Today's Workshop

Warmup

Foundations - Top Down M36 Water Audit
Foundations - Developing the Inputs
Exercise - Top Down M36 Water Audit

Foundations – Data Validation
Exercise - Data Validation

Next Steps for Audit to Action

Quiz

According to the AWWA M36 Water Audit Method, an acceptable level of Unaccounted For Water is:

A. 15%
B. 5%
C. 0%
D. 10%
1957 AWWA report: Revenue Producing vs. Unaccounted-for water. Defines a "metered water ratio."
Percent who ranked topic HIGH IMPORTANCE (4 or 5)  % mean response

- Optimal Pressure Management 57.7%
- Reporting using Best Indicators 50.0%
- ALC Based on Financial Analysis 50.0%
- Validity of NRW Information 45.5%
- Effectiveness of NRW Team & Forecasting 45.4%
- Effectiveness of Leak Detection 45.3%
- Components of Apparent Losses 44.9%
- Water Balance: All Components 44.9%
- Reliability and Accuracy of Billing 44.6%
- Large Meter Program Based on Financial Analysis 40.7%
- ALC Based on Optimization and Rate of Rise 39.8%
- Small Meter Program Based on Analysis and Optimization 27.8%
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Basic Concepts

1. Utilize the Water Balance.

2. Separate Total Water Loss into Real and Apparent Loss.

3. Separate Real and Apparent Loss into their subcomponents.

4. Use metrics in units of Volume, Value & Validity to make your game plan.

---

AWWA Free Water Audit Software

- Industry Standard (M36)
- Free
- Defaults provided
- ~10 Volume Inputs
- ~7 System Data Inputs

awwa.org/waterlosscontrol
IWA/AWWA Standard Water Balance

Entering Water Sources
- Total System Input
  - Water Exported
  - Authorized Consumption
  - Billed Authorized Consumption
  - Non-Revenue Water
  - Real Losses
  - Unbilled Authorized Consumption
  - Apparent Losses

Systematic Data Handling Errors
- Leakage on Mains
- Leakage on Service Lines
- Leakage & Overflows at Storage

Customer Metering & Data Inaccuracies
- Unauthorized Consumption
- Unbilled Unmetered Consumption
- Unbilled Metered Consumption

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Customer Metering & Data Inaccuracies
- Unauthorized Consumption
- Unbilled Unmetered Consumption
- Unbilled Metered Consumption
Real Losses

- Physical loss - leakage
- Cost impacts at 'wholesale' rate
- Tools for control include leakage and pressure management

Apparent Losses

- 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

Non-Revenue Water

- Fire Dept Usage
- Operational Flushing
- Tools for control include efficient flushing practices and awareness campaigns

QUIZ

- Fire Department flushing
- Under registering customer meters
- Pipe joint leakage
- Water theft
- Customer billing adjustment
- DOT usage
- AMR device transmission failure
- Customer toilet leak
- Water main break
- Storage tank overflows
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Unaccounted For Water
Unaccounted For Water Percentage

2003
- Inconsistent use and interpretation
- Unreliable indicator of performance
- Fails to segregate loss into its components for effective management

Water Loss Control Terms Defined
- Why the terms 'unaccounted-for' water and 'unaccounted-for percentage' are misleading.
Water Loss or NRW as % of Supply

Water Loss as a Percentage of Supply is not an Indicator of Performance

Water Supplied (MGD)
Authorized Consumption (MGD)
Water Loss (MGD)

Development Boom
Great Recession, Rates Increases, Conservation
New Normal

Water Loss as a Percentage of Supply is not an Indicator of Performance

Water Supplied (MGD)
Authorized Consumption (MGD)
Water Loss (MGD)
Water Loss (Percent of Supply)
**Simplicity**

Everything should be made as simple as possible, but no simpler.

- Albert Einstein

For every complex problem, there is a solution which is simple, neat, and wrong.

- H.L. Mencken

---

**3-V**

- **Volume**: MG per Year/Gallons/Connection/Day
- **Value**: $ per Year/Economic Loss Index
- **Validity**: Water Audit Data Validity Score/95% Confidence Limits/Key Data Input Grades

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**Volume**

NRW Components - By Volume (MG) - Level 2

- Real Loss
- Apparent Loss
- Unused Consumption

**Value**

NRW Components - By Value Level 2

- Real Loss
- Apparent Loss
- Unused Consumption
Infrastructure Leakage Index (ILI)

ILI = CARL (current leakage)
UARL (technical low leakage limit at current pressure)

Basic Concepts

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Critical Importance of Validation

Water Audits in the United States: A Review of Water Losses and Data Validity

September 2015

Copyright Cavanaugh & Associates, P.A.
2016
Georgia Statewide Water Loss Technical Assistance – Finished Water Meter Testing

<table>
<thead>
<tr>
<th>Test Verification</th>
<th>Pass</th>
<th>Fail</th>
<th>Untestable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authorized</td>
<td>BLUE</td>
<td>RED</td>
<td>GREEN</td>
</tr>
<tr>
<td>Authorized</td>
<td>ORANGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Authorized</td>
<td>NAVY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Authorized</td>
<td>BLACK</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- PASS 18%
- FAIL 49%
- UNTESTABLE 33%

F+w+1

8" Propeller Meter
Check Valve
Well Pump
Accuracy results from MFR test bench: 99.5%
Accuracy results from in-situ test: 142.2%

Courtesy MESCO
**AWWA M36 Water Audit Data Validity Scoring**

In computer science, **data validation** is the process of ensuring that a program operates on clean, correct and useful data.

- AWWA developed a detailed grading matrix for Water Audit inputs
- Based on the utility’s policies and practices for data collection, data management, data archiving, quality control procedures, and derivation of audit inputs
- Provides a quantitative measure of the reliability

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**AWWA Free Water Audit Software© (V5.0)**

**Data Grading for each Water Audit input (excerpt)**

**Guidance on Use of Water Audit Data, based on Level of Data Validity**

<table>
<thead>
<tr>
<th>Audit Data Collection</th>
<th>Level I (0-25)</th>
<th>Level II (26-50)</th>
<th>Level III (51-70)</th>
<th>Level IV (71-90)</th>
<th>Level V (91-100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish policies and procedures for data collection</td>
<td>Establish policies and procedures for data collection</td>
<td>Ensure data is collected and stored in a systematic manner</td>
<td>Establish policies and procedures for data collection</td>
<td>Establish policies and procedures for data collection</td>
<td>Establish policies and procedures for data collection</td>
</tr>
<tr>
<td>Maintain integrity of data collection and storage processes</td>
<td>Maintain integrity of data collection and storage processes</td>
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<td>Maintain integrity of data collection and storage processes</td>
</tr>
<tr>
<td>Implement data validation and quality control procedures</td>
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<td>Establish data management and archiving procedures</td>
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</tbody>
</table>

**Functional Focus Area**

- **Audit Data Collection**
- **Electric Meter Control**
- **Long-term loss control**
- **Target setting**
- **Benchmarking**
- **Establish/revise policies and procedures for data collection**
- **Refine data collection practices and establish as routine business process**
- **Analyze business process for customer metering and billing functions and water supply operations**
- **Identify data gaps.**
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**Research information on leak detection programs. Begin flowcharting analysis of customer billing system.**

**Conduct loss assessment investigations on a sample portion of the system: customer meter testing, leak survey, unauthorized consumption, etc.**

**Establish ongoing mechanisms for customer meter accuracy testing, active leakage control and infrastructure monitoring.**

**Refine, enhance or expand ongoing programs based upon economic justification.**

**Stay abreast of improvements in metering, meter reading, billing, leakage management and infrastructure rehabilitation.**

**Launch auditing and loss control team; address production metering deficiencies.**

**Analyze business process for customer metering and billing functions and water supply operations. Identify data gaps.**

**Establish/revise policies and procedures for data collection.**

**Refine data collection practices and establish as routine business process.**

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### Dec 4-5, 2017

**Conference & Exposition**

**NORTH AMERICAN WATER LOSS 2017**

**SAN DIEGO, CALIFORNIA**

- The premier water loss event in North America
- Over 90 speakers from the United States and around the world
- Technical sessions on water auditing, loss control program implementation, addressing Non-Revenue Water through billing, theft, metering, leakage, pressure, energy and asset management, and regulatory policy development across North America
- Case studies for growing implementation of established IWA/AWWA best practices and innovations for Water Loss Management

[www.ca-nv.awwa.org](http://www.ca-nv.awwa.org)
Utah – Pilot Training Program
AWWA M36 Water Audits & Loss Control

Be SMART!
Cut Water Loss!