



Water Loss Control Tools

Software Tools for Supply Side Efficiency

Today's Goals

- 1) What is Water Loss? (10 min)
- 2) Water Loss Baseline – AWWA Audits (20 min)
- 3) Intervention Strategies – WRF Model (20 min)
- 4) Questions & Discussion throughout!

Water Systems Optimization

- ❖ Water Loss Audits
- ❖ Design and Implementation of Water Loss Control Programs
- ❖ Leak Detection
- ❖ Pressure Management Schemes
- ❖ Source Meter Testing
- ❖ Revenue Enhancement Programs



What Is Non-Revenue Water (NRW) ???



What Is Non-Revenue Water (NRW)?

- ❖ Non Revenue Water consists of:

- ❖ Real Losses



- ❖ Apparent Losses



Apparent Losses



Real Losses



Benefits of Water Loss Control

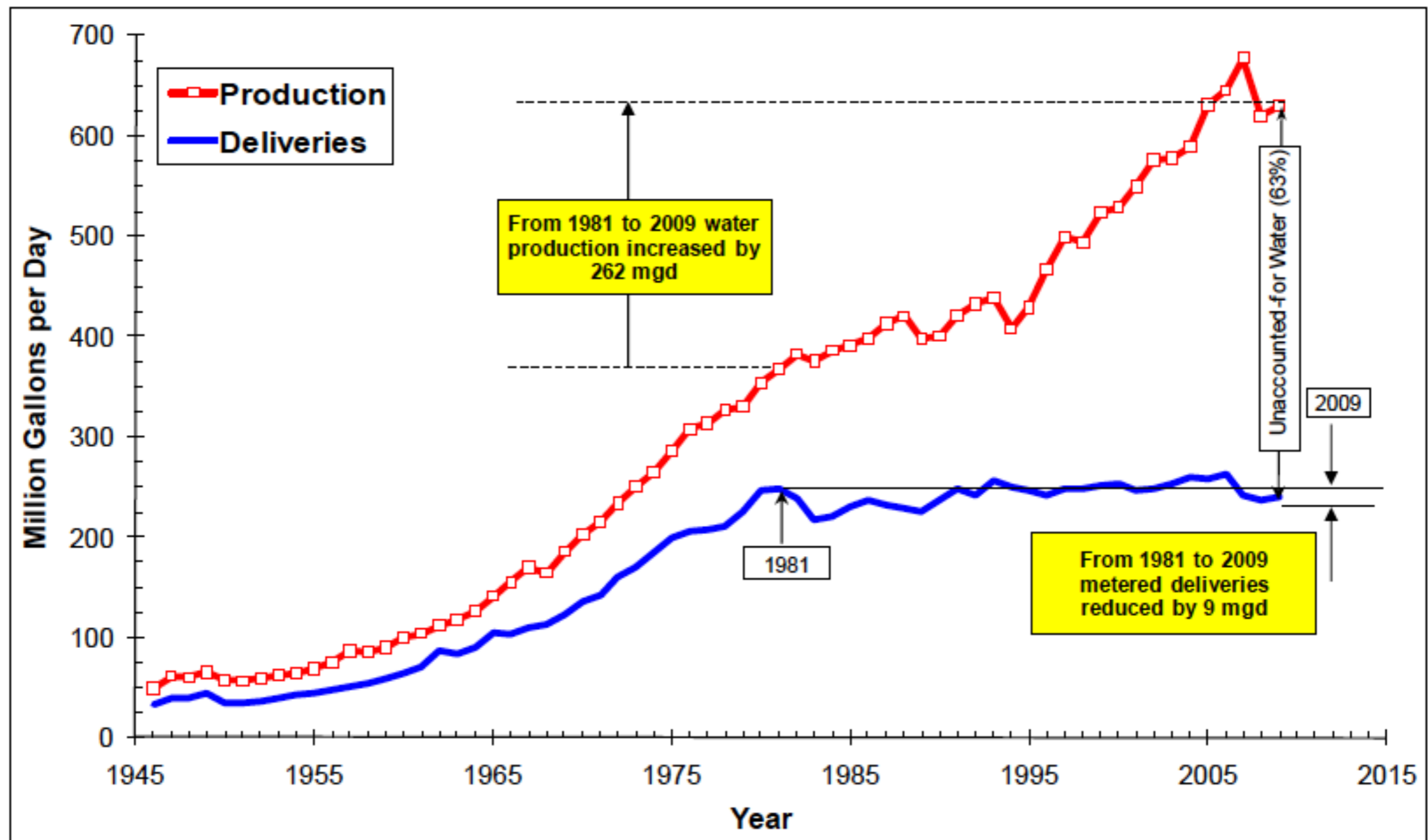
REAL LOSSES

- ❖ Saves WATER!
- ❖ Creates an additional supply – defers capital expenditures and marginal supply development

APPARENT LOSSES

- ❖ Does not save water
- ❖ Optimizes REVENUE GENERATION

What Can Happen without NRW Management?



Source: PRASA.

Benefits of NRW Management

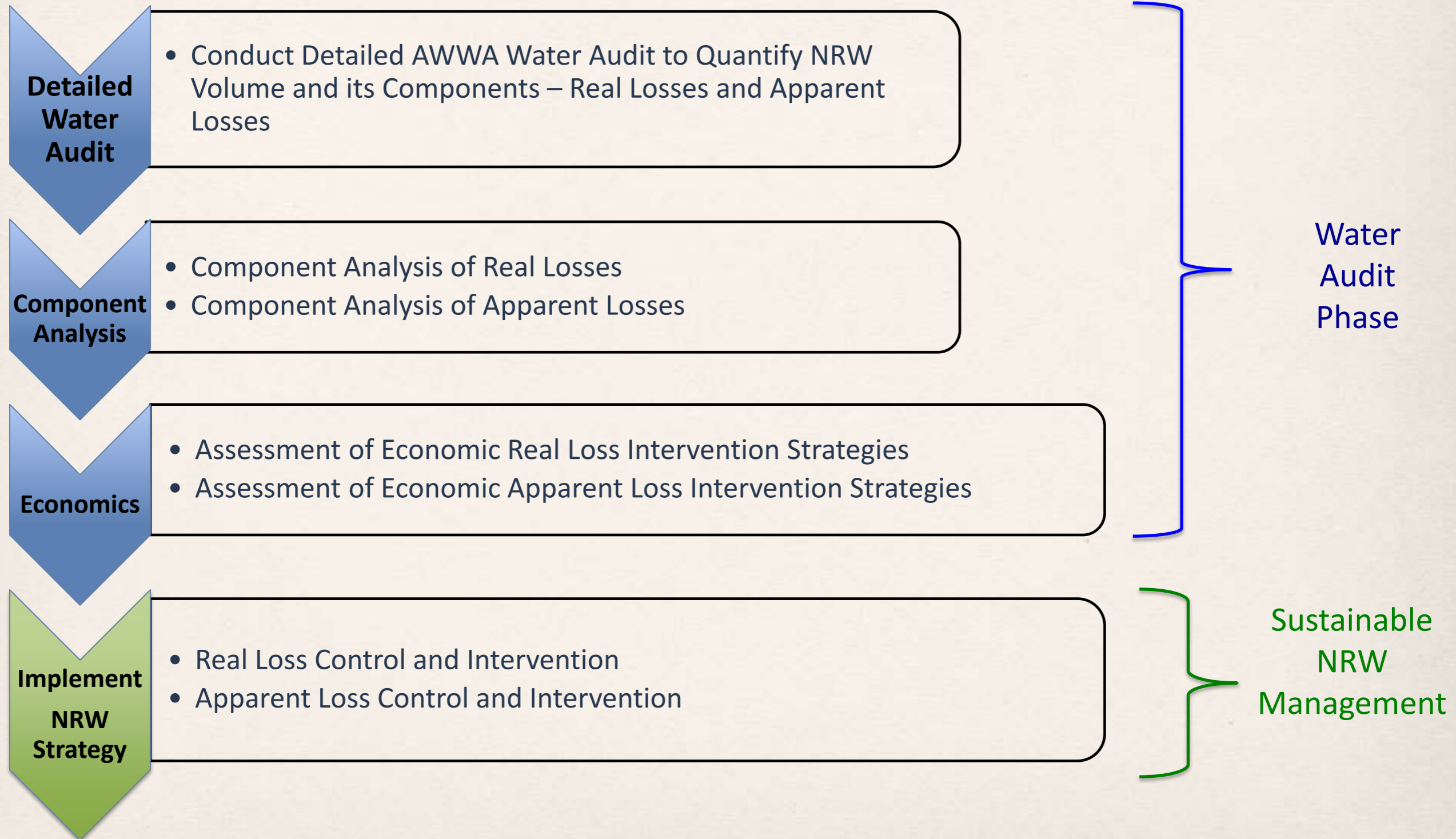
Save Water

Reduce Costs

Culture of
Accountability

- ❖ Identify what you DON'T know
- ❖ Comprehensive understanding of your system
- ❖ Financial Benefits – Reduction in O&M & CIP costs
- ❖ Better Asset Management
- ❖ Optimized Meter Replacement/Management
- ❖ Water Conservation (Supply Side & Demand Side)
- ❖ Sustainability (Water/Energy Nexus)
- ❖ Be Ahead of Regulatory Arena
- ❖ Less Liability
- ❖ Build Credibility with Stakeholders and Regulators

How Can We Strategically Manage NRW??



Best Practice Tools for Water Loss Control

❖ AWWA M36 Publication

- ❖ Water Audits and Loss Control Programs (2009), 3rd Edition features the IWA/AWWA Water Audit Methodology

❖ AWWA Water Loss Control Committee's Free Water Audit Software©

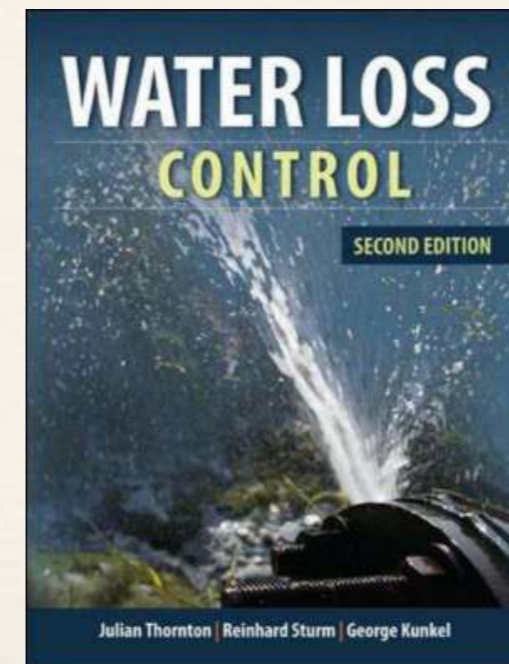
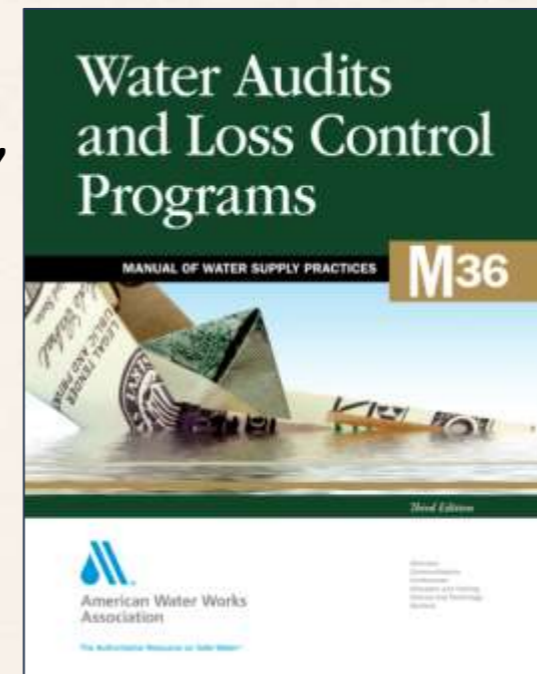
- ❖ Current version is 5.0 in English
- ❖ Includes data grading capability
- ❖ Companion "Compiler" Software

❖ Water Research Foundation Reports

- ❖ Project 2811: Evaluating Water Loss and Planning Loss Reduction Strategies
- ❖ Project 2928: Leakage Management Technologies

- ❖ WRF 4372 published in May 2014

❖ Textbooks



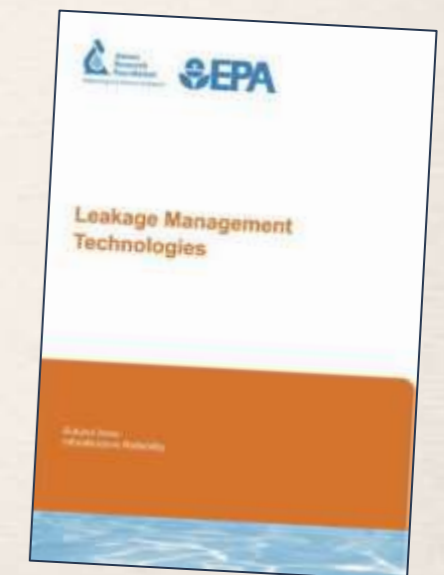
AWWA WLCC Water Audit Software: Reporting Worksheet

Water Audit Report For: Philadelphia Water Department

Reporting Year: 2004

ALL VOLUMES TO BE ENTERED AS ANNUAL QUANTITIES

Category	Item	Value	Unit
WATER SUPPLIED	Volume from own sources	95,326.2	million gallons (MG) per year
	Master meter error adjustment	695.4	million gallons (MG) per year
	Water Imported	0.0	million gallons (MG) per year
	Water Exported	7,210.2	million gallons (MG) per year
WATER SUPPLIED:		98,031.2	million gallons (MG) per year
AUTHORIZED CONSUMPTION	Billed metered	57,335.2	million gallons (MG) per year
	Billed unmetered	0.0	million gallons (MG) per year
	Unbilled metered	179.3	million gallons (MG) per year
	Unbilled unmetered	693.1	million gallons (MG) per year
AUTHORIZED CONSUMPTION:		58,408.1	million gallons (MG) per year
WATER LOSSES (Water Supplied - Authorized Consumption):		39,623.1	million gallons (MG) per year
Apparent Losses	Unauthorized consumption	1,145.2	million gallons (MG) per year
	Customer metering inaccuracies	162.0	million gallons (MG) per year
	Data handling errors	2,751.2	million gallons (MG) per year
	Apparent Losses	4,058.4	million gallons (MG) per year
Real Losses (Water Losses - Apparent Losses):		26,344.2	million gallons (MG) per year
WATER LOSSES:		30,403.1	million gallons (MG) per year
NON-REVENUE WATER:		31,476.0	million gallons (MG) per year
SYSTEM DATA	Length of mains	3,160.0	miles
	Number of active AND inactive service connections	540,289	
	Connection density	170	connections/mile main
	Average length of private pipe	12.0	ft
Average operating pressure:		55.0	psi
COST DATA			
Total annual cost of operating water system:		\$167,604,000	/Year
Customer retail unit cost (applied to apparent losses):		\$3.95	/1000 gallons (MG)
Variable production cost (applied to real losses):		\$133.58	/Million gallons (MG)
DATA REVIEW - Please review the following information and make changes above if necessary:			
- Input values should be indicated as either measured or estimated. You have entered:			
# as measured values			
0 without specifying measured or estimated			
- It is important to accurately measure the master meter - you have entered the measurement type as: measured			
- Cost Data: No problems identified			
PERFORMANCE INDICATORS			
Financial Indicators			
Non-revenue water as percent by volume:		30.41	
Non-revenue water as percent by cost:		21.71	
Annual cost of Apparent Losses:		\$26,020,510	
Annual cost of Real Losses:		\$3,945,760	
Operational Efficiency Indicators			
Apparent losses per service connection per day:		20.23	gallons/connection/day
Real losses per service connection per day:		132.61	gallons/connection/day
Real losses per length of main per day:		N/A	
Real losses per service connection per day per psi pressure:		2.41	gallons/connection/day/psi
Unavoidable Annual Real Losses (UARL):		5.91	million gallons/day
Infrastructure Leakage Index (ILI) (Real Losses/UARL):		12.17	



The Water Balance

		Billed Authorized Consumption	Billed Metered Authorized Consumption	REVENUE WATER	
	Authorized Consumption		Billed Unmetered Authorized Consumption		
SYSTEM INPUT VOLUME		Unbilled Authorized Consumption	Unbilled Metered Authorized Consumption	NON-REVENUE WATER	
			Unbilled Unmetered Authorized Consumption		
	Water Losses	Apparent Losses			Consumption Metering Errors
					Unauthorized Consumption
					Systematic Data Handling Errors
		Real Losses			Leakage/Overflow at Reservoirs
					Leakage from Trunk Mains
					Leakage from Distribution Mains
		Leakage from Service Connections			

Water Balance Validation

SYSTEM INPUT VOLUME	Authorized Consumption	Billed Authorized Consumption	Billed Metered Authorized Consumption	
			Billed Unmetered Authorized Consumption	
		Unbilled Authorized Consumption	Unbilled Metered Authorized Consumption	
			Unbilled Unmetered Authorized Consumption	
	Water Losses	Apparent Losses		Consumption Metering Errors
				Unauthorized Consumption
				Systematic Data Handling Errors
		Real Losses		Leakage/Overflow at Reservoirs
				Leakage from Trunk Mains
				Leakage from Distribution Mains
		Leakage from Service Connections		

System Input Volume

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

Volume from own sources: MG/yr
Water imported: MG/yr
Water exported: MG/yr

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

Master Meter and Supply Error Adjustments

		Pcnt:			Value:	
<input type="button" value="+"/>	<input type="button" value="?"/>	-2.00%	<input type="button" value="*"/>	<input type="button" value="o"/>	<input type="text" value=""/>	MG/yr
<input type="button" value="+"/>	<input type="button" value="?"/>		<input type="button" value="*"/>	<input type="button" value="o"/>	<input type="text" value=""/>	MG/yr
<input type="button" value="+"/>	<input type="button" value="?"/>		<input type="button" value="*"/>	<input type="button" value="o"/>	<input type="text" value=""/>	MG/yr

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

WATER SUPPLIED:

1,020.408 MG/yr

↑
ACCURACY OF METERS IS CRITICAL!

System Input Validation

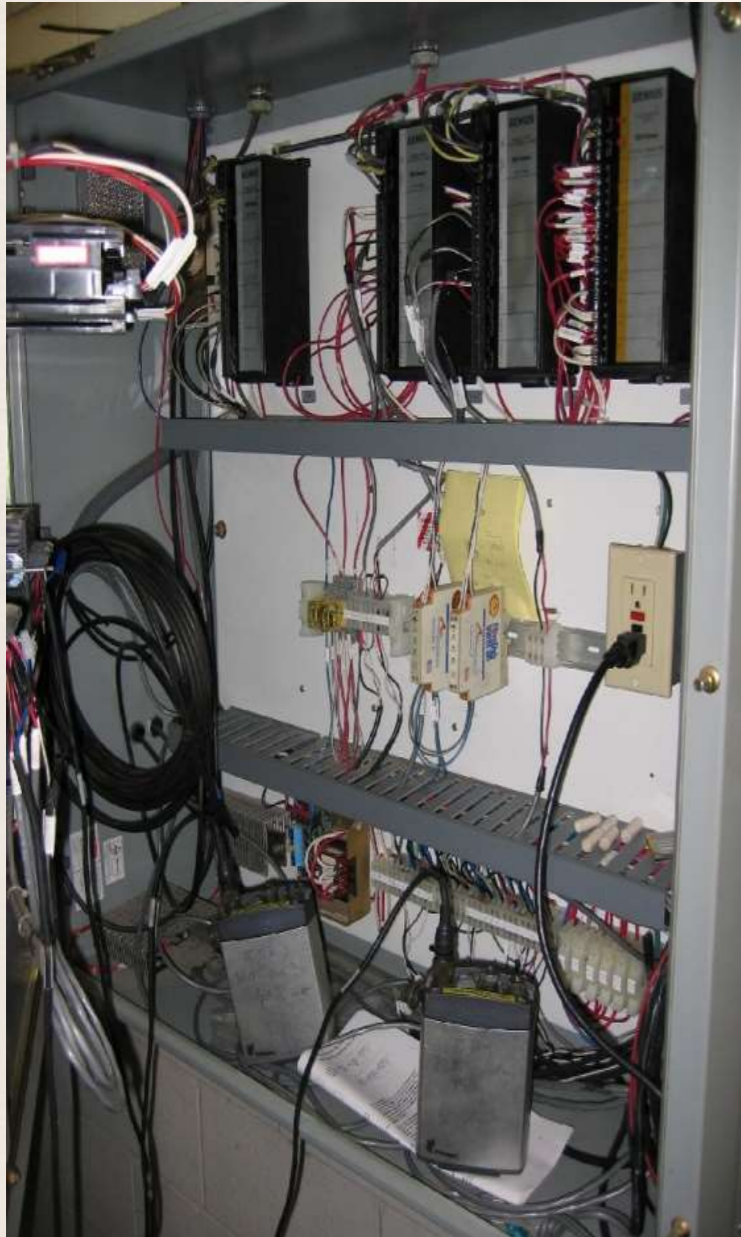
Volumetric Meter Test



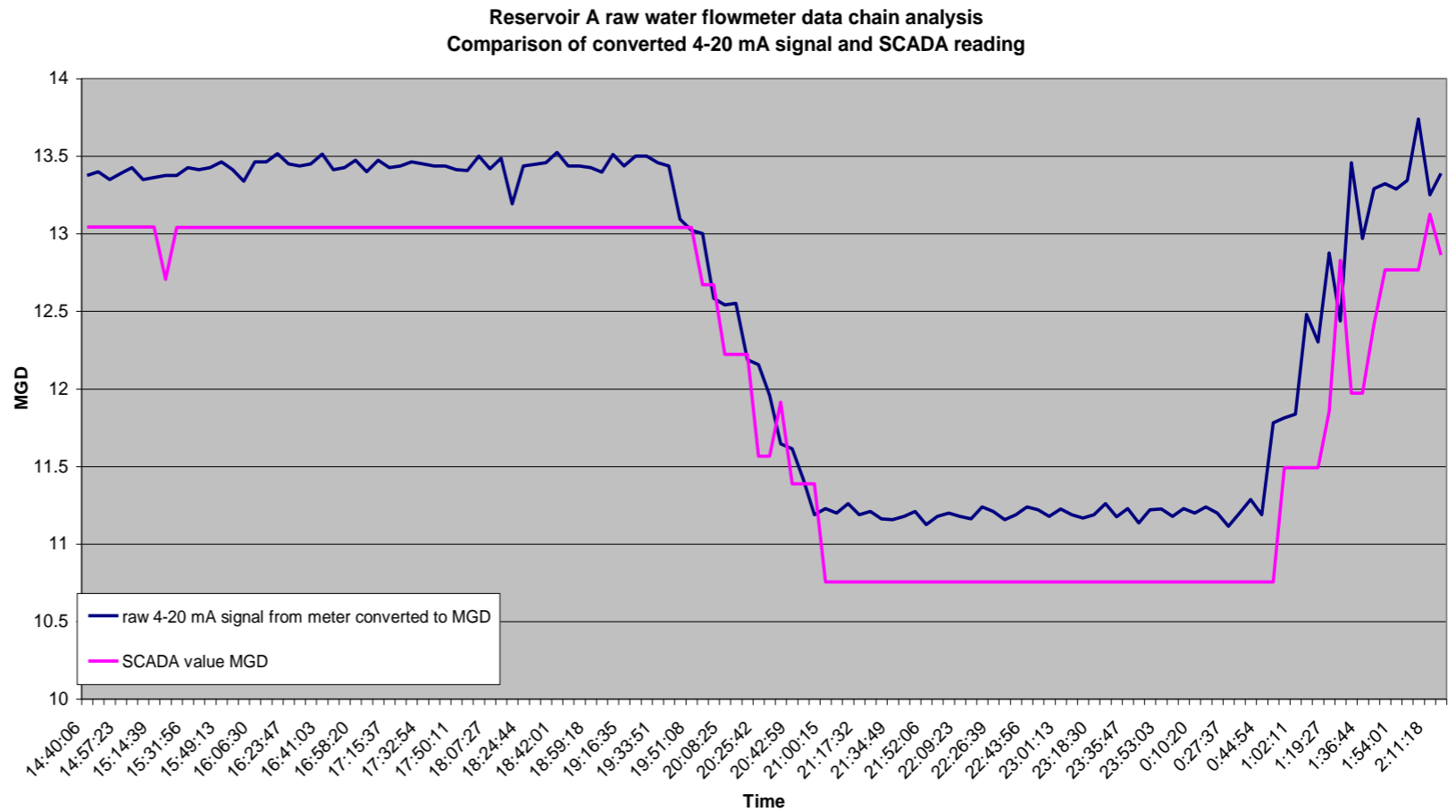
Comparative Meter Test



Challenge Data Transfer Accuracy



$$\text{Flow Rate (MGD)} = \left[\frac{((4\text{-}20\text{mA signal}) - 4)}{16} \right] * \text{Maximum Calibration Flow-range (MGD)}$$



Billing Data Validation

SYSTEM INPUT VOLUME	Authorized Consumption	Billed Authorized Consumption	Billed Metered Authorized Consumption	
			Billed Unmetered Authorized Consumption	
		Unbilled Authorized Consumption	Unbilled Metered Authorized Consumption	
			Unbilled Unmetered Authorized Consumption	
	Water Losses	Apparent Losses		Consumption Metering Errors
				Unauthorized Consumption
				Systematic Data Handling Errors
		Real Losses		Leakage/Overflow at Reservoirs
				Leakage from Trunk Mains
				Leakage from Distribution Mains
		Leakage from Service Connections		

Billing Data Validation

❖ Export Raw Billing Data

- Customer identification fields
- Meter identification fields
- Service type identification fields
- Meter read and consumption fields – units
- Trouble codes or flags

❖ Checks on Accuracy

- Remove Financial Adjustments
- Consider Exclusion of Accounts (Recycled? System?)
- Consider lag between read date and start and end of audit period
- Consumption volumes by meter size and model
- Consumption volumes by meter size and revenue class

Billing Data Validation

SYSTEM INPUT VOLUME	Authorized Consumption	Billed Authorized Consumption	Billed Metered Authorized Consumption	
			Billed Unmetered Authorized Consumption	
		Unbilled Authorized Consumption	Unbilled Metered Authorized Consumption	
			Unbilled Unmetered Authorized Consumption	
	Water Losses	Apparent Losses		Consumption Metering Errors
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		Real Losses		Leakage/Overflow at Reservoirs
				Leakage from Trunk Mains
				Leakage from Distribution Mains
		Leakage from Service Connections		

Apparent Loss Validation

Meter Size	Meter Population	Test Sample Size	Volume-Weighted Average Accuracy	95% Confidence Limit of Accuracy
5/8"	13,548	66	92.0%	4.0%
3/4"	1,392	10	100.0%	0.4%
1"	2,145	20	96.9%	4.2%
1-1/2"	311	5	94.0%	3.8%
2"	391	13	97.6%	1.7%



Apparent Loss Validation

Meter Size	Total Volume Supplied through meters during audit period (MG)	Average Accuracy based on meter test results	Apparent Losses during audit period (MG)
5/8"	691.532	92.0%	59.725
3/4"	94.104	100.0%	-
1"	314.740	96.9%	10.136
1-1/2"	133.960	94.0%	8.535
2"	295.894	97.6%	7.214
Total	1,530.230		85.610



Water Balance Complete

SYSTEM INPUT VOLUME	Authorized Consumption	Billed Authorized Consumption	Billed Metered Authorized Consumption
			Billed Unmetered Authorized Consumption
		Unbilled Authorized Consumption	Unbilled Metered Authorized Consumption
			Unbilled Unmetered Authorized Consumption
		Apparent Losses	Consumption Metering Errors
			Unauthorized Consumption
	Systematic Data Handling Errors		
	Water Losses	Real Losses	Leakage/Overflow at Reservoirs
			Leakage from Trunk Mains
			Leakage from Distribution Mains
			Leakage from Service Connections

Performance Indicators

- ❖ AWWA Recommended Performance Indicators
 - ❖ Real Losses/service conn/day
 - ❖ Apparent Losses/service conn/day
 - ❖ Infrastructure Leakage Index (ILI)

$$ILI = CARL/UARL$$



Performance Indicators



	MGD	%		MGD	%	
System Input	100	100%		System Input	100	100%
Sales	70	70%		Sales	70	70%
Non-Revenue Water	30	30%		Non-Revenue Water	30	30%

Performance Indicators



50



	MGD	%		MGD	%	
System Input	100	100%		System Input	150	100%
Sales	70	70%		Sales	120	80%
Non-Revenue Water	30	30%		Non-Revenue Water	30	20%

Performance Indicators

Utility	% Real Losses	ILI	ELL
A	23%	6	Close to ELL
B	23%	8	Close to ELL
C	36%	2	Close to ELL
D	4%	1.6	Close to ELL
E	22%	2.7	Above ELL
F	5%	1.7	Above ELL
G	7%	3.2	Above ELL

WRF Project Review: #4372a

Effective Organization & Component Analysis of Utility Leakage Data

PROJECT BASICS:

- *Funded by the WRF and EPA*
- *Model Release & Report Publishing in June 2014*
- *Webinar on June 19 2014*

PROJECT GOALS:

- Provide utilities software model for component analysis of real losses
- Provide informative context for performance indicator results
- Develop the software model to optimize use (prioritizing accessibility and adoption)

PARTICIPATING UTILITIES:

- Eastern Municipal Water District
- Metro Water Services, Nashville TN
- Halifax Regional Water Commission
- City of Folsom Utilities Dept
- San Antonio Water System
- Lake Arrowhead Community Services District
- S. Central CT Regional Water Authority
- City of Phoenix Water Services Dept
- Austin Water Utility
- Water & Wastewater Authority of Wilson County

Downloading the 4372 Materials

www.waterrf.org, then search for 4372 or real losses



Water Audits and Real Loss Component Analysis - 4372

Completion Year
2013

Research Value
\$544,023

Research Manager
Maureen Hodgins

Contractor
Water Systems Optimization Inc.

The purpose of this project is to help the North American water industry design efficient and sustainable leakage control programs. The project has been divided into two segments. Real Loss Component Analysis: A Tool for Economic Water Loss Control (Order #4372a) provides water utilities with an analysis tool to better understand the sources of their real losses (reported, un-reported, or background) and a means of analyzing their economic intervention strategies. This project improves the quality of standard leakage component analysis and complements the AWWA Water Audits and Loss Control Program (M36), 3rd edition. **In addition to the research report, the project produced two spreadsheet tools: a Component Analysis Model and the Leak Repair Data Collection Guide, which are available on this project page under Project Resources/Web Tools.** 4372a was published in June 2014. Analysis of U.S. Water Audits (Order #4372b) will provide a national snapshot of IWA/AWWA water audit results including key performance indicators and benchmarks and summarize state regulations as of 2013. Data sources include approximately 2,500 water audits submitted to the California Urban Water Conservation Council, Georgia EPA, Texas Water Development Board, Tennessee Comptroller of the Treasury, and the Delaware River Basin Commission from 2011-2013. 4372b will be available in Fall 2015. Research partner: EPA.

Report Name	Report #	Available	Order Report	Download PDF	Executive Summary
 Real Loss Component Analysis: A Tool for Economic Water Loss Control	4372a	5/30/2014			

Project Resources

Webcasts (1)

What are the Best Economic Options for Managing Leakage?

Web Tools (2)

Leak Repair Data Collection Guide

Component Analysis Of Real Losses Software Model

The AWWA Water Balance

KEY
TOOL

		Billed Authorized Consumption	Billed Metered Authorized Consumption	REVENUE WATER
	Authorized Consumption	Billed Authorized Consumption	Billed Unmetered Authorized Consumption	
SYSTEM INPUT VOLUME	Consumption	Unbilled Authorized Consumption	Unbilled Metered Authorized Consumption	NON-REVENUE WATER
			Unbilled Unmetered Authorized Consumption	
	Apparent Losses	Consumption Metering Errors		
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	Water Losses	Real Losses	Leakage/Overflow at Reservoirs	
			Leakage from Trunk Mains	
			Leakage from Distribution Mains	
Leakage from Service Connections				

Water Loss Control Program Next Steps

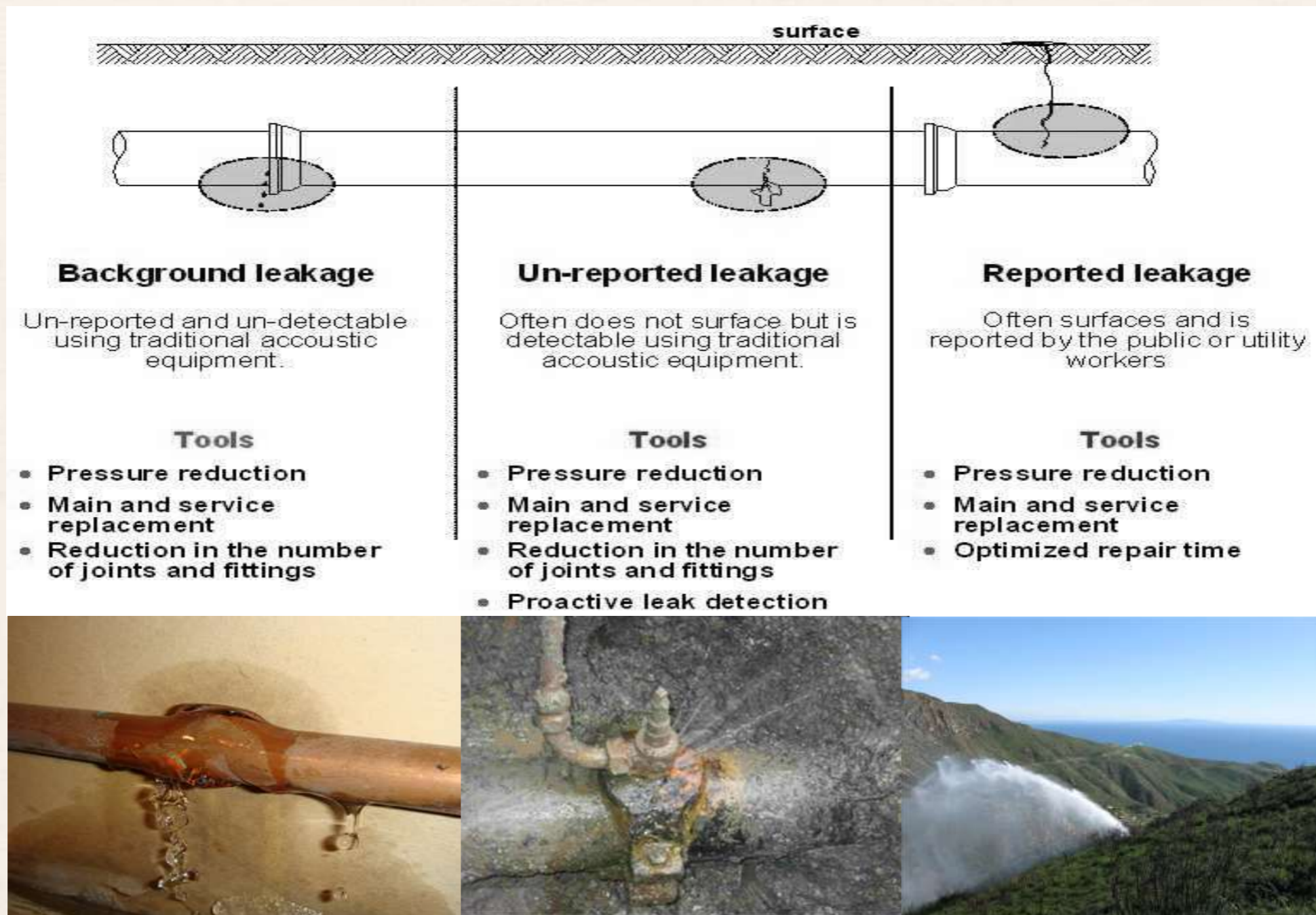
With A Completed AWWA Water Balance:

- ✓ Volume of Apparent Losses
- ✓ Volume of Real Losses
- ✓ Performance Indicators
- ✓ Data Validity Score

Remaining Assessments:

- ➔ Understanding of Real Loss Breakdown
(where are these losses occurring?
what types of leakage?)
- ➔ Evaluation of Cost-Effective Real Loss
Intervention Strategies
- ➔ Cost-Effective Non-Revenue Water
Reduction Strategies

Component Analysis of Real Losses



Key Points For Model Development

- Adoption of AWWA Free Water Audit Software & Importance of Data

Validation

- Contextualized Performance Indicators
 - Break Frequency Research
-

- Tools for developing water loss control strategies
 - ➔ Location & Response Time Improvement
 - ➔ Pressure Management
 - ➔ Proactive Leak Detection

Adoption of Software Methodology & Data Validation

- ❖ Review of statewide regulations and policies regarding water loss and the AWWA Free Water Audit software
- ❖ California Urban Water Conservation Council (CUWCC)
 - ❖ BMP 1.2: annual water audit submissions
 - ❖ Examined FY09-10 data

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%

Contextualized Performance Indicators

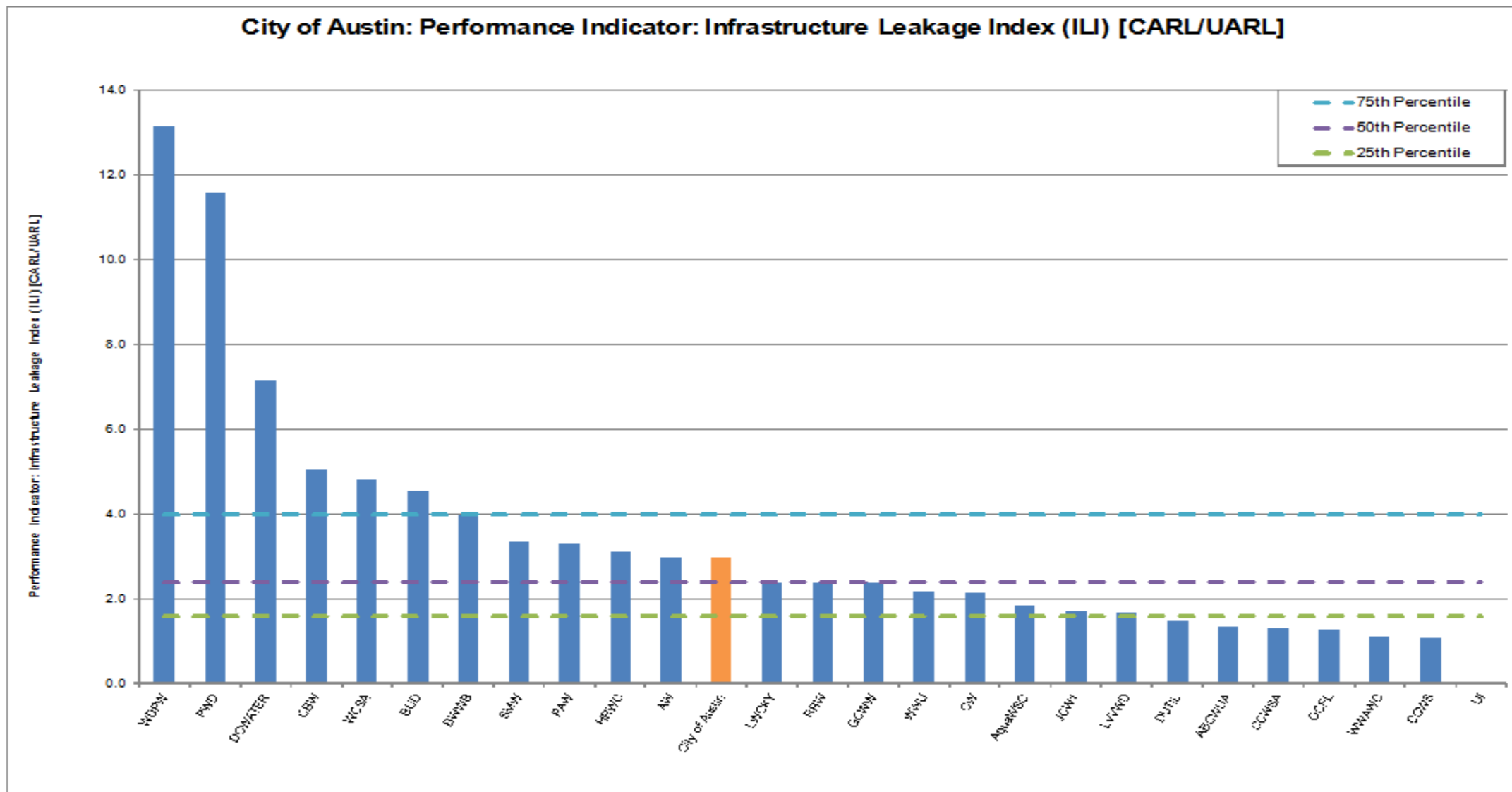
WaterRF 4372: Effective Organization and **Component Analysis of Water Utility Leakage Data**

Water Audit: City of Austin, TX, USA, 2011
PERFORMANCE INDICATOR COMPARISON

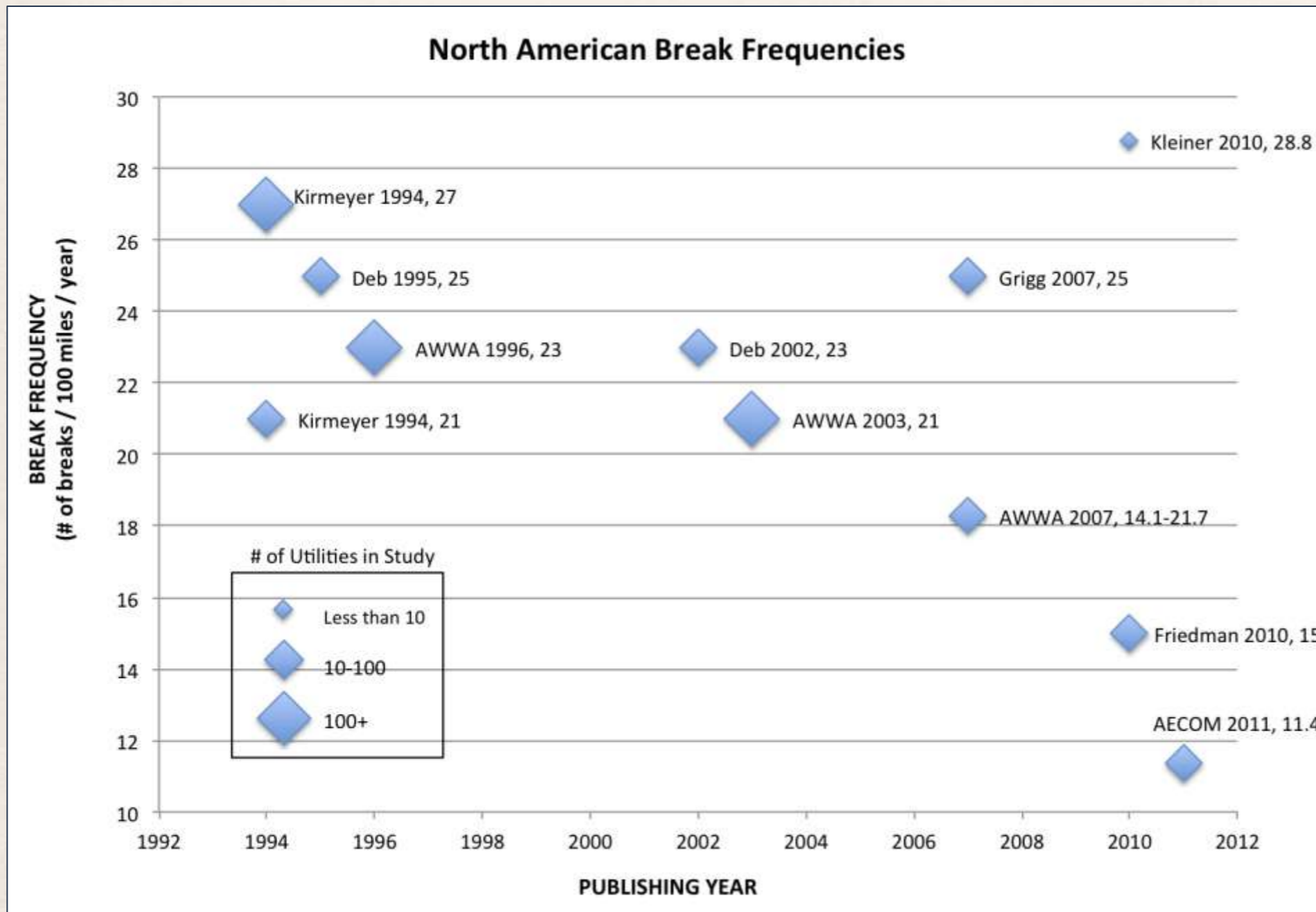
Instructions: Please select a performance indicator from the drop-down box to compare your utility's performance against the AWWA North American Validated Water Audit Data for 2012*. The performance indicator graph also displays the 25th, 50th and 75th percentile of the performance indicators data set.

Utility Name: City of Austin

Performance Indicator:



Break Frequency Research



- Focus on Predictive Models
- Terminology
- Data Collection Completeness

Break Frequency Research

WaterRF 4372: Effective Organization and Component Analysis of Water Utility Leakage Data

Water Audit: City of Austin, TX, USA, 2011
INFRASTRUCTURE FAILURE FREQUENCY ANALYSIS

	Value to be entered by the user
	Value is automatically filled in/calculated by Model
	Recommended default value

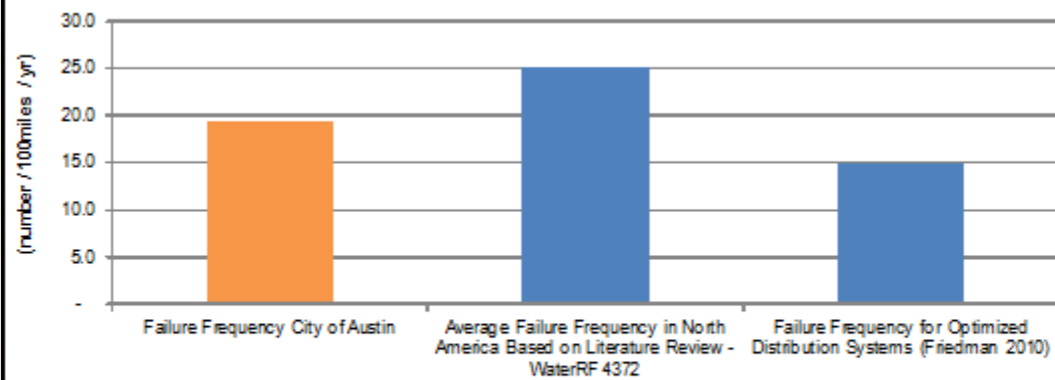
City of Austin

Total Number of Mains Failures Reported for Water Audit: City of Austin, TX, USA, 2011	707	
Total Length of Mains	3,649.0 (miles)	
Failure Frequency City of Austin	19.4 (number / 100miles / yr)	
Average Failure Frequency in North America Based on Literature Review - WaterRF 4372	25.0 (number / 100miles / yr)	
Failure Frequency for Optimized Distribution Systems (Friedman 2010)	15.0 (number / 100miles / yr)	

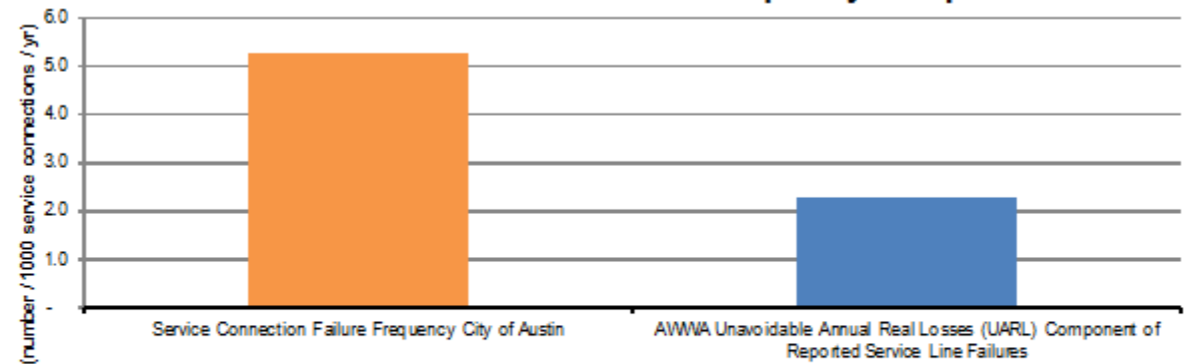
City of Austin

Total Number of Service Connection Failures Reported for Water Audit City of Austin, TX, USA, 2011	1,114	
Total Number of Service Connections	211,839 (service connections)	
Service Connection Failure Frequency City of Austin	5.3 (number / 1000 service connections / yr)	
AWWA Unavoidable Annual Real Losses (UARL) Component of Reported Service Line Failures	2.25 (number / 1000 service connections / yr)	
Ratio of Failure Frequency to UARL Break Frequency	2.3	

Mains Failure Frequency Comparison



Service Connection Failure Frequency Comparison



Participating Utility Insight

- ❖ Integrity and completeness of failure data
- ❖ Readiness of average utility
- ❖ Presentation of software as a TOOL not a REPORT!
- ❖ Estimation/assumption comfort

Real Losses Calculation for Reported & Un-Reported Leakage

Annual Real Loss Volume from Reported Leaks =

*# of leaks by size * average run time * average flow rate (at average system pressure)*

Leakage Occurrence	Pipe Diameter	# of Events	Flow Rate (gpm)	Average Run Time (hrs)	Annual Leakage (MG)
Mains Breaks	8"	6	46	8.25	3.3

↑
Failure Repair Records

↑
Estimated based on pipe size using BABE methodology

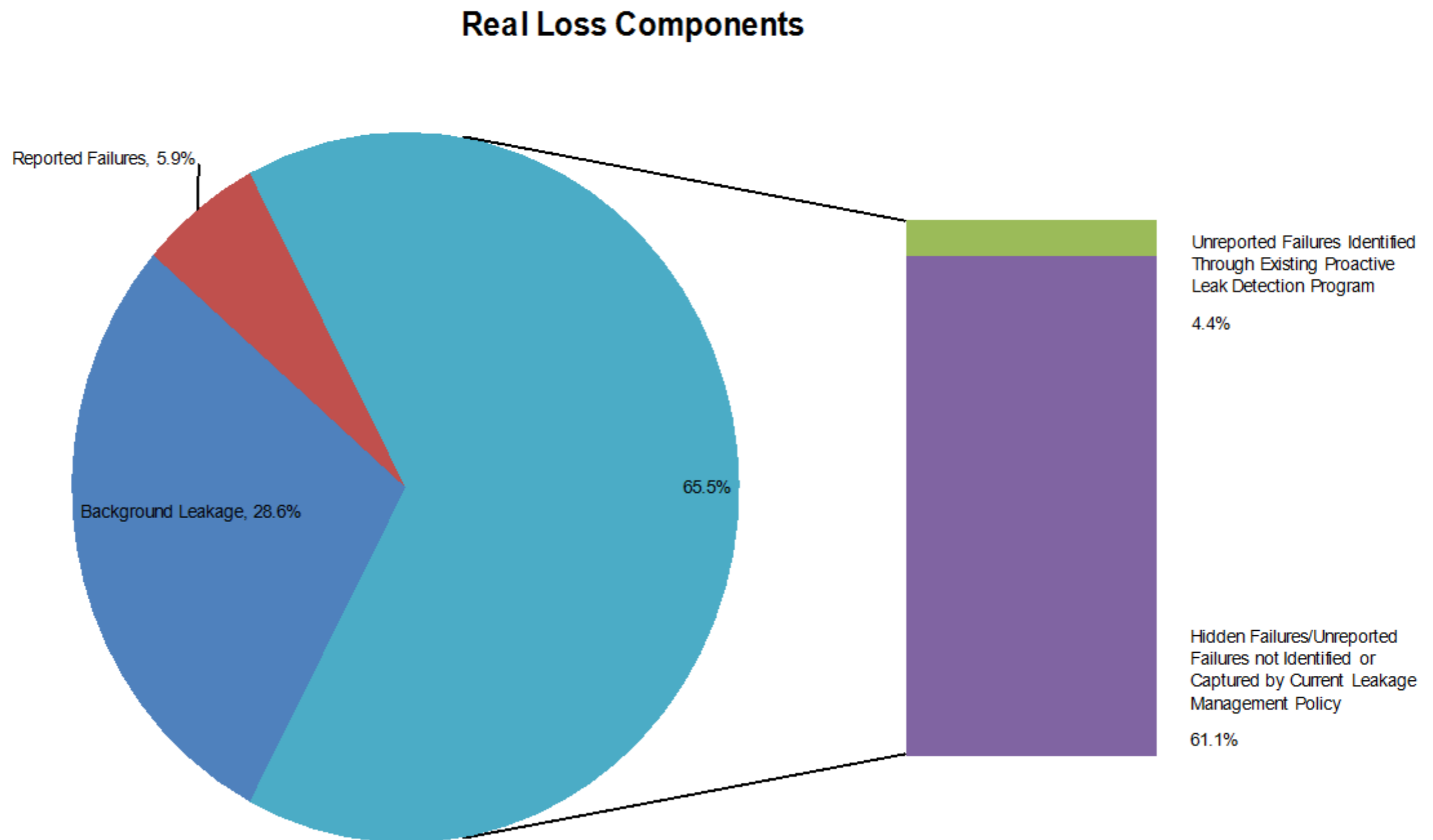
↑
Awareness Time Estimation + Failure Repair Records for Location & Repair Time

Component Analysis of Real Losses

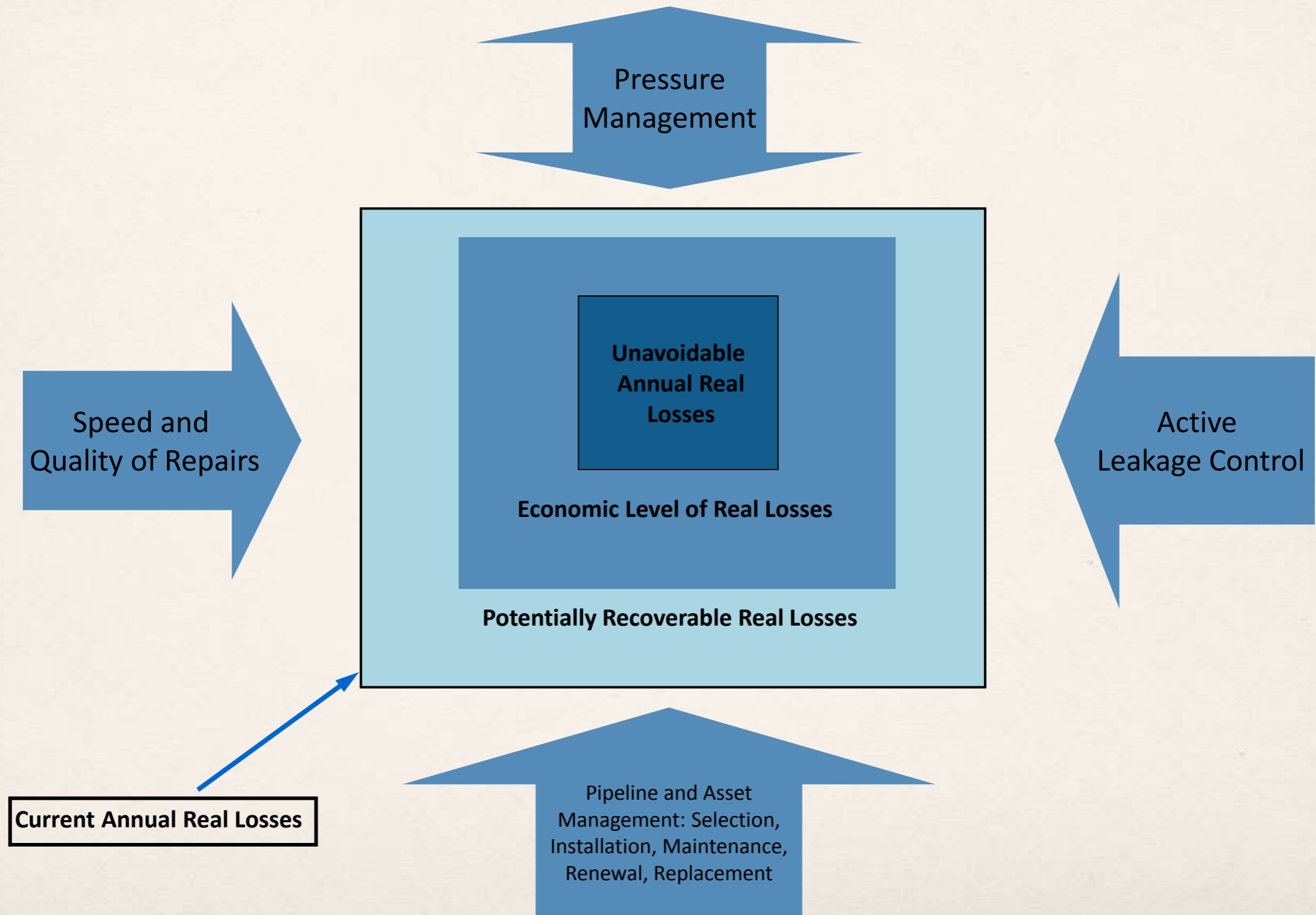
WaterRF 4372: Effective Organization and Component Analysis of Water Utility Leakage Data

Water Audit: City of Austin, TX, USA, 2011

REAL LOSSES COMPONENTS CHART

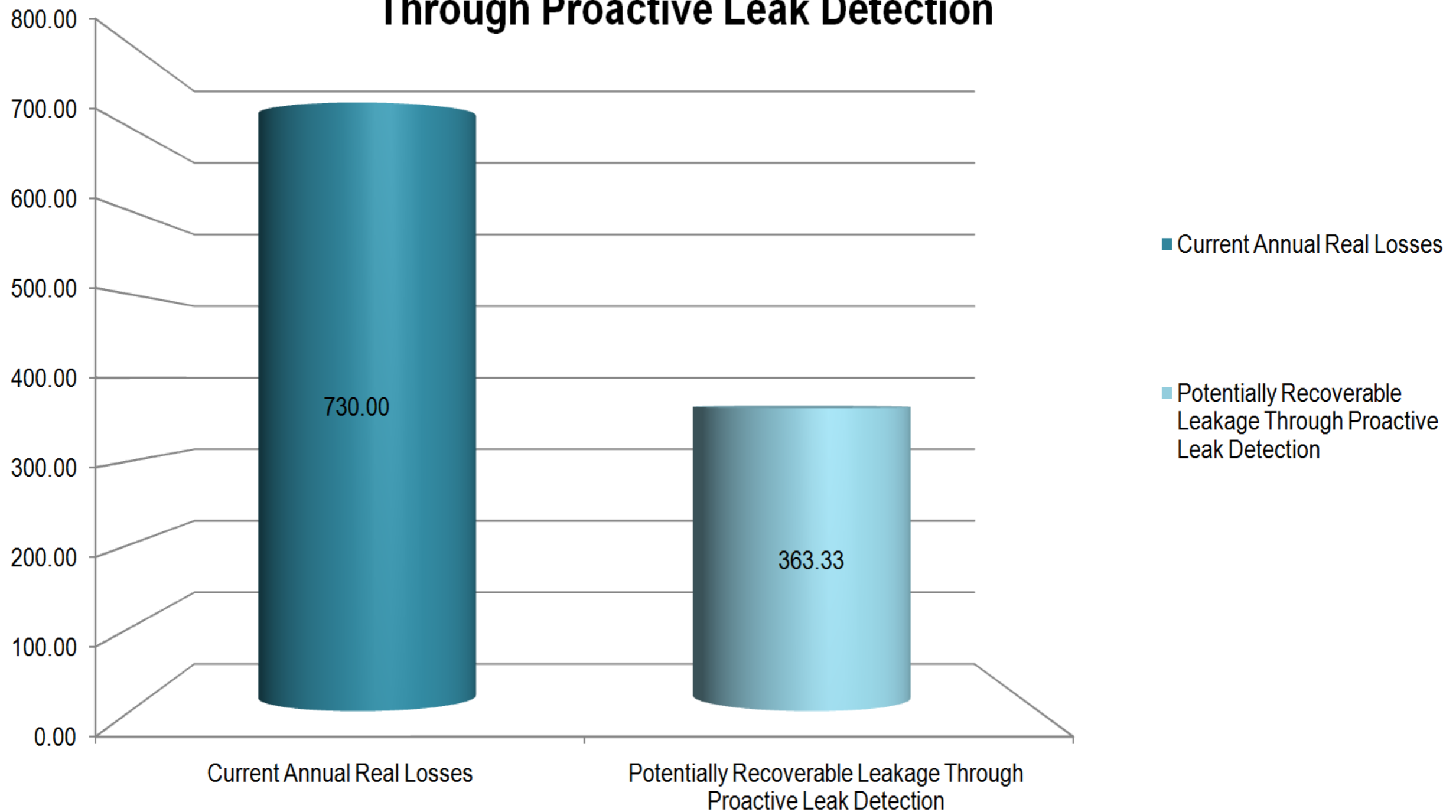


Leakage Management Strategies



Proactive Leak Detection Model

Current Annual Real Losses vs. Potentially Recoverable Leakage Through Proactive Leak Detection



Pressure Management in the Model

Pressure Management Opportunities

Existing Pressure Management Policy		
Current Average System Pressure	77.3	PSI
Total Annual Real Losses	4,332.2	MG/Yr
Value of Real Losses	1,429,630	\$/year

FAVAD N1 Value Used for Calculation of Real Loss Reduction Due to Reduction of Average System Pressure

<input type="radio"/> Use Default N1	1.0
<input checked="" type="radio"/> Use System Specific N1	0.7
Enter % of rigid pipes and service connections in system	100%
ILI	3.0

Alternative Pressure Management Policy		
Assumed Reduction in Average System Pressure	5.0	PSI
Assumed % Reduction in Average System Pressure	6%	
Real Loss Volume Saved Through Alternative Pressure Management Policy	203.1	MG/Yr
Value of Real Loss Volume Saved Through Alternative Pressure Management Policy	67,026	\$/Year
Enter Estimated Cost of Implementing Alternative Pressure Management Policy	100,000	\$
Simple Payback Period for Implementing Alternative Pressure Management Policy	1.5	Years

Response Time Improvement

Reported and Unreported Failure Events			
Failures on Mains			
	Reported	Unreported	
Total Number of Failures on Mains in 2011	707	1	
Average location and repair duration	1.4	1.0	days
Total Volume lost (stemming from location and repair duration)	153.9	0.1	(MG)
Total Cost of Volume lost (stemming from location and repair duration)	\$ 50,785	\$ 23	
What IF Location and Repair Duration is Reduced to	1	0.5	days
Percent Reduction	28%	50%	
Potential Related Savings in Leakage Volume	42.7	0.0	(MG)
Potential Related Savings in Leakage Volume Cost	\$ 14,085	\$ 11	
Service Line Failures			
	Reported	Unreported	
Total Number of Failures on Service Connections in 2011	1,114	11	
Average location and repair duration	1.4	2.0	days
Total Volume lost (stemming from location and repair duration)	16.3	0.2	(MG)
Total Cost of Volume lost (stemming from location and repair duration)	\$ 5,374	\$ 76	
What IF Location and Repair Duration is Reduced to	1	1	days
Percent Reduction	29%	50%	
Potential Related Savings in Leakage Volume	4.65	0.1	(MG)
Potential Related Savings in Leakage Volume Cost	\$ 1,535	\$ 38	
Failures on System Appurtenances			
	Reported	Unreported	
Total Number of Failures on System Appurtenances in 2011	1,867	127	
Average location and repair duration	17.2	49.0	days
Total Volume lost (stemming from location and repair duration)	25.2	33.4	(MG)
Total Cost of Volume lost (stemming from location and repair duration)	\$ 8,323	\$ 11,013	
What IF Location and Repair Duration is Reduced to	1	1	days
Percent Reduction	94%	98%	
Potential Related Savings in Leakage Volume	23.8	32.7	(MG)
Potential Related Savings in Leakage Volume Cost	\$ 7,838	\$ 10,788	
Total Potential Savings if Location and Repair Duration is Reduced as Simulated in the Above Sections	182.3	32.9	(MG)
Total Potential Cost Savings if Location and Repair Duration is Reduced as Simulated in the Above Sections	\$ 23,458	\$ 10,837	Per Year

Summarized Component Analysis

WATER AUDIT PERFORMANCE INDICATORS	
Financial	
Non-revenue water as percent by volume of water supplied:	10.3%
Non-revenue water as percent by cost of operating system:	3.0%
Annual cost of Apparent Losses:	\$4,376,956
Annual cost of Real Losses:	\$1,429,630
Operational Efficiency	
Apparent Losses per service connection per day:	13.7 gal/service conn/day
Real Losses per service connection per day*:	56.0 gal/service conn/day
Real Losses per length of main per day:	N/A gal/mi/day
Real Losses per service connection per day per 1787.62743734595 pressure:	0.7 gal/service conn/day/psi
Unavoidable Annual Real Losses (UARL):	1,453.52 MG/Yr
Current Annual Real Losses (CARL):	4,332.21 MG/Yr
Infrastructure Leakage Index (ILI) [CARL/UARL]:	3.0

REAL LOSS COMPONENT ANALYSIS RESULTS				
System Component	Background Leakage	Reported Failures	Unreported Failures	Total
	(MG)	(MG)	(MG)	(MG)
Reservoirs	22.08	-	-	22.08
Mains and Appurtenances	372.61	217.12	173.49	763.22
Service Connections	844.15	39.55	17.46	901.15
Total Annual Real Loss	1,238.83	256.66	190.95	1,686.44
<i>Real Losses as Calculated by Water Audit</i>				4,332.21
<i>Hidden Losses/Unreported Leakage Currently Running Undetected</i>				2,645.77

AWARNNESS, LOCATION AND REPAIR TIME REDUCTION RESULTS			
	Reported Failures	Unreported Failures	
Total Potential Savings if Location and Repair Duration is Reduced as Simulated on the A-L-R Times Options Sheet	182.3	32.9	(MG)
Total Potential Cost Savings if Location and Repair Duration is Reduced as Simulated on the A-L-R Times Options Sheet	\$ 23,458	\$ 10,837	Per Year

ECONOMIC INTERVENTION FREQUENCY FOR PROACTIVE LEAK DETECTION RESULTS		
Percentage of the System to be Surveyed per Year	31	%
Average Annual Budget for Intervention (Proactive Leak Detection)	283,187	\$/year
Potentially Recoverable Leakage	1,787.63	MG/year

ALTERNATIVE PRESSURE MANAGEMENT SCENARIO RESULTS		
User-Inputted Reduction in Average System Pressure	5.0	PSI
Assumed % Reduction in Average System Pressure	6%	
Estimated Real Loss Reduction from Pressure Management Program	203.1	MG/Yr
Financial Savings from Pressure Management Program	67,026	\$/Year
User-Estimated Cost of Pressure Reduction	100,000	\$
Resulting Pressure Management Program Payback Period	1.5	Years

Please be in touch!

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