



CAVANAUGH

Stewardship Through Innovation

Sustainable Practices for Water Users – Municipal Perspective

South Carolina Water Plan Symposium

May 31, 2018

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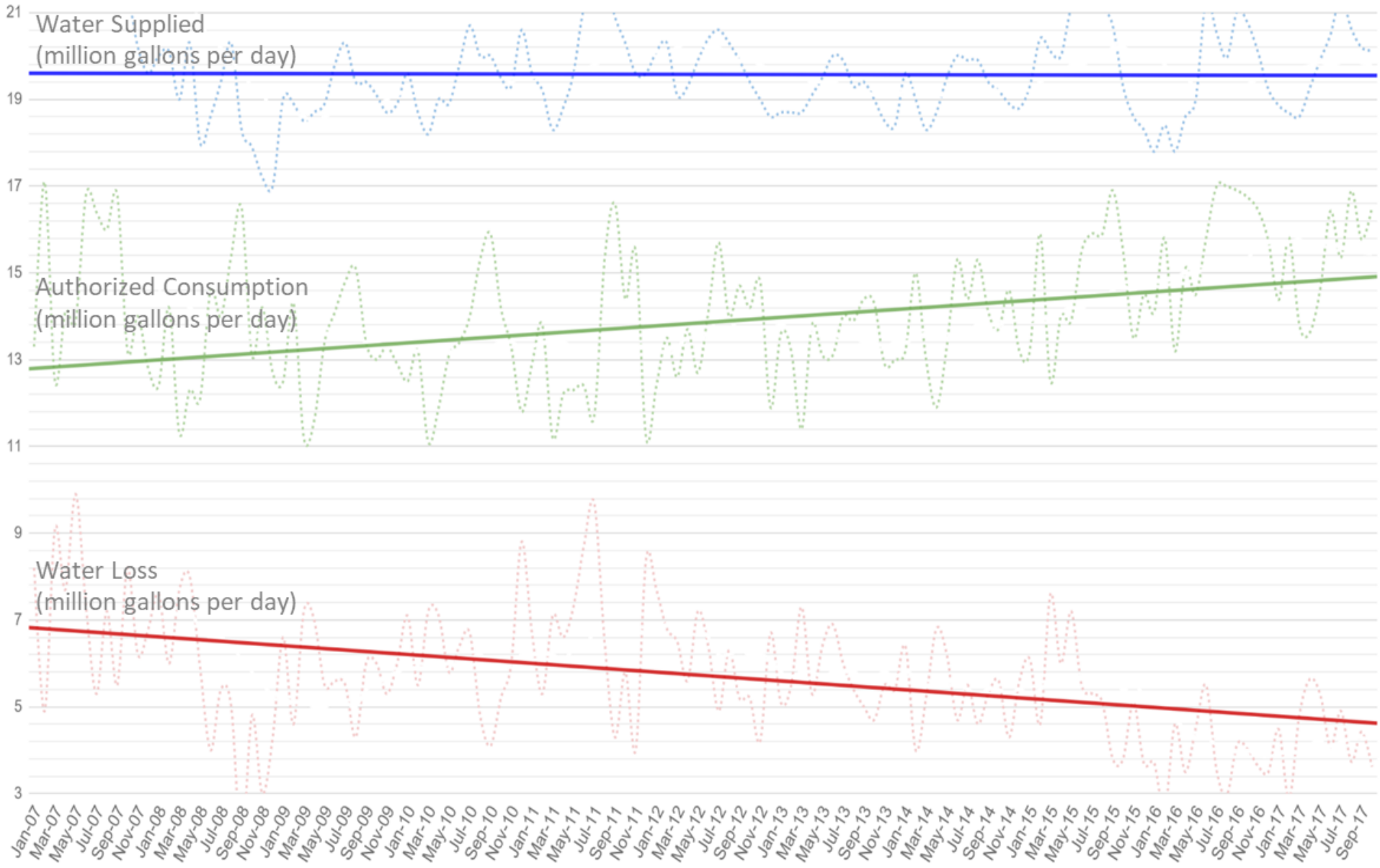
SC RIVERS FOREVER
HEALTHY RIVERS = HEALTHY COMMUNITIES



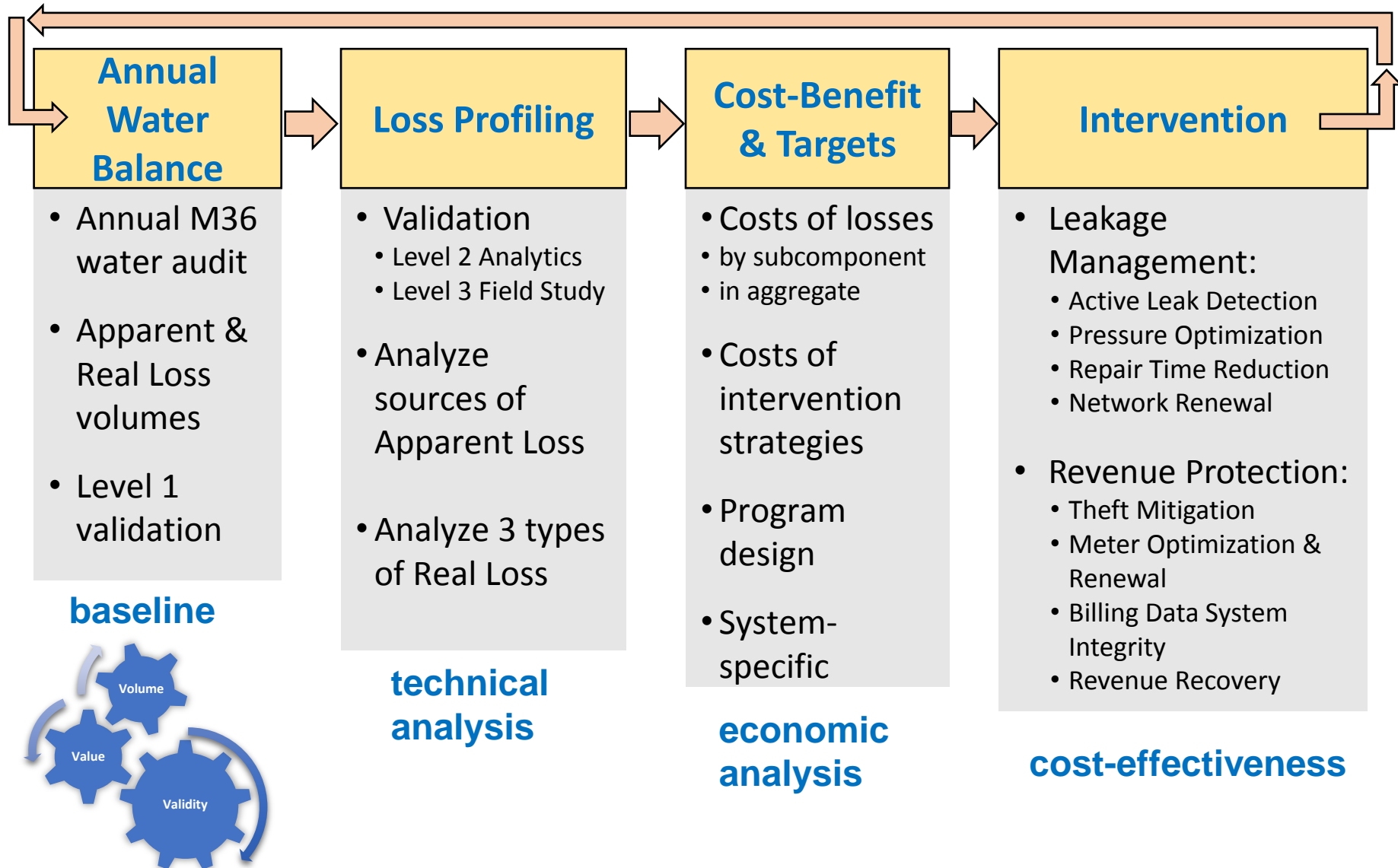
American Rivers
Rivers Connect Us



The Big Picture: Sustainability



The Big Picture: Economic Intervention

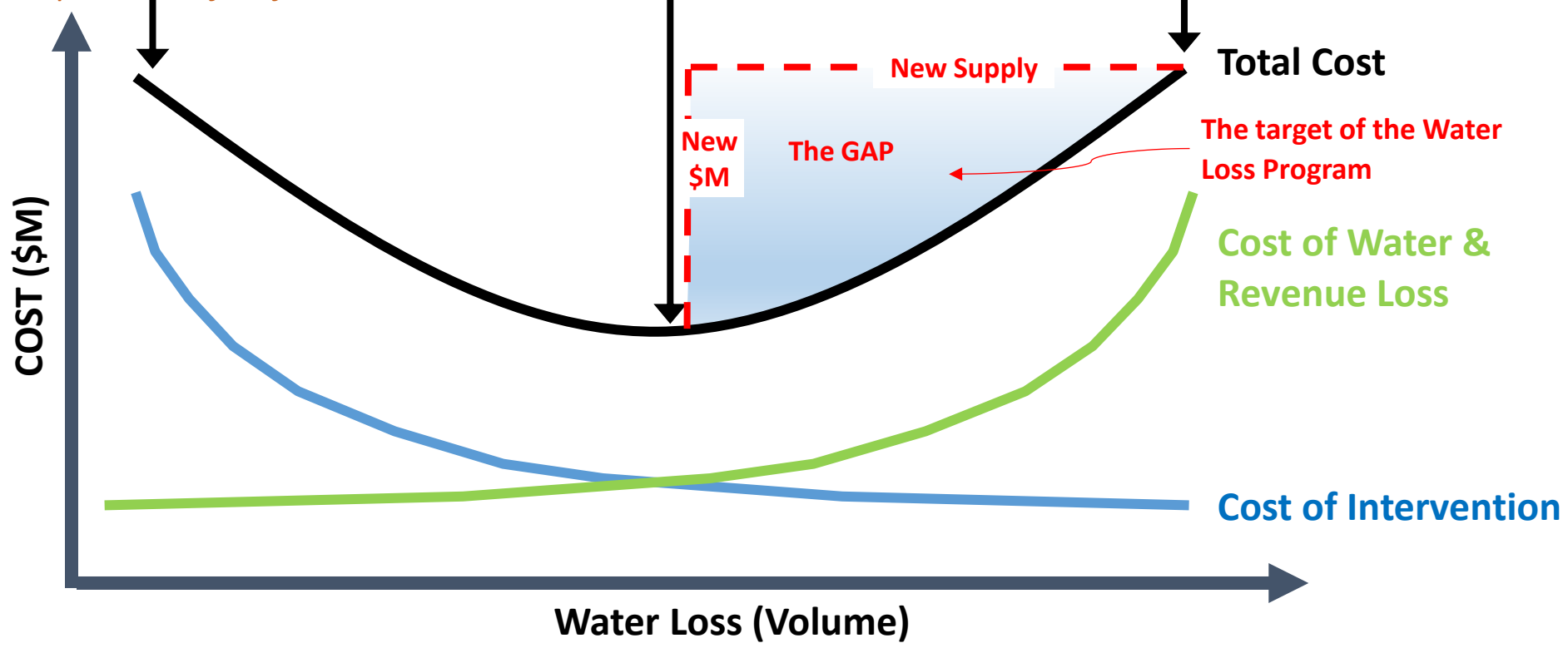


AWWA M36 Economic Optimum

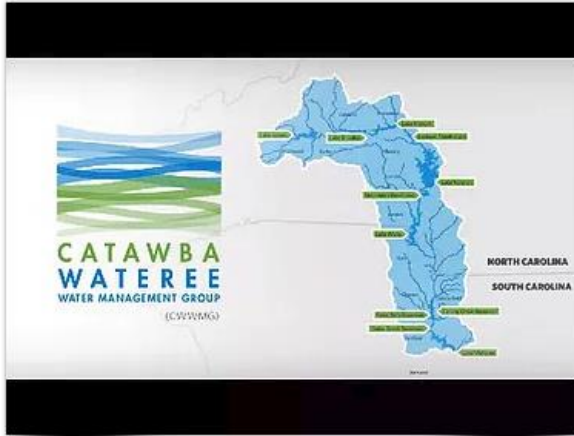
Aggressive Intervention is **Over-Spending**
Example: replacement of pipes and meters before their optimal useful life

Economic Optimum Loss & Intervention
Economic target from benefit-cost design (M36)

Reactive Intervention is **Over-Spending**
Example: fixing only leaks that surface, replacing meters only when they stop



Catawba-Wataree Water Management Group (CWWMG)



In November 2014, the Catawba-Wataree Water Management Group (CWWMG) conducted a training workshop for its members to introduce the basic concepts of the AWWA M36 Methodology of Water Loss Control Management. This workshop introduced the backbone of the methodology, the Water Balance and provided guidance for moving away from the outdated terminology of Unaccounted For Water and outdated practice of using water loss as a percentage of total water supplied as a performance indicator.



Incorporated in late 2007, this 501(c)(3) non-profit group came out of the three and one-half year stakeholder process associated with Duke Energy's re-licensing of the Catawba-Wataree Hydro Project, part of a Comprehensive Re-licensing Agreement (CRA) that defines how the basin will be managed for the next 40 to 50 years.

The CWWMG has 19 members; one member representing each of the 18 public water utilities in North and South Carolina which operate water intakes on either a reservoir in the Catawba-Wataree Hydroelectric Project or on the main stem of the river, and one member representing Duke Energy Carolinas, LLC (Duke Energy).

For more information, visit the [CWWMG Website](#)



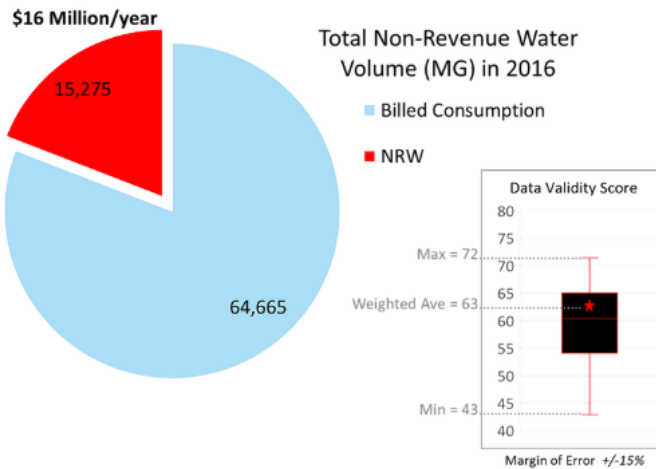
Subsequently, CWWMG desired to develop a Basin-wide Water Loss Program (BWL) that would provide the members with a multi-phase water loss training & technical assistance program. This program would be accommodating for the members at varied levels of water loss management knowledge and experience with the overall goal of the program to result in long-term reductions in water loss for the basin.

1. Belmont
2. Camden
3. Chester MD
4. Charlotte
5. Gastonia
6. Granite Falls
7. Hickory
8. Lancaster CWSD
9. Lenoir
10. Lincoln County
11. Long View
12. Lugoff-Eglin WA
13. Mooresville
14. Morganton
15. Mount Holly
16. Rock Hill
17. Statesville
18. Union County
19. Valdese

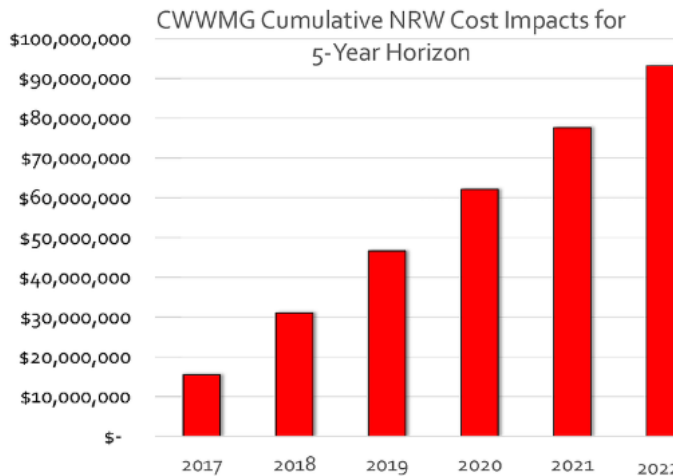
Basin-Wide Data

Individual Utility Data

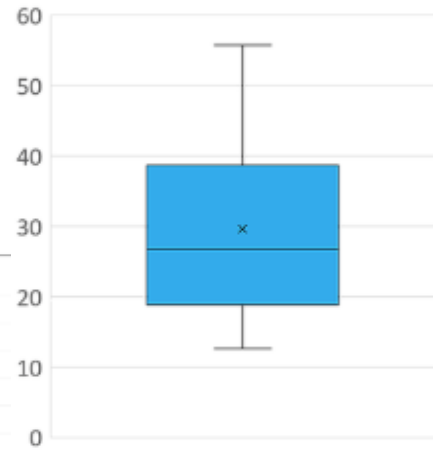
Statistics for Basinwide Aggregate



Statistics for CWWMG Aggregate



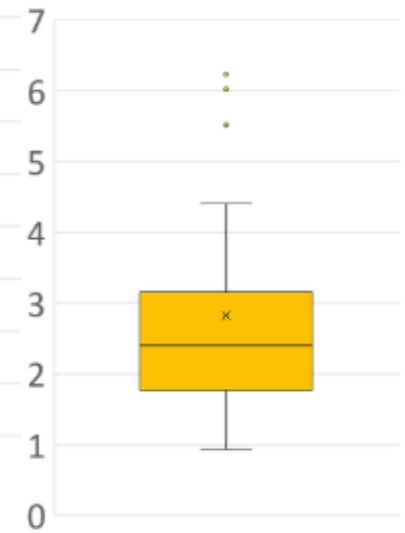
NRW Volume (kgal/conn/year)



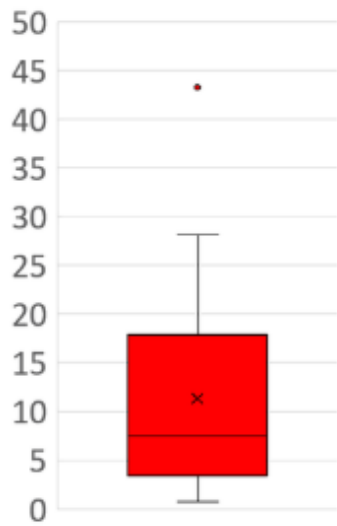
NRW Value \$/conn/year



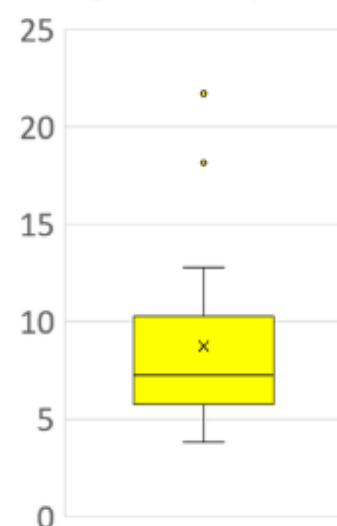
Infrastructure Leakage Index



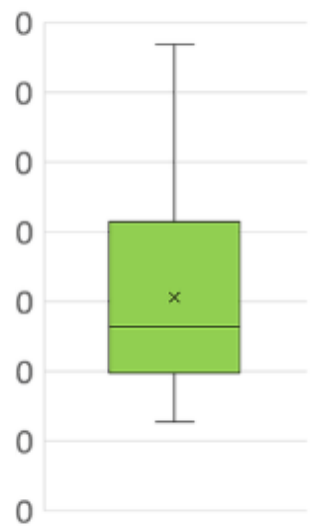
Unbilled Consumption (gal/conn/day)



Apparent Loss (gal/conn/day)



Real Loss (gal/conn/day)



Statewide Water Loss Management Program – Model Implementation

Phase 1

Establish Annual M36 Water Auditing

Phase 2

Achieve Minimum Standard of Audit Reliability

Phase 3

Manage Water Loss Performance for Long-Term Reduction

Auditing
Establish annual M36 Water Auditing for all utilities

Outreach
Educate Regulatory Community on M36 Method and appropriate use of performance indicators
Establish Statewide Water Loss Control Committee

Training & Tech Asst
Develop State Manual and Training Framework
Provide extended, progressive training to utilities (funded)

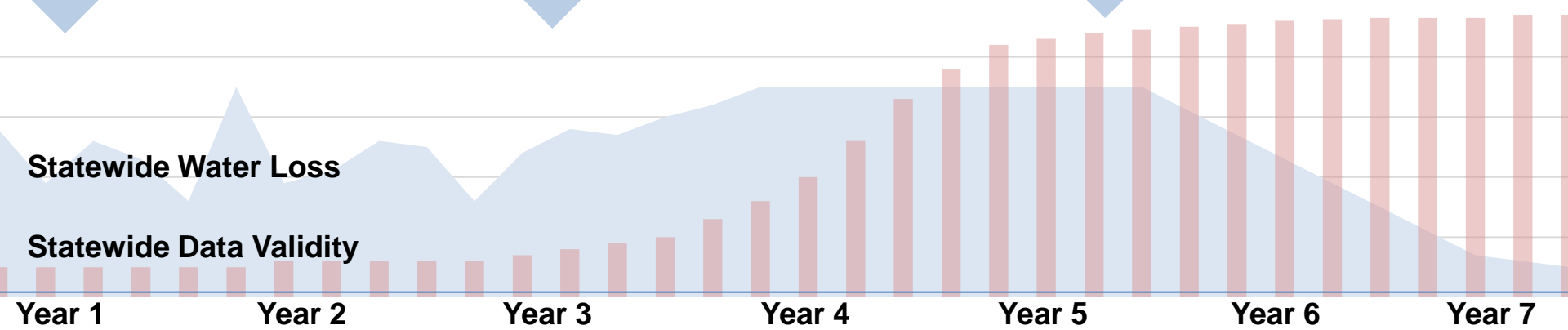
Data Management
Develop and implement data management system
Establish posting system and communication protocols

Validation
Establish minimum standards of validation for quality assurance
Determine by Agency or 3rd Party

Certification
Establish validation program until certification program is in place
Design and implement a Certified Water Audit program for sustained quality control
Statewide Water Loss Control Committee provides support

Benchmarking
Suite of Performance and Process Measures
System specific improvement over time in a cost-effective manner
No universal targets
Excessive thresholds established

Improvement
Annual audit submission threshold exceedances
System specific progress review at designated regulatory touchpoints



Model Legislation

Model State Water Loss Reporting Legislation Version “A” – Comprehensive Annual Water Loss Reporting

SUMMARY

The model legislation draws from existing laws in several states, including Georgia, Texas, and California. NRDC’s website, “Cutting our Losses,” provides for state-by-state summaries and links to existing state legislation and regulations on water loss audits: <http://www.nrdc.org/water/water-loss-reduction.asp>.

The core elements of the model bill are:

- Section 1: Provides a short title of the bill.
- Section 2: A statement of findings, which provides the rationale for requiring annual water loss audits and audit reporting.
- Section 3:
 - Establishes a size threshold for the public water supply systems that will be subject to water loss reporting requirements. This definition excludes all systems that are considered “small” systems under the federal Safe Drinking Water Act.⁴
 - Identifies the state agency that will implement the law.
 - Explains the meaning of “water loss,” based on the AWWA standard terminology.⁵
 - Explains the concepts of “validating” a water loss audit and “data validity scores”.⁶ Validation is a key step in the AWWA water loss audit methodology to ensure that the level of accuracy of data used in the audit is appropriately characterized.

- Section 4:
 - Requires public water suppliers to perform a water loss audit each year, using the AWWA standard methodology.

- The first annual audit report would be due in two years after enactment of the bill.
- State regulations would be issued to specify the audit process, including validation and reporting requirements.
- The state would be required to make audit reports readily available to the public online.
- Following the initial 2 to 3 years of receipt and review of validated water audits, and taking into account the compiled audit results, the state would then (i) set criteria for ensuring adequate data validity in future audit reports and (ii) establish performance standards for water suppliers to reduce water loss.
- Section 5: Provides for technical assistance to utilities, using available state funds, to support performance and validation of audits. Technical assistance would also be available to help utilities improve water loss detection programs, which can improve the accuracy of audits and help identify specific cost-effective steps to reduce water loss.
 - *Note: New funding authorization is not necessary if state agencies fund these technical assistance activities through the “state set-aside” portions of the Drinking Water State Revolving Fund (DWSRF), which exist in all states. Georgia’s water loss audit program presents a good example of how DWSRF set-aside funds can be used in this way.*⁷



NRDC
NATURAL RESOURCES
DEFENSE COUNCIL

Reference Slides for Q&A
(Not delivered during prepared remarks)

Changing “Hysterical” 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).




Where Does South Carolina Stand?

South Carolina

Water loss is an important issue in South Carolina, where approximately 75 percent of South Carolinians are served by public water supplies. The USGS estimates that 114 million gallons/day of the water used by public water supplies comes from groundwater and 504 million gallons/day from surface water. Those public water supplies face enormous challenges when it comes to replacing and repairing their systems. The U.S. Environmental Protection Agency (EPA) found a 20-year capital improvement need of more than \$1.8 billion for South Carolina's water systems to continue to provide safe drinking water (please note that EPA only completed a partial survey of South Carolina's drinking water infrastructure needs).

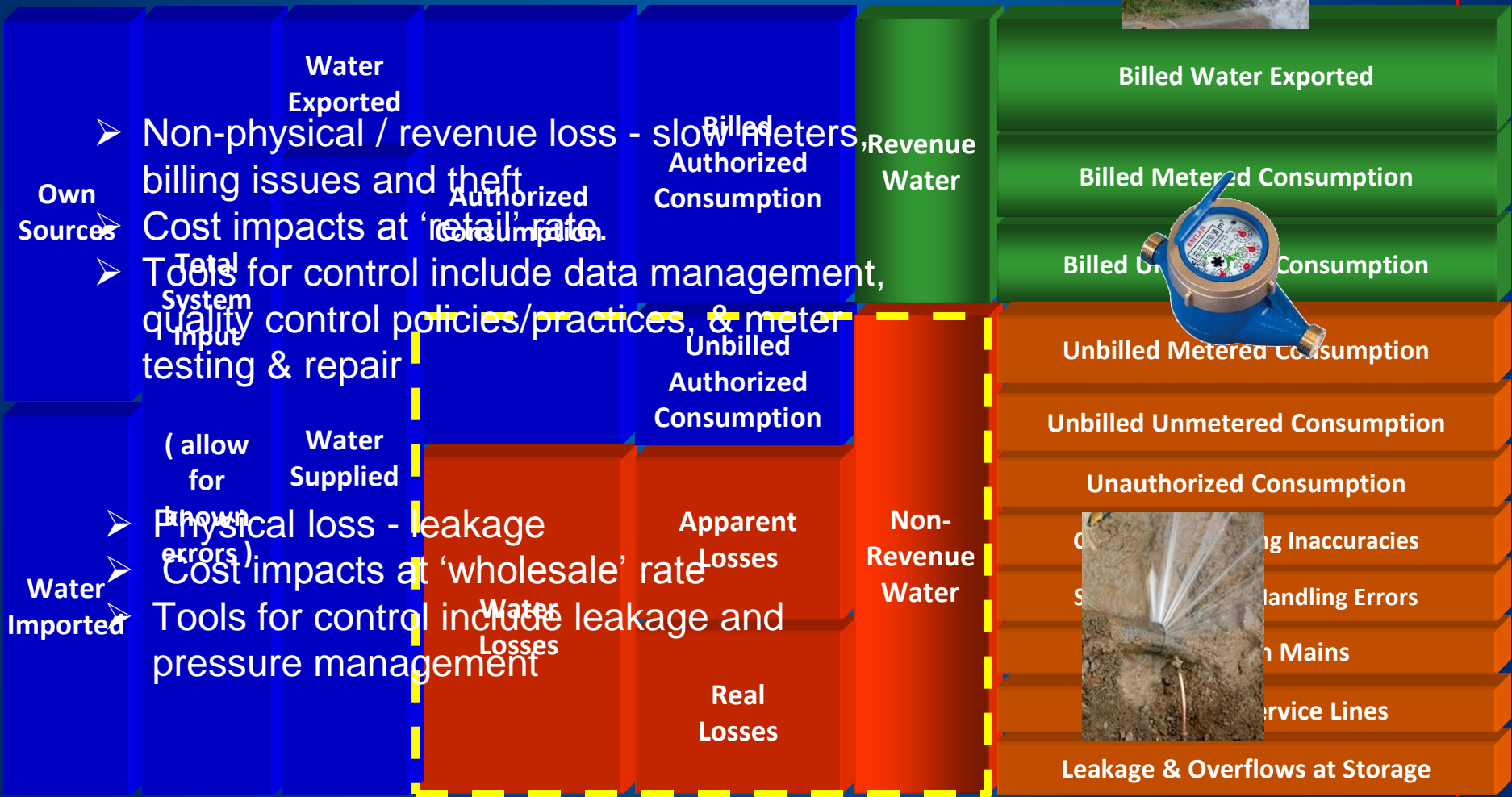
The agency with jurisdiction over water loss reporting is the South Carolina Department of Health and Environmental Control (DHEC). All community water systems must carry out a leak detection and repair program, which includes a water audit and records of all leaks and repairs. These records are reviewed during an annual sanitary survey inspection of the water system. The state recommends that drinking water systems use all AWWA guidelines.

AWWA M36 Water Balance

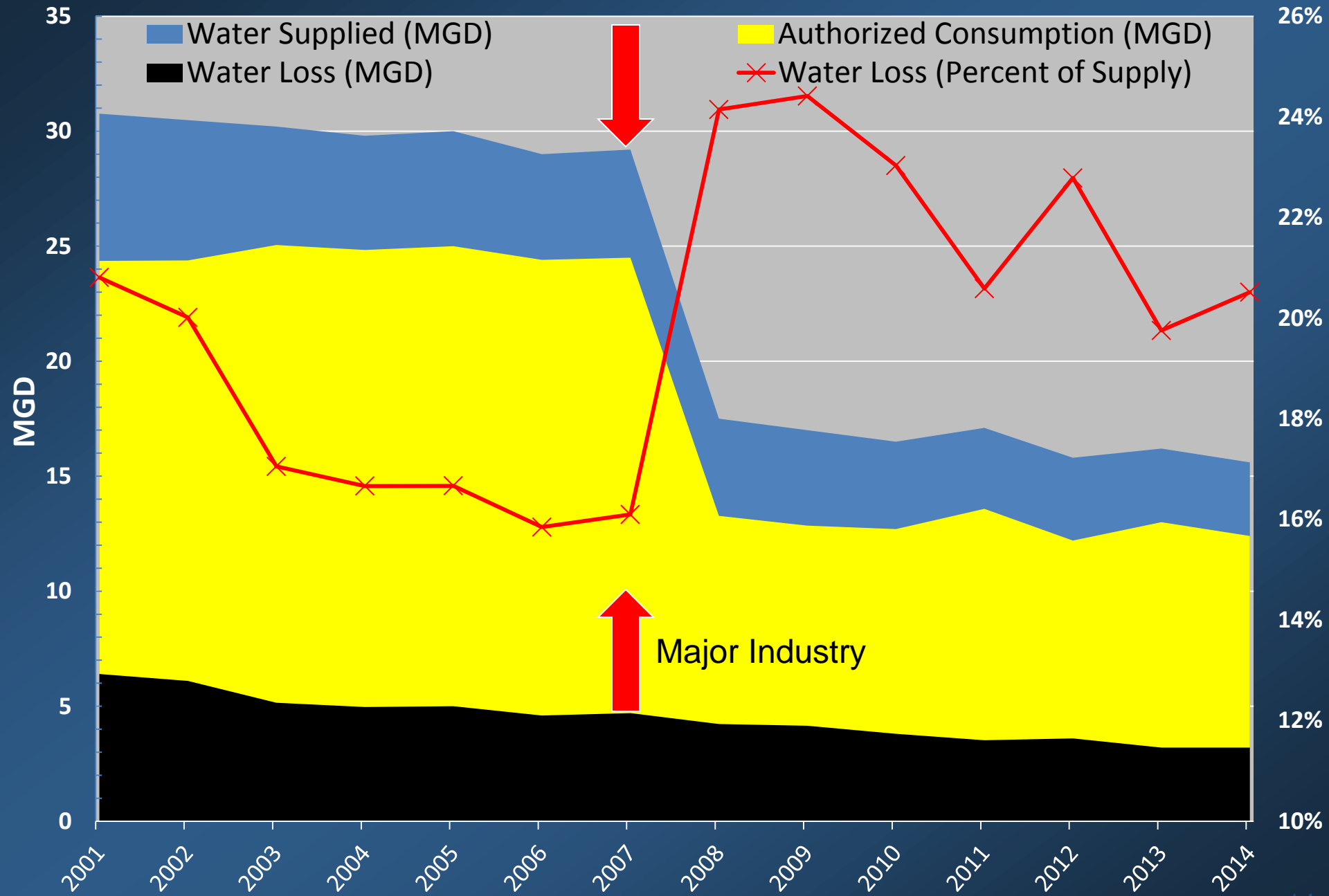
SYSTEM INPUT VOLUME	AUTHORIZED CONSUMPTION	BILLED AUTHORIZED CONSUMPTION	BILLED METERED CONSUMPTION	REVENUE WATER	
			BILLED UNMETERED CONSUMPTION		
		UNBILLED AUTHORIZED CONSUMPTION	UNBILLED METERED CONSUMPTION	NONREVENUE WATER	
			UNBILLED UNMETERED CONSUMPTION		
	WATER LOSSES	\$\$\$ APPARENT LOSSES	CUSTOMER METER INACCURACIES		\$\$\$ NONREVENUE WATER 
			UNAUTHORIZED CONSUMPTION		
			DATA HANDLING ERRORS		
			 REAL LOSSES 		

Management of NRW

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



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

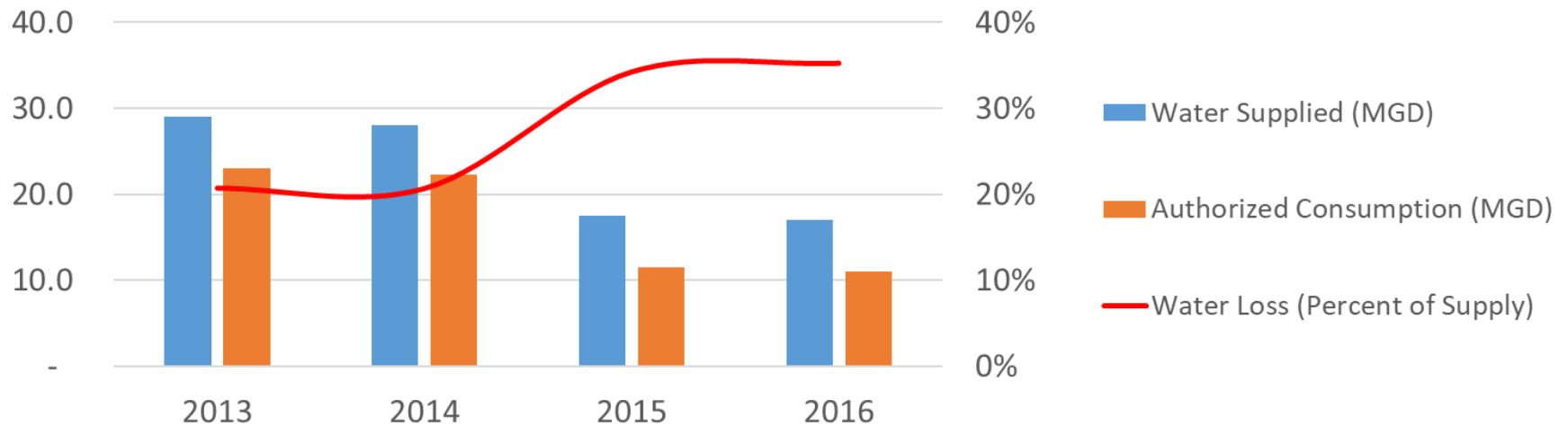


Real World Example

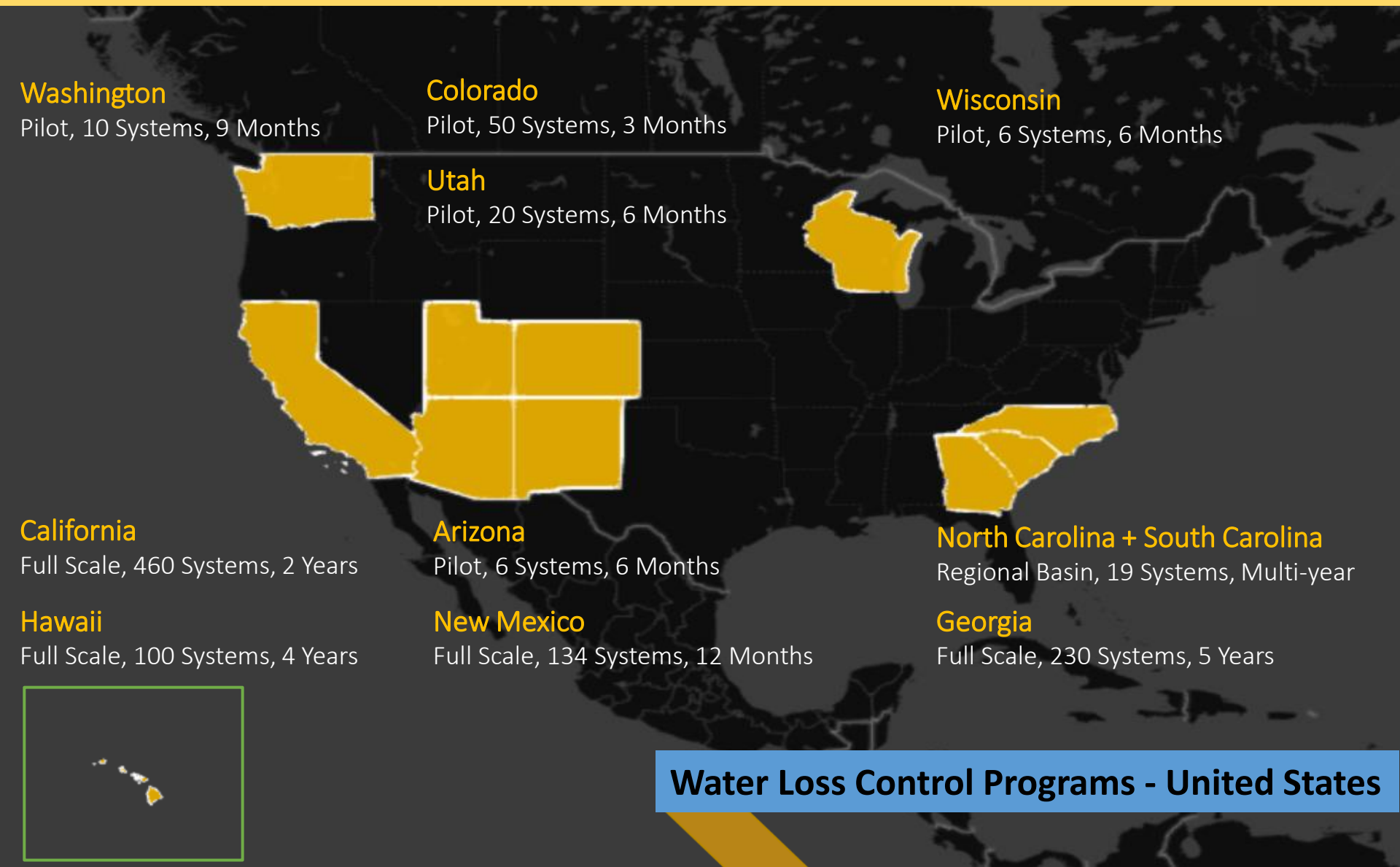
% Based Performance Indicator

Large Industry left → % ↑ →

“Water Loss Problem”



AWWA M36 State Programs



Washington

Pilot, 10 Systems, 9 Months

Colorado

Pilot, 50 Systems, 3 Months

Wisconsin

Pilot, 6 Systems, 6 Months

Utah

Pilot, 20 Systems, 6 Months

California

Full Scale, 460 Systems, 2 Years

Arizona

Pilot, 6 Systems, 6 Months

North Carolina + South Carolina

Regional Basin, 19 Systems, Multi-year

Hawaii

Full Scale, 100 Systems, 4 Years

New Mexico

Full Scale, 134 Systems, 12 Months

Georgia

Full Scale, 230 Systems, 5 Years



AWWA Free Water Audit Software



AWWA Free Water Audit Software: Reporting Worksheet WAS v5.0
American Water Works Association, Copyright © 2014. All Rights Reserved.

Water Audit Report for: **Northern San Leandro Combined Water Sewer Storm Utility District (0007900)**
Reporting Year: **2013** / 1/2013 - 12/2013

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

WATER SUPPLIED

----- Enter grading in column 'E' and 'J' -----

Volume from own sources:	<input type="text" value="5"/>	<input type="text" value="1,000.000"/>	MG/Yr
Water imported:	<input type="text" value=""/>	<input type="text" value=""/>	MG/Yr
Water exported:	<input type="text" value="1"/>	<input type="text" value="100.000"/>	MG/Yr

WATER SUPPLIED: MG/Yr

Master Meter Error Adjustments

Pcnt:	<input type="text" value="1"/>	<input type="text" value="100.000"/>	MG/Yr
Pcnt:	<input type="text" value="9"/>	<input type="text" value="25.000"/>	MG/Yr

Enter negative % or value for under-registration
Enter positive % or value for over-registration

AUTHORIZED CONSUMPTION

Billed metered:	<input type="text" value="8"/>	<input type="text" value="700.000"/>	MG/Yr
Billed unmetered:	<input type="text" value="9"/>	<input type="text" value="50.000"/>	MG/Yr
Unbilled metered:	<input type="text" value=""/>	<input type="text" value=""/>	MG/Yr
Unbilled unmetered:	<input type="text" value=""/>	<input type="text" value="10.313"/>	MG/Yr

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

AUTHORIZED CONSUMPTION: MG/Yr

WATER LOSSES (Water Supplied - Authorized Consumption) MG/Yr

Apparent Losses

Unauthorized consumption: MG/Yr

Customer metering inaccuracies: MG/Yr

Systematic data handling errors: MG/Yr

Apparent Losses: MG/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: MG/Yr

WATER LOSSES: MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains: miles

Number of active AND inactive service connections:

Service connection density: conn./mile main

Are customer meters typically located at the curbstop or property line? (length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure: psi

COST DATA

Total annual cost of operating water system: \$/Year

Customer retail unit cost (applied to Apparent Losses): \$/1000 gallons (US)

Variable production cost (applied to Real Losses): \$/Million gallons Use Customer Retail Unit Cost to value real losses



Industry Standard (M36)

Free

Defaults provided

~10 Volume Inputs

~7 System Data Inputs

Data Validity Grades

PLEASE CHOOSE REPORTING UNITS FROM THE INSTRUCTIONS SHEET BEFORE ENTERING DATA

For each data grading for each input, determine the highest grade where the data meets or exceeds all criteria for that grade and all grades below it.

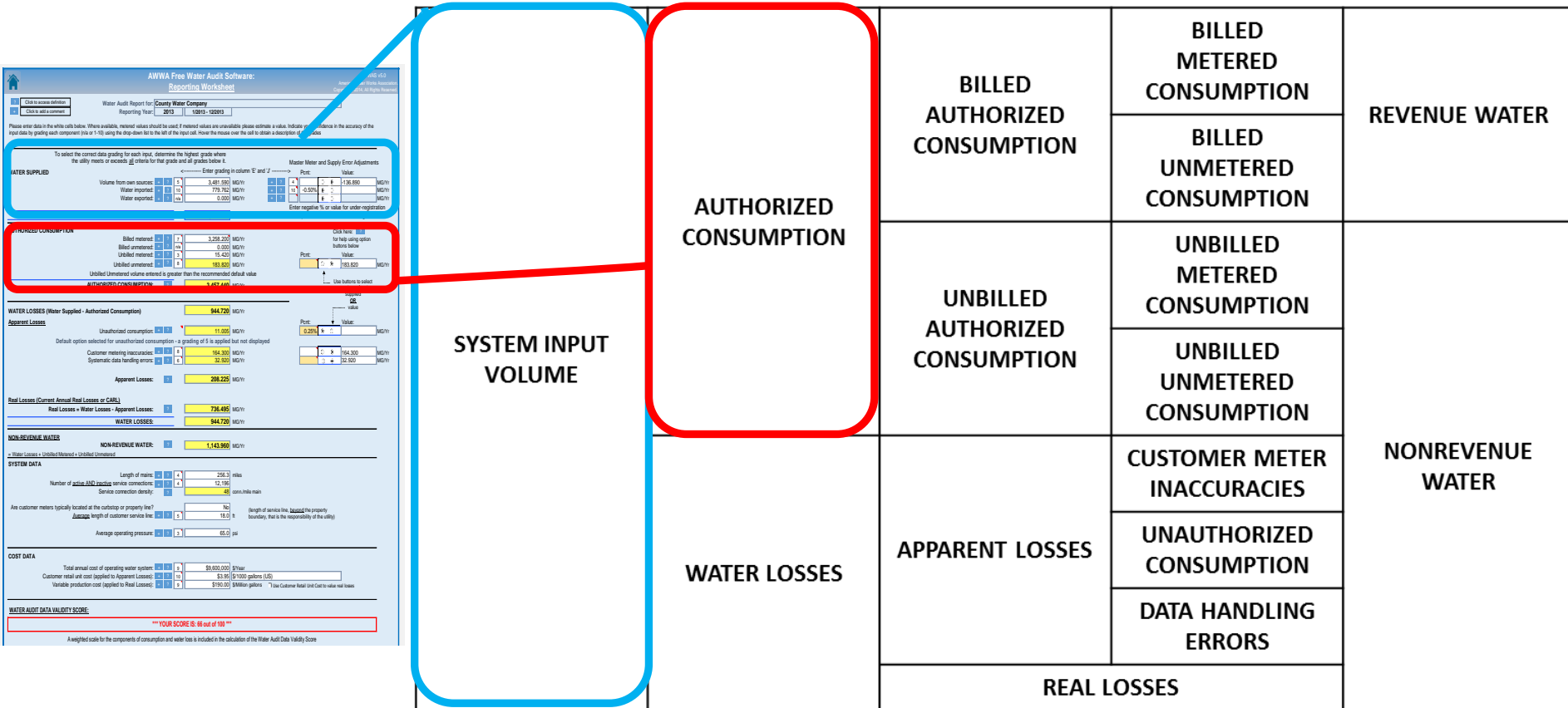
Master Meter Error Adjustments

	Enter grading in column 'E' and 'J'		Pct:	Value:
Volume from own sources:	+	?		n/a (not applicable). Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)
Water imported:	+	?		1. Less than 25% of water production sources are metered, remaining sources are estimated. No regular meter accuracy testing or electronic calibration conducted.
Water exported:	+	?		2. 25% - 50% of treated water production sources are metered; other sources estimated. No regular meter accuracy testing or electronic calibration conducted.
WATER SUPPLIED:				3. Conditions between 2 and 4
Billed metered:	+	?		4. 50% - 75% of treated water production sources are metered, other sources estimated. Occasional meter accuracy testing or electronic calibration conducted.
Billed unmetered:	+	?		5. Conditions between 4 and 6
Unbilled metered:	+	?		6. At least 75% of treated water production sources are metered, or at least 90% of the source flow is derived from metered sources. Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy.
Unbilled unmetered:	+	?		7. Conditions between 6 and 8
Default percentage of 1.25% (of billed metered)				8. 100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy
Unauthorized Consumption:		?		9. Conditions between 8 and 10
				10. 100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy. Procedures are reviewed by a third party knowledgeable in the M36 methodology.
Unauthorized Consumption)			0.000	value

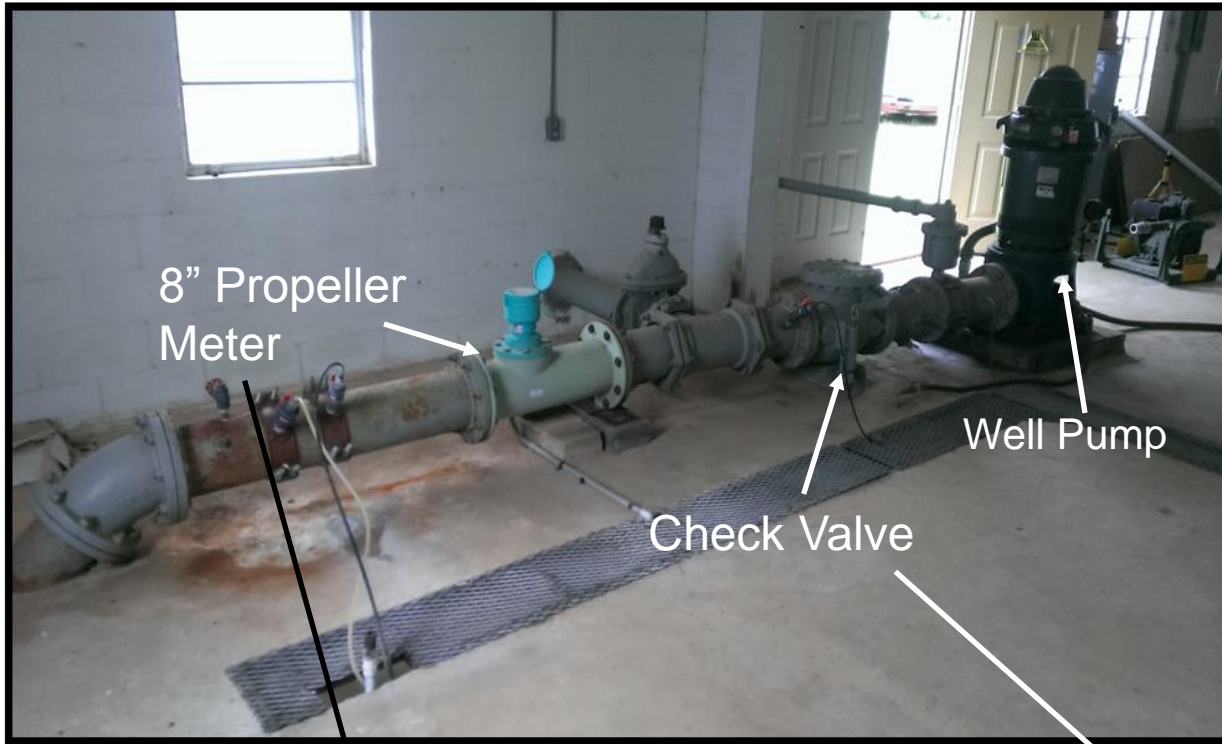
Meet all criteria at a grade for that grade to apply or drop to a lower grade ...

“meet/beat...or retreat”

Accuracy in the Water Balance

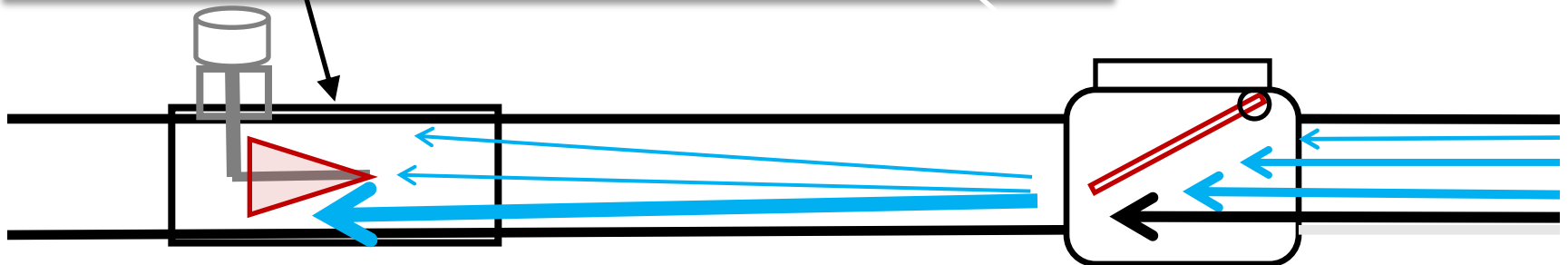


Accuracy in the Water Balance



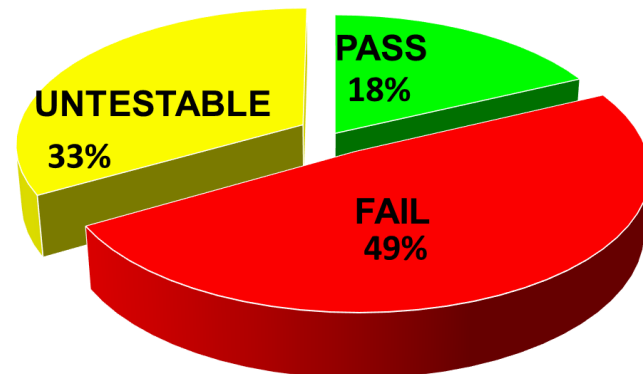
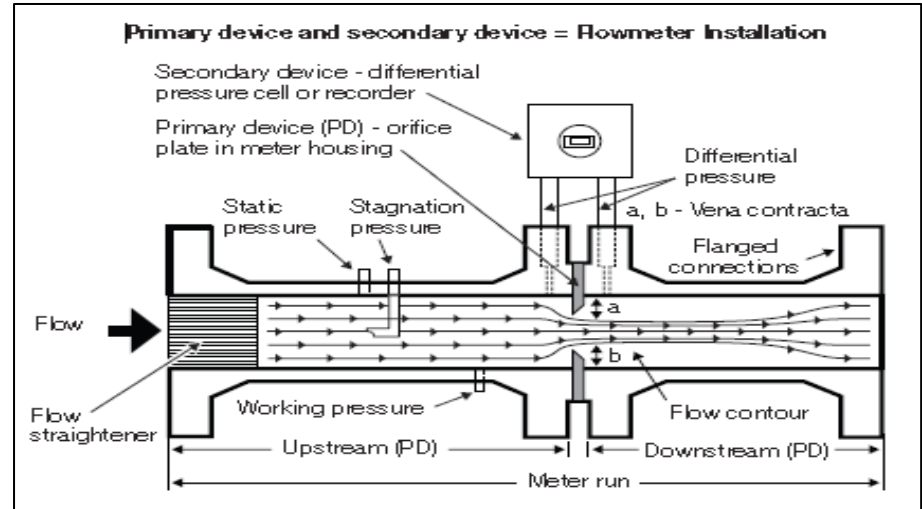
Accuracy results from MFR test bench: 99.5%

Accuracy results from in-situ test: 142.2%



Accuracy in the Water Balance

Example of Water Pumping Data Gaps and		
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

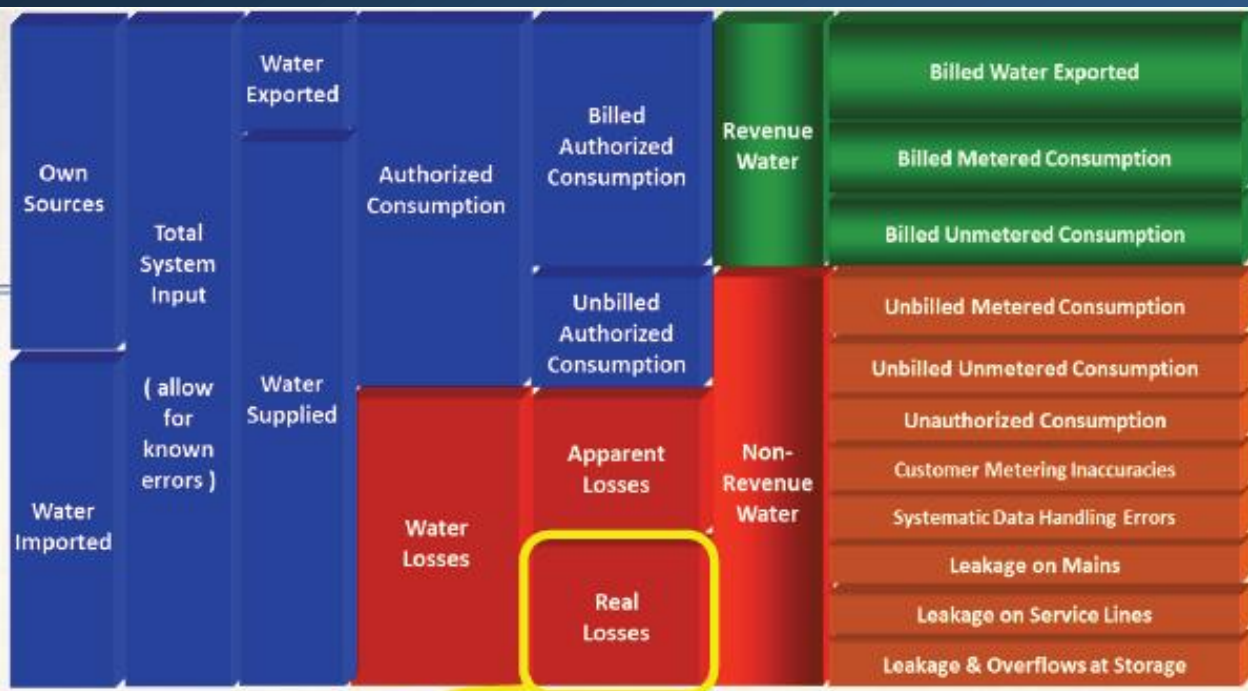
5/8" meters

Location	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

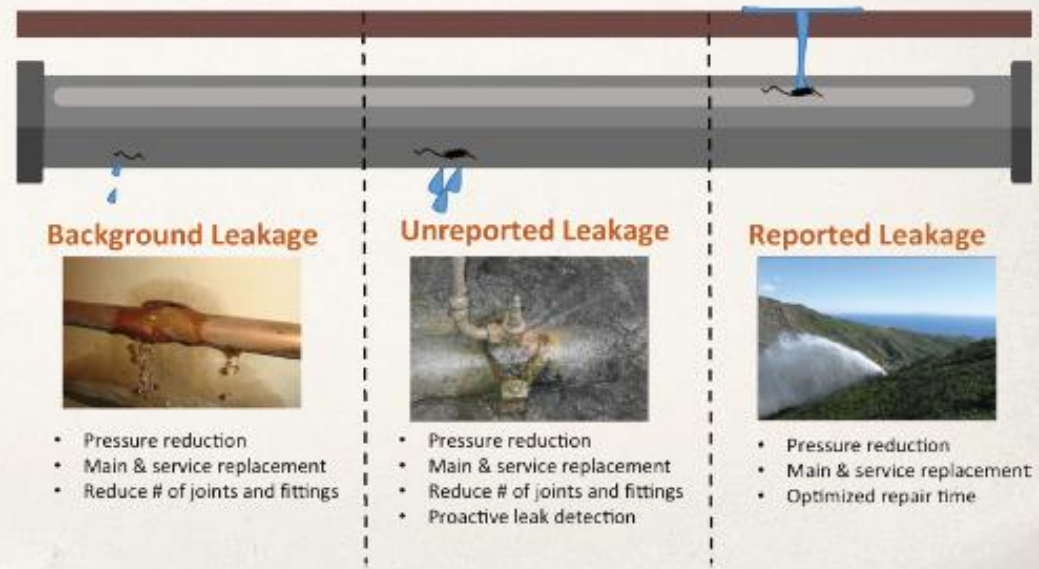
3" meter



Component Analysis of Real Losses

Real Losses

=



Component Analysis of Real Losses



Background Leakage



- Pressure reduction
- Main & service replacement
- Reduce # of joints and fittings

Unreported Leakage



- Pressure reduction
- Main & service replacement
- Reduce # of joints and fittings
- Proactive leak detection

Reported Leakage



- Pressure reduction
- Main & service replacement
- Optimized repair time



The Big Picture: Sustainability

