Halifax Water

Leading Edge Water Loss Control: A Practitioner's Story

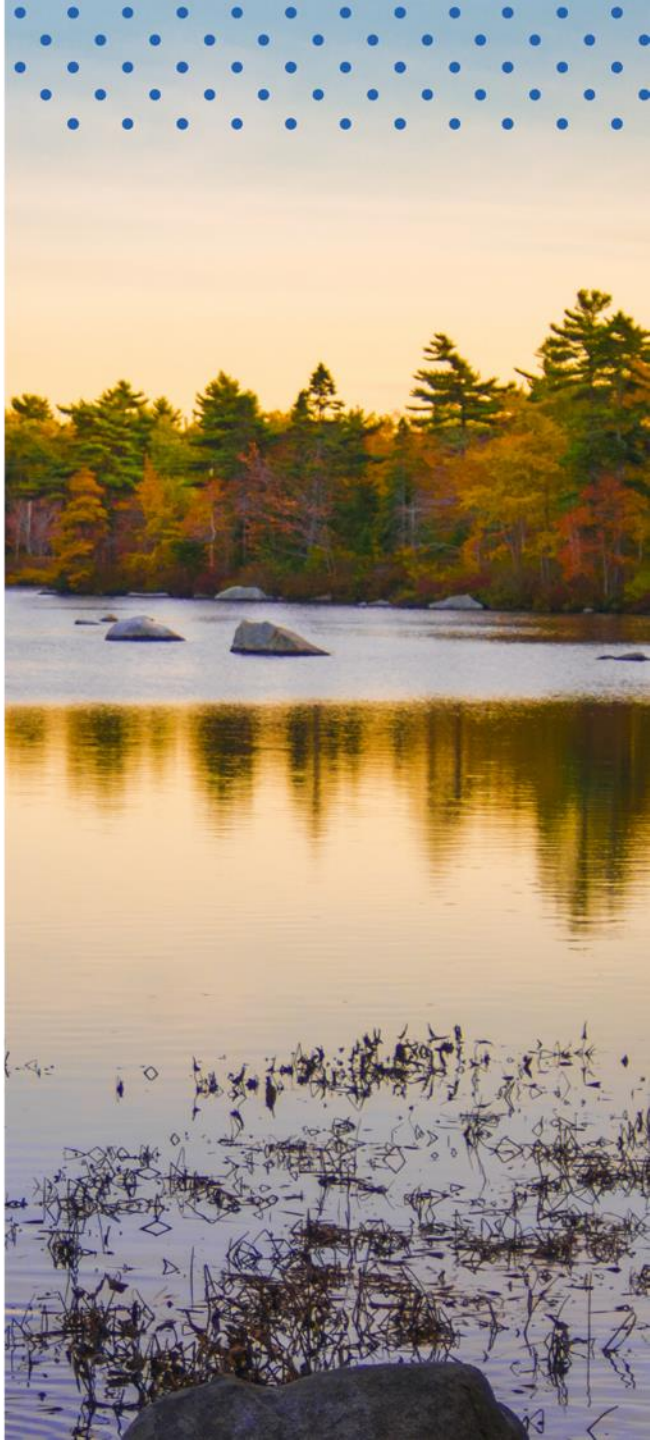
INFRA Congress 2017

Montreal, Quebec

Carl Yates, M.A.Sc., P.Eng.

December 5, 2017

STRAIGHT from the SOURCE



Water Loss Control - Genesis

- In 1997, construction started on a 20 MGD [90 ML/Day] water supply plant in Dartmouth.
- At the time, leakage within Dartmouth distribution system was estimated at 35 percent.
- In 1998, cross departmental team formed to determine best practice in water loss control.
- Initial focus in North America where efforts centered on reduction of “unaccounted-for water”.
- Determined that traditional North American approach to water loss control had shortcomings; no standard terms or methodology.

Water Loss Control - Synthesis

- Investigation expanded worldwide and discovered an emerging methodology being promoted by the International Water Association [IWA] and American Waterworks Association [AWWA].
- In 1999, Halifax Water hired an international expert to assist with training and implementation of the methodology developed by the IWA/AWWA Water Loss Task Force.
- Formally adopted IWA/AWWA methodology in 2000 and banned the term “unaccounted-for water”.
- And the rest………is history!

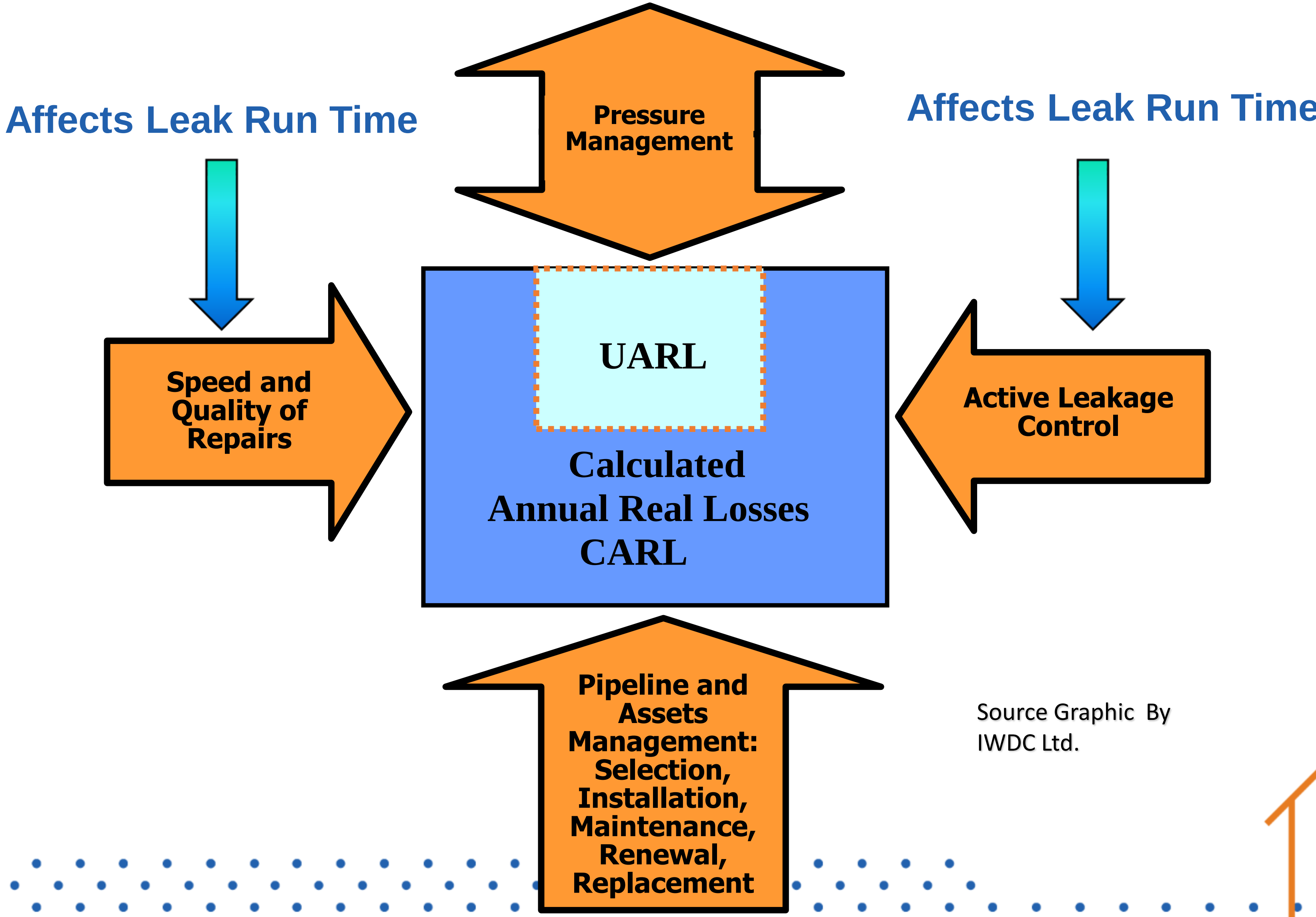
Managing Real Losses

- The foundation of a successful Water Loss Control program begins with a proper water balance.
- The IWA/AWWA methodology utilizes two key performance metrics; the Infrastructure Leakage Index [ILI] and losses/connection/day.
- ILI = $\frac{\text{Calculated Annual Real Losses [CARL]}}{\text{Unavoidable Annual Real Losses [UARL]}}$

IWA Standard Water Balance

System Input Volume	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water
			Billed Unmetered Consumption	
		Unbilled Authorized Consumption	Unbilled Metered Consumption	Non Revenue Water
			Unbilled Unmetered Consumption	
	Water Losses	Apparent Losses	Unauthorized Consumption	
			Customer Meter Inaccuracies	
		Real Losses	Leakage on Transmission & Distribution Mains	
			Leakage and Overflows at Reservoirs	
			Leakage on Service Connections up to metering point	

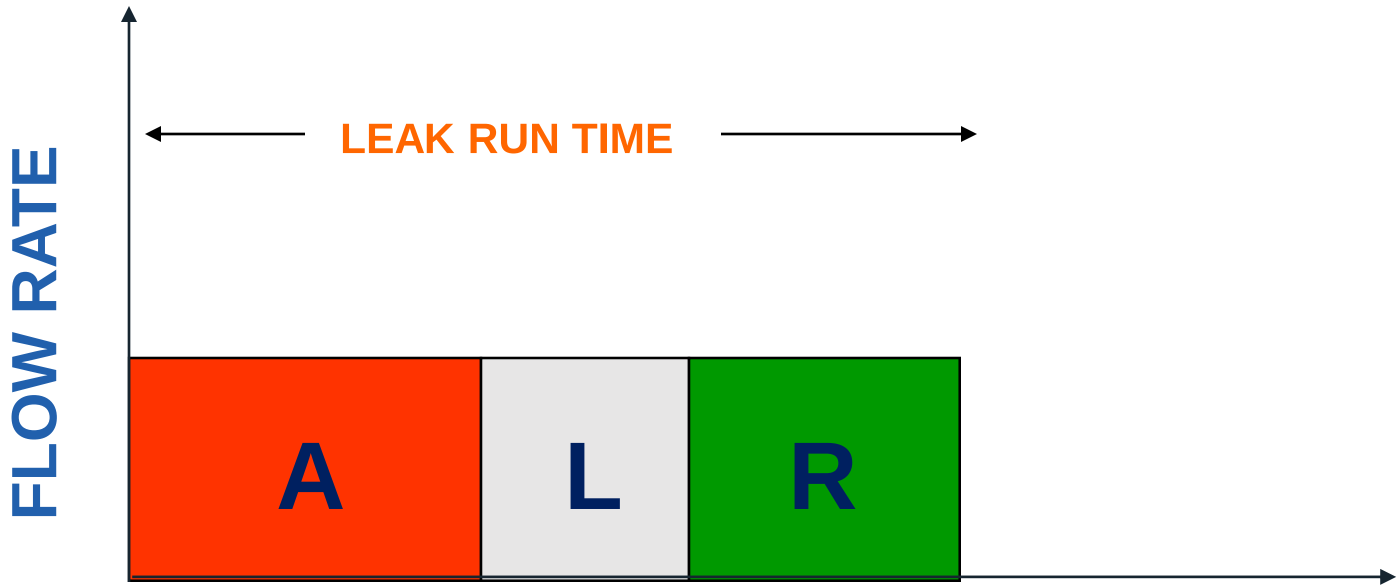
Four Strategies for Reducing Real Losses



Source Graphic By IWDC Ltd.

Leak Run Time Awareness

Leak Volume *Loss* = *(A+L+R) Time x Flow Rate*



RUN TIME = **Awareness + Location + Repair*

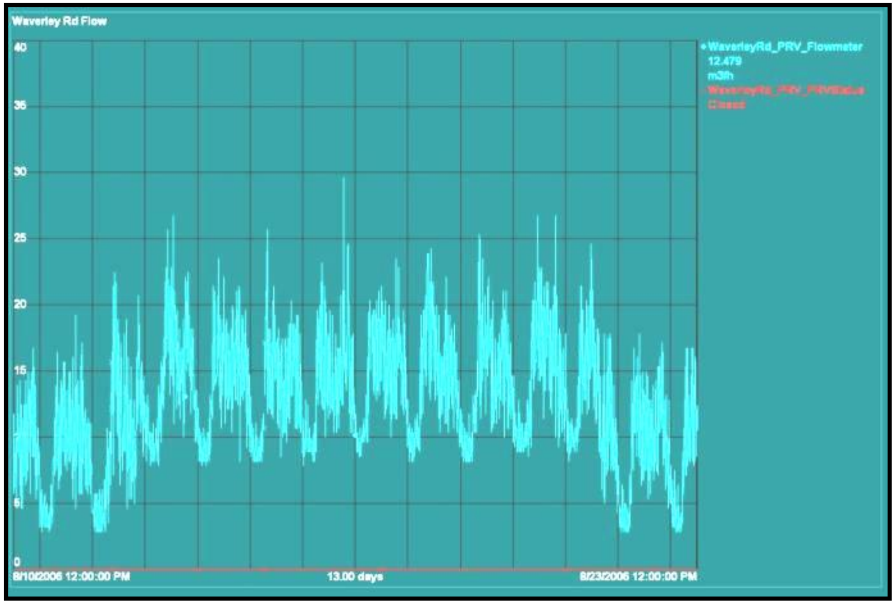
Halifax Water

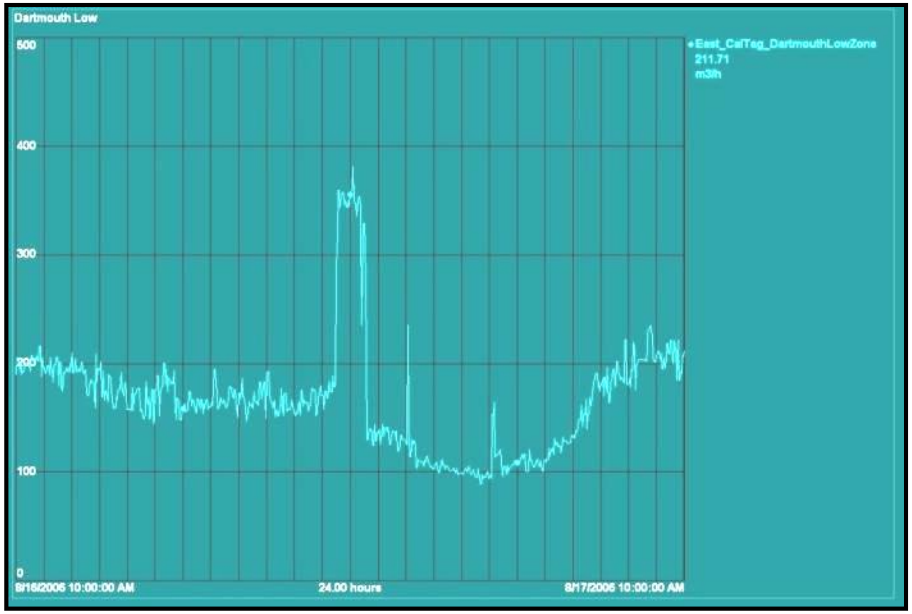
Actual Leak Sequences

Aug 12 – Aug 21 →

9 day runtime 5m3/hr

1080 m3 (237,000 Gal)





← **Aug 16**

200m3/hr 1 hour runtime

200 m3 (44,000 Gal)

Managing Leak Run Time

- The key to managing leak run time for the overall reduction of real losses is awareness of and the willingness to repair leaks.
- The key is finding the leak early when it is a small
- How does a utility become aware of unreported leaks?

District Metered Areas

- District Metered Areas (DMA's) can provide the awareness of leakage in near real time.
  - ✓ Allows monitoring of leaks via SCADA
  - ✓ Manageable zones in distribution system for acoustic leak detection
  - ✓ Ongoing monitoring of minimum night flows [3 to 4 am in the morning]
- If you can measure it, you can manage it.

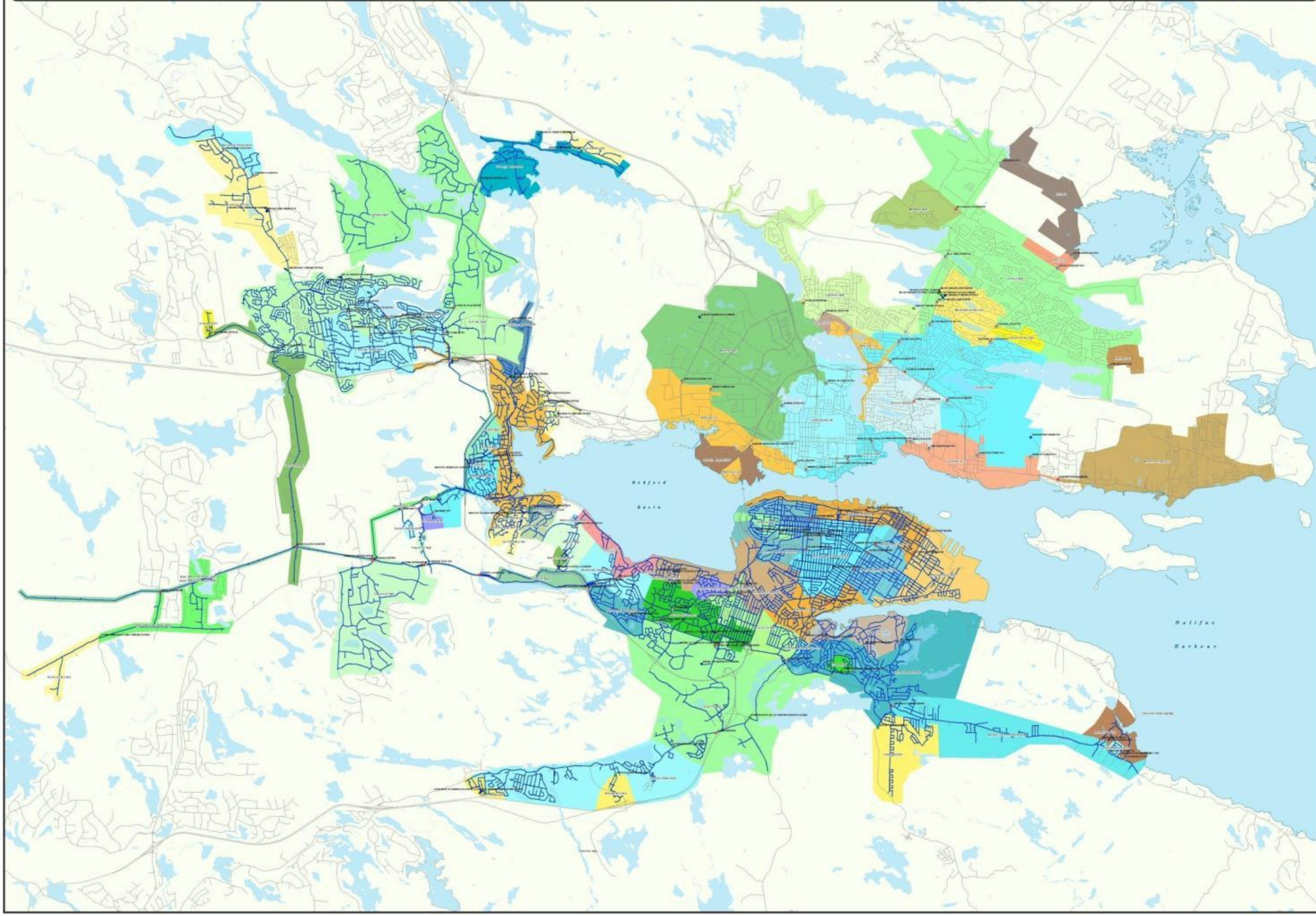
HALIFAX REGIONAL WATER COMMISSION
REGIONAL METER ZONE MAP

- Control Chamber
- Meter Chamber
- PRV
- Pumping Station
- Reservoir Chamber

THIS MAP IS FOR HRWC INTERNAL USE ONLY

NORTH

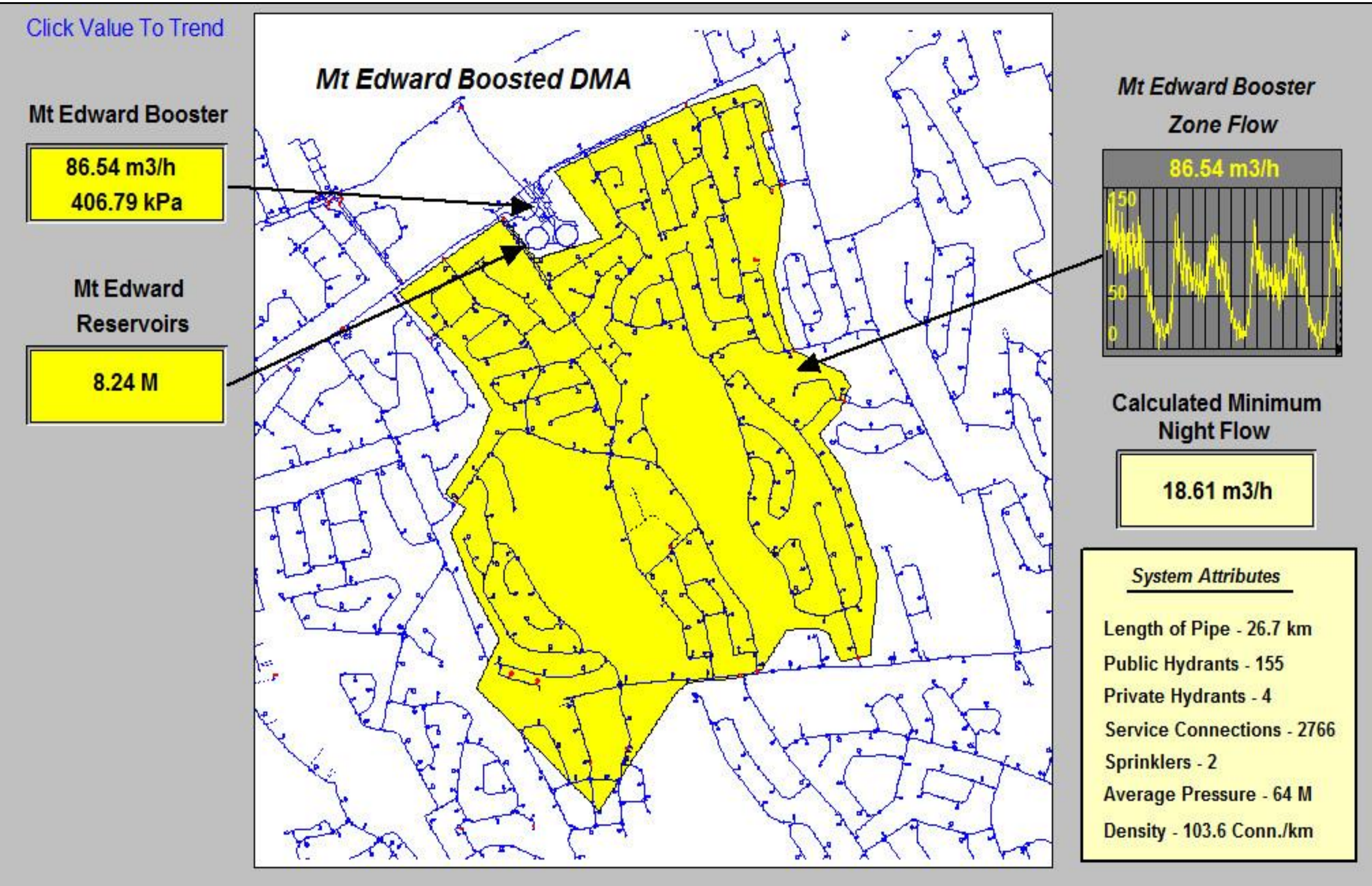
Halifax Water



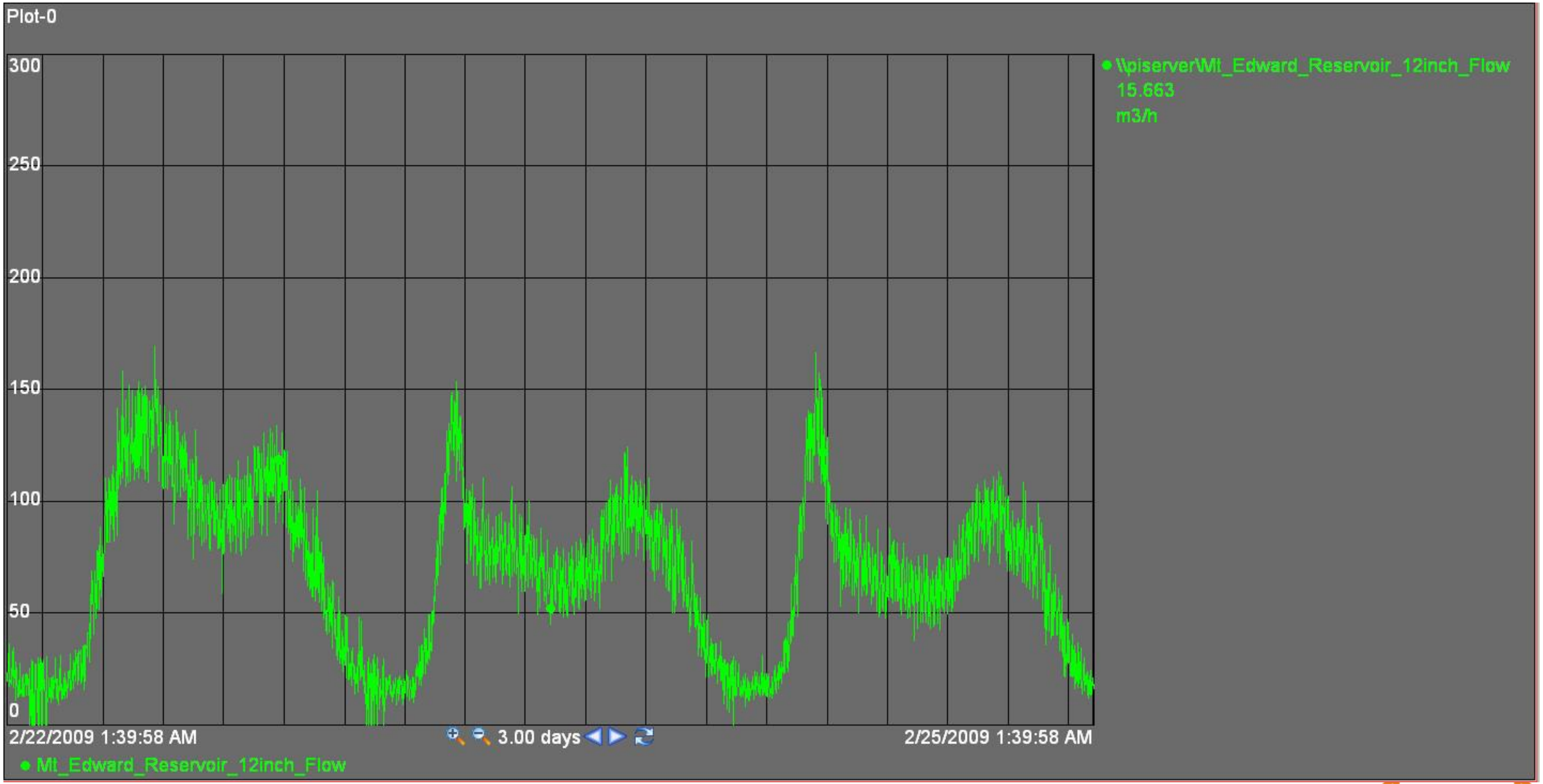
DMA Size - Opportunity Driven

- In many cases size is predetermined.
  - ✓ Boosted systems, existing pressure zones …
- Is smaller better? (if opportunity exists)
  - ✓ Improved resolution, reduced leakage run time.
- Max DMA size based on many factors including acceptable leakage run time and night flow analysis.
  - ✓ Typical DMA contains 30 km of pipe; 200 hydrants; 3,000 service connections

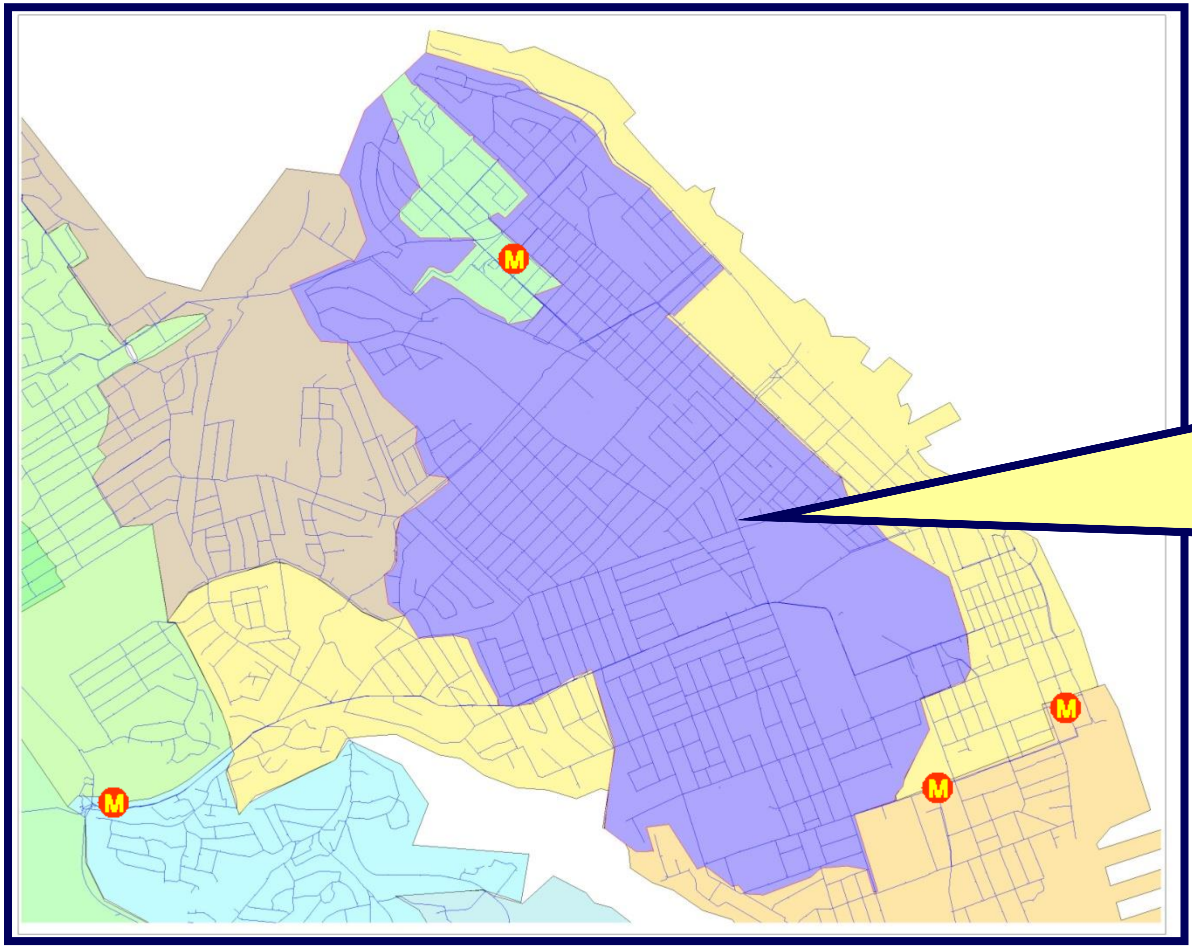
Mt. Edward Boosted DMA



Residential DMA Data for Cost of Service Study – Mt Edward



Peninsula Intermediate:
A Case Study in DMA Refinement



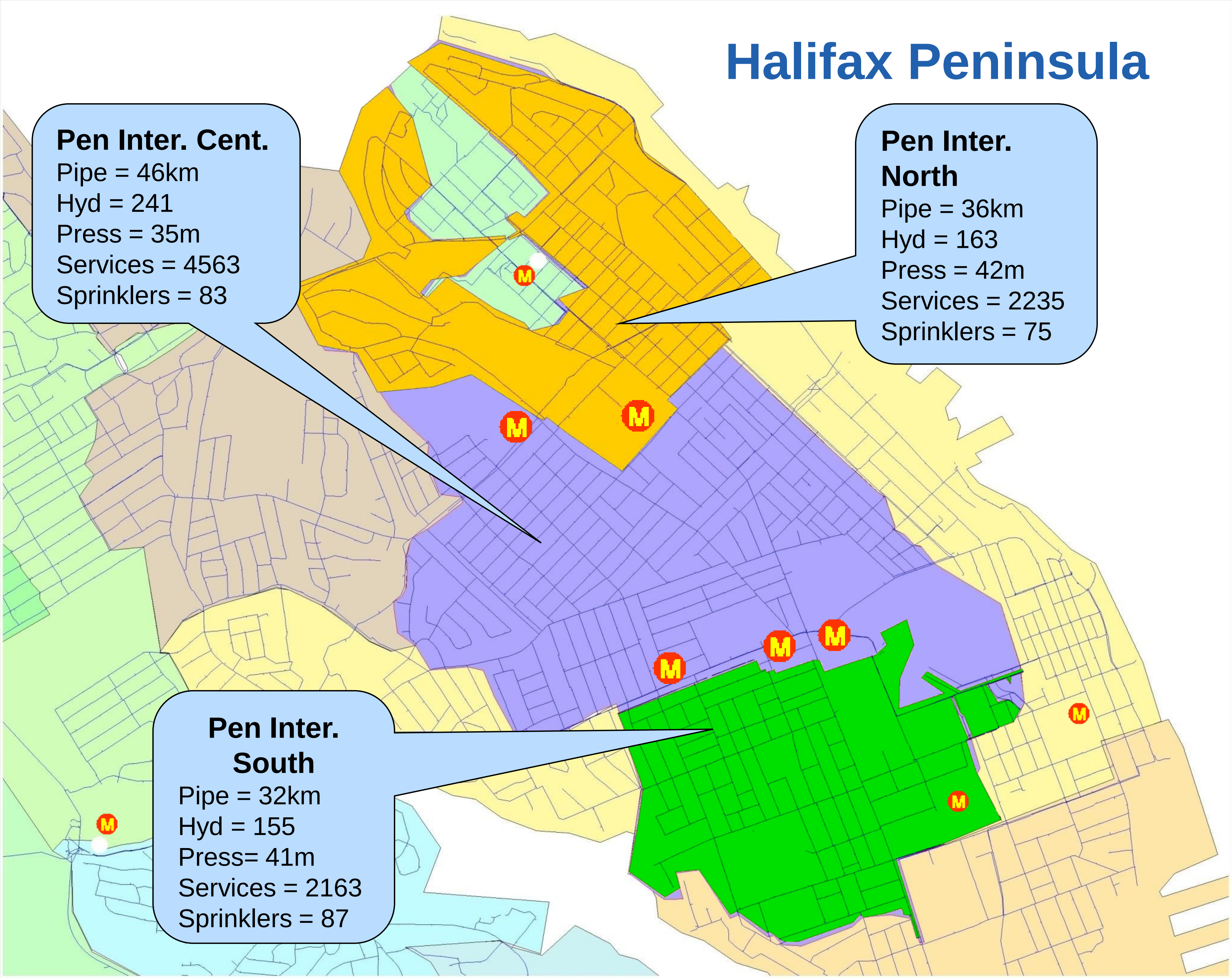
Pipe = 114 km

Hyd = 559

Services = 8961

Sprinklers = 245

Halifax Peninsula

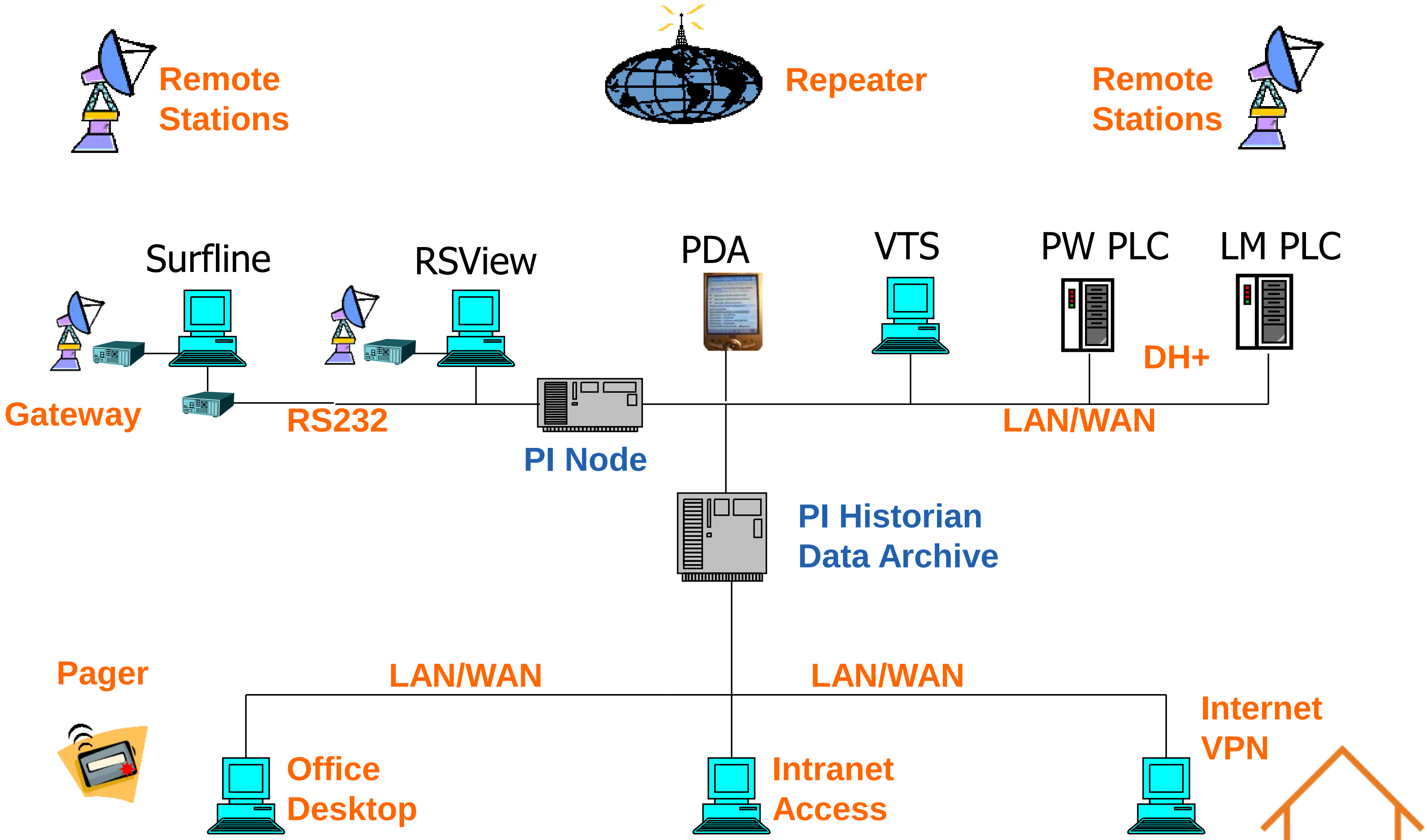


HRWC Standard
Flow Meter Chamber

- Pre cast manhole
- IP 68 Mag meter
- Tap for press xmiter
- Pole Mount RTU

- Total cost approx $25,000

Collecting The Data

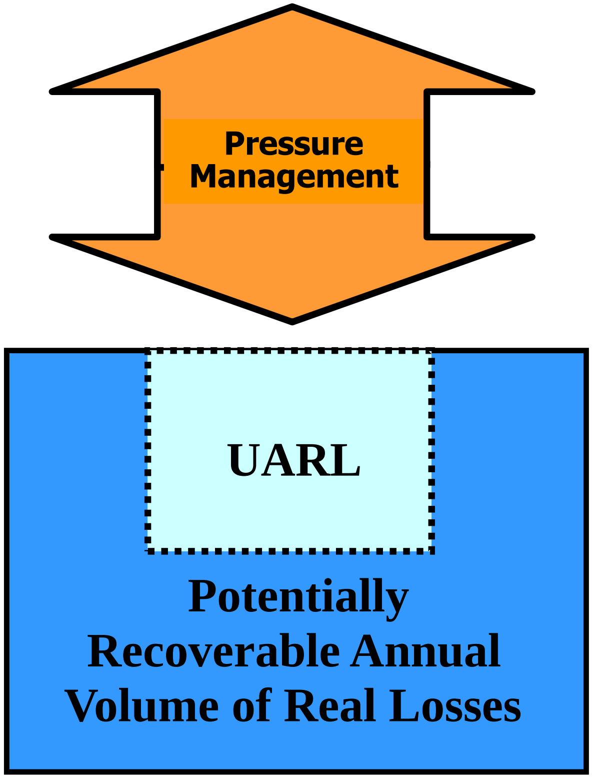


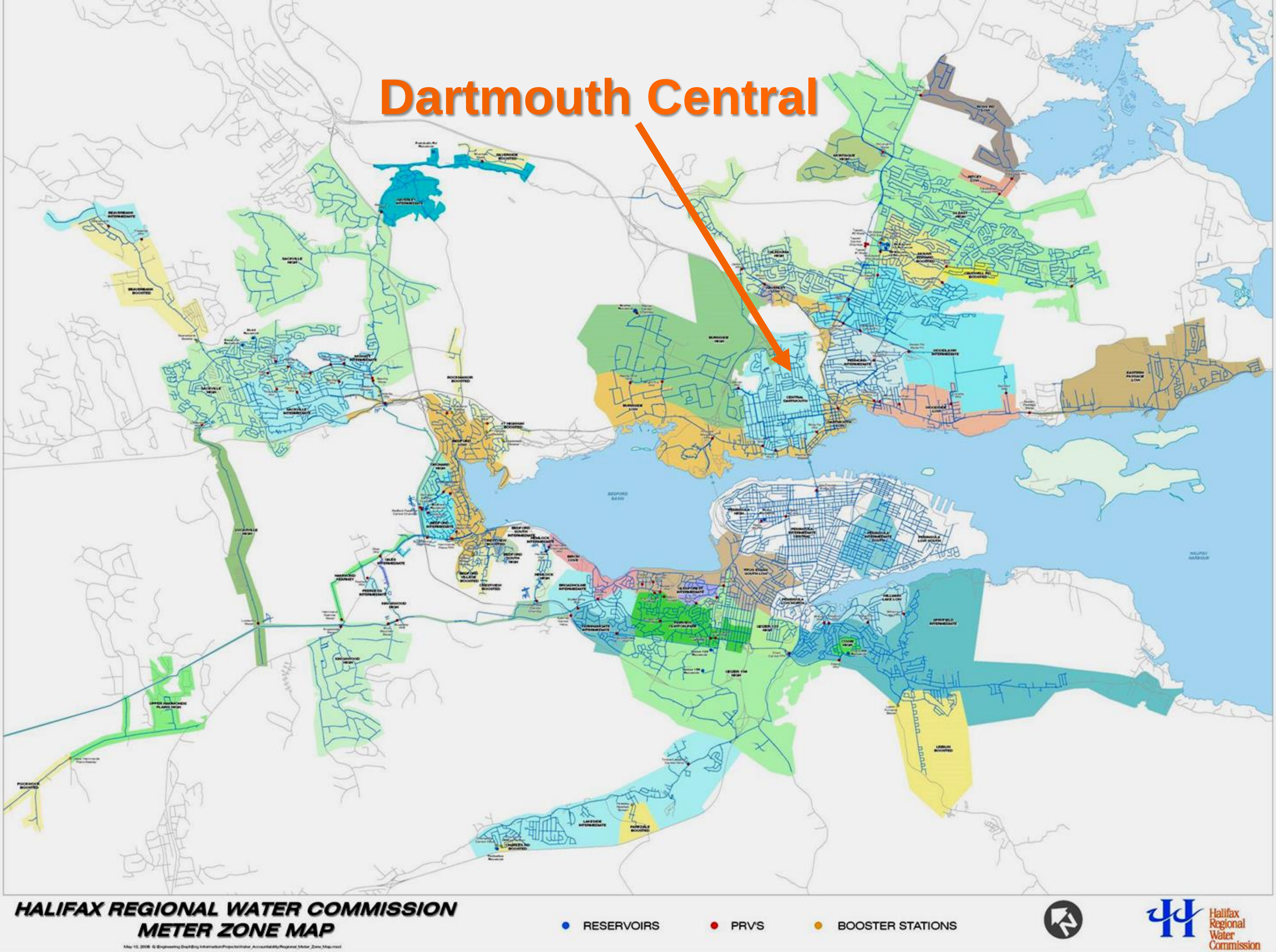
Pressure Management

- Pressure Management is one of the 4 accepted strategies of the IWA/AWWA Water Loss Control Methodology.
- Reducing pressure will reduce breaks.
- There is a direct relationship between pressure and the amount of leakage.
  - ✓ Reduced pressure reduces flow rates from active and background leakage.

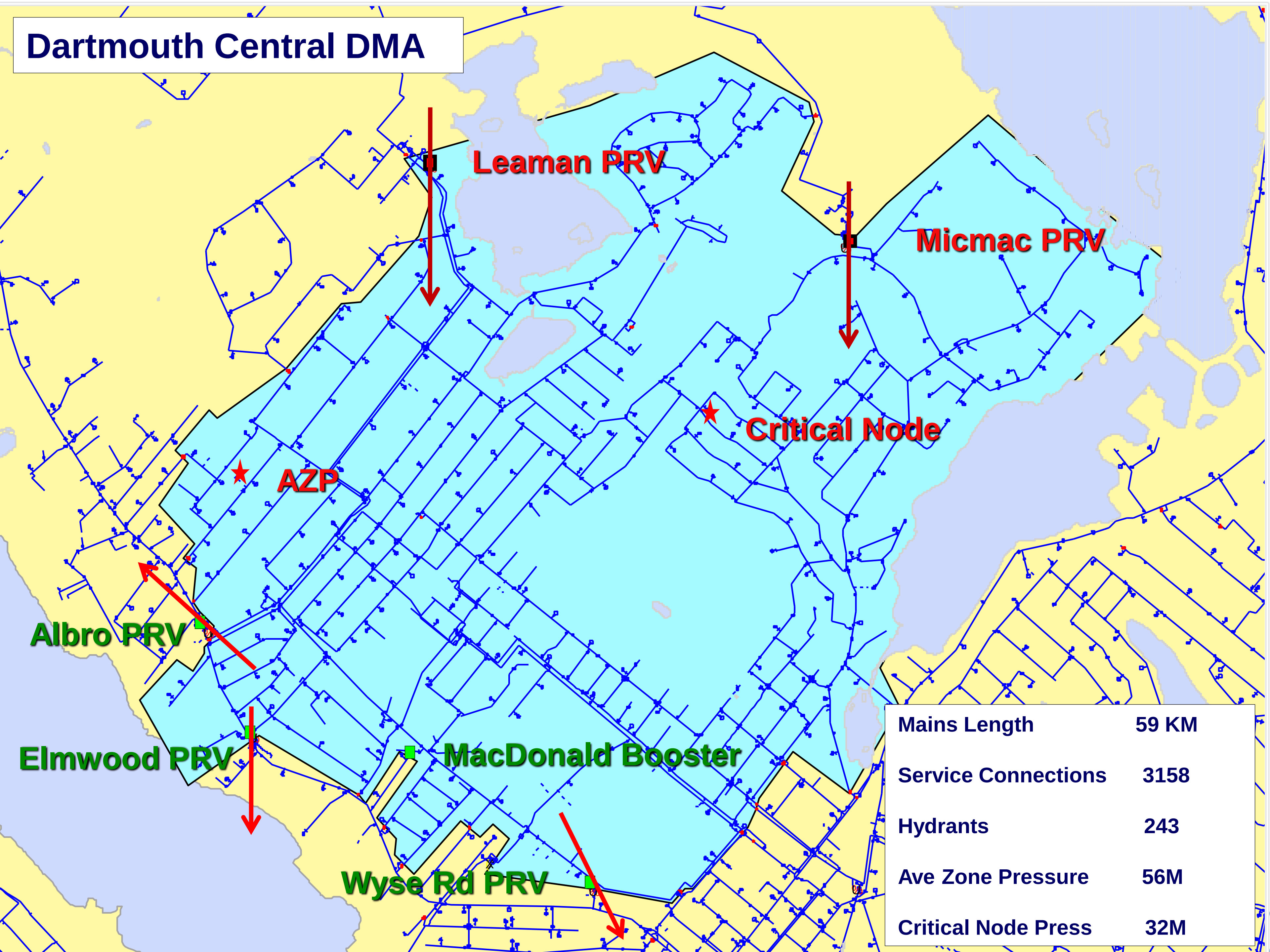
Pressure Management

- Pressure Reducing Valves (fixed outlet control)
- Pressure Control through flow modulation (allows downstream pressure to trend with flow, with limits)
- Optimized approach through WaterRF research under Leakage Management Technologies project




Dartmouth Central
HALIFAX REGIONAL WATER COMMISSION
METER ZONE MAP
RESERVOIRS
PRVS
BOOSTER STATIONS
Halifax Regional Water Commission

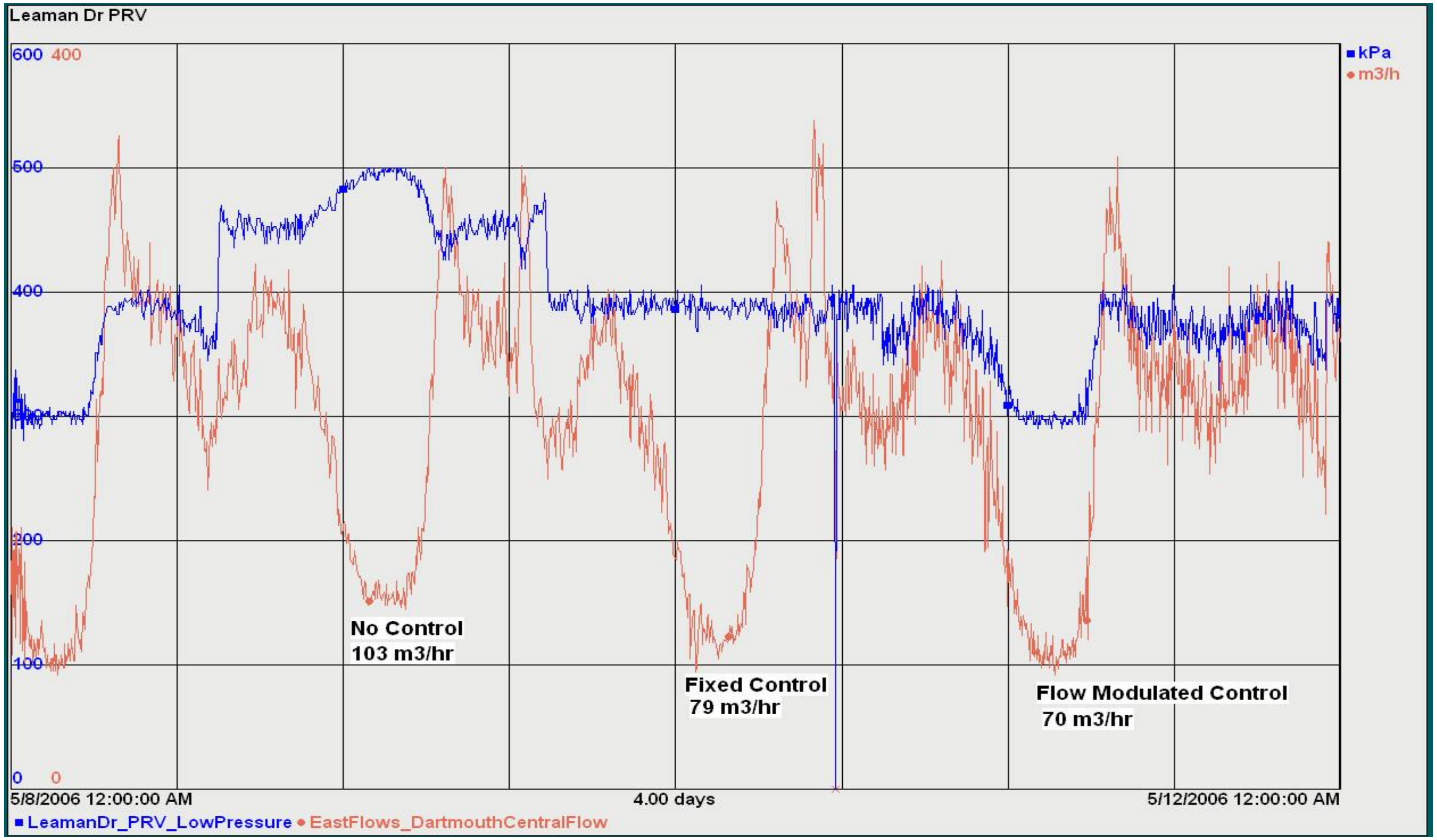
Dartmouth Central DMA



Mains Length	59 KM
Service Connections	3158
Hydrants	243
Ave Zone Pressure	56M
Critical Node Press	32M

Prototype – Flow Modulated Pressure Control

Minimum Night Flows [WRF Project 2928]
No Control - Fixed Outlet - Flow Modulated

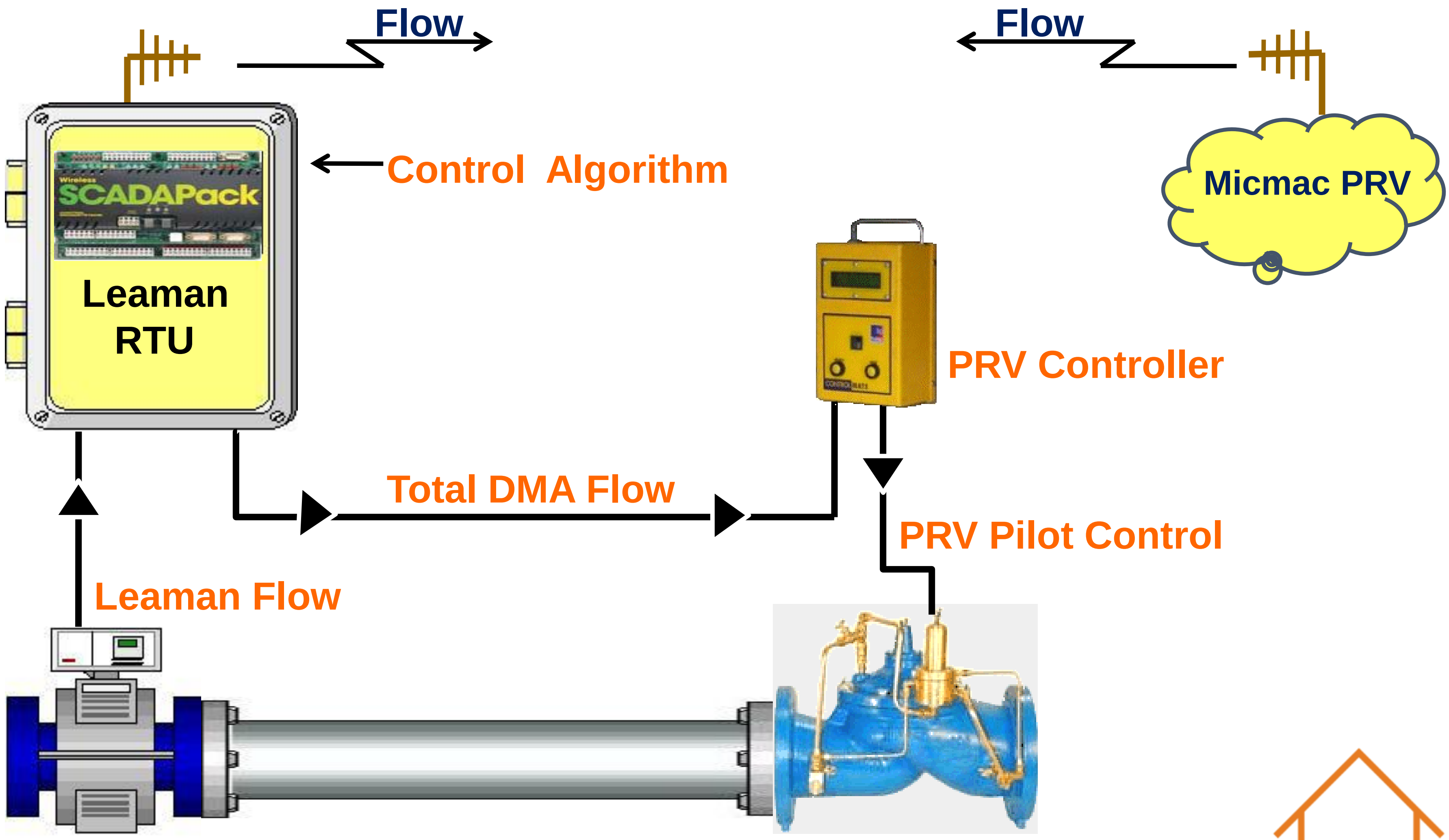


Graph reflects single feed from Leaman supply chamber

Advanced Dual Supply Pressure Control

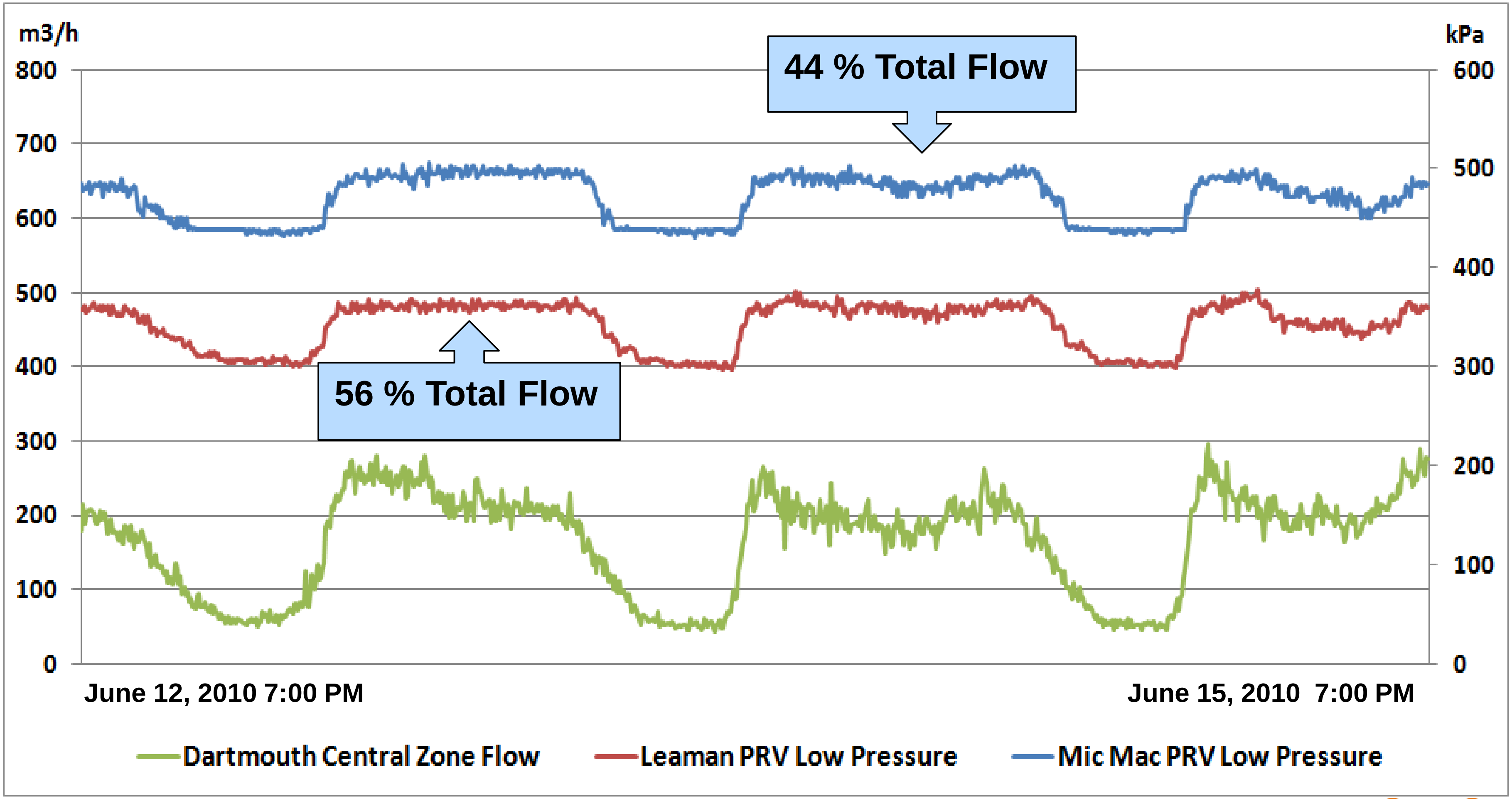
- **Challenge** - Apply flow modulated pressure control in a DMA with two supply feeds.
- **Problem** - An increase in output from one supply chamber causes a reduction in flow at the second supply chamber, eventually shutting the second feed in.
- **Solution** - Establish communications between the supply chambers. Develop a control algorithm that combines the individual flows into a single DMA demand flow that is used as the control variable for both supply chambers.

Solving The Dual Supply Challenge



Halifax Water

Each Supply Chamber Contributes



Water Loss Control Benefits
[Triple Bottom Line Results]

- Highly cost effective; Infrastructure Leakage Index [ILI] reduction from 9.0 to 2.5 with current annual savings of $650,000 [electricity and chemical costs]
- Improves public health protection; a leaky system is prone to contamination
- Improves the level of service provided to rate payers; leaks are found in proactive manner
- Reduces liability to the water supplier
- Leakage recovery often stands as the best source for new water resources for systems facing water supply shortage

Lessons Learned

- It was as much to do with change management, as it was technical methodology
- A project champion[s] is key
- Involve as many people as possible [cross departmental team to break down silos]
- Other unexpected benefits are realized [customer partnerships, intimate knowledge of system, cost of service data]
- Measure performance; celebrate and reward success

Do not follow where the path may lead. Go instead where there is no path and blaze a trail