A Non-Revenue Water Tale of Five Cities

Tory Wagoner, PE/PLS
Cavanaugh & Associates, P.A.
- Fire Dept Usage
- Operational Flushing
- Tools for control include efficient flushing practices and awareness campaigns

Non-physical / revenue loss - slow meters, billing issues and theft
Cost impacts at ‘retail’ rate
Tools for control include data management, quality control policies/practices, meter testing & repair

Physical loss - leakage
Cost impacts at ‘wholesale’ rate
Tools for control include leakage and pressure management
Water Efficiency Management

1. Determine Loss Volumes
   - AWWA water audit
   - Apparent & Real Loss volumes

2. Distinguish Types of Leakage/Losses
   - Breakdown of types of leakage (Component Analysis Model)
   - Sources of Apparent Loss

3. Evaluate Economics
   - Costs of losses
   - Costs of intervention strategies

4. Implement Interventions
   - Leak detection
   - Repair time improvement
   - Pressure management
   - Cost effective!
Water Supplied

- Kansas
- Alabama
- Kentucky
- Indiana
- N Carolina
Non Revenue Water

- Kansas
- Alabama
- Kentucky
- Indiana
- N Carolina
Unavoidable Annual Real Loss (UARL)

Kansas | Alabama | Kentucky | Indiana | N Carolina

Million gallons (US)
Infrastructure Leakage Index (ILI)

- Kansas
- Alabama
- Kentucky
- Indiana
- N Carolina
Data Validity Score

- Kansas
- Alabama
- Kentucky
- Indiana
- N Carolina
System #1 - Kansas

- **Existing Programs:**
  - Leak Detection
  - Customer Meter Testing

- **Initial Assessment:**
  - Unrealistically low ILI – (0.2)

- **Validation Efforts:**
  - Finished Water Meter Testing
  - Billing Data

- **Next Steps:**
  - Calendar Year 2016 Audit – ILI solved?
    - Unmetered Interconnection?
  - Large Meter Testing Optimization
  - Small Meter Testing/Optimum Replacement
  - Leak Detection Optimization

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### Test - Thursday, October 20, 2016

<table>
<thead>
<tr>
<th>Clearwell</th>
<th>Test Meter</th>
<th>Wetwell</th>
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</thead>
<tbody>
<tr>
<td>Starting Level</td>
<td>12.580 feet</td>
<td>Meter Reading: 512.83</td>
</tr>
<tr>
<td>Ending Level</td>
<td>12.327 feet</td>
<td>Time Start: 10:55 AM</td>
</tr>
<tr>
<td>Pump Flow</td>
<td>2 MGD</td>
<td>Time Start: 11:10 AM</td>
</tr>
<tr>
<td>Total Volume</td>
<td>2,523 cubic feet</td>
<td>Time End: 11:10 AM</td>
</tr>
<tr>
<td>0.019 MG</td>
<td>Meter Reading: 512.84</td>
<td>Total Volume</td>
</tr>
<tr>
<td>Meter Volume: 0.016 MG</td>
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<tr>
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<td>12.065 feet</td>
<td>Time Start: 11:10 AM</td>
</tr>
<tr>
<td>Pump Flow</td>
<td>2 MGD</td>
<td>Time Start: 11:25 AM</td>
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<tr>
<td>Total Volume</td>
<td>2,613 cubic feet</td>
<td>Total Volume</td>
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<tr>
<td>0.020 MG</td>
<td>Meter Reading: 512.87</td>
<td>Meter Volume: 0.024 MG</td>
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<td>Meter Volume: 0.016 MG</td>
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<td>Starting Level</td>
<td>12.065 feet</td>
<td>Meter Reading: 512.87</td>
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<tr>
<td>Ending Level</td>
<td>11.773 feet</td>
<td>Time Start: 11:25 AM</td>
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<td>Pump Flow</td>
<td>2 MGD</td>
<td>Time Start: 11:40 AM</td>
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<tr>
<td>Total Volume</td>
<td>2,912 cubic feet</td>
<td>Total Volume</td>
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<tr>
<td>0.022 MG</td>
<td>Meter Reading: 512.89</td>
<td>Total Volume</td>
</tr>
<tr>
<td>Meter Volume: 0.016 MG</td>
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<td>Starting Level</td>
<td>11.773 feet</td>
<td>Meter Reading: 512.89</td>
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<tr>
<td>Ending Level</td>
<td>11.500 feet</td>
<td>Time Start: 11:40 AM</td>
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<tr>
<td>Pump Flow</td>
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<tr>
<td>Total Volume</td>
<td>2,722 cubic feet</td>
<td>Total Volume</td>
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<tr>
<td>0.020 MG</td>
<td>Meter Reading: 512.91</td>
<td>Total Volume</td>
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<td>Meter Volume: 0.025 MG</td>
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- **Test Total:** 0.081 MG
- **Total Non-Revenue Water Volume (MG)**
  - Level 1: 3,634
  - Total: 250
- **Billed Consumption + NRW:**
  - 3,884
System #2 - Alabama

• **Existing Programs:**
  o Leak Detection based on High Volumes of perceived leakage
  o % Based Performance Indicator
    - Large Industry left → % ↑ → “Water Loss Problem”

• **Initial Assessment:**
  o High Pressure = High UARL = ILI of 2.1

• **Validation Efforts:**
  o Level 1 Water Audit

• **Next Steps:**
  o M36 Methodology based tracking & metrics
  o Finished Water Meter Testing
  o Large Meter Testing Program
  o Leak Detection Optimization
System #3 - Kentucky

- **Existing Programs:**
  - Leak Detection based on High Volumes of perceived leakage
  - % Based Performance Indicator
  - Finished Water Meter Testing
  - Master Meter Testing

- **Initial Assessment:**
  - Unrealistic ILI of 13
    - Preliminary Bottom-up Analysis

- **Validation Efforts:**
  - Level 1 Water Audit

- **Next Steps:**
  - M36 Methodology based tracking & metrics
  - Billed Metered Level 2 Validation
  - Large Meter Testing Program
  - Leak Detection Optimization
System #4 - Indiana

- Existing Programs:
  - Leak Detection
  - Customer Meter Testing
  - Rolling 12 month auditing

- Initial Assessment:
  - % Metric used as Indicator

- Validation Efforts:
  - Level 1 Water Audit
  - Customer Meter Inaccuracy Analysis
  - Billing Data Analysis

- Next Steps:
  - Large Meter Testing Optimization
  - Redistricting/Pressure Reduction
  - Leak Detection Optimization
  - Unmetered Fire Line Analysis
  - Small Meter Testing Analysis
System #5 – North Carolina

- **Existing Programs:**
  - Capital based line replacement

- **Initial Assessment:**
  - High Pressure = High UARL

- **Validation Efforts:**
  - Level 1 Water Audits
  - Billing Data Analysis
  - Real Loss Component Analysis
  - Lag-time adjustment (bi-monthly billing)

- **Next Steps:**
  - Large Meter Testing Optimization
  - Pressure Optimization
  - District Metered Areas
  - Leak Detection Optimization
  - Finished Water Meter Testing
SAVE THE DATE
December 4 - 5, 2017
Paradise Point Resort · San Diego, CA

The North American Water Loss Conference (NAWL) will assemble policy and technical experts on non-revenue water management in North America.

Visit ca-nv-awwa.org after January for more information.

Presented by:
American Water Works Association
California-Nevada Section

In cooperation with the Alliance for Water Efficiency and the NAWL 2017 Conference Planning Committee.

Sponsorships will be available.
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