

This presentation premiered at WaterSmart Innovations

watersmartinnovations.com



Water Loss Insanity

Small Southeast Town Gets Intense about Water Loss



Graphic Credit:
Water Online

Presented by:
Will Jernigan, P.E.


CAVANAUGH
Stewardship Through Innovation





Water Online

www.wateronline.com **The Magazine**

A VentMarkets 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:
Treatment Options And Challenges



The New York Times

FIXES

The Art of Water Recovery

By DAVID BORNSTEIN

JULY 10, 2014 8:00 PM



Fixes looks at solutions to social problems and why they work.

Imagine that you spend lots of money of the ground, purifying it and transporting it to the store. 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.

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.)

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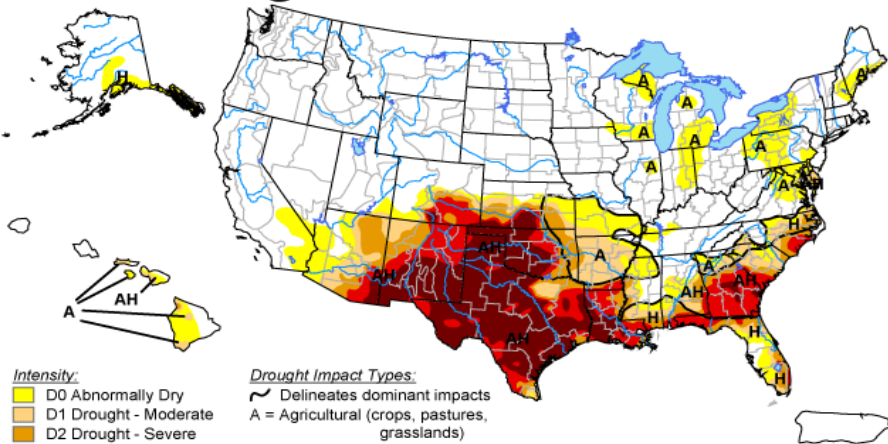






U.S. Drought Monitor

July 26, 2011
Valid 8 a.m. EDT



Intensity:
 D0 Abnormally Dry
 D1 Drought - Moderate
 D2 Drought - Severe
 D3 Drought - Extreme
 D4 Drought - Exceptional

Drought Impact Types:
 ~ Delineates dominant impacts
 A = Agricultural (crops, pastures, grasslands)
 H = Hydrological (water)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

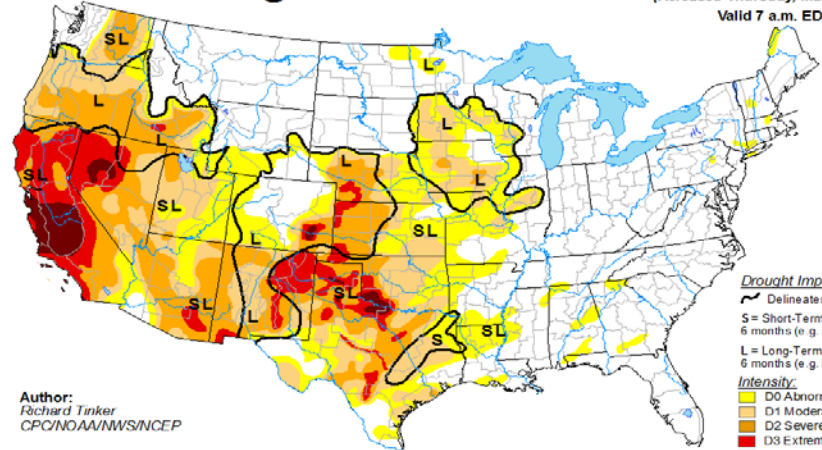


Released Thursday, July 28, 2011
Author: Brad Rippey, U.S. Department of Agriculture

<http://droughtmonitor.unl.edu/dm>

U.S. Drought Monitor

March 11, 2014
(Released Thursday, Mar. 13, 2014)
Valid 7 a.m. EDT



Author:
Richard Tinker
CPC/NOAA/NWS/INCEP

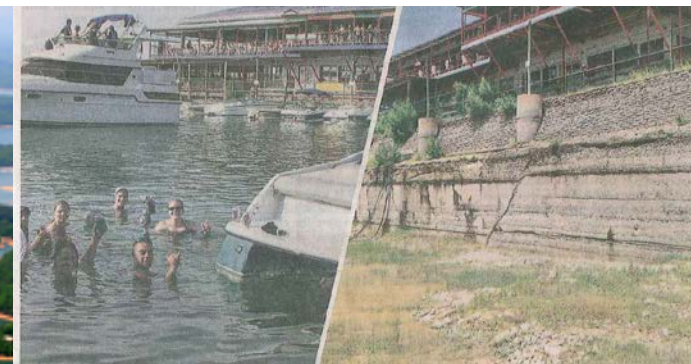
Drought Impact Types:
 ~ Delineates dominant impacts
 S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
 L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:
 D0 Abnormally Dry
 D1 Moderate Drought
 D2 Severe Drought
 D3 Extreme Drought
 D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



<http://droughtmonitor.unl.edu/>



Years ago, Carlos n' Charlie's restaurant along Lake Travis would float when water levels were high. Now it's not even lakeside.

High and dry in Texas

Wendy Koch
@wendykoch
USA TODAY

SPICEWOOD, TEXAS In this browning patch of land in central Texas, C.J. Teare could be fined for using fresh water to keep her decades-old oak trees alive, so she relies on soapy water left over from washing clothes.



Water fights (and not the fun kind) are plaguing the Lone Star State as climate change raises the heat — and the stakes.

PRAY FOR RAIN
1 THESS. 5:17

modbee.com



AP / July 10, 2014, 10:34 AM

'Toilet to tap' wastewater recycling begins in Texas city



FRANCK FIFE/AFP/GETTY IMAGES

23 Comments / 92 Shares / 86 Tweets / Stumble / Email


More +

As much of Texas grapples with **lingering drought**, a second city in the Lone Star State has begun reusing treated wastewater in a state-approved recycling process to bolster drinking supplies.

Wichita Falls, near the Oklahoma border, on Wednesday began reusing millions of

SERIOUS DROUGHT
HELP SAVE WATER

California Couple Tries To Conserve Water, Ends Up Facing \$500 Fine For Brown Lawn

BY KILEY KROH  JULY 20, 2014 AT 12:27 PM UPDATED: JULY 21, 2014 AT 11:29 AM

 11,182 Share This

 660 Tweet This







Michael Korte walks across his lawn in Glendora, Calif. Korte and his wife face a possible fine of up to \$500 for not maintaining their lawn during the drought.

CREDIT: AP PHOTO/DAMIAN DOVARGANES

As California's severe drought deepens and officials look to reduce water consumption in every possible way, the state appears to be sending mixed signals as to which water-related activity is the most egregious.

The entirety of California is currently experiencing drought conditions and more than 80





SERIOUS DROUGHT
HELP SAVE WATER

Water Wasters May Face Jail Time

By Sara Jerome
[@sarmje](#)

When California water regulators authorized \$500 fines for water wasting, the public marveled at how far the state was willing to go to face down the drought.

But one city is going beyond that. In Shasta Lake, water wasters can now be punished



AWWA Tools for Water Loss Control

Water Audits and Loss Control Programs

MANUAL OF WATER SUPPLY PRACTICES

M36

Third Edition



American Water Works Association

Advances
Communications
Conferences
Education and Training
Science and Technology
Systems

Research
Foundation
Report

Infrastructure

WATER LOSS CONTROL

SECOND EDITION

Julian Thornton | Reinhard Sturm | George Kunkel

AWWA Free Water Audit Software: Reporting Worksheet

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 table below. Where available, entered values should be used. If entered values are unavailable, please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (1 to 5) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grade.

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

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

Enter grading in columns 'E' and 'F'

WATER SUPPLIED

Volume from own sources	1	1,000.00	MG/Yr
Water imported	2	50.00	MG/Yr
Water exported	3	100.00	MG/Yr
WATER SUPPLIED:		825.00	MG/Yr

AUTHORIZED CONSUMPTION

Billed metered	1	750.00	MG/Yr
Billed unmetered	2	50.00	MG/Yr
Unbilled metered	3	10.00	MG/Yr
Unbilled unmetered	4	10.00	MG/Yr
AUTHORIZED CONSUMPTION:		760.00	MG/Yr

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

WATER LOSSES (Water Supplied - Authorized Consumption)

Unauthorized consumption	1	64.68	MG/Yr
Unauthorized consumption volume entered is greater than the recommended default value	2	1.00	MG/Yr
Customer metering inaccuracies	3	7.00	MG/Yr
Systematic data handling errors	4	5.00	MG/Yr
Apparent Losses:		15.67	MG/Yr
Real Losses (Current Annual Real Losses or CARL)		49.67	MG/Yr
Real Losses = Water Losses - Apparent Losses		64.68	MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER:		75.00	MG/Yr
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SYSTEM DATA

Length of mains	1	100.0	miles
Number of active AND inactive service connections	2	1,000	connections
Service connection density	3	8.52	connections/mile

Any customer meters typically located at the curbside or property line? **Yes** (length of service line, based on 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: **60.0** psi

COST DATA

Total annual cost of operating water system	1	\$1,000,000	\$/Yr
Customer retail unit cost (applied to Apparent Losses)	2	\$5.00	\$/1000 gallons (US)
Variable production cost (applied to Real Losses)	3	\$3,000.00	\$/million gallons

WATER AUDIT DATA VALIDITY SCORE:

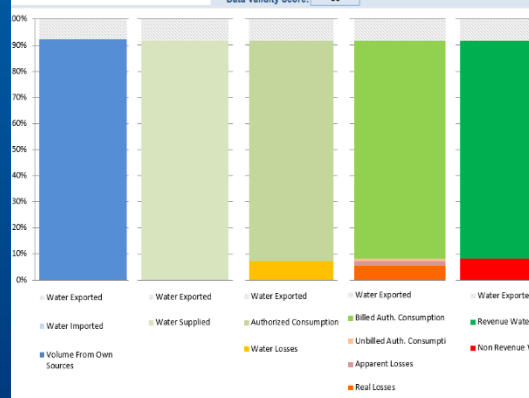
*** YOUR SCORE IS: 60 out of 100 ***

A weighted scale for the components of consumption and water loss included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

- Volume from own sources
- Customer metering inaccuracies
- Total annual cost of operating water system



AWWA Free Water Audit Software: Attributes and Performance Indicators

Water Audit Report for: **Philadelphia Water Department**

Year: **2013** 1/2013 - 12/2013

WATER AUDIT DATA VALIDITY SCORE IS: 77 out of 100 ***

Apparent Losses: **7,495.00** MG/Yr

+ Real Losses: **21,267.50** MG/Yr

= **Water Losses: 28,762.50** MG/Yr

Unavoidable Annual Real Losses (UARL): **2,497.30** MG/Yr

Annual cost of Apparent Losses: **\$54,788,450**

Annual cost of Real Losses: **\$7,368,338** Valued at Variable Production Cost

Return to Reporting Worksheet to change this assumption

Percent by volume of Water Supplied: **38.1%**

Percent by cost of operating system: **25.2%** Real Losses valued at Variable Production Cost

Losses per service connection per day: **38.95** gallons/connection/day

Losses per service connection per day: **110.52** gallons/connection/day

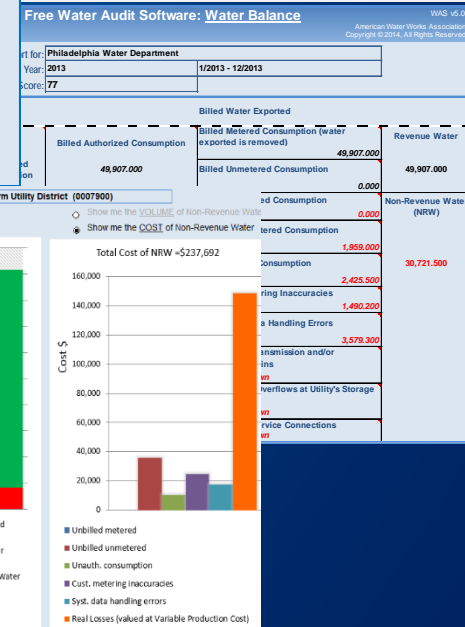
Real Losses per length of main per day: **N/A**

Service connection per day per psi pressure: **1.70** gallons/connection/day/psi

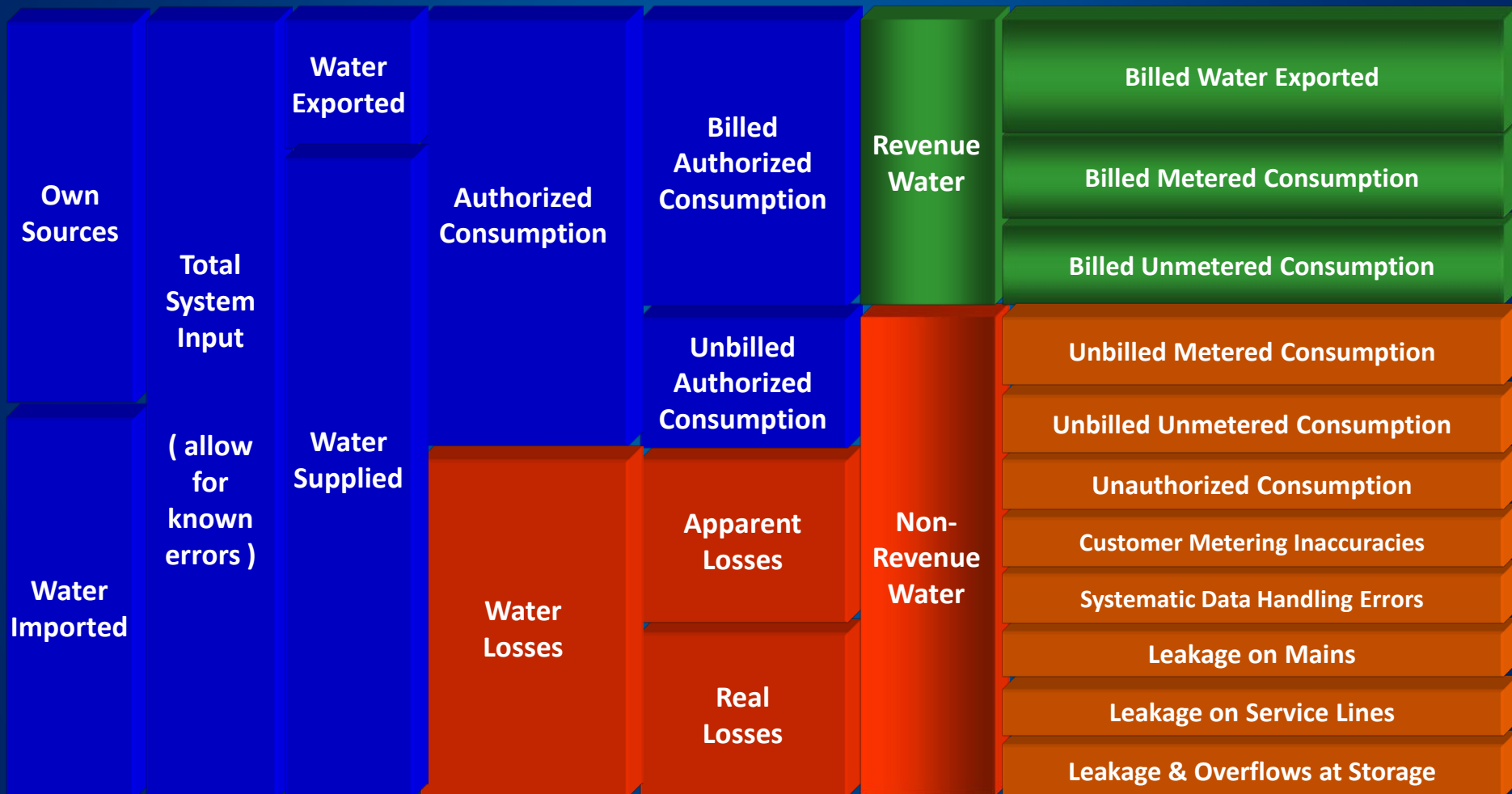
Current Annual Real Losses (CARL): **21,267.50** million gallons/year

Culture Leakage Index (ILI) [CARL/UARL]: **8.52**

Service connection density of less than 32 service connections/mile of pipeline

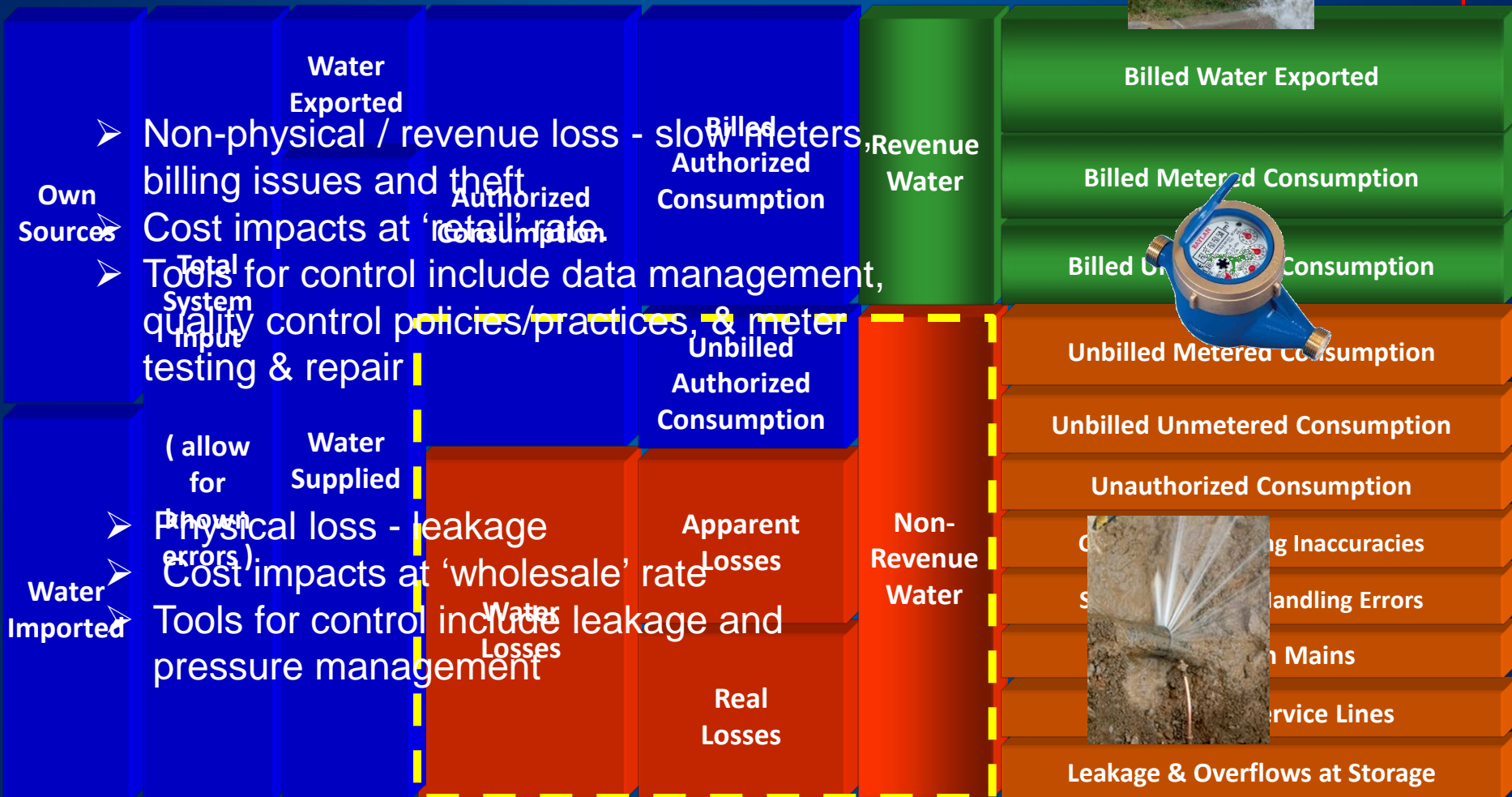


IWA/AWWA Standard Water Balance



IWA/AWWA Standard Water Balance

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



**Unaccounted
For Water**

**Unaccounted
For Water
Percentage**



American
Water Works
Association

BY AWWA WATER LOSS
CONTROL COMMITTEE

COMMITTEE REPORT:

Applying worldwide BMPs in **water loss control**



Water 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 staggering: source 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®

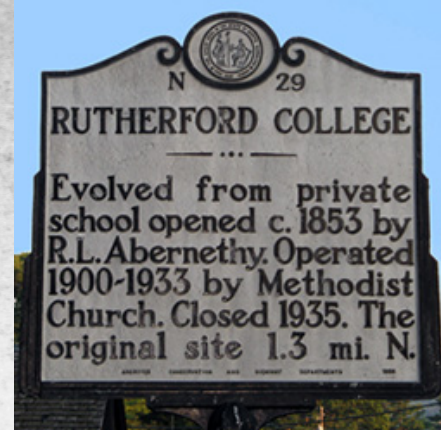
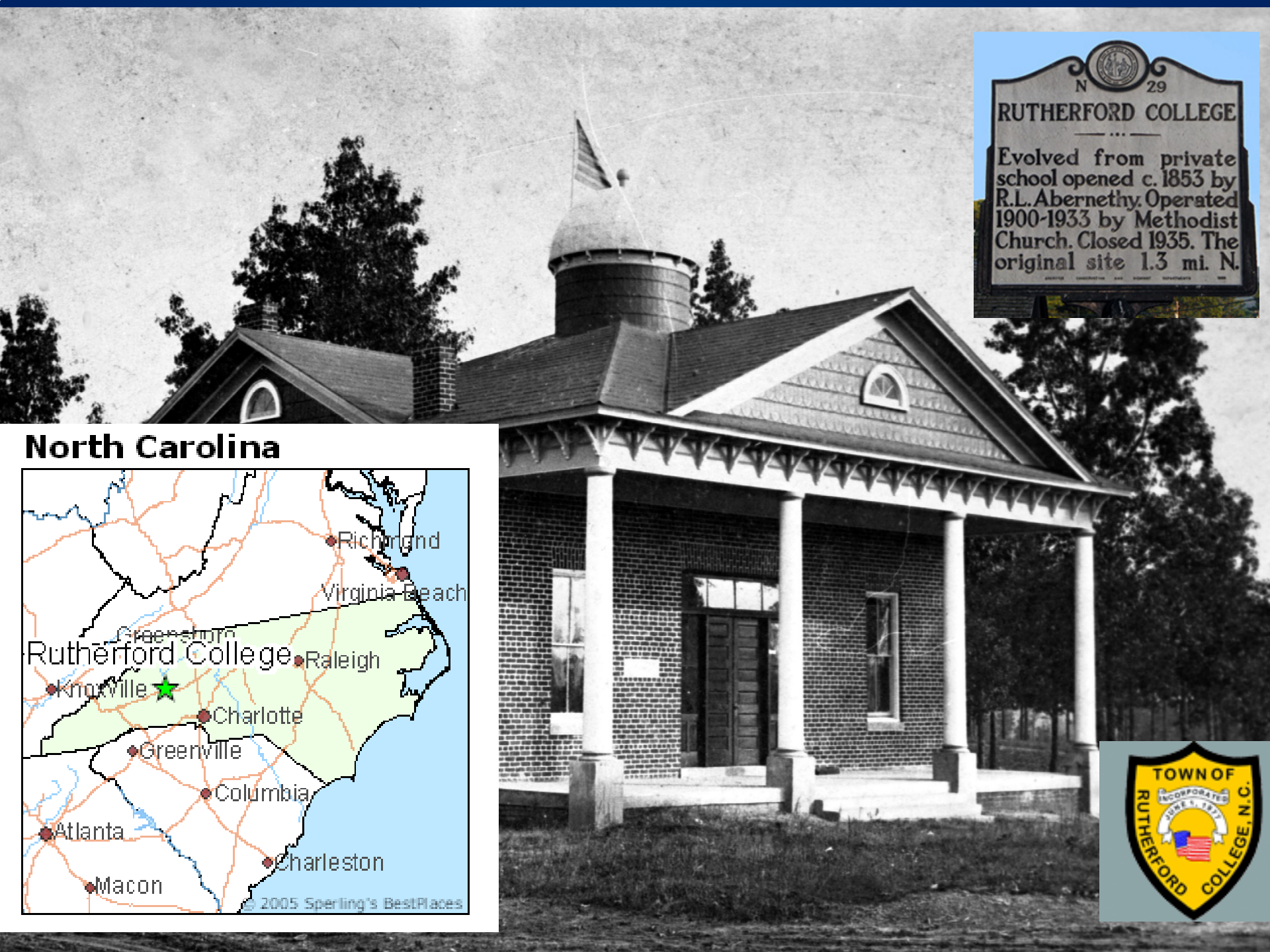
Water Loss Control Terms Defined

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

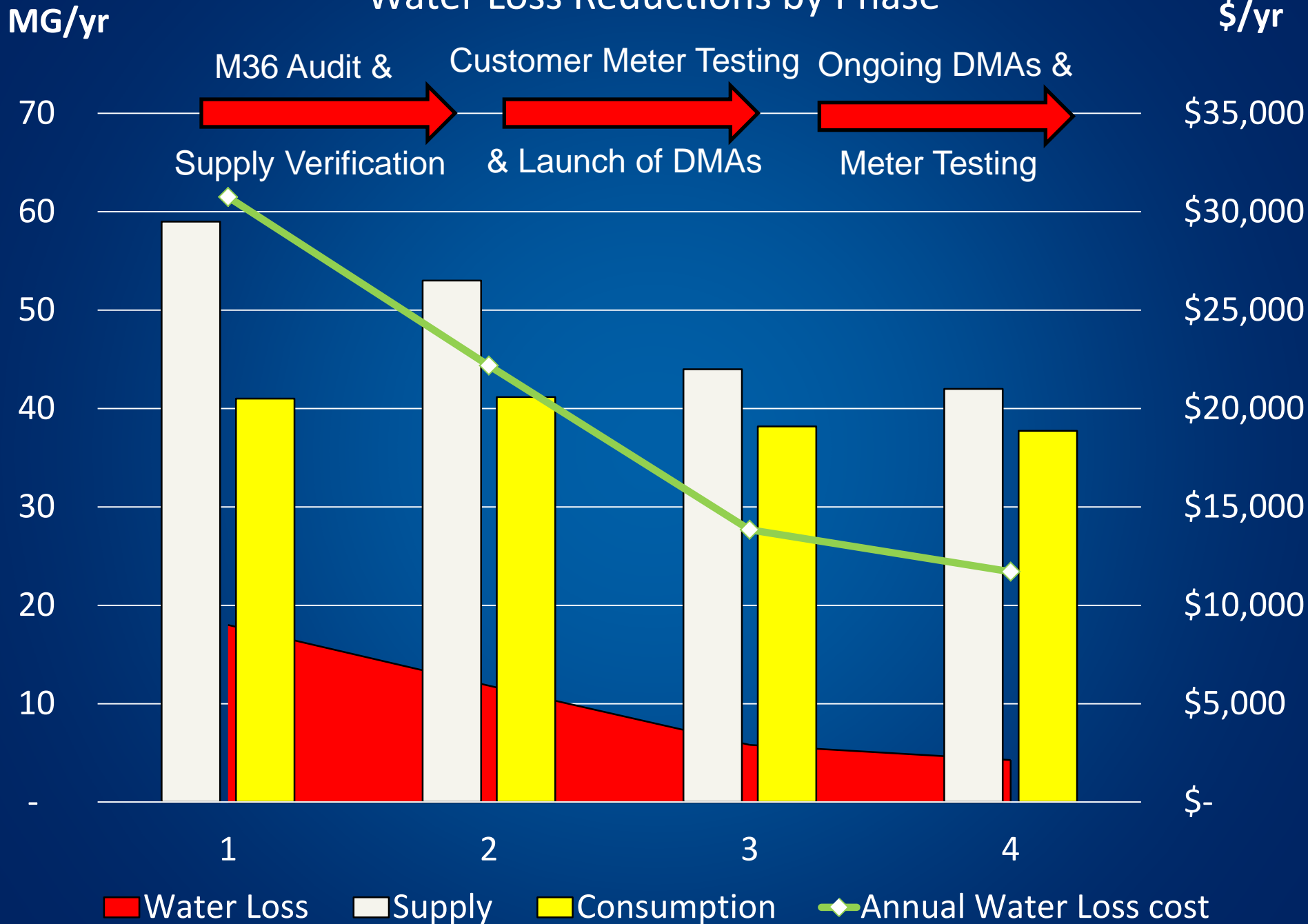


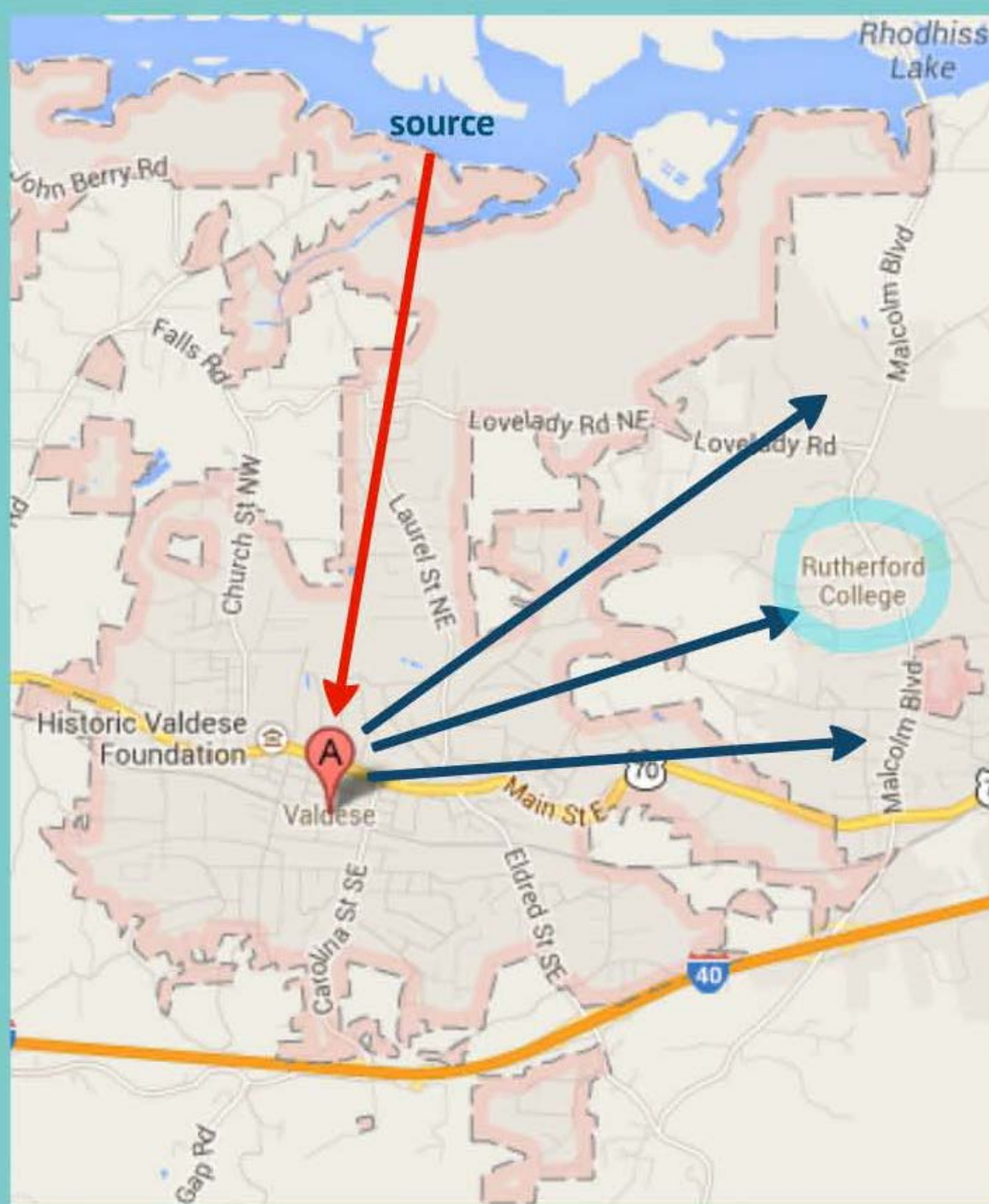


North Carolina

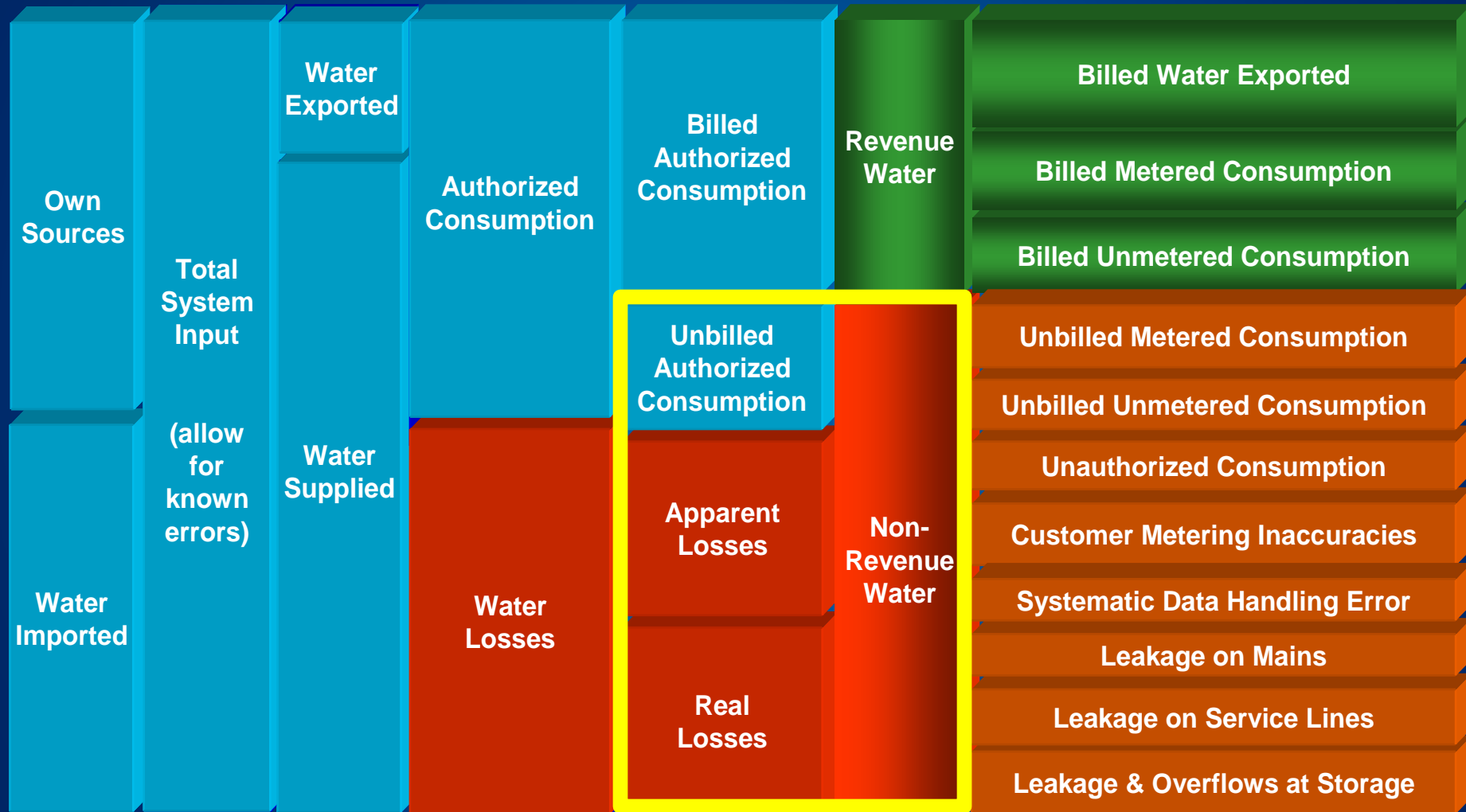


Water Loss Reductions by Phase





Step 1 – AWWA M36 Audit



Step 1 – AWWA M36 Audit

Active meters by size

Size	#
5/8"	768
3/4"	15
1"	5
2"	10
4"	2
6"	1
8"	1
total	802

Active meters by size

Size	#
5/8"	159

Active 5/8" meters by Consumption Tier

Number of Meters	Consumption	Tier (Gal)
0	High	1,496,000 - 2,244,000
3	Medium	748,000 - 1,496,000
677	Low	1 - 748,000
109	0	0

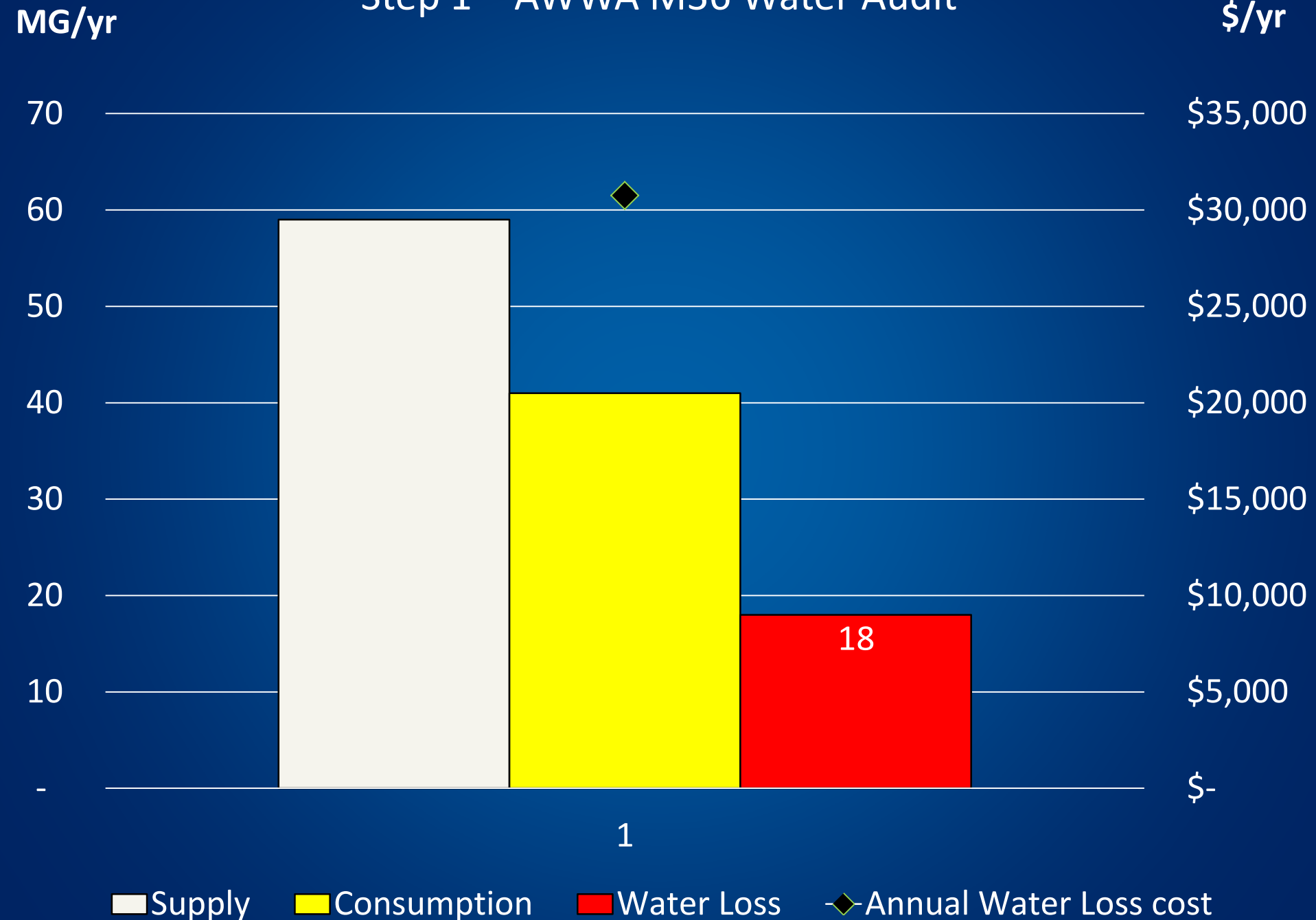
Medium Consumption Accounts:

DOS ARCOS	WA	ACTIVE	1311 MALCOLM BLVD	3/4"
ALAN F JACKS MD	WA	ACTIVE	1776 CASTLE DR	5/8"
RUTHERFORD CLG SPRINKLER SYS	BOTH	ACTIVE	980A MALCOLM BLVD	5/8"

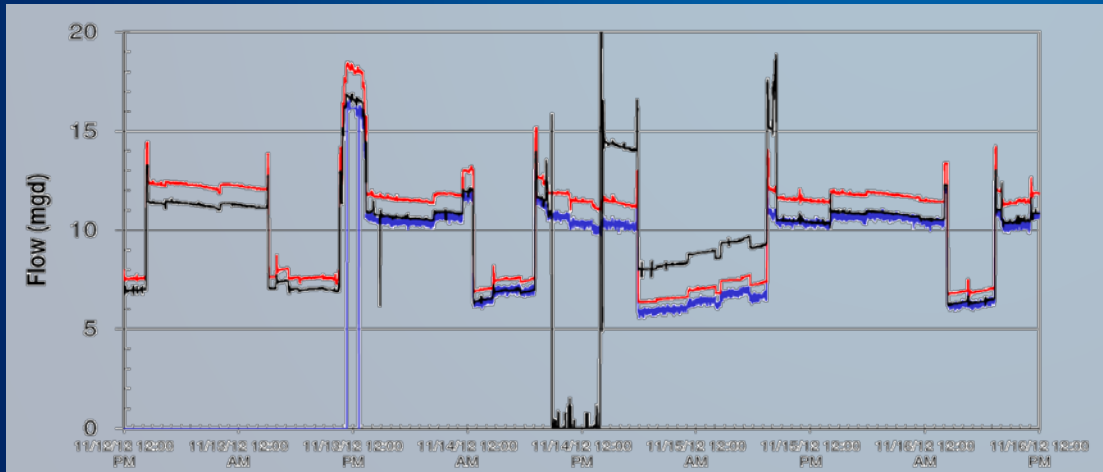
Annual volume and revenue by meter class

Class	Volume (Gal)	Revenue (\$)	% Volume	% Revenue
small	30,653,000	375,037	74 %	88 %
large	10,769,000	51,557	26 %	12 %

Step 1 – AWWA M36 Water Audit



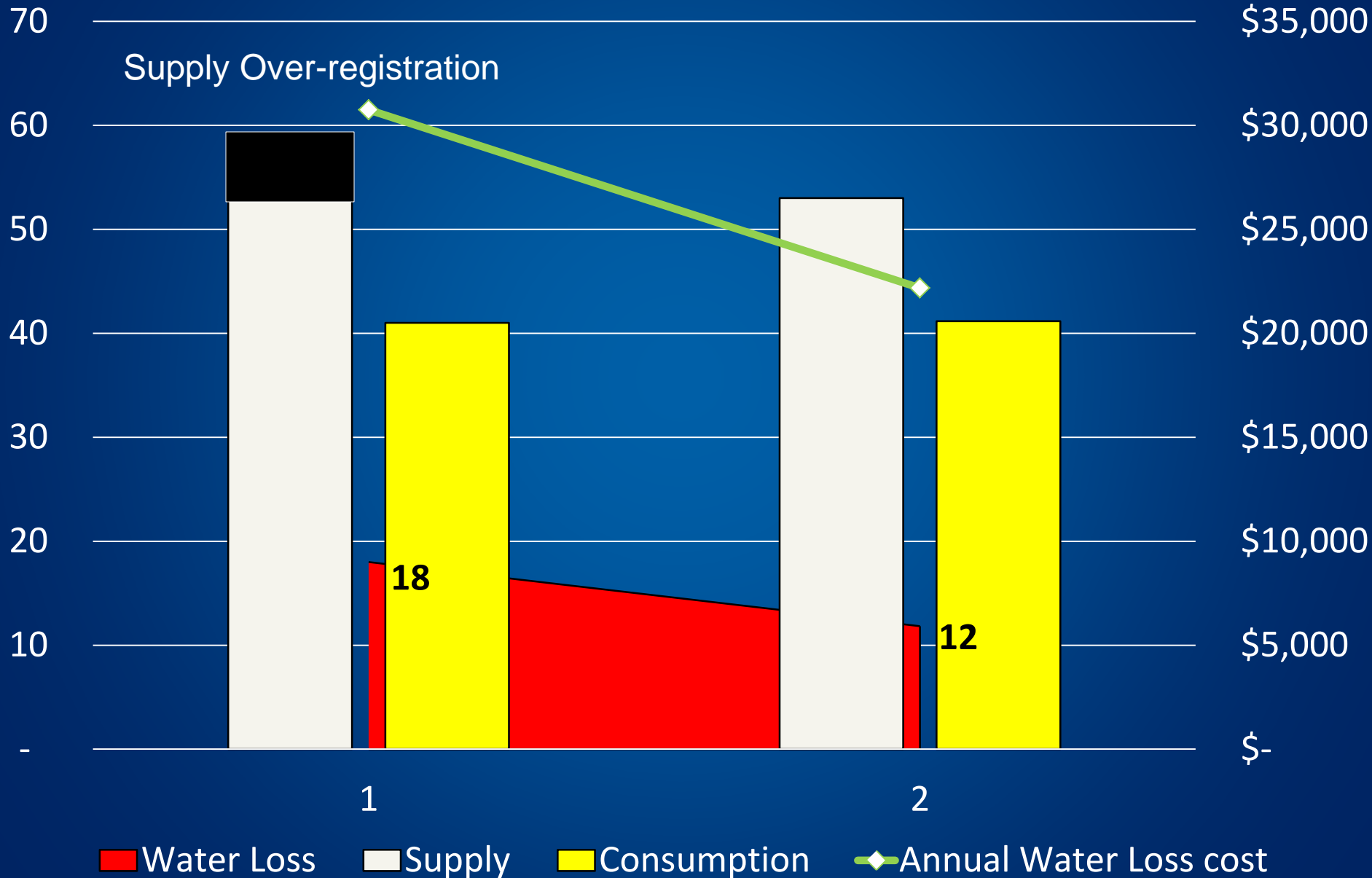
Step 2 – Supply Volume Verification



Step 2 – Supply Volume Verification

MG/yr

\$/yr



Step 3 – Bottom Up Meter Testing/Repair

Rutherford College Large Meter Test Results

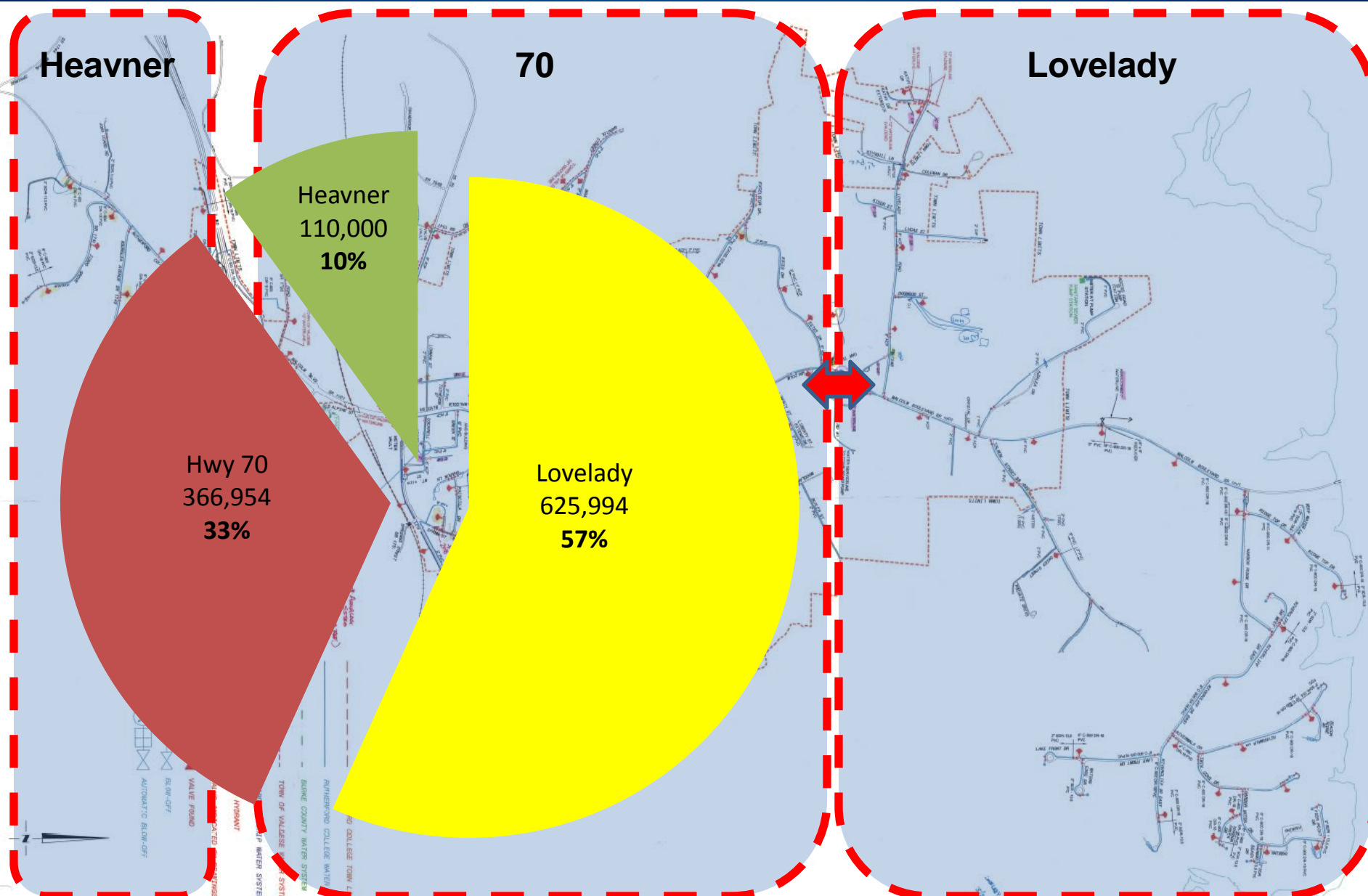
June-12

June-12					Flowrate (gpm):									Estimated	
ID	CUSTNAME	MAKE	MODEL	SIZE	1.5	2	6	10	20	50	100	160	300	Typ Flow	Overall Accuracy
PURCHASE	HWY 70	Badger	Turbine	8"					50.0%	100.0%	100.0%		100.0%	154	100.0%
PURCHASE	HEAVNER AVE	Sensus	Compound	6"	33.0%		60.0%	50.0%		93.0%	101.0%		100.0%	28	80.0%
05-000880	JACK HUFFMAN	Sensus	Omni	2"		100.0%		100.0%		80.0%	78.0%			2	100.0%
02-000320	BURKE COUNTY PUBLIC SCHOOLS	Sensus	Omni	2"		100.0%		98.0%		98.0%		98.5%		2	100.0%
02-000330	BURKE COUNTY PUBLIC SCHOOLS	Invensys				100.0%		100.0%		98.0%		101.0%		3	100.0%
04-000090	WESTERN PIEDMONT CLINIC	Sensus	Omni	2"		100.0%		98.0%		98.0%		99.0%		2	99.0%

Small Meter Testing Results

Flow Test		10 gpm		2 gpm			1/4 gpm			Overall Average Accuracy (%)
Meter ID#	Start Reading	Finish Reading	Accuracy (%)	Start Reading	Finish Reading	Accuracy (%)	Start Reading	Finish Reading	Accuracy (%)	
9642842	840.50	850.50	100%	850.50	860.50	100%	860.60	870.60	100%	100%
6920338529	510.00	520.00	100%	521.00	531.10	101%	532.00	541.30	93%	95%
10032337	960.10	970.10	100%	970.20	980.20	100%	9,080.40	9,090.30	99%	99%
69232926	846.00	856.10	101%	858.00	868.10	101%	871.00	880.70	97%	98%
13898631	840.40	850.40	100%	850.40	860.40	100%	860.40	870.25	99%	99%
32038519	305.00	315.00	100%	315.00	325.10	101%	327.00	336.10	91%	94%
55128122	517.00	527.10	101%	528.00	538.10	101%	540.00	549.90	99%	100%
518146	870.00	880.00	100%	881.00	891.10	101%	893.00	902.80	98%	99%
5528238	82.00	92.10	101%	493.00	503.10	101%	504.00	513.70	97%	98%
1590213	391.00	401.10	101%	402.00	412.10	101%	414.00	423.80	98%	99%
882273	40.30	50.30	100%	150.40	160.40	100%	170.70	177.40	67%	77%
38508	26.00	36.00	100%	837.00	847.10	101%	850.00	859.00	90%	93%
2071460	725.00	735.00	100%	736.00	746.20	102%	747.00	756.50	95%	97%
74223	650.40	660.40	100%	660.50	670.50	100%	670.60	680.55	99%	100%
5869403	2,080.70	2,090.70	100%	2,090.80	2,100.80	100%	900.90	910.80	99%	99%
3147783	804.00	814.00	100%	816.00	826.00	100%	827.60	836.50	89%	92%
69881889	770.00	780.10	101%	781.00	791.10	101%	792.00	801.85	99%	99%
39209379	961.00	971.00	100%	972.00	981.70	97%	983.00	991.20	82%	87%
10374073	390.30	400.30	100%	400.40	410.40	100%	410.60	420.40	98%	99%
55128118	32.00	42.10	101%	44.00	54.00	100%	56.00	65.70	97%	98%

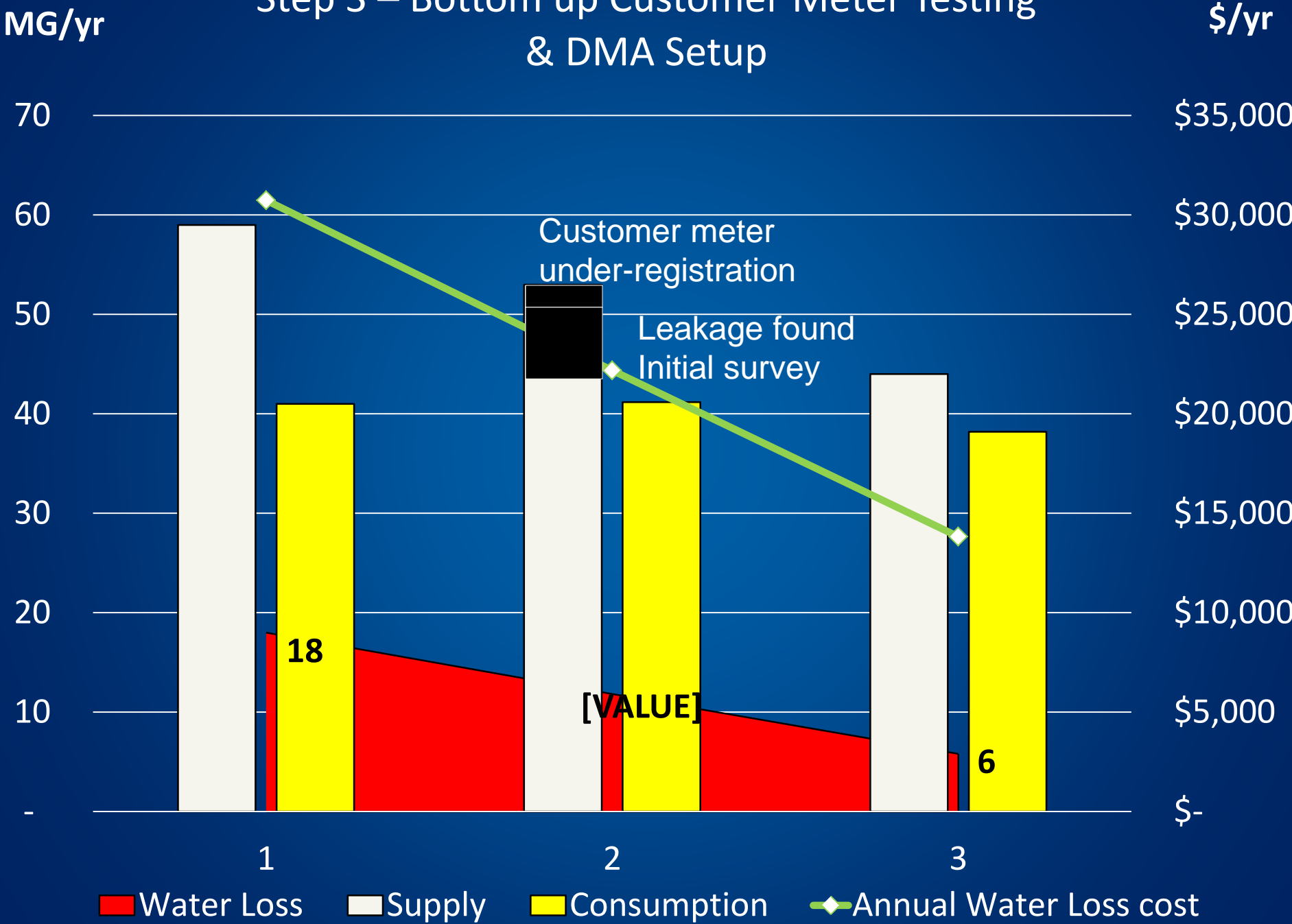
Step 3 – Establishment of District Metered Areas (DMAs)



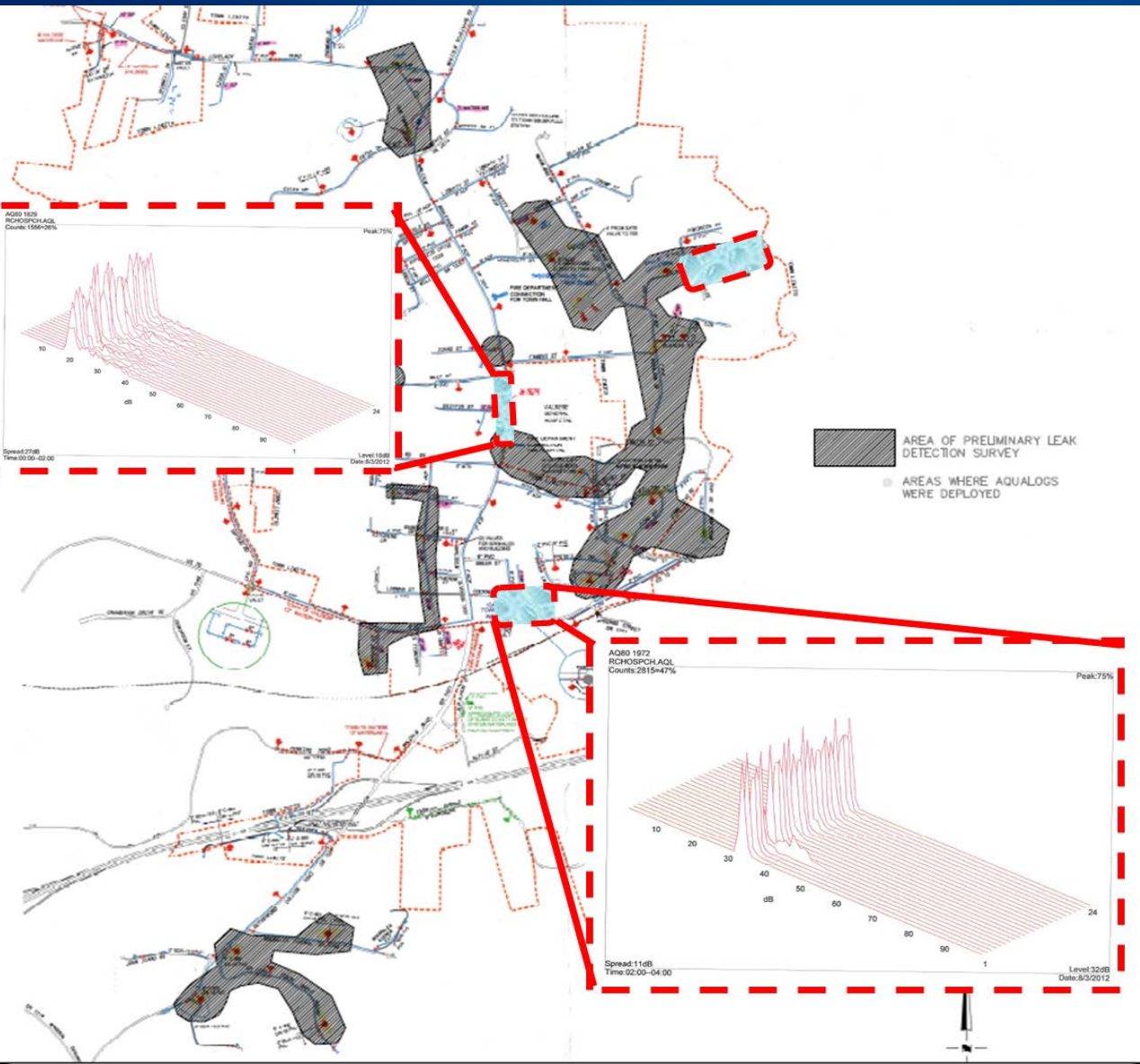
Step 3 – Establishment of District Metered Areas (DMAs)



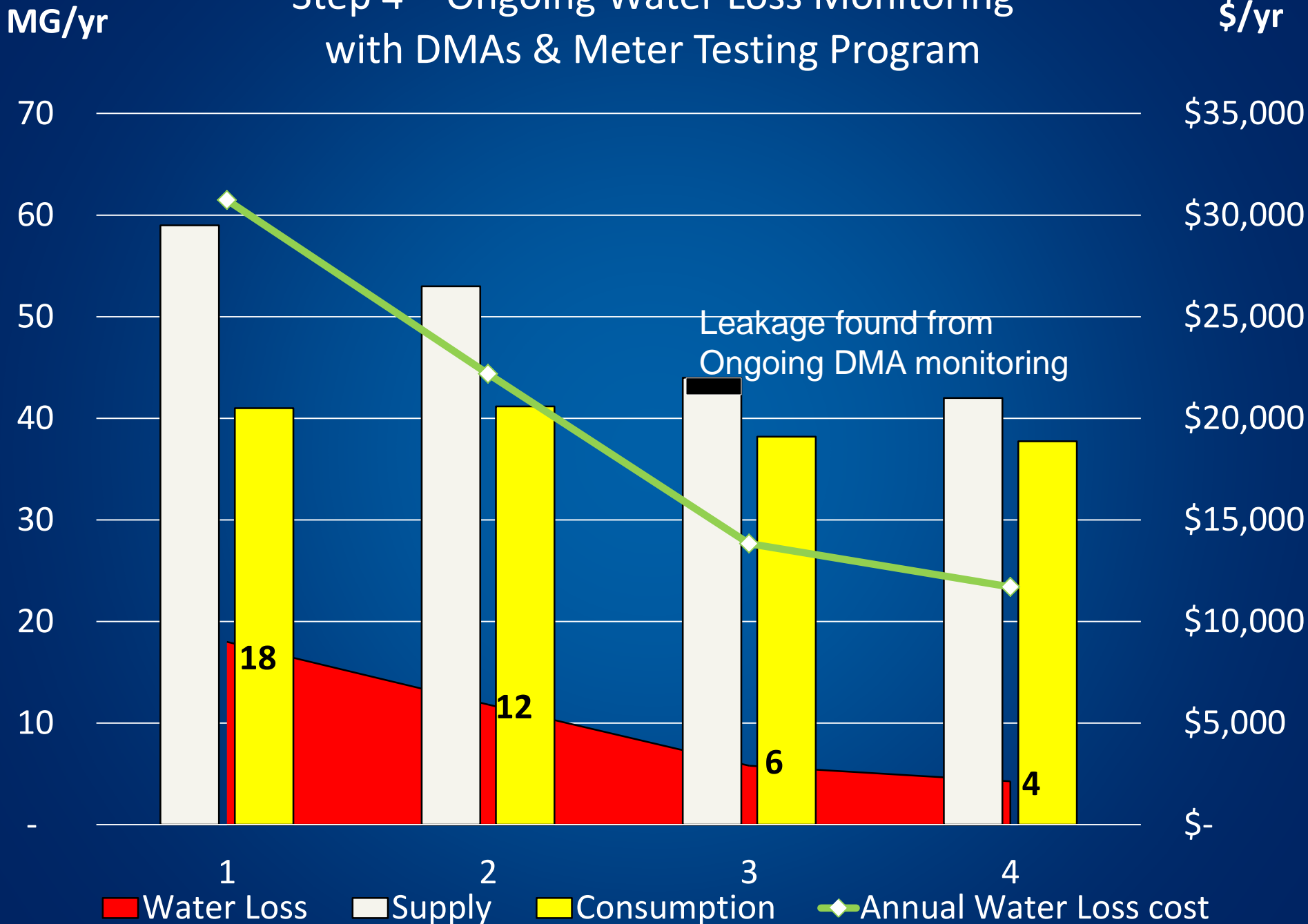
Step 3 – Bottom up Customer Meter Testing & DMA Setup



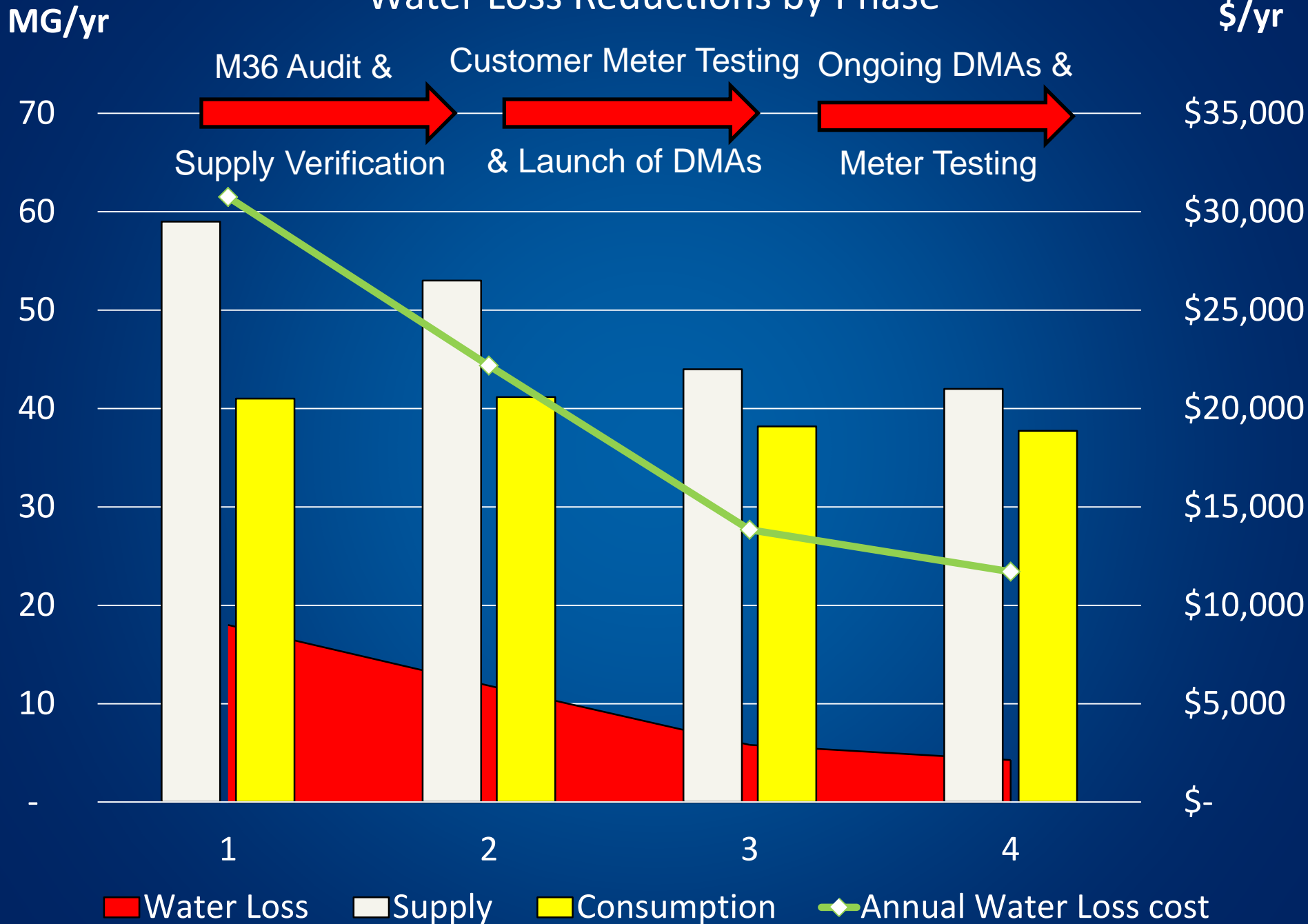
Step 4 – Ongoing DMA Monitoring & Customer Meter Testing



Step 4 – Ongoing Water Loss Monitoring with DMAs & Meter Testing Program



Water Loss Reductions by Phase





Drivers that Compel Change

Water Loss Insanity

Small Southeast Town Gets Intense about Water Loss



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CAVANAUGH

Stewardship Through Innovation