration.





**Technology
that Enables
Decisions**

Internet of Things Connects Sites to People



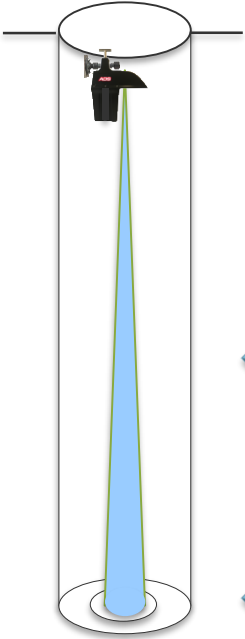
Remote Site Sensors & Communications

Level Monitors



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

2nd
Generation
Focus-Beam



4°
Long
Range
20 ft to 8" pipe

1st
Generation
Spread-Beam



16° to 18°
Limited
Range
2 ft to 8" Pipe

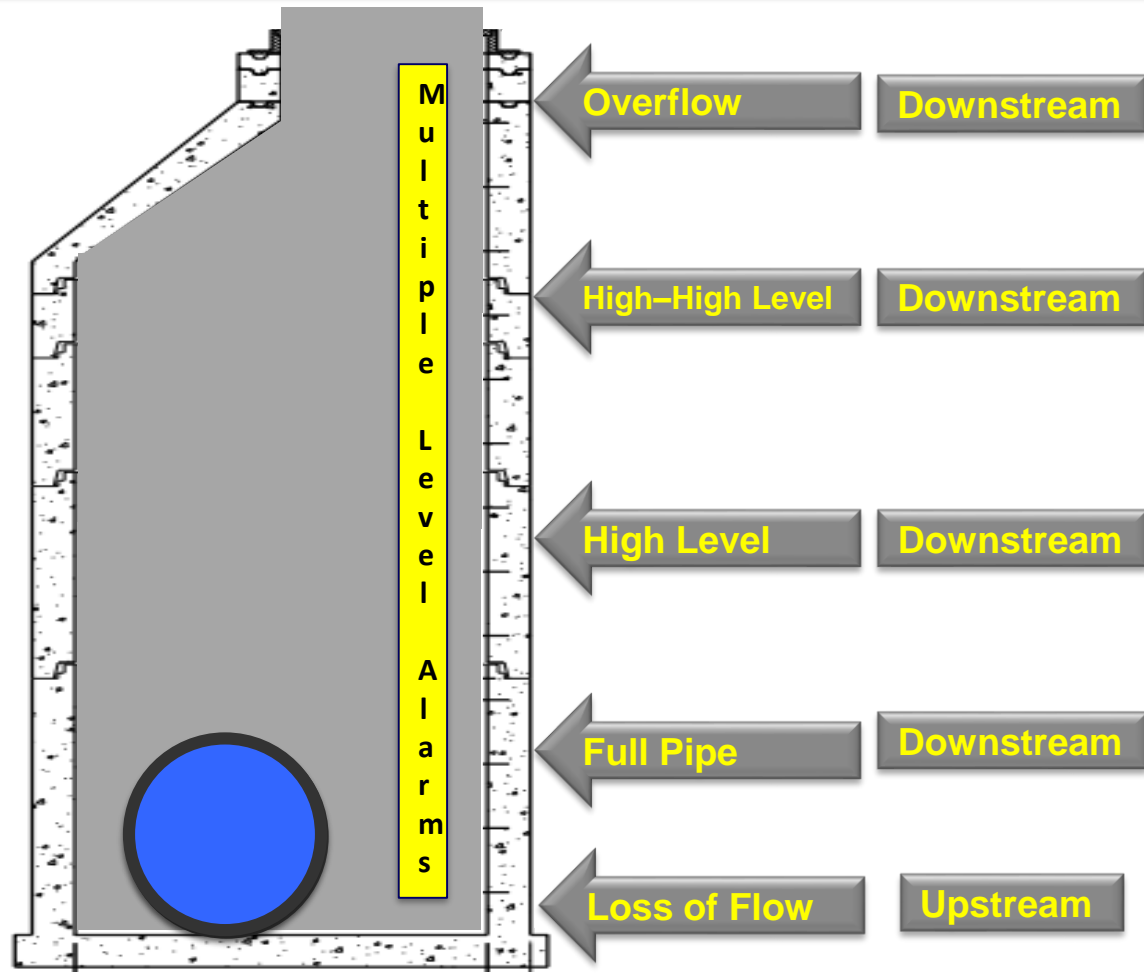
2nd Generation Technologies & Notifications

System Communication



2nd Generation:

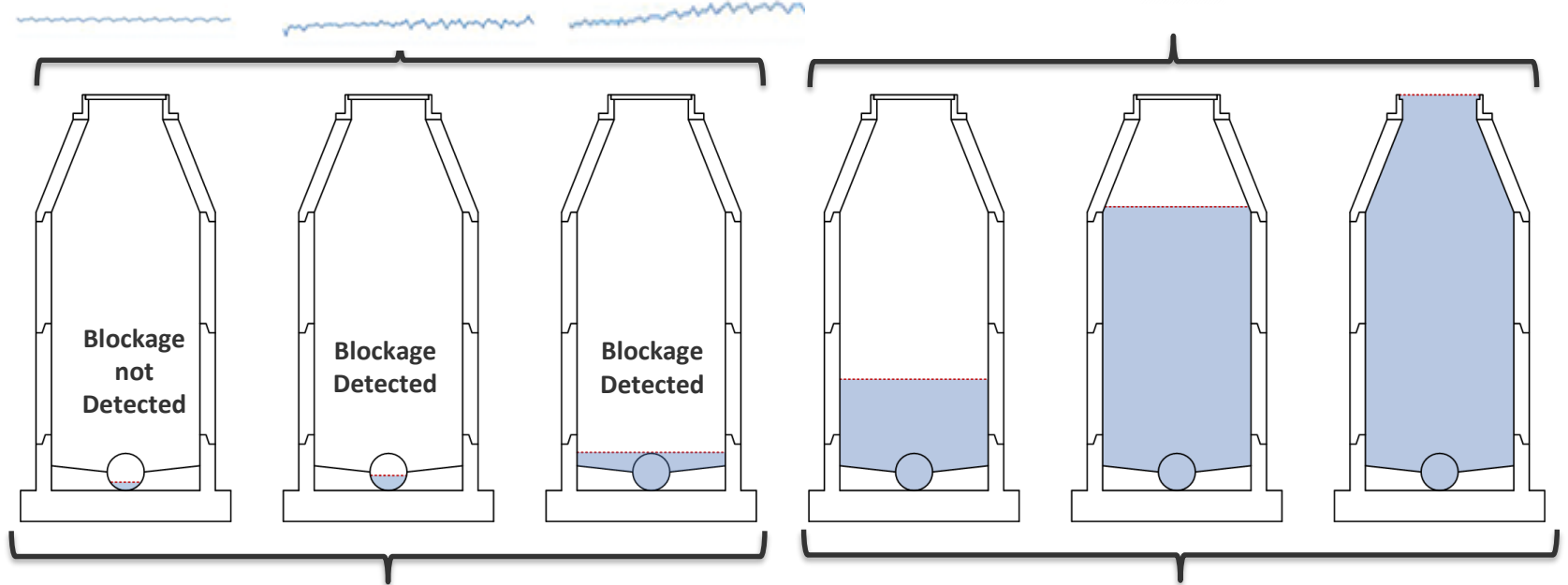
- Redundant Water Level Alarms
- Sensor Alignment Alarm
- System Status



The Blockage Continuum

Proactive

Reactive

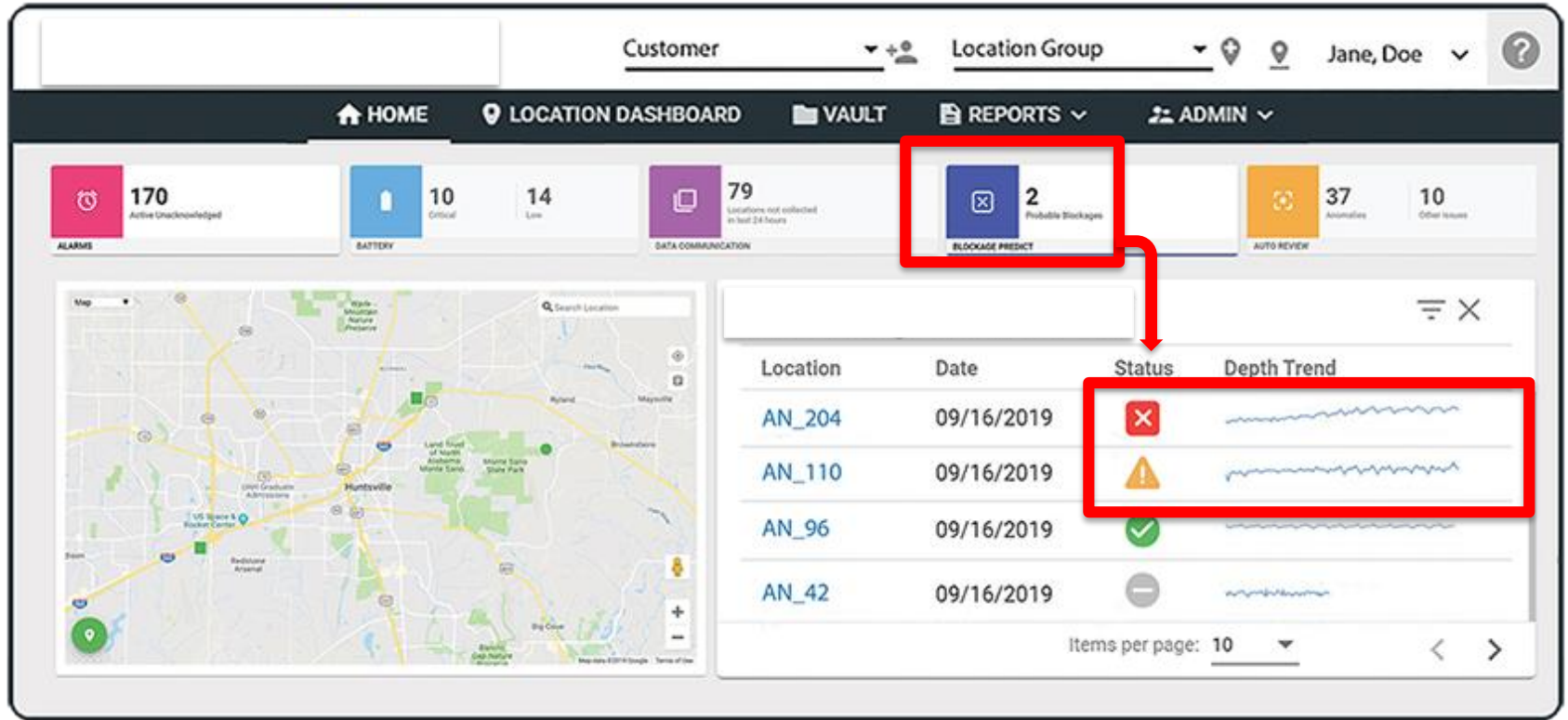


Pre-Alarm

Alarms

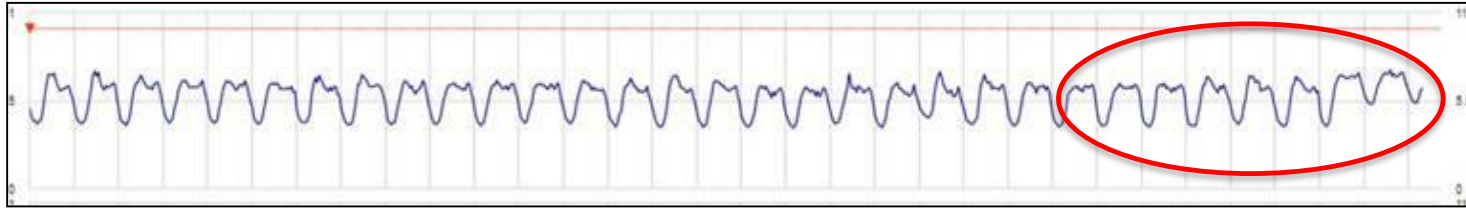
Predictive Analytics

Predicting Blockages

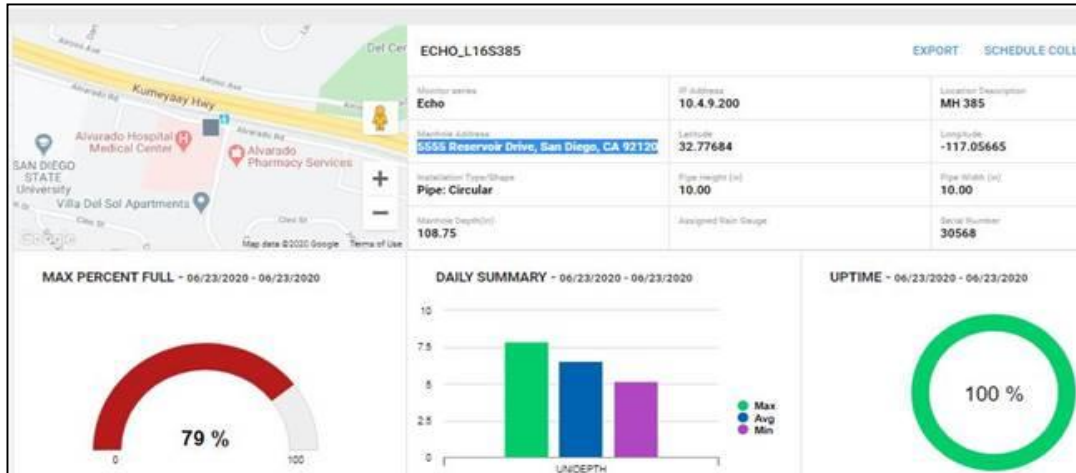


Predictive Analytics dashboards like above provide prioritized view

Site Hydrograph and Summary



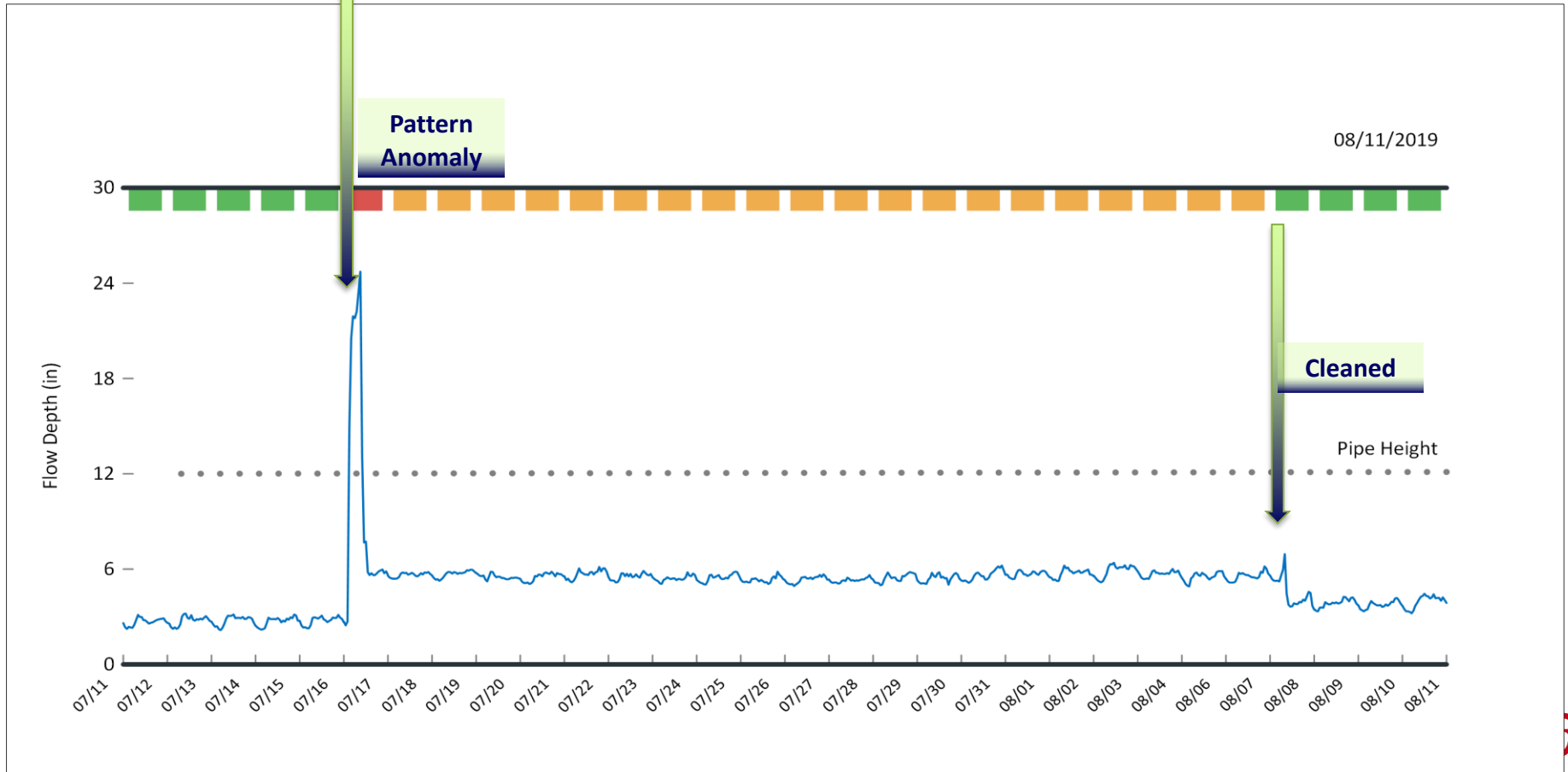
Change in hydrograph pattern



Summary of location and site details

Site Example 1

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

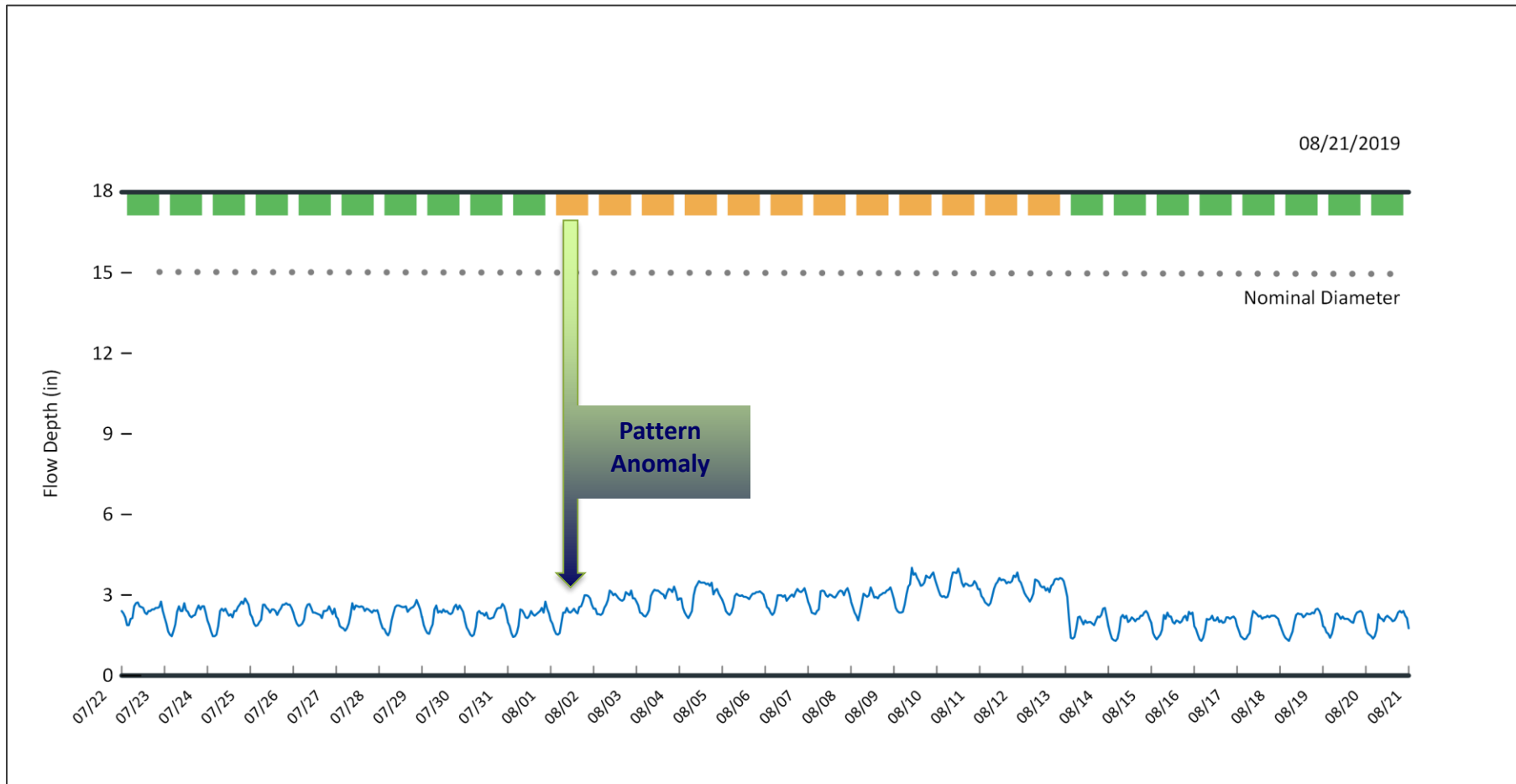


Site Example 1 Site Findings



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

Site Example 2

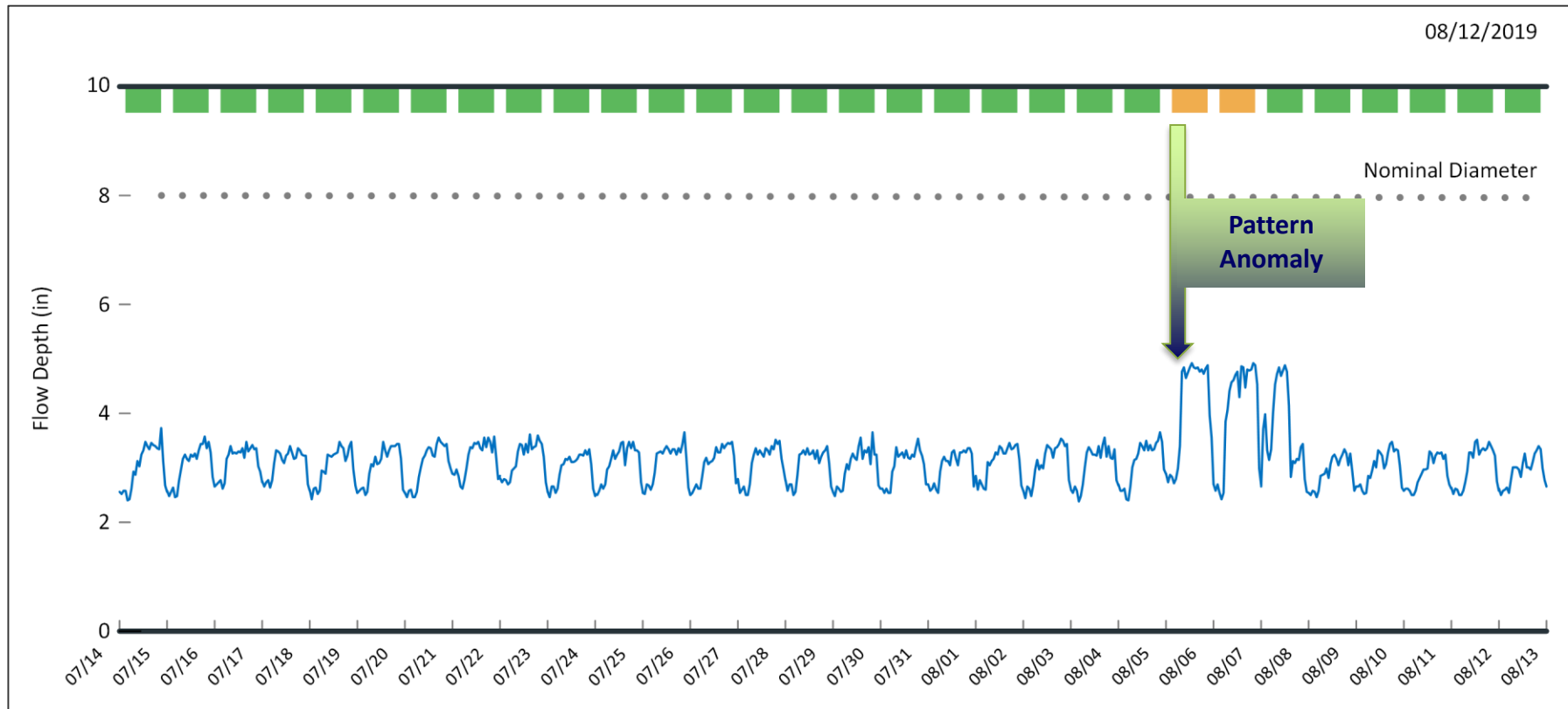


Site Example 2 Site Findings



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



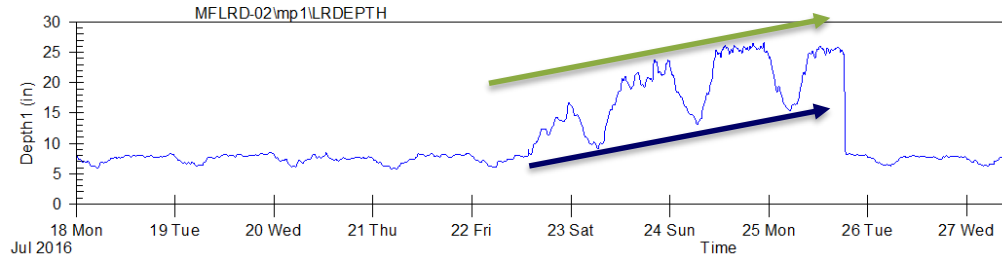
Roots



Collapse

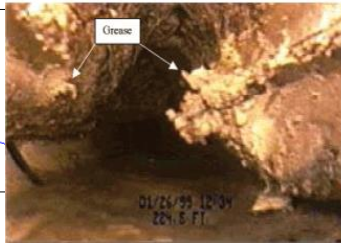
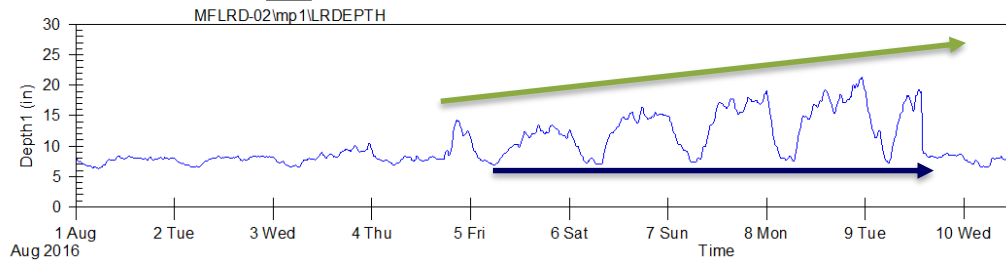


Blockages Have Signatures



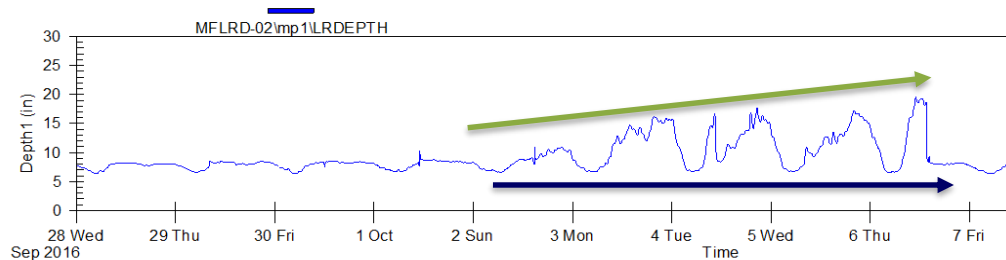
Debris Blockage Signature

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 systems can determine how frequently you need to clean specific sections of your collection system

By Jay Boyd and Paul Fournibaud

The city of La Mesa is located in San Diego County, California, 17 miles west of downtown San Diego. The "back of the city" section being one of the nation's premier locations of the East-coast water utility's handling 100% and maintaining 100% blockages were clear in only seven to 100 minutes.

Since La Mesa has a population of more than 57,000, the city is a mix of public, semi-public, residential, commercial and industrial areas. To support these areas, the city must not operate its collection system, employing a small, highly efficient staff of eight. This group has a reputation for operating during a part of the production maintenance program.

With 100 miles of sanitary sewer pipe and 100-plus miles of storm pipe in total, both the main and the storm pipe systems are classified as unstaffed. Although the annual workload, 100-plus-miles of sanitary sewer pipe, is managed by a small staff of eight.

MAINTENANCE CHALLENGES

The city's production maintenance program has led to their workload level of generating sanitary sewer overflows. However, the city recognized that regular, high frequency cleaning was more than likely leading to overhauling. At times, the practice was being on the safe side, although, high frequency cleaning was better to remove pipe wear from high pressure areas. In other parts of the city's collection system, this could mean dangerous, almost high-voltage pipe and being in general unstaffed.

- Reduce operational demands
- Increase production pipe work
- Continue to generate work

A NEW VISION

The city partnered with ADS Environmental Services, with whom they had already done some forecasting project previously. Through technical discussions the city and ADS Environmental Services, they agreed to work together to make improvements to their existing collection system. The city could not see corresponding benefits from cleaning activities.

The approach was to install a new generation of cleaning solution. The ADS 4300 is a new generation of cleaning solution on charge. The ADS 4300 is a new generation of cleaning solution on charge. The ADS 4300 is a new generation of cleaning solution on charge.



See also more options for the ADS 4300, all of which are based on a highly advanced technology. See also more options for the ADS 4300, all of which are based on a highly advanced technology. See also more options for the ADS 4300, all of which are based on a highly advanced technology.

Cleaning
Optimization
MS&W Magazine
January 2019



Busting Blockages

Predictive technology alerts operators to potential problems before catastrophe strikes

Kevin Erdinger

Seven blockages on a leading town of sanitary sewer overflows (SSO) and when small town crews, men, and blockages pipe. Blockages on a main sewer—and after a major incident—the maintenance reduction system manager, experience, and operators. Reduce technological advances, however, on maintaining the way the sewer blocks about blockages with machine learning and artificial intelligence.

The Blockage Continuum

Blockages are categorized and staged to various stages of development along a blockage continuum, as illustrated in Figure 1 (p. 26). The Advanced Detection allows the personnel stationed. The crew has on blockage and operators in designed with the flow depth less than the pipe's diameter. These measures reduce the pressure present in the face of parallel sewer (leading to avoid blockages). This approach operates on the 300' radius of the blockage continuum. The approach is simple. Clean every gravity sewer periodically, when on the order of once every 3 to 10 years. While the approach is straightforward and helps to reduce the risk of cleaning the sewer, while others in need of cleaning might wait. As

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Thank You!

Questions?

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