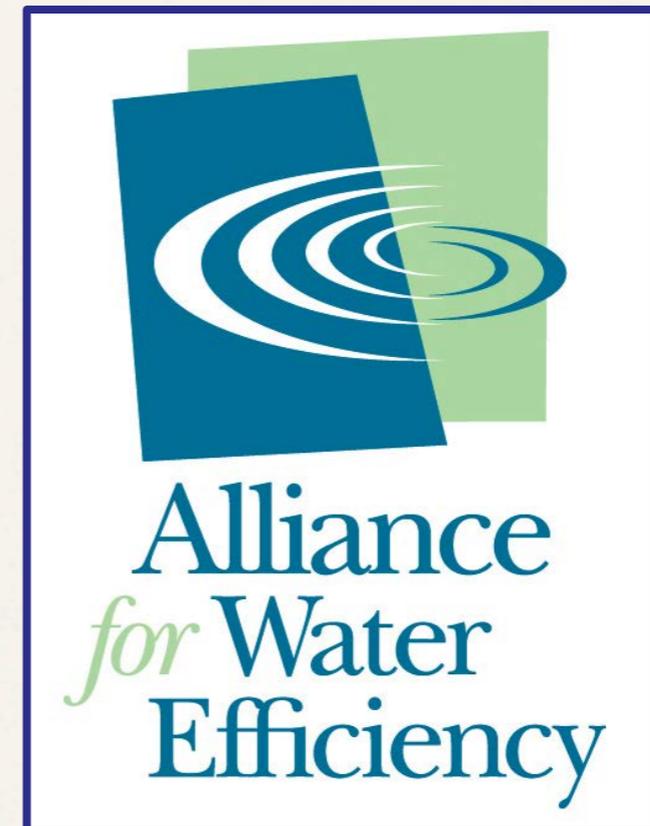




Water Research Foundation 4372a

Real Loss Component Analysis: What's Your Leakage Profile

Project Team



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.

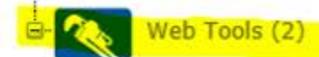
Report Name	Report #	Available	Order Report	Download PDF	Executive Summary
 Real Loss Component Analysis: A Tool for Economic Water Loss Control	4372a	5/30/2014			

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	Authorized Consumption	Unbilled Authorized Consumption	Unbilled Metered Authorized Consumption	NON-REVENUE WATER
			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				

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

Key Points For Model Development

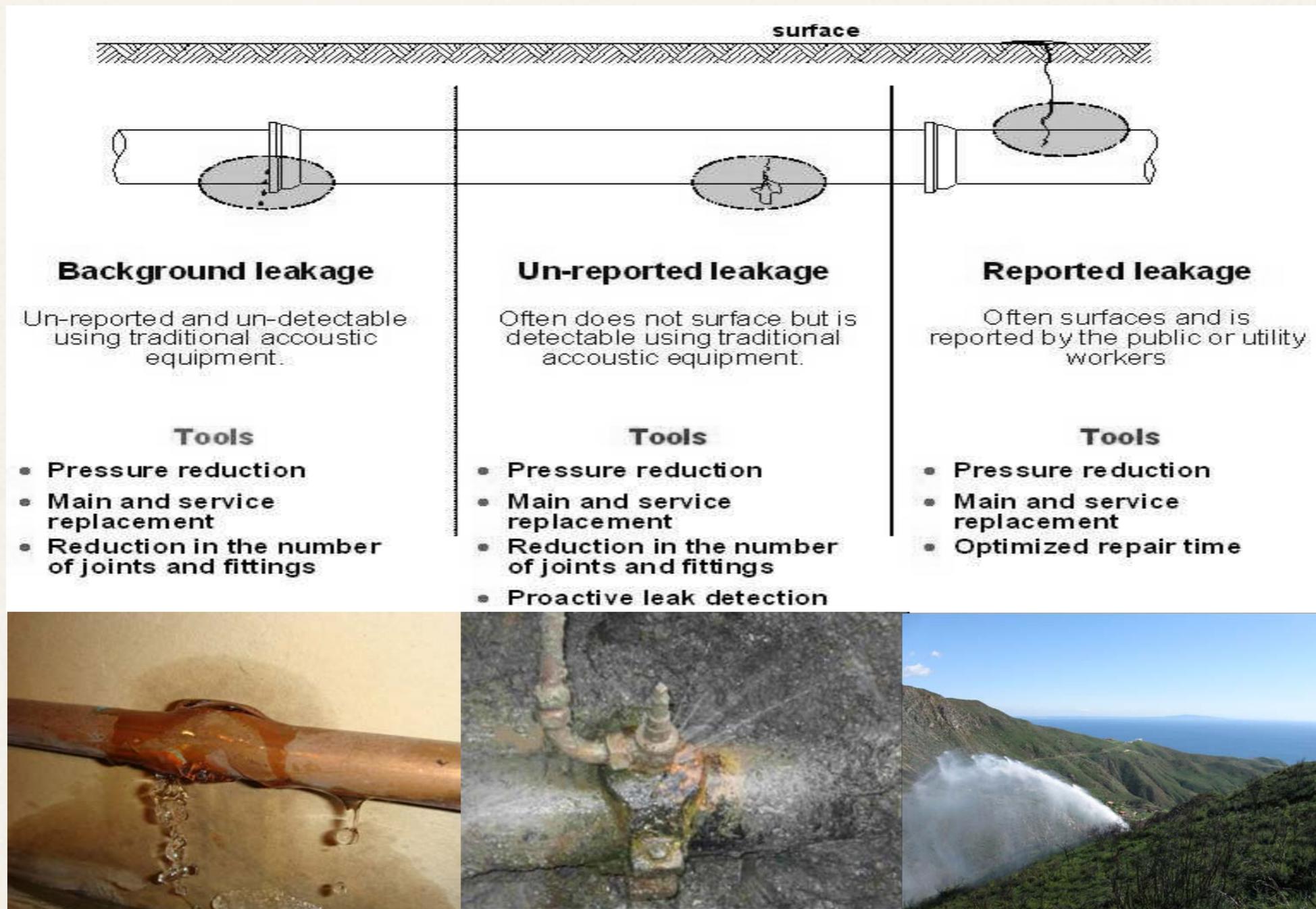
- Adoption of AWWA Free Water Audit Software & Importance of Data

Validation

- Contextualized Performance Indicators
 - Break Frequency Research
-

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

Component Analysis of Real Losses



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

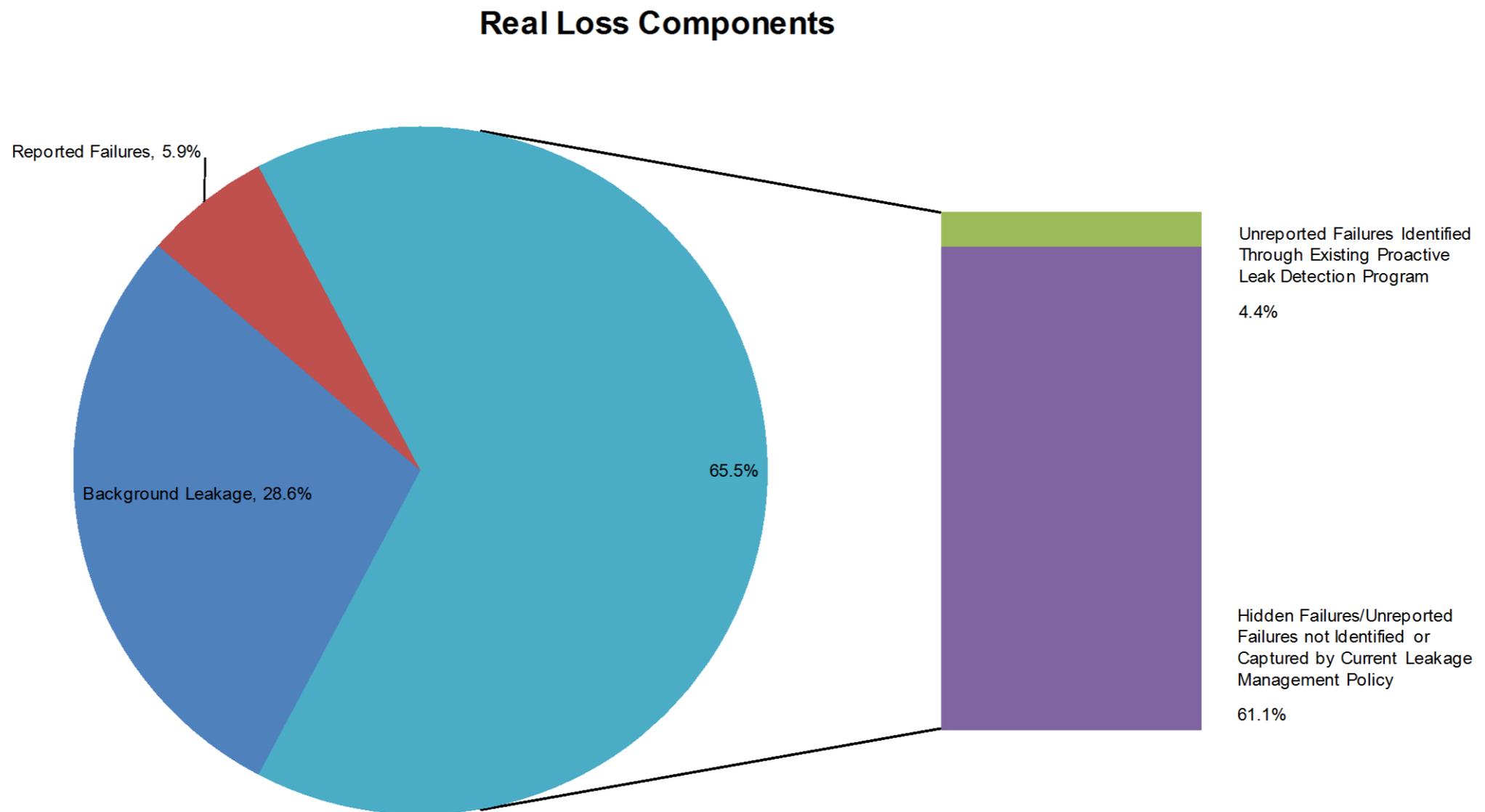
↑
Awareness Time Estimation + Failure Repair Records for Location & Repair Time

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



7/11/2013

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Contextualized Performance Indicators

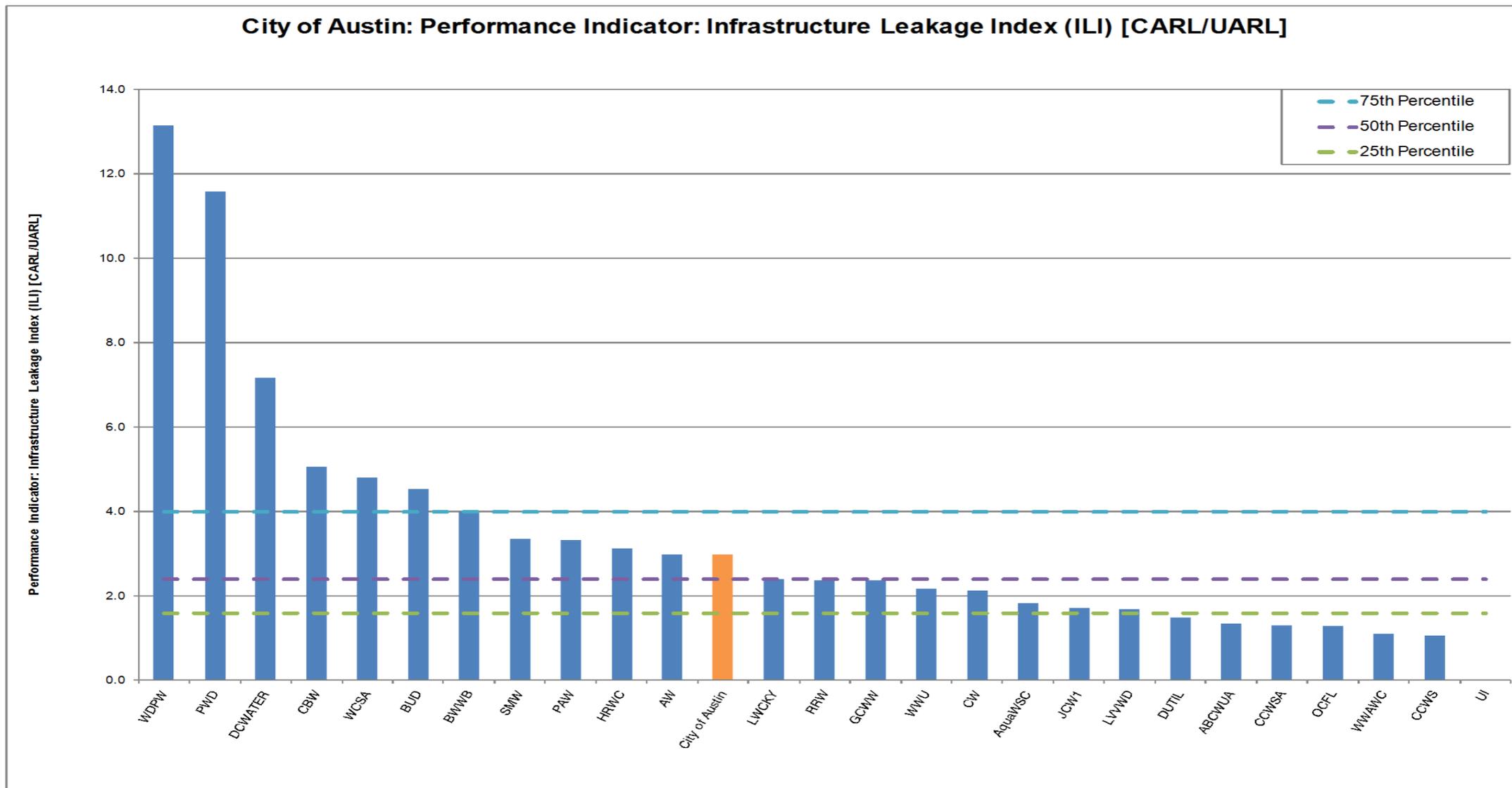
WaterRF 4372: Effective Organization and Component Analysis of Water Utility Leakage Data

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

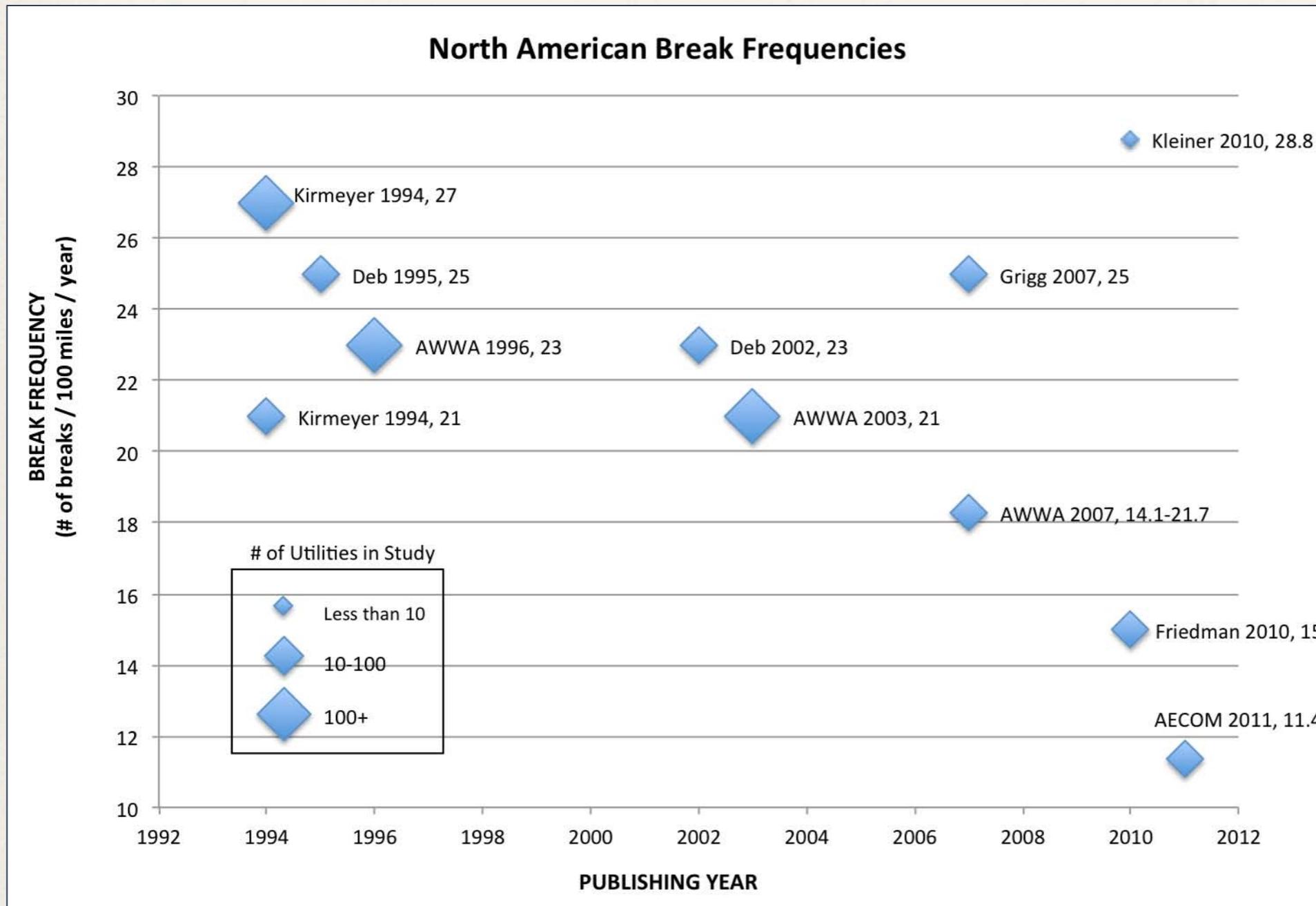
Instructions: Please select a performance indicator from the drop-down box to compare your utility's performance against the AWWA North American Validated Water Audit Data for 2012*. The performance indicator graph also displays the 25th, 50th and 75th percentile of the performance indicators data set.

Utility Name: City of Austin

Performance Indicator: Performance Indicator: Infrastructure Leakage Index (ILI) [CARL/UARL]



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

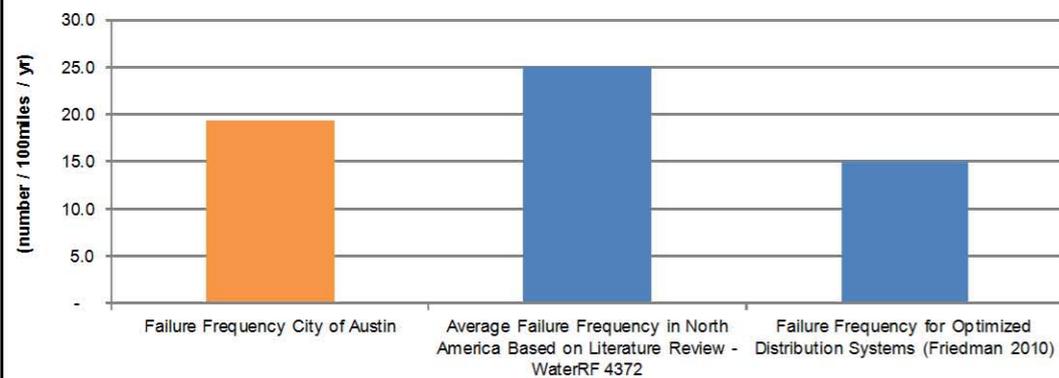
INFRASTRUCTURE FAILURE FREQUENCY ANALYSIS

	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)

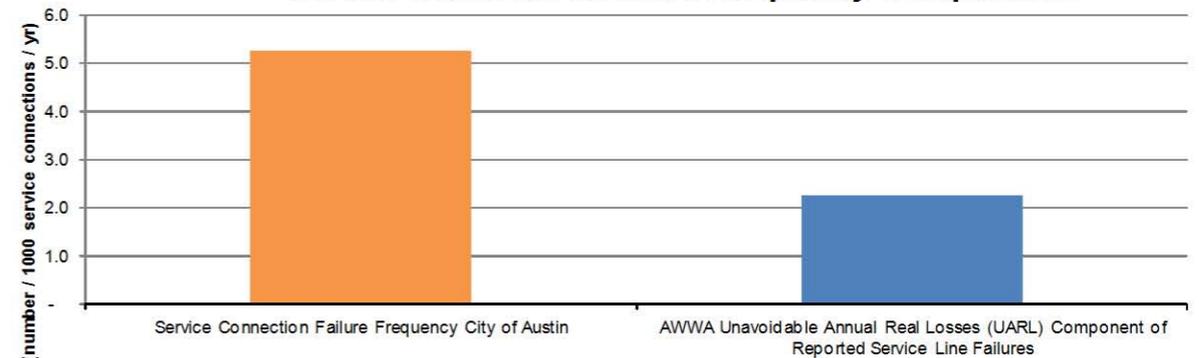
Mains Failure Frequency Comparison



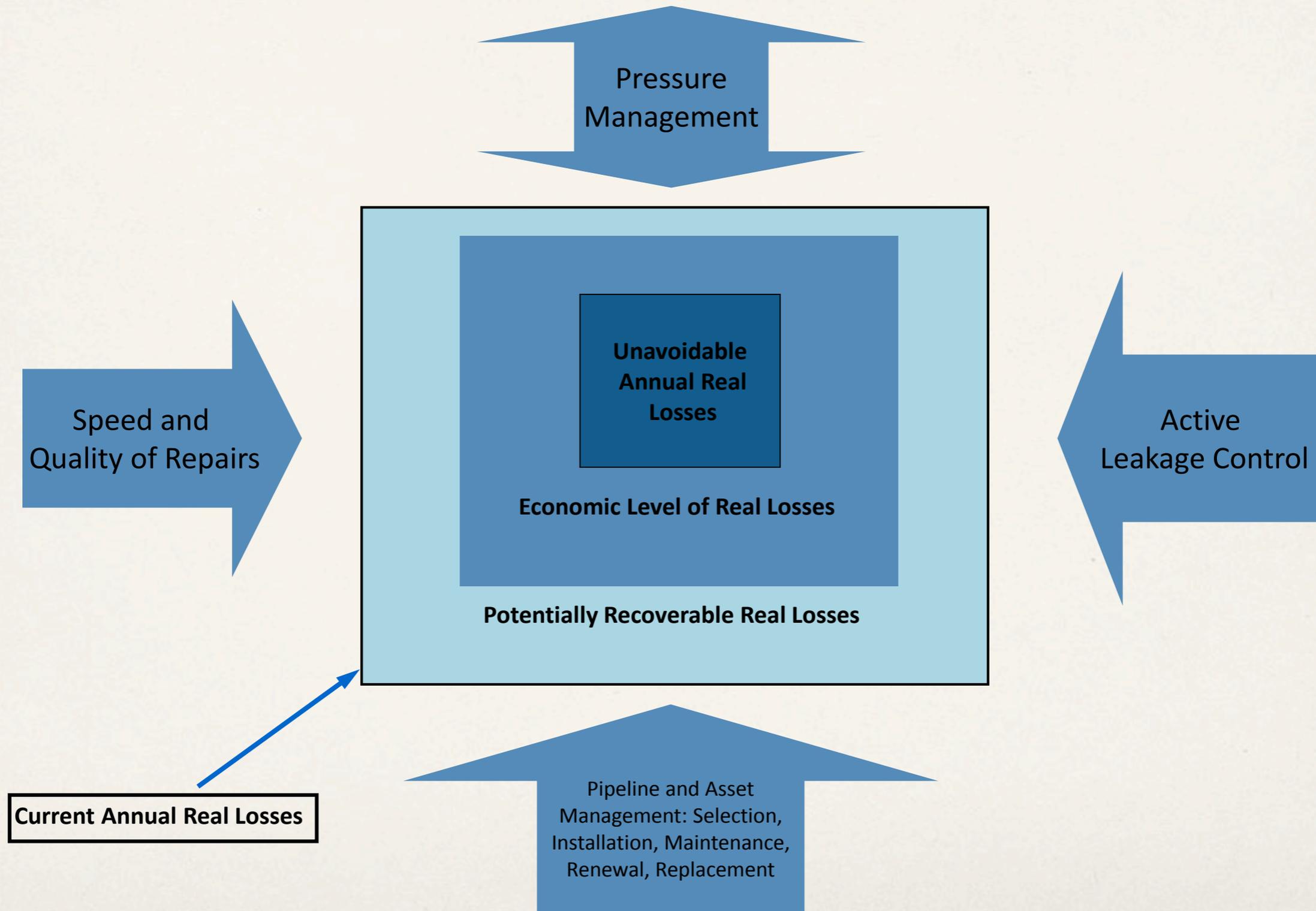
City of Austin

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	

Service Connection Failure Frequency Comparison

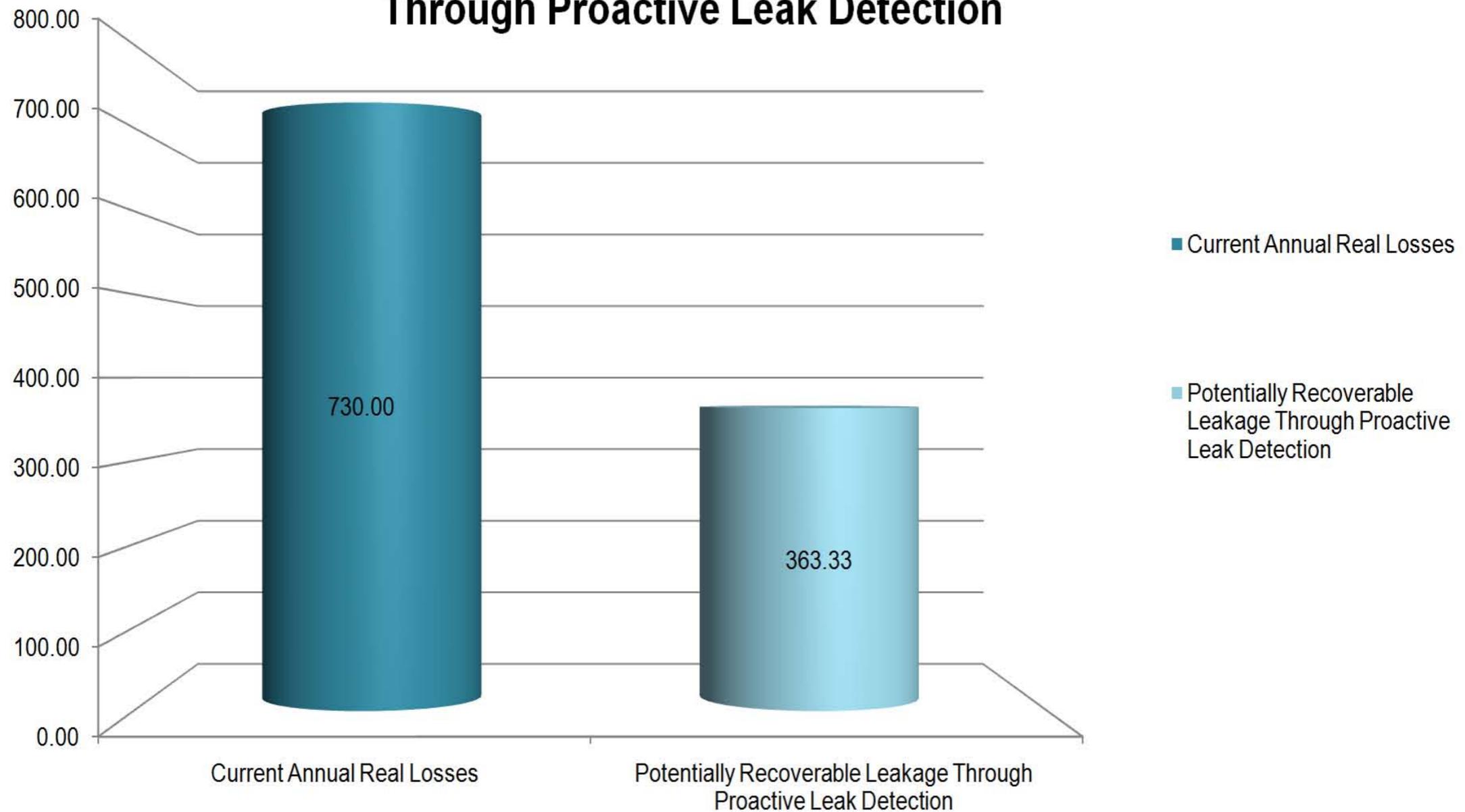


Leakage Management Strategies



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

AWARENESS, 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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