WATER METER EFFICIENCY TESTING AND AWWA WATER AUDITS

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Presentation Overview

- **AWWA Water Audit Overview**
  - Water Audit Goals
  - New Version 6.0 AWWA Water Audit
  - Water Supplied
  - Water Consumed
  - Water Lost
- **Results Analysis and System Evaluation**
- **Additional Resources**

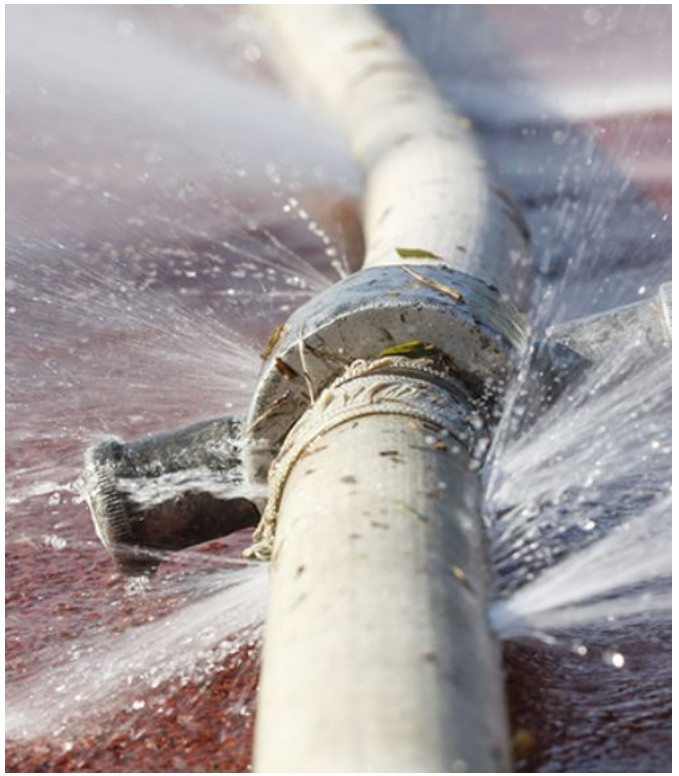


Photo credit: www.awwa.org/resources-tools

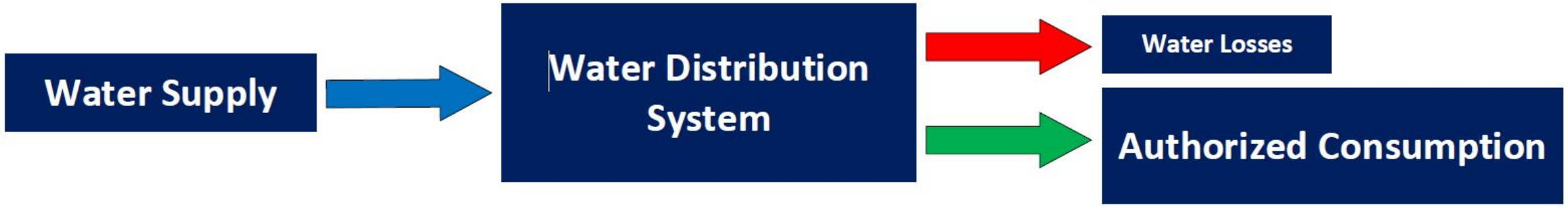
WHAT IS A WATER AUDIT?

- Similar to a financial audit, a water audit compares volumes of water treated and pumped to volumes of water consumed by customers, and other uses such as firefighting and community uses." – Alliance for Water Efficiency

POLL QUESTION:

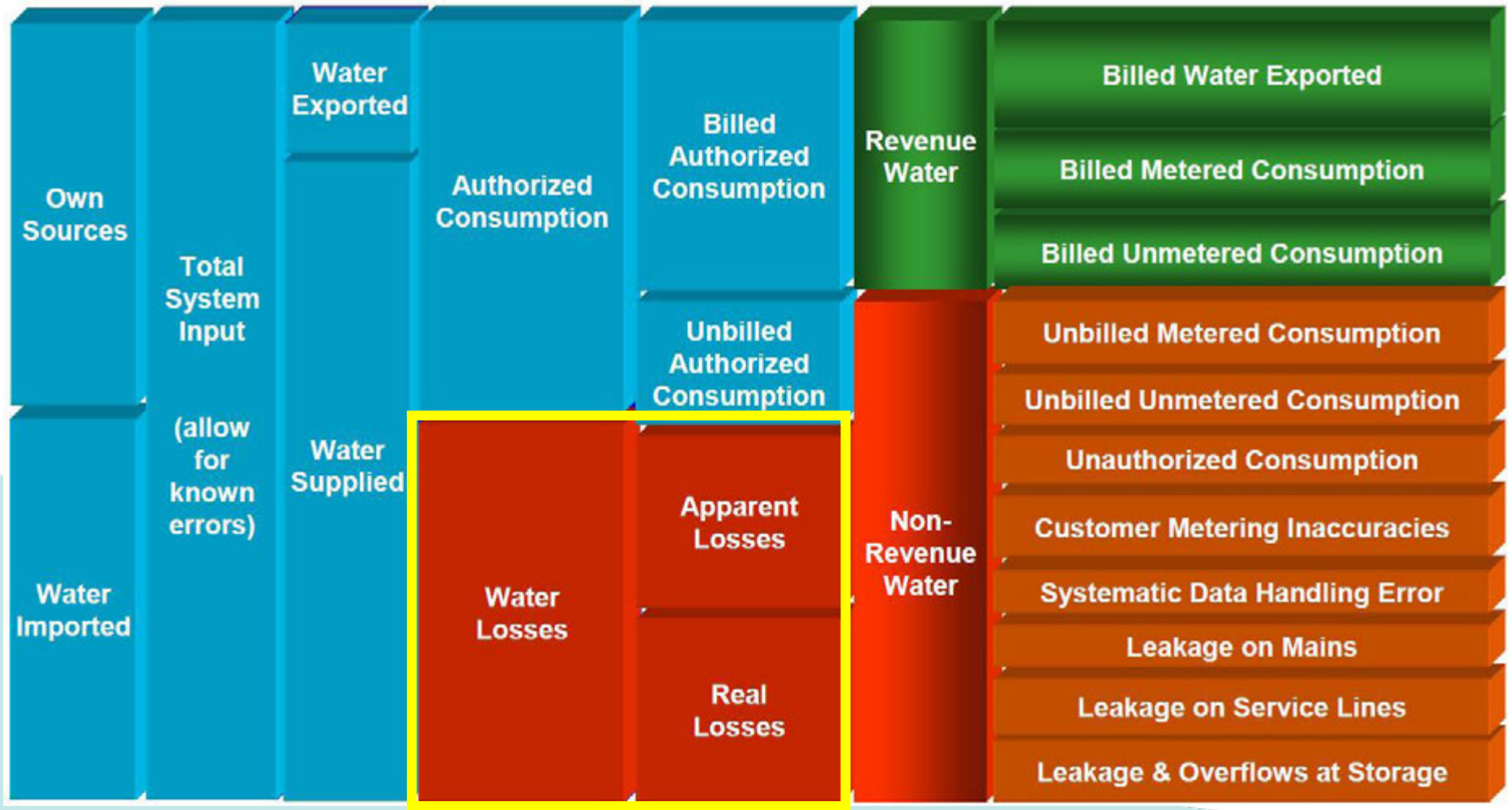
DO YOU HAVE PRIOR EXPERIENCE PERFORMING A WATER AUDIT?

Water Audit Overview



-No system is perfect and all will experience some level losses.

The AWWA/IWA Water Audit Table



AWWA Water Audit Goals

- Evaluate System Performance
- Quantify water losses and associated revenue loss
- Identify action items and opportunities for system improvements

AWWA WATER AUDIT SPREADSHEET

- Version 6.0 Released December 4th, 2020
- Publicly Available at:

https://www.awwa.org/Resources-Tools/Resource-Topics/Water-Loss-Control/Free-Water-Audit-Software

Updates in Version 6.0

- More streamlined data validation (drop down questions)
- Comparison of performance parameters
- Ease of use

ALL MODELS ARE WRONG, BUT SOME ARE USEFUL

-GEORGE E.P. BOX

WATER SUPPLIED

WATER SUPPLIED

VOS	Volume from Own Sources:	n	g	
WI	Water Imported:	n	g	
WE	Water Exported:	n	g	
	WATER SUPPLIED:			0.000

Relevant Equation:

(Volume from Own Source) + (Water Imported) – (Water Exported) = Water Supplied

WATER SUPPLY – SAMPLE DATA GRADING CRITERIA

- What is the frequency of flow accuracy testing?
- Which best describes the frequency of finished water meter readings?
- Which best describes the frequency of data review anomalies/errors?

WATER CONSUMED - AUTHORIZED

AUTHORIZED CONSUMPTION

BMAC	Billed Metered:	n	g		
BUAC	Billed Unmetered:	n	g		
UMAC	Unbilled Metered:	n	g		
UUAC	Unbilled Unmetered:	n	g	3	0.000

Default option selected for Unbilled Unmetered, with automatic data grading of 3

AUTHORIZED CONSUMPTION: 0.000

- Billed metered – Service connections with a water meter that are billed.
- Billed unmetered – Services without a meter but are still billed.
- Unbilled metered – service connections with a meter that are not billed.
- Unbilled unmetered – service connections without a meter that are not billed.

WATER CONSUMED - AUTHORIZED CONSUMPTION BILLED METERED DATA VALIDATION QUESTIONS

- For billed metered accounts, what percentage of bills are estimated during a billing cycle?
- How often does the system read its customers meters?
- How frequently does internal review by staff of the billed metered authorized consumption occur?

WATER CONSUMED - AUTHORIZED CONSUMPTION BILLED UNMETERED DATA VALIDATION QUESTIONS

- Was there any billed consumption on unmetered accounts in the audit year?
- What portion of billed accounts are unmetered (% by number of accounts)?
- What was the methodology used to quantify consumption for unmetered accounts?
- How frequently is unmetered consumption estimated?

WATER LOSSES – APPARENT AND REAL

	WATER LOSSES				0.000
	Apparent Losses				
	Default option selected for Systematic Data Handling Errors, with automatic data grading of 3				
SDHE	Systematic Data Handling Errors:	n	g	3	0.000
CMI	Customer Metering Inaccuracies:	n	g		0.000
UC	Unauthorized Consumption:	n	g	3	0.000
	Default option selected for Unauthorized Consumption, with automatic data grading of 3				
	Apparent Losses:				0.000
	Real Losses				
	Real Losses:				0.000
	WATER LOSSES:				0.000

Real Losses

- Leaks
- Main Breaks

vs.

Apparent Losses

- Water meter inaccuracies
- Meter reading errors
- Accounting/data handling errors
- Water theft

WATER METER ACCURACY

IMPORTANCE OF LARGE METER ACCURACY

- Accurate source meters result in more accurate water audits
- Can be used for treatment purposes to determine proper dosing rates
- In many cases roughly 60% of revenue can be determined by large water meters

Factors Affecting Water Meter Accuracy

Mechanical Wear

- Hardness
- Chemistry
- Meter Use/Application
  - Type/Size

APPARENT LOSSES – CUSTOMER METERING INACCURACIES DATA GRADING

- Do you test meters reactively (when triggered by customer complaint or billing/consumption flag)?
- For small size customer meters, which best describes the frequency of proactive testing?
- To what extent does meter replacement occur and for which meters?

POLL QUESTION:

DO YOU HAVE EXPERIENCE TESTING WATER METER ACCURACY TO MORE ACCURATELY INFORM A WATER AUDIT?

Water Meter Testing/Replacement Strategy

- Prioritize large meter testing
- Prioritize older water meters, most likely to experience degradation
- Focus on characterizing populations of meters
- Larger sample size allows for more accurate characterization of meter population

Data Improvement

Improvements in quantifying volume of billed metered consumption	Start meter reading and volume-based billing; plan computerized billing system	Develop computerized billing system; consider automatic meter reading	Conduct internal checks of billing data; install automatic meter reading	Conduct third-party audit of billed data	Continue and standardize program

- From "Water Loss Audit Manual for Texas Utilities"

AMR VS. AMI METERING

ADVANCED WATER METERING TECHNOLOGIES - AMR

Automatic Meter Reading (AMR) – Allows for meters to be read typically via drive by system.

Benefits:

- Reduced staff time for meter reads
- Less costly than Automated Infrastructure
- Increased safety for meter reading staff

ADVANCED WATER METERING INFRASTRUCTURE - AMI

Advanced Metering Infrastructure (AMI) – Allows for meters to be read via towers and provides real time information.

Benefits:

- Even further reduced staff time for meter reads than AMR
- Can provide real time information (improved leak detection)
- Even further increased safety for meter reading staff since no driving required

Water Audit Performance Indicators

Primary Performance Indicators

- Loss Cost Rate indicator – value per service connection per day
- Normalized Water Losses indicator – volume per service connection per day (includes apparent and real losses)
- AWWA has recommended discontinued use of performance indicators as percentage

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes					Uses and Limitations	Principal Users
			Assessment	Bench-Marking	Target-Setting	Planning	Tracking		
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

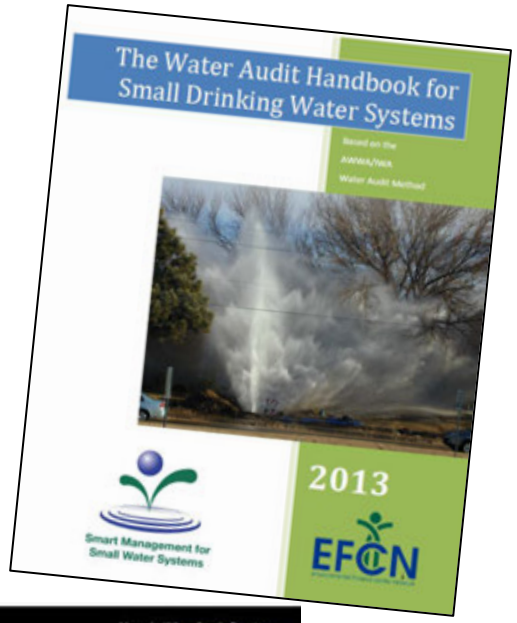
ADDITIONAL RESOURCES

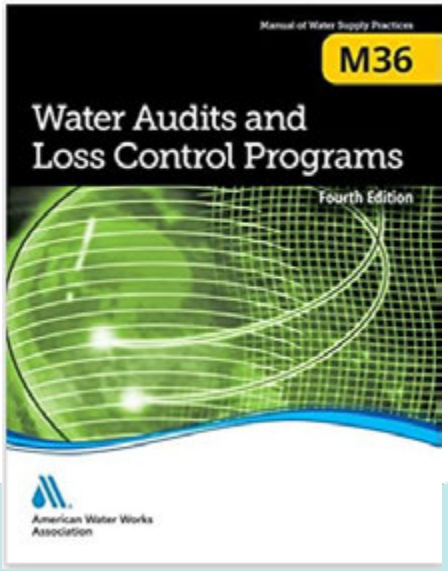
The Water Audit Handbook for Small Drinking Water Systems, EFCN

AWWA M36 Water Audits and Loss Control Programs

Chapter 1: Reducing apparent losses creates a financial improvement by recovering lost revenues.

Chapter 3: The water balance provides a guide for how much water is lost.

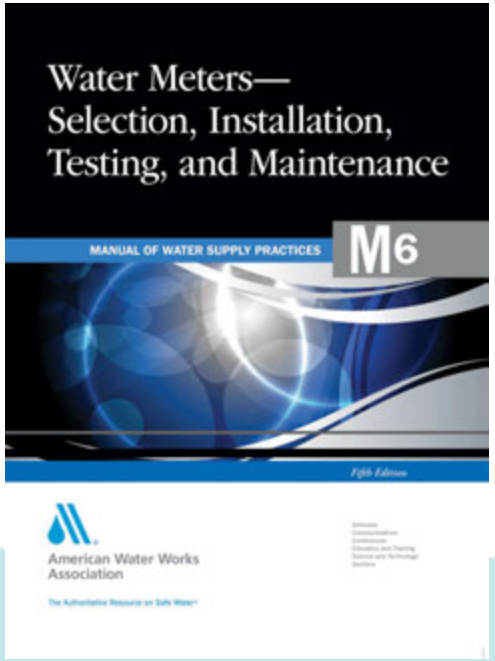




ADDITIONAL RESOURCES

- "The New AWWA Free Water Audit Software is Here" https://www.youtube.com/watch?v=7R_72CfaMlo&t=2333s

- AWWA M6 Water Meters – Selection, Installation, Testing, and Maintenance



QUESTIONS?

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WATER PROGRAMS at sacramento state