Applying Best Practice to Reduce Leakage in Troublesome DMAs using Smart Solutions and Technologies

Tom Crowder – Director at Crowder Consulting

United Kingdom

Introduction

This presentation summarises an overall approach to DMA Leakage reduction projects and provides insight on innovative techniques applied to reduce leakage in troublesome DMAs.

- Thames Water have committed to reducing their leakage by 20.4% by 2025, one of the largest reductions in the UK.
- Crowder Consulting were appointed in 2019 as a main service provider for Lot 4 on the Thames Water Leakage Detection framework, which is for specialist companies to provide innovative techniques to reduce leakage.
- For each leakage reduction project on Lot 4, Thames Water puts forward a request for service providers to bid for work to reduce leakage in specific troublesome DMAs and the best proposal wins the work.
- A large proportion of the leakage reduction work is performance-based, meaning we get paid a set amount for each Megalitre per day of leakage reduced.

Projects Overview

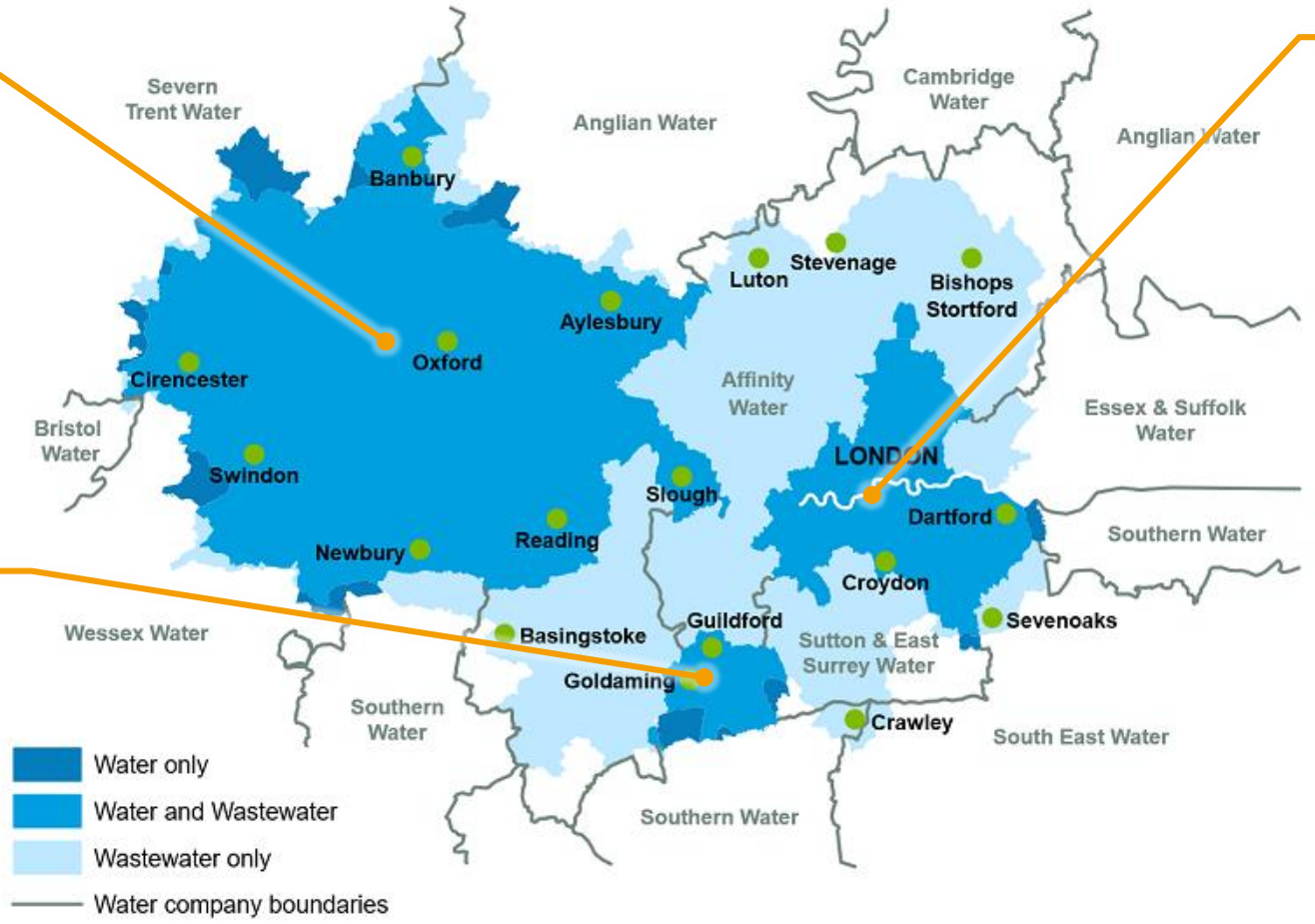
Over the course of the last 2 years we delivered 8 leakage reduction projects, detecting 753 leaks across 42 DMAs and reducing leakage by over 10 Megalitres per day.

Thames Valley
4 Projects

Number of DMAs	26
Number of Connections	58,224
Length of Mains	1,378 km
Leakage Reduction	6.6 Mld
Number of Leaks	520

Guildford
2 Projects

Number of DMAs	5
Number of Connections	9,042
Length of Mains	71 km
Leakage Reduction	0.75 Mld
Number of Leaks	88



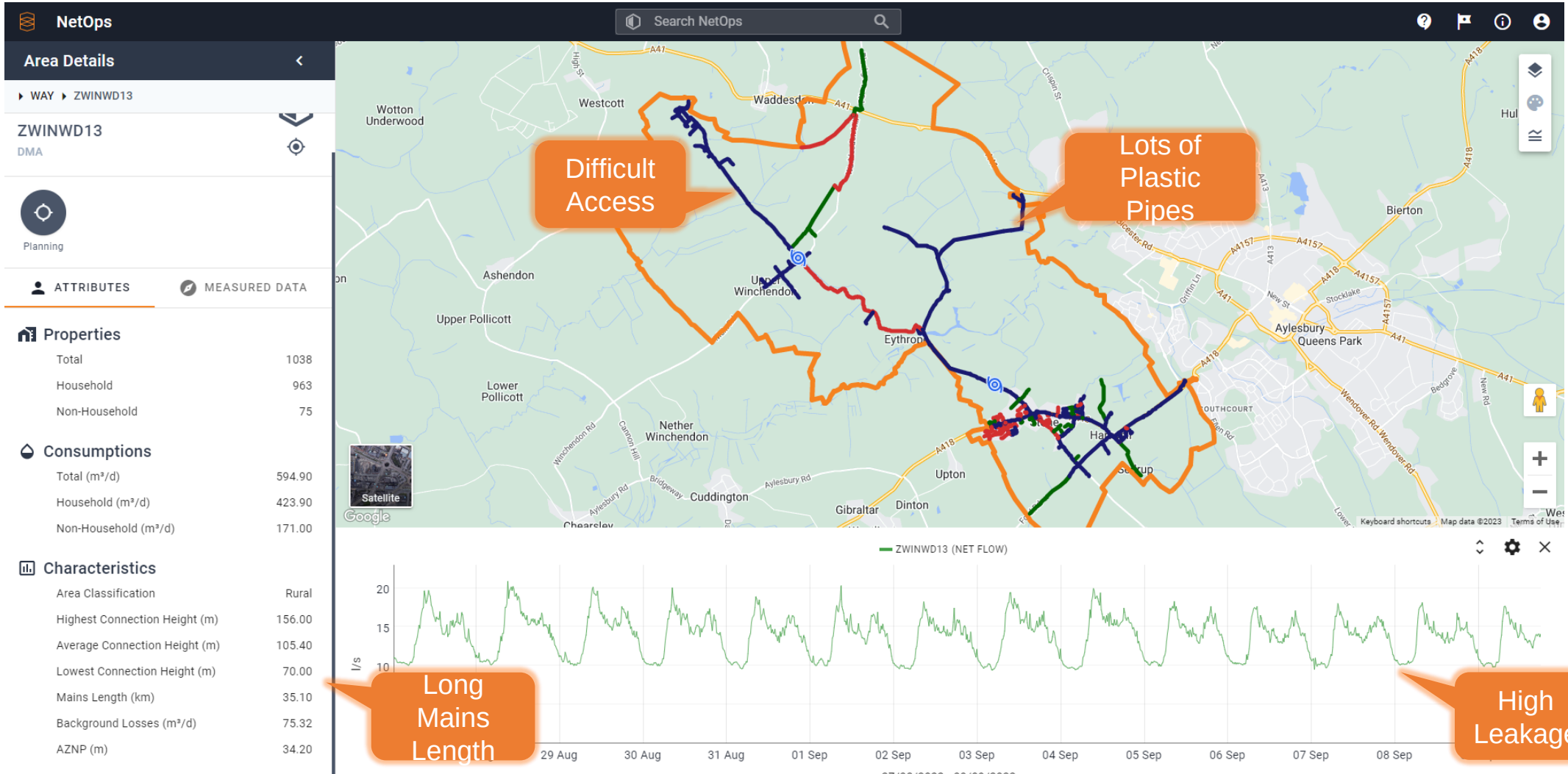
London
2 Projects

Number of DMAs	11
Number of Connections	27,078
Length of Mains	301 km
Leakage Reduction	2.75 Mld
Number of Leaks	145

Crowder Consulting

Troublesome DMAs

Example of a Rural Troublesome DMA

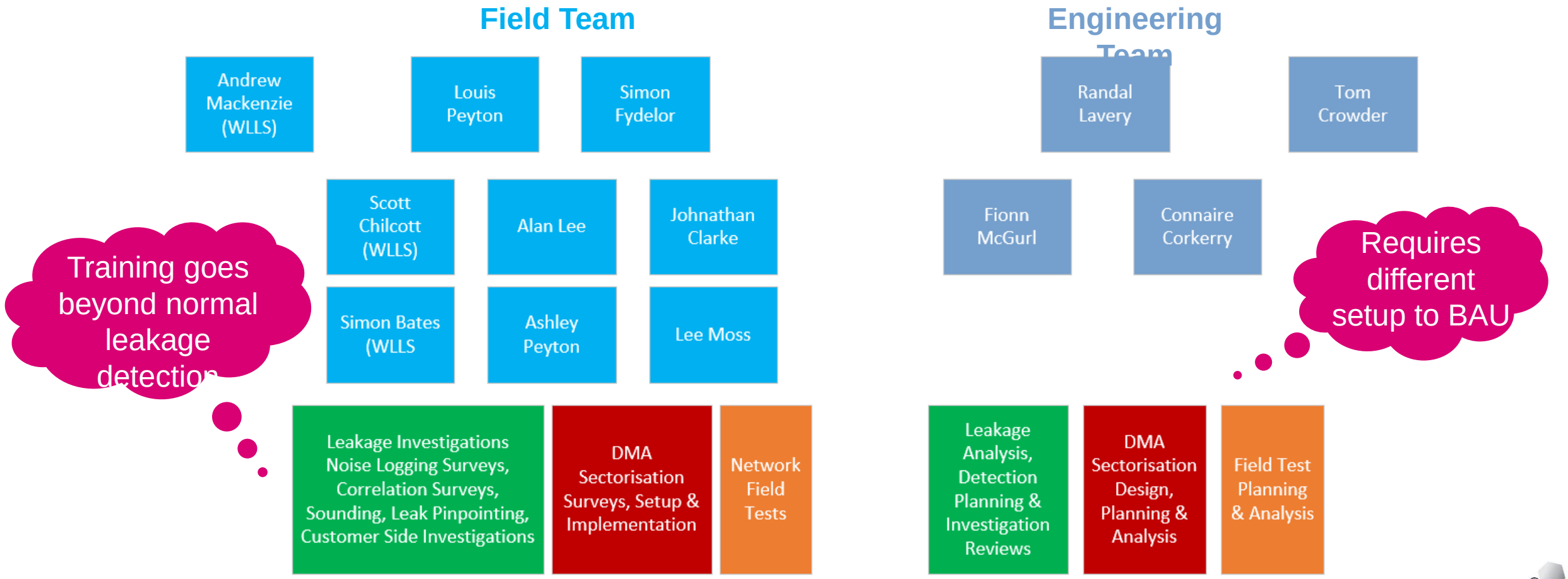


Troublesome DMAs

Example of an Urban Troublesome DMA

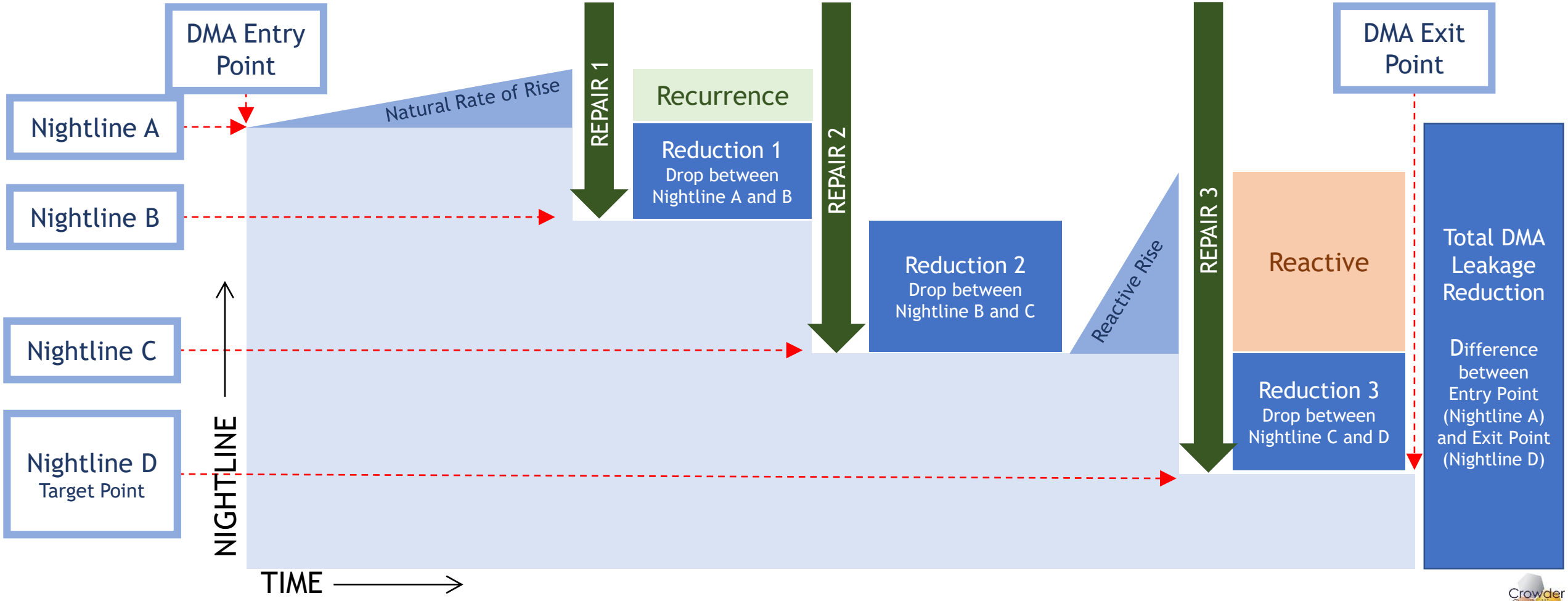
Project Team

We have a dedicated Lot 4 delivery team working on DMA Leakage Reduction Projects, with skills and expertise to leverage the latest innovations in technology.



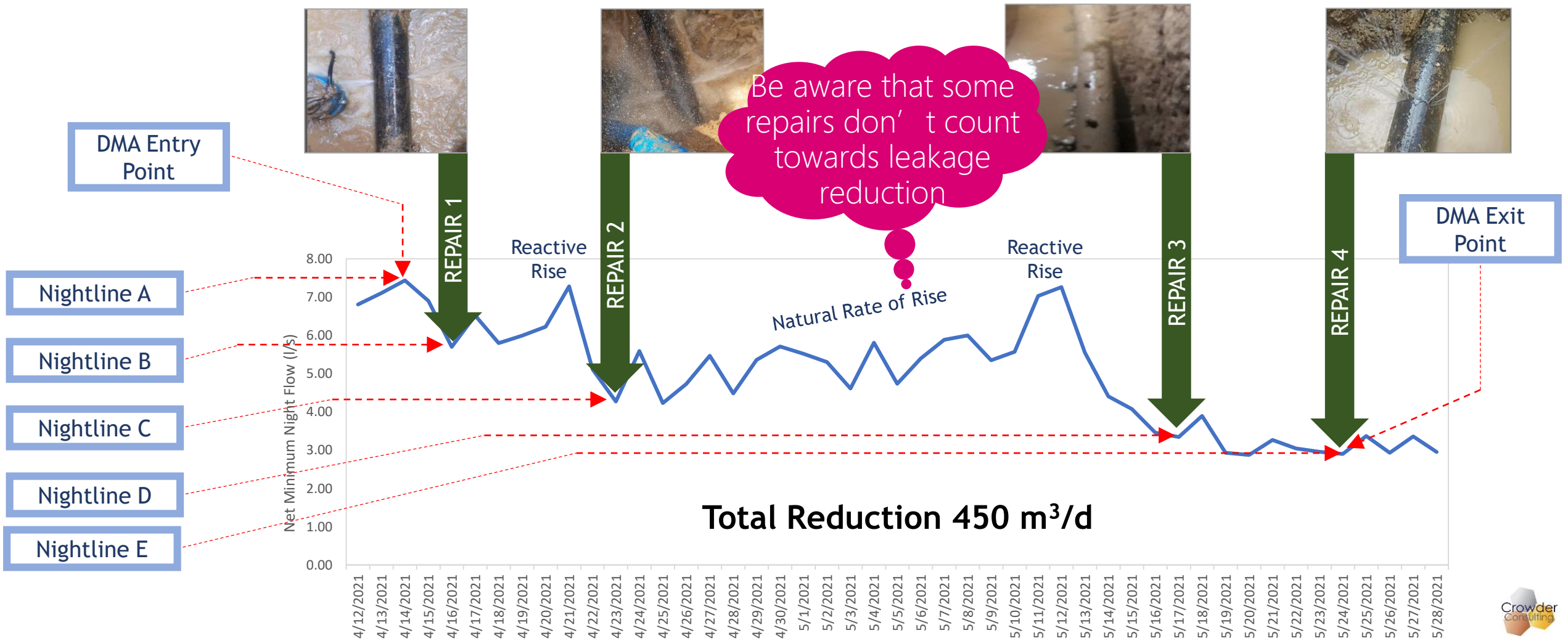
Measuring DMA Leakage Reduction

A standard methodology is applied to calculate the leakage benefit of individual repairs and the overall leakage reduction achieved using the DMA Net Night Flow.



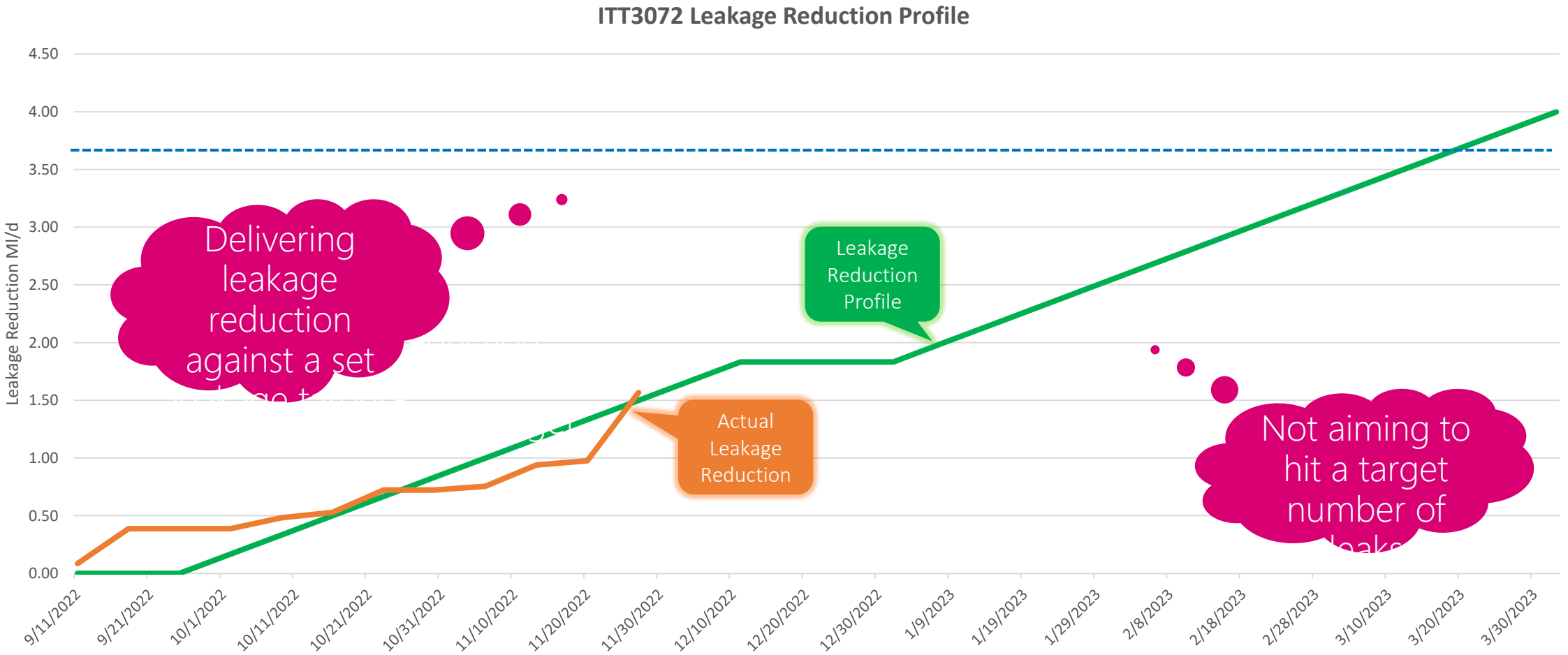
Measuring DMA Leakage Reduction

A proactive repair strategy needs to be put in place to prioritise leaks found and fix them quickly, to achieve effective DMA leakage reductions.



Tracking Leakage Reduction Performance

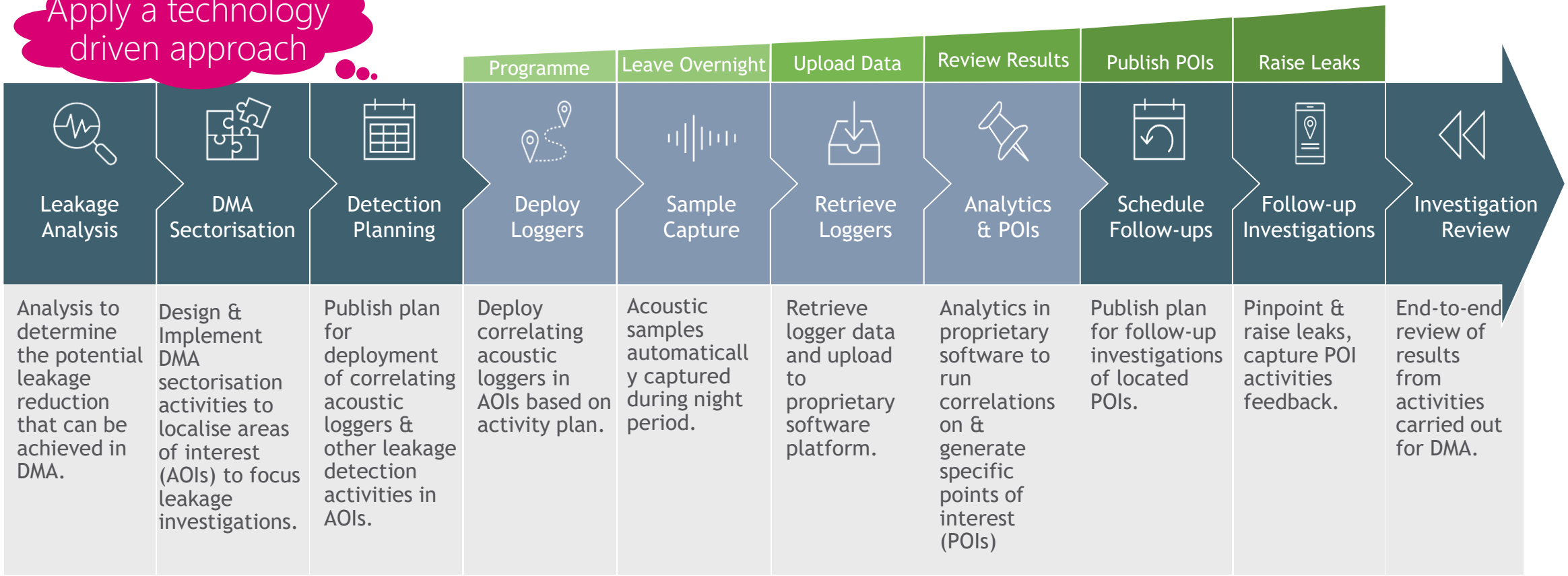
A leakage reduction profile is produced at the outset of the project to track performance. In the example below for our current 4 Mld reduction project we need to reduce leakage on average by 0.16 Mld per week.



Approach & Processes

Following a smart investigation process provides a structured approach to resolve DMAs with high leakage. Information is fed back from the field in a coherent manner, enabling analysis that supports further field activities; with investigation results compiled for regular review.

Apply a technology driven approach



Leakage Analysis

Leakage analysis is carried out on each DMA based on the Netbase Night Flow Water Balance. A target ILI is applied to derive the level of reduction required in each DMA to achieve an overall leakage target.

Leakage Calculation	Total	DMA 1	DMA 2	DMA 3	DMA 4	DMA 5	DMA 6	DMA 7
Minimum Night Flow (m^3/hr)	363	74.00	31.00	63.00	65.00	66.00	38.00	26.00
Night Use (m^3/hr)	85.55	22.60	3.40	10.23	20.00	17.50	7.22	4.60
Night Leakage (m^3/hr)	277.45	51.40	27.60	52.77	45.00	48.50	30.78	21.40
Hour-to-Day-Factor	23.11	22.71	22.71	22.71	22.71	23.04	21.97	21.97
Total Daily Leakage (m^3/d)	6412	1167	627	1198	1022	1117	676	470
UARL(m3/day)	1013	309	64	145	237	116	70	72
ILI	6.33	3.78	9.82	8.26	4.31	9.63	9.66	6.53
% Metallic	75%	44%	87%	67%	52%	93%	94%	86%
% Plastic	23%	51%	13%	32%	44%	7%	3%	8%
Total Daily Leakage (m^3/d)	6278	1167	627	1198	1022	1117	676	470
Potential Daily Leakage Reduction (m^3/d)	4956	753	540	1003	693	916	576	376
Target Leakage Reduction (m^3/d)	4000	472	483	872	489	857	519	308
Target Daily Leakage (m^3/d)	2278	695	144	326	533	261	157	162
Target ILI	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2

Target ILI of 2.2

DMA Sectorisation

Investigating confirmed leakage volumes in localised areas of interest (AOIs) will heed more intensive investigations, resulting in hard-to-find leaks being detected and provide evidence to prioritise repairs.

Not just step testing

Permanent Sectors

Create hydraulic sub-sectors using existing metering within a DMA that are permanently setup and continuously monitored.

Temporary Sectors

Create hydraulic sub-sectors using existing metering within a DMA that are temporarily setup for up to 2-weeks and monitored.

Mobile Sectors

Use of portable metering to create hydraulic sub-sectors within a DMA that are setup over-night and assessed using fast logging.

Dynamic Sectors

Use of inlet/outlet meters to create hydraulic sub-sectors within a DMA that are setup over-night and assessed using fast logging.

Stepped Sectors

Use of metering to create several hydraulic sub-sectors within a DMA through over-night valve operations that are assessed using fast logging.

Non-Hydraulic Sectors

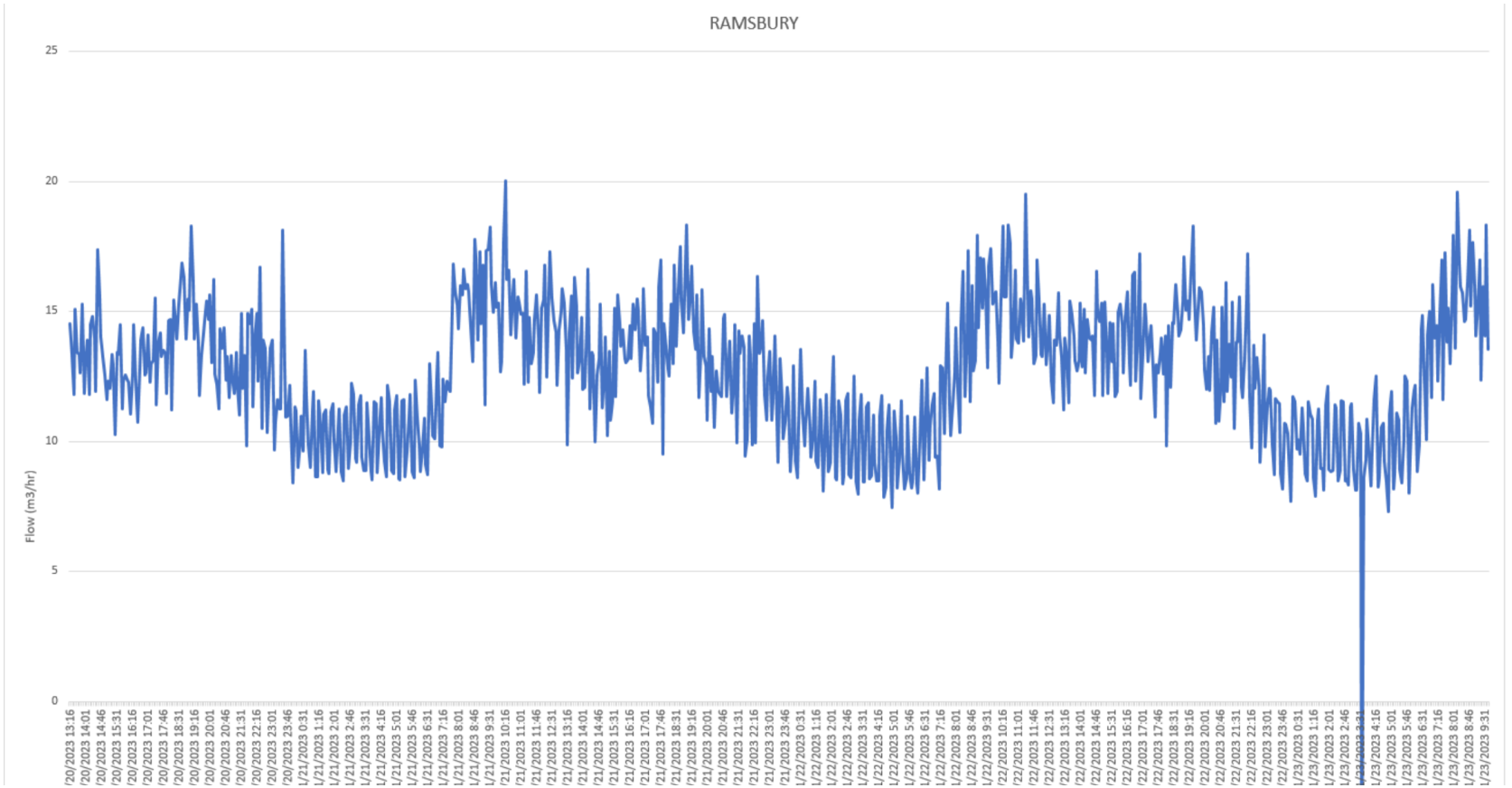
Identify sections of pipe with high propensity of leaks or evidence of potential leaks based on proprietary software and satellite surveys.

Making the most of existing metering

Crowder Consulting

DMA Sectorisation

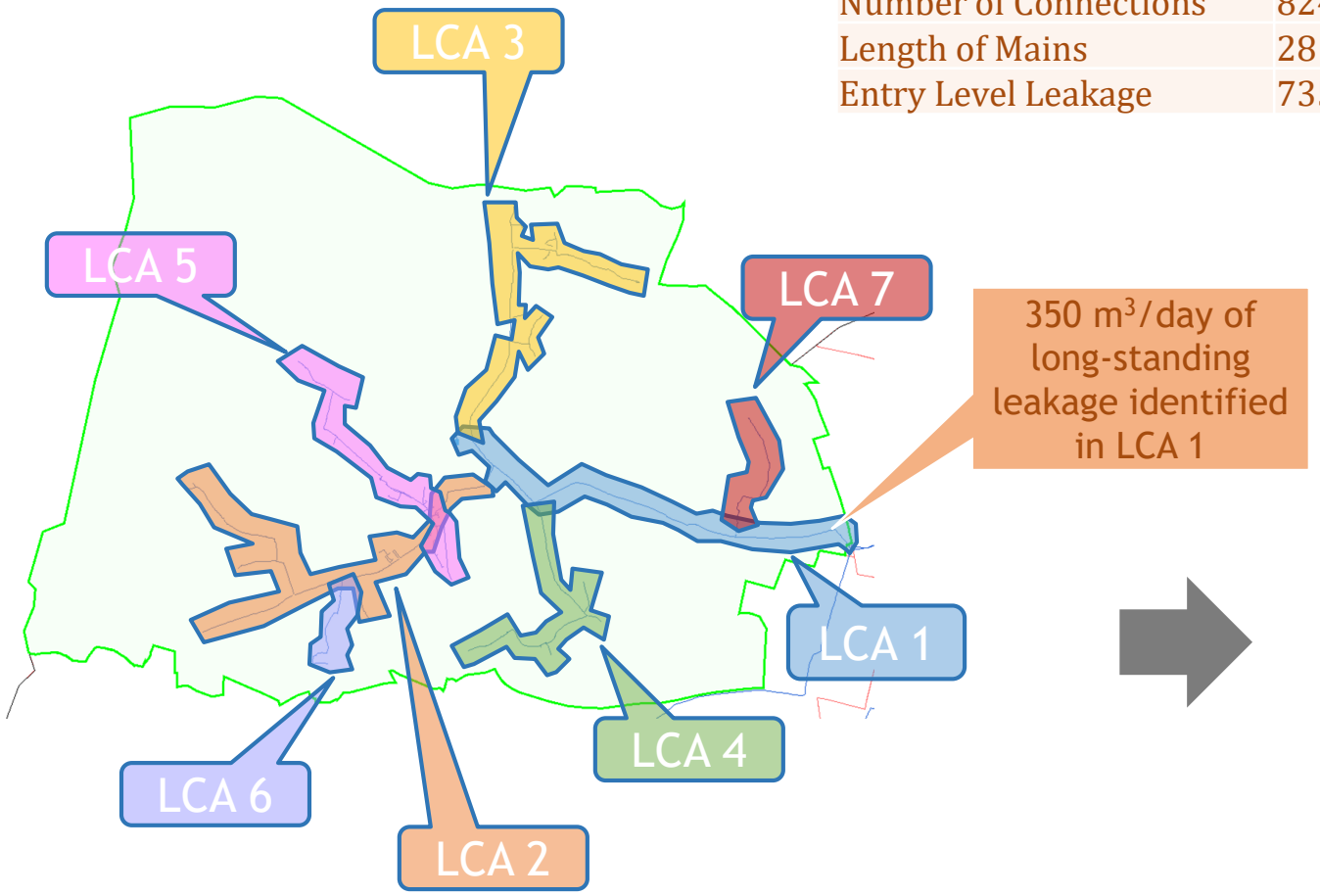
Example of using mobile metering such as an ultra-sonic meter to identify where leakage is located.



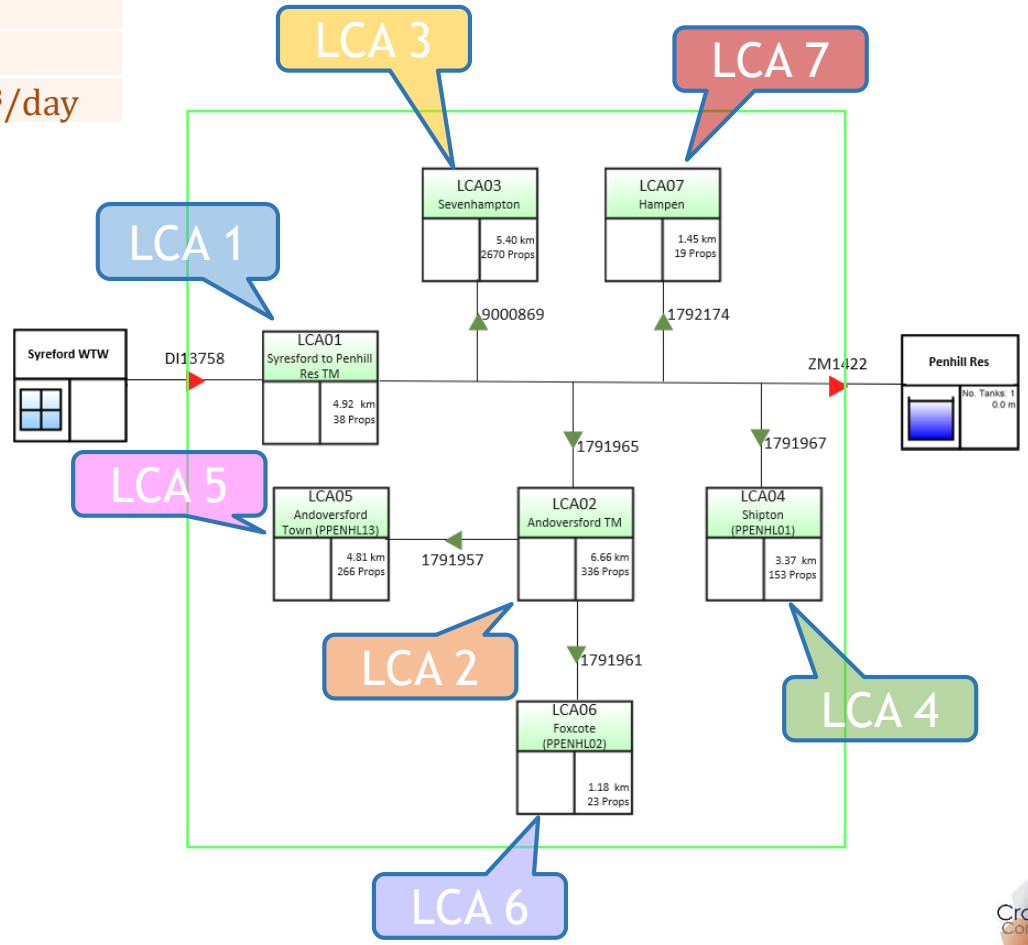
Rural DMA Sectorisation Case Study

The use of existing metering within this rural DMA to create sub-sectors that are permanently setup and continuously monitored greatly helped to achieve meaningful leakage reductions.

Number of Connections	824
Length of Mains	28 km
Entry Level Leakage	735 m³/day



350 m³/day of long-standing leakage identified in LCA 1

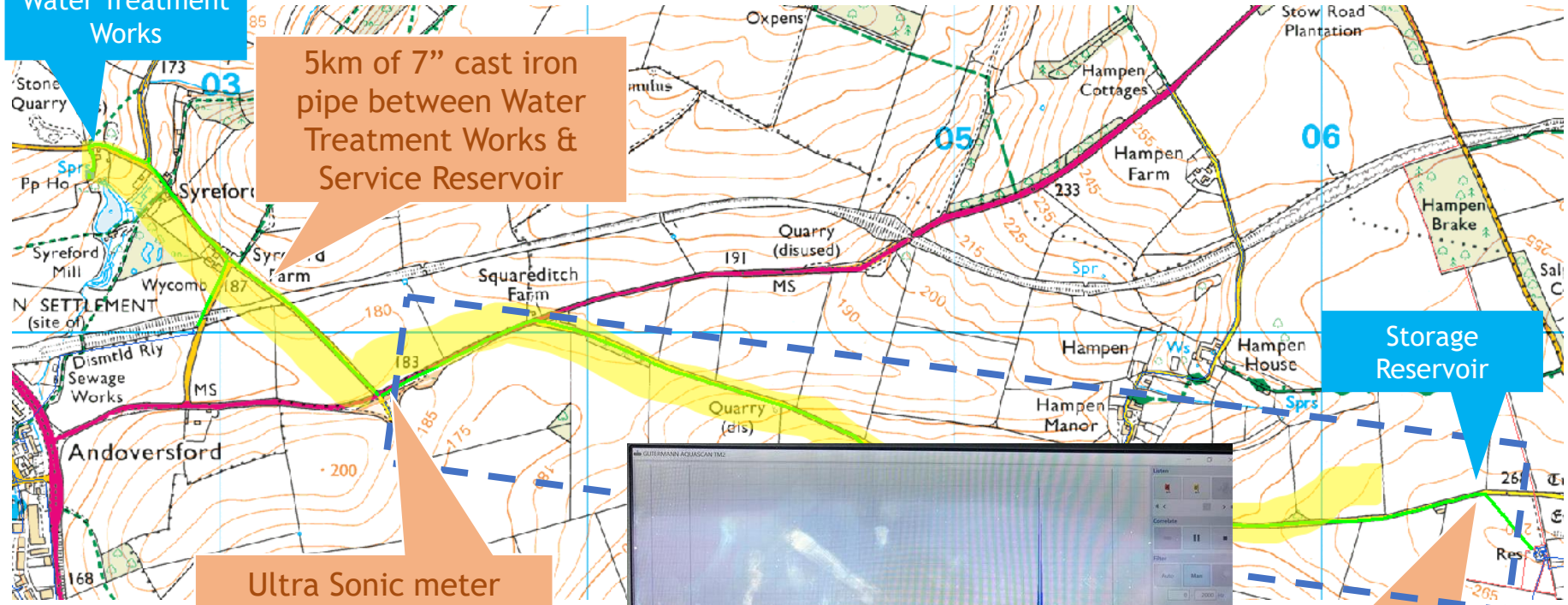


Rural DMA Sectorisation Case Study

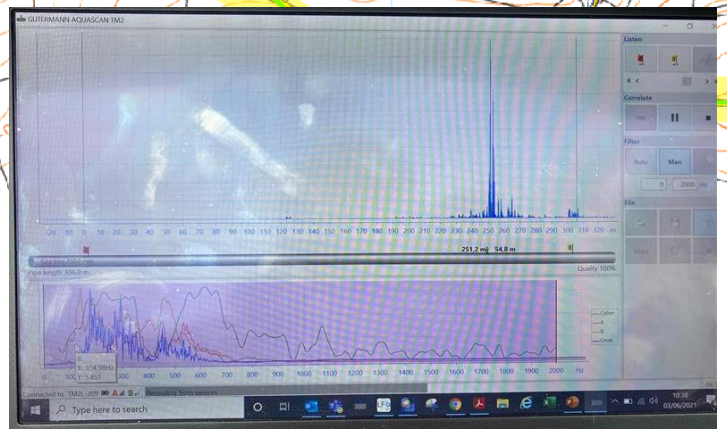
A systematic process was followed to narrow down the leak within the sub-section and pinpoint it to an accurate location.

Water Treatment Works

5km of 7” cast iron pipe between Water Treatment Works & Service Reservoir



Storage Reservoir



Ultra Sonic meter installed here, confirmed 350 m^3/day of leakage on long section to Storage Reservoir

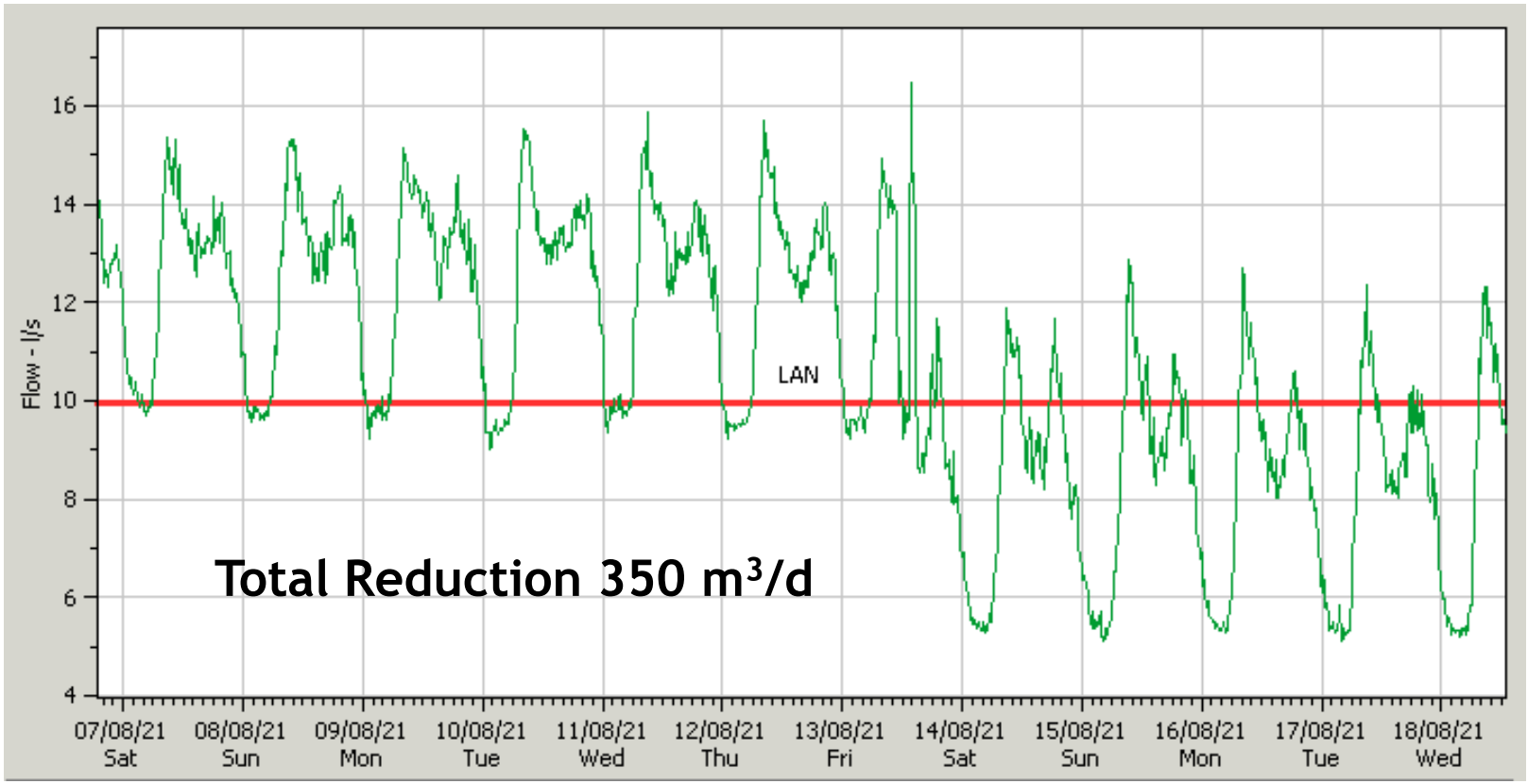
Correlation using high-spec trunk main correlator put leak 50m from Storage Reservoir

Leak located here in field next to an oil pipeline

Crowder Consulting

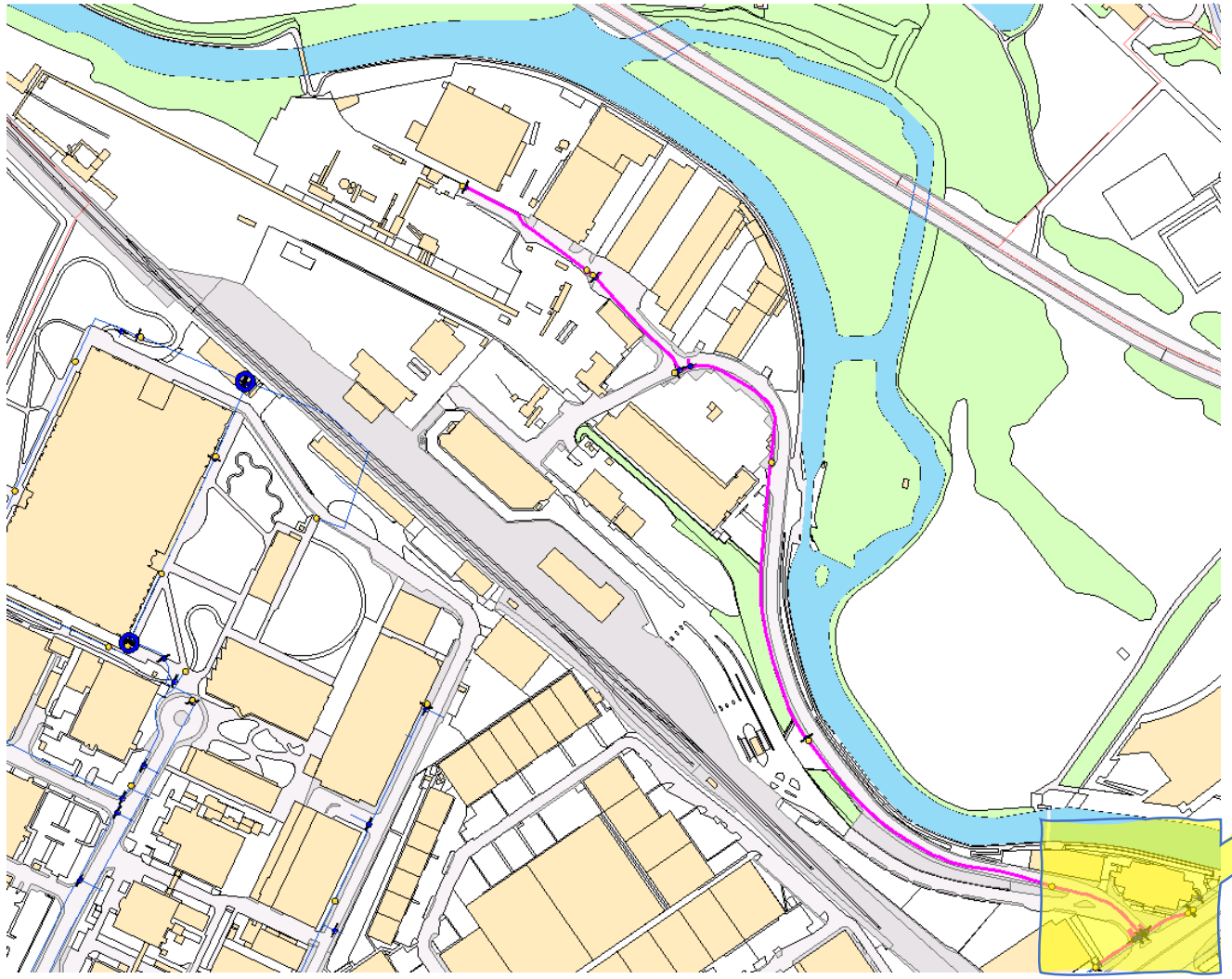
Rural DMA Sectorisation Case Study

Once the leak was repaired it also helped with operation of the network by reducing the amount of water that need to be produced by the Works and pumped towards the Service Reservoir.

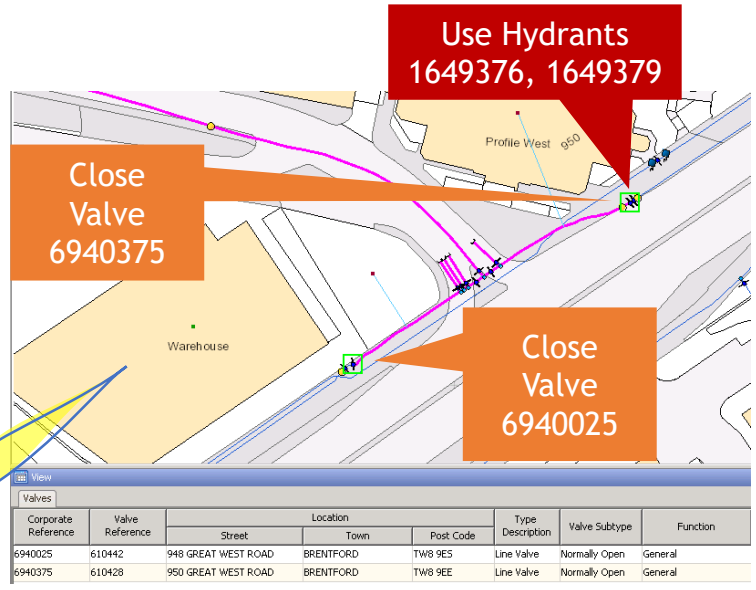


Urban DMA Sectorisation Case Study

Use of portable metering within a DMA to assess the level of leakage in a sub-sector.



Mains Length	0.9 km
No. Props	34
Consumption	87 m^3/day
Night Use	1.42 m^3/hour
Valve Closures	2

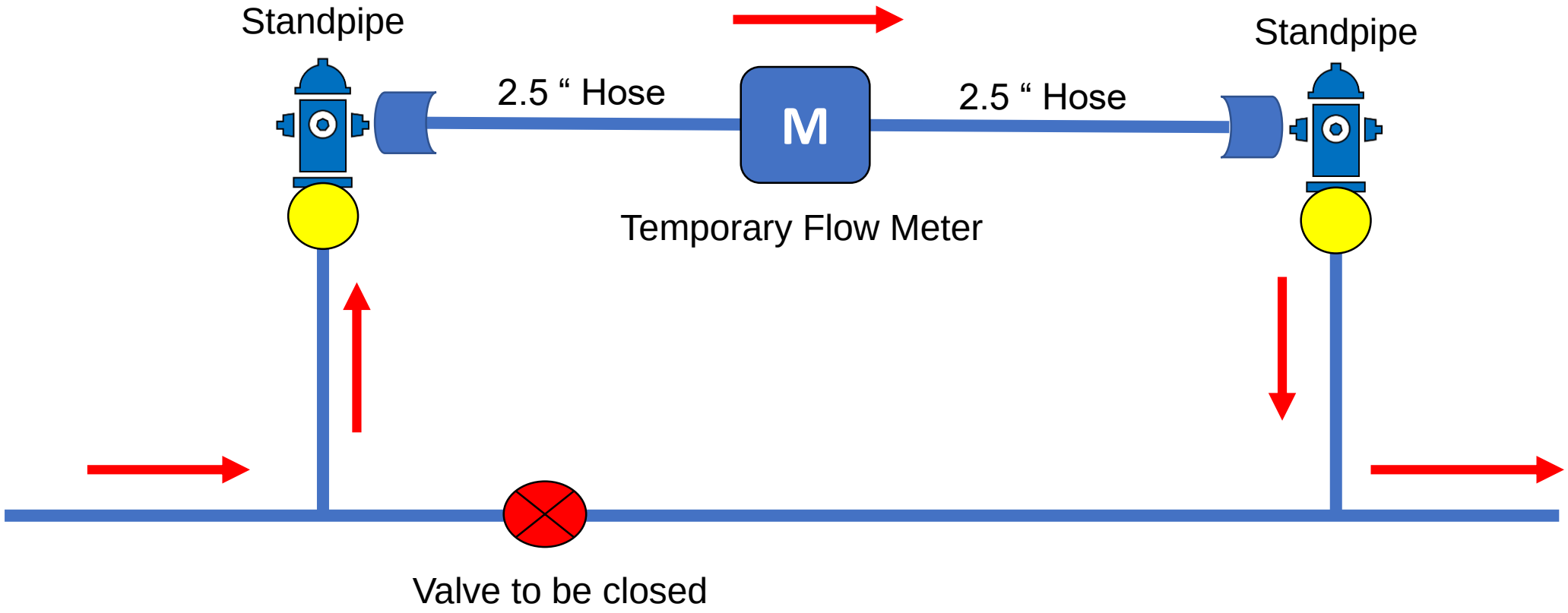


Valves

Corporate Reference	Valve Reference	Location			Type Description	Valve Subtype	Function
		Street	Town	Post Code			
6940025	610442	948 GREAT WEST ROAD	BRENTFORD	TW8 9ES	Line Valve	Normally Open	General
6940375	610428	950 GREAT WEST ROAD	BRENTFORD	TW8 9EE	Line Valve	Normally Open	General

Urban DMA Sectorisation Case Study

Typical setup of portable metering using an OXO setup.

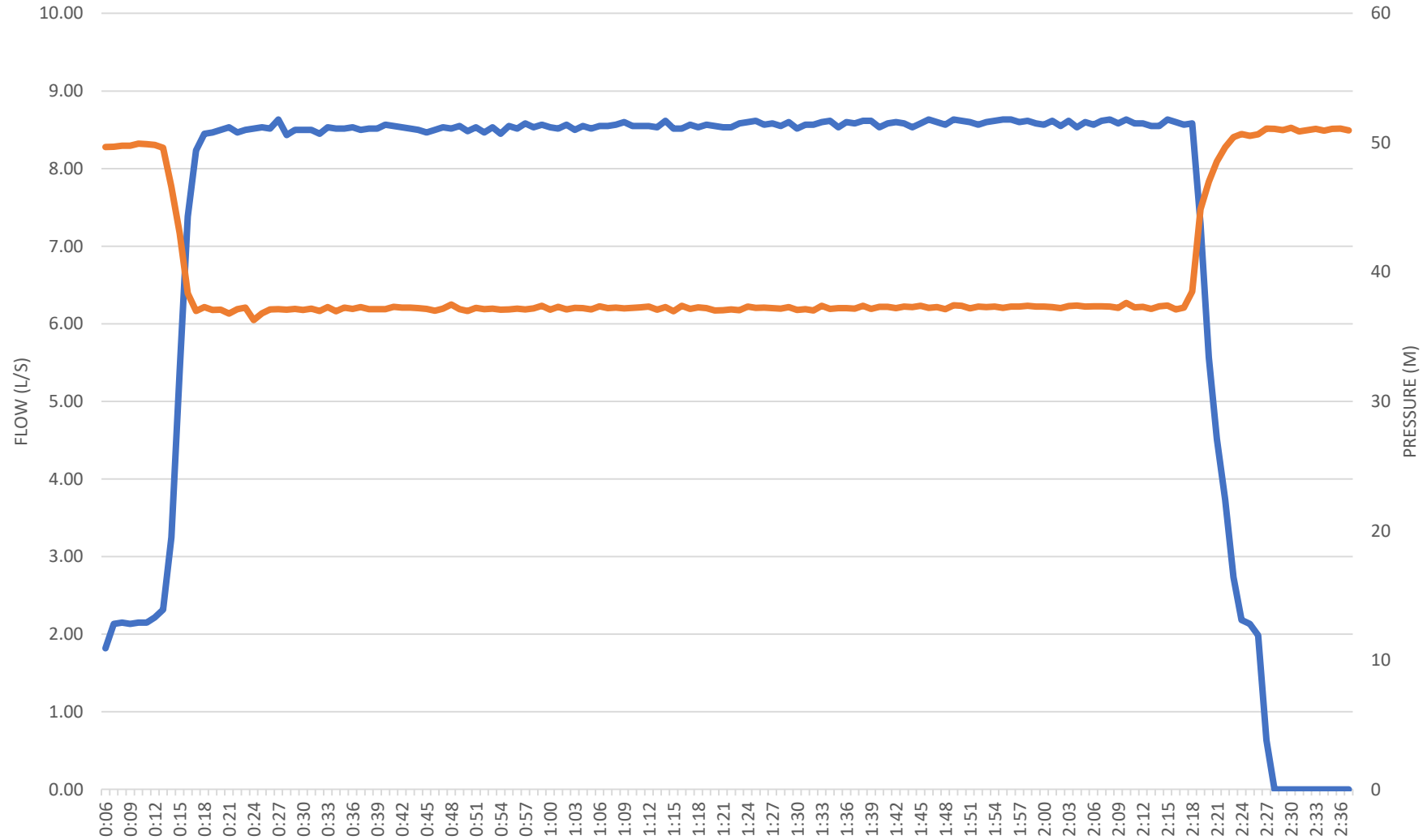


Urban DMA Sectorisation Case Study

The portable meter needs to be setup during the night when there is minimum usage.

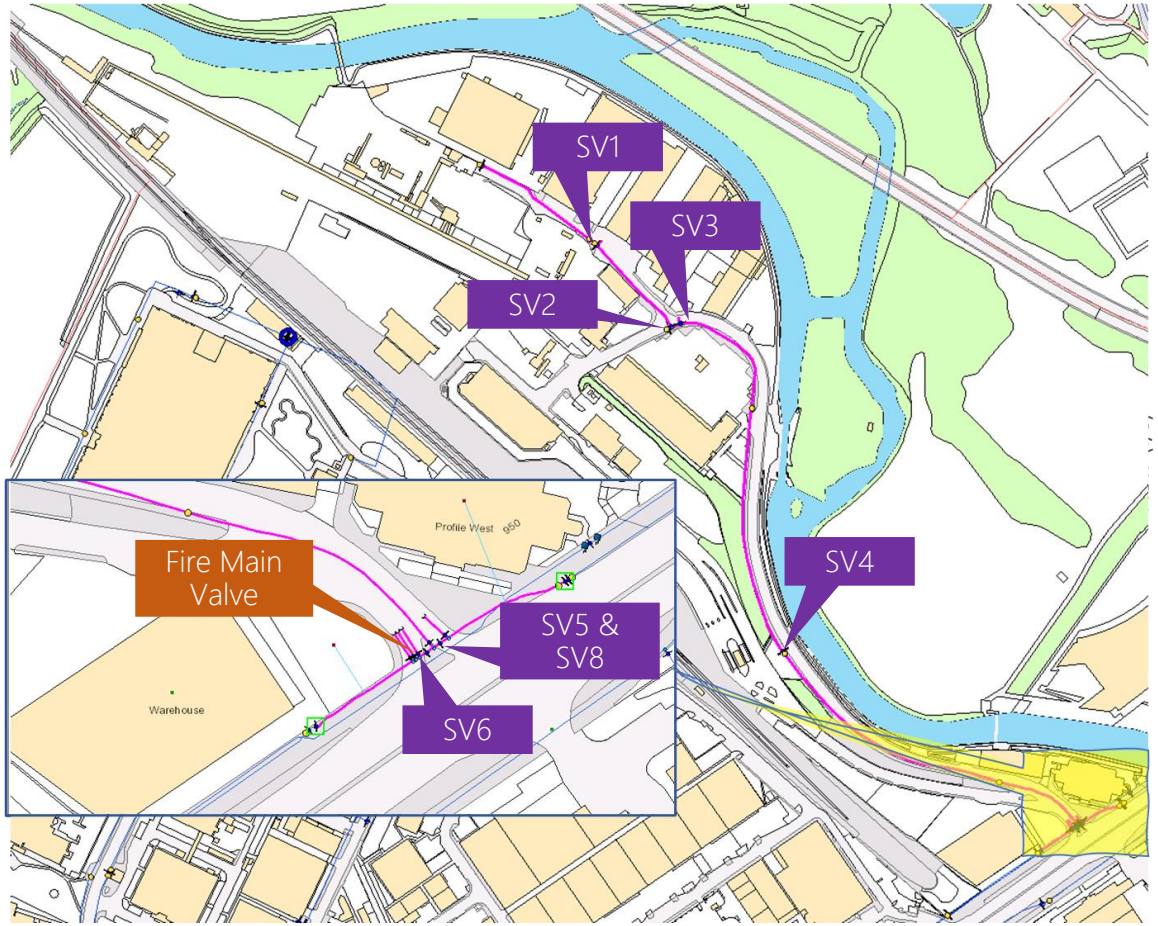
Urban DMA Sectorisation Case Study

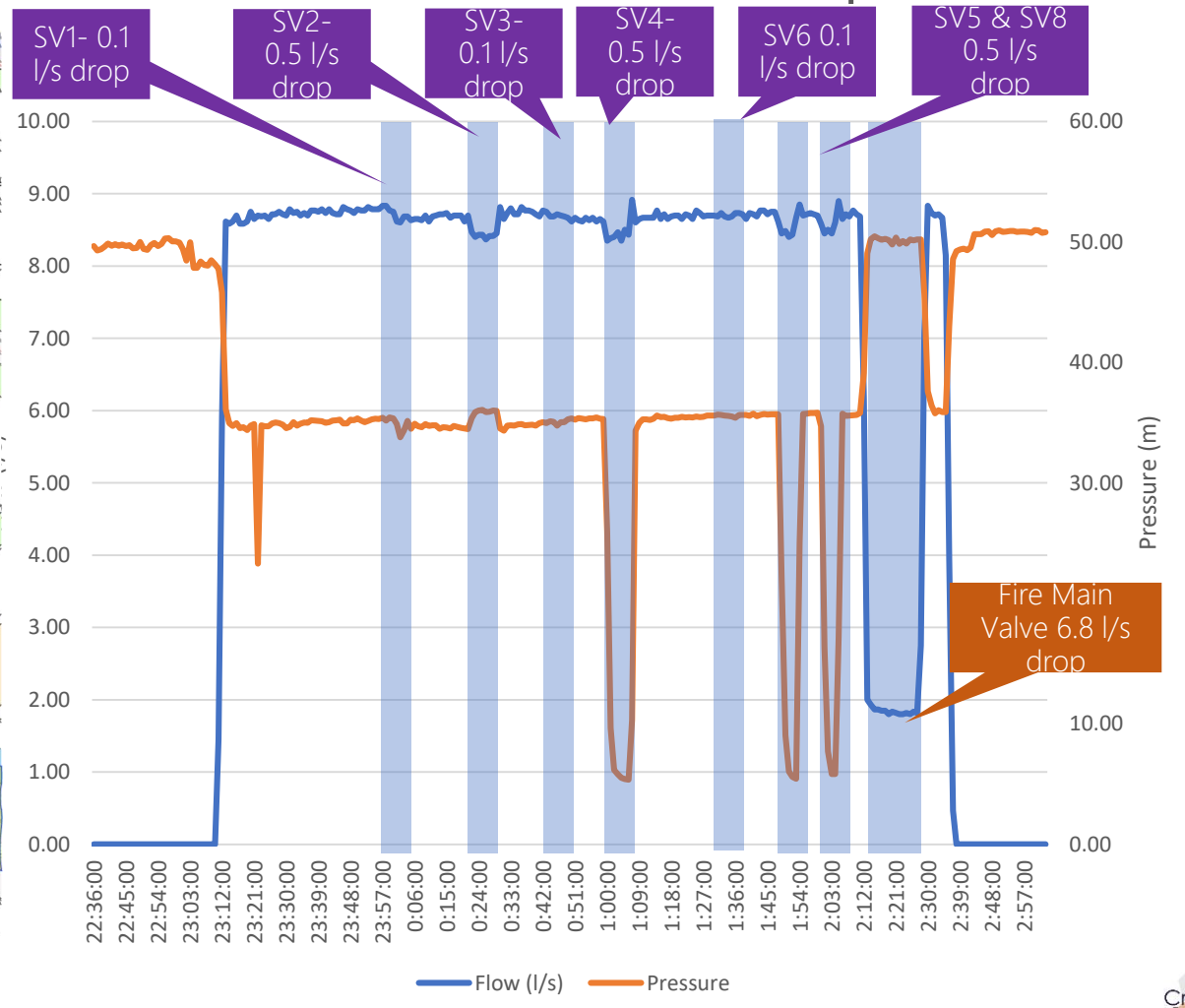
The portable meter logs flows every 30 seconds to enable the true value of leakage to be identified. We also log pressures within the sub-sector to ensure the area is tight.



Urban DMA Sectorisation Case Study

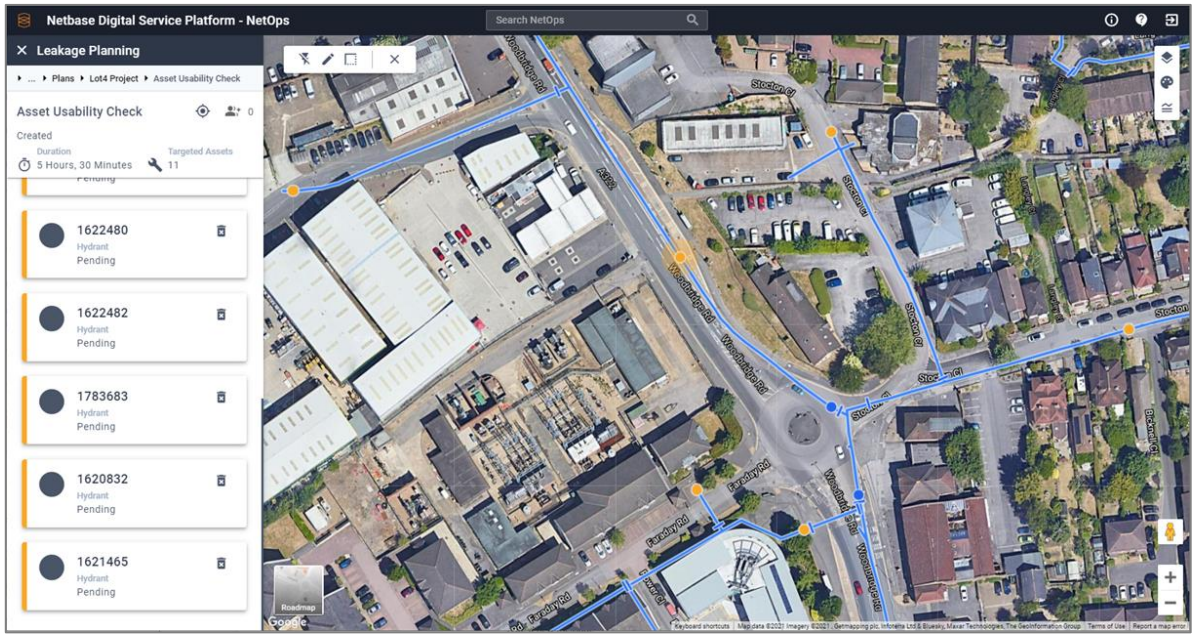
To assess the volume of leakage and determine the leak location, a portable flow meter was setup to measure the flow to a small industrial estate and valves were closed in sequence.





Detection Planning

Leakage activities for Areas of Interest identified from DMA sectorisation activities are planned and tracked in NetOps, our Web-based desktop and mobile application built on top of Netbase and provisioned on our cloud platform.



Planning

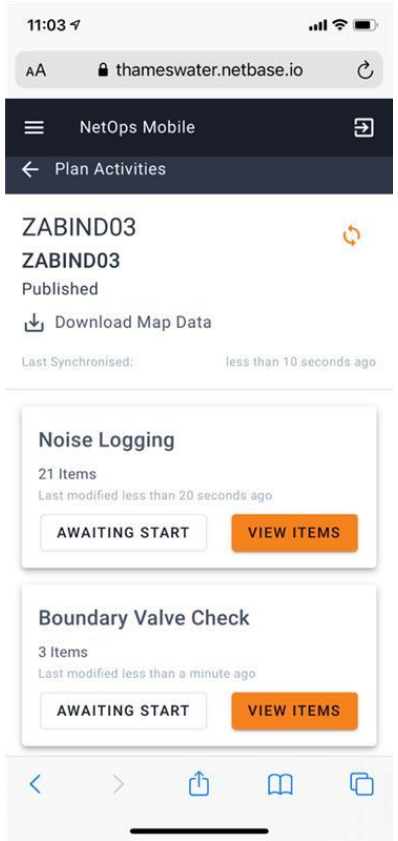
Leakage activities are defined

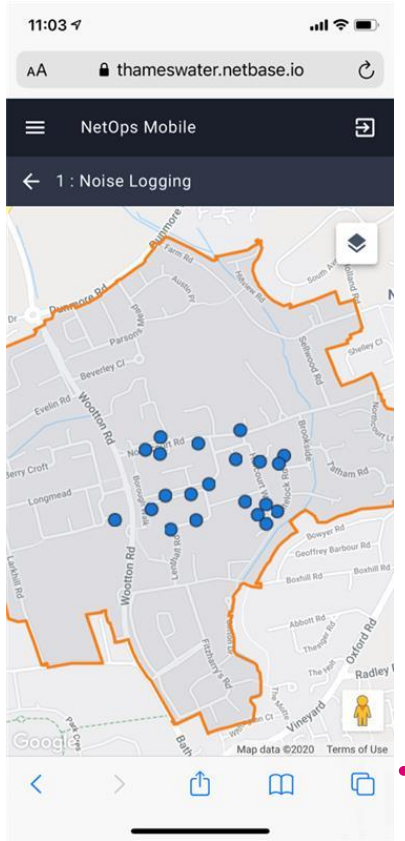
Tracking

Leakage activities are reviewed

Detection Planning

NetOps is used to publish leakage activities to field operatives and receive live feedback.

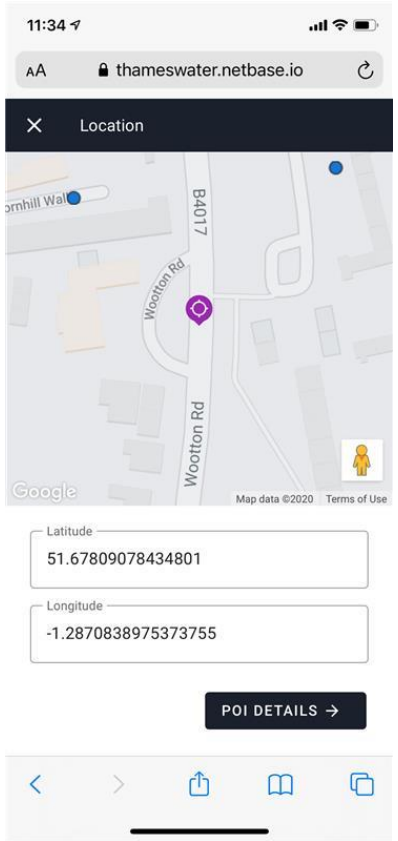


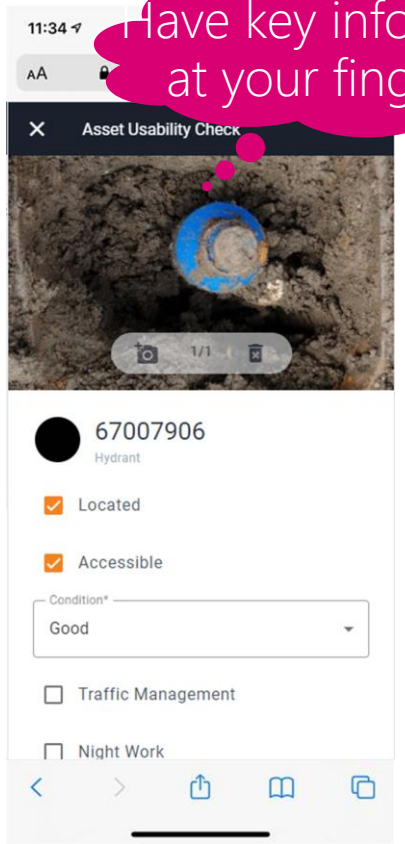


Publish

Activity details sent to field operatives

No more out of date paper plans





Have key information at your fingertips

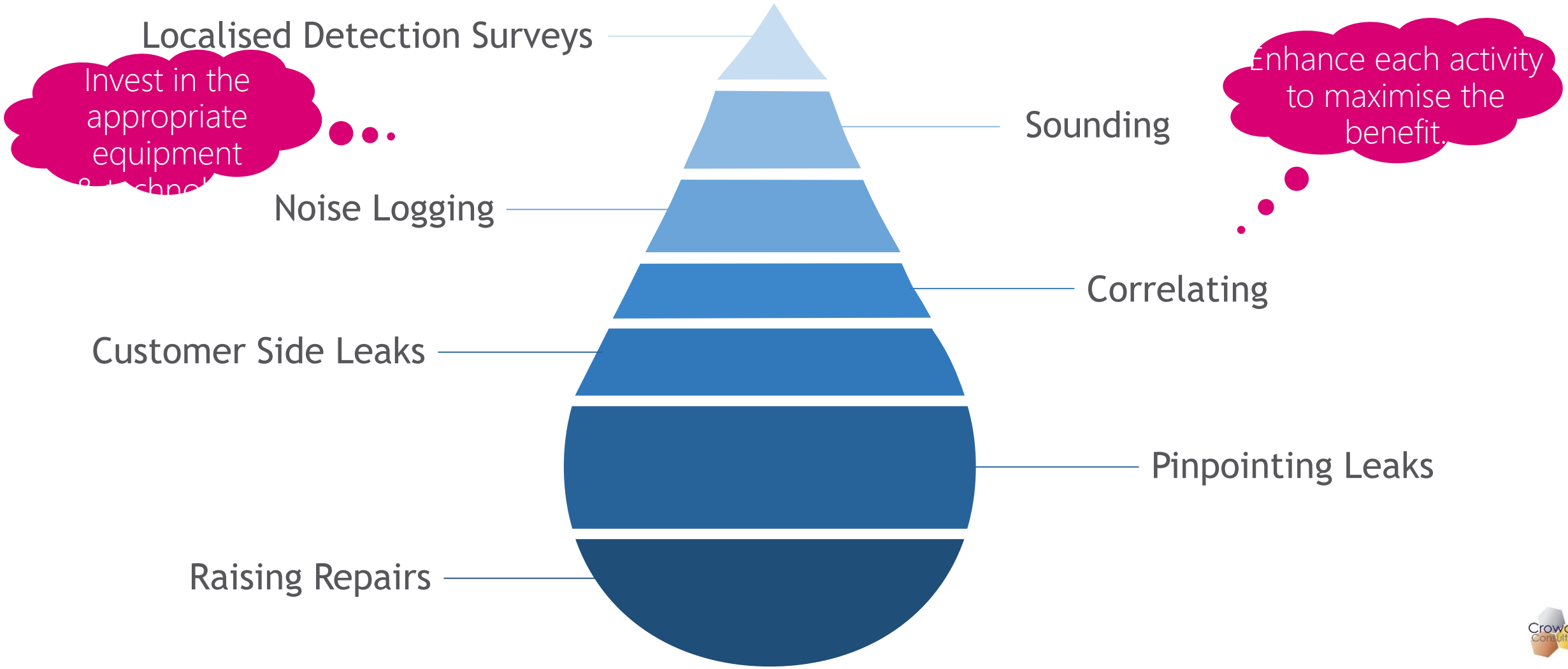
Feedback

Points of interest & asset information gathered

Crowder Consulting

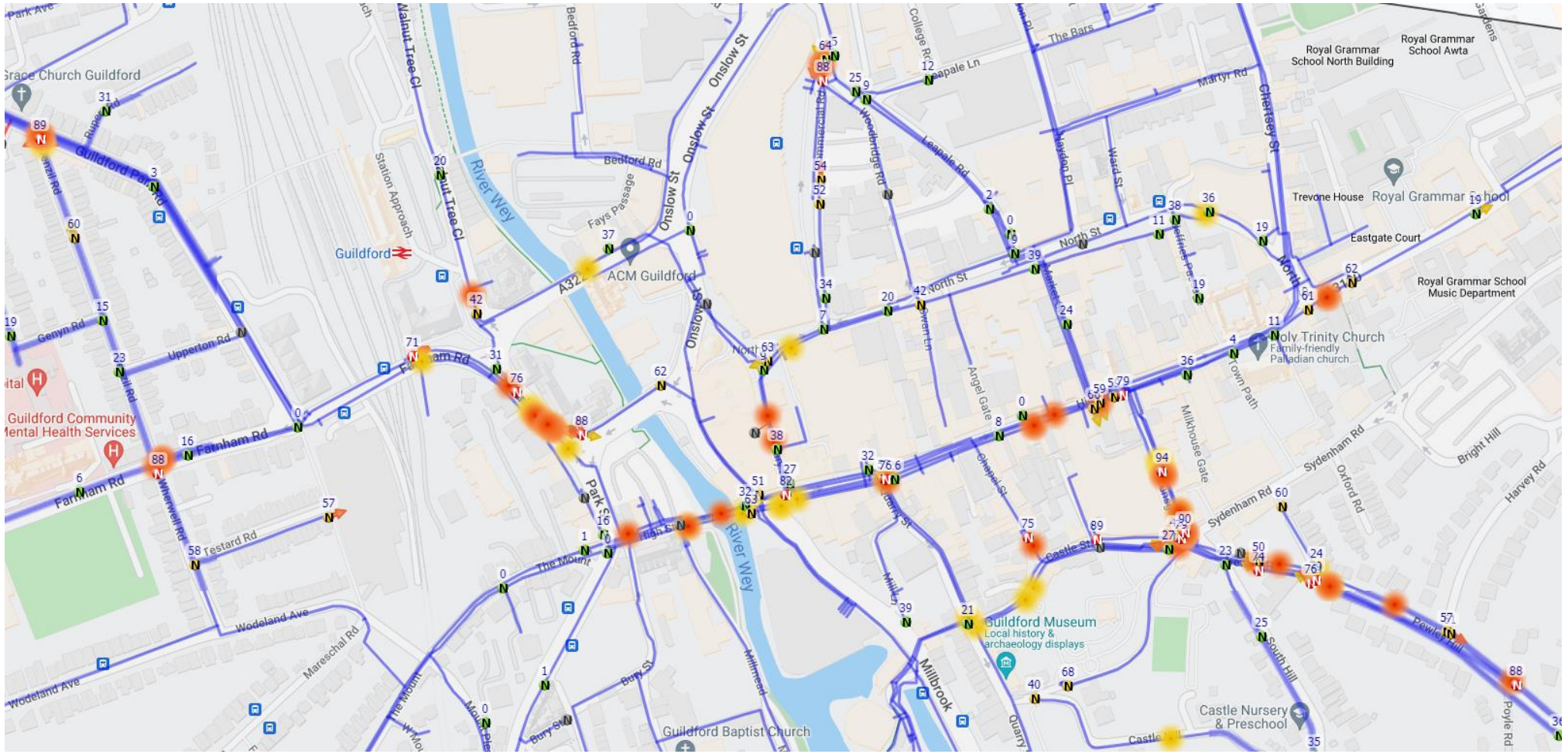
Leakage Detection Investigations

These are the range of leakage activities we do on our DMA Leakage Reduction Projects, we aim to enhance each activity to maximise the benefit.



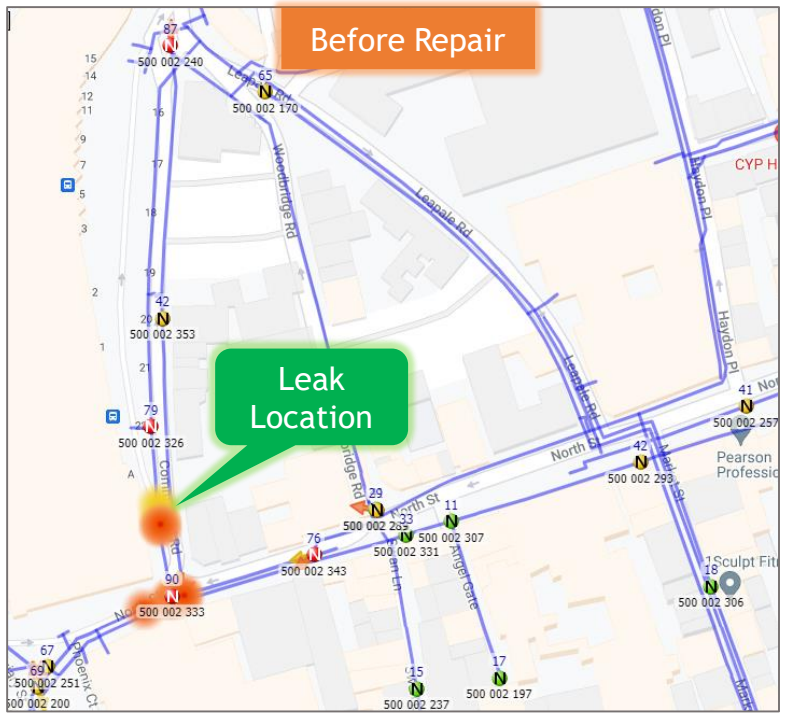
Leakage Detection Investigations

Correlating noise loggers are predominantly deployed to locate leaks in areas of interest identified.



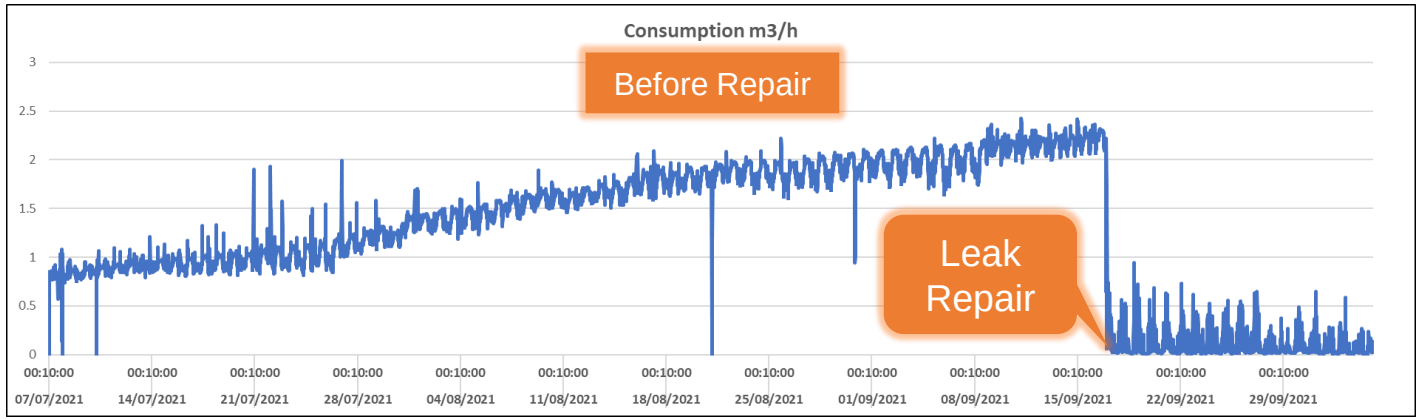
Urban DMA IoT Noise Logging Case Study

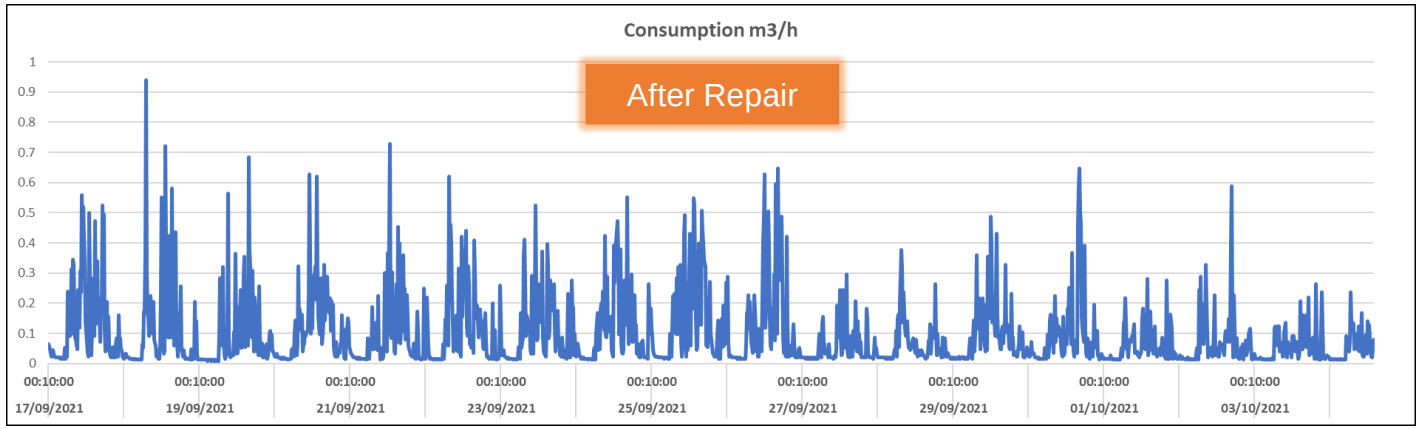
IoT Noise Loggers deployed in a town centre for a 3-month period whilst leakage reduction activities were being carried out.



Leakage Detection Investigations

To improve the customer side leak process, we utilise an AMR water meter with 1-minute interval logger data. We install the meter to quantify consumption, night use and leakage. The meter can be installed on a boundary box for a period of time.

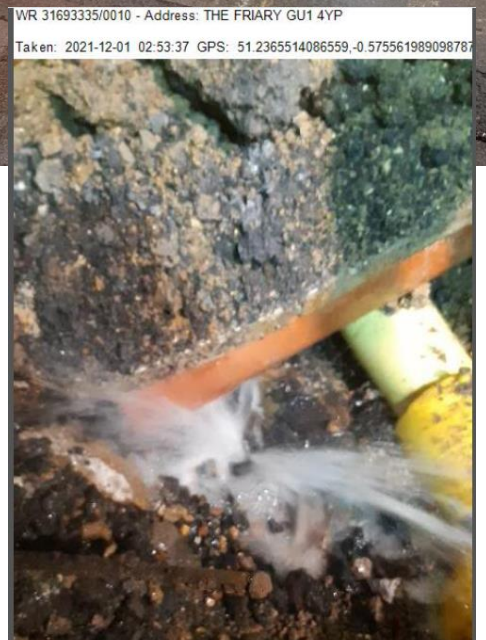


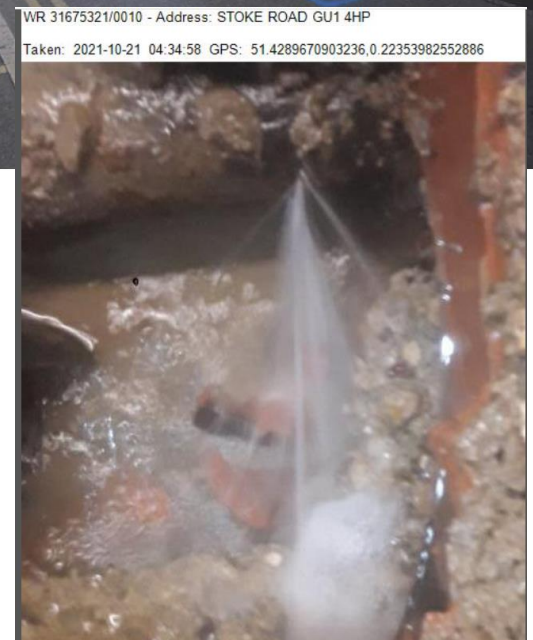


Crowder Consulting

Leakage Detection Investigations

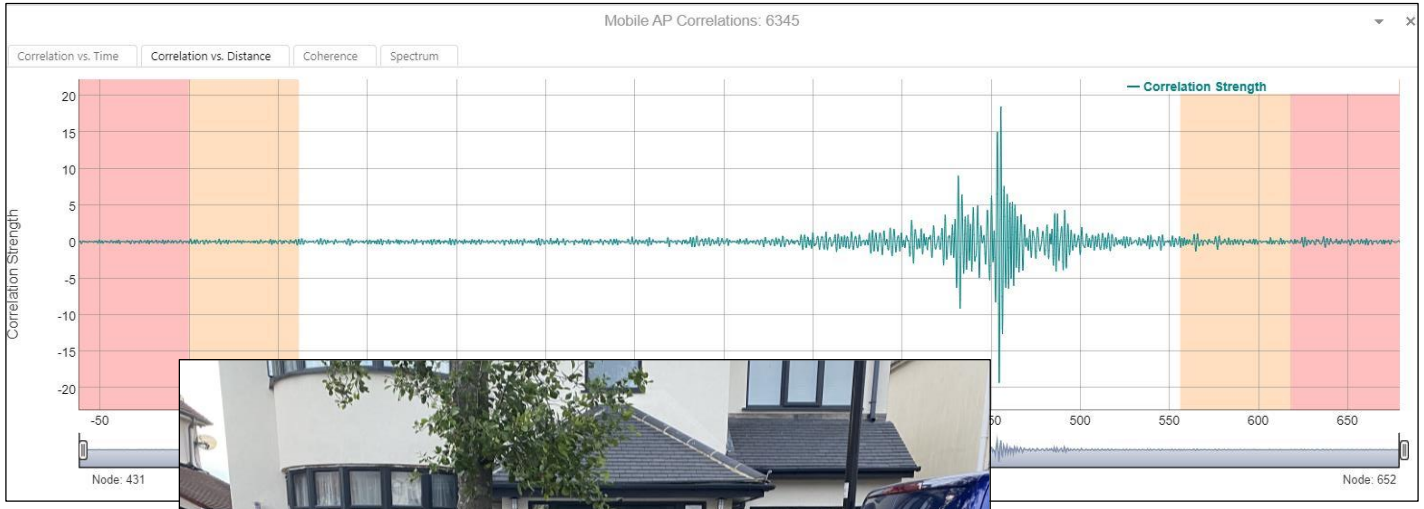
Night work to follow up POIs from noise loggers is an efficient method for detecting leaks in Town Centres.



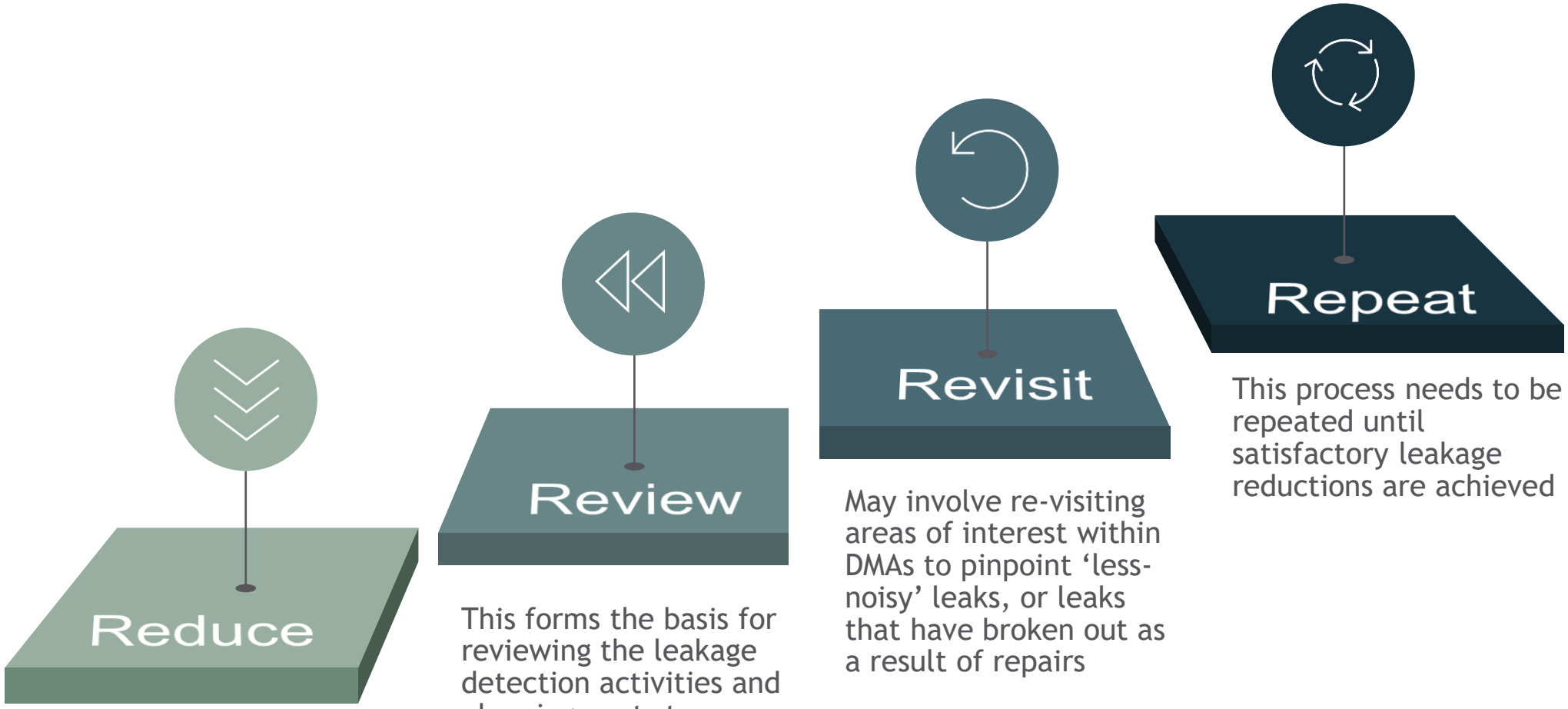


Leakage Detection Investigations

To locate leaks on larger diameter pipes, or longer sections of main with less fitting's, or plastic sections of pipe, high specification correlators, or loggers with hydrophones are utilised to carry out correlation surveys.



Investigation Reviews



All information from the DMA sectorisation, leakage surveys, repairs, and subsequent reductions is compiled into a smart investigation pack

This forms the basis for reviewing the leakage detection activities and planning next steps

May involve re-visiting areas of interest within DMAs to pinpoint ‘less-noisy’ leaks, or leaks that have broken out as a result of repairs

This process needs to be repeated until satisfactory leakage reductions are achieved

Summary

Successful DMA leakage reduction projects require an end-to-end management approach to sustainably reduce leakage and maintain lower leakage levels.

Selection

Careful selection of target areas to achieve high leakage reduction delivery

Analysis

Subdivision, permanent monitoring and quick repairs once area is targeted

Feedback

Coherent and systematic feedback of activities and findings ensures efficiency

Skills

Building skills and expertise to leverage the latest innovations in technology

Thank You