

BUILDING A WORLD OF DIFFERENCE

REAL AND APPARENT LOSS

[PRESSURE MANAGEMENT]

PNWS 2015

April 2015



BLACK & VEATCH
Building a world of difference.

AGENDA

- Review of Pressure Management
- Infrastructure and Control Systems
- NRW Solutions
- Case Examples



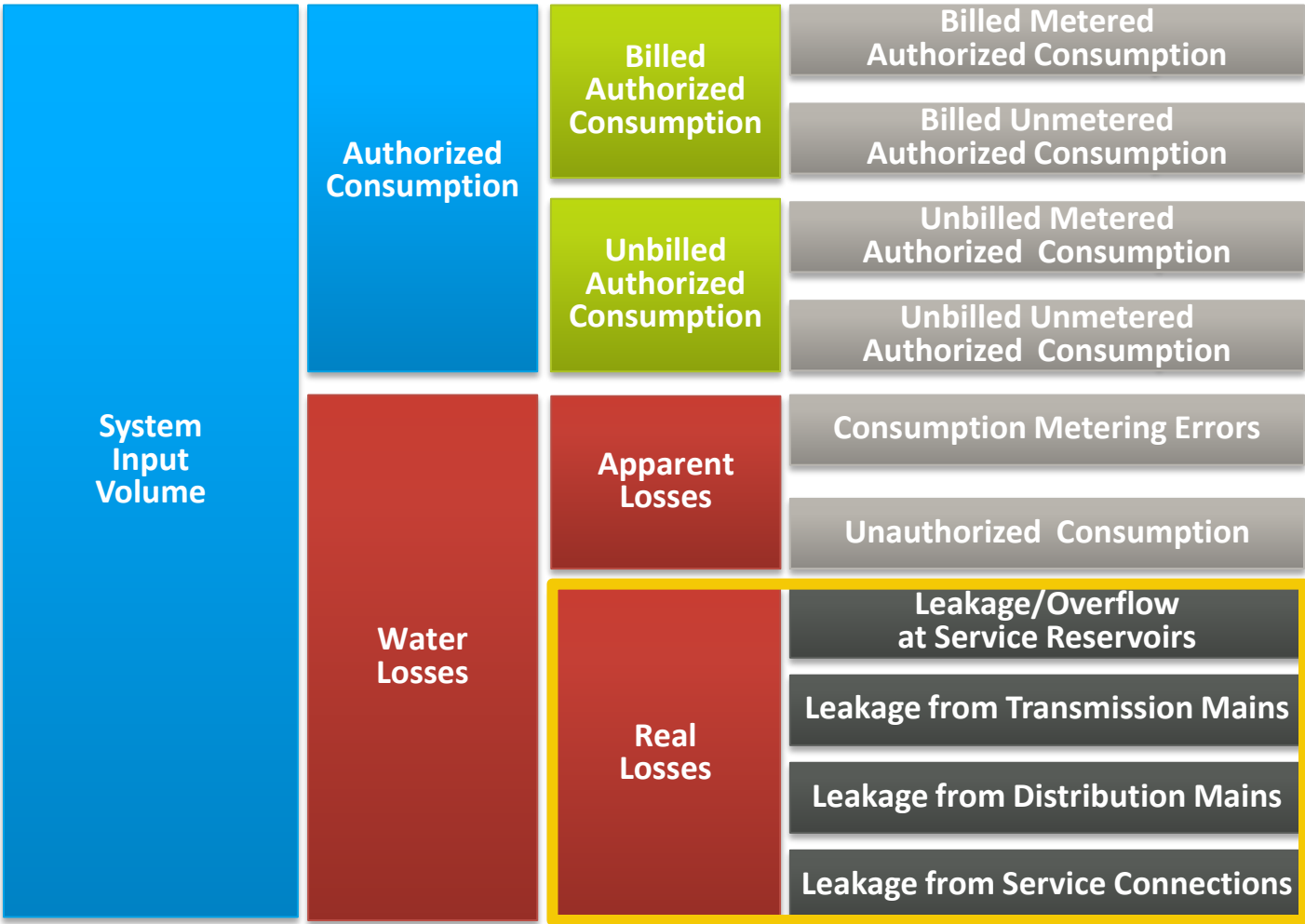
WHY MANAGE PRESSURES?



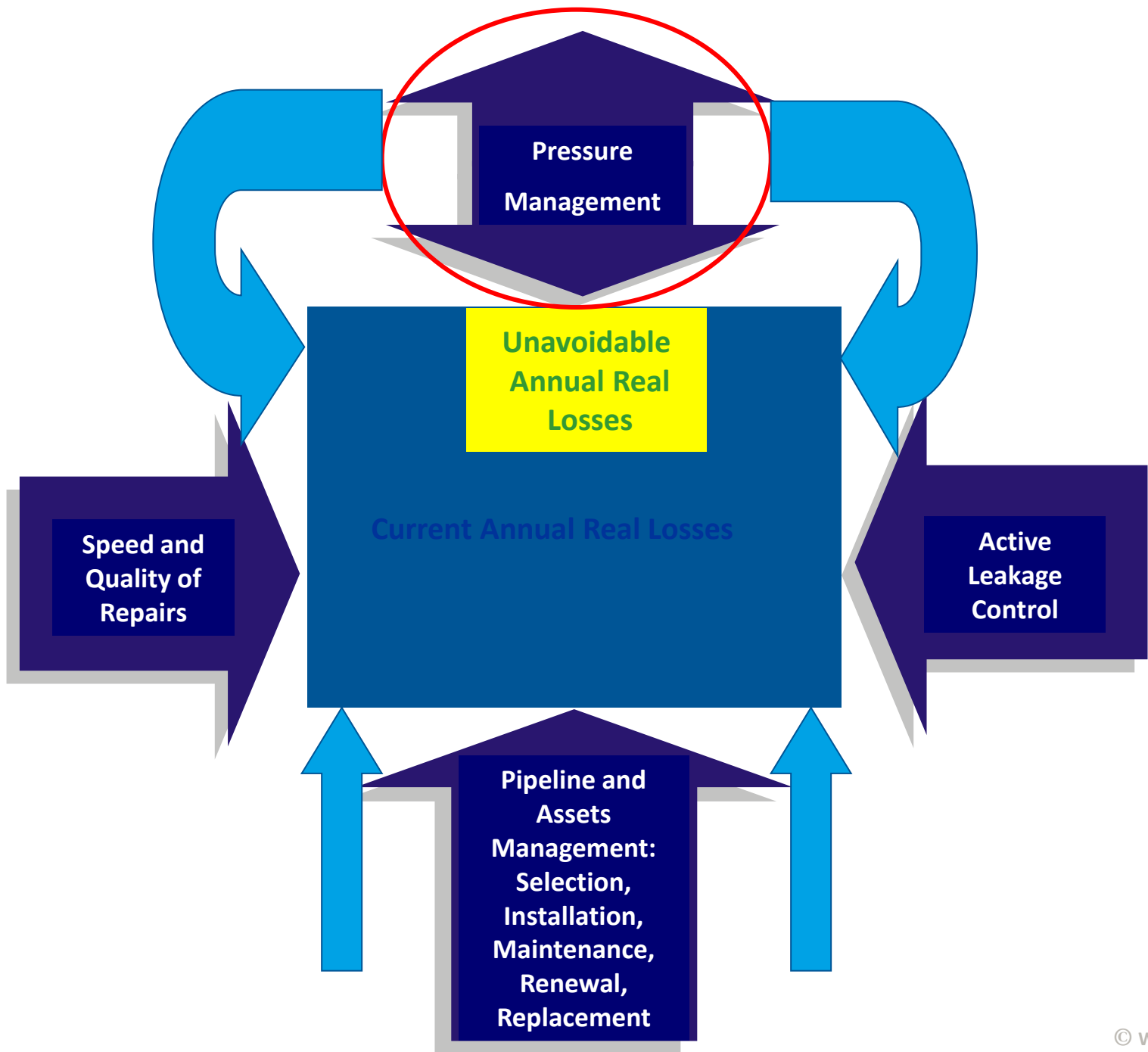
Reduction of excess pressures and surges will:

- Reduce the number of new leaks and main breaks each year, and the associated annual repair costs
- Help to defer mains and services replacements
- Reduce the flow rates of all existing leaks
 - best way of reducing ‘background’ (undetectable) leakage
- Reduce pressure-dependent consumption
- Increase asset life

REAL LOSS IN THE AWWA WATER BALANCE



Real Loss Reduction



Background Leakage

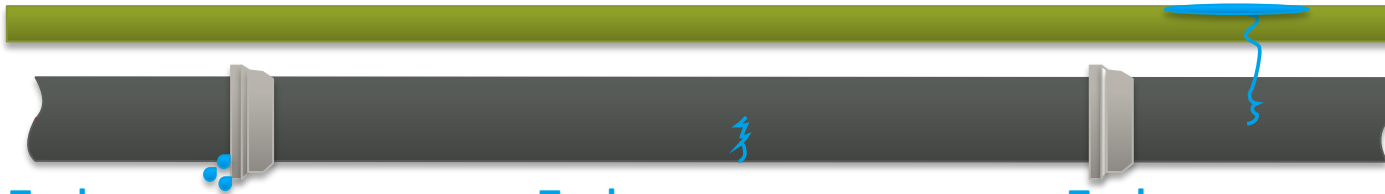
Unreported and undetectable using traditional acoustic equipment.

Un-Reported Leakage

Often does not surface, but is detectable using traditional acoustic equipment.

Reported Leakage

Often surfaces and is reported by the public or utility workers.



Tools

- **Pressure reduction**
- Main and service replacement
- Reduction in number of joints and fittings

Tools

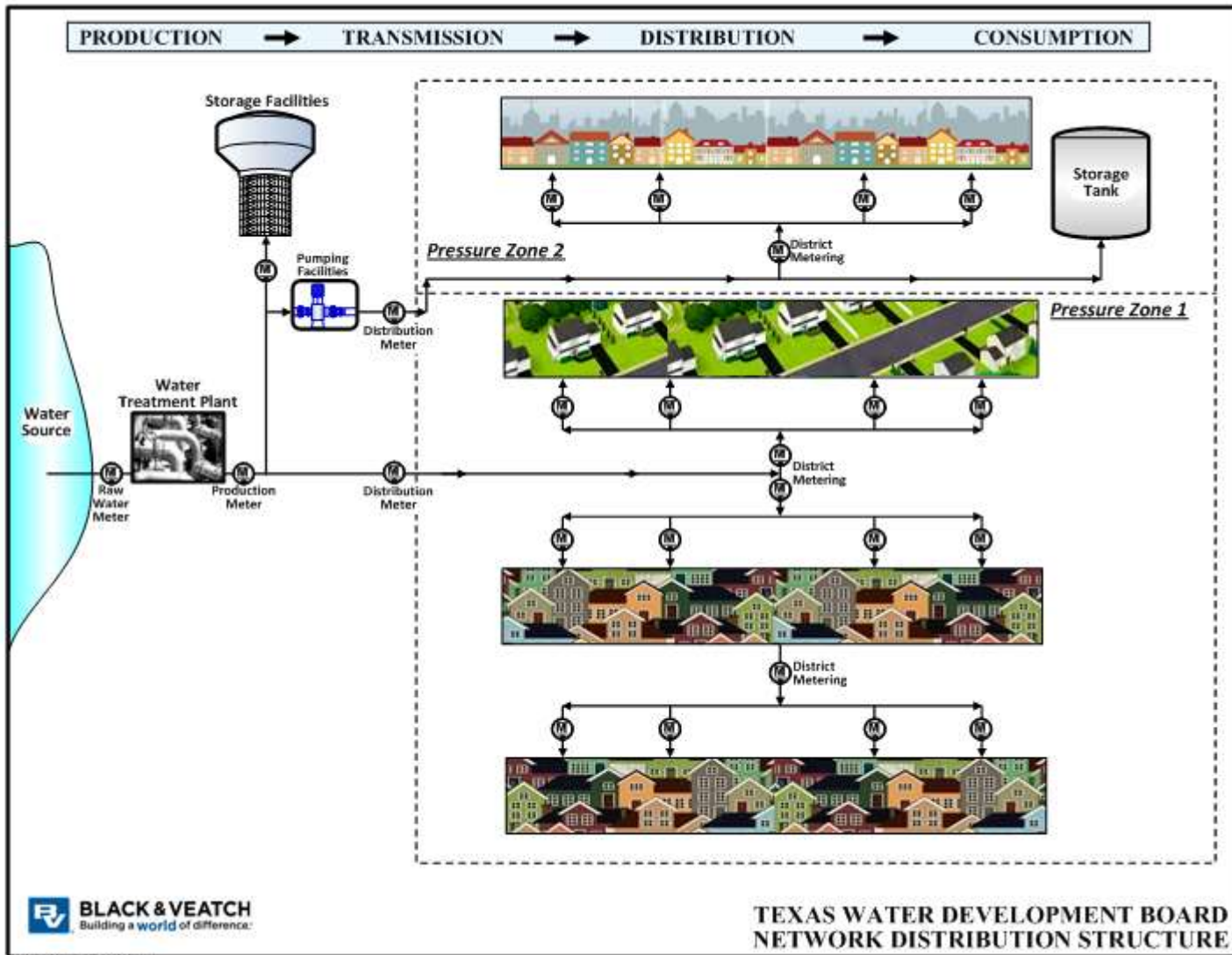
- **Pressure reduction**
- Main and service replacement
- Reduction in number of joints and fittings
- Proactive leak detection

Tools

- **Pressure reduction**
- Main and service replacement
- Optimized repair time

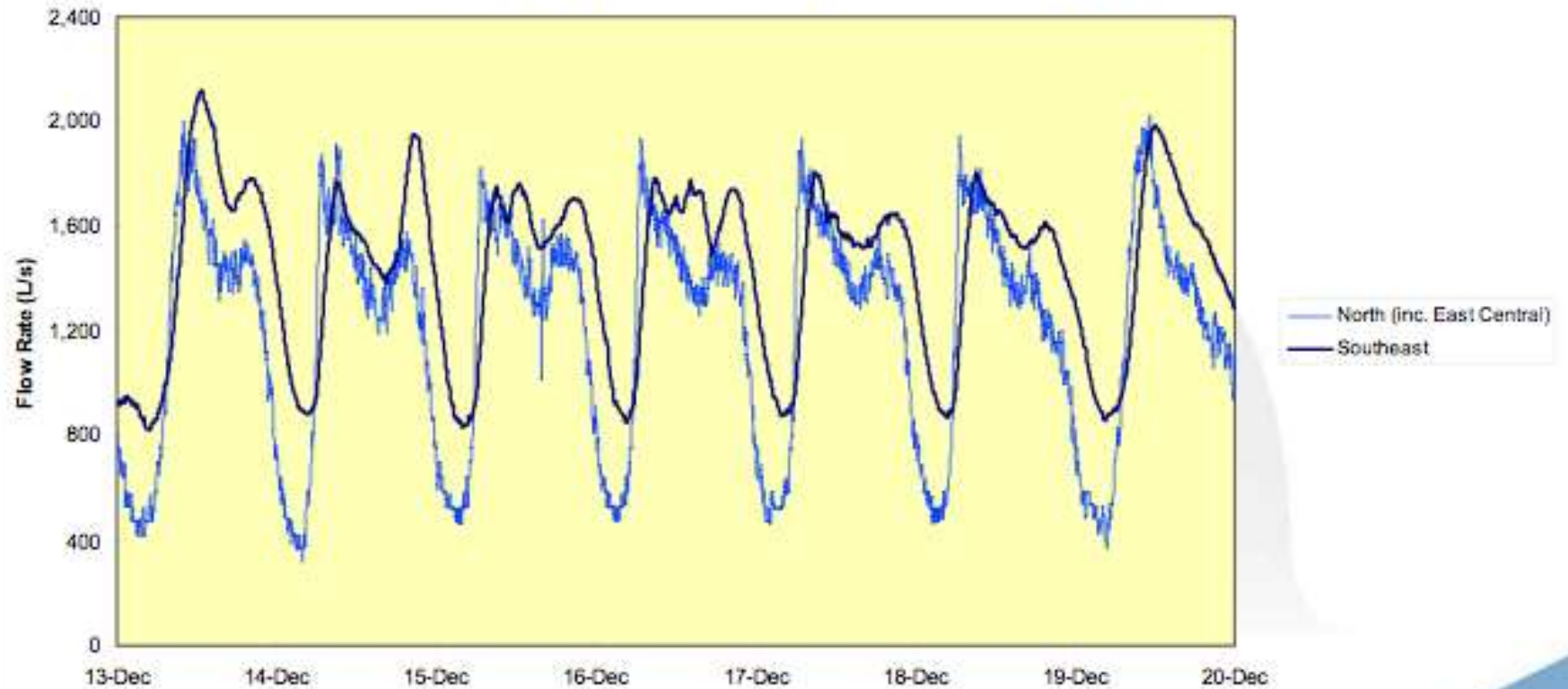


ANATOMY OF A DMA/PMA



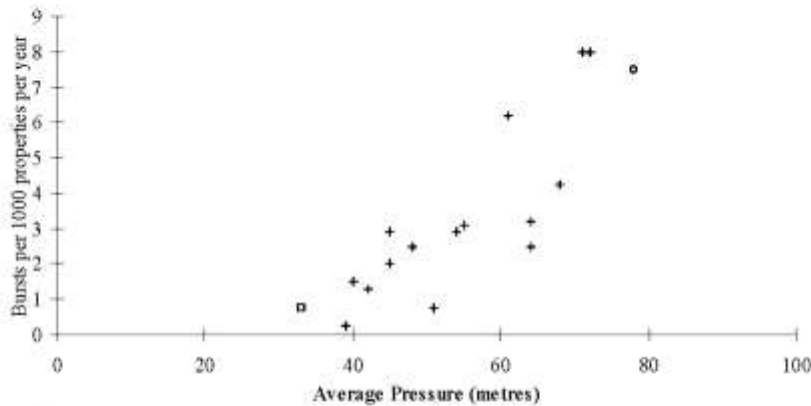
DMA PROFILE

Comparative DMA Profiling
North (including East Central) vs. Southeast Pressure Districts

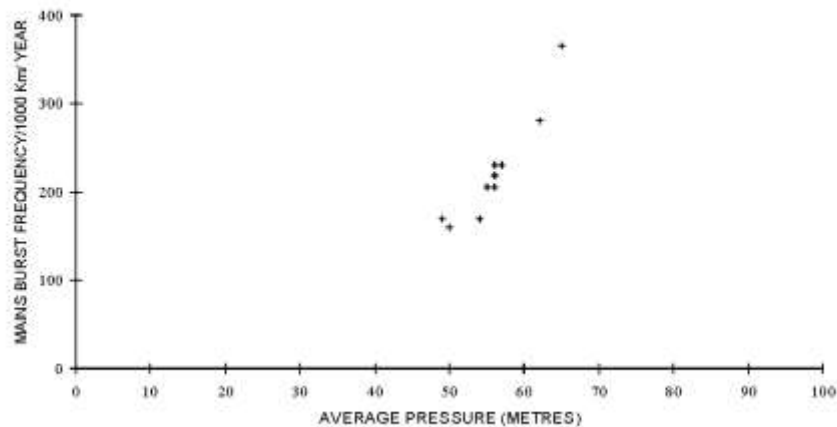


MAIN BREAK FREQUENCY

Influence of maximum pressure on mains burst frequency (UK examples)

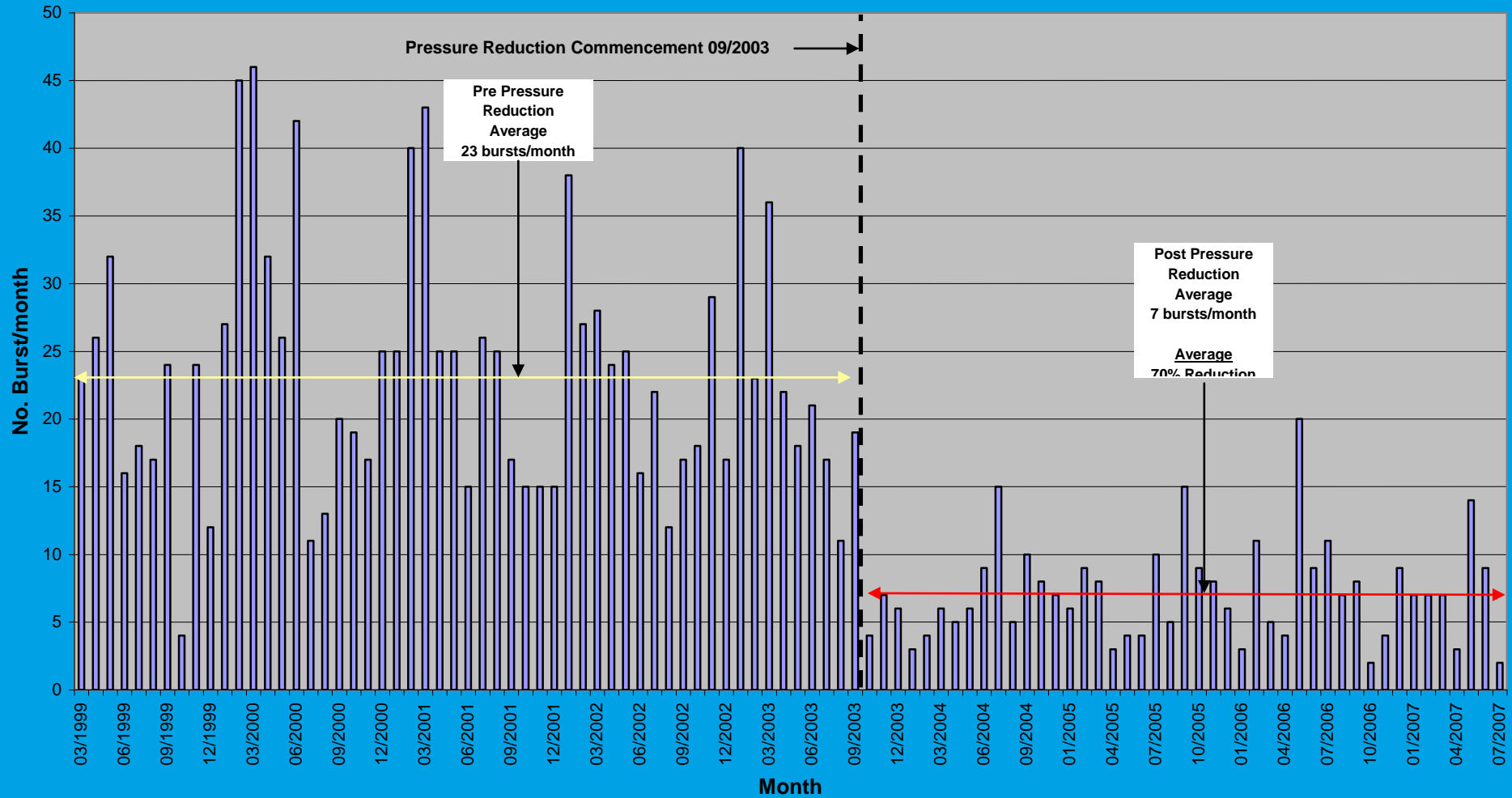


Individual district metered areas in English Midlands



Large supply systems in Wales

REDUCTION OF MAIN BREAKS



PRESSURE MANAGEMENT FACILITIES



ACTIVE LEAKAGE CONTROL MEASURES

Active leakage is defined as an active effort to locate and repair unreported leaks.

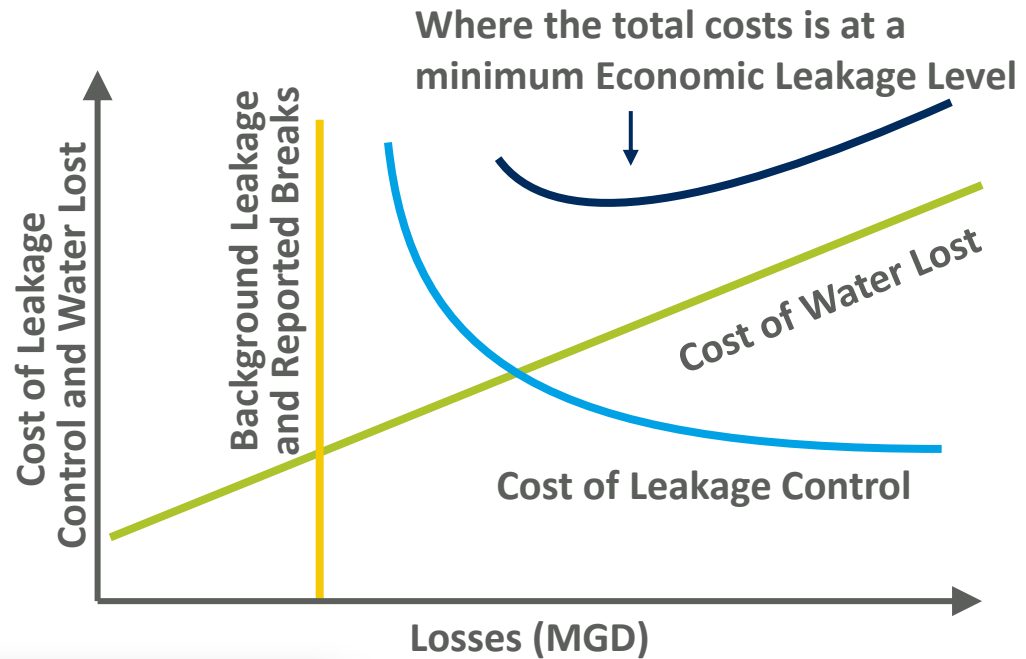
- Sonic Survey
- Correlation Surveys
- Noise Logging Surveys
- Night Flow Sector Analysis
- Temporary or Permanent District Metered Area
- Step Testing
- Transmission Main Surveys



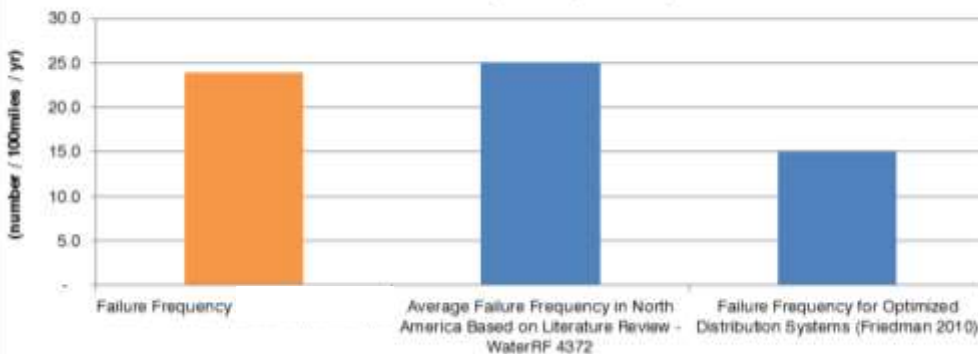
ECONOMIC LEVEL OF LEAKAGE

Real Loss Control Tools

- Proactive Leak Detection
- Pressure Management
- DMAs
- Improved ALR times
- Asset Management



Mains Failure Frequency Comparison



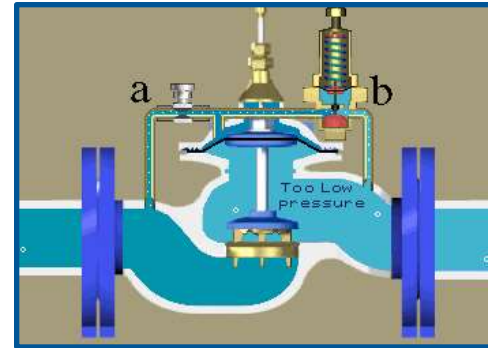
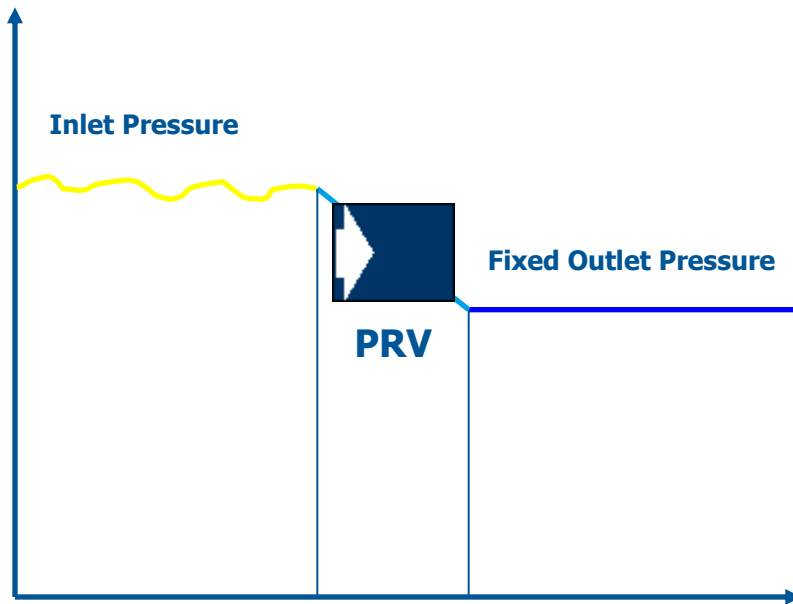
THREE TYPES OF CONTROL

Fixed Outlet Control

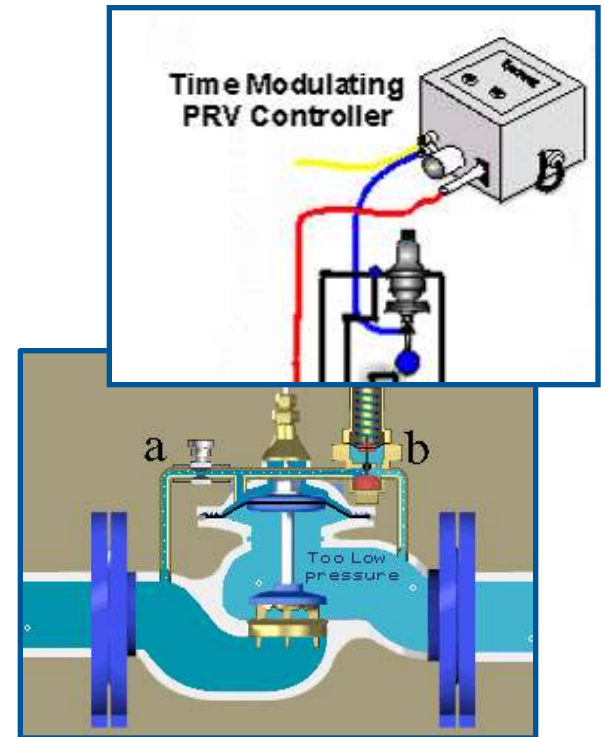
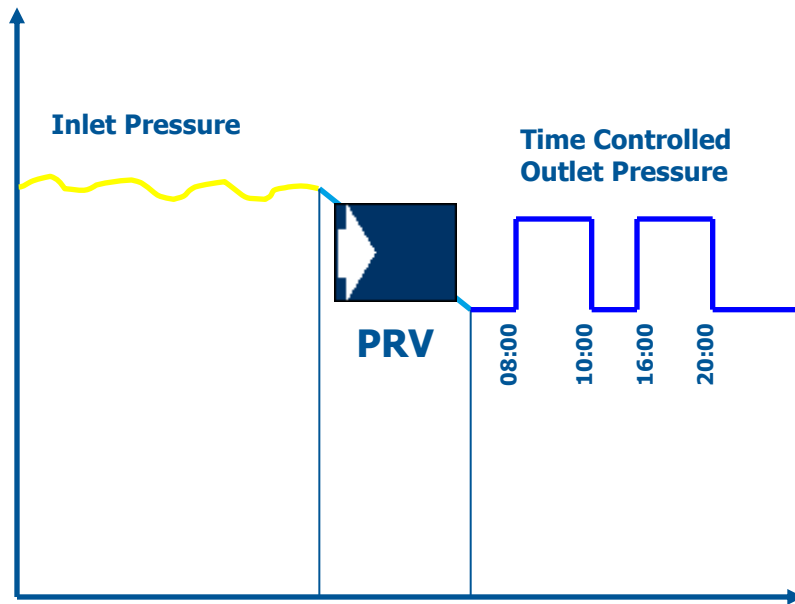
Time Control

Flow Modulation

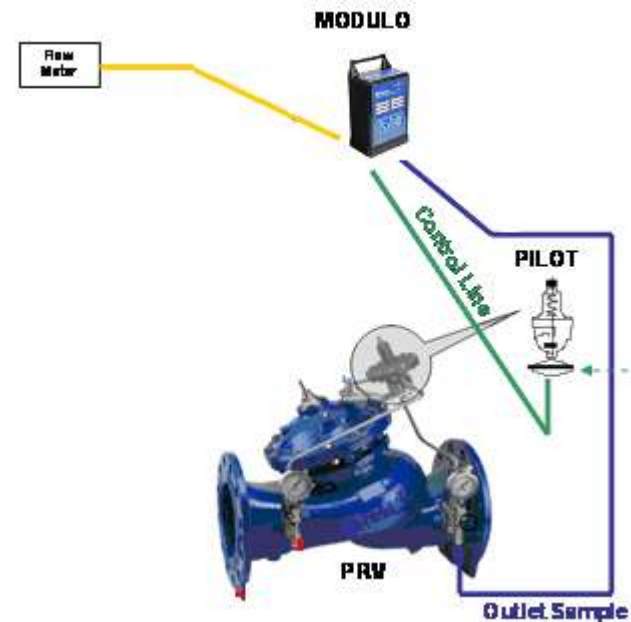
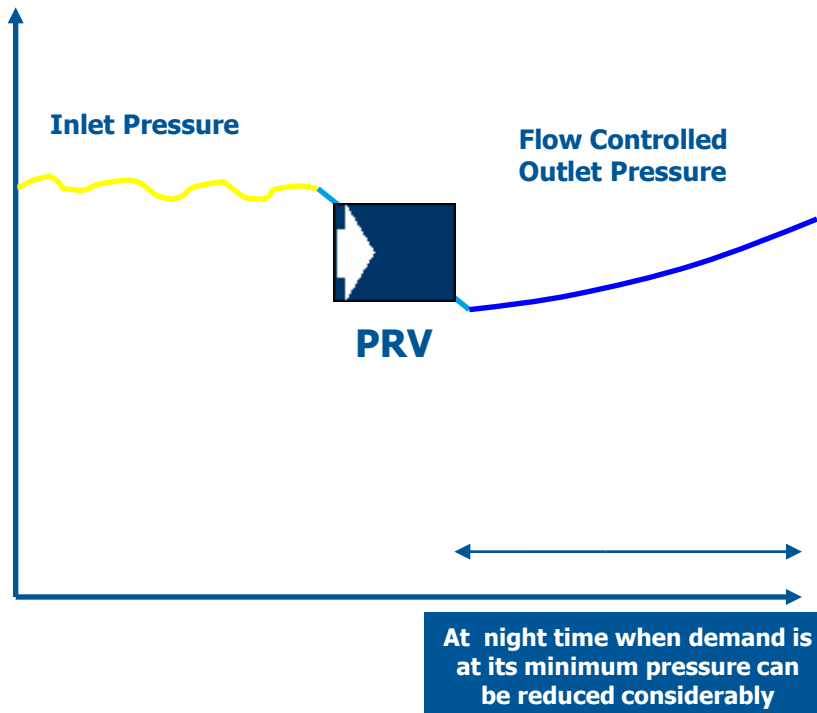
FIXED OUTLET



TIME CONTROL



FLOW MODULATION CONTROL



CASE EXAMPLES



Water Loss Reduction

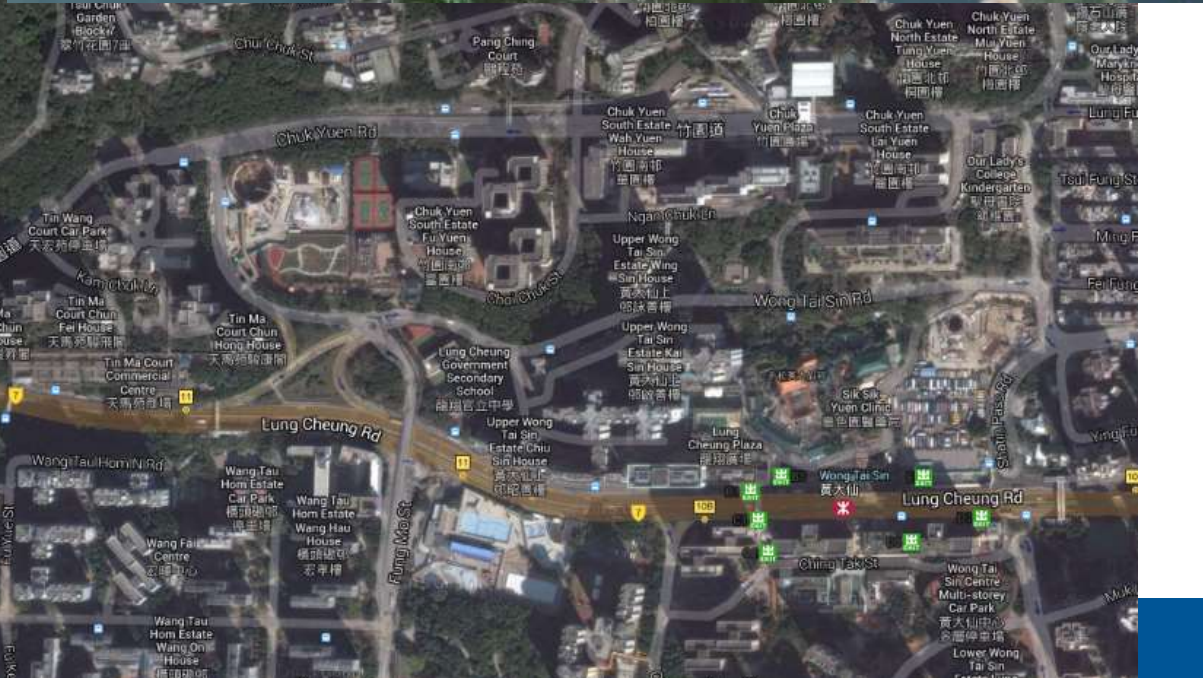
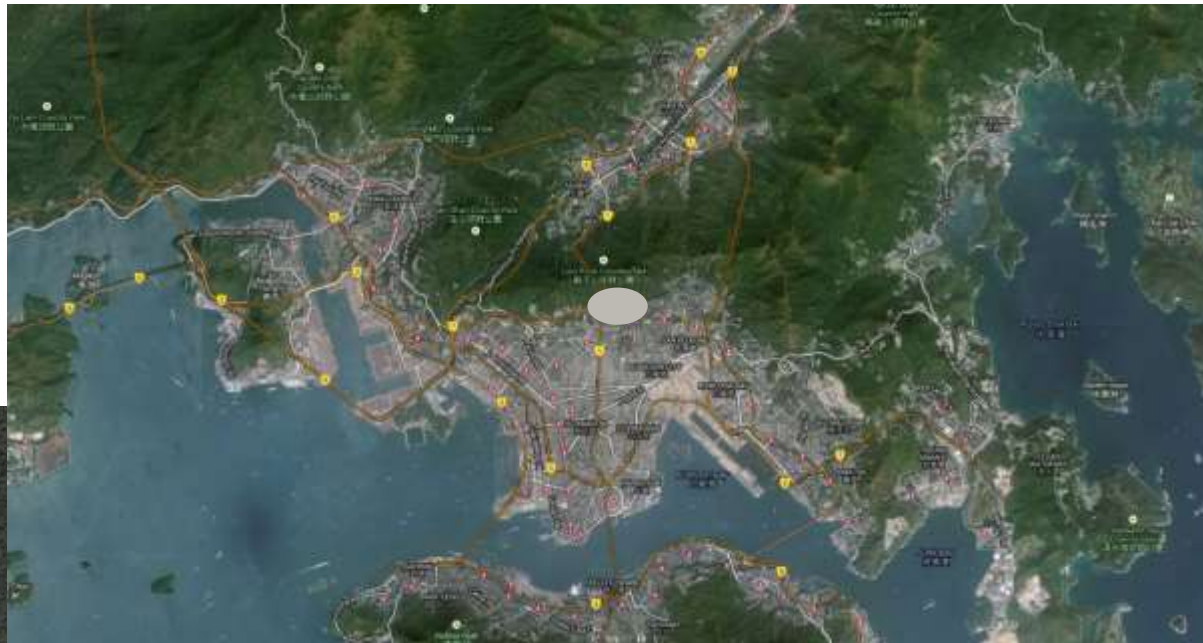
An aerial night view of the Hong Kong skyline, featuring numerous illuminated skyscrapers and buildings. The city is situated on a peninsula with a large harbor in the background, where several boats are visible. The sky is a deep blue, and the city lights create a vibrant contrast against the dark background.

Hong Kong MSD
Water Loss Control – Pressure Management

Hong Kong

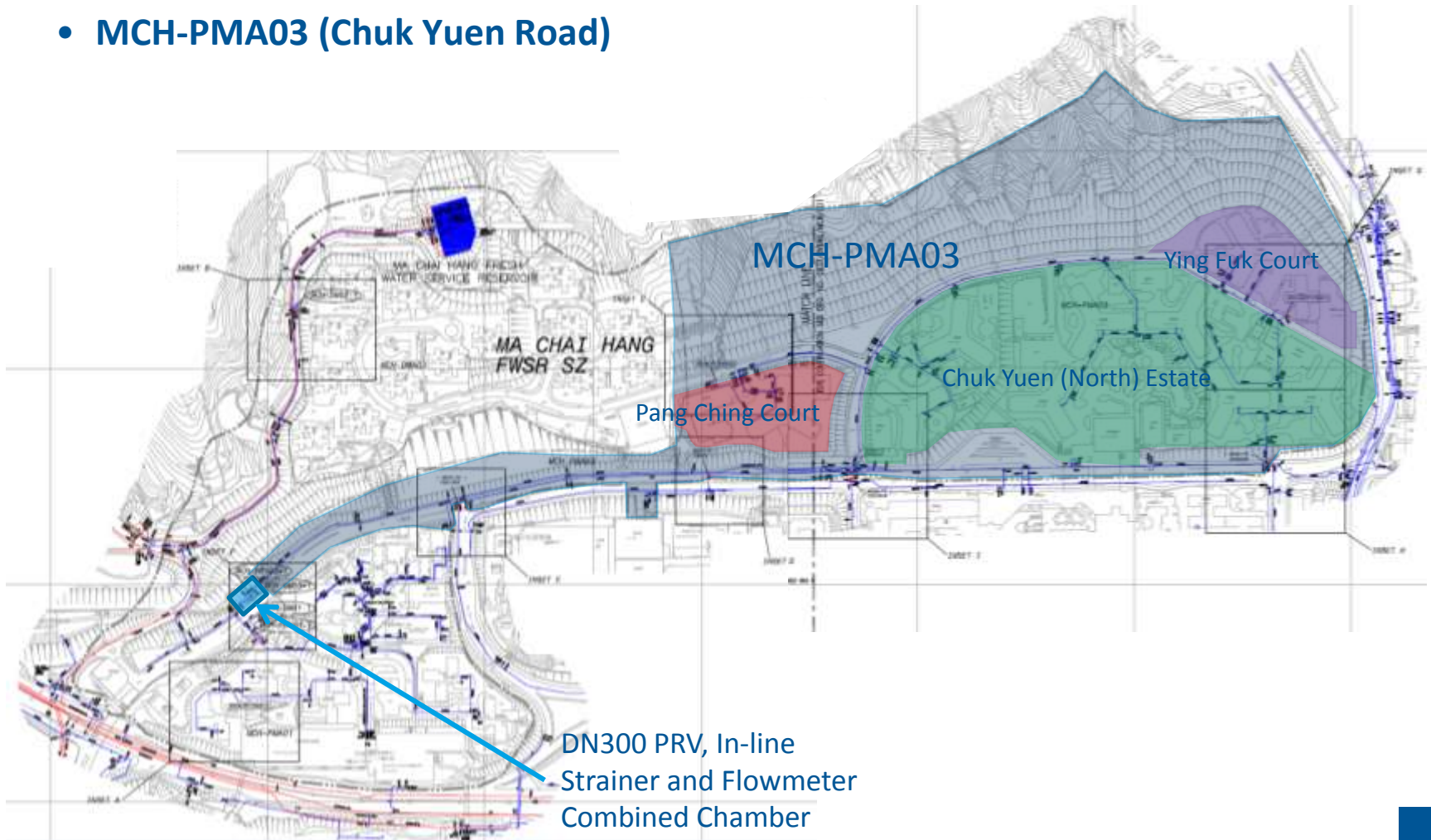
Water Loss Control – Pressure Management

- Very Large water loss control program including pipe replacement, rehabilitation and pressure management
 - 312 Pressure Management Areas (PMAs)
 - 514 District Metering Areas (DMAs)
- Main Breaks/Bursts reduced from 2,479 to 988 through 10-year life of program.



HONG KONG CASE ON PMA IMPLEMENTATION

- MCH-PMA03 (Chuk Yuen Road)



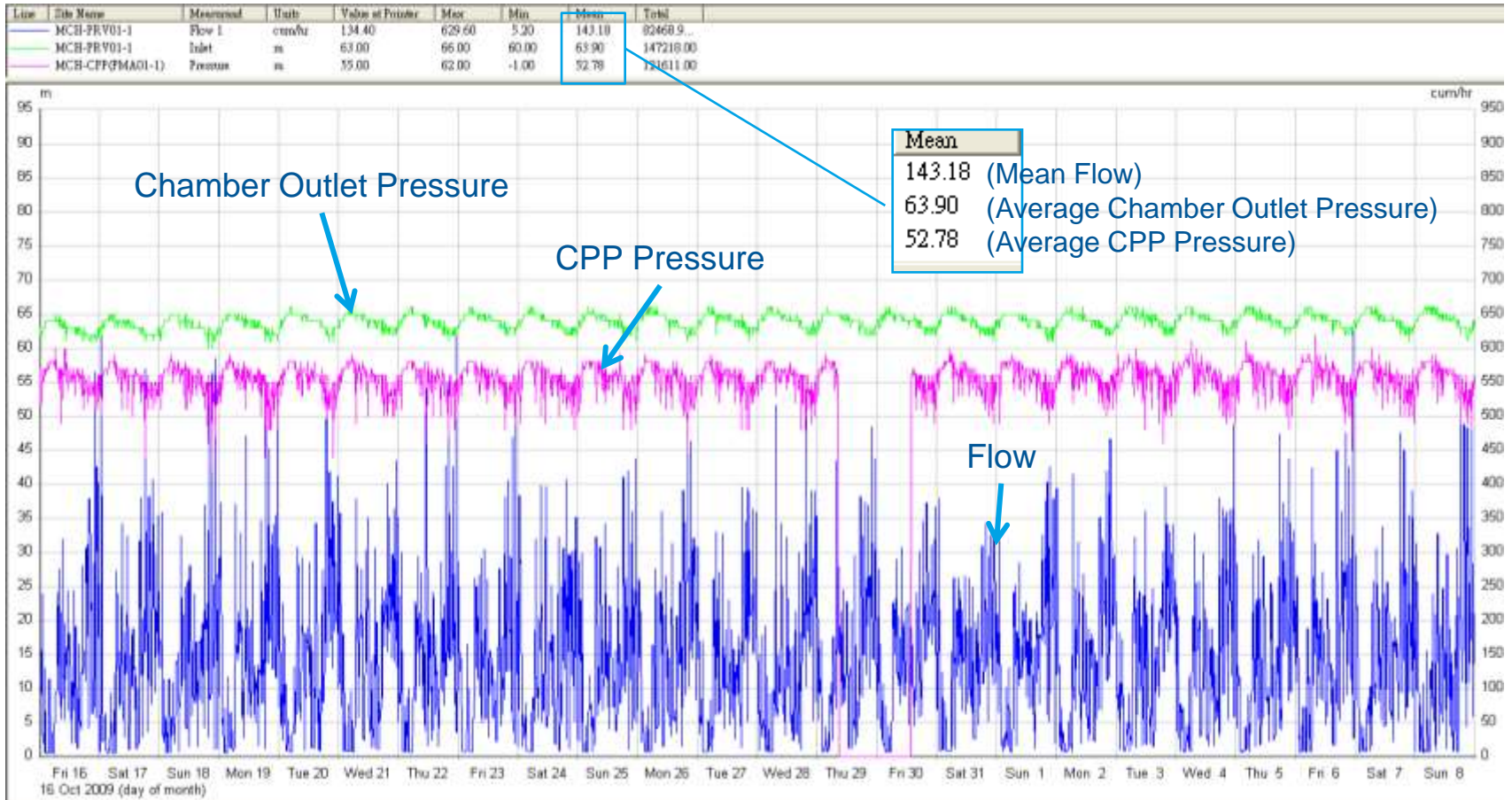
EFFECTIVENESS CASE ON PMA IMPLEMENTATION

- MCH-PMA03 (Chuk Yuen Road)
- DN300 PRV, In-line Strainer and Flowmeter Combined Chamber



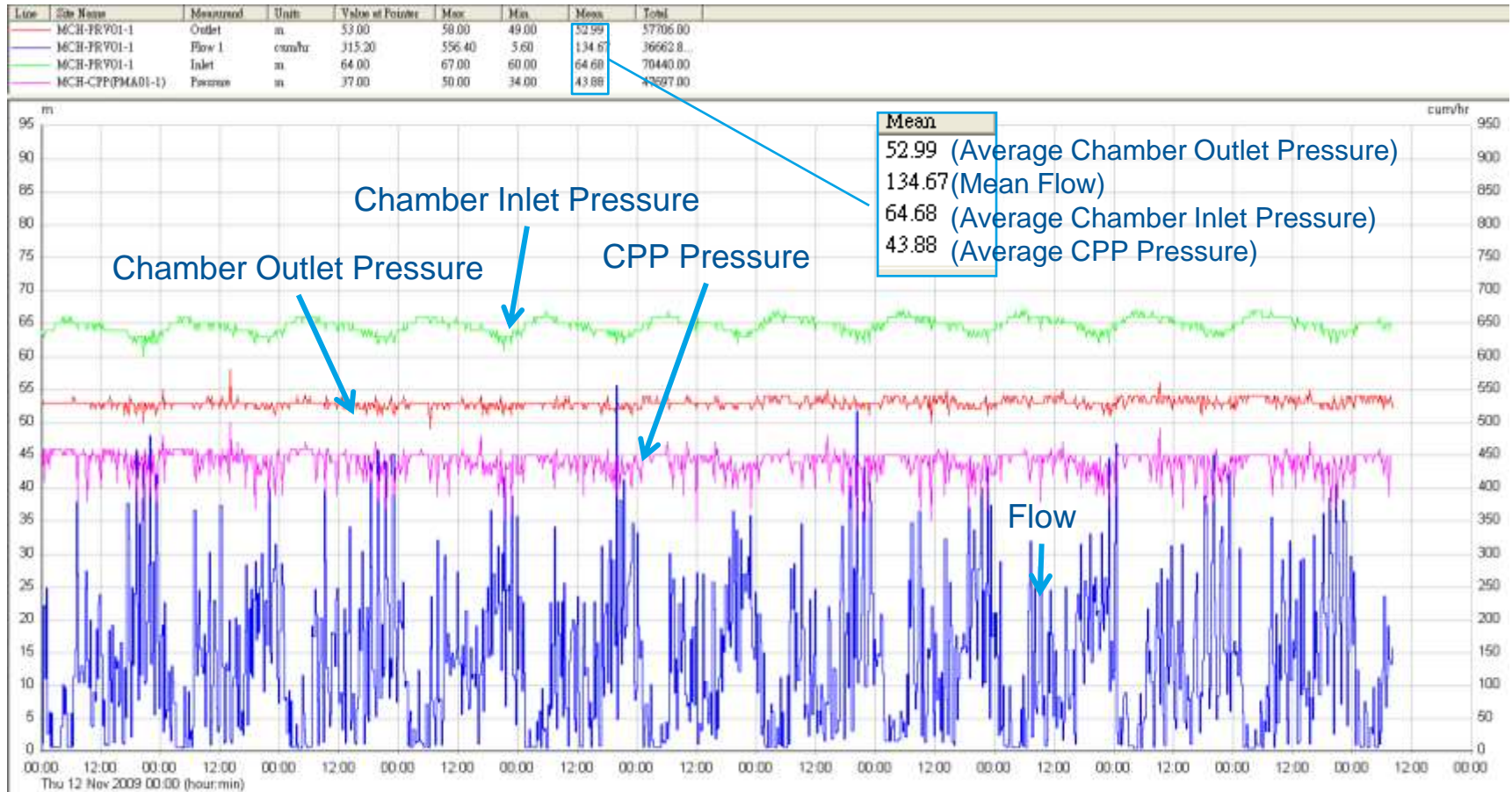
EFFECTIVENESS CASE STUDY – MCH-PMA03 (CHUK YUEN ROAD)

- Data before PMA Implementation (16 Oct 2009 – 8 Nov 2009)



Effectiveness Case Study – MCH-PMA03 (Chuk Yuen Road)

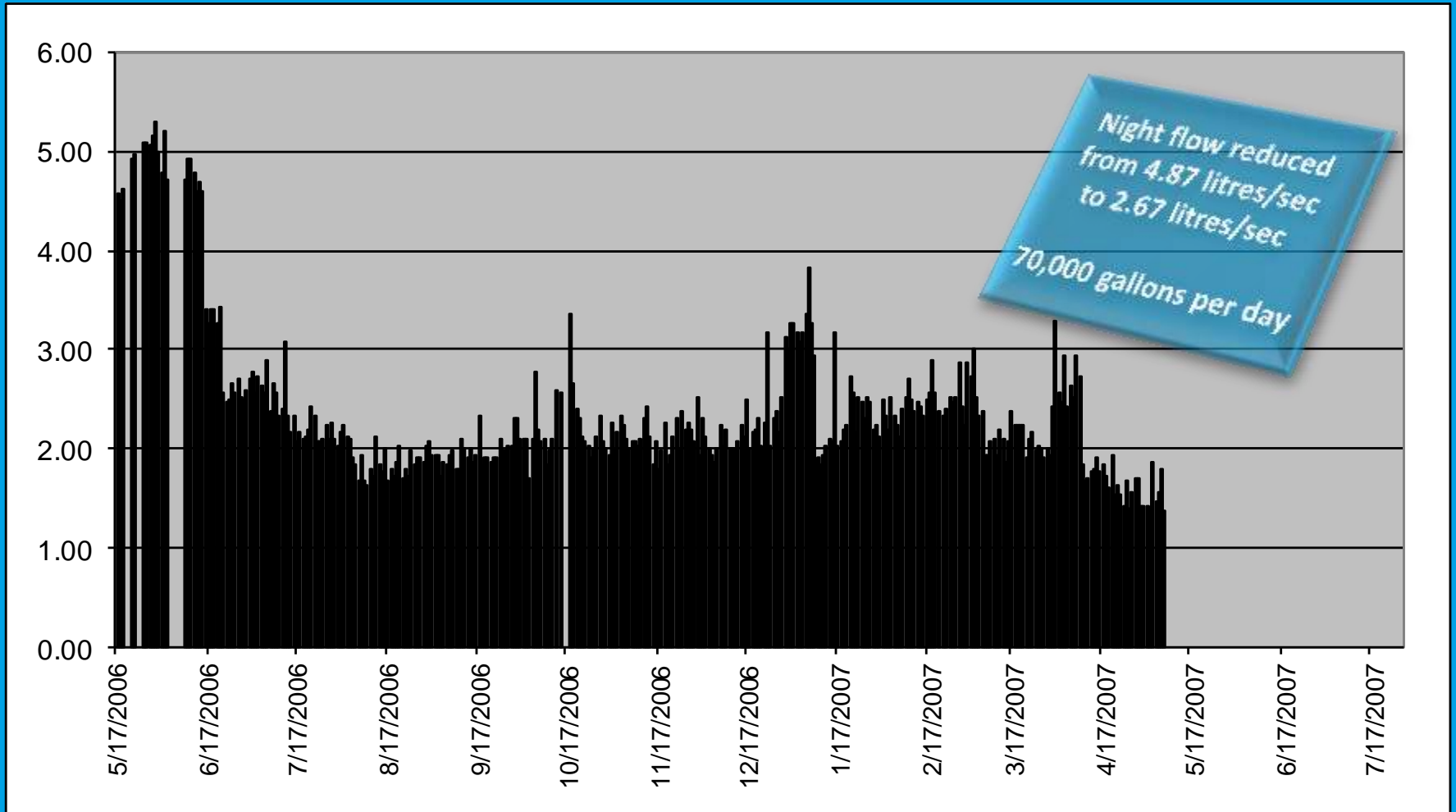
- Data **after** PMA Implementation



EFFECTIVENESS CASE ON PMA IMPLEMENTATION - MCH-PMA03 (CHUK YUEN ROAD)

	Before PMA Implementation	After PMA Implementation	Reduction
Flow	143 cum/hr	134 cum/hr	9 cum/hr (~6.0%) [40 gpm]
Average Chamber Outlet Pressure	63.9 m	53.0 m	10.9 m
Average CPP Pressure	55.6 m	43.9 m	11.7 m

WATER SAVINGS FROM PRESSURE MANAGEMENT – GUINEAS CREEK ROAD



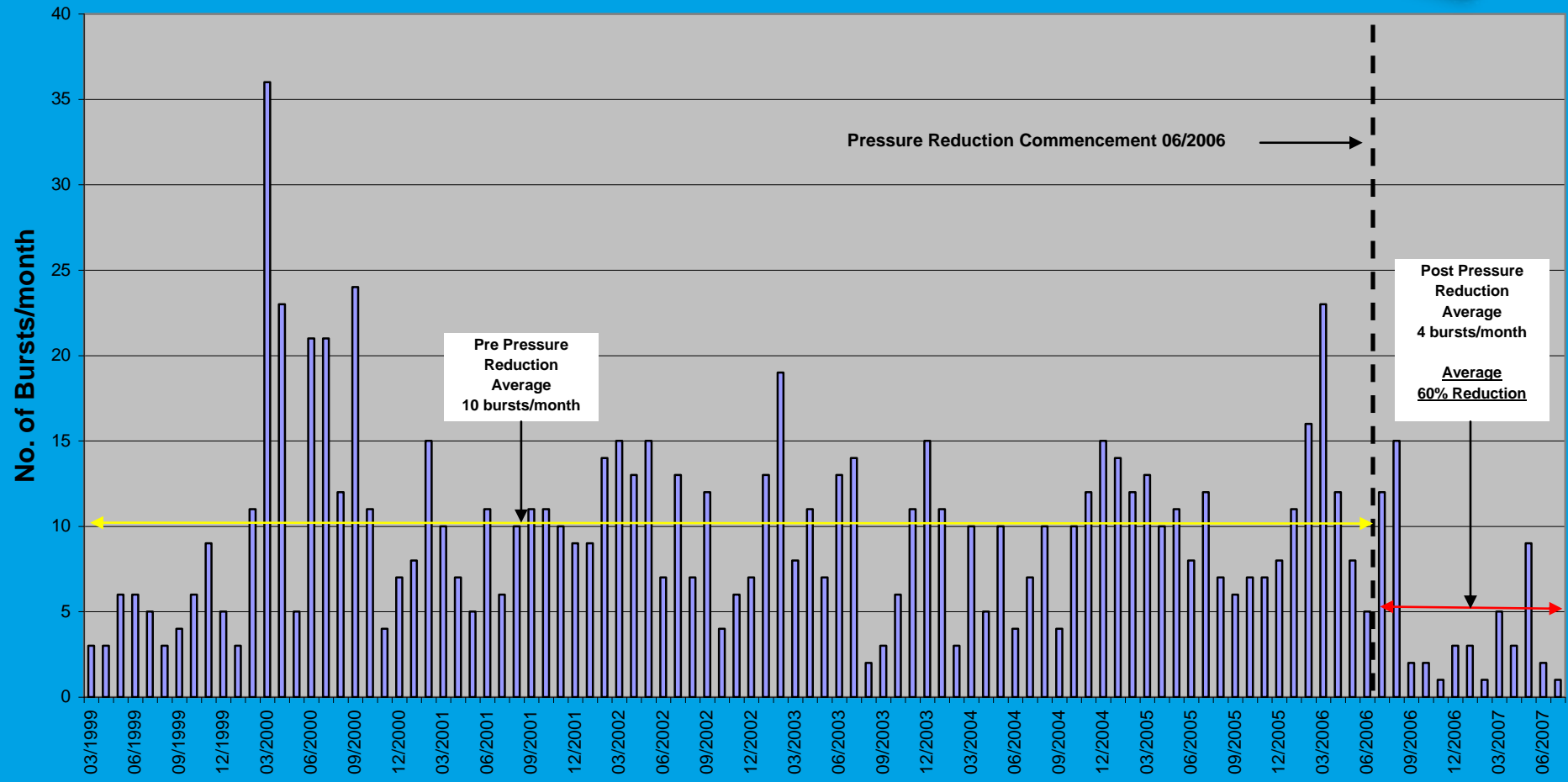
Source: Wide Bay Water

GOLD COAST WATER GUINEAS CREEK ROAD

Bursts reduced
from 10 bursts/mnth
to 4 bursts/mnth

60% reduction

**Burst Frequency - DMA W01-DZ1
Guineas Creek Road**

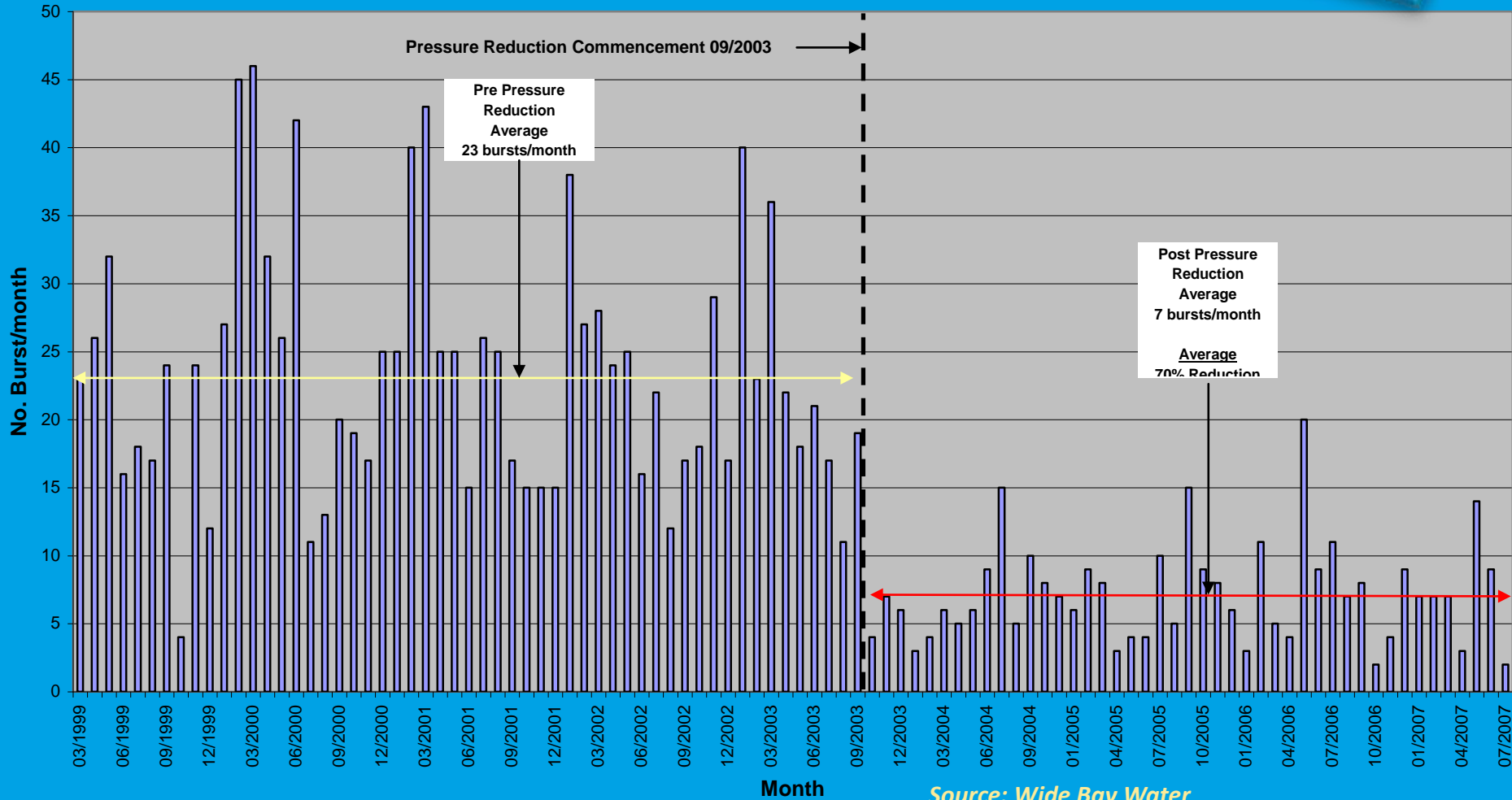


Source: Wide Bay Water

GOLD COAST WATER DEODAR DRIVE

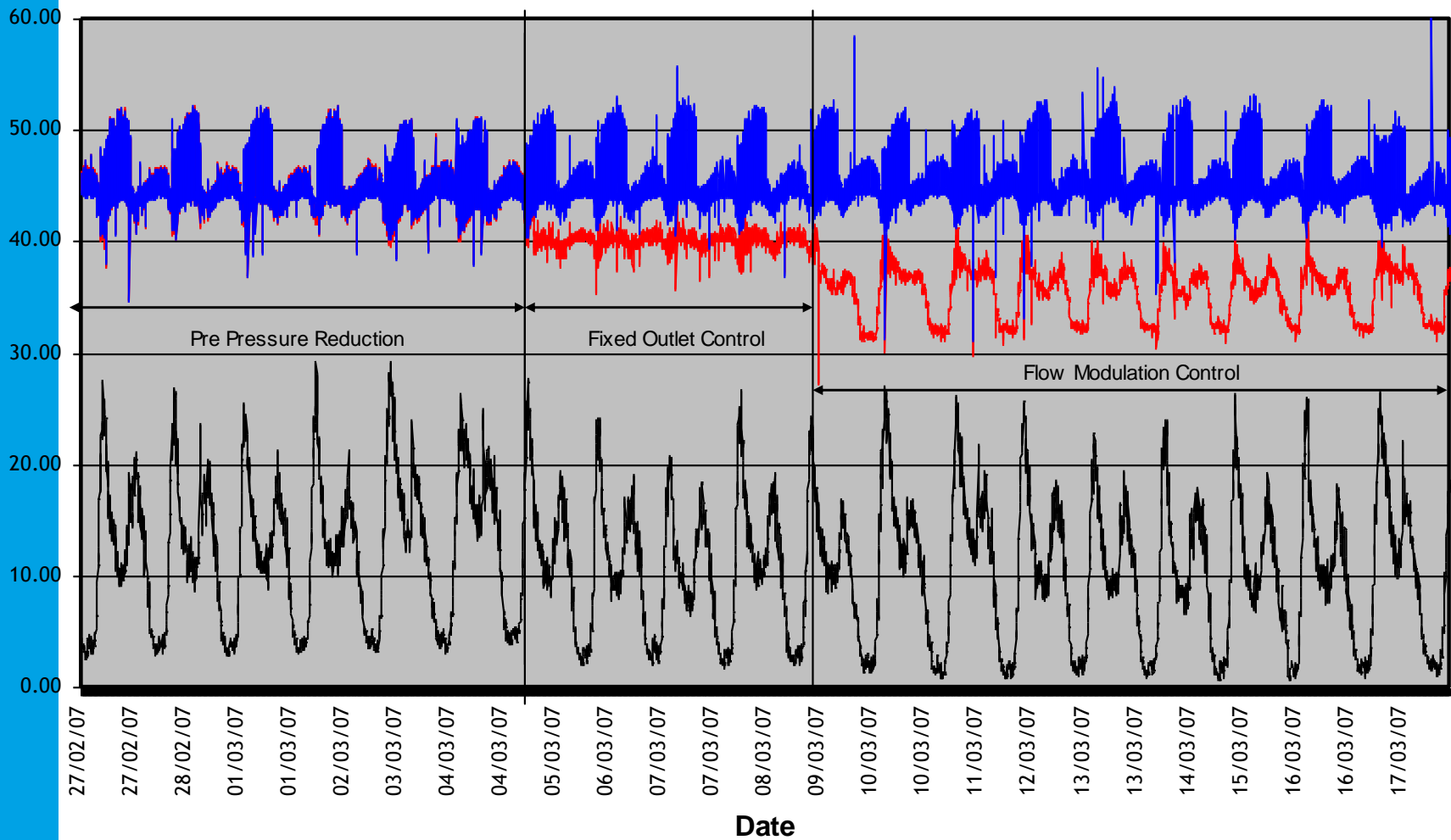
Bursts reduced from 23 bursts/mnth to 7 bursts/mnth
70% reduction

Burst Frequency - DMA W07-DZ1
Deodar Drive

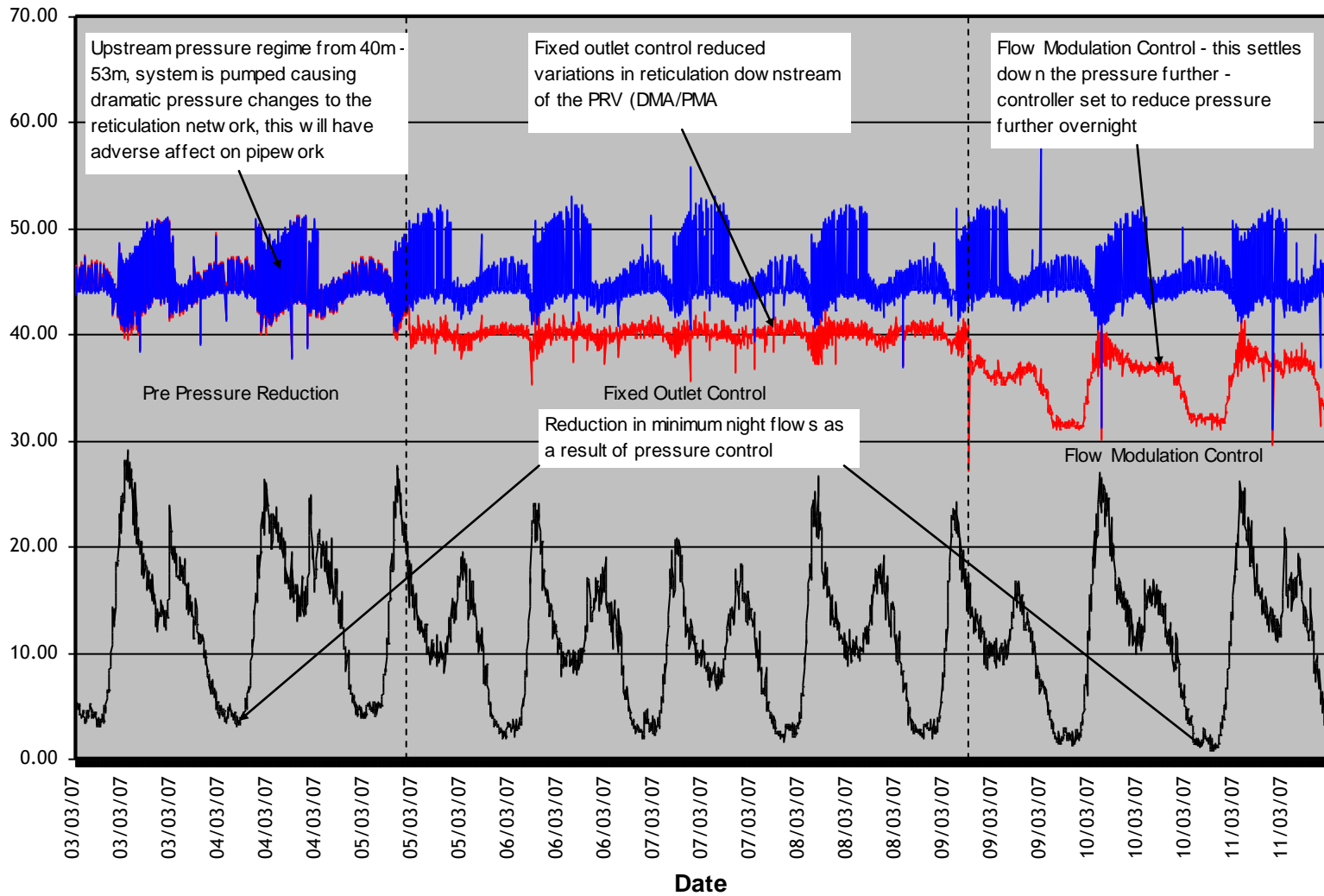


Source: Wide Bay Water

Pressure Control - Woody Point Pilot DMA/PMA

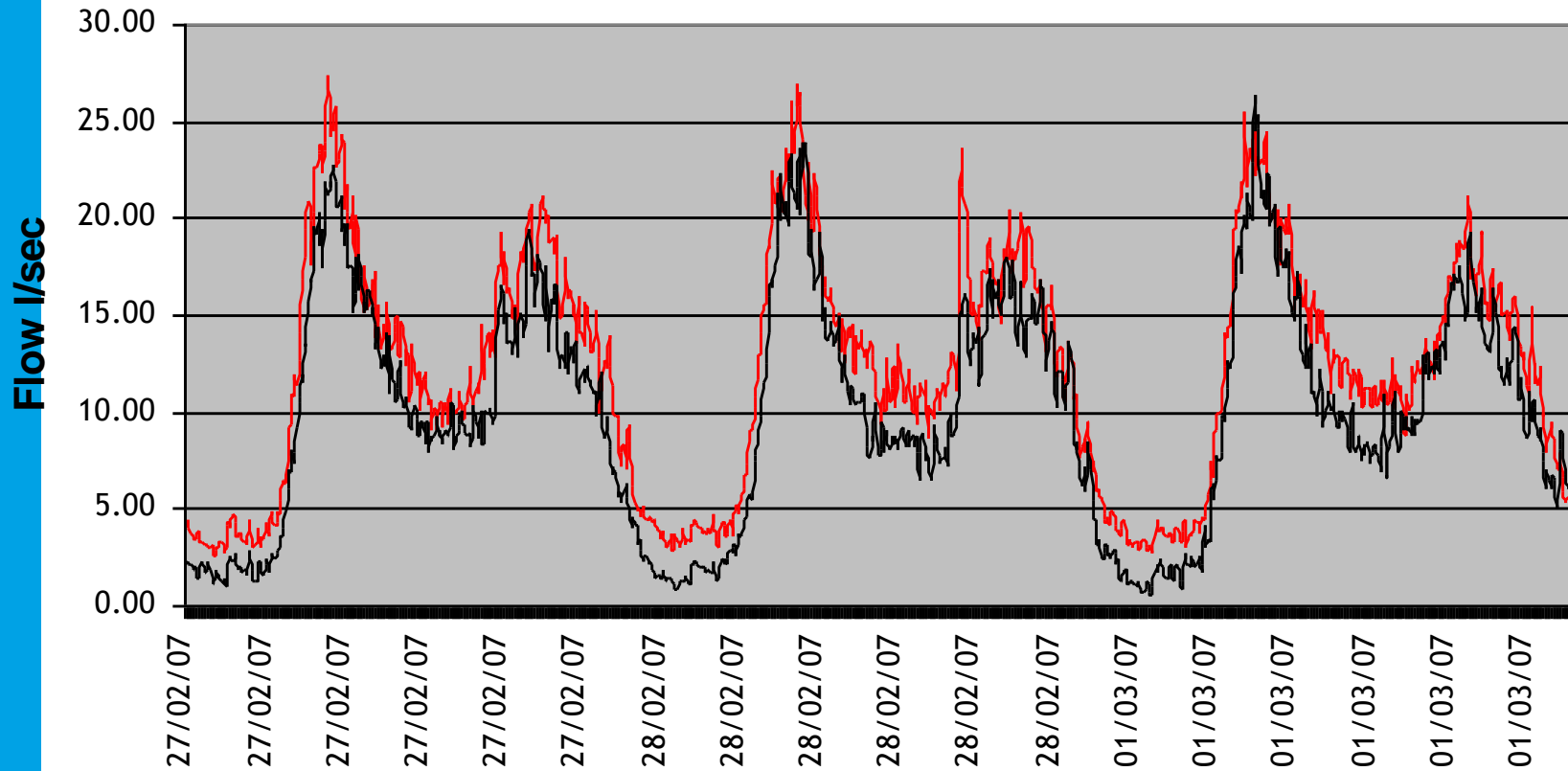


Pressure Control - Woody Point Pilot DMA/PMA - Detail

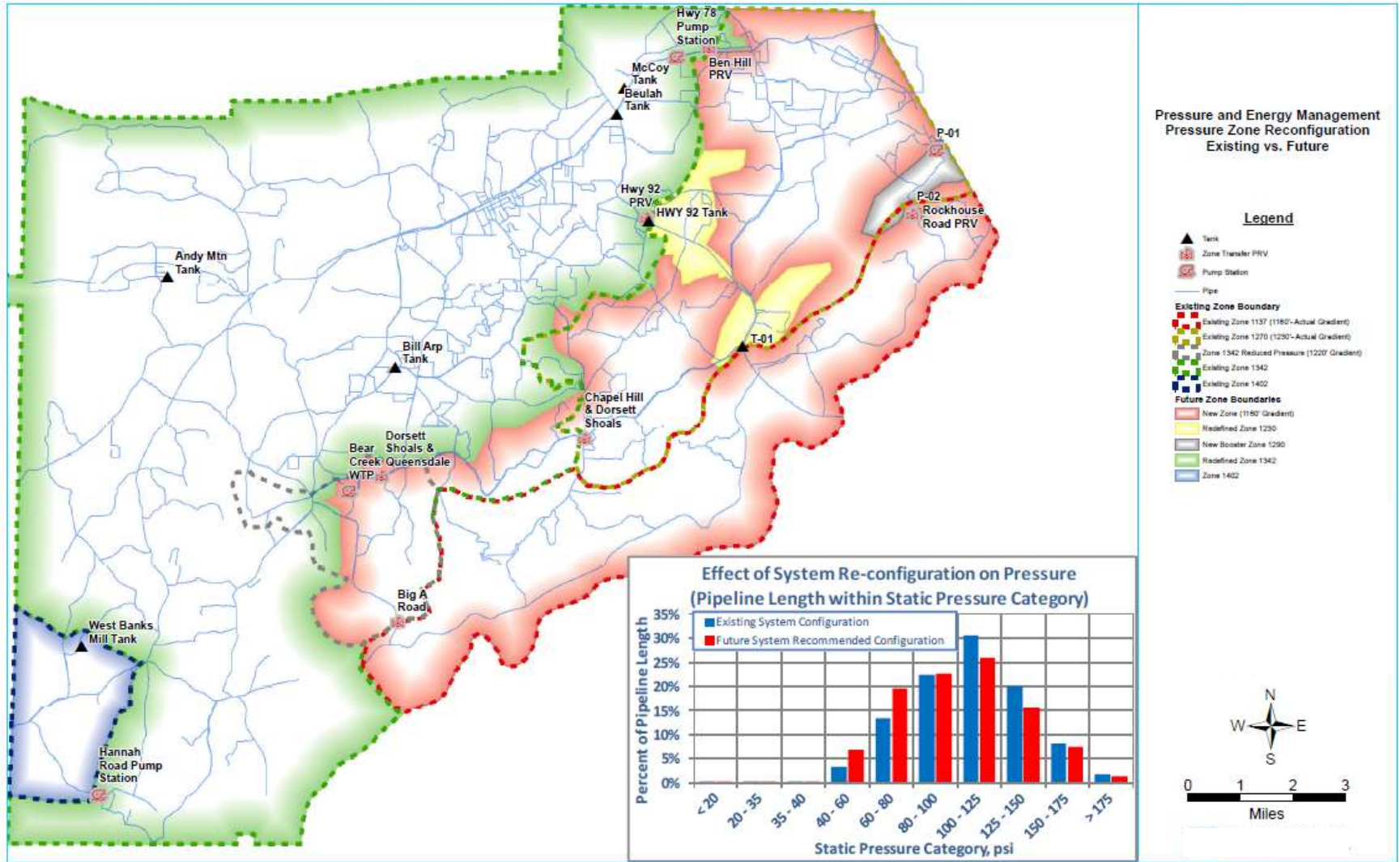


Pressure Control - Oxley Road Pilot DMA/PMA

Reduction in flow rates over 24hr Periods



PRESSURE MANAGEMENT



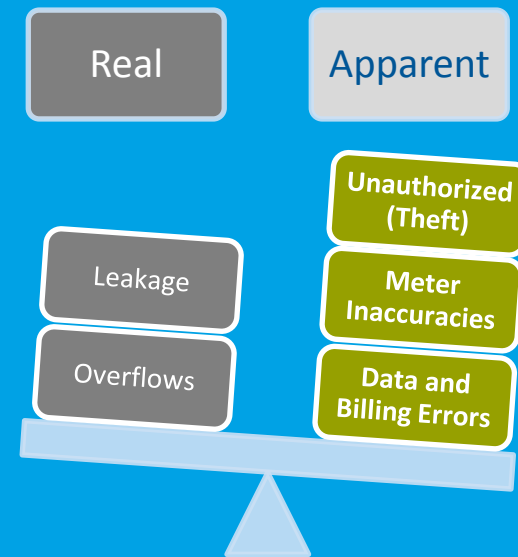
As reduce overall pressure, will reduce leakage and reduce energy demands



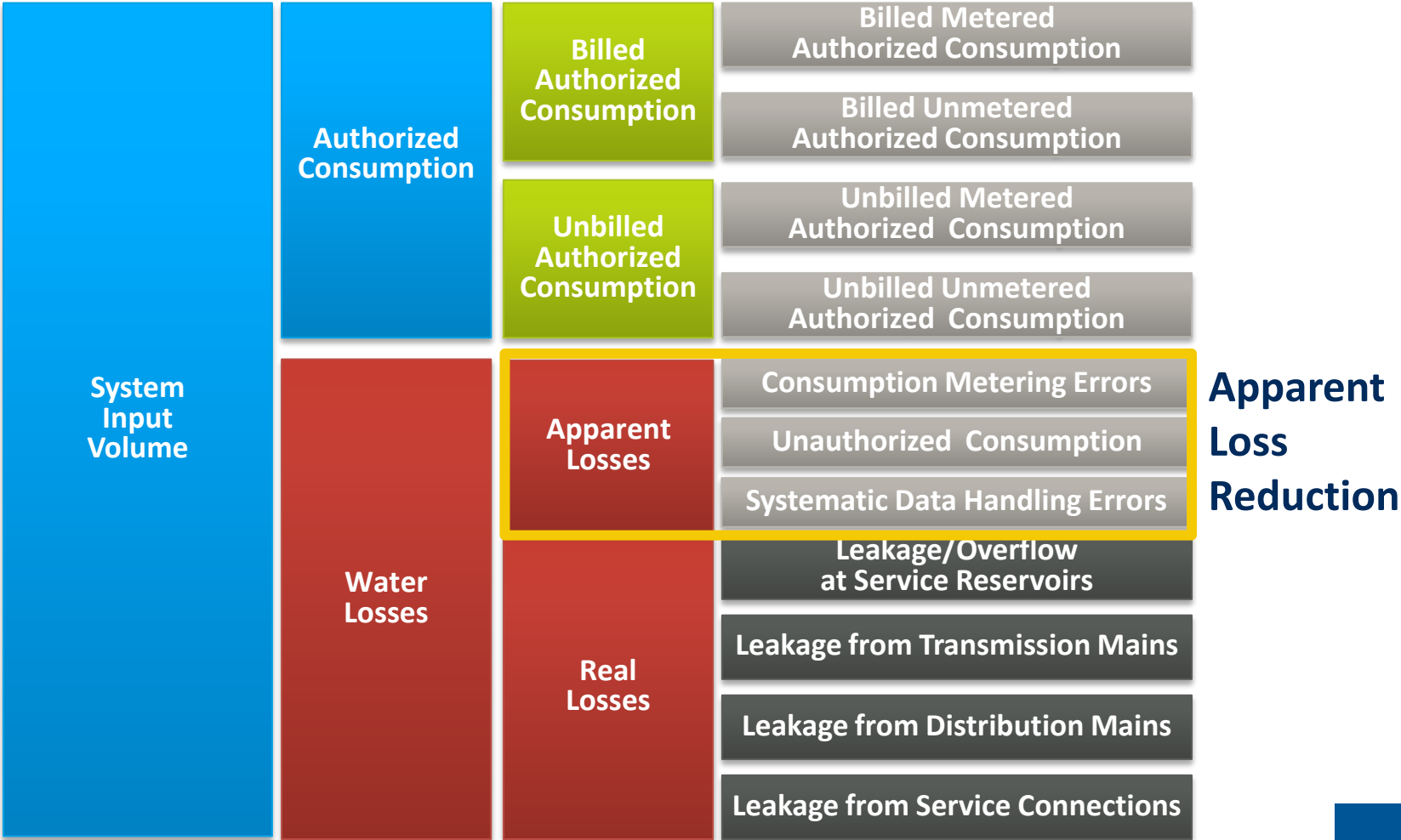
Source: WRP PTY, SA



APPARENT LOSS REDUCTION



APPARENT LOSS IN THE AWWA WATER BALANCE



Meter Inaccuracy and Monitoring

Most utilities replace on age limits. Performance measurement enhances infrastructure life expectancy.

Tools

- Accuracy test analysis
- Database of Sensus meter tests
- Performance measurement curves and payback analyses already constructed

Unauthorized Consumption (Theft)

Often difficult to measure. Detectable using detailed data analytics coupled with field surveys.

Tools

- Identification through billing analytics
- Anomaly review to determine problem accounts

Systematic Data Handling Errors

Errors between meter reads and receipt of bill. Evaluation of billing system integration, meter reading accuracy.

Tools

- Billing System Forensics
- Integration knowledge of multiple billing systems (including, SunGard, HTE, SAP, CC&B,...)



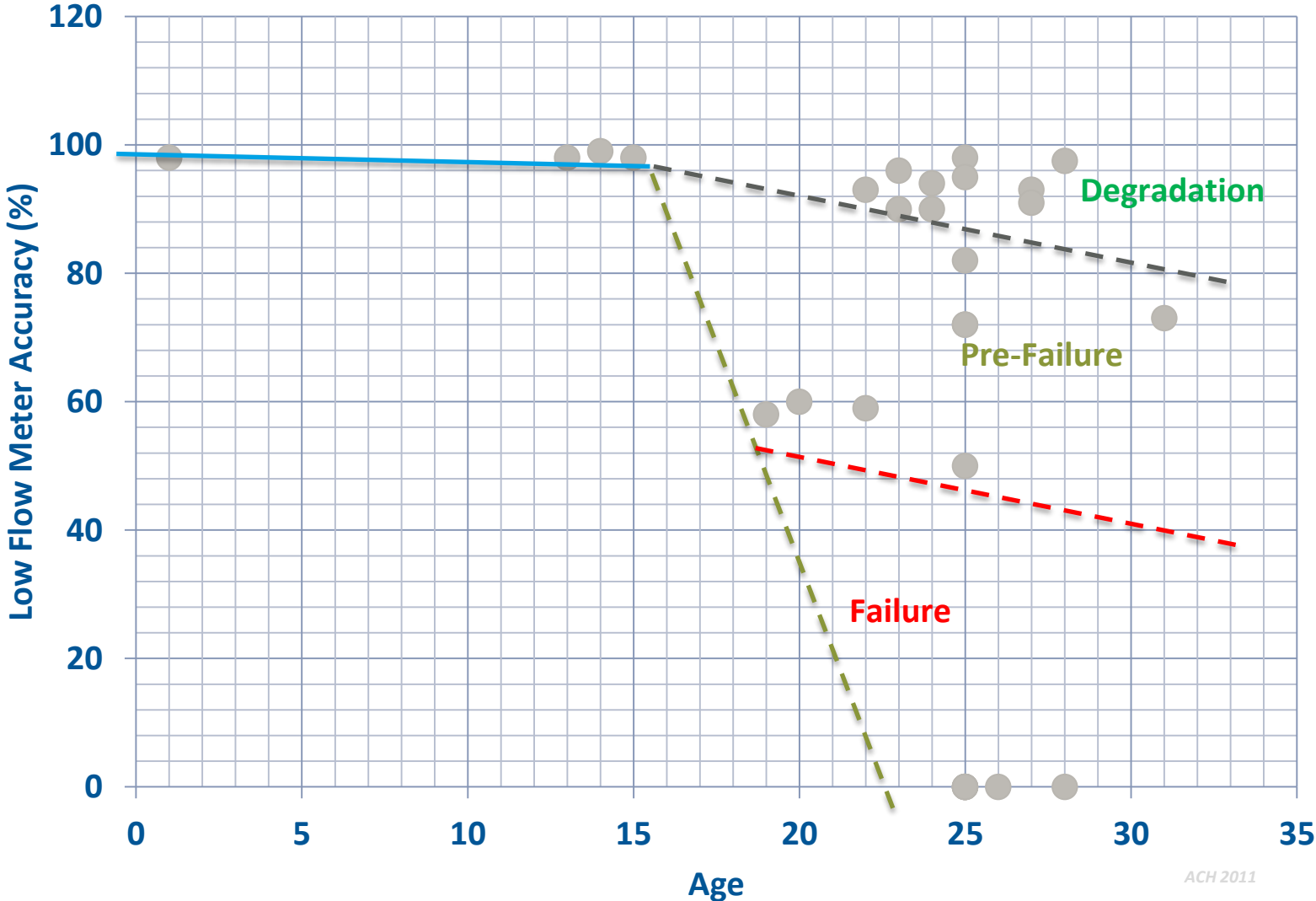
APPARENT LOSSES

Apparent Losses:

- **Customer Metering Inaccuracies**
 - Assemble meter demographics from records
 - Conduct regular meter accuracy testing, small samples of meters will suffice
- **Unauthorized Consumption**
 - Can use default value of 0.25% of water supplied volume
- **Systematic Data Handling Errors**
 - Billing system forensic analysis
 - Meter reading anomalies

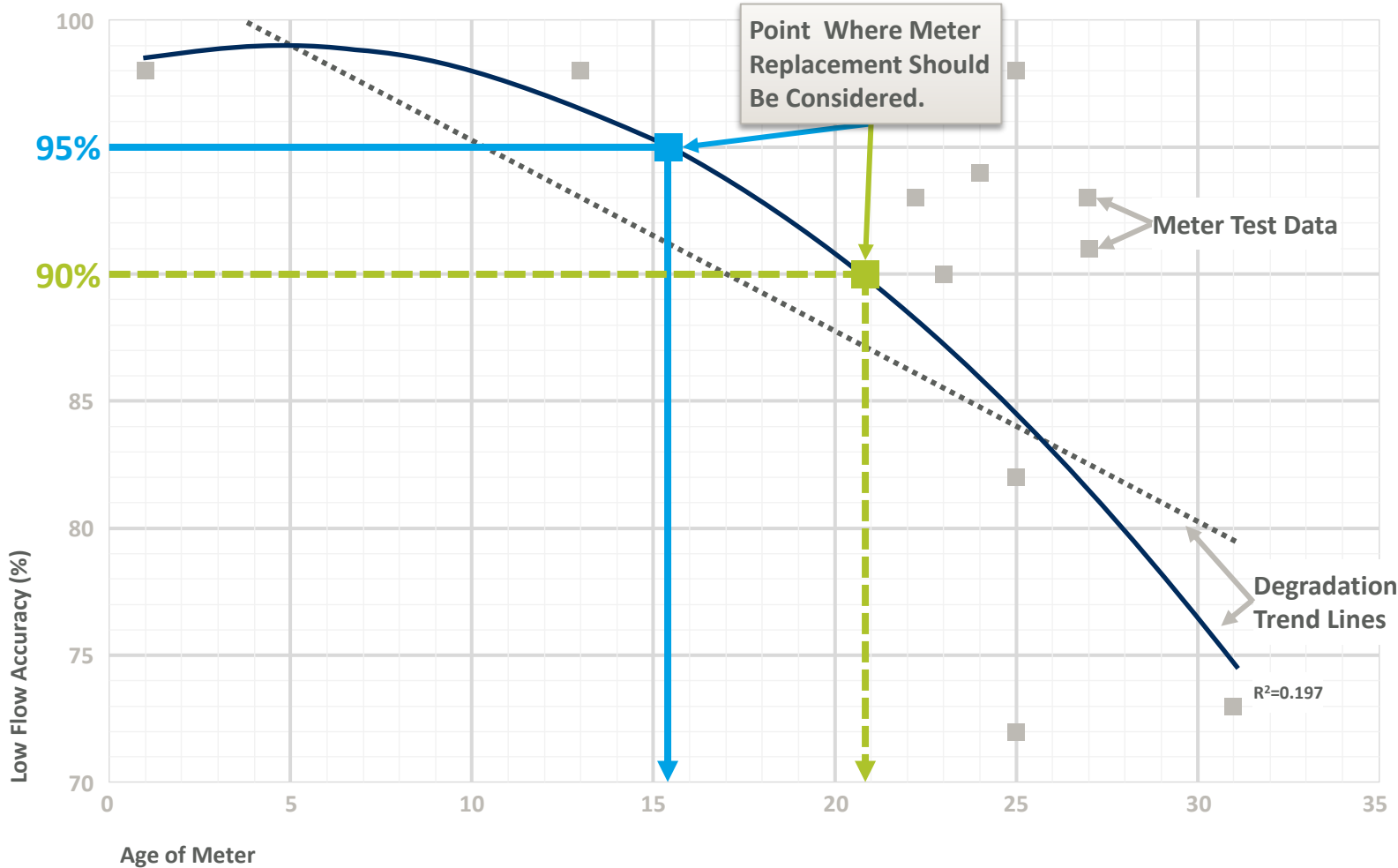


METER ACCURACY

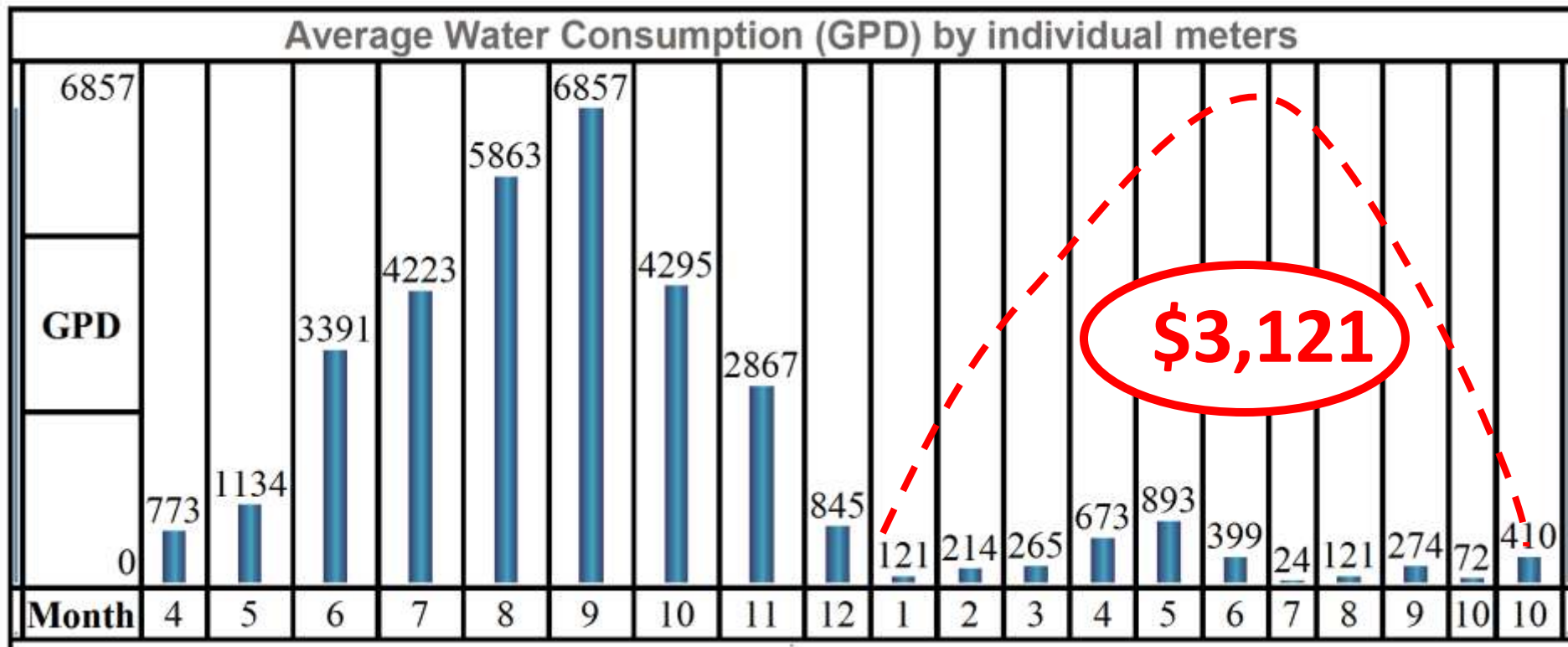


METER ACCURACY EVALUATION METHODS

PERFORMANCE MEASUREMENT



IDENTIFICATION OF INACCURATE METERS



This can also be done by good database analysis of monthly read data

UNAUTHORIZED CONSUMPTION (THEFT)



- **Illegal Connections**
- **Contractors at Hydrants**
- **Open bypasses**

CREATIVE USAGE REDUCTION



SYSTEMATIC DATA HANDLING ERRORS

WATER, NO WASTEWATER

	<i>Name</i>	<i>LocID</i>	<i>Address</i>	<i>Other Info.</i>	<i>Check</i>
1	James L. West Special Care	3426	1101 Summit Ave.	C Large user average (3 years) 187 CCF – If correct costing: \$7,090 per year.	Yes
2	IDI	3678	1201 Summit Ave.	C Large user, need to change to Irrigation.	Yes
3	Haws Athletic Center	208	200 Franklin St.	DB changed to YD 05/8/06 .	Done
4	Paddock Park	212		DB	No
5	Inner City	214		DB	No
6	Superior Meats	424	1413 Calhoun St.	I (monitored?)	Old
7	Oncor Electric Delivery	506	501 Texas St.	C (need to research)	Yes
8	First United Methodist Church	678		NP (Has other location ID accounts with sewer.)	No
9	Kent A. Riibe	2904-8	1500 E. 4th St.	R Added WW 8/7/08.	Done
10	HB Zachary Co.	2926	1712 Heathcote St.	C Old	Old
11	James L. West Special Care	3426	1101 Summit Ave.	C Large user 400 CCF – research	Yes
12	IDI	3678	1201 Summit Ave.	C Large user, need to change to Irrigation.	Yes
13	Cook Childrens' Medical Center	4136	1400 W. Humboldt St.	C Small user, need to add WW after research.	Yes
14	Beall Concrete, Inc.	35452	2725 Premier St.	C Large user, possibly monitored.	Yes
15	Fort Worth FC	33732	1413 Baurline St.	C May be Irrigation.	Yes
16	General Industrial Corp.	33982	3602 N. Sylvania Ave.	C Medium user	Yes

WA/NoWW



1201 Summit Ave

WA/NoWW



1101 Summit Ave

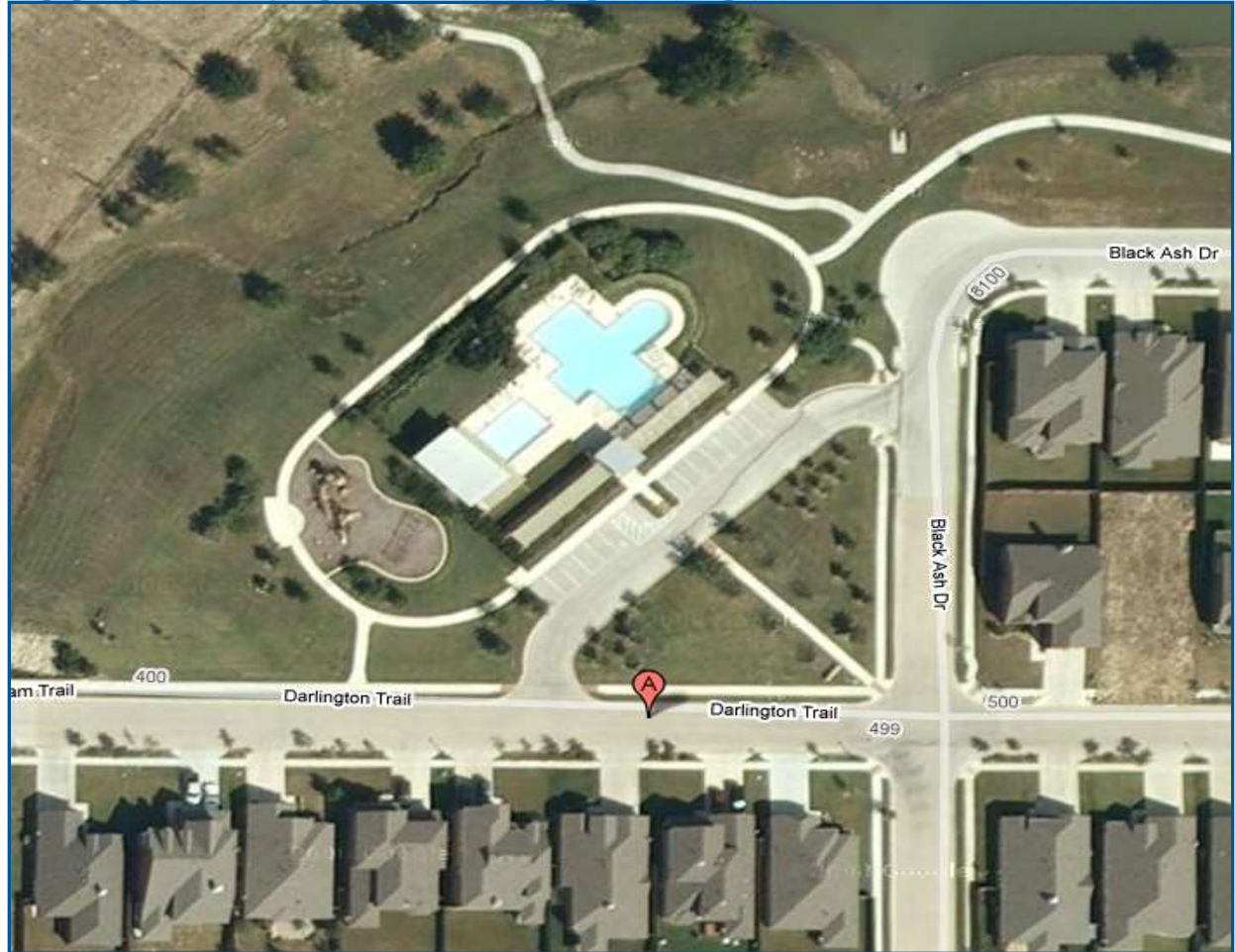
REVENUE GENERATION

- **There were 2,856 users which fell into the WA/NoWW framework. Of those, some are:**
 - Old accounts or in areas not served by sewers.
 - Secondary accounts with sewer.
 - Just irrigation accounts, no sewer.
- **More than 100 customers remain who were WA/NoWW and should be billed.**
- **Revenue enhancement ~\$90,000 per year.**

REVENUE GENERATION

INCORRECTLY ASSIGNED: CREEKWOOD HOA

- One other location, classed as Commercial.
- High use for Residential-class property.
- No irrigation meter.
- Water meter up to 500 CCF per month, with 290 CCF average.
- Estimated revenue increase if changed to Commercial and/or irrigation meter added: \$1,500 to \$11,000/year.



SMART METERING TECHNOLOGY



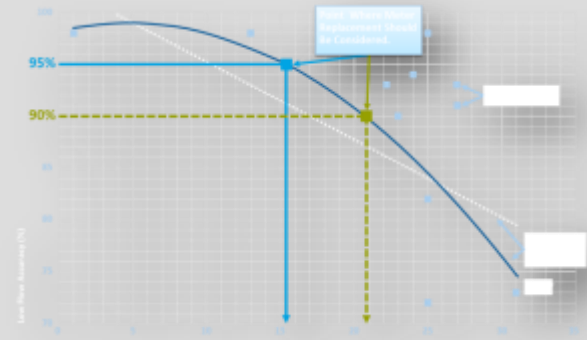
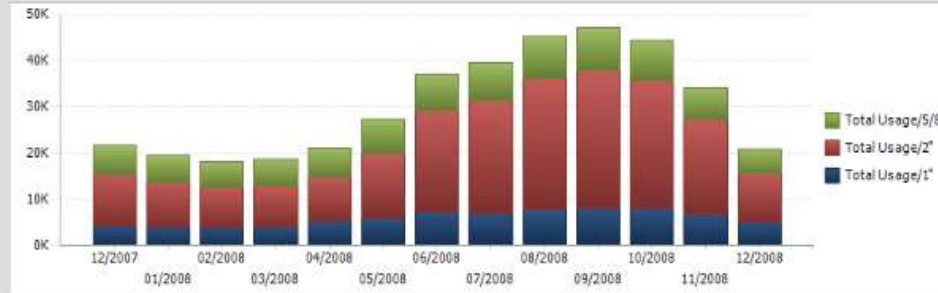
Customer Metering and Demand Analysis | Yearly Usage

Customer Metering and Demand Analysis

Meter Usage

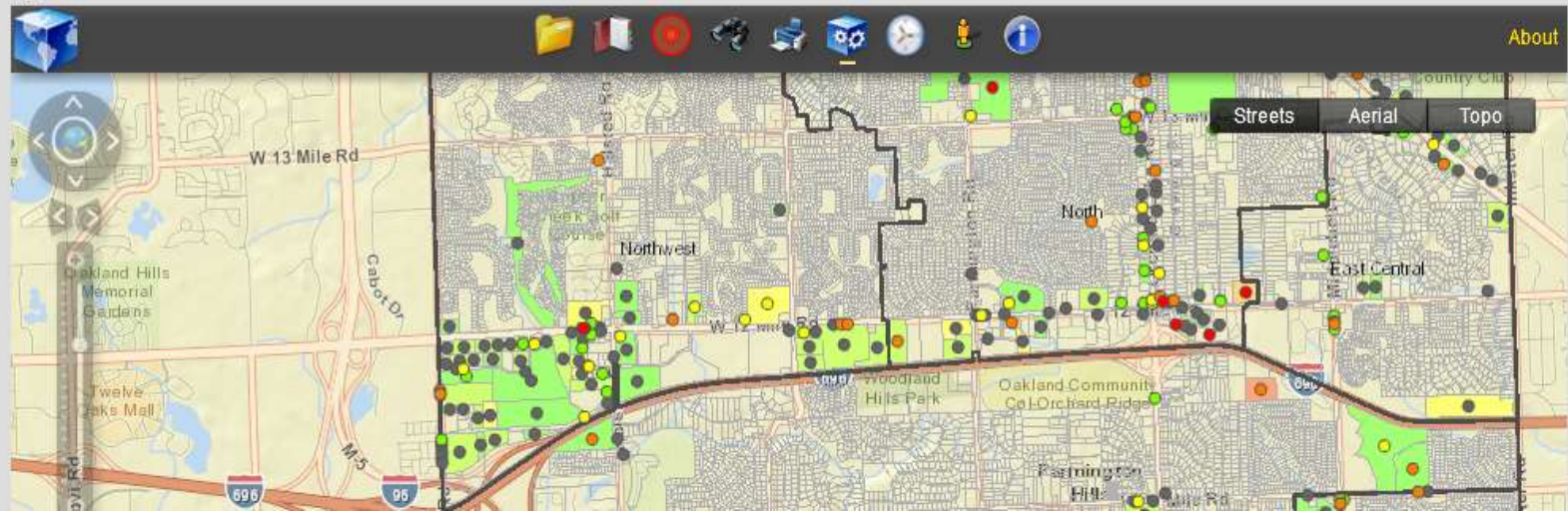
Month: 12/2008 Class: Commercial Manufacturer: NEPTUNE
FlowType: All MeterSize: 1", 2", 5/8" Age: All
Route: All District: All Cycle: All

Meter Size Water Usage

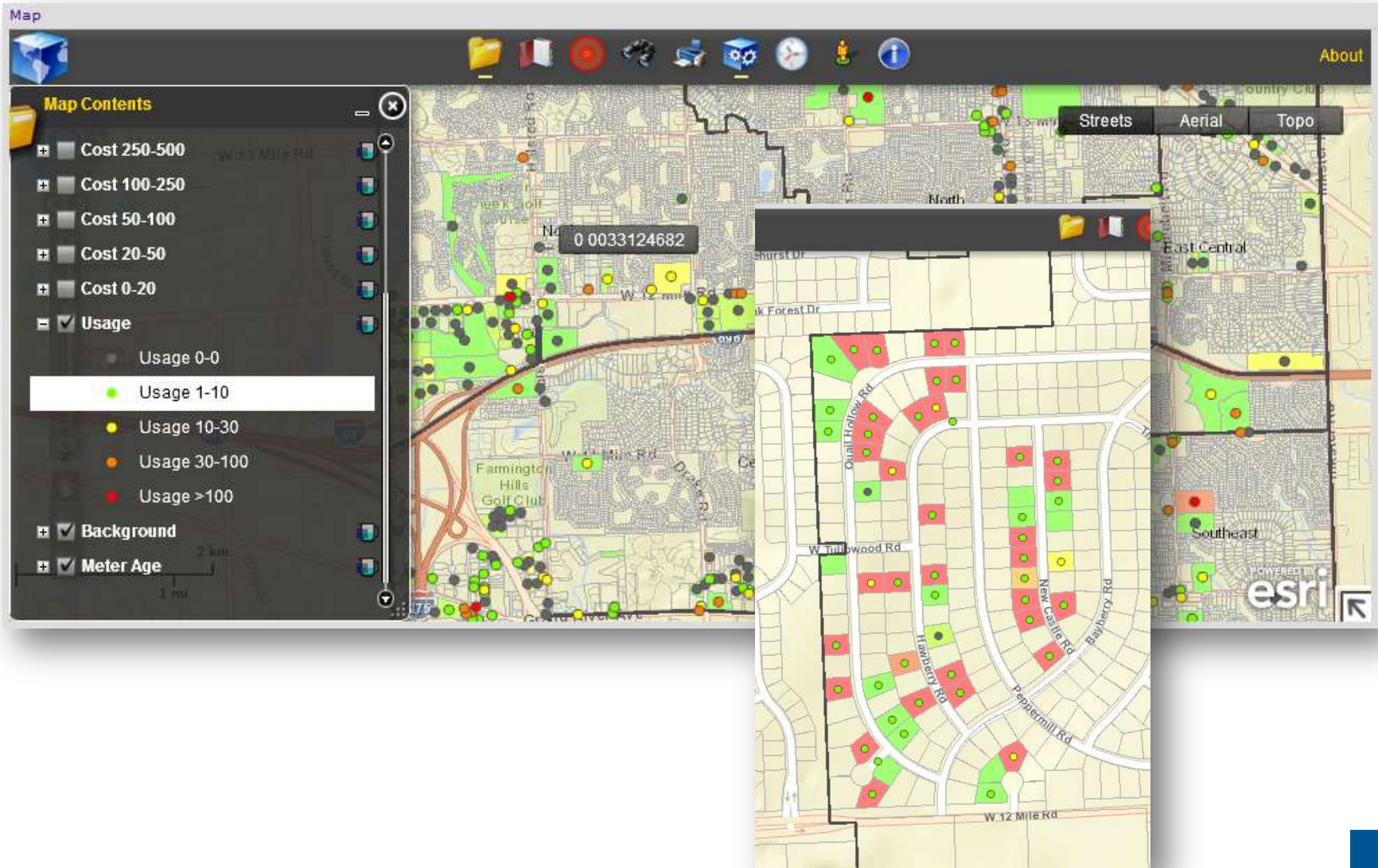


Layer: Usage

Map



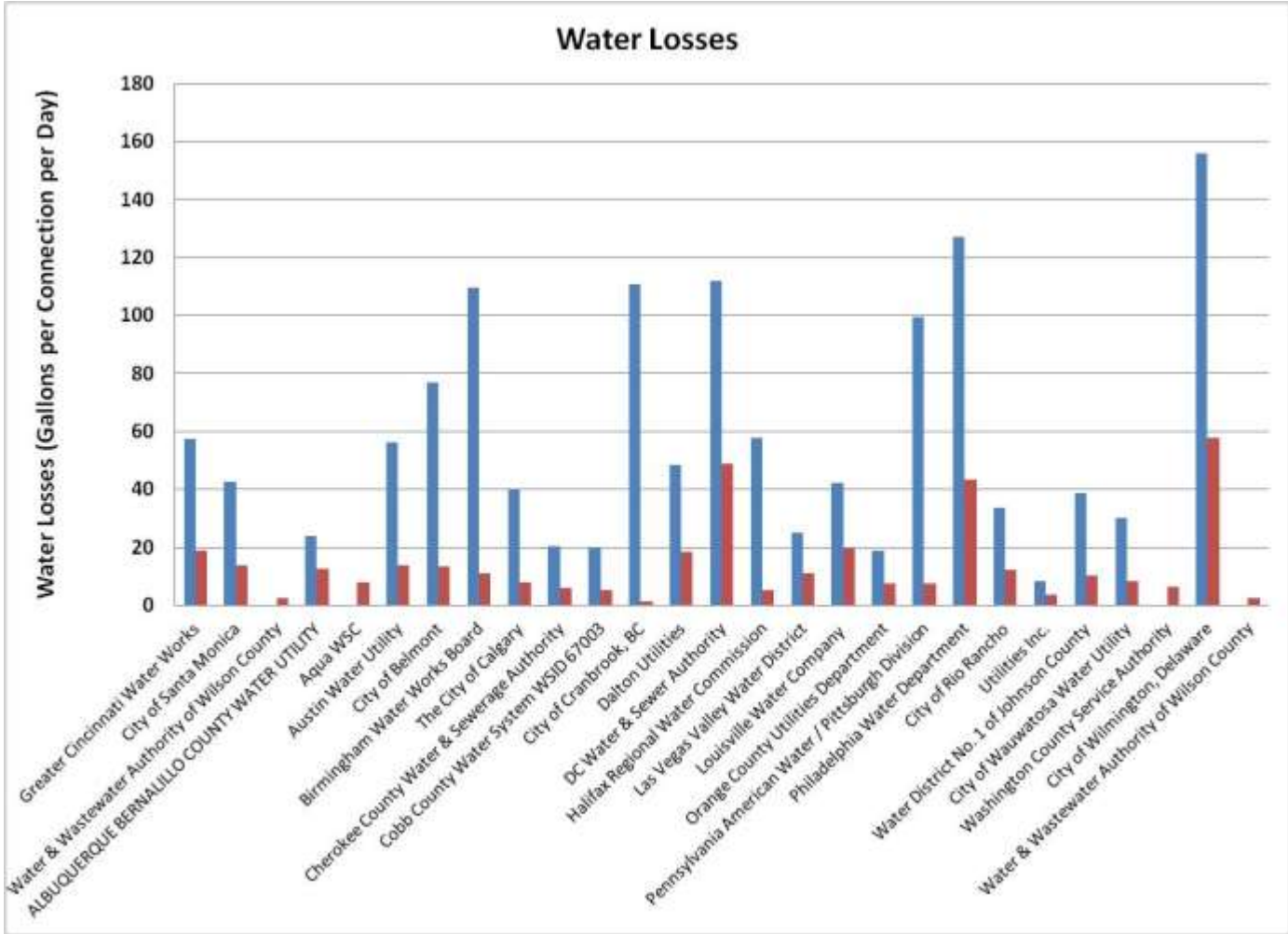
VISUALIZATION AND ANALYTICS



APPARENT WATER LOSS DATA AND COMPARISONS

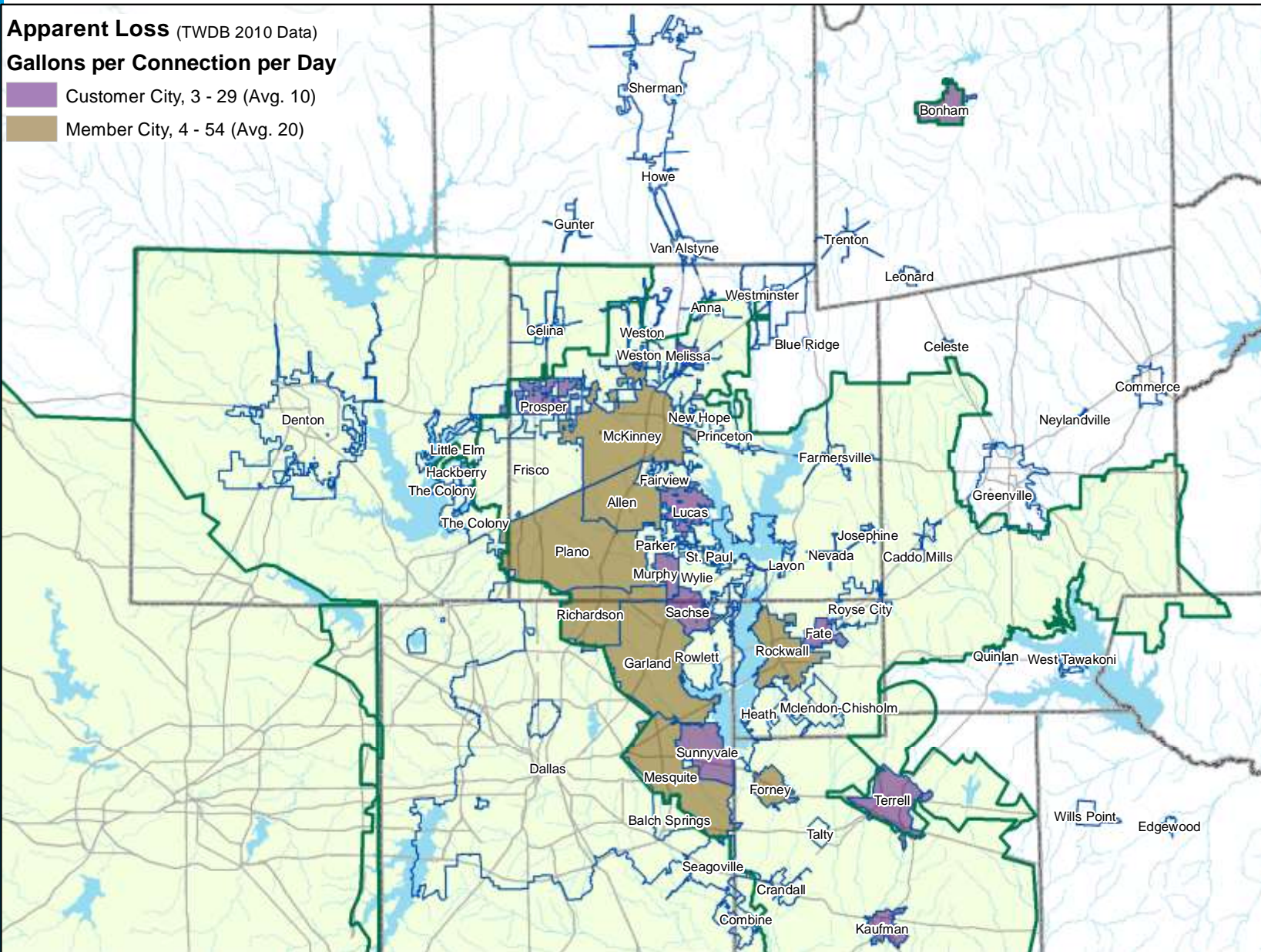


OVERALL WATER LOSSES





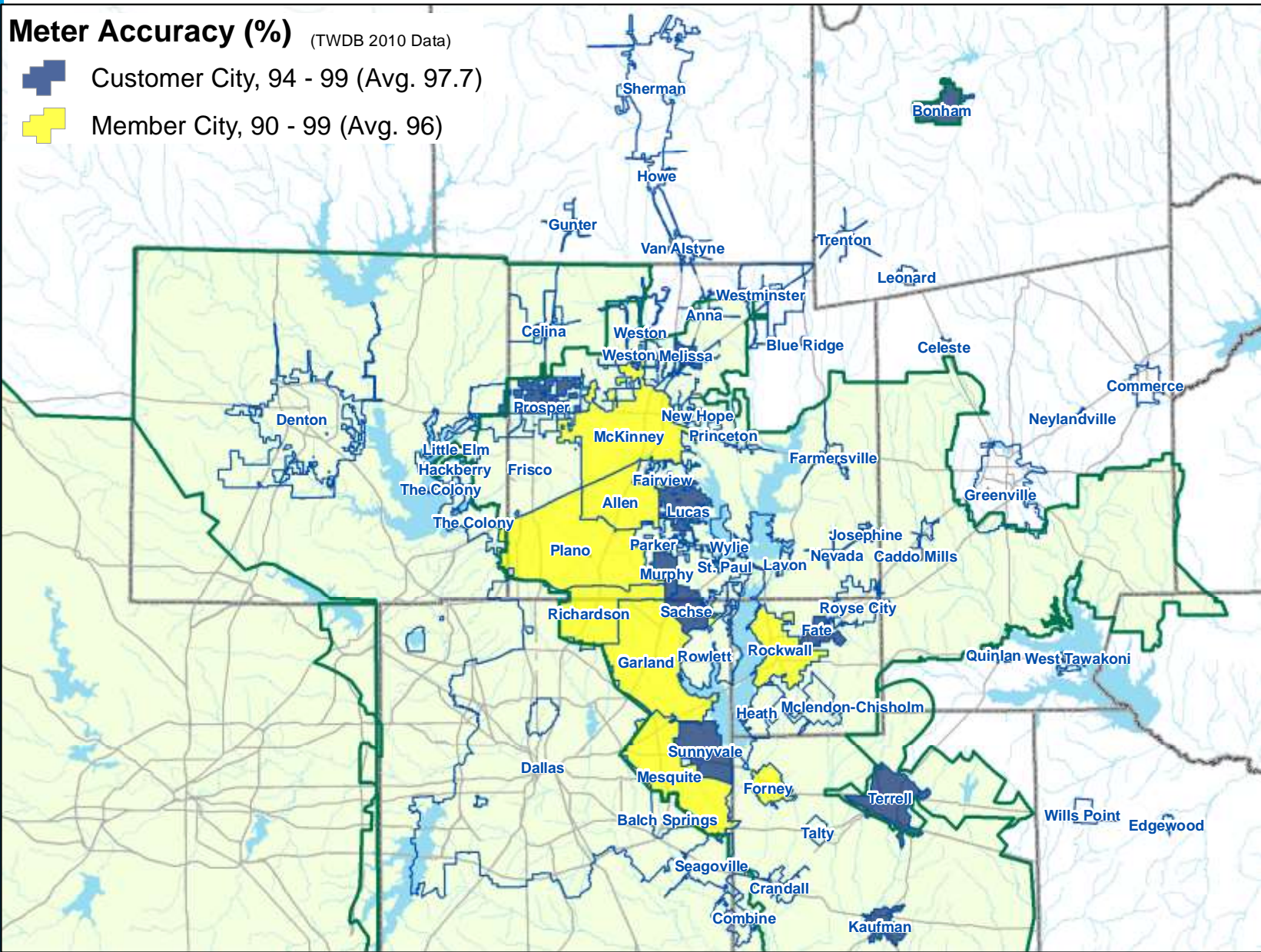
Apparent Loss (TWDB 2010 Data)
Gallons per Connection per Day

- Customer City, 3 - 29 (Avg. 10)
- Member City, 4 - 54 (Avg. 20)

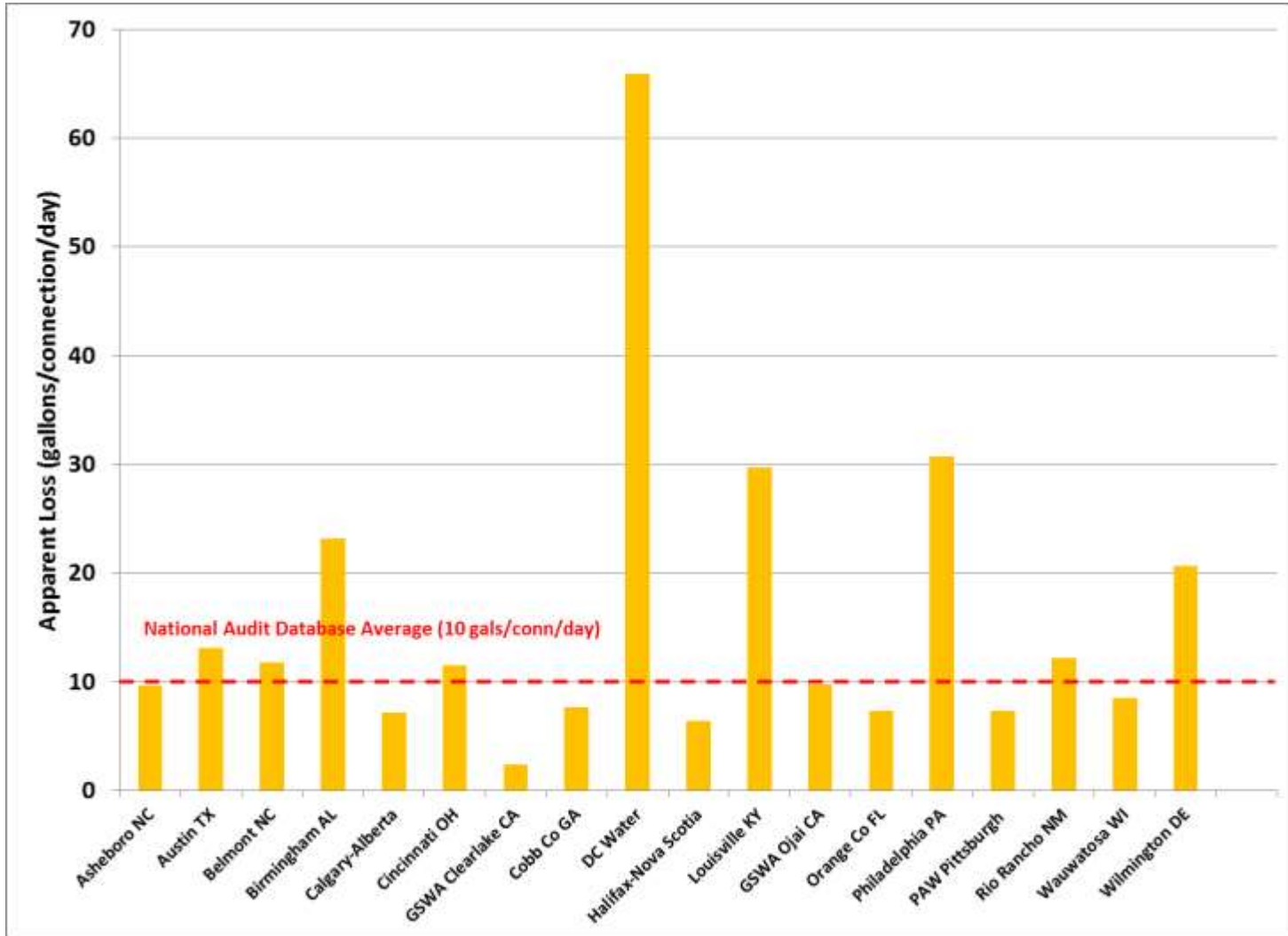


Meter Accuracy (%) (TWDB 2010 Data)

-  Customer City, 94 - 99 (Avg. 97.7)
-  Member City, 90 - 99 (Avg. 96)



BENCHMARK APPARENT WATER LOSSES



2012 Dataset – Real and Apparent Loss per connection

DATA SUMMARY (JUNE 2013)

Key Performance Indicator	n	AVG	NTMWD
Data Validity Score	310	62.5	60*
Non-Revenue Water as % by Volume	310	23.1%	
Non-Revenue Water as % by Cost	310	9.1%	
Apparent Loss (gal/connection/day)	310	11.2	15
Real Loss (gal/connection/day)	248	56.5	55
Real Loss (gal/mile of main/day)	62	1,932	
Infrastructure Leakage Index	283	3.0	

CONTACT DETAILS

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