## This presentation premiered at WaterSmart Innovations

watersmartinnovations.com



#### **Trending & Analysis of Validated Water Loss Audits in Georgia**

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Stewardship Through Innovation



Y A VertMarkets<sup>-</sup> Magazine

**Clean Water Edition** 

## **State Of Loss**

How Non-Revenue Water Is Impacting The U.S.

Also In This Issue: Next-Generation Arsenic Removal **Disinfection Byproducts:** 

Water Online

ww.wateronline.com The Magazine

Treatment Options And Challenges









#### The Art of Water Recover By DAVID BORNSTEIN JULY 10, 2014 S:00 PM



Fixes looks at solutions to social

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problems and why they work

Imagine that you ru spend lots of mone

of the ground, puritying it and transporting it for sale. Then, one day, you discover that a large number of bottles never make it to the stores. They are falling through holes in the trucks.

Ehe New Hork

Times

Wouldn't you want to know what could be done about it? Wouldn't you be crazy to allow the situation to continue?

Well, that's what's happening with many water utilities in the United States. The Environmental Protection Agency estimates (pdf) that public water systems lose, on average, one-sixth of their water - mainly from leaks in pipes. The E.P.A. asserts that 75 percent of that water is recoverable. (In truth, the volume of leakage in the nation's 55,000 drinking-water systems is unknown, because few conduct water audits using the standards established by the International Water Association and the American Water Works Association.)



### Timeline



## Water Audit Background and Regulatory Drivers













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#### **Georgia Water System Audits** and Water Loss Control Manual

Produced for:

Georgia Department of Natural Resources

Georgia Environmental Protection Division Georgia Watershed Protection Branch

> January - 2014 Version 1.1



### **AWWA Tools for Water Loss Control**

SECOND EDITION

#### Water Audits and Loss Control Programs





ADVANCING THE SCIENCE OF WATERS

#### awwa.org/waterlosscontrol



### IWA/AWWA Standard Water Balance







## Unaccounted For Water

Unaccounteo For Water Percentage



American Water Works Association

BY AWWA WATER LOSS CONTROL COMMITTEE

### COMMITTEE REPORT: Applying worldwide BMPs in Water loss control



ater resources today are less expensive and more accessible than they ever will be again, according to participants at a recent AWWA conference workshop on water resources. The North American water industry is facing growing challenges in developing new drinking water supplies, and the demands are stagree water protection finished water quality public health risks

#### 2003

 Inconsistent use and interpretation

 Unreliable indicator of performance

 Fails to segregate loss into its components for effective management

#### American Water Works Association

The Authoritative Resource on Safe Water®

#### Water Loss Control Terms Defined

## Why the terms 'unaccounted-for' water and 'unaccounted-for percentage' just don't work!

Tracking water loss in drinking water utilities as the percentage of the estimated losses over the volume supplied is believed to have been first documented in the 1957 AWWA Committee Report "Revenue Producing vs. Unaccounted-for Water." In the ensuing decades after this paper was published many state and regional water regulatory agencies adopted

### **Unaccounted-For No More**



### **Critical Importance of Validation**

#### California

Table 2.6 CUWCC BMP 1.2 – 2010 Water Audit Data Set Validation Steps

	Count	Percentage
Number of Utilities Reporting Water Audit Result	130	100%
Number of Utilities Reporting Negative Water Losses	5	4%
Number of Utilities Reporting ILI<1	36	28%
Number of Utilities Reporting ILI>20	3	2%
Number of Utilities Reporting Erroneous Infrastructure Data	1	1%
Final Data Set After Removal of Erroneous Water Audit Reports	85	65%

2,046 34%

130

35%

lexas		
Item Number	Detail	Number of Audits
	Working from initial database, including 2,046 utilities	
6A	Zero Water Supplied	115
6B	Negative System input volume	1
6C	Negative cost of Real Losses	132
6D	Negative cost of Apparent Loss	4
6E	Negative real loss volume	8
6F	ILI <0.5	430

#### Georgia:





### Validation Process

Quality control for input errors Verification of data grading Uniform adherence to grading matrix definitions Consistent definitions and

calculations

GEFA Water Audit Technical Assistance and Training Audit Validation Call - CHEAT SHEET

#### In preparation for your call

Review the audit, check for obvious errors/omissions such as units and missing data grades. If there is a lot of missing information, I suggest have the utility fill in the missing info prior to your call. If it's just a few things missing, go ahead and have the call and work those out on the call. Remember, this will be your utility for Round 2 as well, so when the learn it here it saves time later. So don't just correct it for them w/o their involvement.

Otherwise, review the audit to look for anomalies/flags listed below. If there are anomalies/flags, you might ask the utility to send you ahead of the call some of the backup data such as production, billing or testing records.

- 1. Low NRW %.
- 2. Low Water Loss. This is not a single cell; just do a quick check of G54 vs. G19.
- 3. High Unbilled Unmetered.
- 4. High Customer Metering Inaccuracy (5% or greater).
- ILI near or below 1. Study to see is this caused by high UARL, high Apparent Loss, or simply low Water Loss? That will tell you where to look for potential adjustments.
- 6. High Data Validity.
- 7. High data gradings of 9 or 10.
- 8. Anything else that looks wrong or cooked.

General Comments:

- Make them feel comfortable, set the tone up front my saying there may be some numbers we adjust up or down in our discussion, all in the spirit of having a good roadmap from this audit for the 2012 audit.
- Encourage them to write down <u>everything</u> on their cheat sheets and keep those on file. Remind them it will make things go very smoothly for the 2012 audit.
- 3. Try to ask open ended questions such as "tell me about your meter testing" rather than "do you

### Validation Process

	Questioning strategy: Source profile - ground v surface, number and type of master meters. What's
	the testing program for those master meters – how often, tell me about the test, is it flow verification
Volume from Own	with an independent meter or just checking the instrumentation. If Data Validity is suspiciously
Sources	high/low, the data grading for this one is likely too high/low.
	Standardization: If only doing electronic calibration, not flow verification, OK to stick to 4.2 grading but
	educate and document the recommendation to do both.
	Questioning strategy: Is this number based off a flow verification test or a guesstimate? How are
	production volumes recorded (manual v auto, with or w/o SCADA). If SCADA, tell me about how you
Маанал Манал Галан	have that checked for matching up with what's on the source meters. Many folks here are not going to
	be factoring tank storage changes into daily production numbers, so they will be graded a 2 or 3. If
Adjustment	NRW, Water Loss or ILI are low – this number may possibly be too low (under-registration). OK to
	adjust this number a little if it's a guesstimate, leave as is if it's based on flow verification test results.
	Standardization: If no tank changes incorporated into daily system input calculation, grade limited to 3.
	Questioning strategy: What number and type of master purchase/sell meters; what's the testing on
Wator	those; don't forget about emergency connections. Has the number been adjusted for known error in
water	the master purchase/sell meter.
Imported/Exported	
Imported/Exported	Standardization: If only doing electronic calibration, not flow verification, OK to stick to 4.2 grading but
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## Large >10,000 population

## Small 3300 - 10,000 population



### Large system audits – pre and post Validation FIRST SUBMITTAL

		Pre-Validation			Pos	Change				
	n	AVG Range			AVG	Range				
Volume from own sources	90	7.3	1	-	10	6.2	1	-	10	(1.1)
Master meter error adjustment	94	5.4	1	-	10	4.8	1	-	10	(0.6)
Water imported	50	7.9	3	-	10	6.4	2	-	10	(1.4)
Water exported	51	7.7	2	-	10	6.4	2	-	9	(1.3)
Billed metered	106	7.4	3	-	10	6.5	2	-	10	(0.9)
Billed unmetered	19	8.2	4	-	10	7.1	3	-	10	(1.1)
Unbilled metered	72	6.7	1	-	10	6.4	1	-	10	(0.3)
Unbilled unmetered		5.4	2	-	10	5.4	2	-	10	(0.0)
Unauthorized consumption	107	5.1	2	-	9	5.0	2	-	7	(0.1)
Customer metering inaccuracies	106	6.1	2	-	10	5.3	2	-	10	(0.8)
Systematic data handling errors	107	5.9	2	-	10	5.7	2	-	9	(0.1)
Length of mains	107	6.6	1	-	10	6.6	1	-	10	0.1
# of active + inactive svc connections	107	6.3	1	-	10	6.3	1	-	10	0.0
Average length of customer service line	107	8.5	2	-	10	10.0	10	-	10	1.5
Average operating pressure	107	5.4	1	-	10	5.1	1	-	10	(0.2)
Annual cost of operating water system	107	7.9	1	-	10	8.5	1	-	10	0.6
Customer retail unit cost	107	7.4	1	-	10	6.4	1	-	10	(1.0)
Variable production cost	107	7.2	2	-	10	6.8	2	-	10	(0.4)
Water Audit Data Validity Score	107	68.8	39	-	94	62.9	38	-	81	(5.9)

## Large Systems Year 1 Pre/Post Data Validity Scores



## Large Systems Year 1 Pre/Post ILIs



## Large Systems Year 1 All Priority Areas for Improvement



### Small system audits – pre and post Validation TRIAL RUN

<b>Refore</b> Training Program			Pre-\		Post-V	Change					
		n	AVG Range			AVG	AVG Range				
	Volume from own sources	78	7.3	1	-	10	4.5	2	-	10	(2.8)
	Master meter error adjustment	76	5.4	1	-	10	2.9	1	-	9	(2.5)
	Water imported	34	7.9	3	-	10	5.1	2	-	9	(2.7)
	Water exported	22	7.7	2	-	10	5.0	3	-	9	(2.6)
	Billed metered	91	7.4	3	-	10	5.6	2	-	10	(1.8)
	Billed unmetered	22	8.2	4	-	10	5.4	1	-	10	(2.9)
	Unbilled metered	64	6.7	1	-	10	5.3	1	-	10	(1.4)
	Unbilled unmetered	92	5.4	2	-	10	4.9	0	-	9	(0.6)
	Unauthorized consumption	92	5.1	2	-	9	5.1	5	-	10	(0.0)
	Customer metering inaccuracies	91	6.1	2	-	10	3.9	1	-	9	(2.1)
	Systematic data handling errors	92	5.9	2	-	10	5.1	4	-	9	(0.7)
	Length of mains	90	6.6	1	-	10	4.7	1	-	10	(1.8)
4	# of active + inactive svc connections	90	6.3	1	-	10	5.5	1	-	10	(0.8)
Av	erage length of customer service line	92	8.5	2	-	10	9.5	2	-	10	1.0
	Average operating pressure	91	5.4	1	-	10	4.3	1	-	10	(1.1)
А	nnual cost of operating water system	90	7.9	1	-	10	7.2	1	-	10	(0.7)
	Customer retail unit cost	91	7.4	1	-	10	6.0	2	-	10	(1.4)
	Variable production cost	90	7.2	2	-	10	5.7	1	-	10	(1.5)
	Water Audit Data Validity Score	92	68.8	39	-	94	52.1	8	-	77	(16.7)

Water Audit Training – Phase 1 Program Overview



### Small system audits – pre and post Validation FIRST SUBMITTAL

After Training Program		Pre-Va	n	Post-	Change					
		AVG	Range			AVG Range		;e		
Volume from own sources	86	5.3	2	-	10	4.8	2	-	9	(0.5)
Master meter error adjustment	86	3.4	1	-	9	2.8	1	-	8	(0.6)
Water imported	37	5.9	2	-	10	5.7	2	-	9	(0.2)
Water exported	24	5.8	1	-	10	5.0	1	-	9	(0.8)
Billed metered	100	6.0	2	-	10	5.2	2	-	8	(0.8)
Billed unmetered	24	6.7	1	-	10	6.9	2	-	10	0.3
Unbilled metered	74	6.0	1	-	10	5.9	1	-	10	(0.1)
Unbilled unmetered	100	5.0	0	-	10	5.0	1	-	10	0.0
Unauthorized consumption	100	5.1	3	-	10	5.0	5	-	5	(0.1)
Customer metering inaccuracies	100	4.3	1	-	10	4.0	1	-	10	(0.2)
Systematic data handling errors	100	5.2	0	-	10	5.2	1	-	9	0.1
Length of mains	100	4.9	1	-	10	4.8	1	-	10	(0.1)
# of active + inactive svc connections	100	5.7	2	-	10	5.6	2	-	10	(0.1)
Average length of customer service line	100	8.9	1	-	10	9.9	4	-	10	1.0
Average operating pressure	100	4.2	1	-	10	3.7	1	-	10	(0.5)
Annual cost of operating water system	100	7.1	2	-	10	7.9	2	-	10	0.8
Customer retail unit cost	100	6.2	2	-	10	6.4	2	-	10	0.2
Variable production cost	100	5.6	1	-	10	5.3	1	-	10	(0.2)
Water Audit Data Validity Score	100	55.4	3	-	86	53.8	31	-	74	(1.6)

## Small Systems Year 1 Pre/Post Data Validity Scores



## Small Systems Year 1 Pre/Post ILIs



## Small Systems Year 1 All Priority Areas for Improvement



## Large Systems Year 1 All Priority Areas for Improvement



#### Water Loss Technical Assistance – Customer Meter Testing (CMT)



#### Water Loss Technical Assistance – Finished Water Meter Testing



## Observations from Validated Audit Results

- For both large and small systems Volume from own sources was the top area for improving audit results
- For both large and small systems Validation resulted in decreased of Data Validity Score and increase of ILI
- Water auditing and validation are new skillsets still for many utilities, ongoing training and technical assistance are going to be important

### Next steps

Category	Large Systems	Small Systems
2011	Validated	N/A
2012	In process	Validated
2013	In process	In process
2014	TBD	TBD

#### Planned Use of Water Audit Results WATER AUDIT RESULTS FOR LARGE GEORGIA PUBLIC DRINKING WATER SYSTEMS FOR 2011

#### 2011 Water Audit Results for Large Georgia Public Water Systems

IDENTIFIER	WATER UTILITY	SERVICE	POP	DISTRIBUTION	AVERAGE				TOP 3 ARE	EAS TO IMPR	OVE AUDIT
WSID	NAME	COUN	SERVED	MAINS (miles)	PRESSURE (psi)		VALIDITY	Op24	1	2	3
GA0950000	ALBANY	DOUGHERTY	$\int \partial \phi$	ンアニの取		1.35	66	16.33	MMEA	VOS	CMI
GA2610000	AMERICUS	SUMTER				4.01	68	69.7	VPC	VOS	BM
GA0590000	ATHENS-CLARKE CO.	CLARKE	92/ 1		90	1.33	72	29.89	VOS	MMEA	CMI
GA1210001	ATLANTA	FULTON	∖∀∧∖	770		3.99	58	88.97	VOS	MMEA	CRUC
GA2450000	AUGUSTA-RICHMOND CO.	RICHMOND	a a	/ 3 3	5 81	5.94	65	124.59	VOS	MMEA	CMI
GA0870001	BAINBRIDGE	DECATUP	18,000		50	6.52	46	100.2	VOS	UM	BM
GA0090000	BALDWIN CO.	BALDWIN	GE	R	GIA	3.40	48	*1,848.74	WI	UM	BM
GA0130031	BARROW CO.	BARROW	U L		UIA	0.29	56	8.51	WI	WE	CMI
GA0150001	BARTOW CO.	BARTOW				1.18	59	*1,205.53	WI	MMEA	VOS
GA1270000	BRUNSWICK	GLYNN	35,250	238.0	54	1.10	60	14.25	VOS	MMEA	BM
GA0350051	BUTTS CO.	BUTTS	21,500	281.0	70	1.14	80	*777.19	VOS	MMEA	WI
GA1310000	CAIRO	GRADY	10,239	120.0	65	2.09	53	40.44	VOS	MMEA	CRUC
GA1290000	CALHOUN	GORDON	49,088	819.0	103	2.07	48	*1,947.19	VOS	WE	UM
GA0570001	CANTON Geor	aia∘En∖	/irom	mental	Protectio	bn.@	)ivisio	n 84.81	VOS	MMEA	WI
GA0450001	CARROLL CO.	CARROLL	35,770	750.0	90	0.90	79	*728.21	VOS	MMEA	UC
GA0450002	CARROLLTON	CANWate	rshee	Protec	ction Bra	inch	68	28.44	VOS	BM	CRUC
GA0150002	CARTERSVILLE	BARTOW	24,830	185.0	85	4.36	65	89.24	VOS	WE	CMI
GA0470000	CATOOSA CO.	CATOOSA	49,40	inuary a	<b>113</b> 113	0.78	74	22.2	VOS	MMEA	CMI
GA2330000	CEDARTOWN	POLK	11,700	85.9	84.6	6.22	44	138.65	VOS	MMEA	TAC
GA2130000	CHATSWORTH	MURRAY	26,913	400.0	93.8	1.76	63	*1,567.67	VOS	BM	CMI
GA0570002	CHEROKEE CO.	CHEROKEE	145,389	1,227.3	60	1.31	73	20.26	VOS	CMI	BM
GA0630000	CLAYTON CO.	CLAYTON	270,000	1,381.0	65	1.19	74	18.5	VOS	WI	MMEA
GA0670003	COBB CO.	COBB	533,000	2,915.0	80	1.05	68	20.16	WI	SDHE	UC
GA1210002	COLLEGE PARK	FULTON	20,382	70.0	68	1.72	71	30.78	CMI	WI	BM
GA0730000	COLUMBIA CO.	COLUMBIA	93,600	689.0	65	2.41	63	38.88	VOS	MMEA	UM
GA2150000	COLUMBUS	MUSCOGEE	229,000	1,143.0	91.9	1.81	75	38.73	VOS	MMEA	UC
GA0810001	CORDELE	CRISP	11,608	135.8	70	1.80	61	32,45	VOS	VPC	BM
GA2170001	COVINGTON	NEWTON	20,080	160.0	80	2.60	75	54.43	BM	CRUC	CMI
GA0770042	COWETA CO. WSA	COWETA	59,800	962.2	45	1.01	75	*434.01	CRUC	VPC	VOS
GA1170000	CUMMING	FORSYTH	21,512	300.0	45	2.28	62	25.19	VOS	UM	VPC
GA0830000	DADE CO.	DADE	17,747	340.0	102	1.14	64	*976.01	VOS	MMEA	BM
GA3130000	DALTON UTILITIES	WHITFIELD	99,315	1,259.2	103.4	1.47	64	48.27	VOS	MMEA	WE
GA0890001	DEKALB CO.	DEKALB	670,000	2,600.0	95	3.54	71	75.63	VOS	BM	UC
GA1370004	DEMOREST	HABERSHAM	13,965	260.0	95	1.42	53	*1,147.72	WI	MMEA	BM



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#### **Stepping Up Water Loss Control** Lessons from the State of Georgia

For any state or agency looking to increa M36, there are several key takeaways fro auditing requirements:

# Georgia's water loss initiatives are gaining national attention

State agencies and their partners should place emphasis on the value and usefulness of M36 for utilities. Beyond instituting any auditing requirement, states should highlight the benefits of this practice in helping utilities improve business operations.

**Data validation is paramount.** Water loss audits and future planning must be based on accurate and reliable audit results in order to effectively improve water systems.

*Encourage strong relationships between state and local governments.* It is critical for states to have a strong commitment to providing training resources and support to utilities as they adopt the M36 auditing method.

*Encourage public reporting.* Sharing audit results improves transparency, accountability and understanding between a utility and its customers.

Enthusiastic training sessions. The auditing process can

engaging trainings that g the M36 method.

THE AMERICAN WATER WORKS ASSOCIATION (AWWA) AND INTERNATIONAL WATER ASSOCIATION (IWA) WATER AUDITING METHODOLOGY PRODUCT (M36) IS NATIONALLY RECOGNIZED AS THE BEST METHOD FOR ACHIEVING A ROBUST AND STANDARDIZED WATER LOSS AUDIT. IT ALLOWS UTILITIES TO RATE THEIR DATA VALIDITY AND IDENTIFY INTERNAL ISSUES, WHILE HELPING STATES AND REGIONS TO LOOK AT WIDER-SCALE WATER LOSS TRENDS. THIS ENABLES THEM TO MORE EFFECTIVELY REDUCE WATER WASTE, AND MAKE A STRONGER ECONOMIC CASE FOR INFRASTRUCTURE REINVESTMENT AND OTHER WATER LOSS INITIATIVES.<sup>2</sup>

#### **Trending & Analysis of Validated Water Loss Audits in Georgia**



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