Intelligent Meter Asset Management: Prioritizing Your Meter Replacement Program

A Case Study in a Medium-Sized Utility

PA AWWA Conference – Hershey, PA
April 18, 2019
Agenda

- Apparent Water Loss 101
- Water Loss Regulations and Guidelines
- Hidden Revenue Locator Solution
- CCWA Apparent Water Loss Opportunity
- Key Results & Learning
- Where Are We Now?
**Apparent Water Loss**: revenue losses due to inaccurately measured or unauthorized water consumption. Includes 1) customer meter inaccuracies, 2) data handling errors, 3) unauthorized consumption.

**Current Approach:**
- Reactive, top down water audits
- Report driven, not action driven
- Variable accuracy

**Future Approach:**
- Proactive, bottoms up data driven monitoring & resolution
Apparent Water Loss 101
M36 Water Audits and Loss Control Programs:

Chapter 1: Reducing apparent losses creates a financial improvement by recovering lost revenues from customers who have been undercharged or have gained water in an unauthorized manner.

Chapter 3: The water balance provides a guide for how much water is lost as a result of customer metering inaccuracies, systematic data handling errors, and unauthorized consumption (collectively, apparent losses), as well as leakage (real losses).
M6 Manual States:

“Although a metered system is the best known for equitably spreading the cost of water service, serious inequities and injustices can occur unless all meters are maintained at a high, uniform level of efficiency and unless every effort is made to prevent inequities from occurring.”

• **Analytics:** Knowing where metering inaccuracies exist and to what extent allows the water utility to rectify inequities in the most efficient manner available.
M6 Manual States:

“A water meter, like any other mechanical device, is subject to wear and deterioration and, over a period of time, loses its peak efficiency. How long water meters retain their overall accuracy depends on many factors, such as the quality of the water being measured, rates of flow and total quantity, and chemical buildup and abrasive materials carried by the water”

• Analytics: By having the ability to investigate the performance of every single meter within a population, and comparing that performance not only against the meter’s own historical performance but also against neighboring meters, all variables are taken into consideration.
Many water utilities are or will soon be required to submit water audits:

- Georgia – validated audit 2011
- California – validated audit since 2017
- Hawaii – validating audit in 2018
- Indiana – bi-annual validated audit in 2020
- Texas
- Tennessee, Delaware River Basin utilities
- Province of Quebec
Pennsylvania DEP

Requires submission of an Annual Water Supply Report form.

“The form defines water loss as “the difference between the water produced and the water used by customers,” and which “include(s) both real and apparent losses”
Meter Asset Management

**Status Quo State**

- No replacement until meter fails
- Age-based replacement
- Random sampling approach

**Future State**

A data driven approach based on:

- Meter age
- Volume throughput
- Degradation curve
- Water Quality
- Normalization
- Learning & Re-learning

**Status Quo:** 6-10% of meters actually require replacement
Meter Under-Registration Model: Why is it Better?

Typical programs:
- No replacement until meter fails
- Age-based replacement
- Random sampling approach to replacement

Status quo: 6-10% of meters actually require replacement
A Data Driven Approach

Data Inputs
- Historic and current meter and billing data

Machine learning/AI
- Industry Intelligence

Dashboards
- Operational Interventions

Outputs
- Revenue Recovery
- Operational Efficiency
- Informed Operators
- Happy Customers
Delivery Milestones

- Contract Review
- Contract Signed
- Kickoff
- Data Acceptance
- Planning
- Integration
- Configuration
- Dashboard Launch
- Launch and Training
- Go-Live
- Active Analytics
- Renewal

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Key Personas

IT Supervisor --- Operations Manager --- Billing --- General Manager / Finance Manager
“Utilizing innovation to provide industry leading service to our community”

- Water, sewer, stormwater
- Metering & Billing
  - 80,000 meters
  - AMR (installed 2006-2010)
  - Mostly residential
  - Mostly mechanical meters
- $110M in revenue, $24M capital/yr
- Water loss control historically was an audit activity
## Value of Non-Revenue Water

<table>
<thead>
<tr>
<th>CCWA</th>
<th>Real Loss Valued At</th>
<th>Apparent Loss Valued At</th>
<th>Unbilled Authorization Valued At</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wholesale Rate</td>
<td>$0.80 - $1.00 per 1,000 gallons</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Variable Production Cost</td>
<td>$2.36 per 1,000 gallons</td>
<td>-</td>
<td>Per type of use; water audit software</td>
</tr>
<tr>
<td>Retail Rate</td>
<td>-</td>
<td>$5.57 per 1,000 gallons</td>
<td>-</td>
</tr>
</tbody>
</table>
The Opportunity

How can CCWA proactively manage apparent loss to yield benefits such as:

- revenue recovery
- more accurate water demand quantification
- improved capital planning
- operational efficiencies

A program was established using Valor’s solution:

- Project 1 (2016) – All meters/system state
- Project 2 (2017) – 1.5 and 2 inch meters – Bench test results
- Project 3 (2018-current) – All large meters (1.5 inch and above)
<table>
<thead>
<tr>
<th>Indicators</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Metering Inaccuracies</td>
<td></td>
</tr>
<tr>
<td>Meter Under-Registration</td>
<td>Detects meters whose accuracy is decreasing over time, causing the meters to register less water than is flowing through them.</td>
</tr>
<tr>
<td>Meter Right Sizing</td>
<td>Detects if the customer has a water meter sized differently than their demand</td>
</tr>
<tr>
<td>Meter Read Errors</td>
<td>Detects negative and implausible meter reads.</td>
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<tr>
<td>Non-Reporting Meters</td>
<td>Detects meters that are not reporting any reads.</td>
</tr>
<tr>
<td>Systematic Data Handling Errors</td>
<td></td>
</tr>
<tr>
<td>Missing Base Charge</td>
<td>Detects if the base/service charge is missing from a bill.</td>
</tr>
<tr>
<td>Customer Misclassification</td>
<td>Identifies meters that have been incorrectly classified with regards to their customer type.</td>
</tr>
<tr>
<td>Unauthorized Consumption</td>
<td></td>
</tr>
<tr>
<td>Meter Tampering</td>
<td>Detects potential residential water meter tampering or instances of wire error that may be tampering.</td>
</tr>
</tbody>
</table>
Project 1 Results

Meter under-registration was the top issue

For flagged under-registration meters, $754,424 in revenue loss over 4 years

3% of residential meters flagged
  - $6 per meter

15% of non-residential meters flagged
  - $67 per meter
Project 2 Results

For 1.5 and 2 inch tested meters, $207,214 in revenue loss over 5 years

39% precision vs status quo (6%)
  - 28 of 72 tested flags confirmed
  - Revenue loss not greater for older meters necessarily
Example Revenue Calculation
Revenue and Volume Calculations

Meter Read Volume: The volume given to Valor with a given meter read

Scaled Volume: The meter read volume, scale to reflect trends in the population for that service area

Predicted Volume: The read Valor would predict a meter to have based on its baseline consumption

Volume Discrepancy: The difference between Valor’s predicted volume and the scaled volume

Revenue Discrepancy: The volume discrepancy multiplied by the rate associated with that meter
Project 3 in Progress

- CCWA & Valor partnership continues
  - Proactive large meters water loss program
  - Data driven decision making for operations
    - Prioritized meter replacement
    - Revenue enhancement targets
  - Partners in innovation
Data science enhances the quality of outcomes - More value for the same cost!

⇒ greater revenue recovery
⇒ greater operational efficiency
⇒ better quantify consumption and ultimately water loss

Recommendations for utilities:

● For short-term gains, focus non-residential meters (assuming you are not already actively testing this population)
● Shift in consumption patterns towards low flow
● Ongoing monitoring and resolution reduces revenue losses
Thank you!

Questions?

Carl Sharkey – carl@valorwater.com
(530) 379-5633