

# 2012 Clean and Safe Drinking Water Workshop – Gander, Nfld.

“Let’s Find Those Leaks and Fix Them in Small Systems”

Kingsley Blease, P.Eng.  
G & M Project Management

# “Let’s Find Those Leaks and Fix Them”



## Is This Your Small System?

1. Only have a few main breaks and service leaks a year – no water loss problem
2. Water loss less than 10%
3. We complete a leakage survey from time to time



## OK? In Past – But Times Changing

- Main breaks, service leaks increasing, as system ages
- Cost of hydro for pumping increasing significantly
- Some small systems struggling with water supply capacity

# Recent Systems – Non Surfacing Leaks, Night Flows

## System 1

- 757 services; night flow before 73 gpm, after 20 gpm
- 4 leaks (bleeder, 2 x trailer park, service)

## System 2

- 249 services; night flow before 150 gpm, after 35 gpm
- 2 leaks (mains)

## System 3

- 993 services; night flow before 44 gpm, after 24 gpm
- 2 leaks (mains)



# More Systems – Non Surfacing Leaks, Night Flows

## System 4

- 120 services; 77 gpm before, 22 gpm after
- 2 leaks (plastic mains – saddle on both mains leaking badly)

## System 5

- 320 services; 150 gpm before, 100 gpm after
- 18 leaks (services, hydrants, mains)



# System 3 Leak – estimated running 2 years





# System 3 Leak – water loss cost \$8,500





## Look At Water Loss and Costs - Newfoundland 2010 Municipal Water Use Report (2006 statistics)

Utility Size Number of Customers	Av Daily Flow Nfld Average (litres per capita)	TOTAL Flow 2.5 people per house (m3 per day)	Water loss 15 % - <b>KB Number</b> (m3 per day)	Loss Value PER YEAR Production <b>variable cost</b> (10 cent per m3)	Retail value of Loss PER YEAR <b>sale to customers</b> (\$1.50 per m3)
500	813	1,016	152	\$5,564	\$83,460
1,000	813	2,033	305	\$11,128	\$166,919

# Utility Energy Use - 1

<b>kWh to produce and treat 1 m<sup>3</sup> of Water</b>	<b>0.58 kWh</b>
kWh to pump and treat 1 m <sup>3</sup> of Wastewater	0.10 kWh
Total kWh to produce and treat 1 m <sup>3</sup> of Water and Wastewater	0.68 kWh
kg of CO <sub>2</sub> per kWh of electricity	0.270 kg of CO <sub>2</sub>
kg of Co <sub>2</sub> from production and treatment of 1 m <sup>3</sup> of Water and Wastewater	0.184 kg of CO <sub>2</sub>



## Utility Energy Use - 2

Utility Size: Number of Customers	Av Daily Flow (litres per capita) CANADA AVERAGE	Total Flow (m <sup>3</sup> per day)	Water and Wastewater Total Hydro Use PER YEAR	Water and Wastewater Total CO <sub>2</sub> Produced PER YEAR
500	609	761	188,880 kWh	51,109 kg of CO <sub>2</sub>
1,000	609	1,522	377,760 kWh	102,217 kg of CO <sub>2</sub>
5,000	609	7,613	1,888,800 kWh	511,289 kg of CO <sub>2</sub>

## Demonstrate in next 20 Minutes

- Can reduce water loss
- Will save operating costs
- Water Utility – biggest hydro cost is for Water Treatment and Distribution, plus Wastewater Treatment and Pumping
- Stopping leakage gives greenhouse gas reduction via energy reduction



# Leak Detection Techniques

## Passive leak detection

- Reported leaks (emergency leak repair)

## Active leak detection

- Annual sounding survey
- Repeated sounding in “hot” areas
- Temporary monitoring of flow (DMAs) and leak detection
- Permanent monitoring of flow (DMAs) and leak detection
- **Who has set up DMAs?**

# Categorizing Leaks

**Three main types of leaks:**

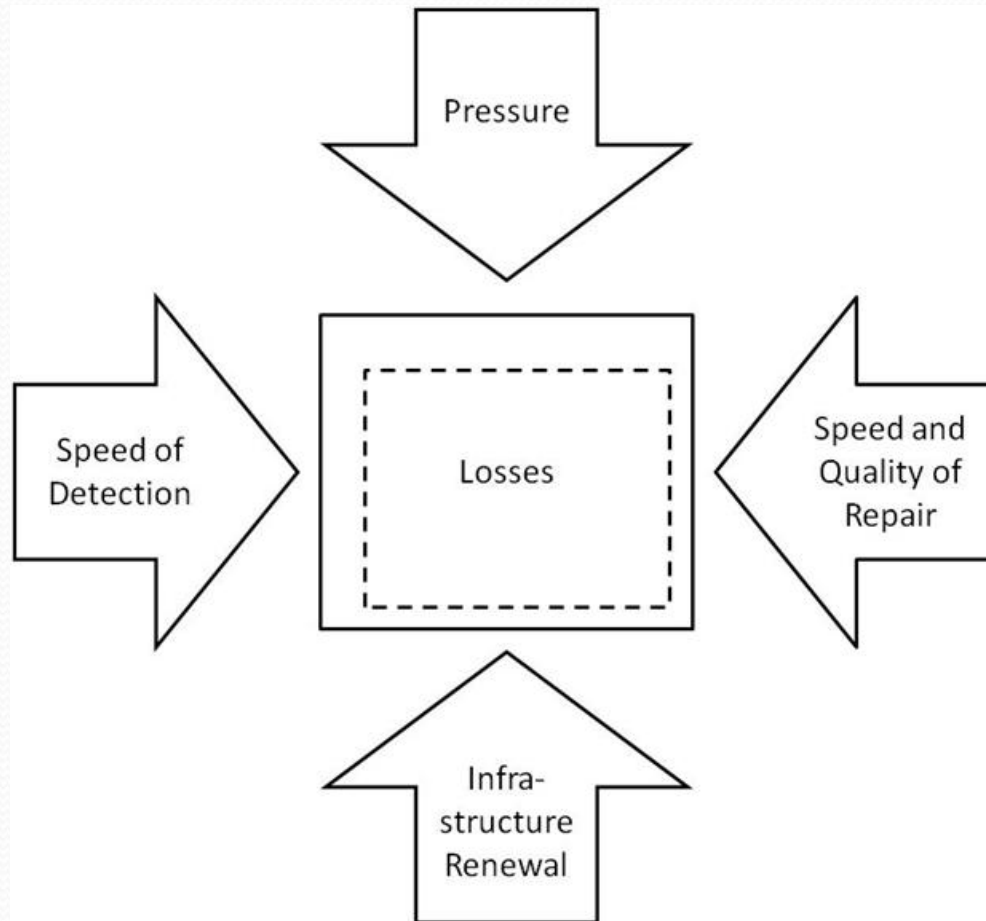
*Reported* – come to surface, and are repaired

*Unreported* – do not surface, but are economically viable to find and repair - **DMAs**

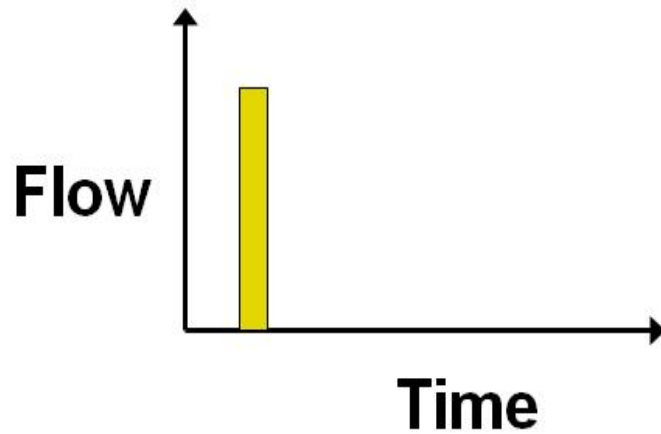
*Background* – do not surface, and are not economic to find and repair - **DMAs**



# Influences on Leakage

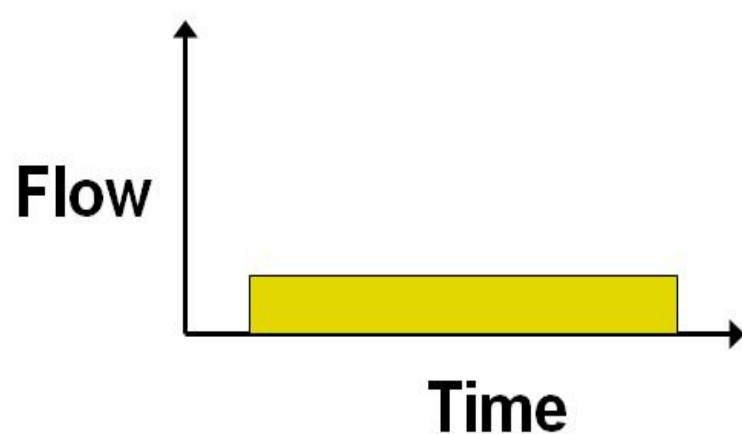


# Leak Losses Compared



Main Break

Flow 50 gpm  
Time 12 hrs  
Volume **36,000**  
gals



Service Leak

Flow 2 gpm  
Time 90 day  
Volume **259,200** gals



# Let's Find Those Leaks and Fix Them

## Focus:

Ongoing unknown main breaks and service leaks that are

not coming to surface

## Approach:

1. Measure flows into areas of the distribution system at night to find them – District Meter Areas (DMAs)
2. Fix the leaks, and measure the reduced flow into the DMA – quantify the flow rates/volumes of the leaks repaired

# DMA Design

- Measure flow into the distribution system – for small systems need a source flowmeter
- Natural boundaries – the small system
- Normal flow direction – from source into small system
- Maintain peak demand and fire flow pressures
- DMA size varies – as small as 200 connections (can be upto 3,000)



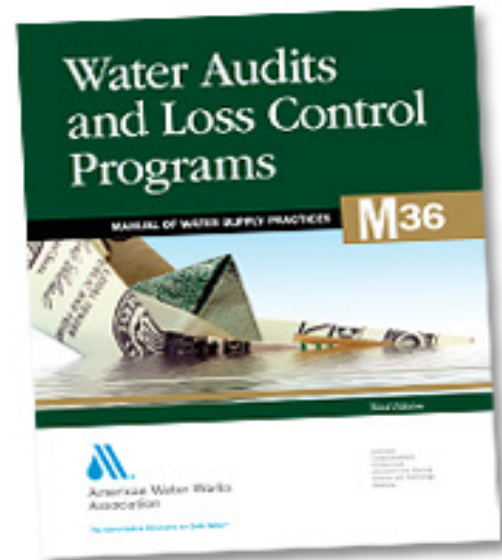
# DMA Methodology

- Measure Actual Flow at night “**Minimum Night Flow**”
  - period of interest (**1.00 to 4.00 am**)
- Calculate “**Legitimate Night Flow**”
  - theoretical expected night flow
- Difference of “Actual” and “Legitimate” = **Potential Leakage**
- Effective with all pipe materials, especially non metallic

# AWWA M36 Manual

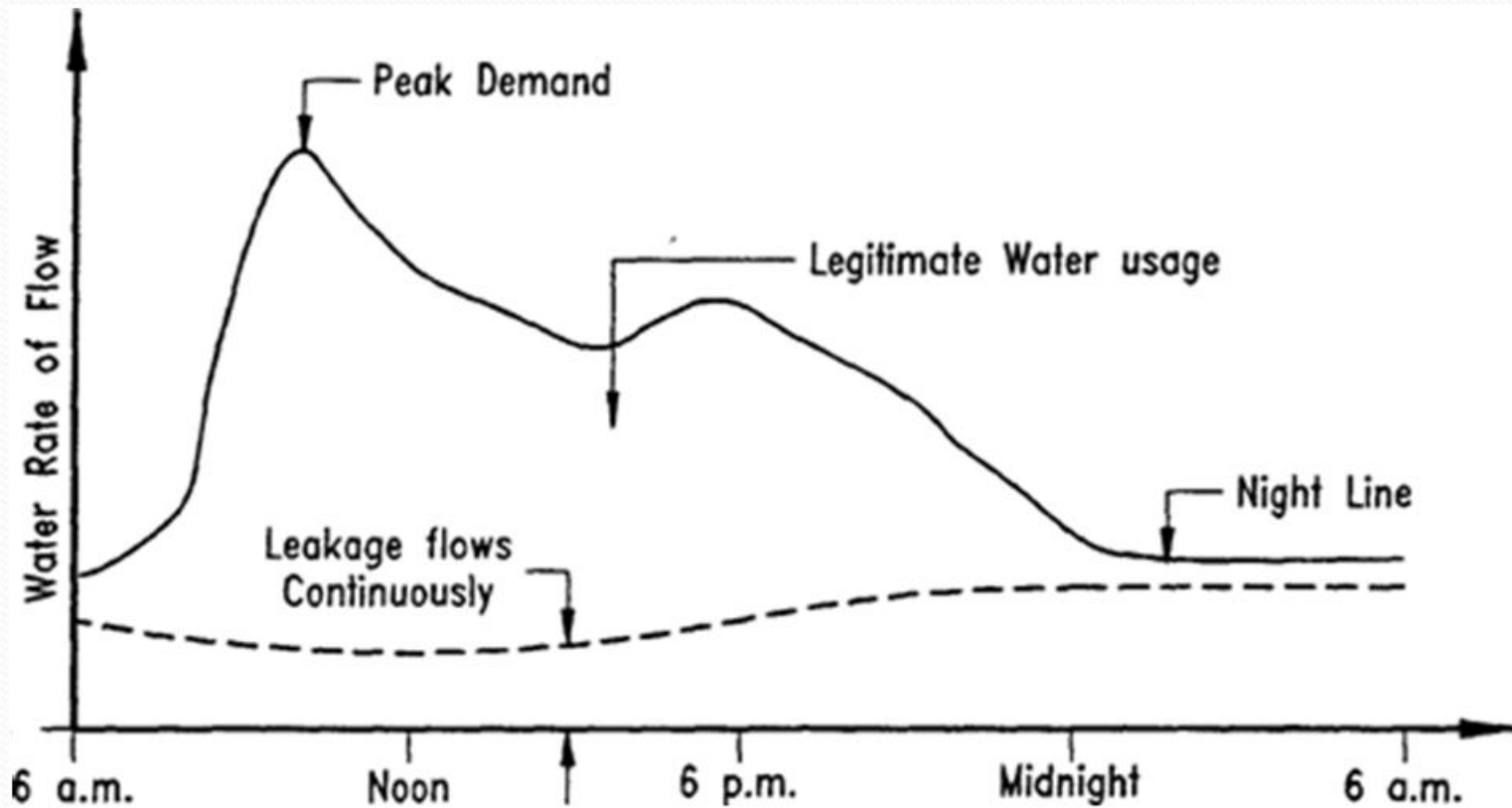
## M36 - “Water Audits and Loss Control Programs”

- **“Top Down Approach”** – IWA Water Audit and Water Balance. Complete every year
- **“Bottom Up Approach”** – Active Leak Detection using District Meter Areas (DMAs)

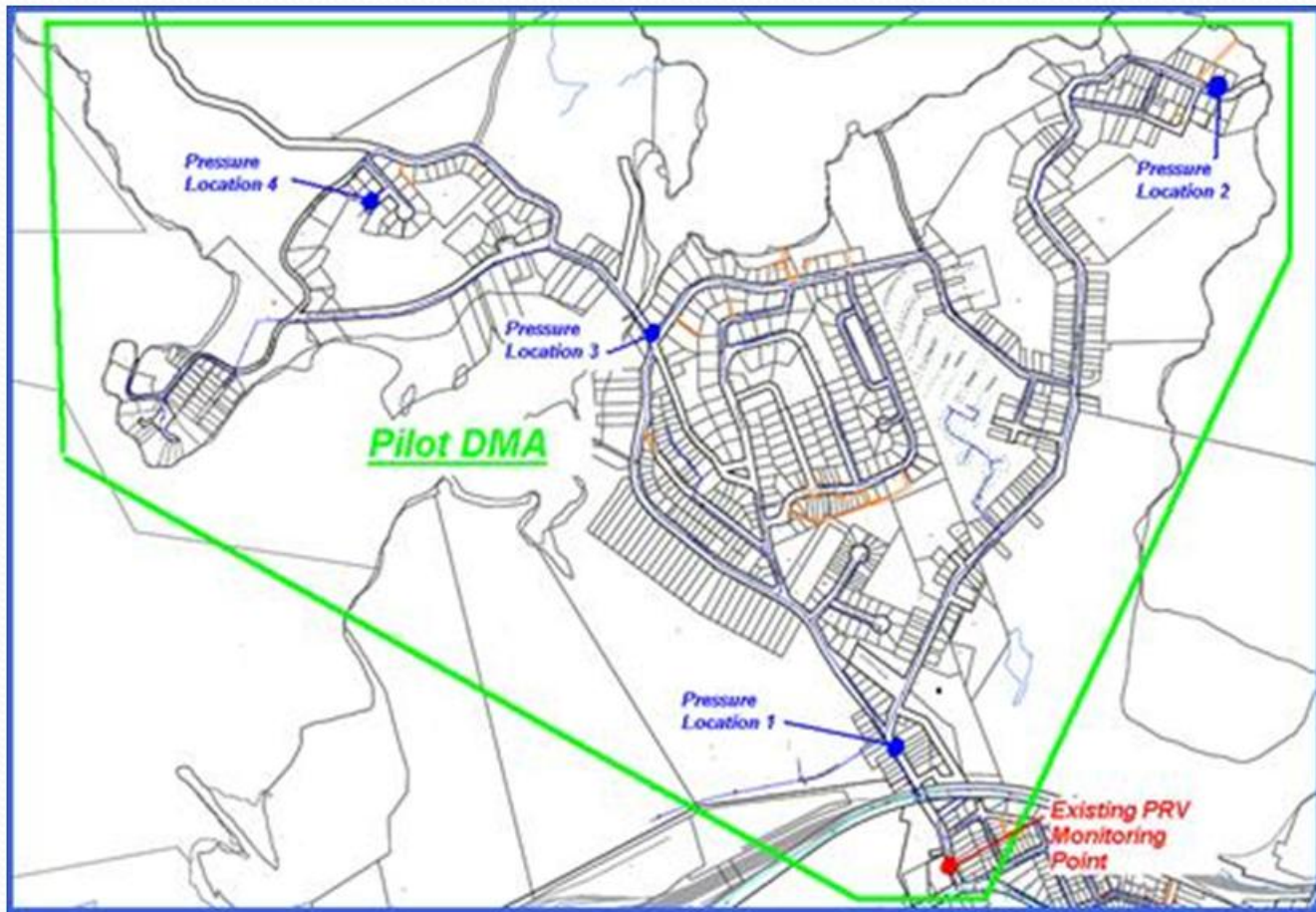




# DMA Flow Profile



# DMA 1 – Saint John, NB

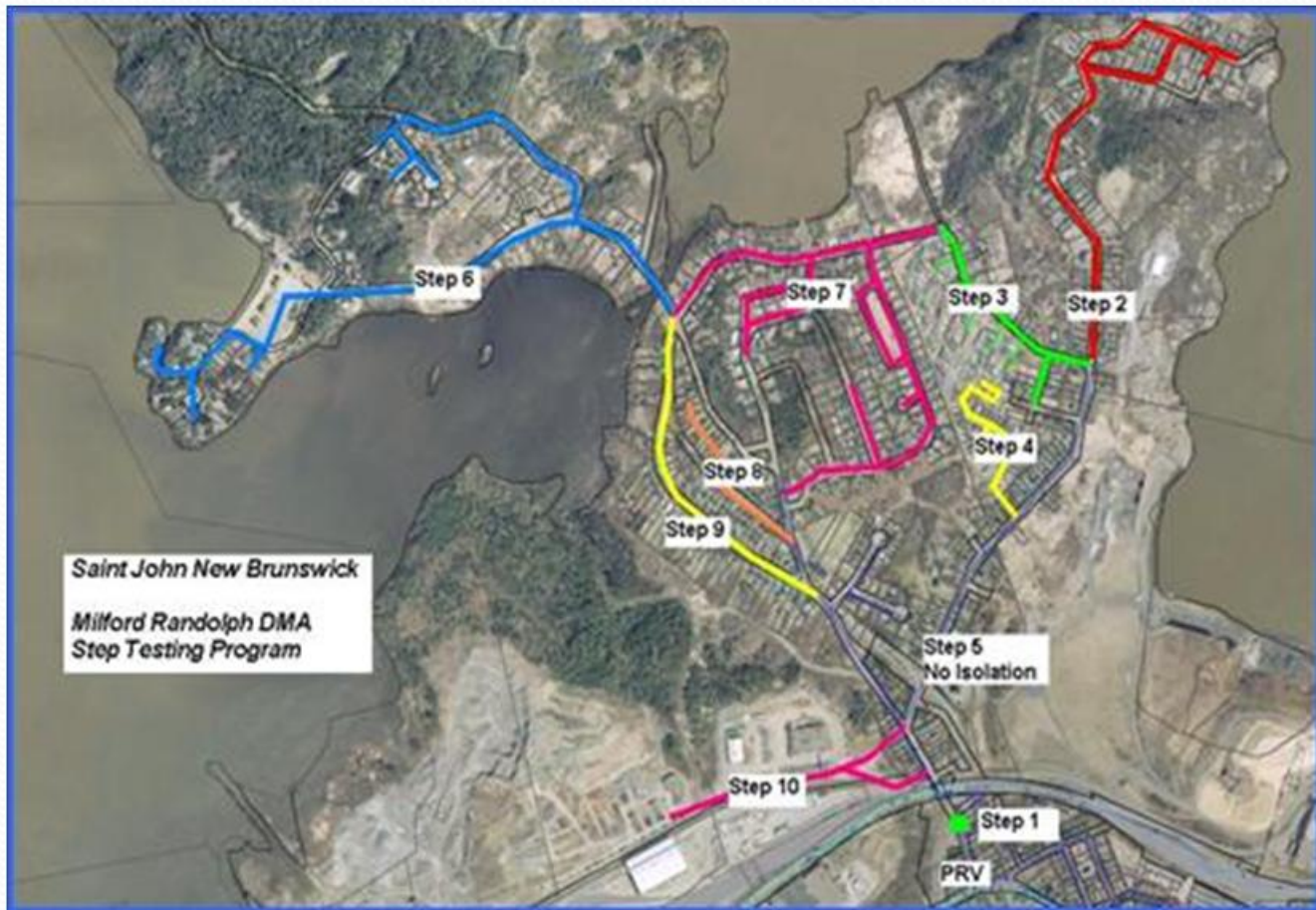




# DMA 1 Characteristics

- 25 km of watermain
- 757 customers – primarily residential
- Average pressure 42 m (60 psi)
- 70 hydrants
  
- Measured night flow 5.5 l/s (20.0 m<sup>3</sup>/hr; 73 gpm)
- Legitimate night flow 1.5 l/s ( 5.5 m<sup>3</sup>/hr; 20 gpm)
- Potential water loss **4.0 l/s** (14.5 m<sup>3</sup>/hr; 53 gpm)

# DMA 1 - Step Testing Plan





# DMA 1 - Water Loss Investigation

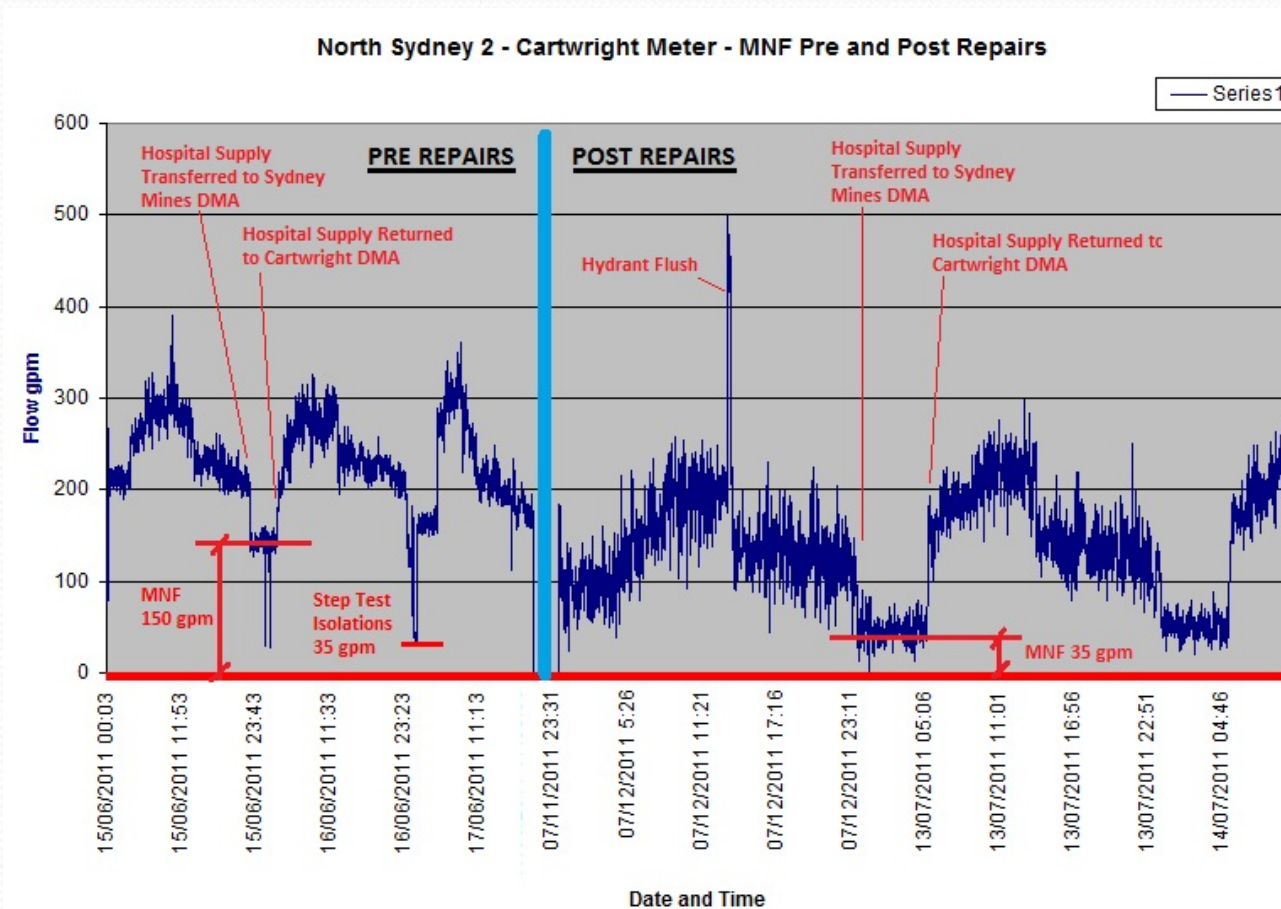
- In Step 1 – flushing (bleeder) was closed – resulting in **1 l/s** reduction
- In Step 3 – two of five metered supplies to trailer park in Kingsville Road were leaking – resulting in **2 l/s** reduction
- Unable to isolate Step 5 (valve operation) – found leaking service in Milford Road

## DMA 2 – North Sydney, Cape Breton

- 9.1 km of watermain
- 249 customers – primarily residential
- Average pressure 46 m (65 psi)
- 47 hydrants
  
- Measured night flow 150 gpm
- Legitimate night flow 7 gpm (if 100% residential)
- Potential water loss **143 gpm**



# DMA 2 – Flows Before and After Repairs

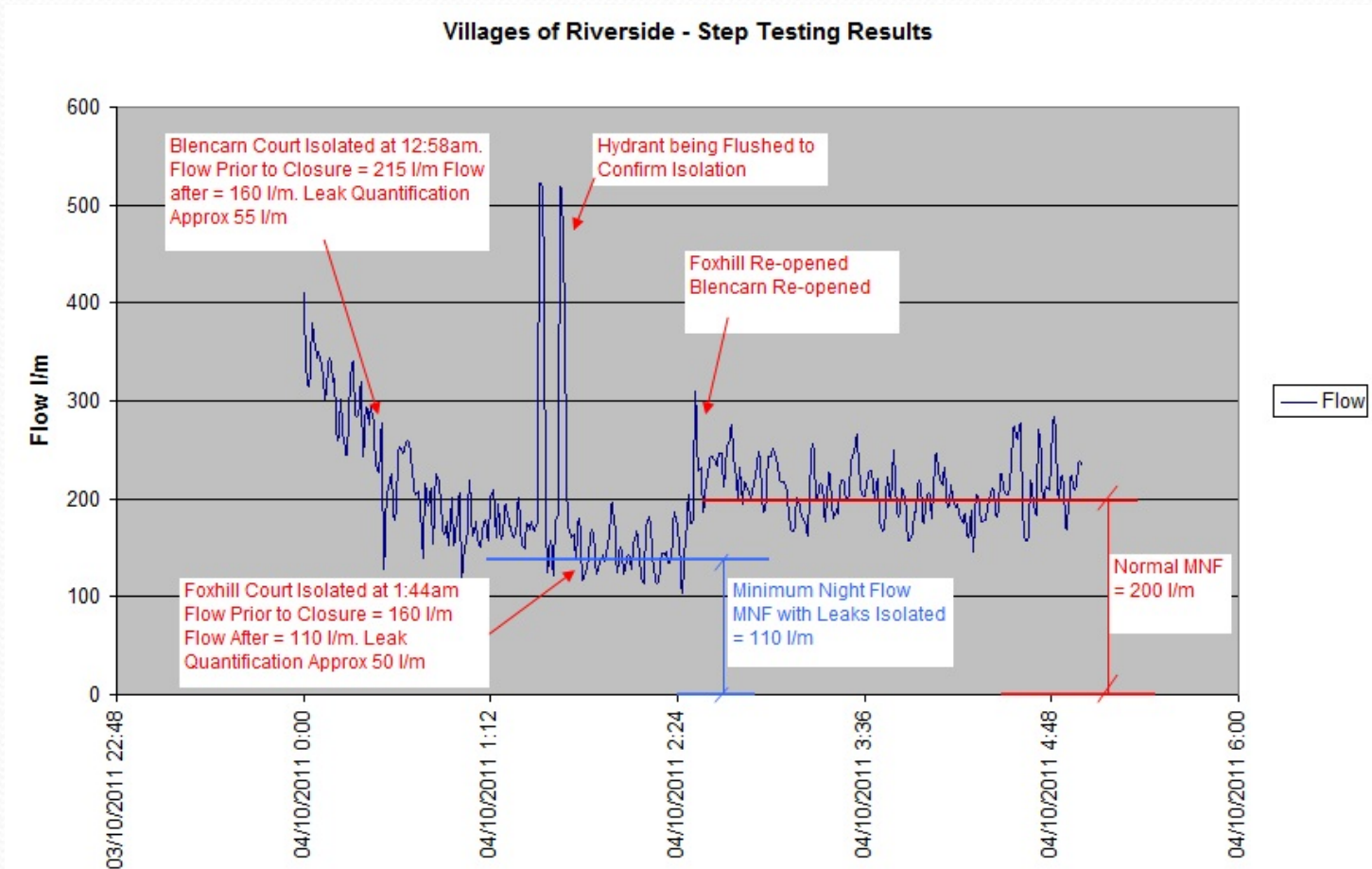


## DMA 3 – Windsor, On

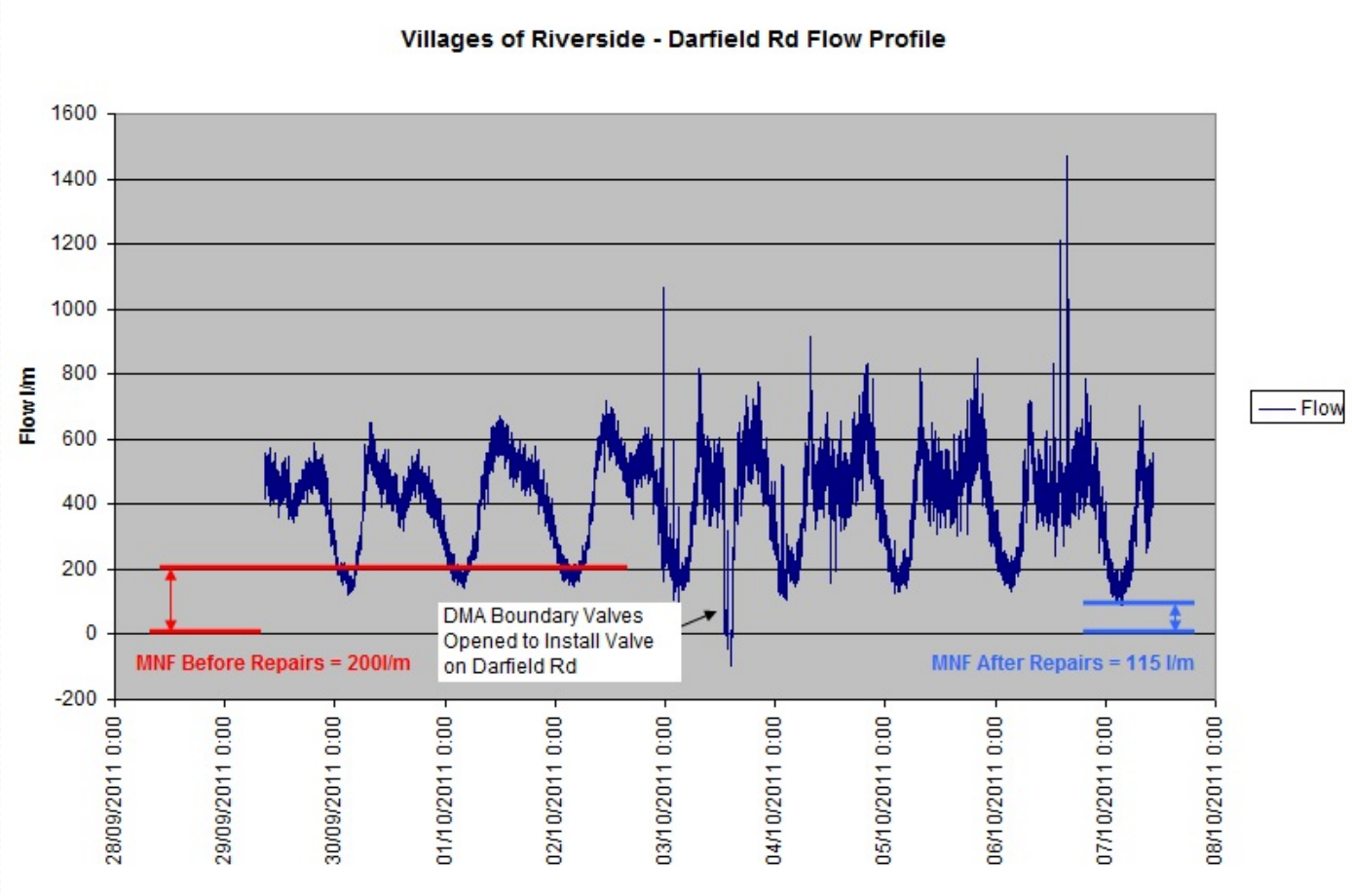
- 9.1 km of watermain
- 993 customers – primarily residential
- Average pressure 65 psi
- 43 hydrants
  
- Measured night flow 200 l/m
- Legitimate night flow 86 l/m
- Potential water loss **114 l/m**



# DMA 3 – Step Testing Results



# DMA 3 – Flows Before and After Repairs





# “Let’s Find Those Leaks and Fix Them”

