

Leveraging AMI Data to Support Leakage Management

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10/11/17

'Leak detection' can mean multiple things

- **In the distribution network**
 - Before the meter
 - Non-revenue water
 - May never surface
- **Consumer-side**
 - After the meter
 - Revenue water
 - Leak on premise (service line, toilet, dripping faucet, faulty sprinklers)

Why Distribution Network leak detection?

Regulatory pressures to reduce water loss

- At least 29 states with some form of water loss control*
- AWWA water audit being used more and more, can effect bond ratings
- Water loss is key input into audits and understanding Non Revenue Water

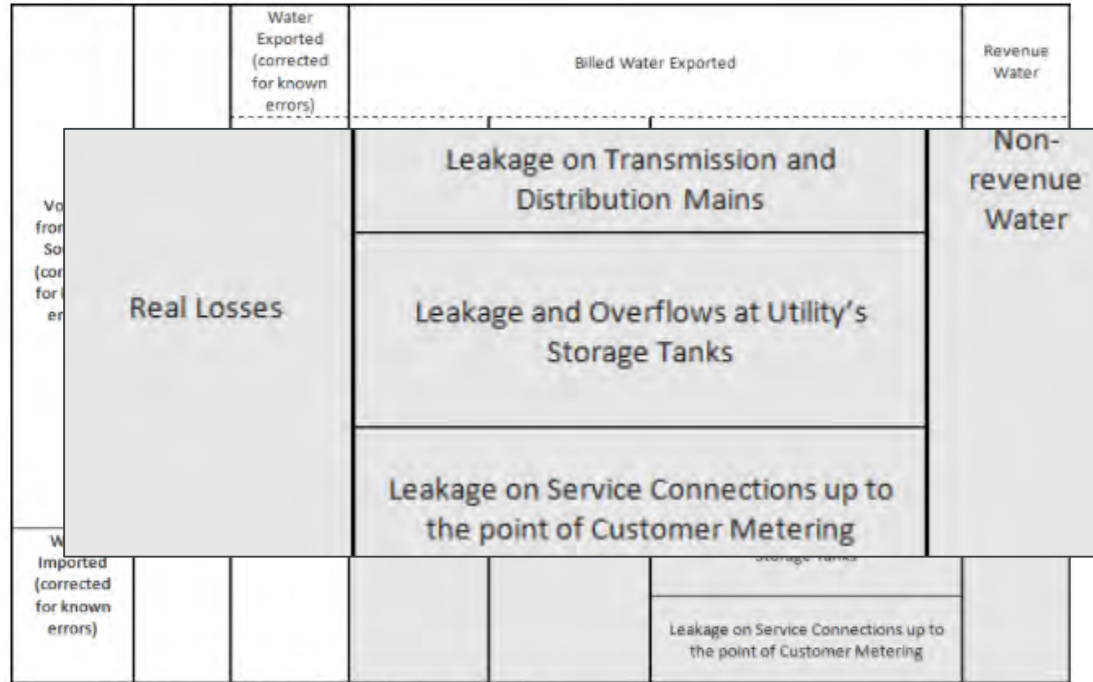
Volume from Own Sources (corrected for known errors)	System Input Volume	Water Exported (corrected for known errors)	Billed Water Exported			Revenue Water
		Water Supplied	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water
Water Losses	Unbilled Authorized Consumption			Billed Unmetered Consumption		Non-revenue Water
		Unbilled metered Consumption				
	Unbilled unmetered consumption					
	Apparent Losses					
Water Imported (corrected for known errors)			Real Losses	Systematic Data Handling Errors		
				Customer Metering Inaccuracies		
				Unauthorized Consumption		
				Leakage on Transmission and Distribution Mains		
				Leakage and Overflows at Utility's Storage Tanks		
				Leakage on Service Connections up to the point of Customer Metering		

* Jernigan, Will. 2012. State of the States: Emerging Water Loss Regulations in the United States. Presentation at the WaterSmart Innovations Conference.

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Why Distribution Network leak detection?

Monitor aging infrastructure

- Identify leaks and bursts
- Reduce durations
- Extend asset lifetimes
- Use maintenance and repair budgets more efficiently

“According to the American Water Works Association, an estimated \$1 trillion is necessary to maintain and expand service to meet demands over the next 25 years.”

“Many (current pipes have) a lifespan of 75-100 years... averaging pipe replacement rate of 0.5% per year...estimated 200 years to replace the system”

Why Distribution Network leak detection?

Cost reduction

- Non-revenue water loss is 11-18% across US*
- Estimated 6 billion gallons of treated water lost PER DAY (costing \$4B/year)
- 80% is real loss through leaks
- Wasted power to pump lost water -75% of cost is electricity



*Center for Neighborhood Technology, The Case for Fixing the Leaks: Protecting people and saving water while supporting economic growth in the Great Lakes region, November 2013

Why Distribution Network leak detection?

Water scarcity

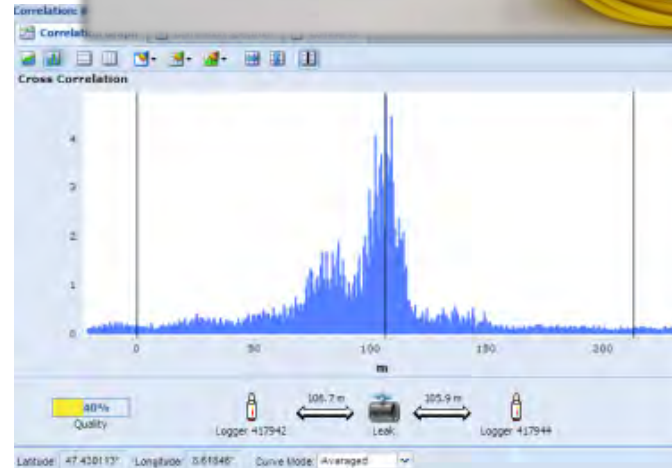
- Growing population and urbanization
- Draw down of traditional resources
- Climate change and droughts



“According to state water managers, experts, and literature GAO reviewed, freshwater shortages are expected to continue into the future. In particular, 40 of 50 state water managers expected shortages in some portion of their states under average conditions in the next 10 years”

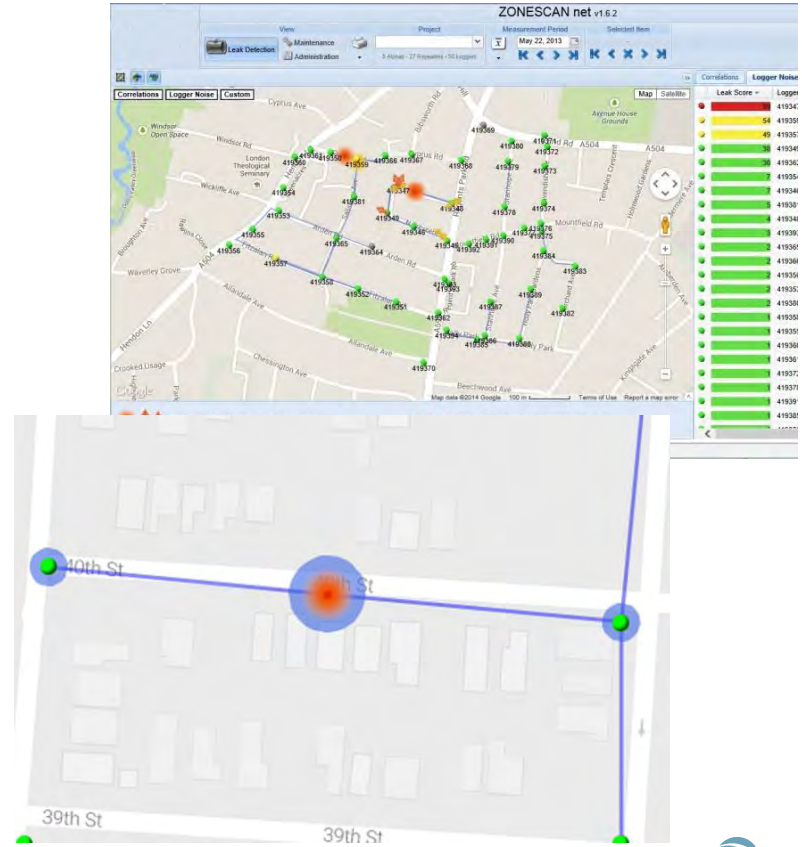
AMI and Distribution Network leak detection

- Acoustic loggers (microphones) are placed on valves
- Loggers listen for and record leak “noise” transmitted through the pipe
- Recordings are uploaded over the AMI Network to the head-end
- All recording activity, data upload, and analyzing is automated and continuous



AMI and Distribution Network leak detection

- Algorithms in the head-end analyze the recordings for unique sound of water leaks
- Delays as sounds reach multiple loggers are correlated to give leak locations
- Head-end software displays leak 'scores' and color coded GIS maps for instant identification of problem areas
- Correlations between loggers are highlighted with locations
- Leak and correlation notifications can be 'pushed' to key personnel



Benefits of AMI Distribution Network leak detection

- Reduce the run-time of a leak
- Reduce the man hours spent searching for leaks
- Reduce false alarms
- Identify a leak before it becomes a major incident
- Reduce the amount of night-work and over-time
- Find quiet leaks that are inaudible during the day
- Reduce repair costs through earlier intervention
- Improve public image and customer service of utility



Continuous and automatic leak detection monitoring with no manual intervention, coupled with powerful analytics, leads to the fastest actionable data available

Leak detection at the residence

Increased Customer Satisfaction

- Proactive notification of potential problems
- Avoid bill disputes
- Reduce write-offs

Constant consumption and abnormal-use analytics quickly identify residences that may have leaks

“We now have more outgoing calls on the customer service side than we have incoming calls...” Large eastern city utility manager

“The Aclara report tells us which accounts have continuous usage over a three day reporting period. We notify those users...” West coast utility manager

“By analyzing the constant consumption data we can even tell the resident if it’s likely a fill or flapper valve leak...” Northwest city utility manager

User-side leak detection using AMI

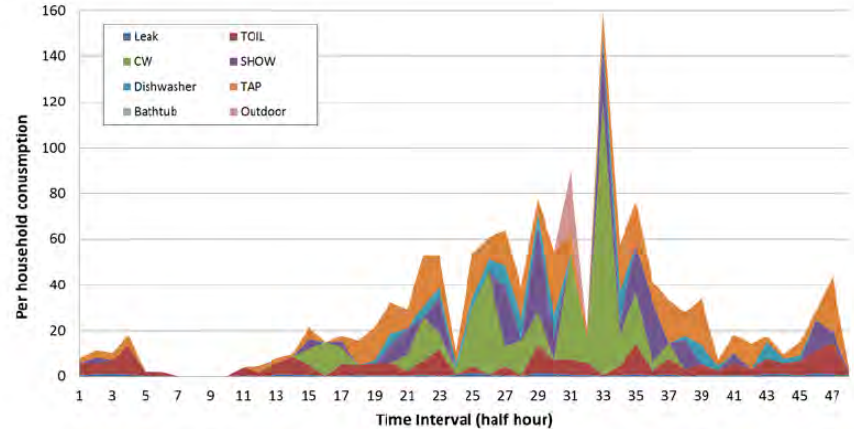
- Typical residences have no water use at some part of the day (middle of the night)
- AMI system continuously monitors consumption and identifies lack of zero flow
- Automated analytics and reports mine large quantity of data to uncover **'constant consumption'** locations

Constant Consumption Report

Report Type: Constant Consumption
Run Time: 11/07/2012 12:01:37 AM to 11/07/2012 12:01:41 AM
Date Range: 10/1/2012 to 10/31/2012

Prmise	MU	Port	Number of Intervals	Start Time	End Time	Low Consumption	High Consumption
600001013001	1013	1	116	09/08/2012 12:00:00 am	11/05/2012 12:00:00 am	2 Gals.	47 Gals.
600001015001	1015	2	116	09/08/2012 12:00:00 am	11/05/2012 12:00:00 am	5000 Gals.	71000 Gals.
600001017001	1017	1	1408	09/07/2012 12:00:00 am	11/05/2012 12:00:00 am	10 Gals.	1500 Gals.

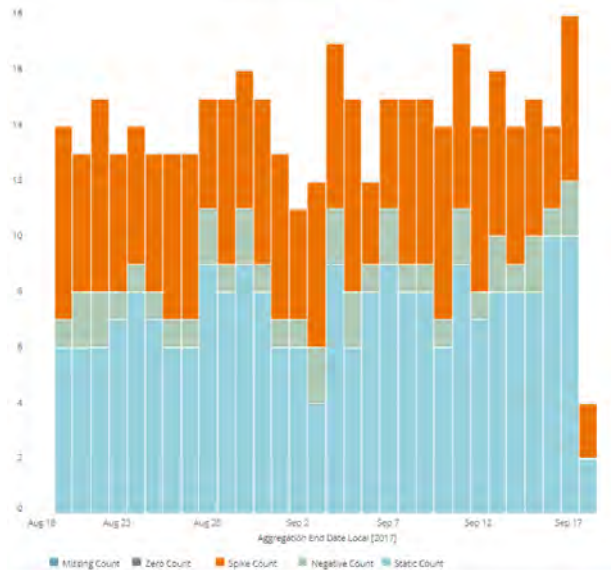
View 1 - 3 of 3



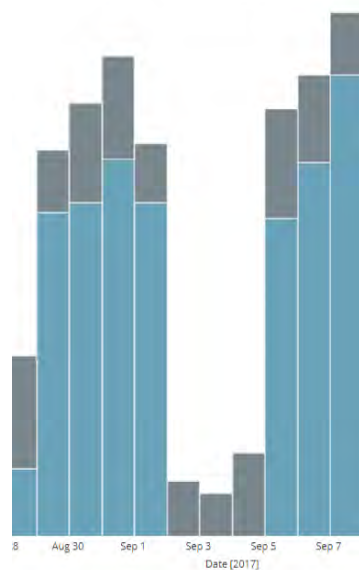
Duncan, H & Mitchell, Valerie. (2008). A stochastic demand generator for domestic water use. Conf. Proc. Water Down under 2008. 725-736.

Billing Management - VEE

Validation Summary Trend



Total Estimated Interval Trend



AclaraOne® Fred Hiltmore | Logout

AclaraOne / Billing Management / Edit Invalid Meters

Edit Invalid Meters

Reads On: 9/15/2017
 Endpoint ID:

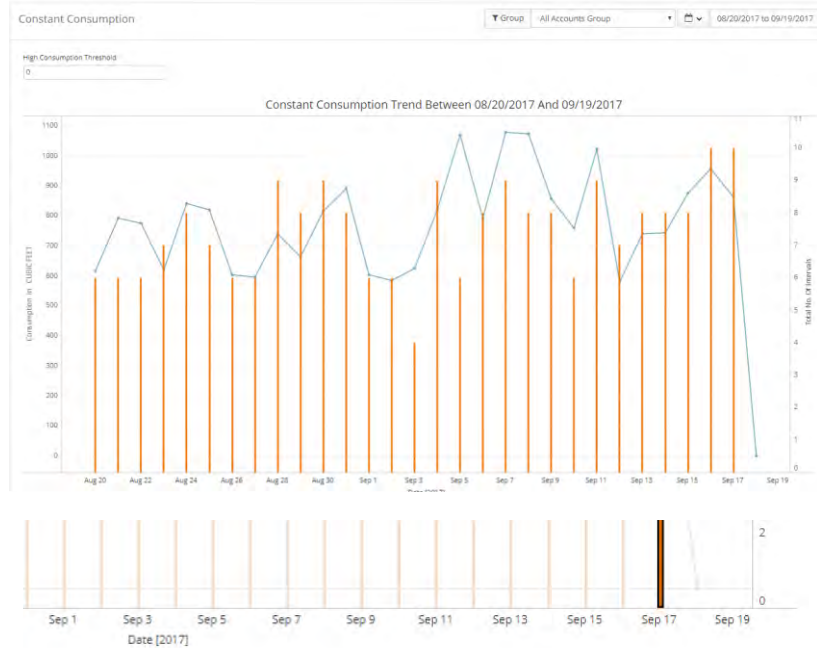
Endpoint ID	Account Number	Profile	View Details
negative_consumption	negative_consumption	admin	View Details
lowreadline	lowreadline	admin	View Details
lowbattery-meter	lowbattery-meter	admin	View Details
jamming	jamming	admin	View Details
constant_consumption	constant_consumption	admin	View Details
abnormalconsumption	abnormalconsumption	admin	View Details
142931	62119001	admin	View Details
139075	11120401	admin	View Details

Date/Time	Meter Data	Estimated Value	Edited Value	Final Value	Status	Edit
<input type="checkbox"/>	09/15/2017 11:00:00 PM	-8	-5	-5	Approved	✎
<input type="checkbox"/>	09/15/2017 10:00:00 PM	-4	-5	-5	Approved	✎
<input type="checkbox"/>	09/15/2017 09:00:00 PM	-4	-8	-8	Approved	✎
<input type="checkbox"/>	09/15/2017 08:00:00 PM	-1	-4	-4	Approved	✎
<input type="checkbox"/>	09/15/2017 07:00:00 PM	-4	-4	-4	Approved	✎

Start Date: 9/15/2017
 End Date: 9/15/2017
 Status: Approved Not Approved

Constant Consumption

- Leaks from:
- Toilet: 1-10 gph
- Faucet/Shower: 0-2 gph
- Hose/irrigation: 5-20



Date	Account #	Mtu Serial #	Endpoint ID	Meter Type	High Co..	Low Cons..	Average C..
09/17/2017	20279301	47412031	131833	Nept/Schlum T-10 2 ProRe.	50.00	0.00	22.22
	jasonwong	111111	jasonwong	Nept/Schlum T-10 1 ProRe.	12.00	12.00	12.00
	lowbatterymeter	46346257	lowbatterymeter	Nept/Schlum T-10 1 ProRe.	12.00	12.00	12.00
	62119001	46176622	140931	Nept/Schlum T-10 5/8 ProR.	10.00	0.00	1.67
	81180801	47412154	144597	Nept/Schlum T-10 3/4 ProR.	10.00	0.00	3.54
	90393401	6117807	131147	Nept/Schlum T-10 5/8 ProR.	10.00	-1.00	5.39
	20003101	47303473	117790	Neptune T-10 5/8 E-Coder.	6.27	0.10	0.85
	abnormalconsumption	46346257	abnormalconsumption	Nept/Schlum T-10 1 ProRe.	6.00	6.00	6.00
	constant_consumption	46346257	constant_consumption	Nept/Schlum T-10 1 ProRe.	2.00	2.00	2.00

Benefits of AMI User-side leak detection

- Positive interaction with customers
- Reduce the run-time of a leak
- Proactively notify customers
- Avoid bill shock
- Quick notification lowers write-offs
- Improve public image and customer service



Granular data at hourly intervals and automated analytics quickly identify potential leaks in the residence, while reducing the data analysis and customer service burden on utility personnel

Questions

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