Why Percent Water Loss as a Metric Isn't Cutting It in Rate Cases But What Are The Alternatives?

Relevant Roles:
Chair, AWWA Water Loss Outreach Subcommittee
IWA Water Loss Specialist Group, US Representative
Chief Innovation Officer, Cavanaugh

Steve Cavanaugh, P.E.
steve.cavanaugh@cavanaughsolutions.com

Staying In Tune with Success
In Utility Regulation
42nd Annual NCRA/Nashville

What's Driving Change?

U.S. Has Reached 52 Percent Drought

By Sara Jerome
@sarmje

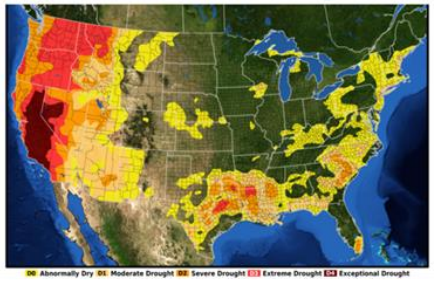
It's official: Most of the U.S. is facing drough conditions.

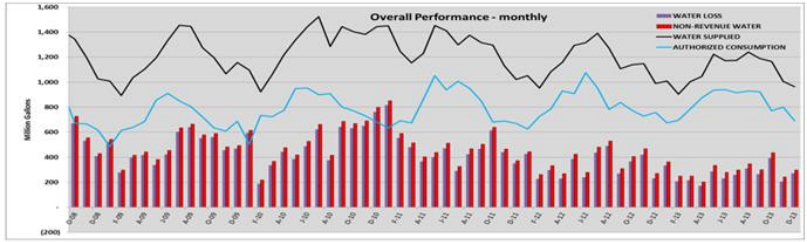
"The U.S. Drought Monitor, whi analyses every Tuesday and rele every Thursday, says that 52.00% of the United States — including Alaska, Hawaii, and Puerto Rico — is suffering from a lack of precipitation and is now abnormally dry or stuck in a drought," Gawker reported.

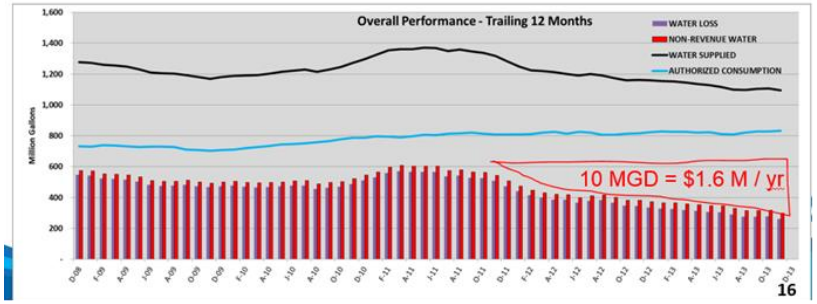
More Than Half of the United States Is Abnormally Dry or Officially in a Drought

U.S. Drought Monitor | September 8, 2015

Issued: 9/10/15 | Data: NDMC | Map: The Vane | thevane.gawker.com | @wxdam







Senate Bill No. 555

October 9, 2015

Contact: Melissa Jones, (916) 651-4003

Governor signs Wolk drought preparedness, renewable energy bills

Bills improve water management & conservation, increase use of renewable energy programs

SACRAMENTO –Governor Edmund G. Brown Jr. signed into law a measure by Senator Lois Wolk (D-Davis) to improve water management and conservation in California, and another bill to boost participation in programs enabling utility customers to receive part of their electricity from renewable energy sources.

Today, Brown signed Senate Bill 555, which requires all urban water suppliers in California to conduct annual water loss audits to detect leaks and breaks in their water distribution systems and submit the results to the Department of Water Resources for public review. The measure would also require the State Water Resources Control Board to develop performance standards to minimize water loss in the water agencies' distribution systems.

"The fastest and cheapest way to save water is to identify and recover the water lost on a daily basis in our urban areas," Wolk said. "It is estimated that we could save hundreds of thousands of acre-feet this way. Every drop counts."

18

Challenging Reporting

New Jersey

DEP is responsible to make an "annual enumeration" of water loss by water systems serving greater than 500 persons that have "unaccounted for water" greater than 15%, triggering potential compliance action against such utilities. Actions might include directing revised Plans **to act on reducing losses**, more frequent Plan submission, and/or set a time frame for reduction of losses to occur.

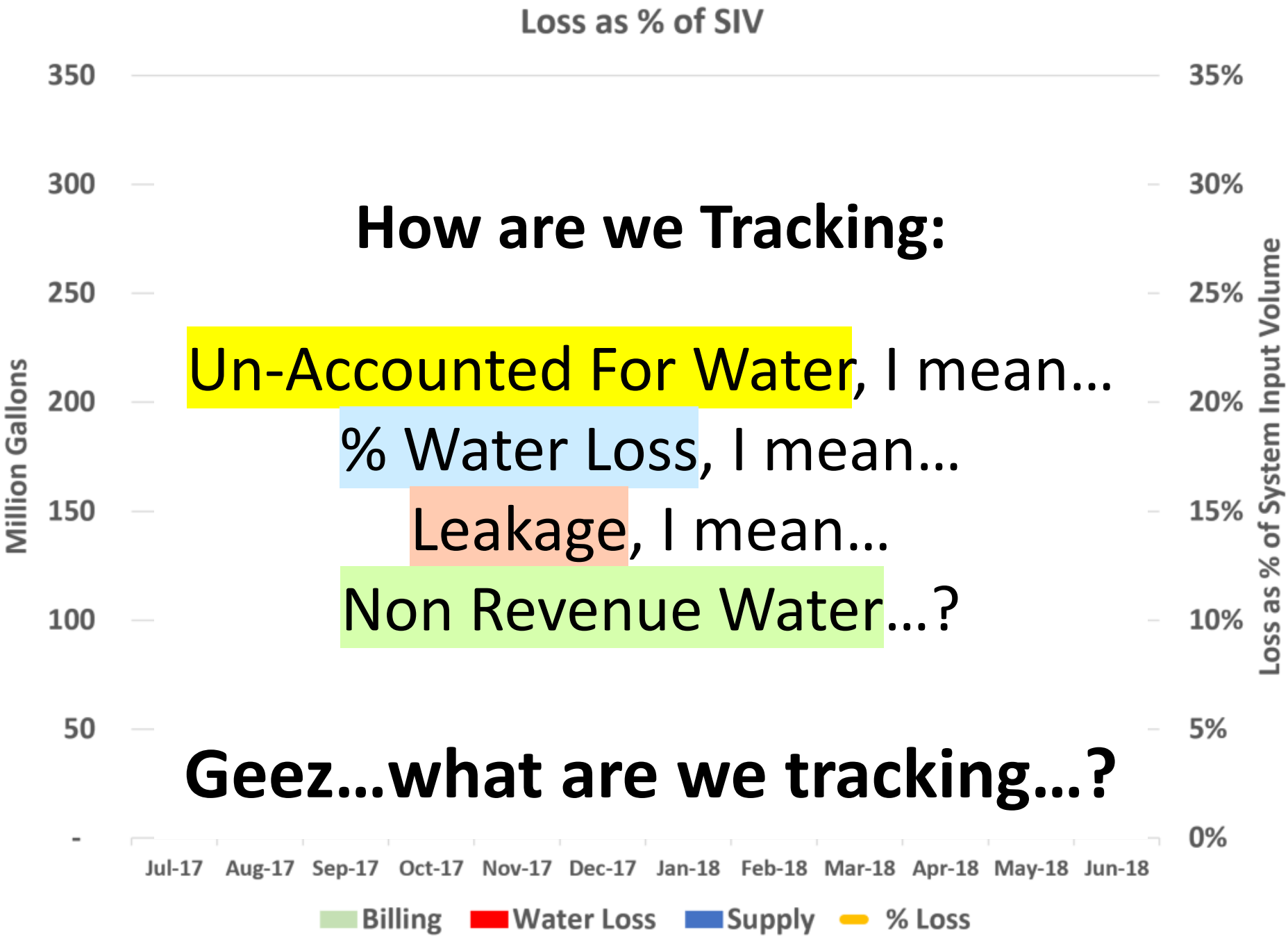
Kentucky

The agency with jurisdiction over water loss reporting is the Kentucky Public Service Commission (PSC). The PSC has set forth laws and regulations for investor owned water utilities and to fulfill these laws and for the purposes of rate setting, utilities must determine their UFW percentage, and it **must not exceed 15%** of total water produced and purchased (807 KAR 5:066 Water – Section 6 Water Supply Measurement).

Source: Cutting our Losses - NRDC

manager.[4] As general manager, Mr. Hall is Southern District's chief executive officer, as defined by KRS 74.040.

This formal investigation and show cause action has its genesis in Southern District's request for a rate adjustment in Case No. 2018-00230.[5] The Staff Report filed in that case stated that Southern District had outstanding loans for which it did not obtain Commission approval as required by KRS 278.300; that Southern District reported significant unaccounted-for water loss in excess of the 15 percent limit pursuant to 807 KAR 5:066, Section 6(3); and that Southern District had not complied with its tariff



How are we Tracking:

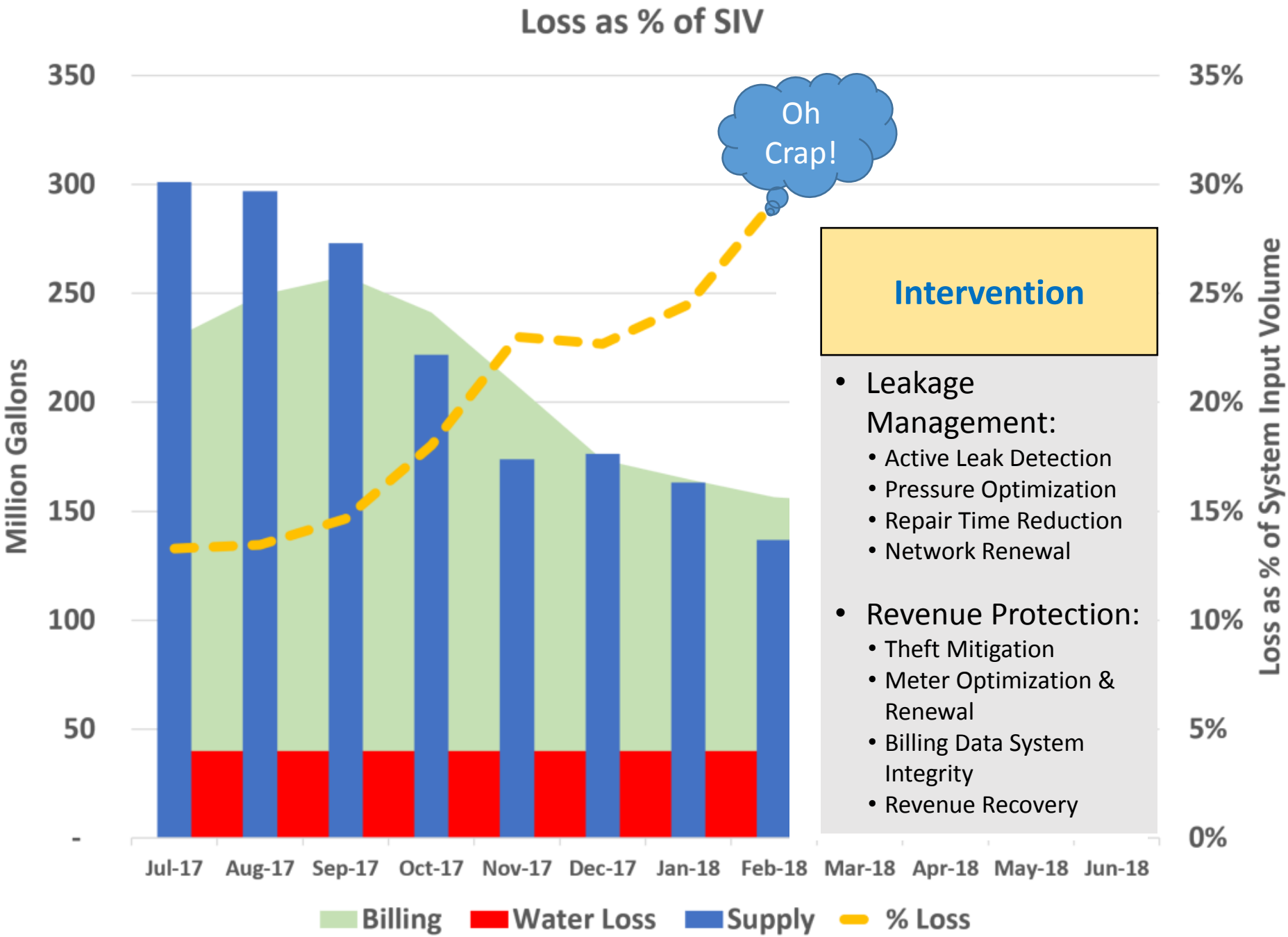
Un-Accounted For Water, I mean…

% Water Loss, I mean…

Leakage, I mean…

Non Revenue Water…?

Geez…what are we tracking…?


Loss as % of SIV
350
300
250
200
150
100
50
-
Million Gallons
35%
30%
25%
20%
15%
10%
5%
0%
Loss as % of System Input Volume
Oh Crap!
Intervention
• Leakage Management:
• Active Leak Detection
• Pressure Optimization
• Repair Time Reduction
• Network Renewal
• Revenue Protection:
• Theft Mitigation
• Meter Optimization & Renewal
• Billing Data System Integrity
• Revenue Recovery
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
Jan-18
Feb-18
Mar-18
Apr-18
May-18
Jun-18
Billing
Water Loss
Supply
% Loss

Right Tool, Wrong Problem?

Starting to Question Reporting

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

ELECTRONIC INVESTIGATION INTO THE MEASURING, RECORDING, AND REPORTING OF WATER LOSS BY KENTUCKY'S JURISDICTIONAL WATER UTILITIES	))))	CASE NO. 2018-00394

ORDER

Upon its own motion, the Commission initiates this investigation to review the adequacy of the methods used by Kentucky's jurisdictional water utilities to measure, record, and report their water loss. As part of this investigation, the Commission will provide guidance to jurisdictional water utilities regarding the reporting of water loss, as well as provide an updated water loss form for measuring and tracking this loss.

3.f. Unaccounted-for Water Plan

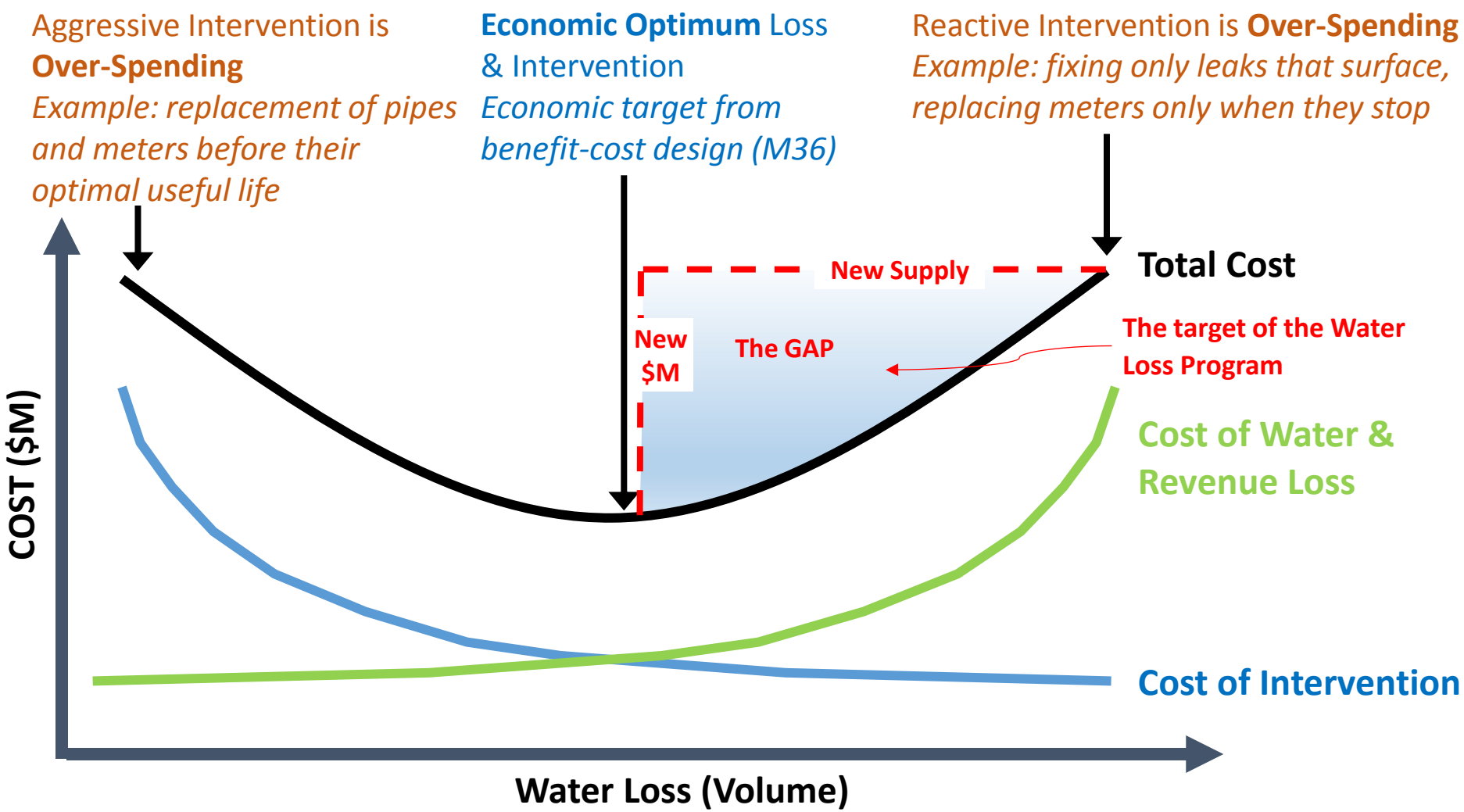
A detailed description of the MVWA's Leak Remediation Program was provided as Exhibit C.2. It is also attached to this document.

"AWWA [American Water Works Association] has recommended against use of the term 'unaccounted-for' water and the 'unaccounted-for water percentage.' Instead, it recommends use of the term Non-revenue Water and the array of performance indicators included in the IWA/AWWA Water Audit Method."[i]

According to the AWWA, "Revenue Water" includes both metered and unmetered billed consumption. "Non-revenue Water" includes: both metered and unmetered unbilled consumption, unauthorized consumption, customer meter inaccuracies, systematic data handling errors, leakage in transmission and distribution mains, storage leaks and overflows from water storage tanks, and service connection leaks up to the meter.

The MVWA cannot provide a schedule for reducing system unaccounted-for water to 15% because water leaks are dynamic and varied. Controlling water losses is a continuous process. ***The MVWA is strongly committed to reducing water losses and will have augmented tools within the next three to four years that will help quantify and reduce water losses.***

AWWA M36
Economic Optimum

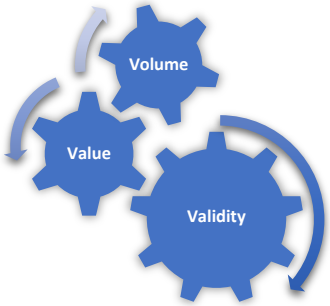


The Big Picture: Economic Intervention

Annual Water Balance

- Annual M36 water audit
- Apparent & Real Loss volumes
- Level 1 validation

baseline



Loss Profiling

- Validation
  - Level 2 Analytics
  - Level 3 Field Study
- Analyze sources of Apparent Loss
- Analyze 3 types of Real Loss

technical analysis

Cost-Benefit & Targets

- Costs of losses
  - by subcomponent
  - in aggregate
- Costs of intervention strategies
- Program design
- System-specific

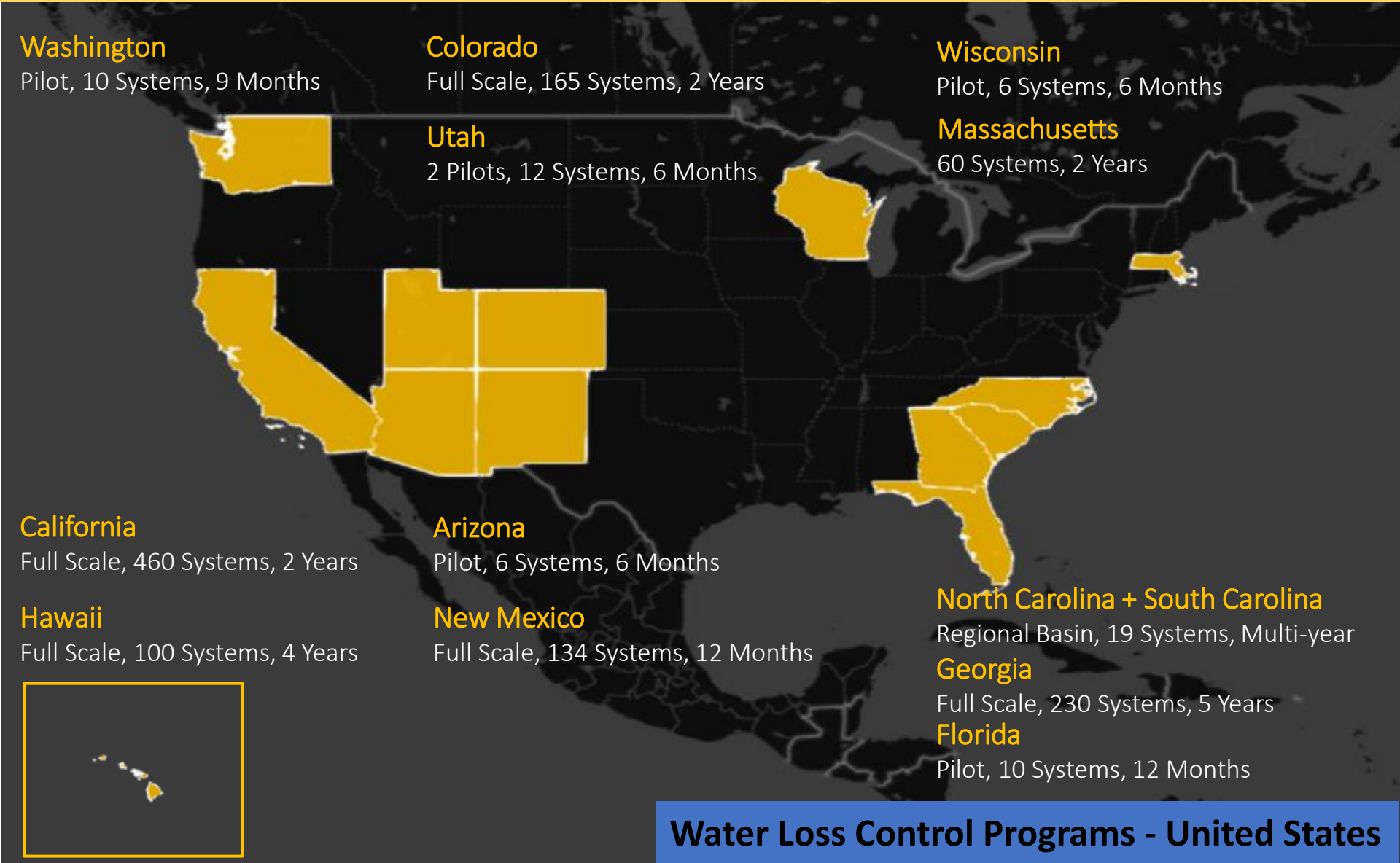
economic analysis

Intervention

- Leakage Management:
  - Active Leak Detection
  - Pressure Optimization
  - Repair Time Reduction
  - Network Renewal
- Revenue Protection:
  - Theft Mitigation
  - Meter Optimization & Renewal
  - Billing Data System Integrity
  - Revenue Recovery

cost-effectiveness

AWWA M36
U.S. State Programs



Water Loss Control Programs - United States

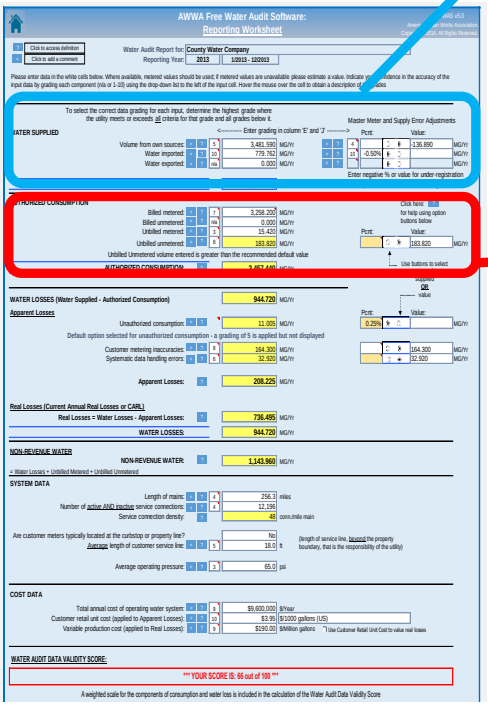
Extra Slides

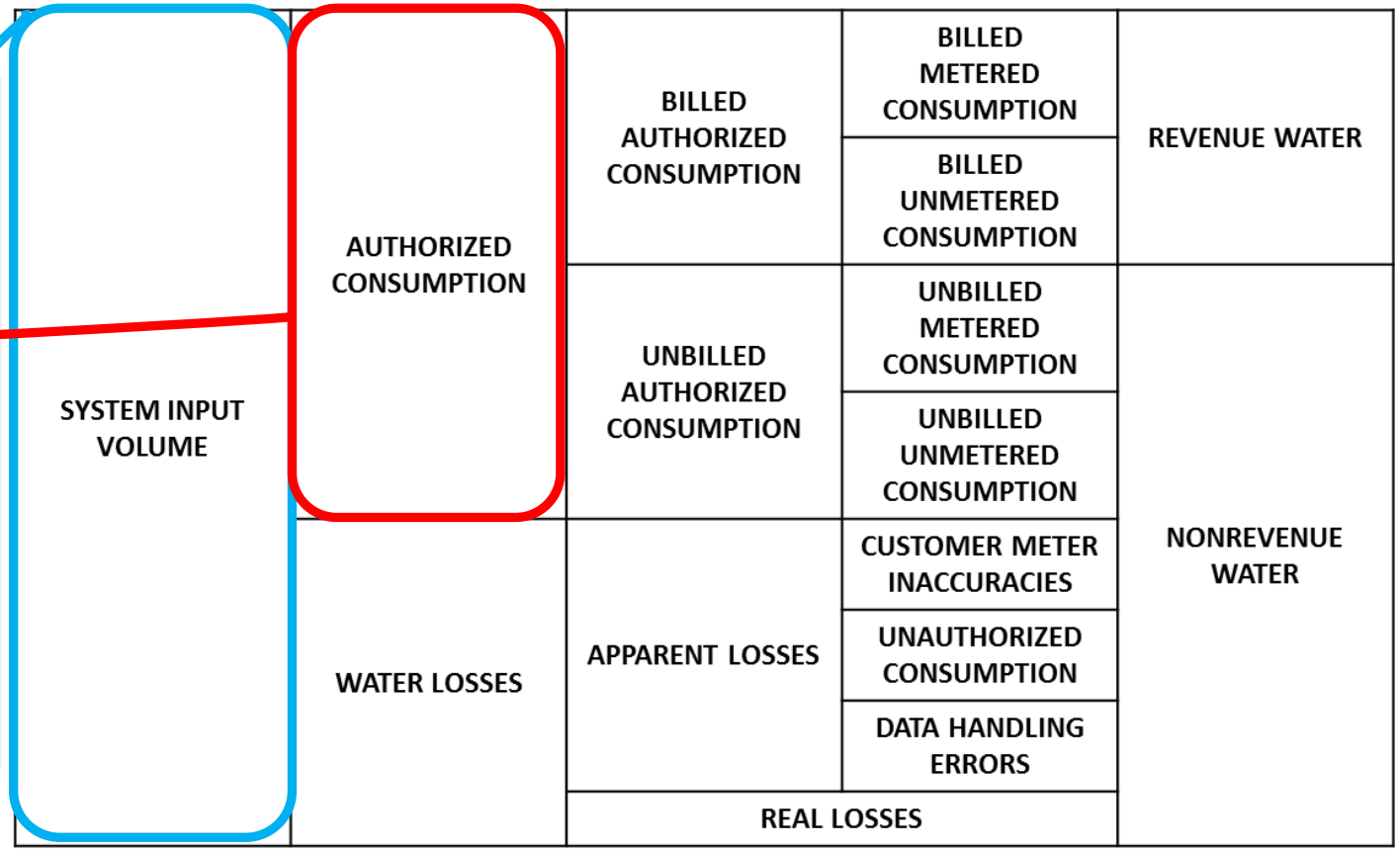
For questions during panel

AWWA M36 Water Balance

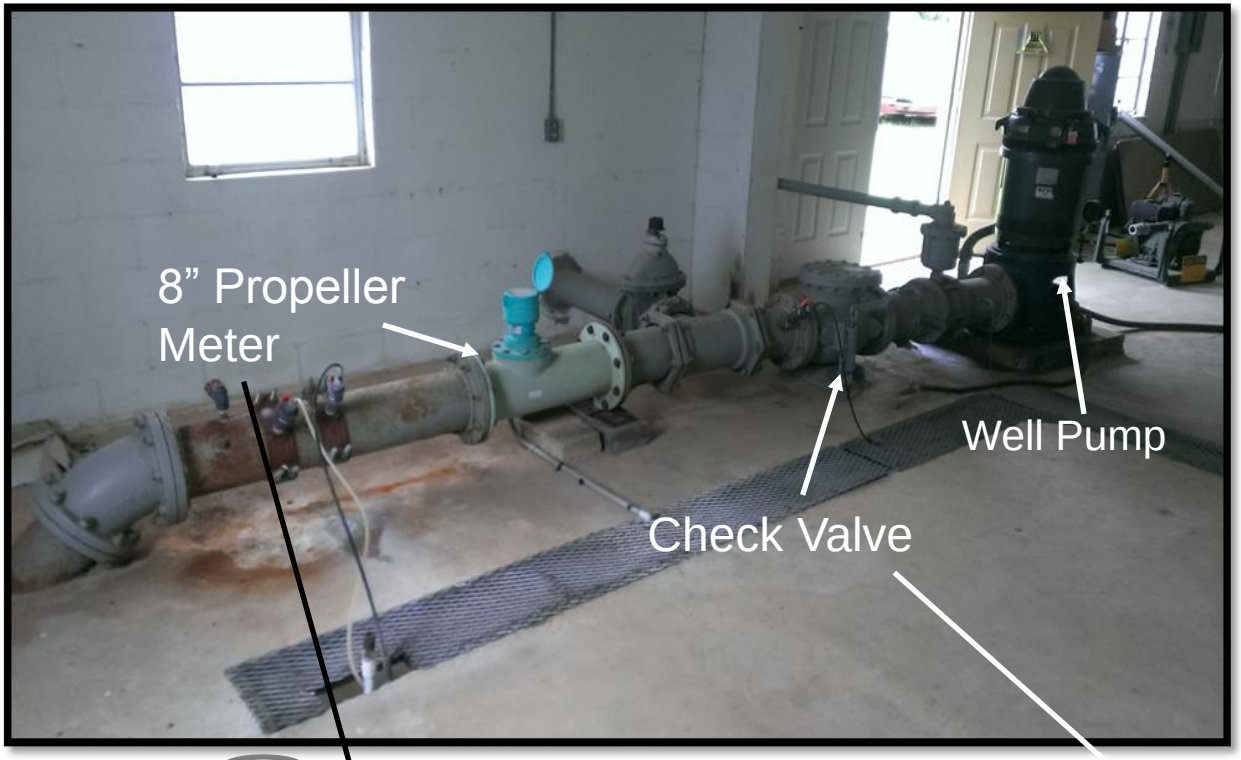
<table>
<tr><td rowspan="8">SYSTEM INPUT VOLUME</td><td rowspan="5">AUTHORIZED CONSUMPTION</td><td rowspan="2">BILLED AUTHORIZED CONSUMPTION</td><td>BILLED METERED CONSUMPTION</td><td rowspan="2">REVENUE WATER</td></tr>
<tr><td>BILLED UNMETERED CONSUMPTION</td></tr>
<tr><td rowspan="3">UNBILLED AUTHORIZED CONSUMPTION</td><td>UNBILLED METERED CONSUMPTION</td><td rowspan="6">$ $ $
NONREVENUE WATER
💧</td></tr>
<tr><td>UNBILLED UNMETERED CONSUMPTION</td></tr>
<tr><td rowspan="3">WATER LOSSES</td><td rowspan="3">$ $ $
APPARENT LOSSES</td><td>CUSTOMER METER INACCURACIES</td></tr>
<tr><td>UNAUTHORIZED CONSUMPTION</td></tr>
<tr><td>DATA HANDLING ERRORS</td></tr>
<tr><td colspan="2">💧 REAL LOSSES 💧</td></tr>
</table>

Accuracy in the Water Balance



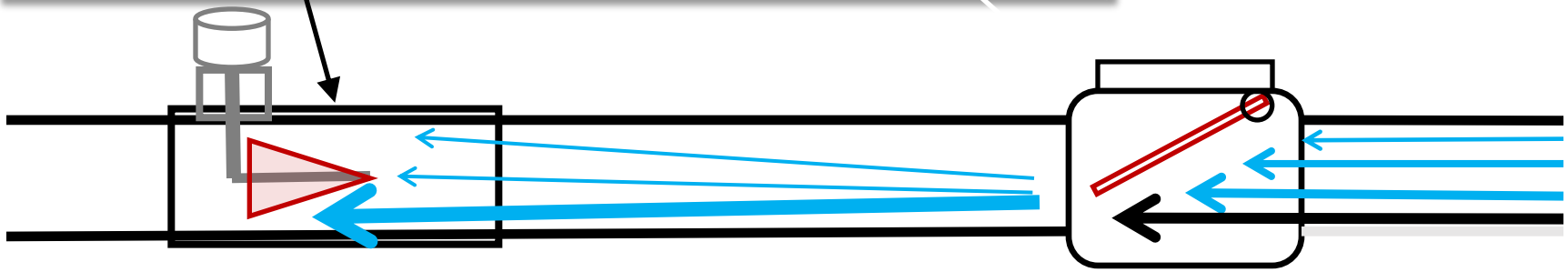


Accuracy in the Water Balance



Accuracy results from MFR test bench: 99.5%

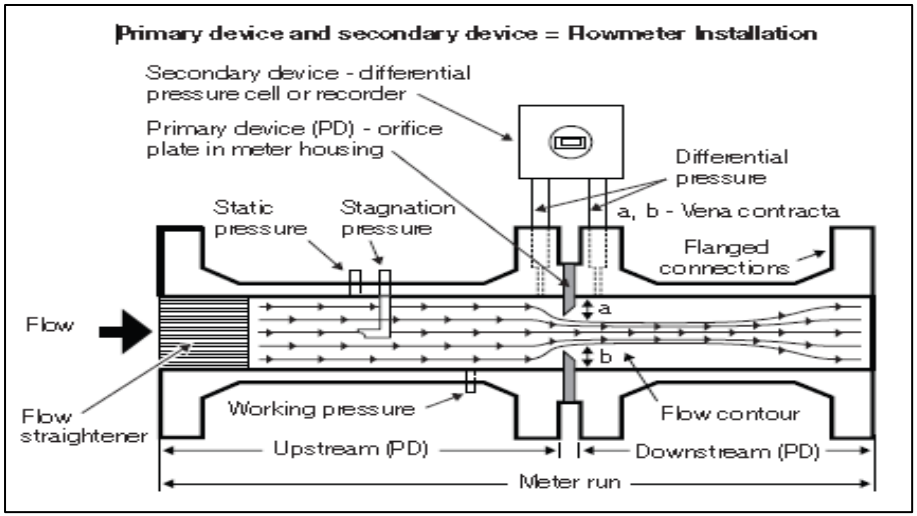
Accuracy results from in-situ test: 142.2%

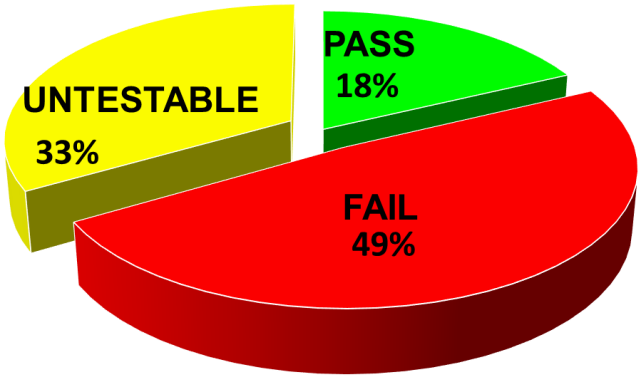


Courtesy MESCO

Accuracy in the Water Balance

Example of Water Pumping Data Gaps an		
8/15/2012, hrs	High Service Pumping Rate, mgd actual flow	High Service Pumping Rate, mgd raw recorded data
0:00	8.69	8.69
1:00	8.65	8.65
2:00	8.32	8.32
3:00	8.11	8.11
4:00	7.94	0
5:00	8.02	0
6:00	8.44	0
7:00	8.98	0
8:00	9.34	0
9:00	9.25	0
10:00	9.17	0
11:00	9.12	9.12
12:00	9.27	9.27
13:00	9.22	9.22
14:00	9.08	9.08
15:00	8.99	8.99
16:00	9.14	9.14
17:00	9.18	9.18
18:00	9.25	9.25
19:00	9.22	9.22
20:00	8.82	8.82
21:00	8.78	8.78
22:00	8.75	8.75
23:00	8.71	8.71
0:00	8.68	8.68
Total	**212.43**	**151.29**
Average	**8.85**	**6.30**
Difference		**2.55**





Accuracy in the Water Balance

Locatio	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
26478	413	369	430	387	27437		1375	536	513	441	381	455

3” meter

Locatio	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
130558	4	5	4	10	419	13	31	34	25	5	14	7

1” meter

Location	1	2	3	4	5	6	7	8	9	10	11	12	Grand Total
36534	1	44	309										354
110936	430	17			0	0	0	0	0	1	1	1	450
31014	4	4	3	6	1	0	9	7	7	8	2	409	460
139728	345	0	0	0	0	1	6	22	12	0	0		386
43636	0	0	1	0	1	1	0	0	0	0	0	282	285
1464	7	244	3			0	2	5	3	4	4	5	277
124422	2	262	2	1	2	17	22	16	10	11	2	3	350
43992	6	7	3	5	0	2	0	0	0	0	0	255	278
16600	0	149	15	0									164
115394	11	0	5	3	6	10	58	100	183	120	52		548
130224	7	4	1	0	0	28	1	0	42	211	0	3	297
2906	19	25	12	7	6	8	6	13	10	8	8	214	336

5/8” meters

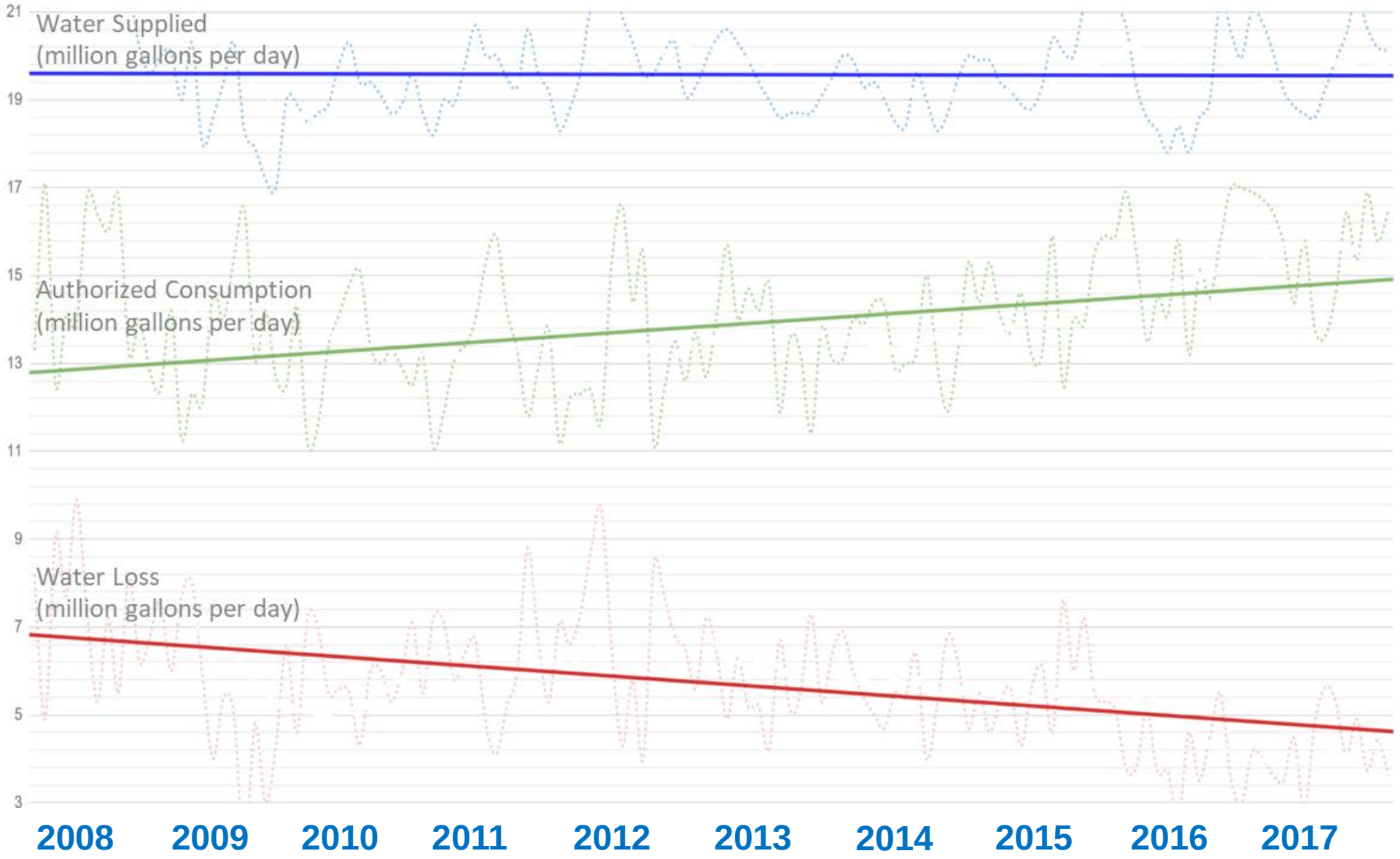
Location II	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
88964	2	3	2	3	169	915	939	657		700	7	2
93972	574	438	512	513	439		1374	1048	1092	1245	842	1217
88954	75	80	59	65	267	877	924	630		826	66	56

2” meter

2” meter

3” meter

The Big Picture: Sustainability



Relevance: Impact on Bond Ratings

STANDARD & POOR'S RATINGS SERVICES
McGRAW HILL FINANCIAL

MOODY'S

Strong – Utility has performed a water audit consistent with the AWWA M-36 methodology on an annual basis for the prior five years. The utility has a well-structured and documented Non-Revenue Water Management Program that includes ongoing leak detection work and annual accuracy testing of finished water meters and a representative sample of customer meters.

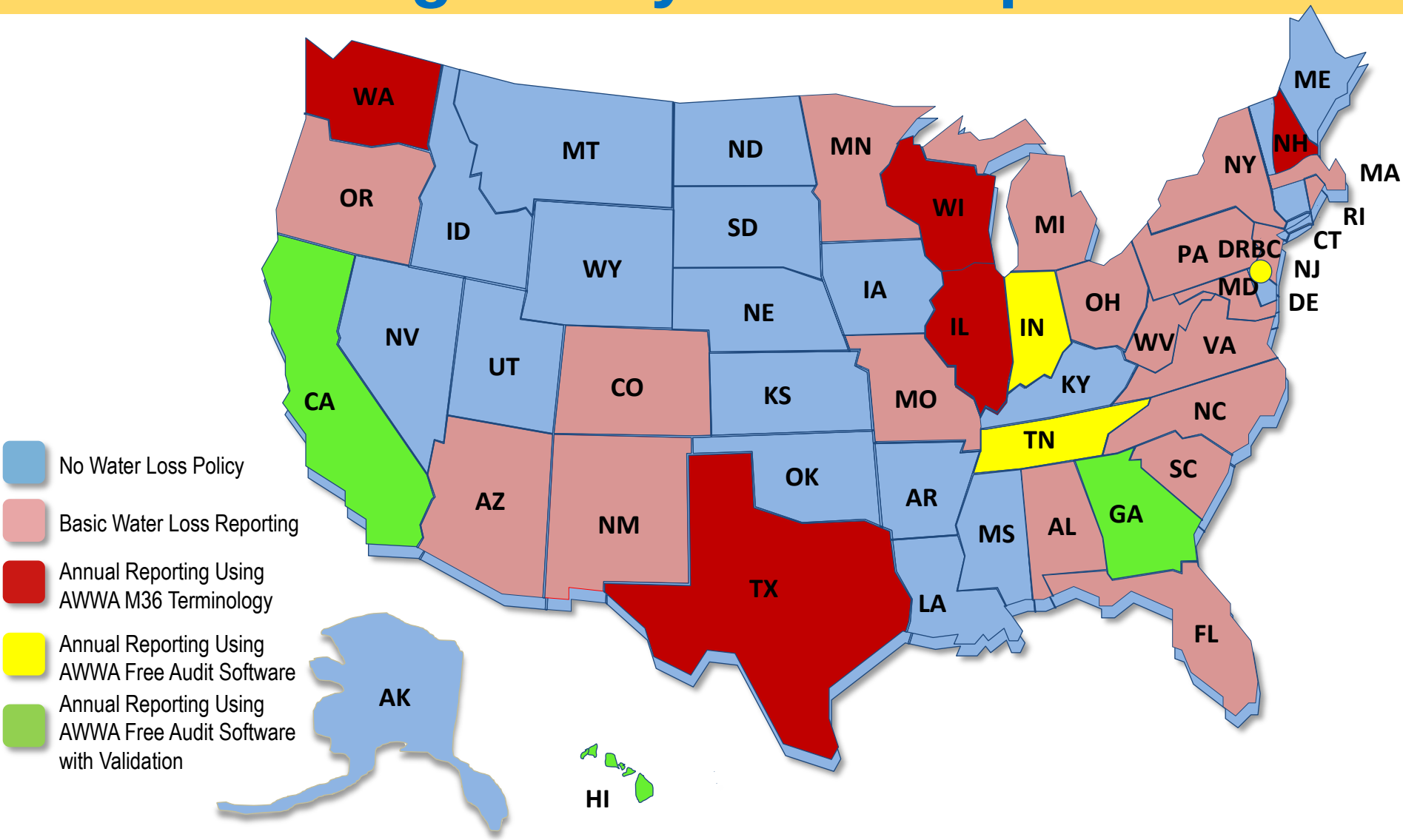
Good – Utility has performed a water audit consistent with the AWWA M-36 methodology on an annual basis for the prior three years. The utility has engaged in specific components of a Non-Revenue Water Management Program such as periodic finished water meter testing, accuracy testing of samples of customer meters and active leak detection.

Standard – Utility has performed a water audit consistent with the AWWA M-36 methodology but does not do so on an annual basis. The utility tracks some basic water loss information on a monthly basis but does not have an active Non-Revenue Water Management Program.

Vulnerable – Utility has not performed a water audit consistent with the AWWA M-36 methodology and does limited tracking of some basic water loss information on a monthly basis. This information is generally reported on a percentage of volume-supplied basis.

#48 Enterprise Risk Profile Assessment Factors (Table 10)

AWWA M36
Regulatory Landscape



AWWA M36 Methodology

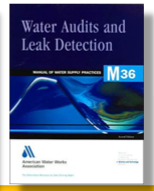
AWWA adopts IWA standard, abandons Unaccounted For Water

WRF study shows audit validity is a widespread challenge

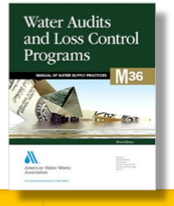
Validation method developed

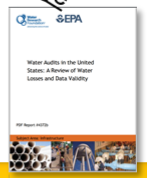
M36 1st Ed.

M36 2nd Ed.

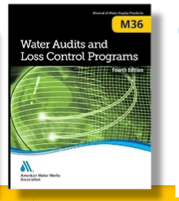


M36 3rd Ed.





M36 4th Ed.



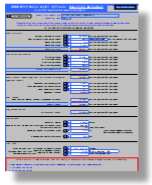
American Water Works Association

Water Research Foundation

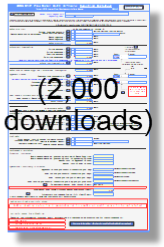
Ongoing Research & Development:
Performance Indicator Task Force
WRF 4695-Effective WLC Planning

1991 | 1999 | 2003 | 2006 | 2009 | 2010 | 2014 | 2015 | 2017 | 2019 | 2020

AWWA Audit Software v1



AWWA Audit Software v4



(2,000 downloads)

AWWA Audit Software v5

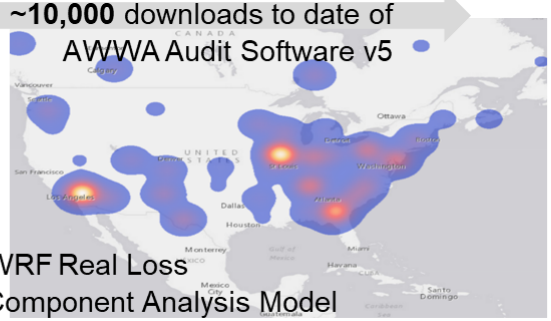
NORTH AMERICAN WATER LOSS 2015
Georgia

NORTH AMERICAN WATER LOSS 2017
California

NORTH AMERICAN WATER LOSS 2019
Tennessee

AWWA Audit Software v6

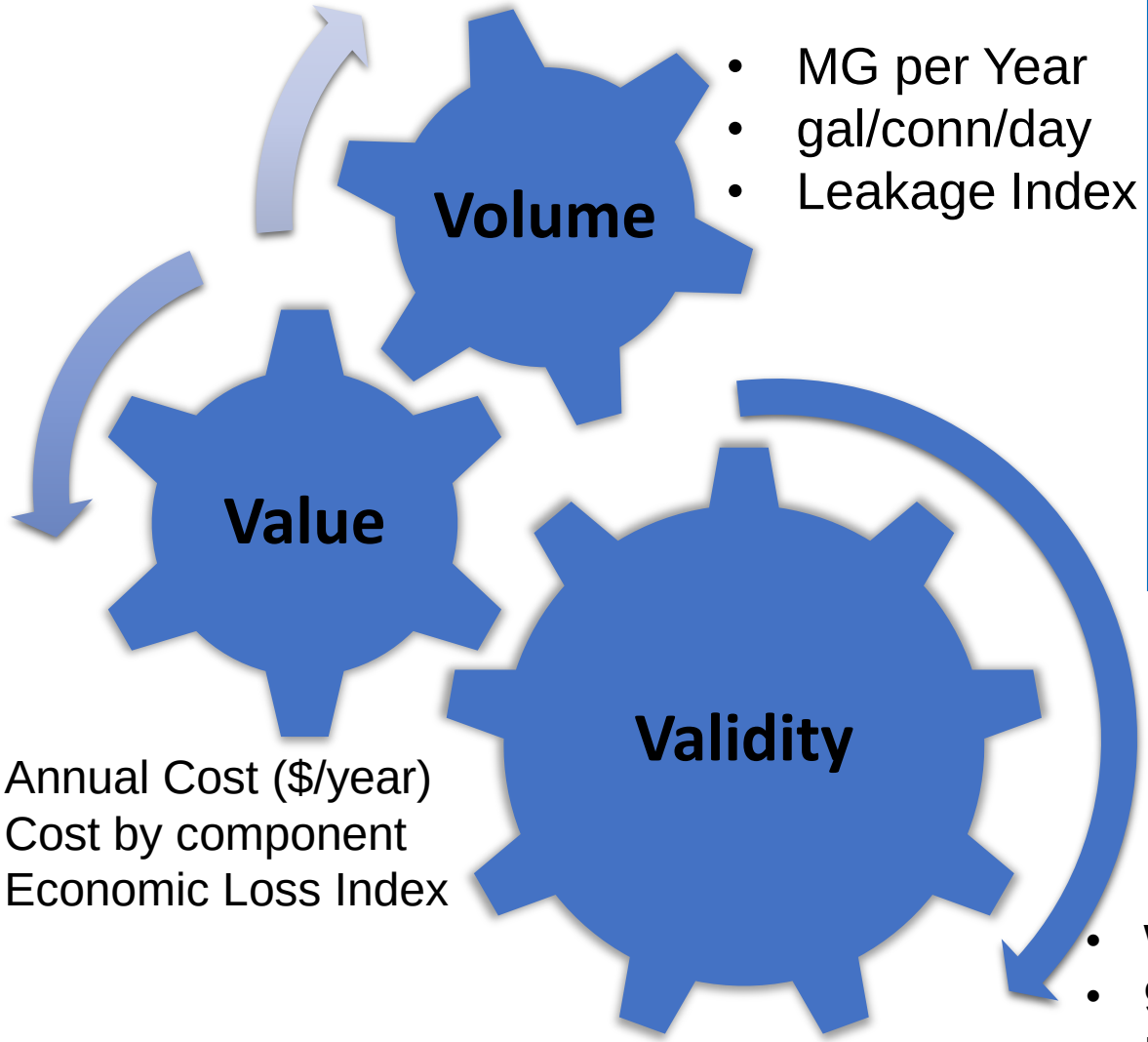
~10,000 downloads to date of AWWA Audit Software v5



AWWA Compiler developed for large audit sets

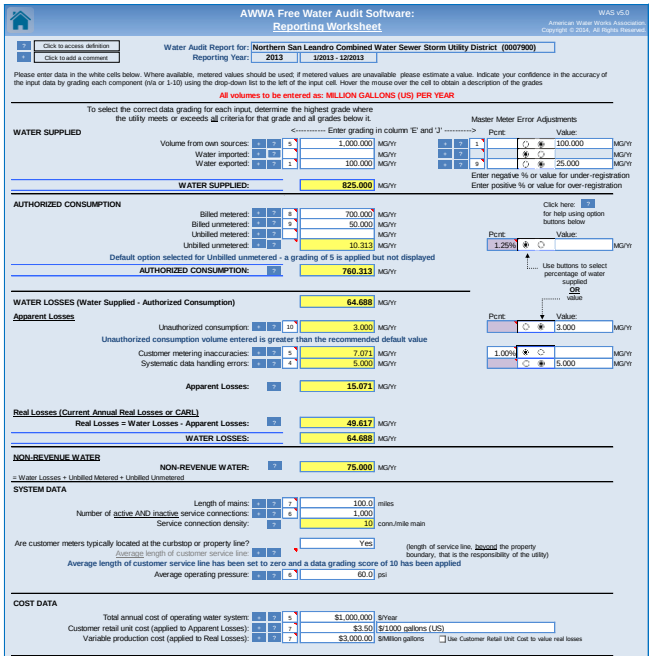
WRF Real Loss Component Analysis Model

Measuring Performance: The Three Vs



- MG per Year
- gal/conn/day
- Leakage Index

- Annual Cost ($/year)
- Cost by component
- Economic Loss Index



- Water Audit Data Validity Score
- 95% Confidence Limits
- Key Data Input Grades

Team Engagement

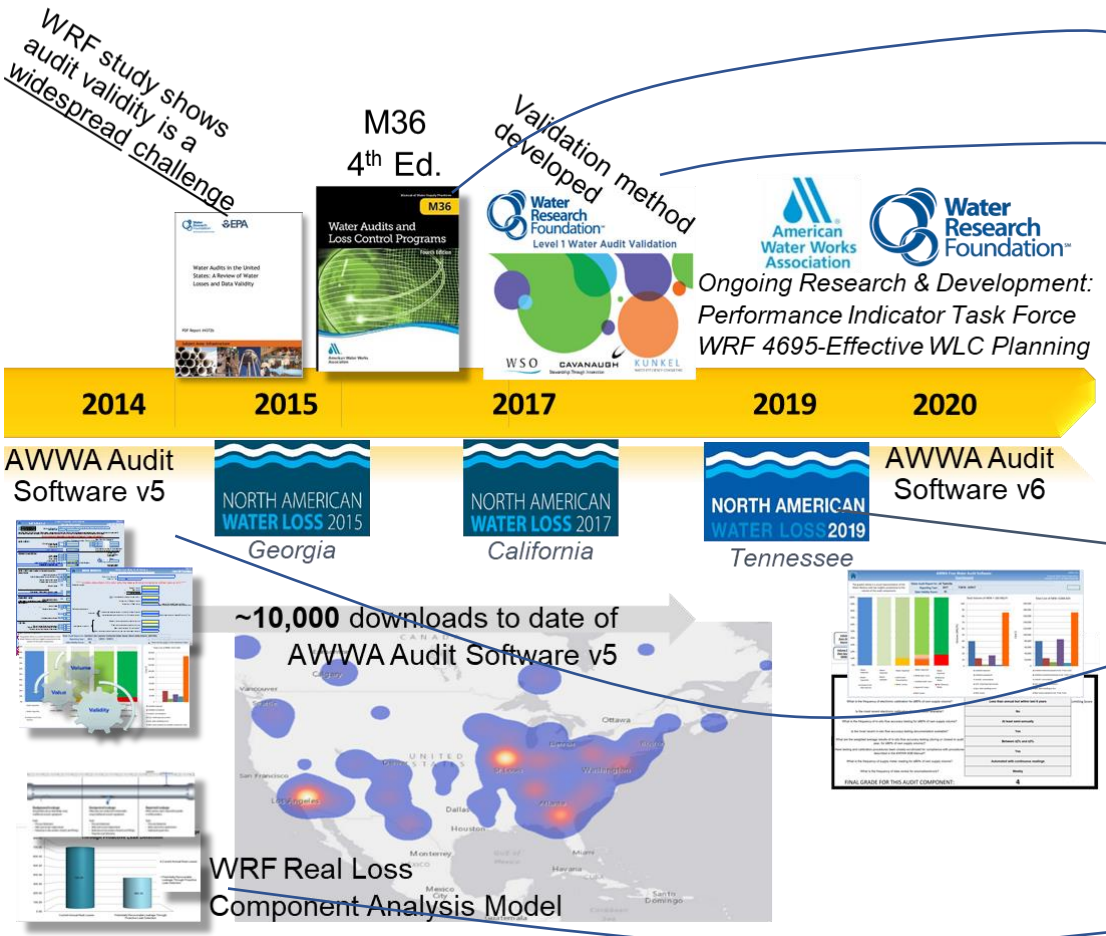
American Water Works Association

NORTH AMERICAN WATER LOSS 2019

NASHVILLE, TENNESSEE
DECEMBER 3 – 5

Save The Date

Resources



www.awwa.org
M36 Manual 4th Edition

www.waterrf.org
Level 1 Water Audit Validation Manual

www.awwa.org/waterloss
NAWL 2019

www.awwa.org/waterlosscontrol
Free Water Audit Software v5.0

www.waterrf.org
Real Loss Component Analysis Model