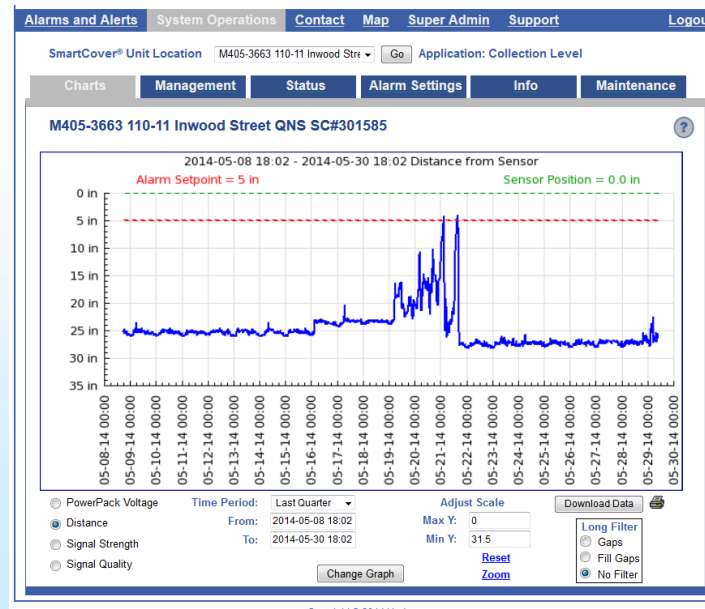
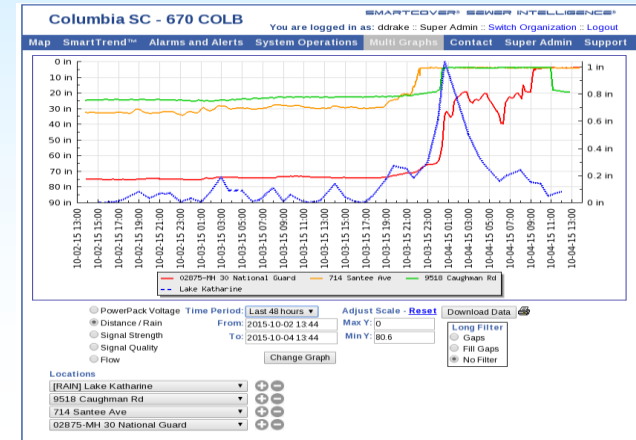
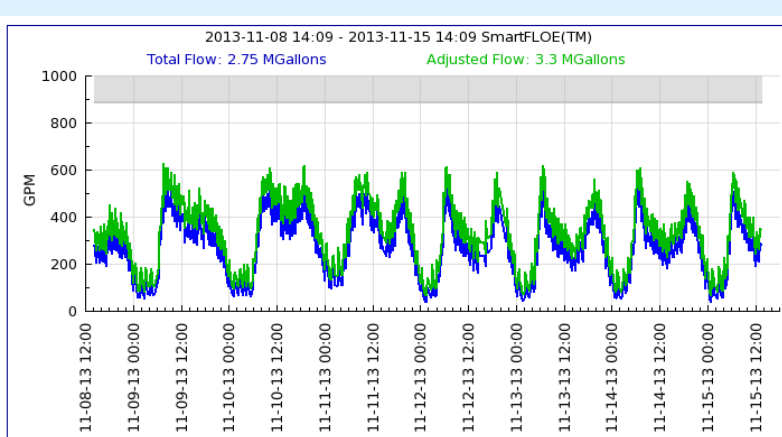


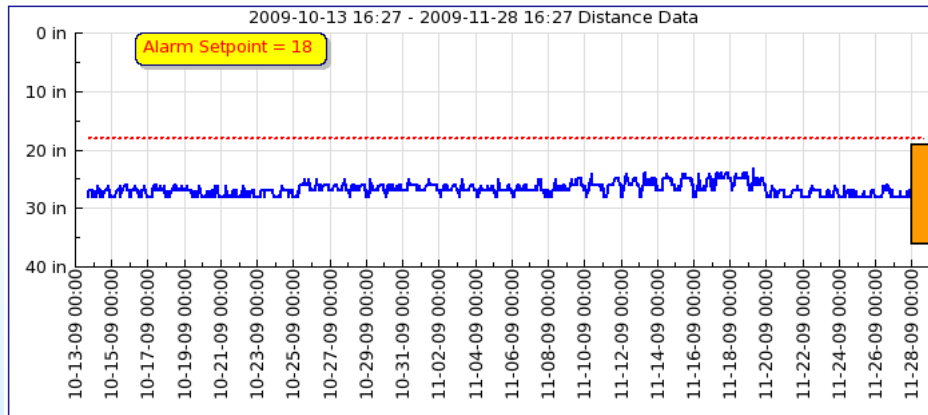
# The Latest with SmartCovers



Brogan Quist  
Western Regional Manager  
SmartCover Systems  
SCAP Meeting, March, 2016

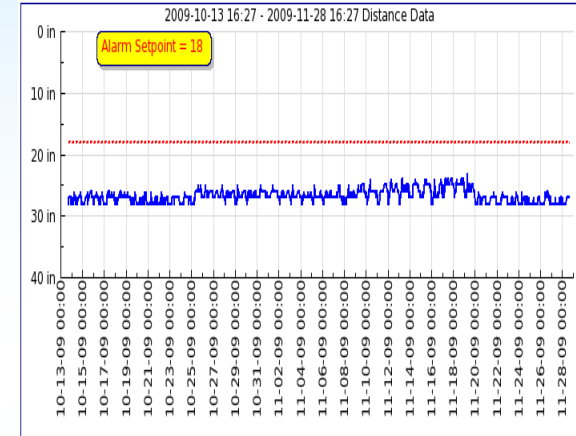
# SmartTrend<sup>™</sup>

*“Turning Your Data into Decisions<sup>™</sup>”*



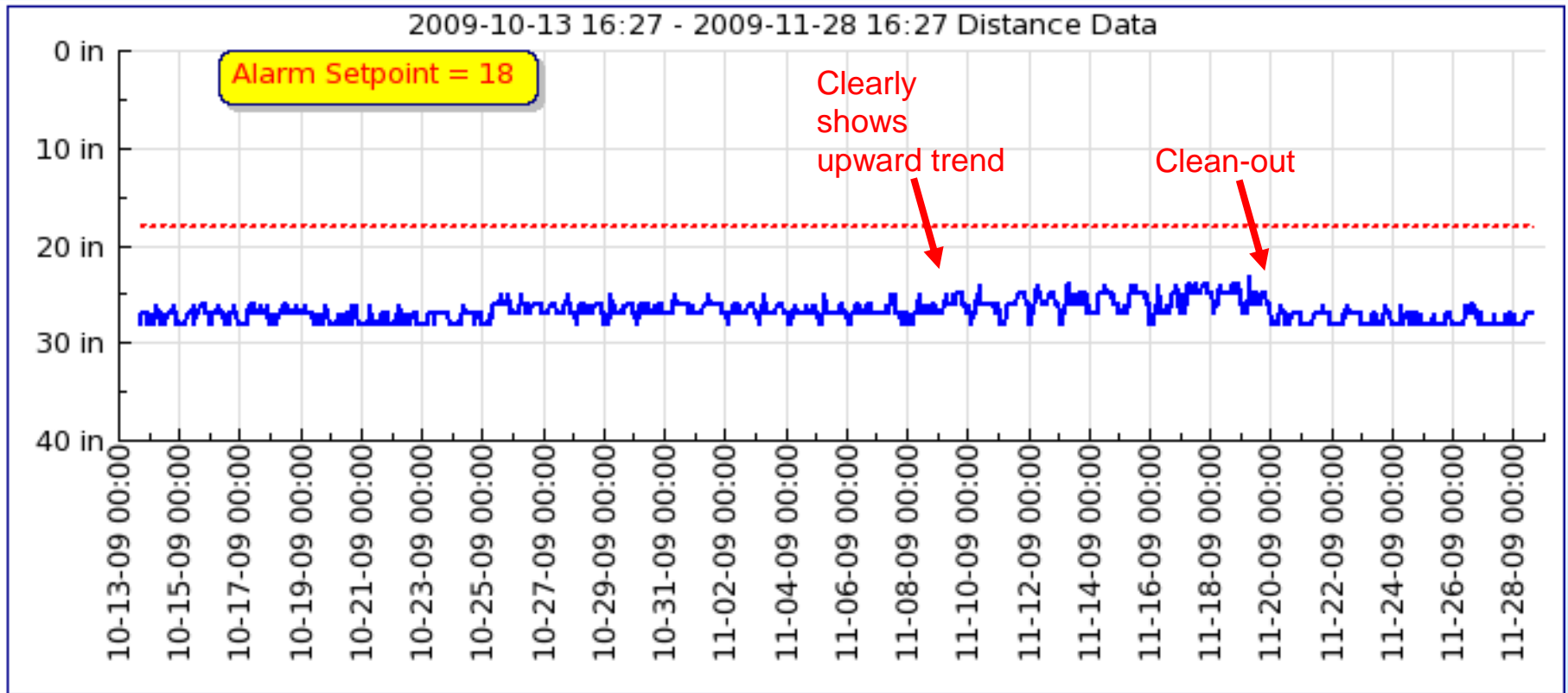
# Collection System Challenges

- **Enhanced Frequency Cleaning areas**
  - Targeting known problematic areas
  - Cleaning schedule based on history
  - Heavy burden on resources and staff
- **Site over-maintenance**
  - Site may have had one spill
    - Response could be with 'high' or 'enhanced' frequency cleaning
- **Easements**
  - Difficult to get equipment to site
  - Difficult to observe/check



# Data Shows Trending

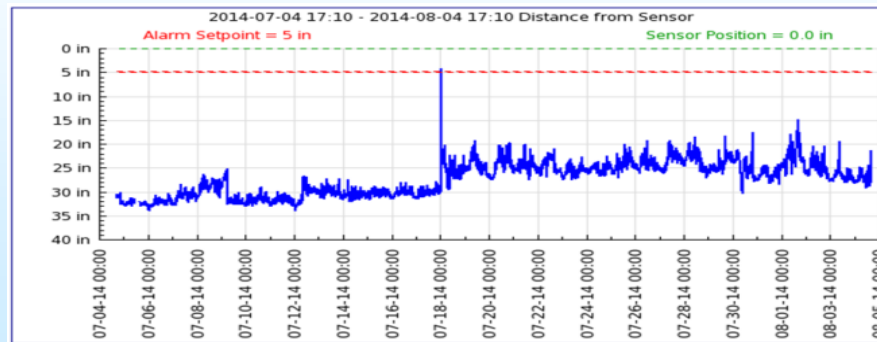
- This is a very typical build-up profile
- Nov. 10 showing upward trend
- Ten days later clean-out occurs
  - No emergency, routine daily cost



# What is SmartTrend™?

**SmartTrend™** : predictive, data analysis tool

- Automatically analyzes all remote monitoring sites for anomalous change
- Automates assessment and prioritizes focus
- Transforms response from reactive to planned
  - Drive maintenance with data
  - Lowers Costs and Risks



# SmartTrend™ Dashboard

Carlsbad CA - 12 CARL

SMARTCOVER® SEWER INTELLIGENCE®

You are logged in as: jboyd :: Super Admin :: [Switch Organization](#) :: [Logout](#)

Map

SmartTrend™

Alarms and Alerts

System Operations

Multi Graphs

Contact

Super Admin

Support

Report

Dashboard

SmartTrend™ Analysis Engine: ☒ On ☐ Off

Last Trend Analysis: Jan 13 2016 3:01 AM

Run Analysis Now

Save Changes

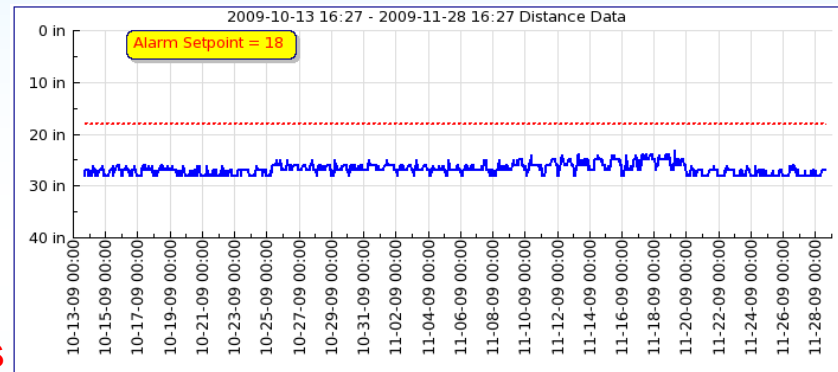
Location	Trends			Type of Flow				Intermittent Comms
	Average Level Rise	Average Level Fall	High Level Advisory	Diurnal Flatline	Low Amplitude	Irregular		
<a href="#">1C-2 VC Trunk CARL ENCINA</a>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<a href="#">2386 Jefferson</a>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<a href="#">3363 Roosevelt St. (Just North of Chestnut)</a>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<a href="#">5080 Shore Dr.</a>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<a href="#">Avenida Encinas</a>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<a href="#">Batiquitos Lift Station Overflow</a>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<a href="#">BSD Costco 15</a>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<a href="#">Buena Vista Circle</a>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<a href="#">Cannon and Avenida Encinas</a>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<a href="#">Cannon Lift Station MH 23A-67</a>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<a href="#">Chinquapin Lift Station MH 16C-84</a>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<a href="#">Chinquapin Street</a>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<a href="#">Demo Unit</a>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<a href="#">El Fuerte 5818 El Cam Real</a>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- Dashboard has two major parts:
1. “Trends” where “Rise”, “Fall” and “High Level” designate the current trend state
  2. Type of flow characterizes the frequency pattern

# Advisories via Email

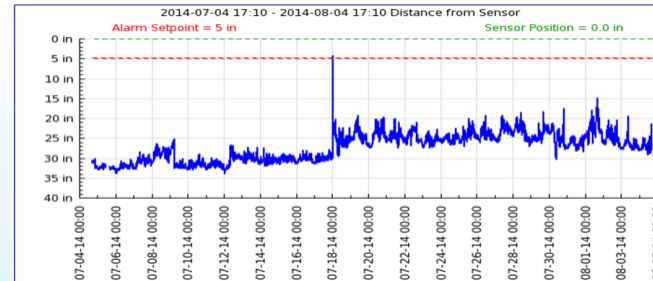
**MESSAGE:** The following SmartCover<sup>®</sup> monitored sites are showing a RECENT WATER RISE

[12345 Hawthorne Way](#) 9/11/14 9:32:54 AM



Location, advisory time, condition analysis

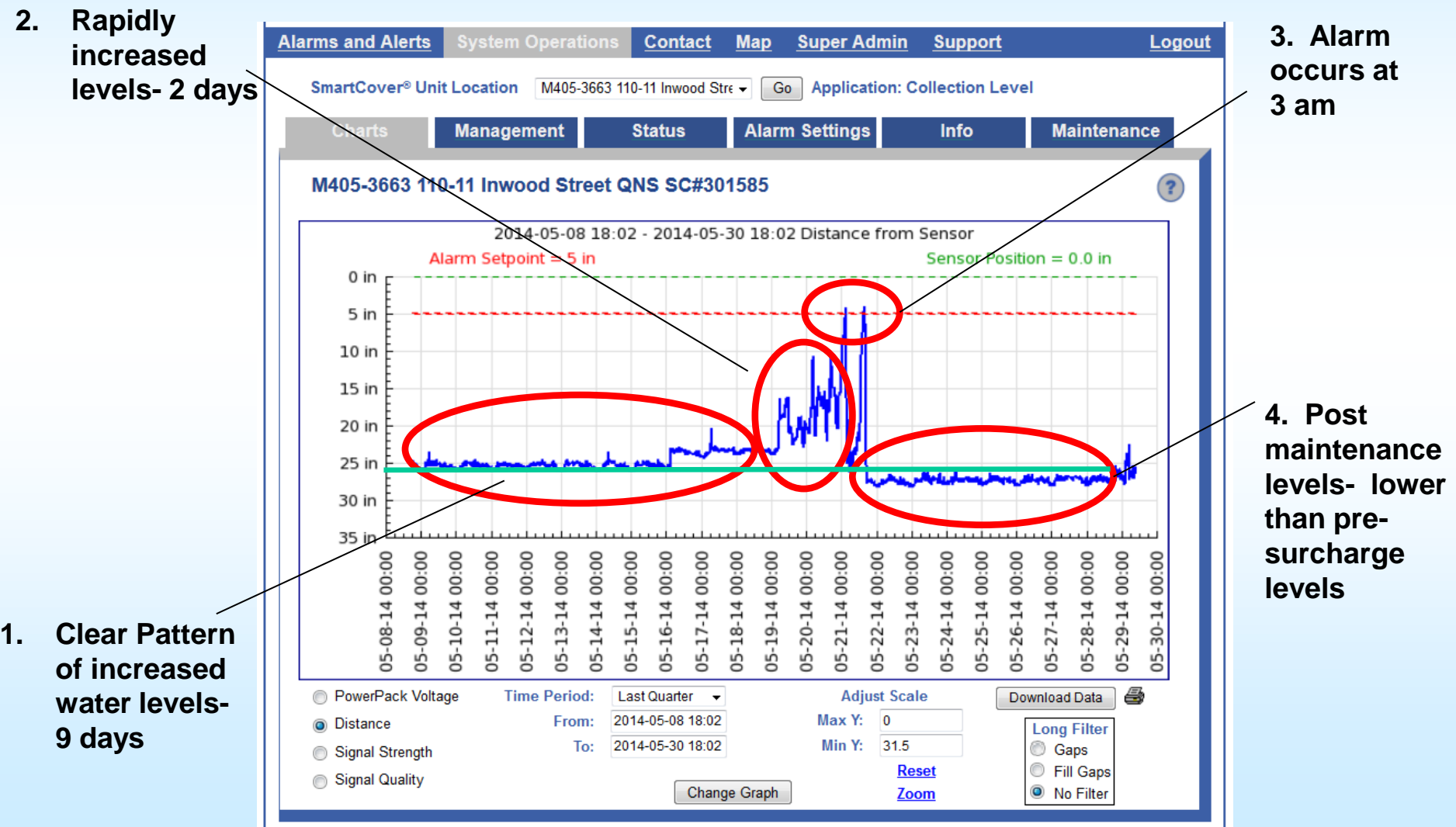
[Wilkie and 119<sup>th</sup>](#) 9/11/14 9:32:54 AM



Thumbnail  
of location  
for  
immediate  
assessment

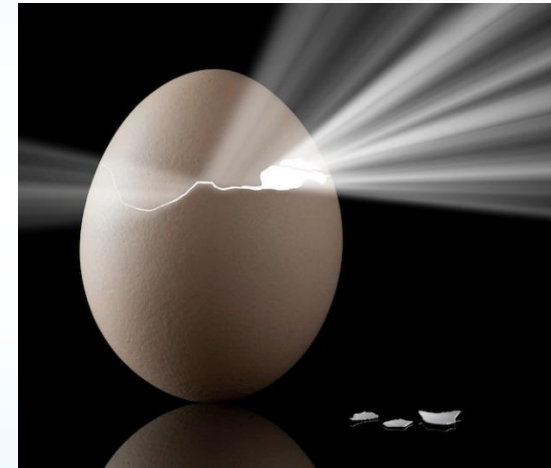
Click on the location to go to your SmartCover<sup>®</sup> website for further investigation.

# No Trend: Progressive Build-Up & Alarm



# Data Driven Maintenance

- **Transforms work processes**
  - Historical to Real-Time data
  - Reactive response to Proactive response
- **Benefits**
  - Lower maintenance cost
  - Less organizational and personnel disruption.
  - Lower risk from all of the impacts from spills
  - Provides peace of mind

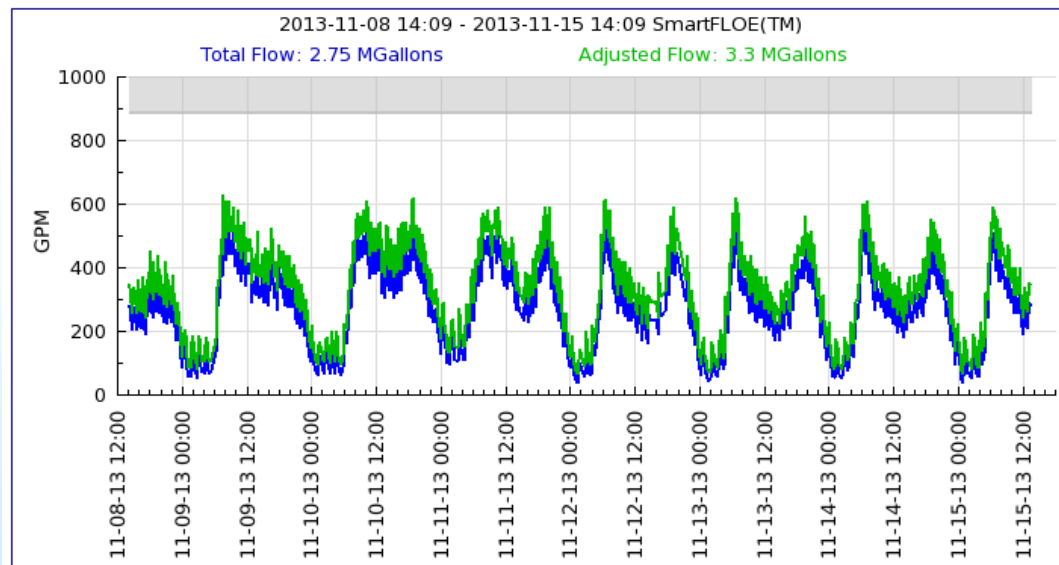


*Anticipates an outcome before it occurs*

*Bottom Line: Don't wait for an alarm, avoid it*

# SmartFLOE™

## Open Channel Flow Estimation

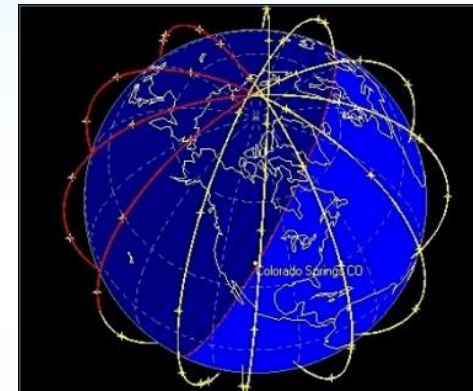


# Flow Estimation Using Level

SmartFLOE™

## Fluid **L**evel **O**ptimization **E**stimation

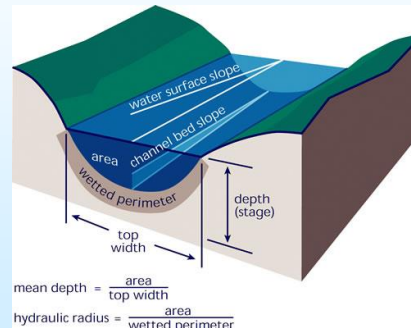
- Uses SmartCover® level sensing with Manning's equation
- Provides repeatable data with reasonable accuracy
- Low cost alternative to AV meters



## Open Channel Flow Estimation with Manning's Equation

$$Q = VA = \left( \frac{1.49}{n} \right) AR^{\frac{2}{3}} \sqrt{S} \quad [\text{U.S.}]$$

$$Q = VA = \left( \frac{1.00}{n} \right) AR^{\frac{2}{3}} \sqrt{S} \quad [\text{SI}]$$



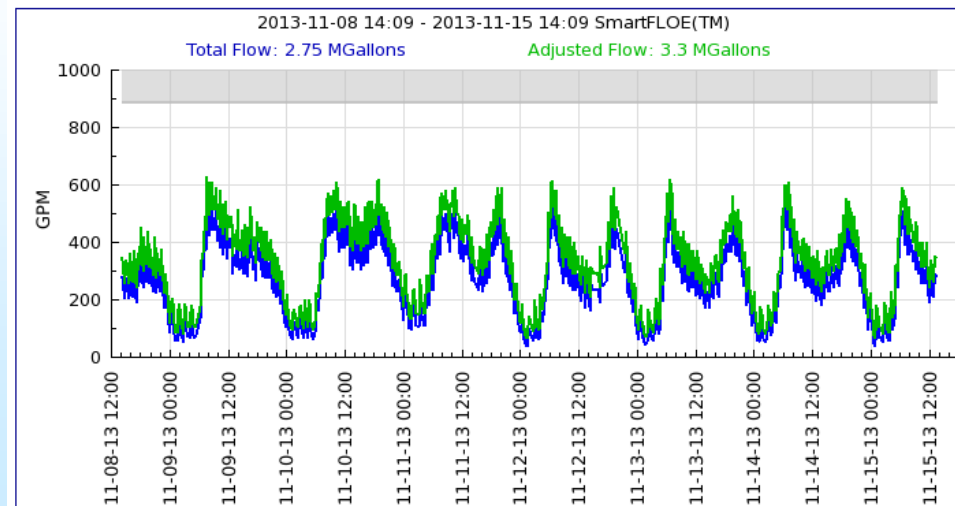
Q is function of WATER LEVEL ONLY when flow is:

- Uniform (doesn't change along flow) and
- Steady (doesn't change in time)

# Flow Estimation Applications

## Key Use for SmartFLOE is I & I Assessment

- Compare Diurnal patterns
  - Dry vs. wet weather conditions
- Repeatability is most important



# Flow Calculation

## Manning's Coefficients for FLOE

- Pipe Diameter (in)
- Slope ( $\Delta y/y$ )
- Roughness coefficient (pipe material)
- Distance of sensor to bottom of invert

City of Phoenix

SMARTCOVER® MONITORING SYSTEM

You are logged in as: hadronex :: Super Admin

Old River City

Operations

Contact

Map

Super Admin

Support

Logout

SmartCover™ Unit Location

Opportunity Way east of Vis

Go

Application: SmartFLOE™

Charts

Management

Status

Alarm Settings

Info

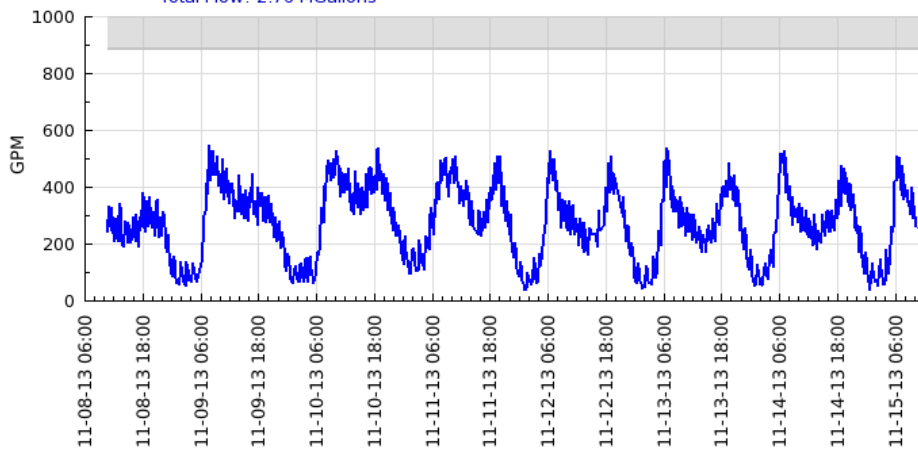
Maintenance

17684 East Washington Avenue

Opportunity Way east of Vision Way

17684 East Washington Avenue Block 6

013-11-15 10:45 SmartFLOE(TM)



☐ PowerPack Voltage

Time Period:

Last Week

Adjust Scale

Download Data

☐ Distance

From:

2013-11-08 10:45

Max Y:

976

☐ Signal Strength

To:

2013-11-15 10:45

Min Y:

40

☐ Signal Quality

Reset

Zoom

☒ Flow

Change Graph

Long Filter

☐ Gaps

☐ Fill Gaps

☒ No Filter

Flow Parameters

	Current	Adjusted
Pipe Diameter (in)	18.0	<input type="text"/>
Pipe Slope (delta y / y)	0.00120	<input type="text"/>
Manning's Roughness Coefficient	0.0120	<input type="text"/>
Level Adjustment	0.0	<input type="text"/>

Units

☐ MGD

☐ CFS

☒ GPM

To preview adjusted flow parameters, enter adjusted values to the left and click Change Graph above.

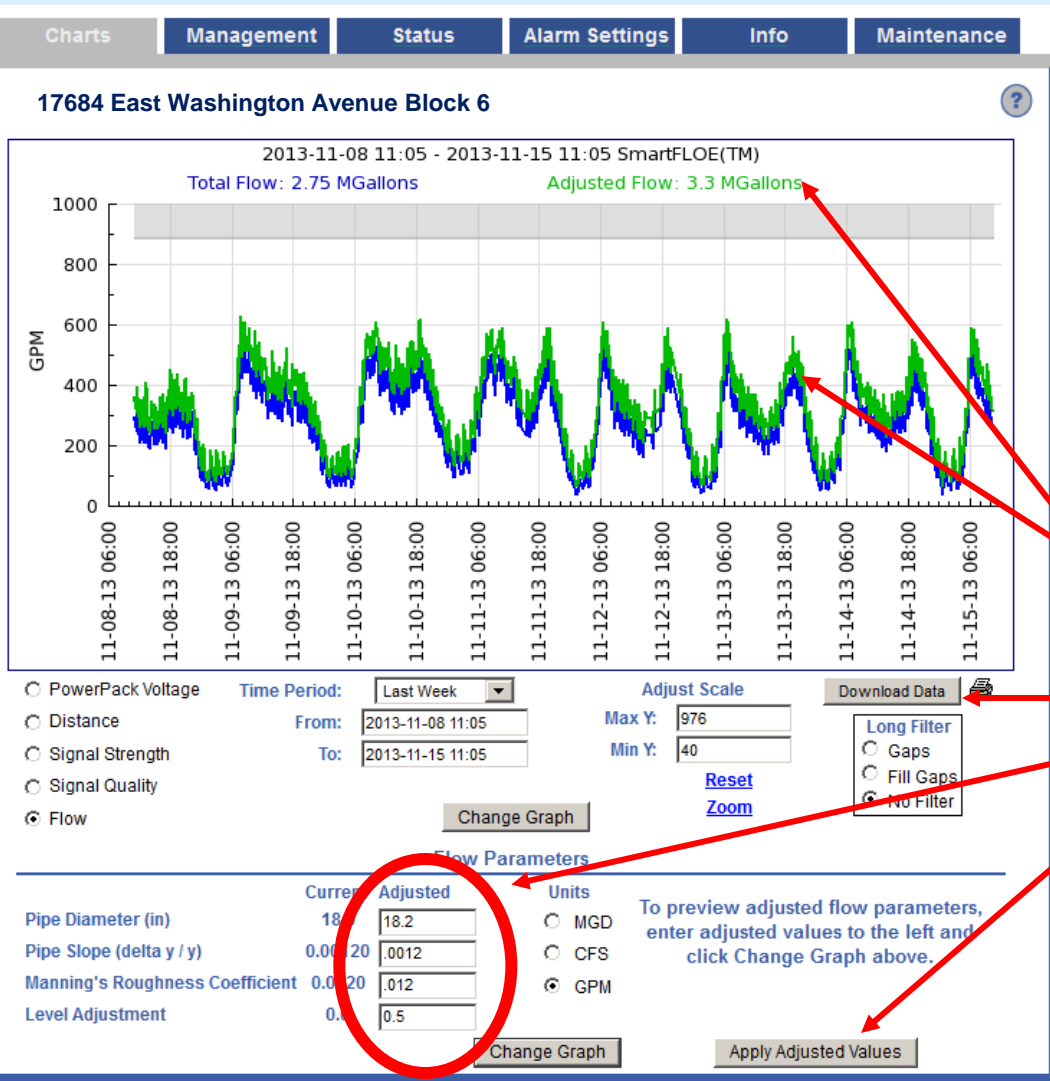
Change Graph

Apply Adjusted Values

# Adjusting Flow

**Patent-Pending SmartFLOE™**  
Allows adjustable parameters for:

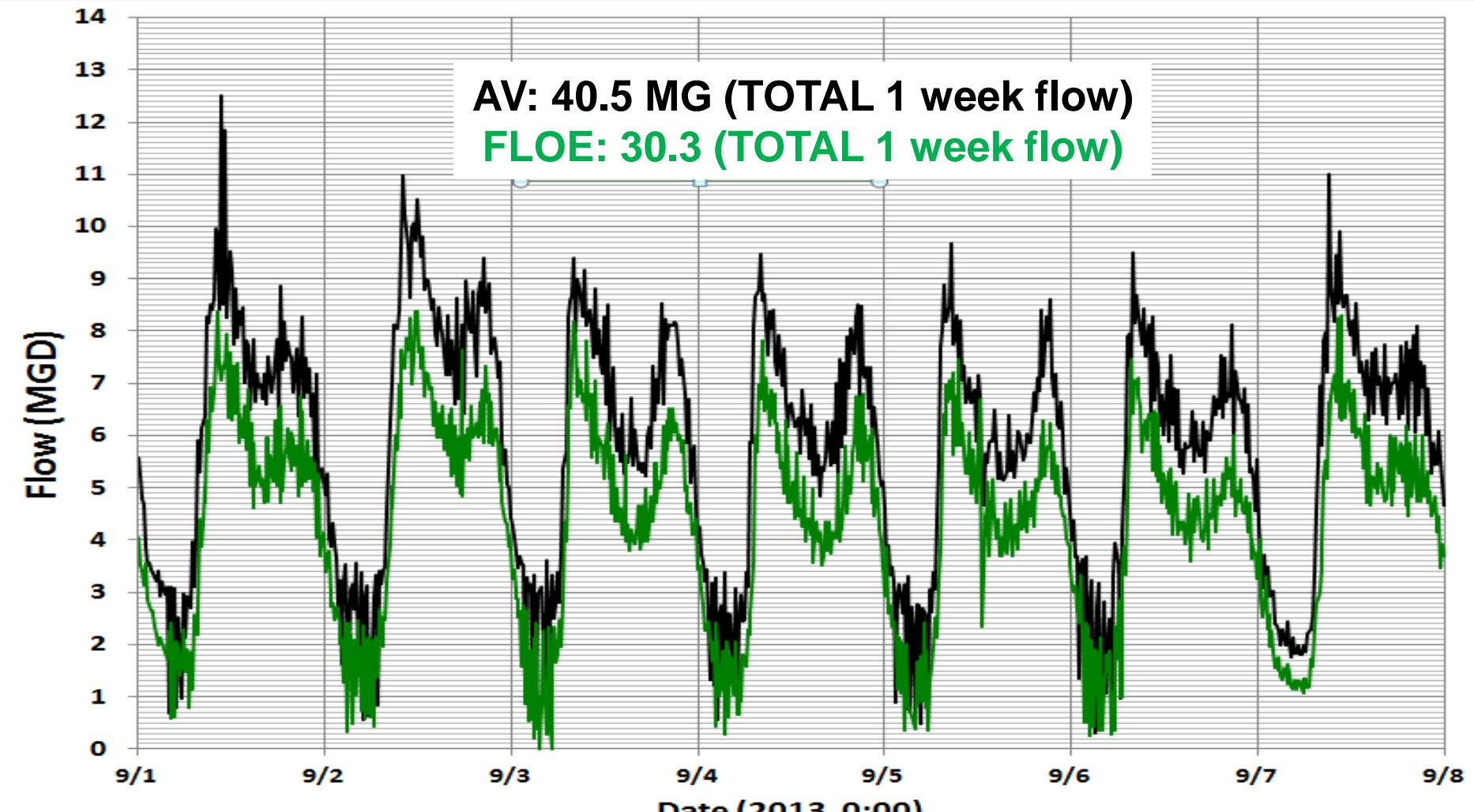
1. Error correction
  2. Modeling
  3. Calibration to AV Meter
- Adjusted flow curve and total flow
  - Download displayed data
  - Adjusted parameters
  - Store changed parameters



# Adjust Level

	Start	End
Level Shift	0.0"	0.5"
Pipe Diameter	39.0"	
Pipe Slope	0.0026	
Roughness	0.014	

**RESULT: 25.2% variance (1 week TOTAL flow)**

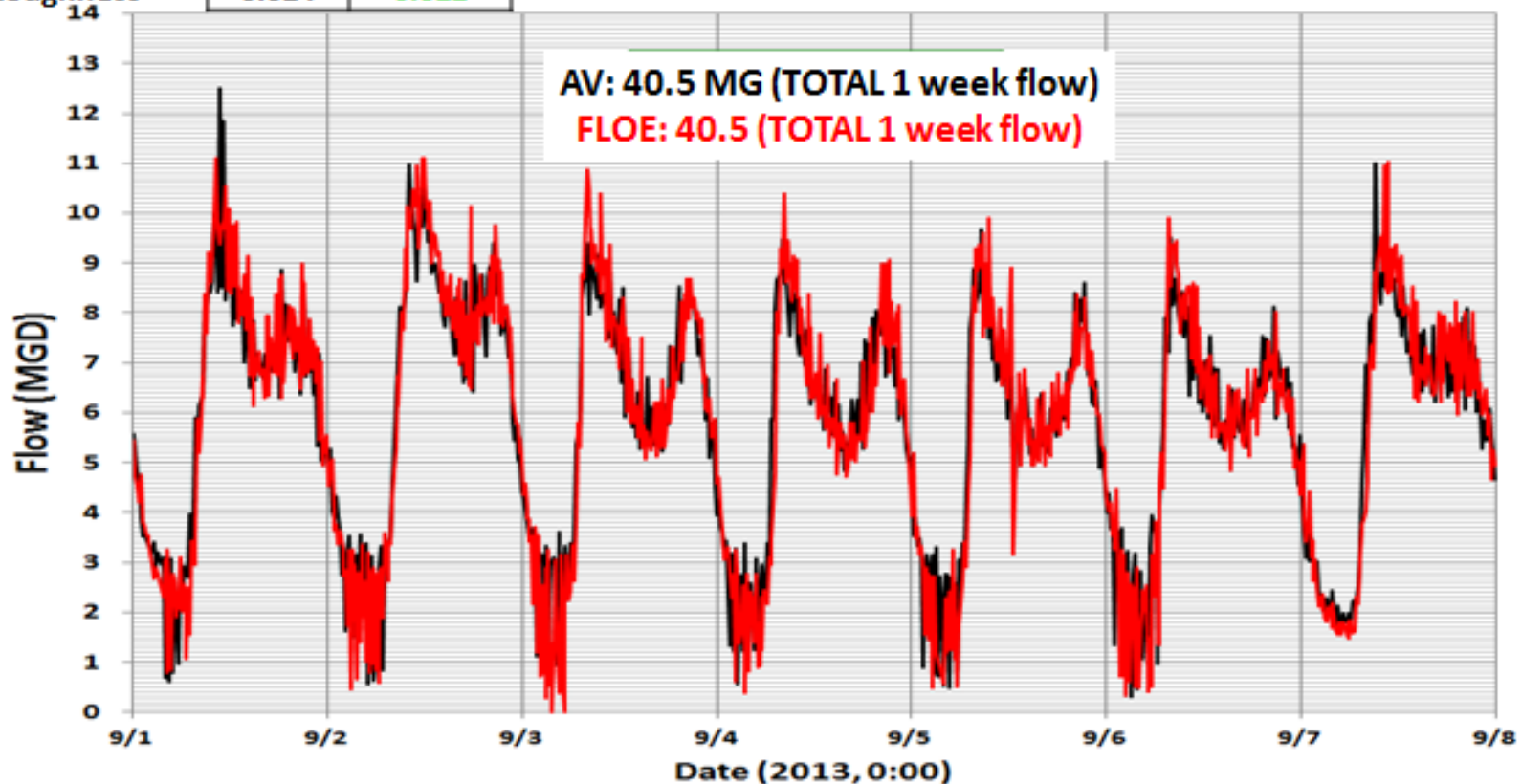


# Comparison to AV Meter

## Adjust Other Parameters for Best Fit

	Start	End
Level Shift	0.0"	0.5"
Pipe Diameter	39.0"	38.7"
Pipe Slope	0.0026	0.0028
Roughness	0.014	0.011

**RESULT: 0% variance (1 week TOTAL flow)**



# Review: SmartFLOE™

## Essential Features of the System

### These Differentiate Us from A/V Meters

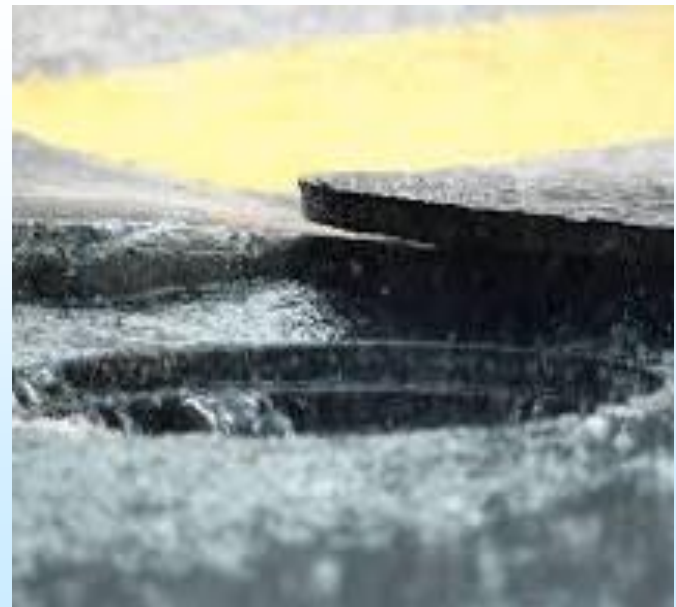
- **Low costs** system means...
  - Multiple site deployment under same conditions of *time and weather*
  - Substantial time savings for studies
- **Non-contact** system for ease-of-maintenance
- Typically **no confined space** entry for installation
- **Desk-top data** “capture” from remote locations
- **Analytical tools**
  - On the fly adjustments with immediate results
  - Downloads with .cvs for analysis

# SmartRain™

Integrating Rain with Level  
and Flow Data

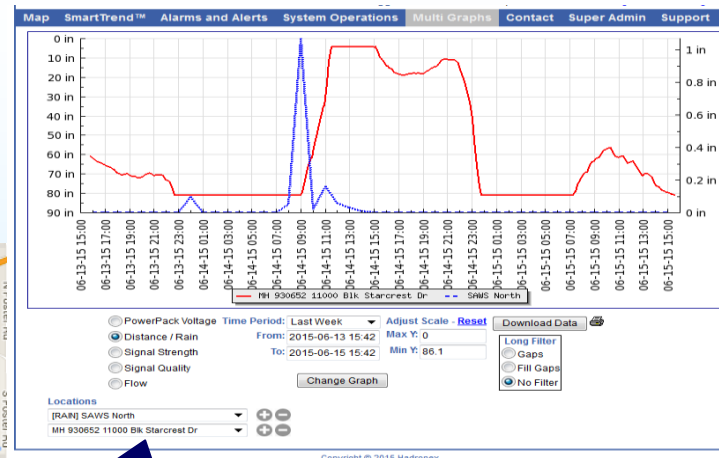
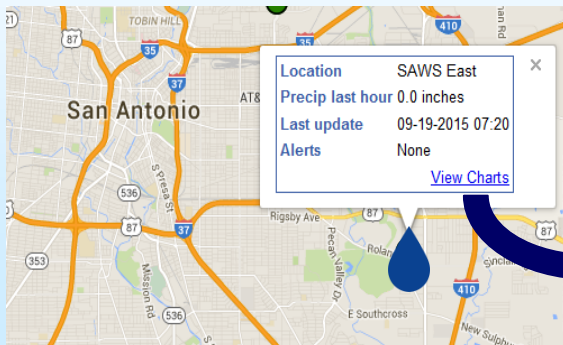
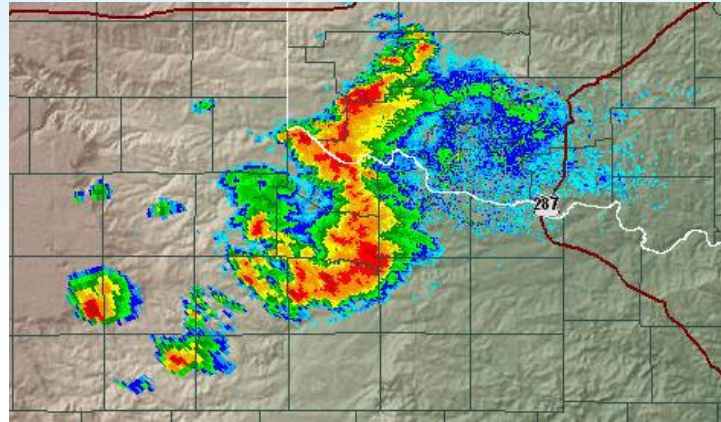
# SmartRain™

- Integrates rainfall, level & flow data in real-time
- Creates a profile of the *Sewershed*
- Identifies costly I&I sources
- Provides easy, rapid, low cost deployment



# SmartRain RD™ Key Features

- Doppler Radar based
- Provides hourly updates
- 1 km (0.62 miles) diameter range
- 0.001 inch sensitivity
- Downloads to spreadsheets



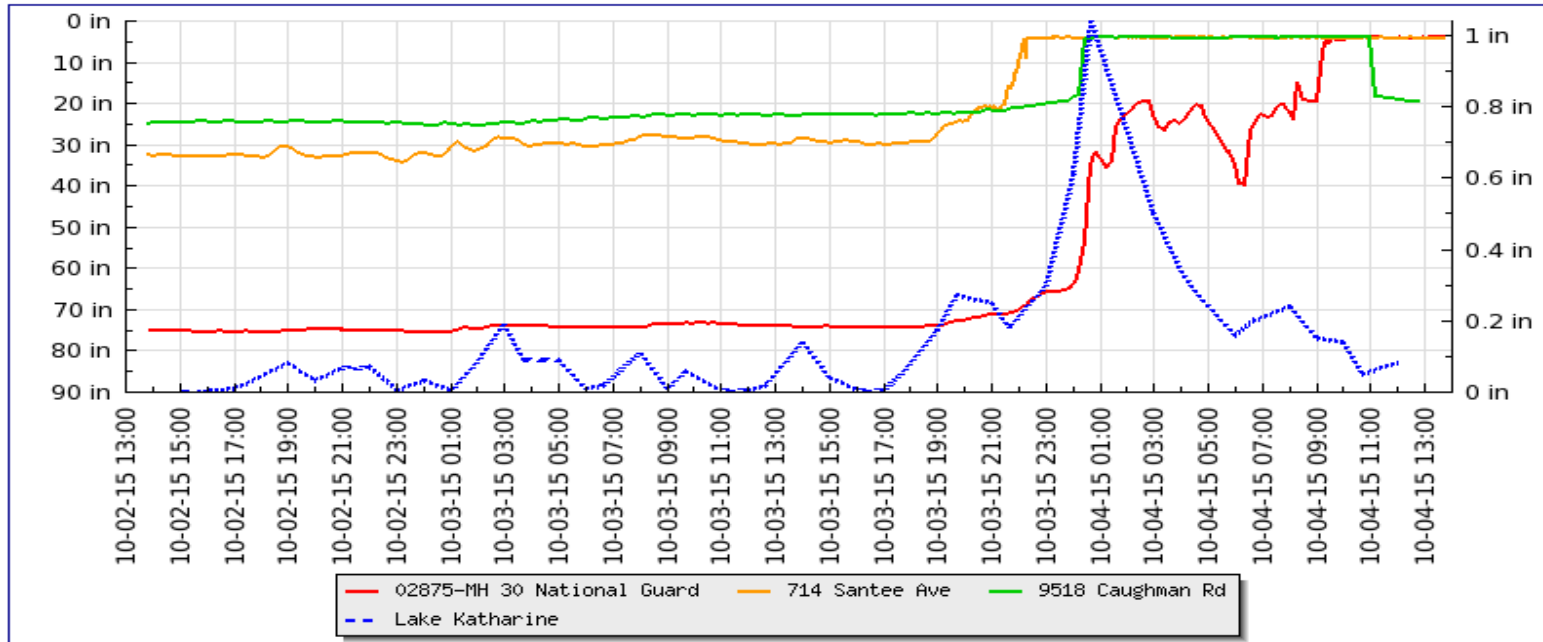
# Multi-Site View

## Columbia SC - 670 COLB

SMARTCOVER® SEWER INTELLIGENCE®

You are logged in as: ddrake :: Super Admin :: [Switch Organization](#) :: [Logout](#)

[Map](#) [SmartTrend™](#) [Alarms and Alerts](#) [System Operations](#) [Multi Graphs](#) [Contact](#) [Super Admin](#) [Support](#)



- ☐ PowerPack Voltage
- ☒ Distance / Rain
- ☐ Signal Strength
- ☐ Signal Quality
- ☐ Flow

Time Period: [Last 48 hours](#)

From: 2015-10-02 13:44

To: 2015-10-04 13:44

[Change Graph](#)

[Adjust Scale - Reset](#)

Max Y: 0

Min Y: 80.6

[Download Data](#)

[Long Filter](#)

- ☐ Gaps
- ☐ Fill Gaps
- ☒ No Filter

### Locations

[RAIN] Lake Katharine

9518 Caughman Rd

714 Santee Ave

02875-MH 30 National Guard



# **“Two-Year” Battery**

- **Two year PowerPack™ April 2016**
  - **Longer life**
  - **Power protection circuit added**
- **Less Maintenance involved year by year on the SmartCover units**
- **Same size as existing PowerPack**