Horizon Water Infrastructure

Future Water Association
Informing, Innovating, Influencing

HUBBELL

SEVERN TRENT

Leakage and Metering

07.07.26 – 08.07.26

Introduction to Future Water Association

Paul Horton, CEO

Get more with membership

Future Water Association

Inform

Access to industry events & expert insights

Influence

Shape water policies

Innovate

Collaborate in specialist working groups

We're a community of members bringing the water sector together.

5 reasons to join

Future Water Association

Access to 50+ events

Network with decision-makers from across our members and the wider sector.

Strengthen your positon in water

Establish your brand as a key player in the UK water landscape.

Innovate

Use our Water Dragons competition to pitch your work to experts so they can take it further.

Meet with water companies

Get in front of the right people with our free in-person meetings.

Collaborate for change

Join our transformative working groups

"An incredible community to join, with informative sessions, strong networking, and a team that truly listens to the needs of the industry."

- Future Water Member


Upcoming Events
Future Water Association
www.futurewaterassociation.com/events
Future Water Awards & 40th Anniversary
24TH 09 2026
Thu 24th September
One Great George St, London
Members meet with
YorkshireWater
Thu 8th October
Head Office, Bradford
OT and Cyber Resilience Forum
Tues 20th October
Horiba Mira, Nuneaton
Networks November
Year in Water Review
& drinks reception
Tues 3rd November
Sec Newgate, London

Future Water Association

Future Water Report Card

Mains Leakage - Current Grade C

- Strong regulatory pressure from **PR24 – strict requirements of the AMP8 Totex Mandate, utilities are working to hit a mandatory 17% short-term leakage cut**
- **AMP8** is accelerating leakage reduction - backed by over £100 billion in committed private investment.
- Utilities are investing heavily in predictive technologies
- Focus has shifted from reactive repairs to proactive asset management.
- Transition toward structural resilience has become critical for combatting "weather whiplash”

Future Water Association

Future Water Report Card

Customer Side Leakage - Current Grade D

- Over 10 million smart meters are being deployed at pace.
- However, value is constrained by poor use of meter data:
    - 15-minute telemetry is largely under utilised.
    - 54% of leaders lack confidence in their data.
    - Up to 70% of collected data is unused for decision making.
- Without trusted analytics, customer leaks remain difficult to detect.

Future Water Association

Future Water Report Card

What Needs to Change to Improve the Grades...

- Effective data governance, not just technology deployment.

- Secure and resilient OT cyber security as digital assets expand.

- Trusted data that supports automated, investment-grade maintenance decisions.

- Compliance with increasing regulatory scrutiny and executive accountability.

Future Water Association

Introduction from Future Water's Leakage Group Chair

James Hargrave, Anglian Water

UPSTREAM METERING UNDERSTANDING ERROR

How does error affect upstream reporting?

INSPIRATIONAL QUOTES

“No measurement is ever absolute”

MacGillivray A. Measurement Uncertainty – Lecture 12: Principles and Practices of Flow Measurement, NEL, 2008

“All Instruments are Liars”

Plint M.A. and Martyr A.J. Engine Testing: Theory and Practice, Butterworth Heineman, Oxford 1994

WHAT IS INACCURACY?

In the Olympic 100m event what is the margin of error allowed in timekeeping?

1,000th of a second

How accurate is a car speedometer?

3-10% higher than the actual vehicle speed

How accurate is GPS on an iPhone?

5-10 meters (16-33 feet)

- **All water meters have errors and most will be larger than the one's here.**
- **This is due to cost and investment into improving accuracy.**
- **We need to understand how wide it can vary and the impact.**

METER ERROR DEFINITIONS

- **What do we mean by over/under recording?**

- If an Inlet is recording 100 and is now over recording by 2% what is the real number?
  - *Formula – True Reading = Displayed reading / (1 + error)*

  100 / (1+0.02) = 98.04

- If an Outlet meter is recording 50 but we know the true reading should be 51 what is the error percentage?
  - *Formula – True Reading – Meter Reading = 51-50 = 1*
  - *Percentage Error = Error/True Reading *100*

  *1/51 * 100 = 1.96% under recording*

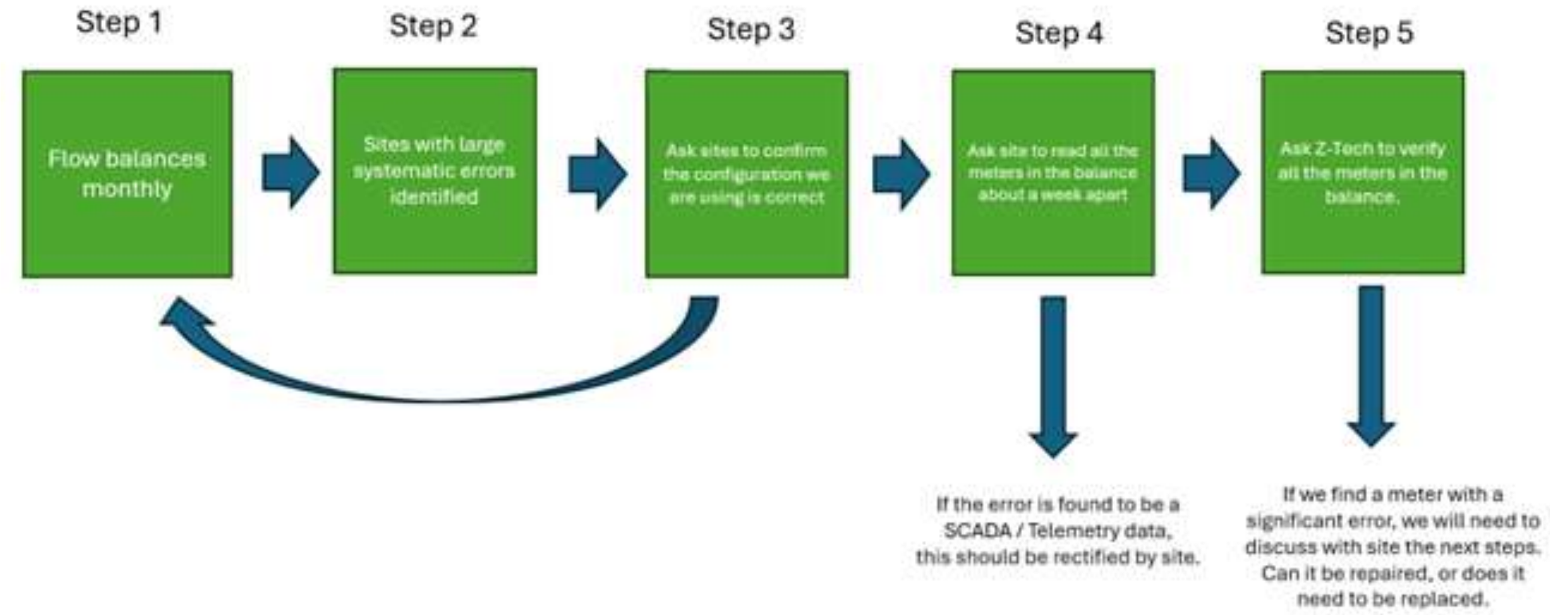
WHAT DOES THIS MEAN?

- The more uncertainty in our meter accuracy the potential for our upstream figures to be inaccurate increases.
- A 1% difference in uncertainty for all our inlet meters could mean a change of approx. **20mld**.
- Meter error is based on age, model, size etc which is why we need surveys as it could significantly impact reporting figures.
- The example below shows an example of a large water company with a number of AZ's and meters. Their reported figure is 187.90 but with just a 2% change in error could see these values alter from 146.64 to 229.16 a change of approx. 80mld.

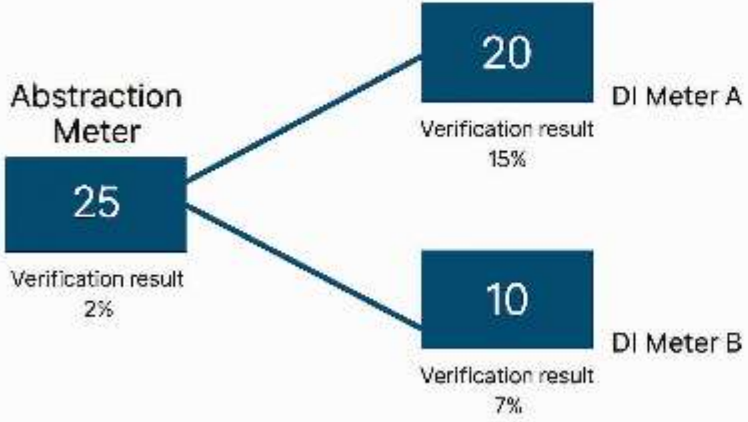
	Inlet												
DMA	-10%	-5%	-4%	-3%	-2%	-1%	0%	1%	2%	3%	4%	5%	10%
10%	-224.72	-116.87	-95.30	-73.73	-52.16	-30.59	-9.02	12.55	34.12	55.69	77.26	98.84	206.69
5%	-126.27	-18.41	3.16	24.73	46.30	67.87	89.44	111.01	132.58	154.15	175.72	197.29	305.15
4%	-106.57	1.28	22.85	44.42	65.99	87.56	109.13	130.70	152.27	173.84	195.42	216.99	324.84
3%	-86.88	20.97	42.54	64.11	85.68	107.25	128.82	150.39	171.97	193.54	215.11	236.68	344.53
2%	-67.19	40.66	62.23	83.80	105.37	126.94	148.52	170.09	191.66	213.23	234.80	256.37	364.22
1%	-47.50	60.35	81.92	103.50	125.07	146.64	168.21	189.78	211.35	232.92	254.49	276.06	383.91
0%	-27.81	80.05	101.62	123.19	144.76	166.33	187.90	209.47	231.04	252.61	274.18	295.75	403.61
-1%	-8.12	99.74	121.31	142.88	164.45	186.02	207.59	229.16	250.73	272.30	293.87	315.44	423.30
-2%	11.58	119.43	141.00	162.57	184.14	205.71	227.28	248.85	270.42	291.99	313.57	335.14	442.99
-3%	31.27	139.12	160.69	182.26	203.83	225.40	246.97	268.54	290.12	311.69	333.26	354.83	462.68
-4%	50.96	158.81	180.38	201.95	223.52	245.10	266.67	288.24	309.81	331.38	352.95	374.52	482.37
-5%	70.65	178.50	200.07	221.65	243.22	264.79	286.36	307.93	329.50	351.07	372.64	394.21	502.06
-10%	169.11	276.96	298.53	320.10	341.67	363.25	384.82	406.39	427.96	449.53	471.10	492.67	600.52

HOW CAN WE REDUCE ERROR?

Have a verification programme that identifies meters with high errors.

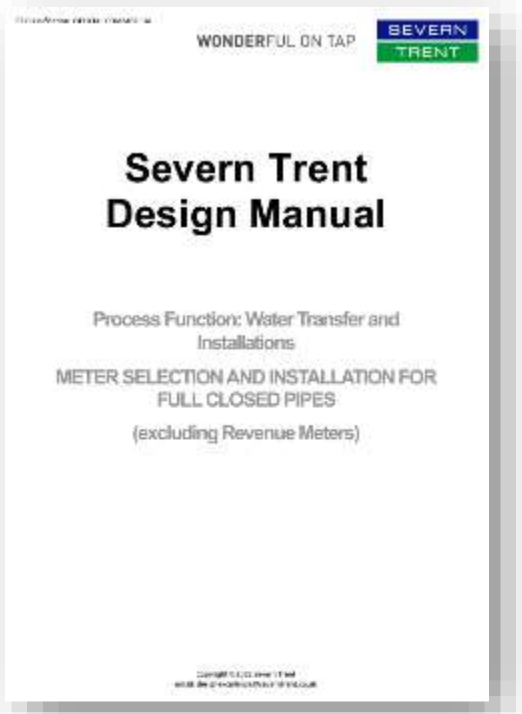


STEP 5



	Permanent Meter (ML/d)	Verification Meter (ML/d)	% Difference	Commentary
Abstraction Meter	25	25.5	2%	Good match between abstraction meter and verification meter
DI Meter A	20	17	-15%	Difference between DI Meter and verification meter is larger than we would expect
DI Meter B	10	10.7	7%	A 7% difference is plausible especially if the verification took place in non-ideal conditions, used few paths and / or signal strength was poor.
Difference (DI - Abs)	5	2.2		

HAVE GOOD INSTALL STANDARDS



WONDERFUL ON TAP

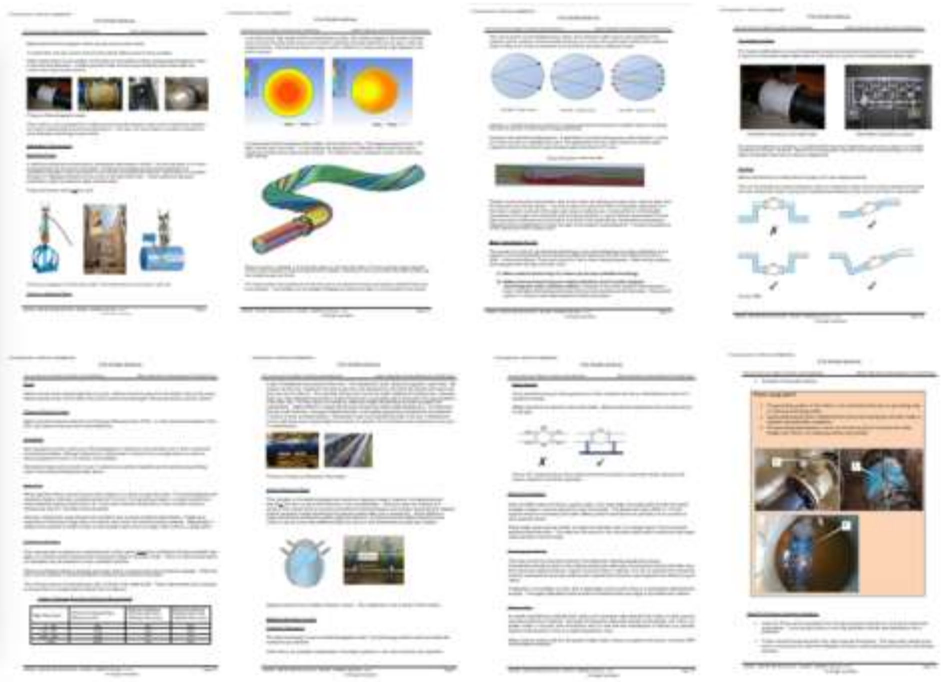
SEVERN TRENT

Severn Trent Design Manual

Process Function: Water Transfer and Installations

METER SELECTION AND INSTALLATION FOR FULL CLOSED PIPES

(excluding Revenue Meters)



WHAT RECENT CLAMP-ON TESTING HAS TAUGHT US

Mikal Willmott (Severn Trent)

7th July 2026

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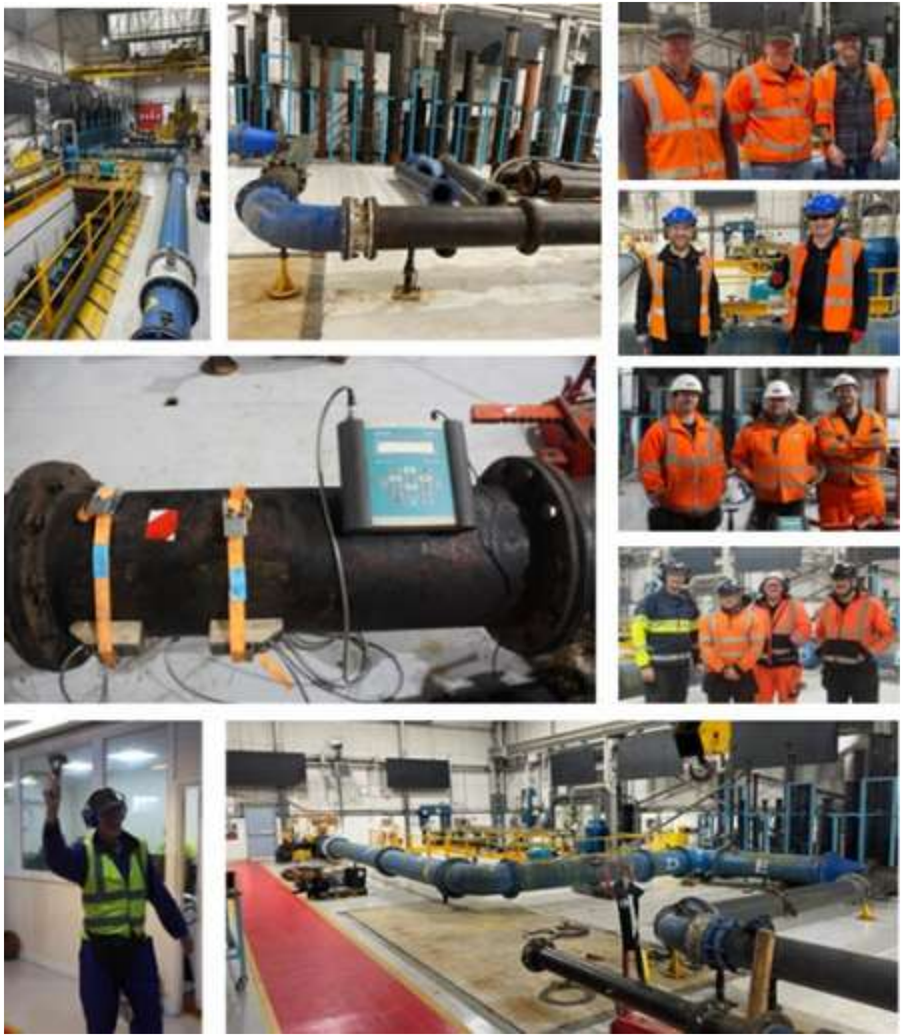
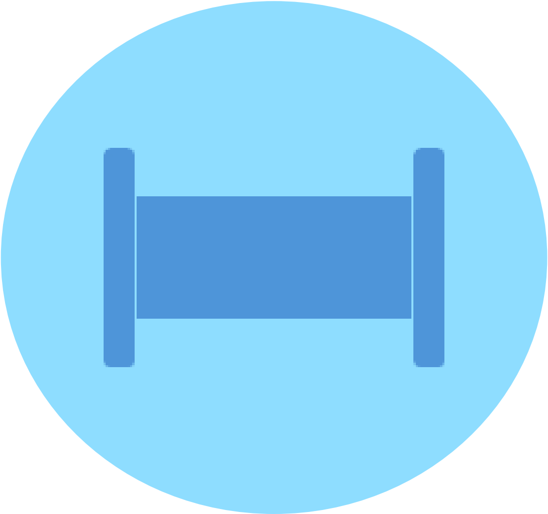
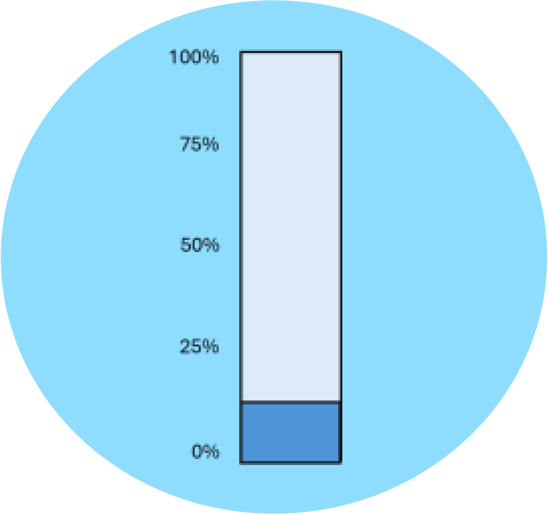


TRUNK MAINS IN THE UK

TRUNK MAINS IN THE UK



The UK has around 60,000 km of Transmission Mains.

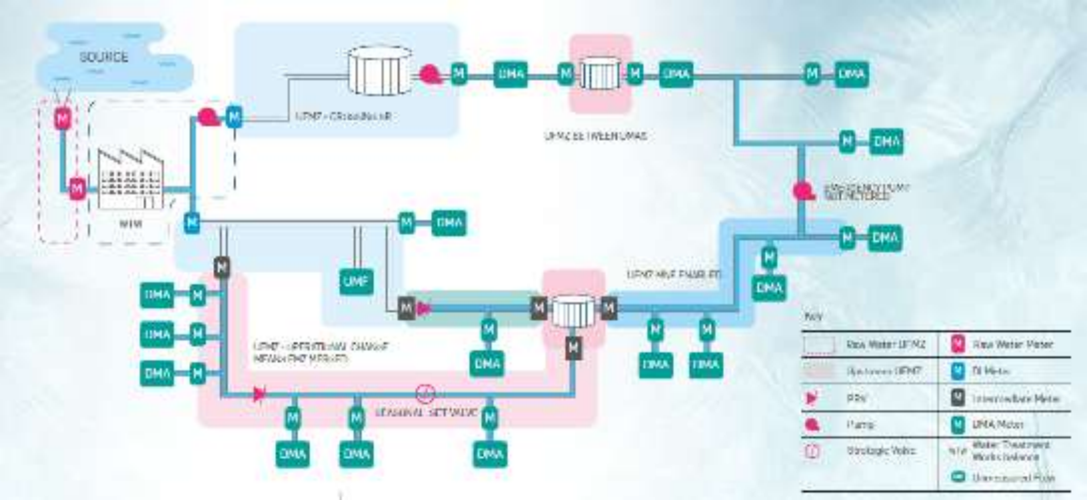


This is around 13% of mains.

AN END OF BURST AND BACKGROUND ESTIMATES IN THE UK

"The default approach to monitoring trunk mains leakage should be a flow balance approach…Reliance on the BABE approach for reporting trunk main leakage should be phased out by the [utility]"

(Ofwat, PR24 Common Performance Commitments)

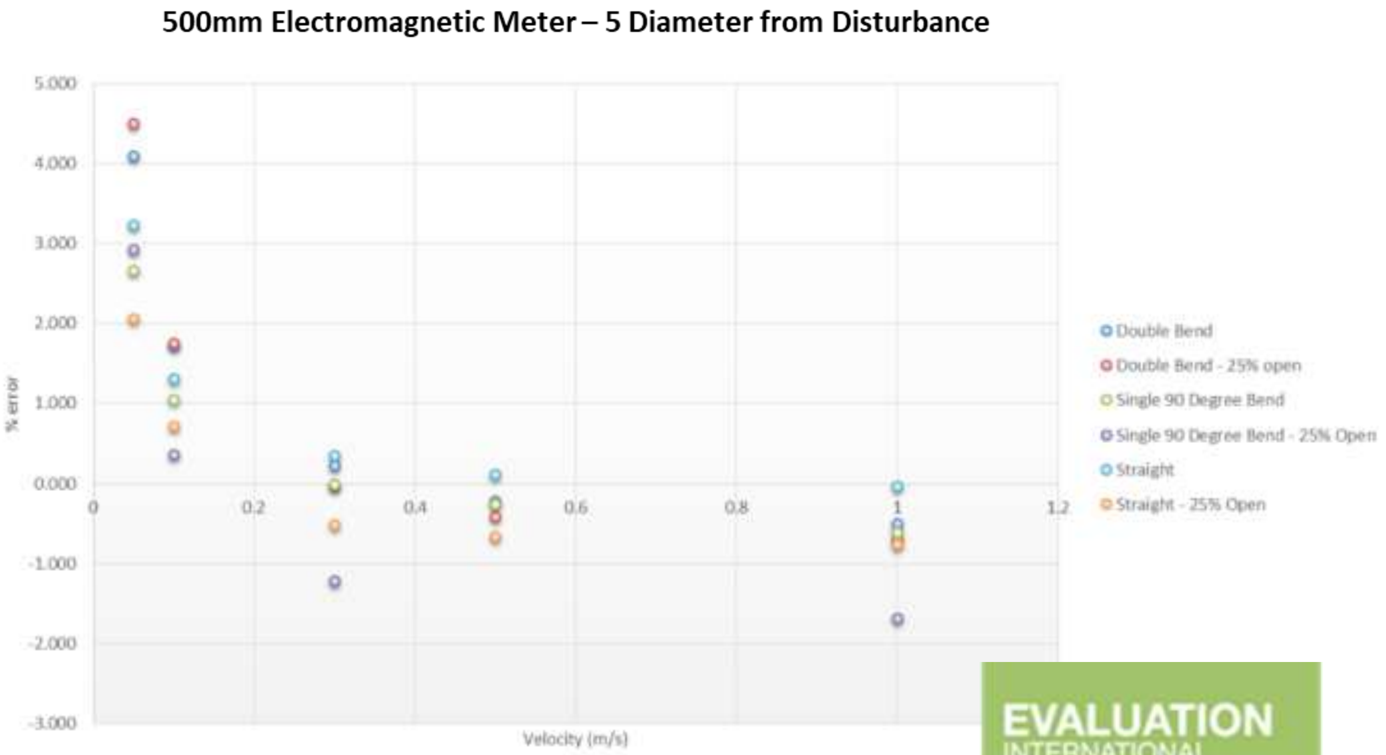


THE POPULARITY OF THE ELECTROMAGNETIC METER IN THE UK

97% of Distribution Input Meters in the UK are Electromagnetic Meters

Godley A., Karachountris S., Eglitis J., Improving the Accuracy of Large Flow Meters – Part 1 State of the Knowledge Review, WRc, 2017

ELECTROMAGNETIC METERS ARE HIGHLY ACCURATE



EVALUATION INTERNATIONAL

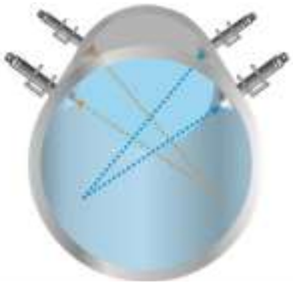
THE CHALLENGE OF INSTALLING ELECTROMAGNETIC METERS IN THE UK

- **Regulatory Standards** - Water utilities receive financial penalties if water is not available for more than 3 hours

- **Cost** – Activities like diversions and contingency planning are expensive.

- **Risk** – Long unused valves and fittings increases the likelihood of failure.

RETROFIT METERING ON TRANSMISSION MAINS IS BECOMING MORE POPULAR



Picture & Graphic Sources: Flexim, McCrometer & Nivus

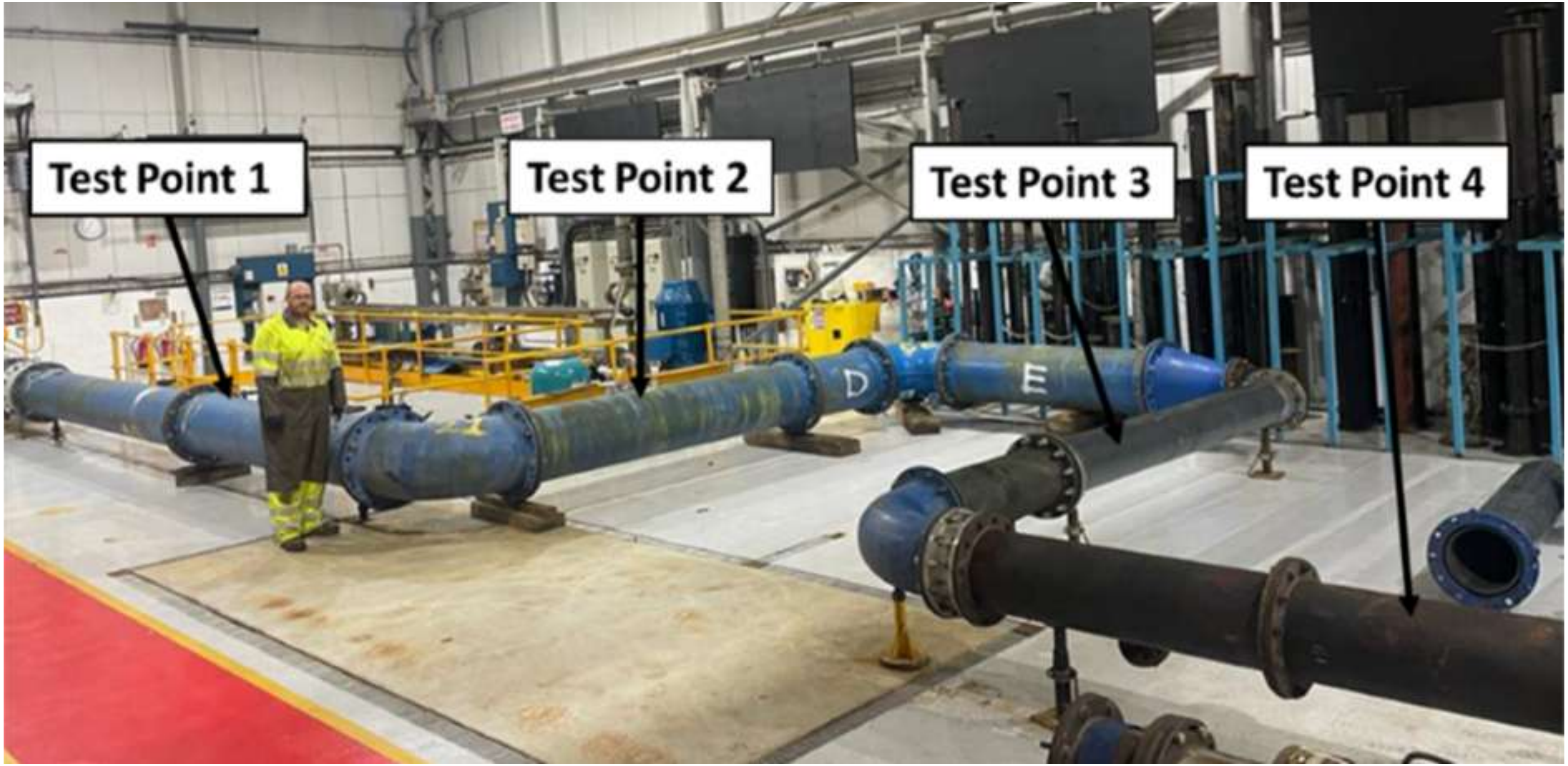
HOW ACCURATE CAN CLAMP-ONS BE & WHAT LESSONS CAN WE LEARN?

8 Water Utilities, 1 Regulator,
2 Consultants, 4 Research Partners

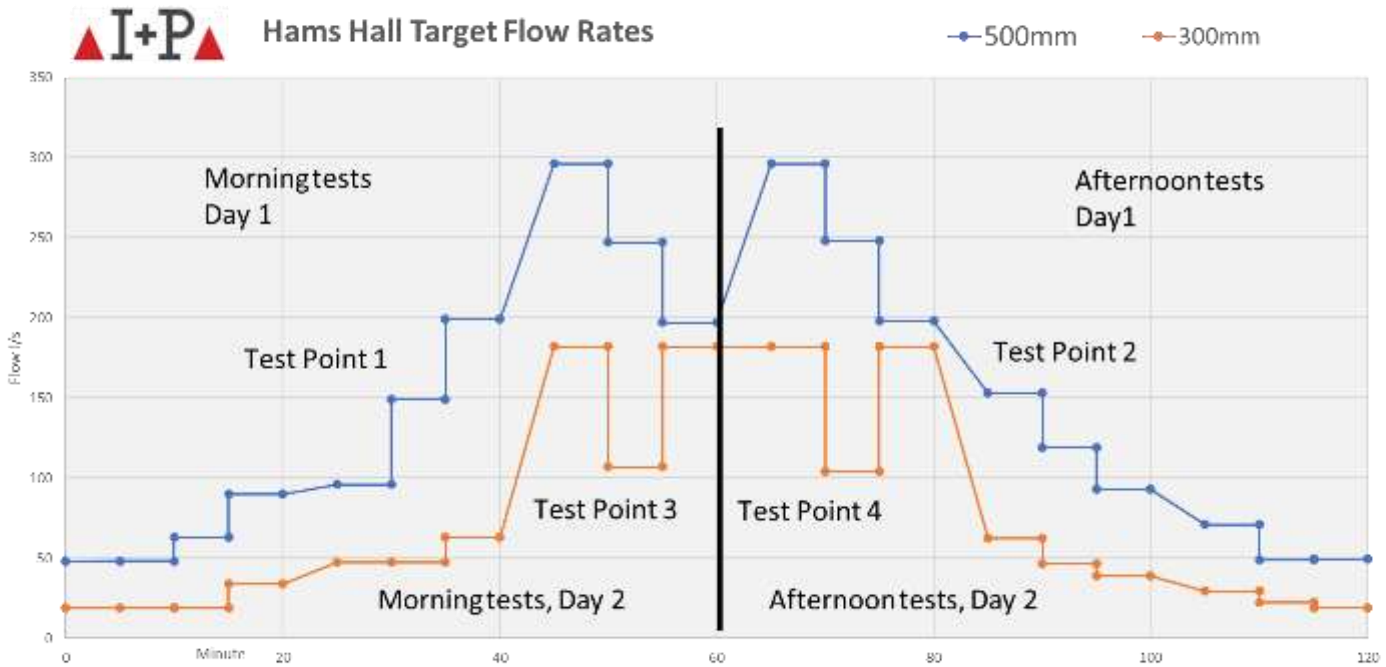
Dr Alun Thomas

Dave Morris

TEST POINTS



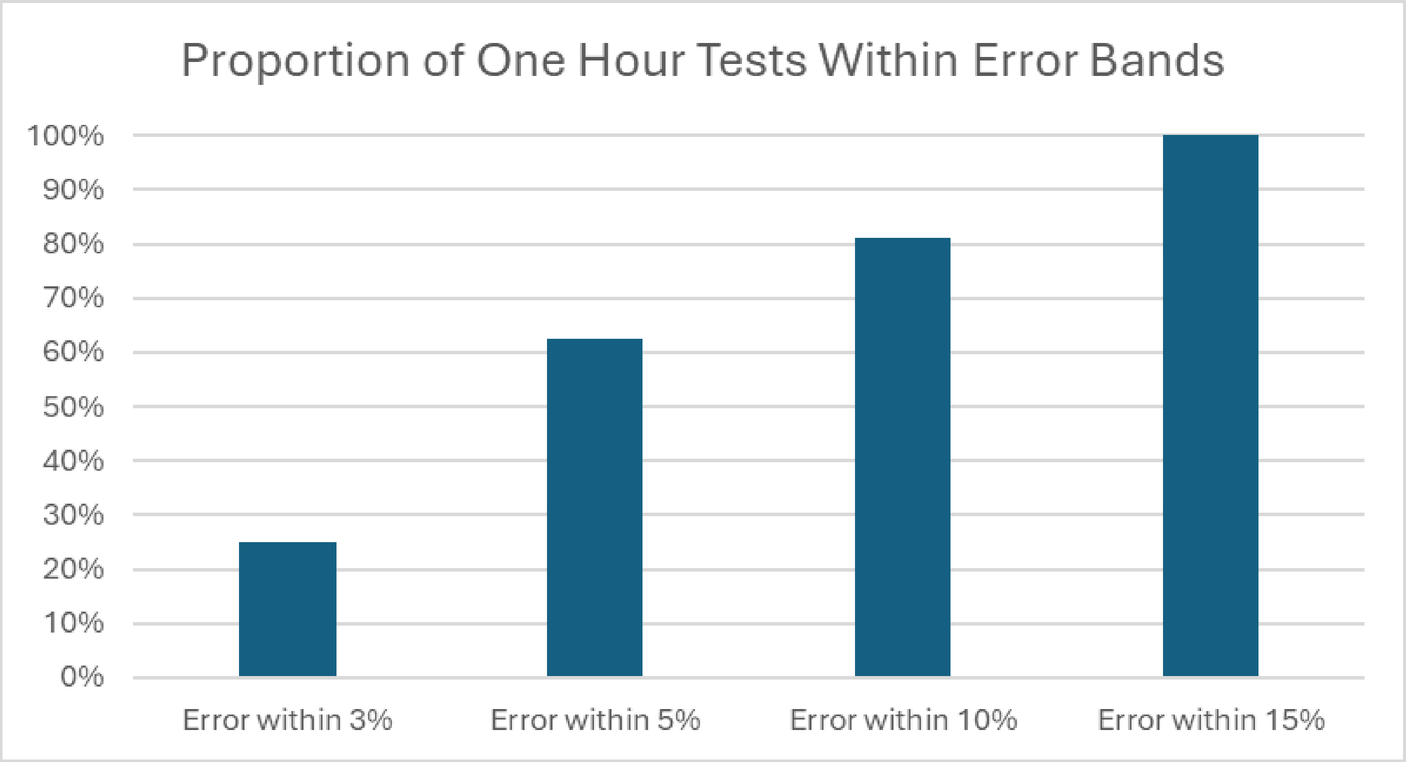
TESTING REGIME



TEST RESULT

Test Point	Average Absolute Error	Lowest Absolute Error	Highest Absolute Error
1	2.4 %	0.8 %	4.2 %
2	8.3 %	3.2 %	13.0 %
3	2.8 %	0.1 %	5.9 %
4	6.1 %	3.5 %	11.0 %

ONLY A QUARTER OF TESTS HAD ERRORS OF LESS THAN 3%

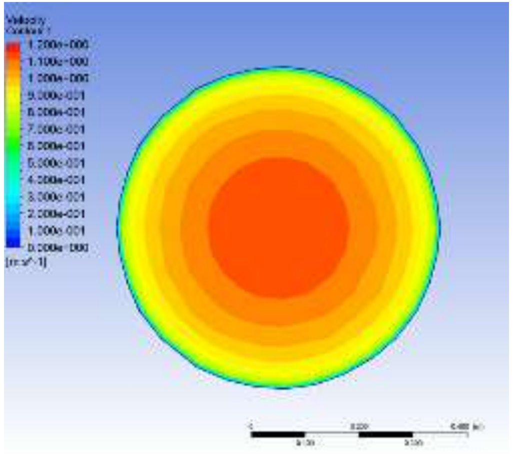


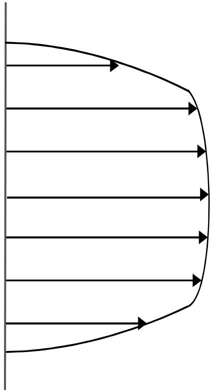
FLUID DYNAMICS

- **Fluid Dynamics** play a key role in measurement accuracy
  - Hence the difference between Test Point 1 & Test Point 2

BASIC HYDRAULICS

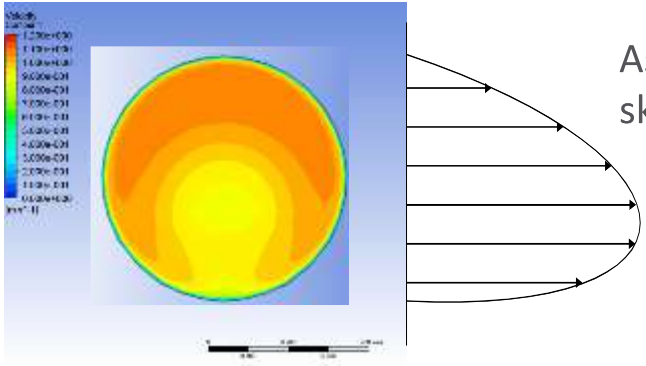
Straight Run



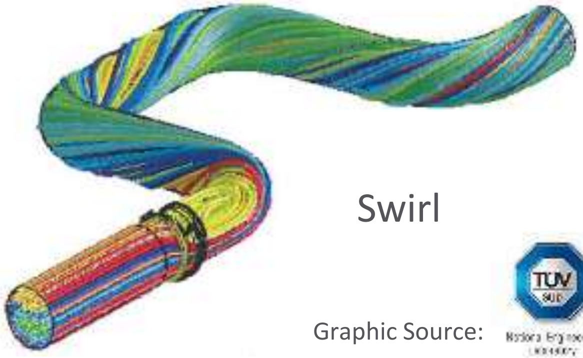


Fully developed,
axisymmetric profile

After a Bend



Asymmetric,
skewed profile



Swirl

Graphic Source:

FLUID DYNAMICS

- **Fluid Dynamics** play a key role in measurement accuracy
  - Hence the difference between Test Point 1 & Test Point 2
  - The coning down from 500mm to 300mm, seems to have “improved” the fluid dynamics

VELOCITY

- Increasing **Velocity**, increases accuracy

Groupings	Average Abs. Error (%)
Low (0.3-0.4m/sec)	6.42%
Medium (0.6-0.9m/sec)	5.16%
High (1.2-2.5m/sec)	4.58%

CORRECTION FACTORS

- **Correction Factors** improve accuracy
  - Two suppliers used the exact same equipment, only one used correction factors.
  - The supplier that used correction factors got more accurate results.

	Absolute Error (%)	
Test Point	Supplier who did **NOT** use correction factors	Supplier who did use correction factors
Test Point 1	2.52%	3.54%
Test Point 2	14.63%	10.70%
Test Point 3	6.02%	1.59%
Test Point 4	11.41%	6.20%

ADDITIONAL PATHS

- **Additional Paths** de-risks the chance of significant error

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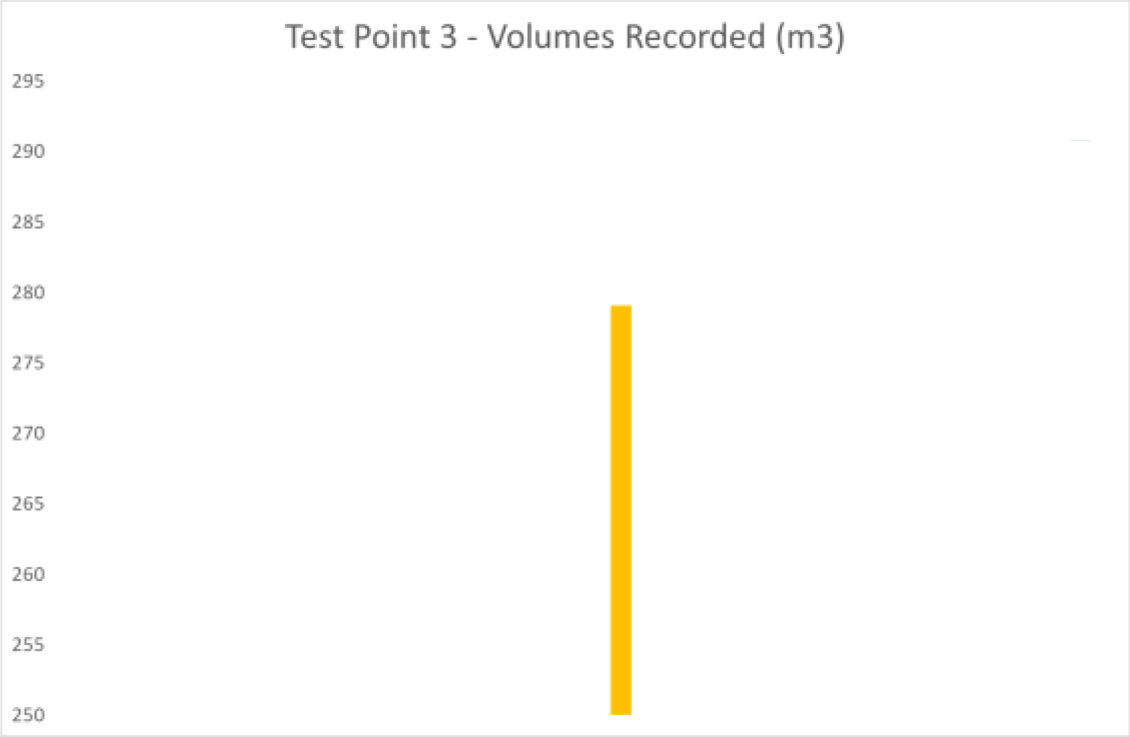
- **Additional Paths** de-risks the chance of significant error

Actual Flow: 279m3

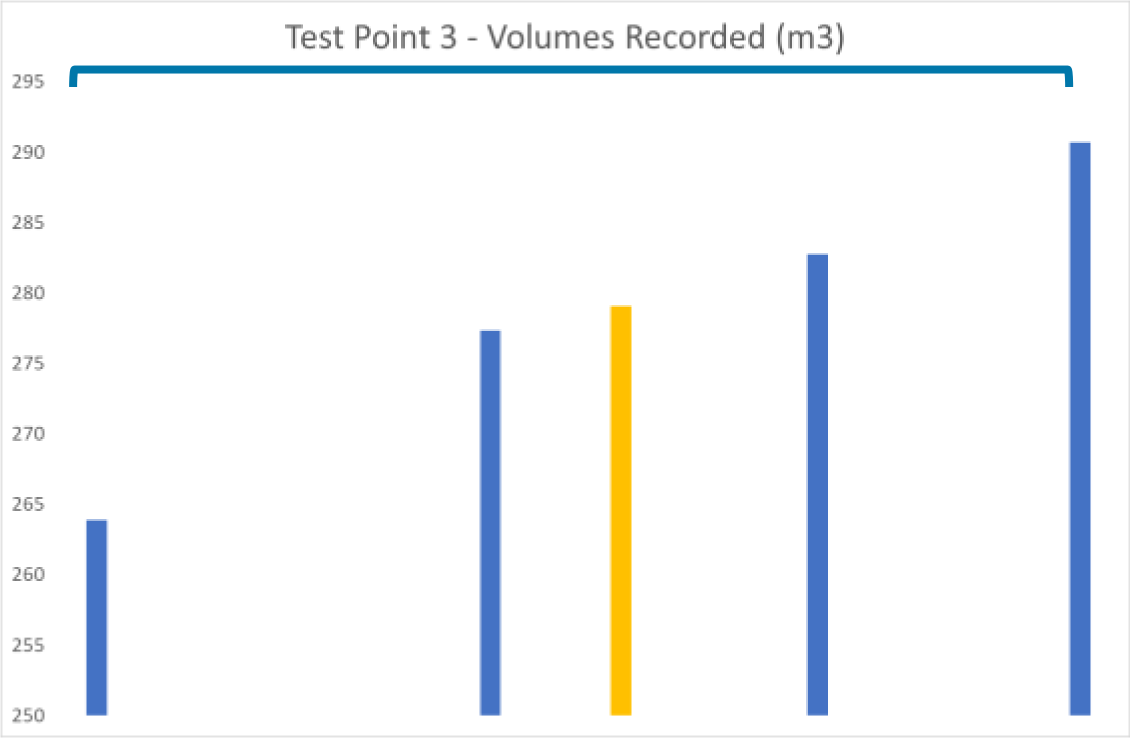


ADDITIONAL PATHS

- **Additional Paths** de-risks the chance of significant error

Actual Flow: 279m3

Path A: 264m3
Path B: 277m3
Path C: 283m3
Path D: 291m3

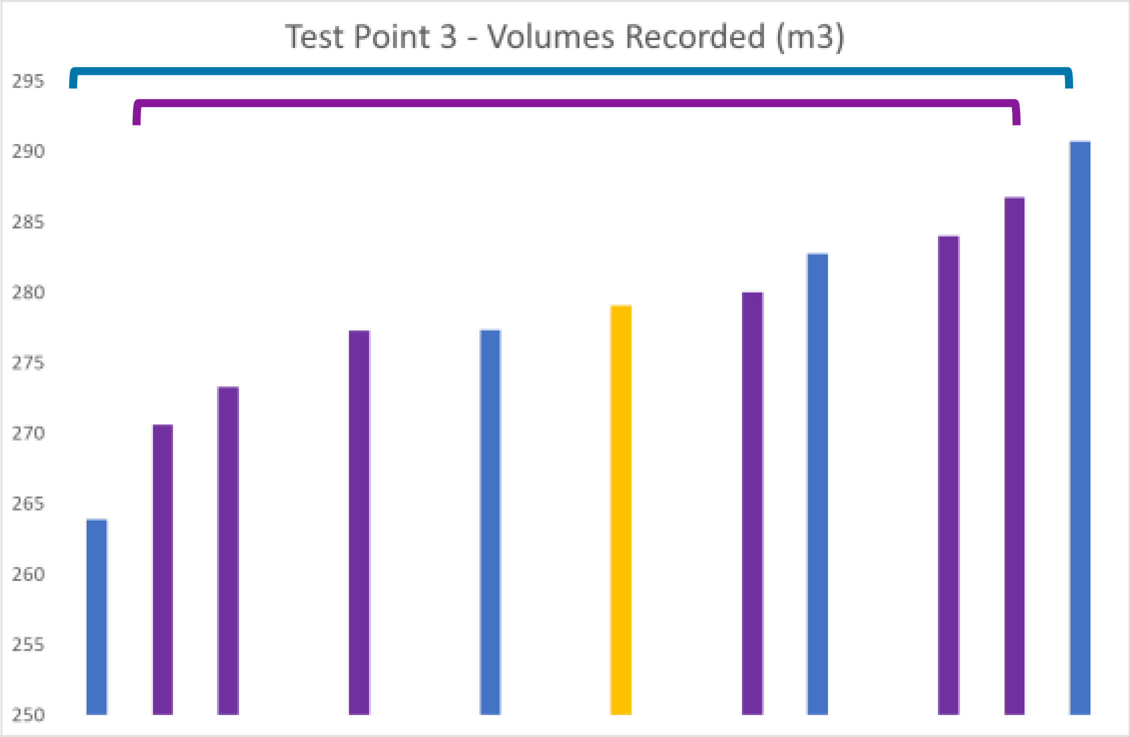


ADDITIONAL PATHS

- **Additional Paths** de-risks the chance of significant error

Actual Flow: 279m3

Path A&B: 271m3
Path A&C: 274m3
Path A&D: 278m3
Path B&C: 280m3
Path B&D: 284m3
Path C&D: 287m3

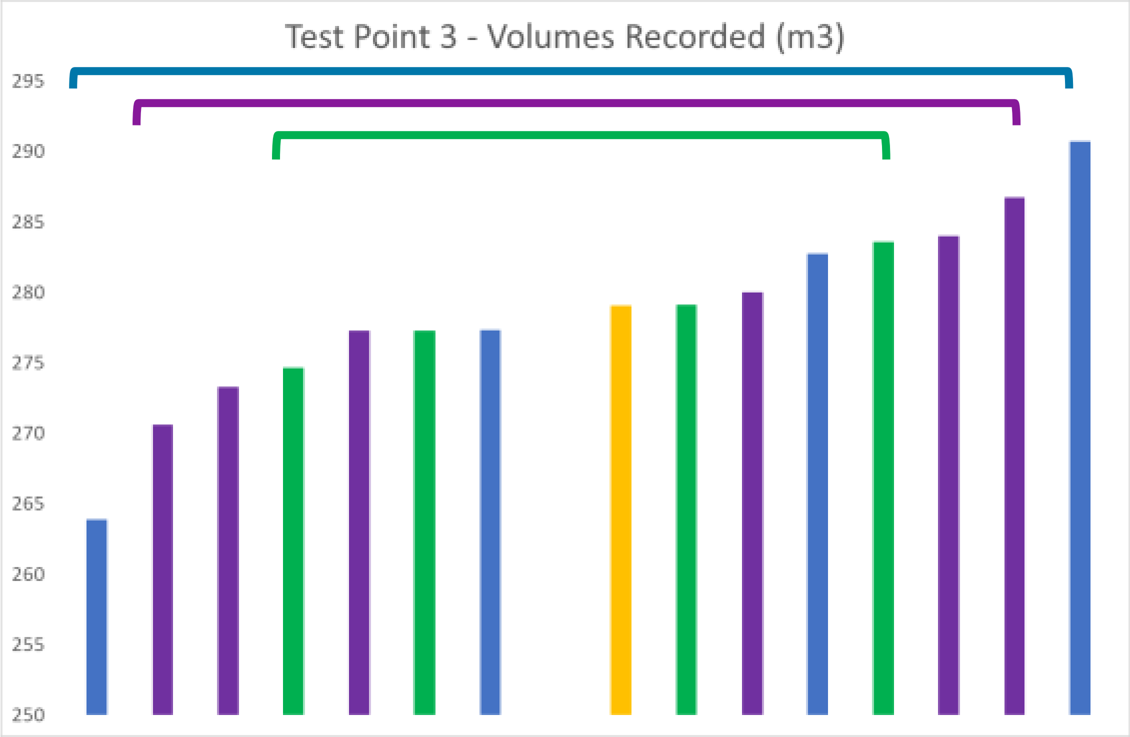


ADDITIONAL PATHS

- **Additional Paths** de-risks the chance of significant error

Actual Flow: 279m3

Path A&B&C: 275m3
Path A&B&D: 277m3
Path A&C&D: 279m3
Path B&C&D: 284m3



ADDITIONAL PATHS

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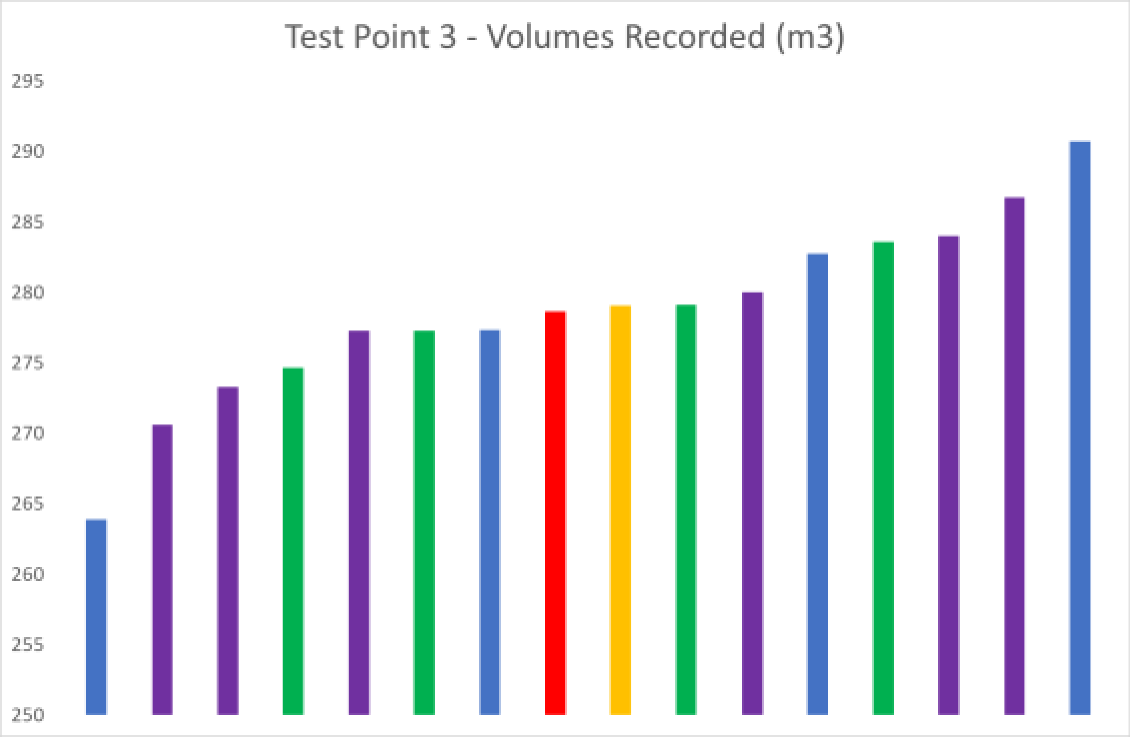
Actual Flow: 279m3

Path A&B&C&D: 279m3



LARGEST ERRORS

Test Point	1 -Path	2 - Path	3 - Path	4 - Path
3	5.46%	3.22%	1.62%	0.15%

LARGEST ERRORS

Test Point	1 -Path	2 - Path	3 - Path	4 - Path
1	1.92%	1.67%	1.40%	1.05%
2	4.59%	4.21%	3.65%	3.25%
3	5.46%	3.22%	1.62%	0.15%
4	10.29%	6.43%	4.75%	3.54%

TAKE AWAYS

- Find the best hydraulic location possible
  - Get as far downstream from a disturbance as possible
- Increase Velocity
  - Installing on two smaller mains rather than one large main, is likely to bring more accurate results
- Use Correction Factors
  - Manufacturers need to explain these better
- Maximise The Number of Paths

WHAT IS NEXT?

- **Testing on 200mm Main, WRc Flow rig**
  - What is the impact of pipe conditions on performance?
  - Are Clamp-on meters on smaller mains more accurate than on larger mains?

- **Testing on 900mm Jeff Farrow Main, Kempton**
  - What is the impact of pipe conditions on performance?
  - What is the accuracy possible on very large mains?
  - What is the impact of additional paths on clamp-on accuracy?

WITH SPECIAL THANKS TO:

DR ALUN THOMAS (I&P SERVICES)

DAVE MORRIS (I&P SERVICES)

ANDY GODLEY (WRC)

Report summary can be found on Research Gate

Extended Report and Report Summary can be found on the Spring Platform (subscription required)

wrc
creating a better tomorrow

Insertion Flowmeters – Time to Take Another Look?

Andy Godley

Future Water Leakage and Metering Conference

July 2026

Introduction

Contents

- Set the scene
- Trunk mains metering
- Alternative solutions
- Findings from testing insertion probes
- Leakage reporting
- Conclusions

WRc

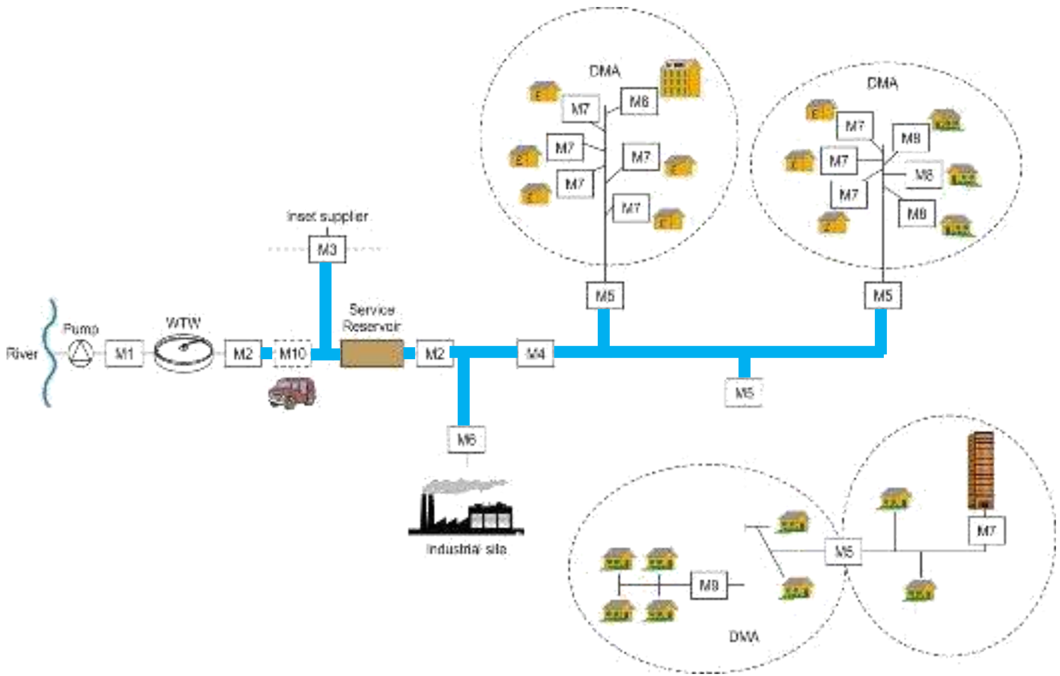
- Research, technology and testing
- Based in Swindon, UK
- Independent
- Work for water utilities, suppliers and regulators
- Various flow test facilities

Me

- Head of Metering and Testing
- >35 years experience flow and metering technology
- Member various BS, EN, ISO standards committees
- Sit on industry steering groups concerned with flow and metering

Setting the scene

- UK >60,000 km trunk mains
- Good DMA coverage
- Been successful in driving down leakage in DMAs
- Historically less attention paid to trunk mains
- Interest increased in last 10 years
- *2020 UKWIR Best Practice for Upstream Flow Monitoring Results (Cartwright K, Brammer M et al)*
- Ofwat keen to see utilities act on this and construct trunk mains balances to reduce losses
- But…
  - …needs good quality data
  - …needs reliable meters
  - …needs more understanding of large meter uncertainty



Trunk mains meters

- One DI (SIV) meter → 10’s DMA meters +… → 1000’s customer meters
- Frequently large
- 70-80% water supplied through meters ≥DN500
- Small errors more significant
- Typically full bore electromagnetic meters
- Generally not built with by-passes
- Often not in ideal locations
  - Poor hydraulics
  - Limited access
- Aging stock
- Cost of installation / replacement £10k’s - £100k’s
- New installation or replacement means shutting off supply
  - Costs of supply diversion
  - Penalties for supply interruptions
- Not enough…
- … or in wrong place

Alternative solutions

Clamp-on ultrasonic meters

- Attach to outside of pipe
- Multipath for better accuracy
- Accurate pipe details essential for good accuracy

Single point insertion meters

- Hot tap boss onto pipe for insertion
- Electromagnetic sensor
- Measures velocity at single point
- Uncertainty driven by measured velocity vs. mean velocity

Multi-point insertion meters

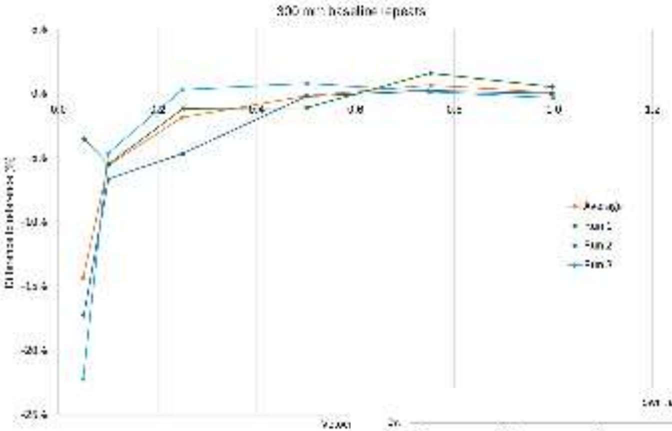
- Hot tap boss onto pipe for insertion
- Multiple electromagnetic sensors along shaft
- Measure at several points across a diameter

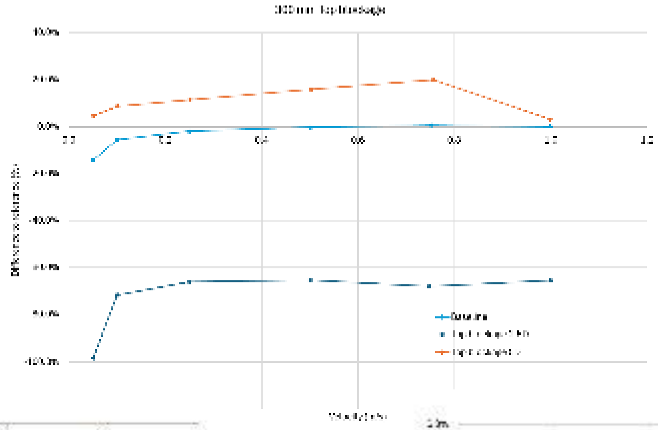
Avoid shutting down line, need to divert supply, no supply interruption etc

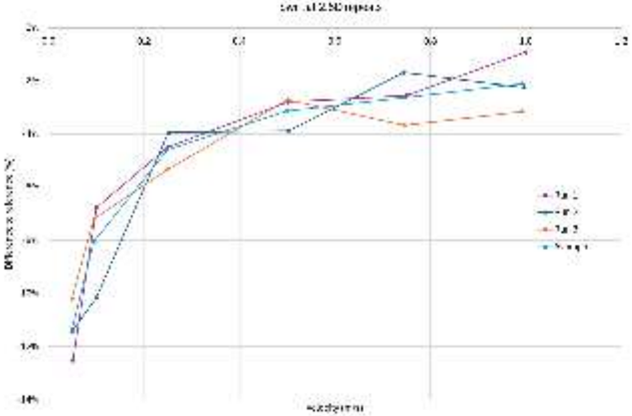
Testing insertion meters

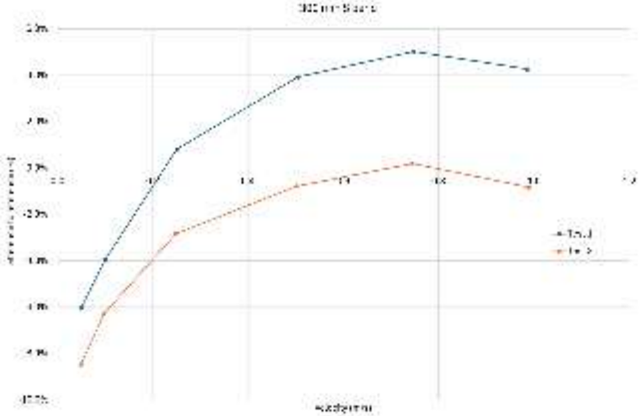
- 300 mm and 500 mm
- 300 mm 0.05 – 1 m/s
- 500 mm 0.05 – 0.5 m/s
- Baseline (>20D u/s straight pipe)
- Half plate horizontal
- Half plate vertical
- Single 90° bend
- ISO 4064 Swirl generator (300 mm)
- Double (S) bend
- Each at 2D and 5D
- 10 minute runs at each flowrate
- 3 repeats at each point
- Referenced against calibrated electromagnetic meters
- Probes chosen as being representative of their type

300 mm Single point

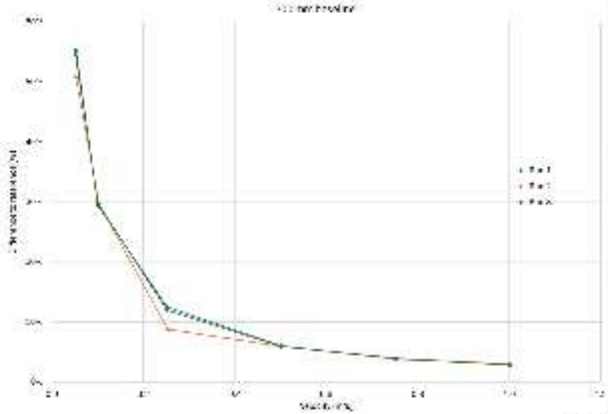


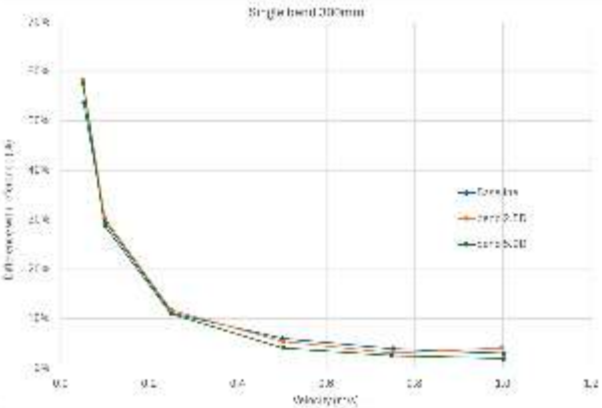


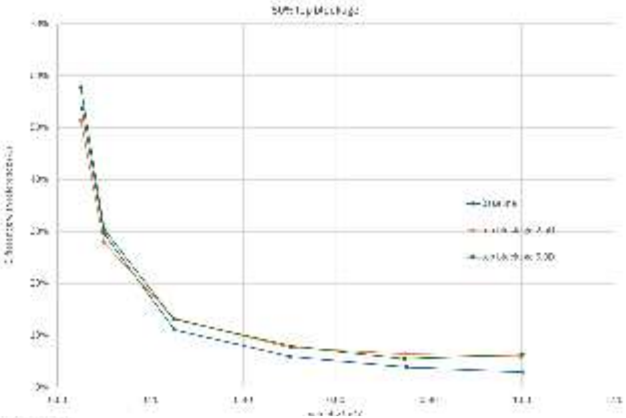


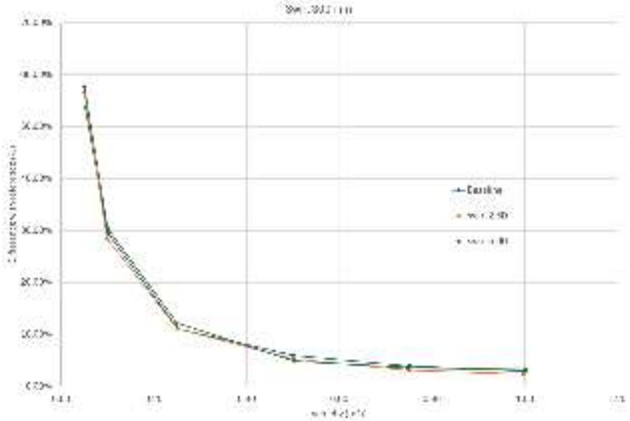


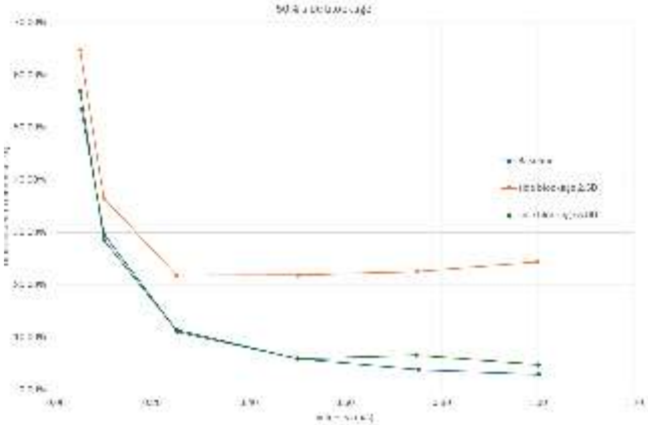
300 mm multi-point





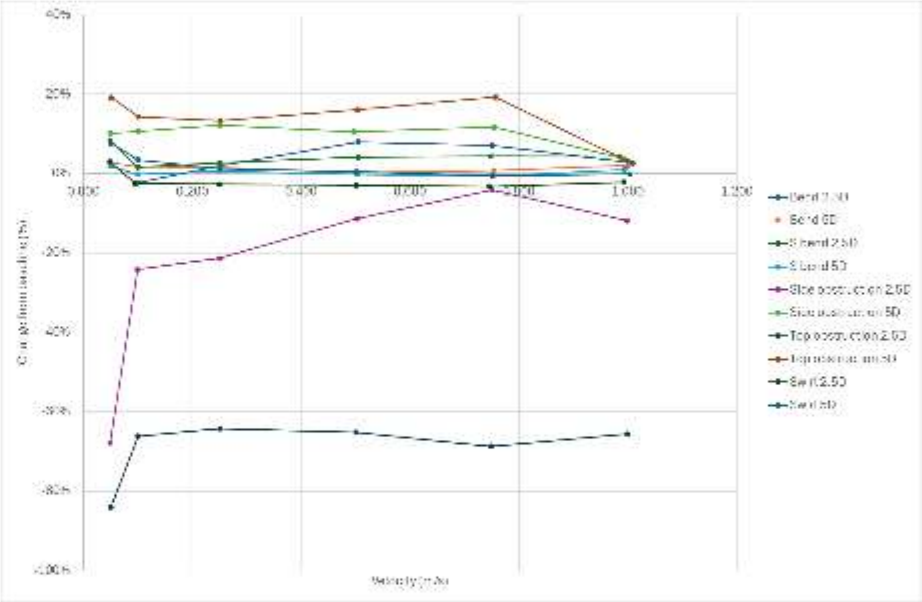




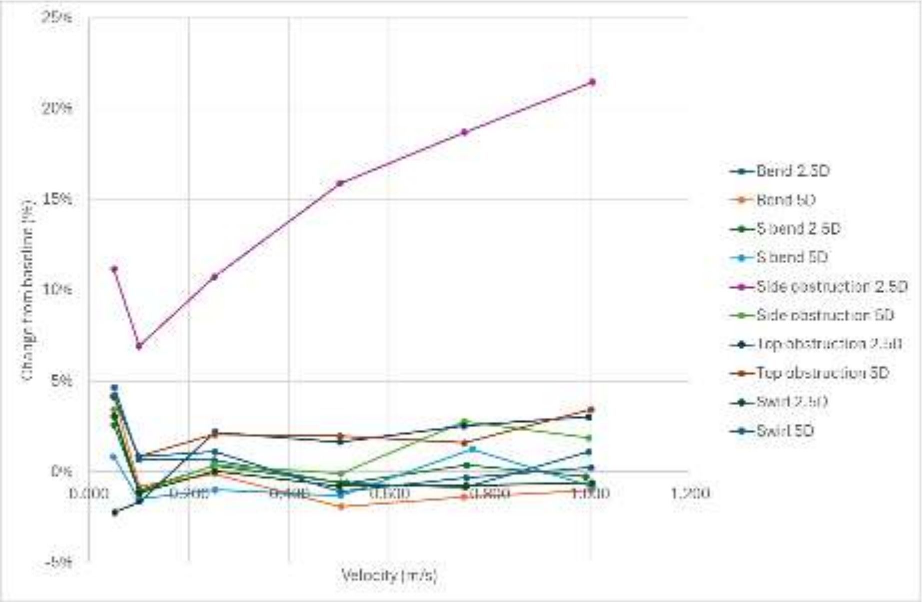


Change from baseline (300 mm)

300 mm single point

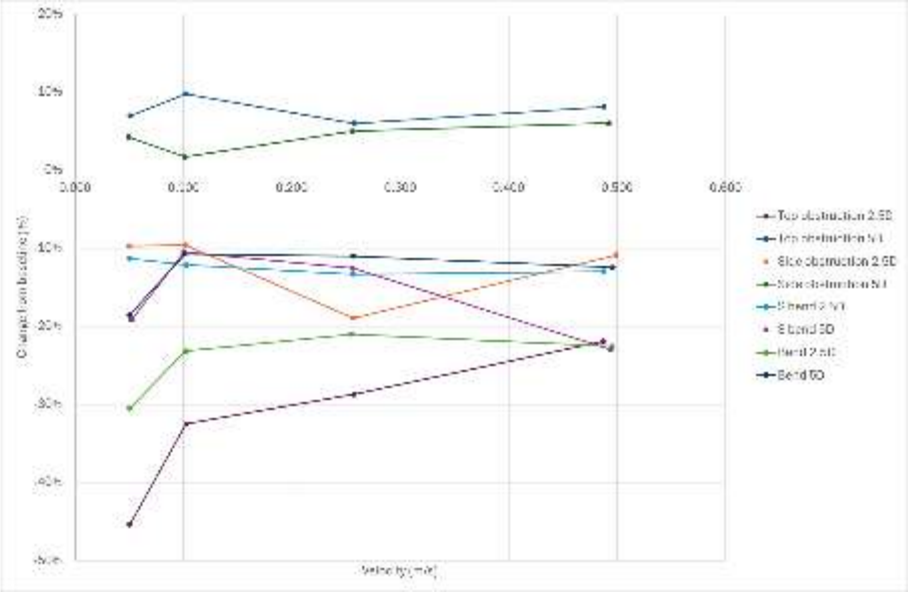


300 mm multi-point

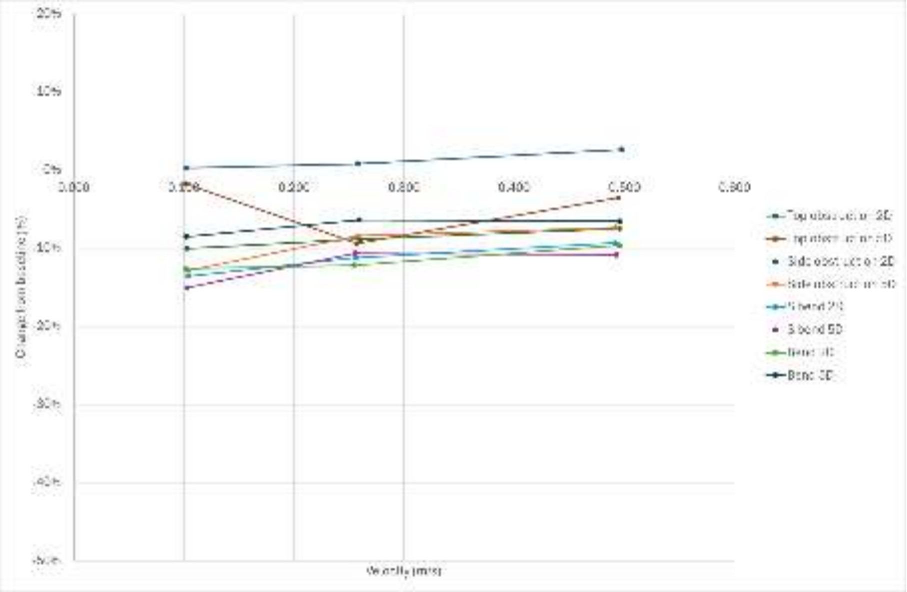


Change from baseline (500 mm)

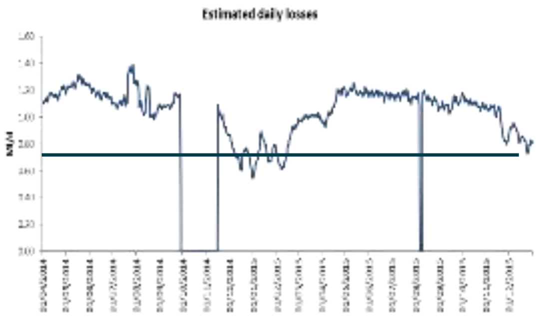
500 mm single point

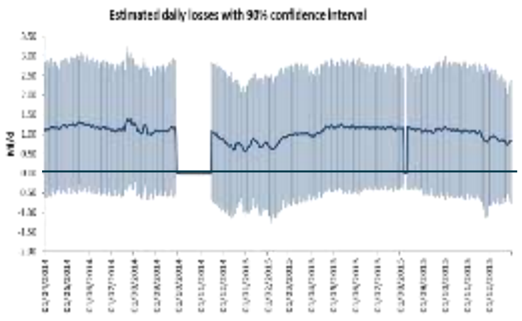


500 mm multi-point



Understanding uncertainty informs decisions





- TM balance example 1
- Raw flow balance (In – out)
- ≈0.7 Ml/d losses?

- TM balance example 1
- Include meter uncertainties
- Meter errors?

- TM balance example 2
- Positive residual including meter uncertainties
- Indicates real loss or unknown connection
- Prioritise for investigation

Updating Leakage Reporting Guidelines

- 5 work packages commissioned by Ofwat
- WRc - WP4 Ensuring Meter Accuracy
- Data from meters underpins leakage and regulatory reporting
- Source to tap
- Meters are critical assets but not always treated as such
- Quality and completeness of asset records highly variable
- Evidence of good practice but not consistent
- Metering stock increasing
- Essential to have confidence in the data produced

Robust flow data		
Selection Technology Sizing Performance	**Installation** Location Hydraulics Electrical Telemetry	**Operation** Checking Maintenance Replacement Asset records

"The industry should develop and adopt a Code of Practice governing metering from source to tap that includes meter selection, installation and on-going management of the meter stock to achieve the required levels of accuracy. This would provide a common framework for managing meters across all water companies and regulated applications."

Conclusions

- Retrofit solutions, clamp-on and insertion meters, can help increase density of meters, and hence data, in upstream network
- Another tool in the box for understanding upstream losses….
- …but need to understand behaviour and uncertainties
- Knowledge of pipe characteristics and dimensions key component of uncertainty
- In testing single and multi-point probes demonstrated good repeatability
- The change in error with the multi-point probe was far smaller than that with the single point probe under non-ideal flow conditions

- Understanding uncertainty in measurements is critical to making effective use of data
- Management of meters at all levels is not consistent in the industry
- We need to get better at all aspects of managing meter stocks to improve data quality

- Should there be a Metering Code of Practice?

Thank you

Andy Godley

Head of Metering and Testing

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TRANSFORMING WASTEWATER INTO A VALUABLE RESOURCE

SMART ECO ENGINEERING LTD.

SMART WATER REUSE FOR A CIRCULAR FUTURE

Protect Environment | Save Water | Build Climate Resilience

SMART ECO ENGINEERING

SMART ECO ENGINEERING LTD. (SEEL)

SEEL

- Smart Eco Engineering Ltd. (SEEL) is a UK based Water Tech Startup Registered in 2023
- SEEL Team members have more than 10 years of R&D experience in Wastewater Treatment & Recycling System
- Our Parent Associated firm, (Green Engineering Consultant) in Pakistan has been closely working with General Electric (Gte), UNDP, UNDP, ADB, Government of Pakistan, national & national Organizations Uca Cola,

  PEPSICO HONDA Pharmasol. Zenith ZAFA Chemicals

  Pure and Gourmet Foods, Serana Hotel, Aruj and Mehmood Group of Textile
- Developer and Manufacturer of Advance Wastewater Treatment & Recycling System duly Integrated with IoT and Digital Monitoring Solution

- ISO 9001, ISO 14001, ISO 45001 Certified
- UK IPO Patent Published Technology/ UK IPO Approved Design
- Member of Future Water Association
- Member of EU Water Market
- Approved (R&D) Vendor of UNDP & World Bank

First of Our Wastewater Treatment & Recycling plant of capacity 500 L/hr is being manufactured for installation at a 40 Bedrooms hotel in Eastbourne, UK

PURPOSE / VISION / MISSION

PURPOSE

To create practical, intelligent, and sustainable water reuse solutions that support environmental protection and long-term water security.

We exist to transform wastewater into a sustainable resource, helping communities and industries become water resilient in the face of global climate pressure.

VISION

To become a leading global provider of smart decentralized water reuse technologies.

2035 STRATEGIC TARGETS

- Recycle 1 Billion litres of water annually
- Expand across UK, Europe, Middle East & Africa
- Recognised global climate-tech innovator
- Contribute directly to Net Zero and ESG goals

MISSION

To deliver intelligent water recycling solutions through engineering innovation, digital technology, and sustainable infrastructure.

STRATEGIC OBJECTIVES

- Reduce global freshwater demand
- Promote circular water reuse at scale
- Lower environmental impact & pollution
- Improve water resilience for business
- Support Net Zero targets & ESG
- Enable sustainable urban development

THE GLOBAL WATER CHALLENGE

Water security is the defining challenge of this century. Without urgent action, communities and industries face catastrophic operational and environmental risks.

Water Scarcity
Growing global freshwater deficit; 2 billion+ people living in water-stressed regions.

Climate Change
Extreme weather events disrupting supplies; UK faces 5 billion litres/day deficit.

Rising Water Costs
Water and sewage costs rising for businesses and municipalities globally.

Aging Infrastructure
Outdated centralized systems unable to meet modern, expanding urban demand.

Untapped Resource
Millions of litres of treatable wastewater discharged unused daily instead of being recycled.

OUR SOLUTION: SMART WATER REUSE PLATFORM

SYSTEM INTELLIGENCE • LIVE DASHBOARD

Up to 90%
WATER RECOVERY

24/7
IOT MONITORING

CA
ANALYTICS

Advanced MBR Tech
High-performance biological treatment producing **reuse-quality** water consistently.

Smart IoT Hub
Real-time intelligence with sensor-driven data collection and **performance dashboards**.

Modular Design
Compact, **containerized units** for scalable deployment from residential to industrial sites.

AI Automation
Predictive operation with **AI-assisted fault detection** and automated dosing optimization.

Remote Monitoring
Cloud-enabled visibility with **24/7 oversight** without requiring on-site presence.

Water Recovery
Recovering **up to 90%** of wastewater for non-potable or industrial applications.

WHY SMART ECO?

	TRADITIONAL SYSTEMS	SMART ECO PLATFORM
ARCHITECTURE	Centralized, large-scale	Decentralized & Compact
OPERATING COST	High overhead & logistics	Lower Operating Costs
OPERATION MODE	Manual, labour-intensive	IoT-Enabled Intelligence
WATER RECOVERY	Limited (up 40-60%)	Up to 90% Water Recovery
CARBON FOOTPRINT	High energy intensity	Significantly Reduced
SLUDGE GENERATION	High volume disposal	Reduced Sludge Generation
SCALABILITY	Fixed, inflexible infrastructure	Modular Deployment
DATA INTEGRATION	Minimal or none	Full IoT Integration
BUSINESS MODEL	Linear (Use & Dispose)	Circular Water Economy
MONITORING	Periodic manual checks	24/7 Remote Monitoring

- Up to 90% Recovery
- IoT-Driven Intelligence
- Modular Scalability
- Circular Economy Ready

PRODUCT PORTFOLIO: SEEL SERIES

SEEL-15

RESIDENTIAL

Small-scale household and community units for focused water reuse.

SEEL-100

COMMERCIAL

Designed for light commercial buildings and boutique facilities.

SEEL-300

COMMERCIAL

Mid-scale solution optimized for hospitality and corporate offices.

SEEL-500

COMMERCIAL

High-capacity systems for large commercial and multi-site complexes.

Industrial Systems

INDUSTRIAL

Custom engineered, bespoke solutions for complex industrial processes.

Supporting Services & Integration

- Water Testing & Analysis
- Consultancy & Engineering
- OEM Solutions & Integration
- Maintenance & Support
- Smart Monitoring Platform

UPSHOT-SEEL SYSTEMS

Key Features

- Advance MBR High Tech System
- Cost Effective and Energy Efficient
- Compact
- Online Data Monitoring and

Usage

- Flushing in Toilets
- Gardening
- Car washing
- Cooling Towers
- Industrial Operations
- Building & Construction

Performance

- Up to 90% Water Recovery
- Up to 50% reduction in water Bills
- Odor Free

MARKET VALIDATION: PROGRESS ACHIEVED

SEEL

2023-2024

2024

2025

2026

2027

Concept & Research

Initial research phase and concept development identifying key water reuse market opportunities and technological gaps.

Prototype Development

Integration of advanced Membrane Bioreactor (MBR) technology with IoT monitoring. Development of modular SEEL platform.

Testing & Refinement

Rigorous testing phase establishing environmental engineering expertise and platform performance refinement.

Validation Phase

Active industry engagement and official submission to the Water Dragons Innovation Challenge. Validation of system efficiency.

Commercial Deployment

Targeted first commercial installations and wider market adoption across commercial and industrial sectors.

Strategic Roadmap for Decentralized Water Technology Evolution

CURRENT STATUS: 2026 VALIDATION & INDUSTRY ENGAGEMENT PHASE

MARKET OPPORTUNITY

SEEL

$70B+

GLOBAL WATER REUSE MARKET SIZE

Projected valuation by 2030 with ~15% annual growth trajectory.

9.8%
Compound Annual Growth Rate (CAGR)

2 Billion+
Population in Water-Stressed Regions Globally

5 Billion
Litres/Day Projected UK Freshwater Deficit by 2055 (UK EA)

USD 60B+
Estimated Core Market Value by 2030

Strategic Target Sectors

- ✓ Commercial Office Buildings
- ✓ Hospitality & Hotels
- ✓ Manufacturing Facilities
- ✓ Sustainable Housing Developments
- ✓ Water Utilities & Infrastructure
- ✓ Industrial Parks & Logistics
- ✓ Public Sector & Municipalities

CORE MARKET DRIVERS

- Escalating Water Scarcity
- Mandatory ESG Compliance
- Net Zero Commitments
- Cost Reduction Imperative
- Tightening Regulations
- Climate Resilience

CONSUMER BENEFITS

20-50%
POTABLE WATER REDUCTION

90%
WATER RECOVERY RATE

70-90%
DISCHARGE REDUCTION

30-60%
CARBON FOOTPRINT REDUCTION

Up to 50 %
Water Bills Reduction

24/7 Monitoring
REAL-TIME IOT INTELLIGENCE & ANALYTICS

Strategic & Operational Advantages

- **Cost Optimization**
  Significant reduction in water supply and sewer discharge charges.
- **Risk Mitigation**
  Reduced dependency on municipal freshwater supply and supply risks.
- **Automated Reliability**
  Consistent water quality with low-maintenance, easy-to-operate systems.
- **ESG Transparency**
  Automated data collection for precise sustainability and ESG reporting.
- **Climate Resilience**
  Future-proofing infrastructure against water scarcity and regulations.
- **Circular Efficiency**
  Transforms wastewater from a liability into a high-value resource.

COMMERCIAL FUNDING & COLLABORATION REQUEST

SEEL

Funding Partnership
- Pilot Plant Deployment Funding
- Scale-up Manufacturing Investment
- Commercialization Support
- International Market Expansion

Pilot Demonstration Sites
- Industrial & Municipal Pilot Sites
- Performance Validation
- Case Studies
- Customer References

Commercial Collaboration
- Joint Manufacturing
- Distribution Partners

Research & Innovation
- Joint R&D
- Bio-based MBR
- AI & IoT Research

Utility & Regulatory
- Utility Validation
- Third-party Verification

💰 FUNDING REQUEST – £250,000
- Pilot Project Installation
- Plant Commissioning & Start-up
- Performance Testing & Optimization
- Independent Results Validation
- Water Quality & Compliance Verification
- Technical Documentation & Commercial Case Study

We invite investors EPC contractors and industry partners to collaborate with SEEL to commercialize next-generation sustainable wastewater treatment solutions.

GROWTH ROADMAP 2026–2030

2026

VALIDATION

Pilot Deployment & Validation; first demonstration sites live in strategic UK locations.

2027

COMMERCIAL ROLLOUT

Scale-up of commercial installations; first revenue-generating deployments across key sectors.

2028

UK EXPANSION

Broad UK Market Expansion; target 10+ installations with long-term service contracts.

2029

INTERNATIONAL

European market entry; expansion into high water-stress regions in the Middle East & Africa.

2030

GLOBAL GROWTH

International strategic partnerships; global platform licensing and operational scaling.

KEY SUCCESS METRICS

IMPACT
Water Saved (Million Litres)

SUSTAINABILITY
Carbon Emissions Reduced (tCO_2)

SCALE
Total Customers Deployed

FINANCIALS
Recurring Service Revenue

Meet the Team

Muhammed Umair

CEO & FOUNDER

- IES-UK Full Member
- M.Phil. in Environmental Science & Total Quality Management
- Post Diploma in Environmental Environmental Control Tech
- 10+ Years of Environmental Engineering Experience

Operations Director

MANAGEMENT LEADERSHIP

- M.Phil. in Public Policy & Strategic Security Management Management
- Expertise in Large-Scale Industrial Efficiency
- Specialist in Organizational Growth & Governance
- 35+ Years of Experience in Operations & Strategic Management

Raja Muhammad Zubair

CTO & CO-FOUNDER

- Masters In Embedded System Engineering - UK
- 20 Years of Experience

> *"We are dreamers and creators to the core, dedicated to protecting our planet through engineering excellence."*

Capture the knowledge.

Store it forever.

Make it **accessible**.

LeakSolve AI

Leakage is Becoming More Data-Driven.

Leak is in this DMA.

Localise

- Campaign management & insights
- Pressure modelling
- Improved metering & analytics

Leak is in this area.

Locate

- Fixed network sensors
- Satellite surveys
- Dark fibre

Leak is in this square meter.

Pinpoint

- Technician judgement

Skill

Knowledge

Experience

LeakSolve AI

The Skills Gap.

Knowledge lives in the **experienced technician's mind.**

When they leave, that **knowledge is lost forever.**

Capture the knowledge.

Store it forever.

Make it **accessible**.

LeakSolve AI

LeakSolve AI

Capture the knowledge 1

- Experienced technicians log their steps and methodology in the field.
- **Trainers & experienced technicians contribute to knowledge bank.**

2 Store it forever

- Data stored in a secure cloud-based encrypted database.
- **AI analysis provides operational insights** to management.
- Validated data used to train **machine learning** model.

3 Make it accessible

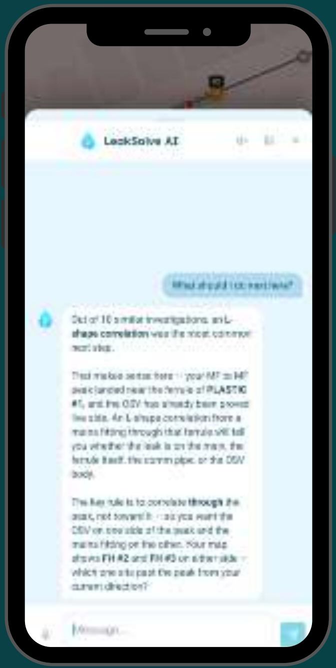
- **AI recommends next steps** based on best practice learnt from similar historical cases.
- LLM intelligently assists with complex jobs and field-based queries based on **captured knowledge.**

Field Application

- **Designed for the Field**
  Large, tactile buttons, simple interface and minimal manual entry required.
- **Hands-Free Chat**
  Easily communicate with LeakSolve chat via voice input and speech-to-text.

- **Next Step Suggestions**

- **Correlation Suggestions**



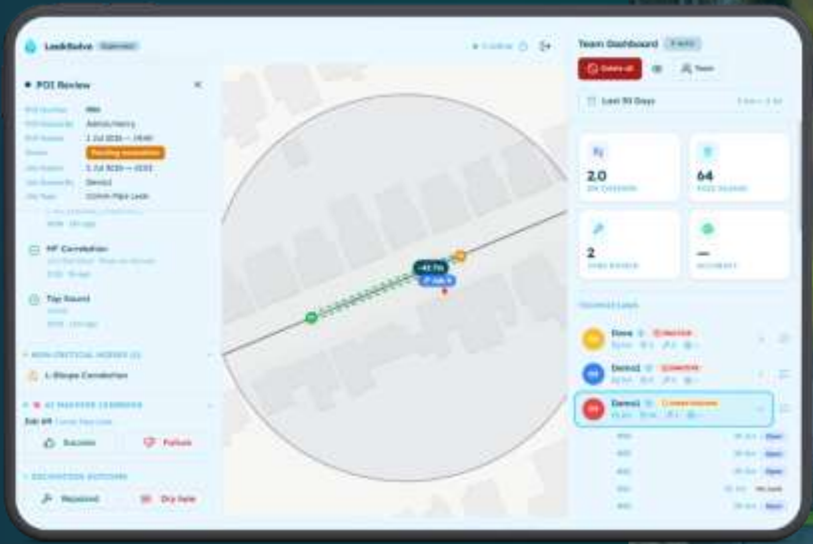
- **AI Assistance**

Full Operational Oversight for Supervisors.

- **Manage Remotely**
  See what each technician is doing, what questions they're asking, and how they're approaching each job.

- **Build The Knowledge Bank**
  Continually contribute to company best practice and how-to guide.

- **AI Trend Analysis**
  Provides operational insights to streamline & upskill their team effectively.



Capture the knowledge.

Store it forever.

Make it **accessible**.

LeakSolve AI

harry@leaksolveai.com

+44 7514 188816

www.leaksolveai.com

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Future Water Association

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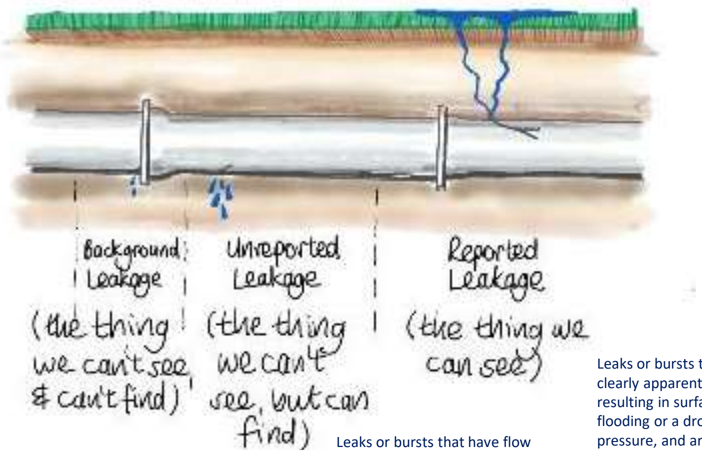
GWF

Unavoidable Background Leakage (UBL)

Mark Shepherd
Product Manager Digital Water Solutions

WHAT IS LEAKAGE AND UNAVOIDABLE BACKGROUND LEAKAGE IN THE FIRST PLACE?

The International Water Association (IWA) defines real losses (leakage) as the physical escape of water from the distribution system before it reaches the end user. This comprises leakage from mains, service lines, and overflows at storage tanks, resulting primarily from failed infrastructure, poor operations, and pressure issues, and often broken down into three specific, standardised categories:



The aggregate of the many, small, individually undetectable leaks – weeps at joints, fittings and fixtures – that persist on every distribution network **even when brand new.**

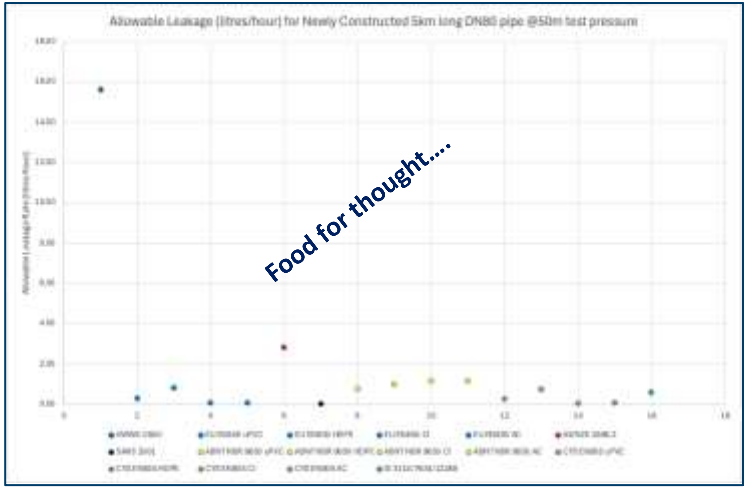
Leaks or bursts that have flow rates large enough to be detectable but remain unknown to the water utility because they have not yet been observed or reported.

Leaks or bursts that become clearly apparent, typically resulting in surface water flooding or a drop in pressure, and are subsequently reported to the utility by the public or company staff.

Even when brand new you say?

Did you know…..

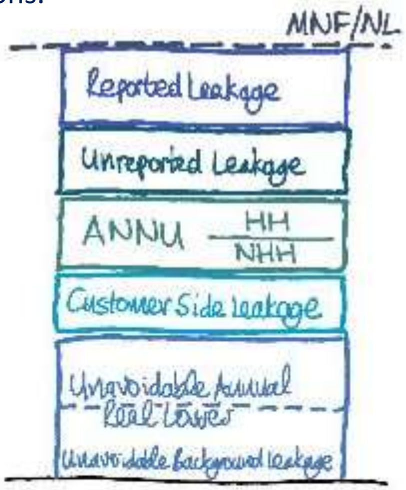
Numerous international standards make provision for allowable leakage or make-up water in newly laid pipes



UNAVOIDABLE BACKGROUND LEAKAGE (UBL)

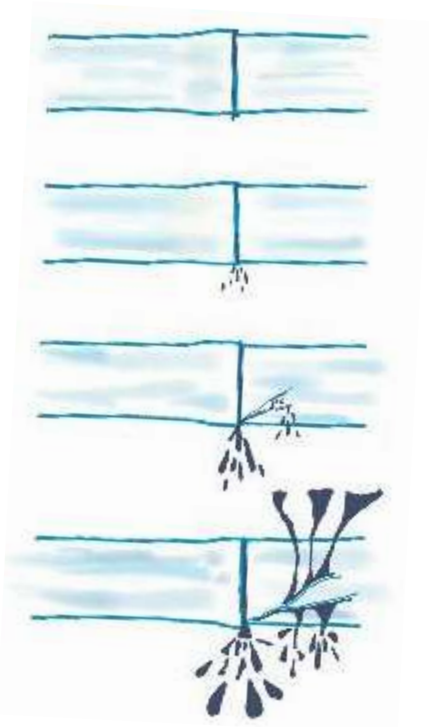
UBL belongs in leakage calculations as it is normally the dominant component of UARL (which is used in international KPMs such as the ILI). Without a definable UBL floor, the “how low can you really go?” has no answer.

It makes a MNF component-based analysis diagnostic (quantitative) rather than introducing qualitative assumptions.



But is it REALLY there…?

Well, every leak has to start somewhere

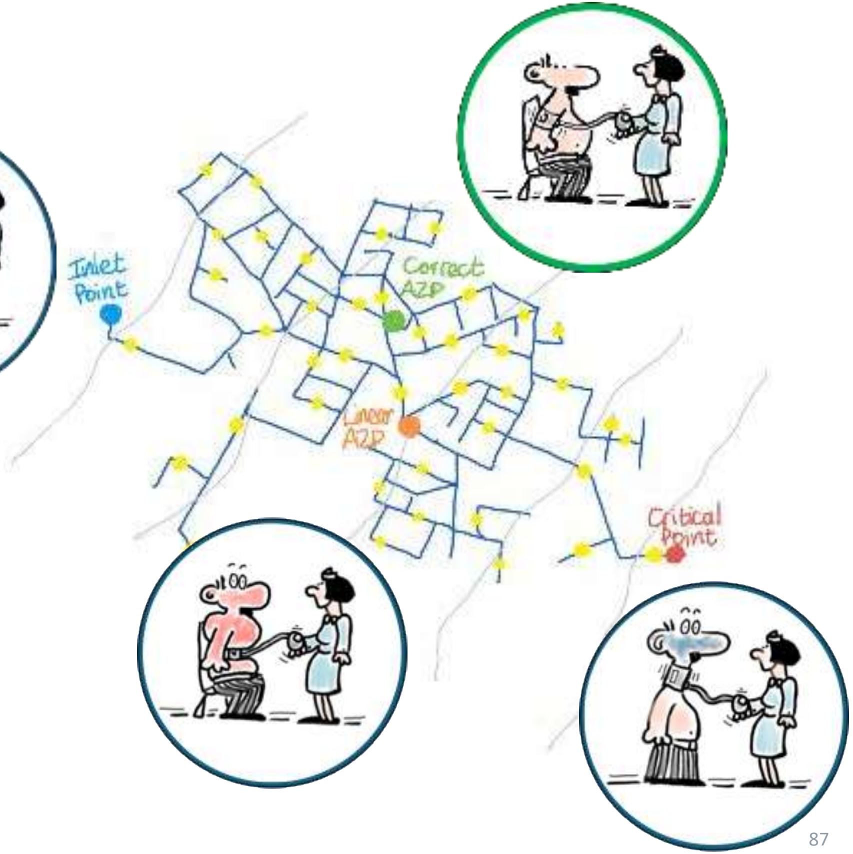


UNAVOIDABLE BACKGROUND LEAKAGE (UBL) AND PRESSURE

UBL is pressure sensitive/dependent, so the use of the "correct" pressure is paramount. For all accurate and relevant leakage calculations, we must use the Average Zone Pressure.

IWA definition – "A point where the pressure variations are supposed to be representative of the pressure variations influencing the sum of leak flow rates in a zone as a whole".

Pressure Measurement Used	Effect on UARL	Effect on Leakage Interpretation
Inlet pressure (over-or under-estimates AZP)	UARL increased according to N1 behaviour	DMA appears better managed than what it is
Critical point pressure (under-estimates AZP)	UARL reduced according to N1 behaviour	DMA appears worse managed than it is
Measured AZP (correct)	Accurate UARL	Leakage calculations valid – meaningful for benchmarking and regulatory reporting
Average of inlet and critical point pressure	May accidently approximate AZP in flat DMAs; systematically wrong in topographically varied DMAs	Error magnitude depends on DMA geography - unpredictable



FWA

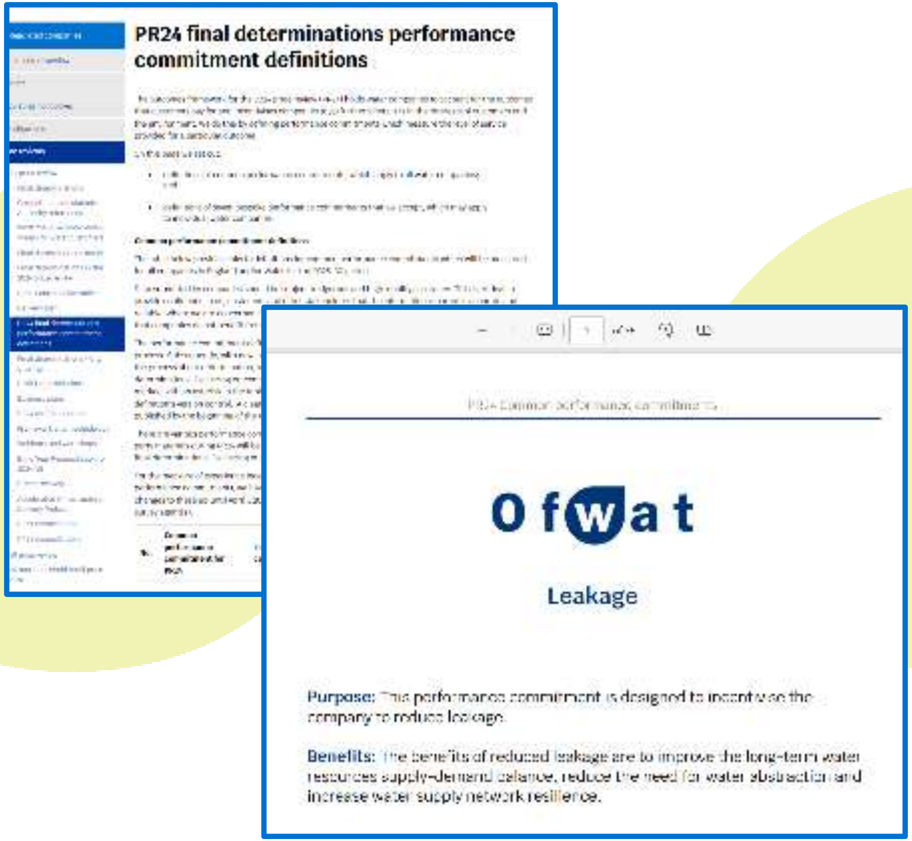
Background leakage doesn't exist (….does it?)

Ian Pemberton
BSc CEng CWEM MICE MCIWEM
Principal Engineer

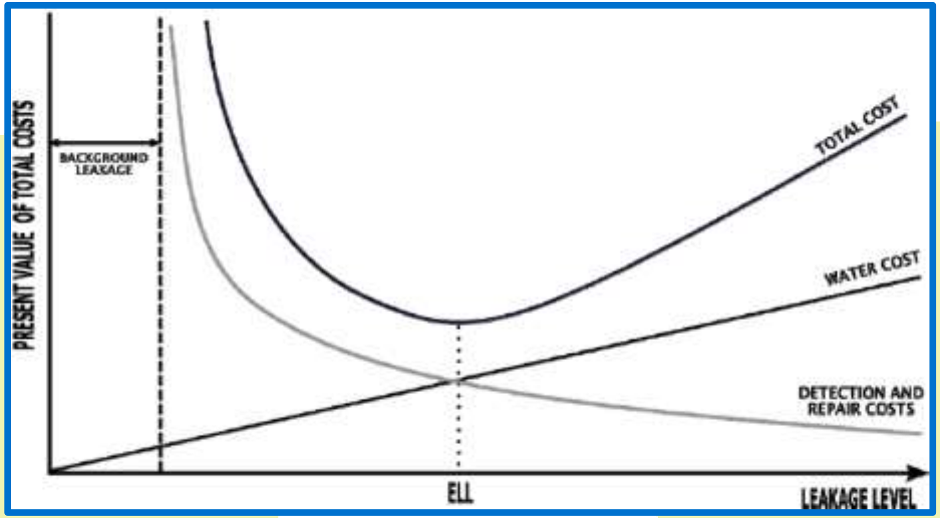
June 2026

Ofwat

Question : What is 'Leakage'? (In England and Wales)



[Performance commitment definition - Leakage]()



Background Leakage is currently defined in the Water UK Leakage Routemap (2022) as the "**level of leakage that cannot be reduced further using current detection technology**".

it can only be altered by **replacing pipes, or by reducing pressure**, within the distribution network.

What does reported leakage mean to each of us

Top Down / Bottom Up

Distribution Input

Business Demand

PCC

BABE

Trunk Mains

Service Reservoirs

Household / Non Household

Meters

Smart Meters

MUR

Accuracy
Availability
Replacement
Verification
Comms
Type

DMAs

Operability and Availability

NHHNU

Hour to Day

HHNU

MLE

CSPL

Breakout

PALM

ESPB

APRs

Targets

Pressure Management

ALC

Background Leakage

Outcomes (PC definitions)

Leakage Targets

Government Policy

Enhancement costs

Base costs

Water Resources

Licence Compliance

APRs

Assurance

Environment Agency

Investors

Innovation

Stakeholder confidence

Smart Meters

Natural Resources Wales

Customer Experience

Media Interest

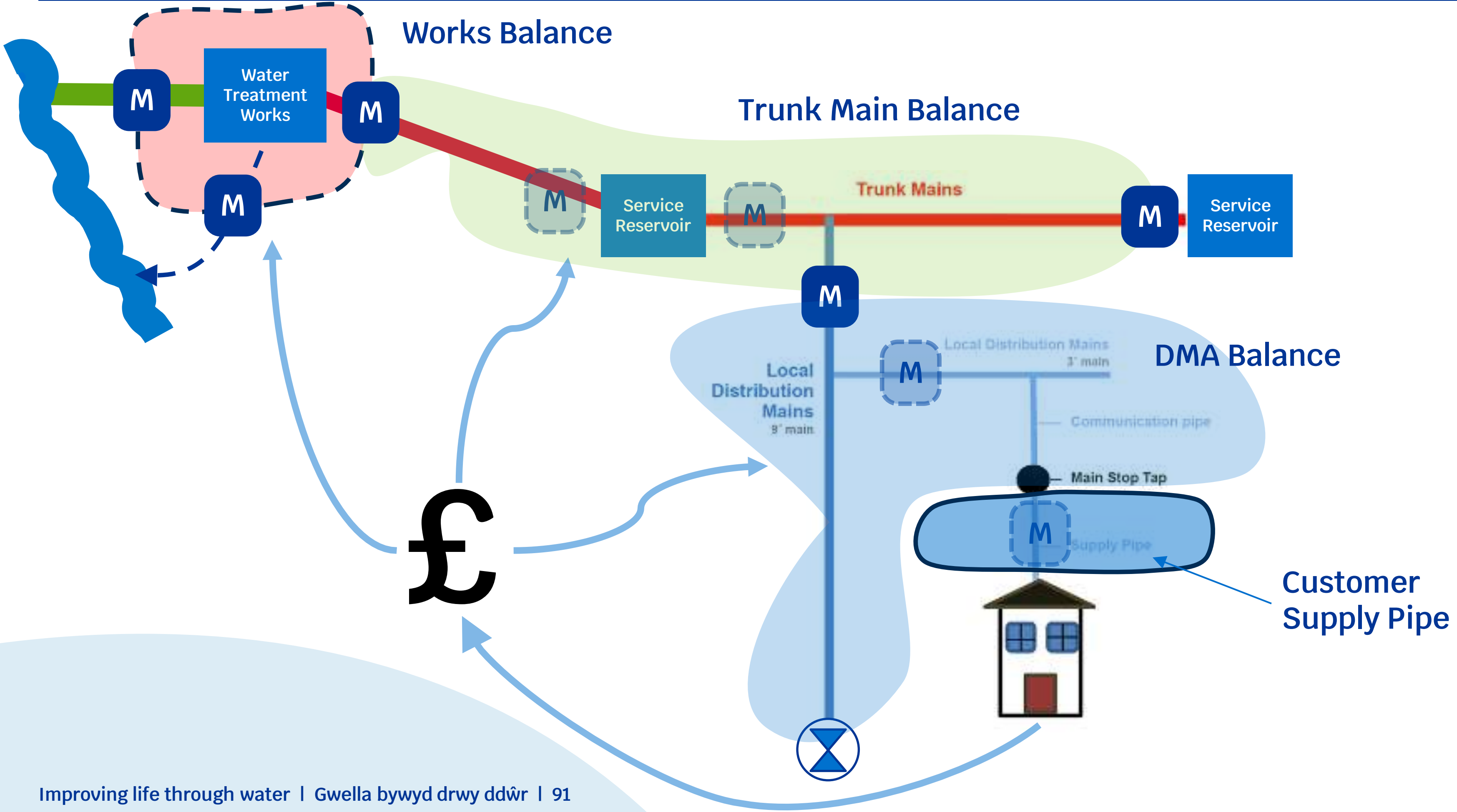
	Water balance	Company level
39		
40	Measured household consumption (excluding supply pipe leakage)	
41	Unmeasured household consumption (excluding supply pipe leakage)	
42	Measured non-household consumption (excluding supply pipe leakage)	
43	Unmeasured non-household consumption (excluding supply pipe leakage)	
44	Total annual leakage	
45	Distribution system operational use	
46	Water taken unbilled	
47	Distribution input	
48	Distribution input (pre-MLE)	

Table 6B
Cell E 44

Table 3D
Cell J10

Three Year Rolling Average

A balanced view of the network – Where to target the effort?



Thank you

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Future Water Association
Informing, Innovating, Influencing

The LEAKSSuite Library

The Background Leakage challenge

Allan Lambert

Why did UK Utilities decide to use 1994 'Average' (not 'Low' values) of Background Leakage in 2000 (and ever since then?)

UK Managing Leakage 1994

1994 UK Managing Leakage Report E : Interpreting Measured Night Flows				
Background Losses standardised to average pressure P = 50 m				
Based on 124 DMAs with 43 to 9130 properties (average 1697), average AZNP 47.2m				
Background Loss Component	Units	Low	**Average**	High
Distribution Mains Lm	l/km/hr	20	**40**	60
Communication Pipes Nc	l/prop/hr	1.5	**3.0**	4.5
Underground Supply Pipes length) Lp	l/prop/hr	0.25*	**0.50***	0.75*
Background Night Flow Losses standardised to 50 metres pressure		20 x Lm + 1.75 x Nc	**40 x Lm + 3.50 x Nc**	60 x Lm +5.25 x Nc
		* after 50% plumbing losses deducted		

IWA KPIs Report 1999

IWA 1999 KPIs Report Unavoidable Background Leakage UBL				
Based on UK 1993 to 1999 data and feedback from German night flow data, at P = 50 metres				
IWA UARL equation uses UK 'Low' values for mains and CPs, and 'average' for supply pipes				
Background Loss Component	Units	**UBL**	2 x UBL	3 *UBL
Distribution Mains Lm	l/km/hr	**20**	40	60
Communication Pipes Nc	l/prop/hr	**1.5**	3.0	4.5
Underground Supply Pipes Lp	l/prop/hr	**#0.50**	#1.00	#1.50
Background Night Flow Losses standardised to 50 metres average pressure		**20 x Lm + 2.0 x Nc**	40 x Lm + 4.0 x Nc	60 x Lm + 4.5 x Nc
#Plumbing losses are assumed to be part of within-property metered consumption				

No other high-income country (World Bank Classification) uses the 'Average' values to calculate the UBL component of leakage, this bars the UK from calculating ICF, UARL and ILI for international comparisons.

The link between background leakage and pressure management

- **If Background Leakage has reduced since 1993-4 tests it would not be surprising as AZNPs are likely have reduced significantly since Managing Leakage 1994 data was analysed**
  - Numerous pressure management schemes following 1995-96 drought
  - Gradual reduction of minimum standard of service for pressure at the property boundary; now 7 metres minimum, what was it in the early 1990’s? Around 15 metres?
- **If assume 10 metres reduction (from 50 to 40 metres), this would imply:**
  - 20% reduction if linear pressure:background leakage is assumed
  - 28% reduction if background leakage varies to power 1.5 (more likely)
- **Stage A Report Appendix 3 needs to show AZNPs, so reader can interpret influence of AZNP on the l/property/hour figures**

International Comparisons /Benchmarking

- Both OFWAT and the IWA Water Loss Specialist Group have consistently stated that % of system input volume (SIV) is not fit for purpose.
- 1st IWA Water LossTask Force developed $UARL_{1999}$ and ILI 25 years ago for international and national comparisons of technical performance of large systems at mid-range pressures
  - **ISO standard 24528 (Annexe C.2.3)** now limits application to > 5000 services and within 45-60m pressure.
  - **UARL with System Correction Factor SCF** now available for smaller zones/DMAs, higher or lower pressure
- Examples of UK Company ILIs in International and European comparisons.
  - IWA 1999 International data, 27 Utilities: 6 from UK in Performance Band A (ILI < 2.0) of which 2 are in Band A1 (ILI < 1.5)
  - EC 2016 'Good Practices' Report, 71 Utilities: UK have 7 of the 25 Companies in Band A, of which 2 are in Band A1
- IWA KPIs should use litres/physical service connection at the main /day, if countries use litres/property/day instead, this can significantly distort comparisons
- WLR&A have developed a Rosetta Stone approach which should enable any annual leakage KPI to be converted into any other annual leakage KPI

Potential Changes to Upstream Leakage Reporting

FWA – Leakage and Metering 7th July 2026

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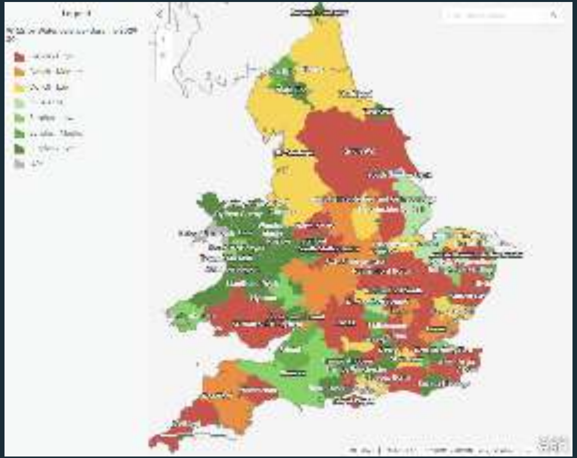
2026

Is Upstream Leakage a Problem?

- Target to reduce leakage by 1000Ml/d by 2050
- Upstream networks ~ 11% of the total potable water network
- ~ 281Ml/d currently reported as Trunk Main and SR leakage
  - 2% of Total DI
  - 10% of Total Reported Leakage
- APR 2023/24 – 12 companies reported Red or Amber, mostly for discrepancies within the Water Balance and MLE being great than 2%
  - Could this be upstream leakage?



Water Scarcity by WRZ

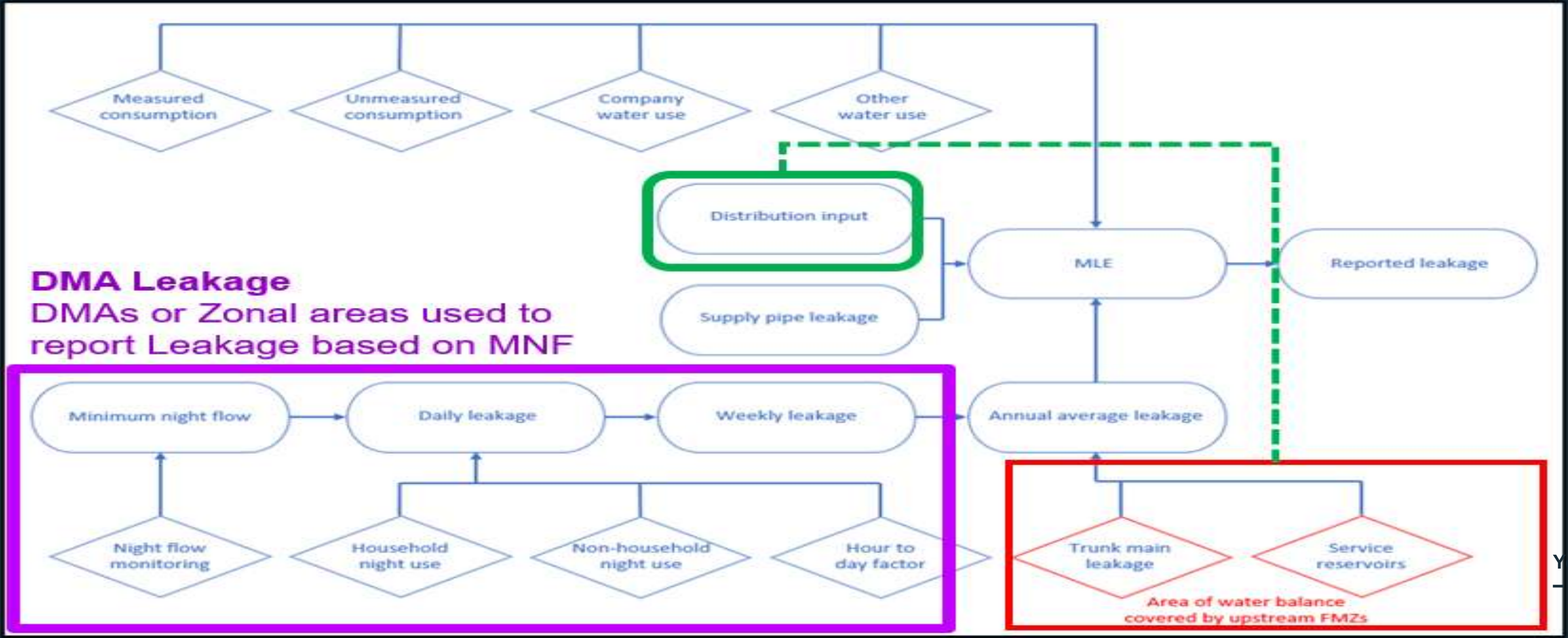
'Ofwat-Upstream-Losses-Report' - Part of Ofwat's review into future changes to Leakage reporting.
www.ofwat.gov.uk - Leakage-reporting-methodology - Upstream Leakage

Is Upstream Leakage a Problem?

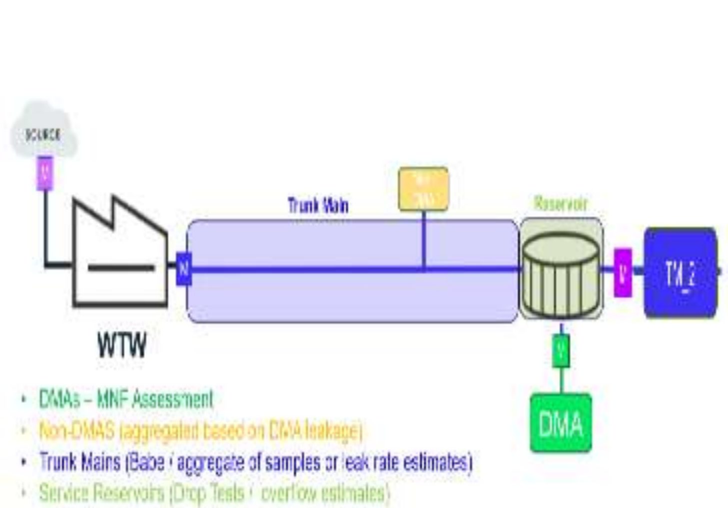
A **30-inch trunk main** burst near Holland Park roundabout. [standard.co.uk] ~**2,000 properties lost supply** (low pressure or no water). [standard.co.uk] Flow estimated at **~600 L/s escaping**, causing severe flooding. [standard.co.uk] Flood depth reached **~1 metre**, affecting **50+ homes and a hotel**. [standard.co.uk] Wider disruption across **Shepherd's Bush, Kensington, Notting Hill, Soho, Westminster**

- Not just about water loss – reputation, structural damage, legal costs, ODI penalties, Pollution Penalties

The Water Balance – Where is Upstream Leakage



Example Flow Balance – TMAs and SRs



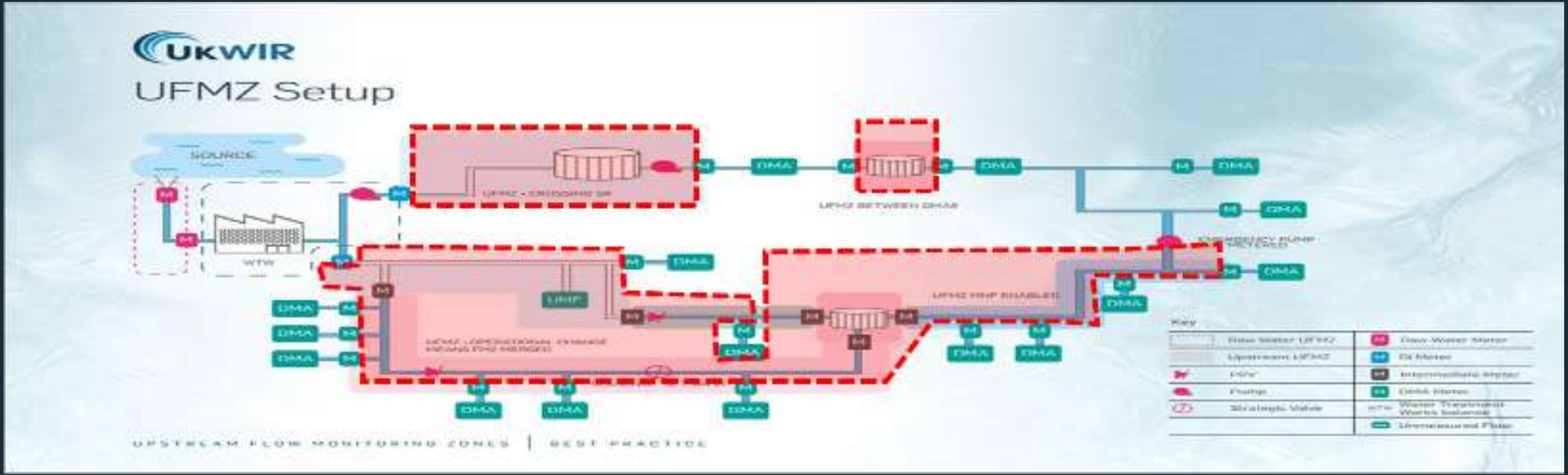
Balance	In	Out	UFW	Valid
Trunk main	36.8	0	36.8	No – no outlet meter
SR	0	33.2	-33.2	No – no inlet meter

Balance not valid – BABE Estimate at 0.1Ml/d on TM and 0.05Ml/d on SR

What are ‘Upstream Areas and Leakage’

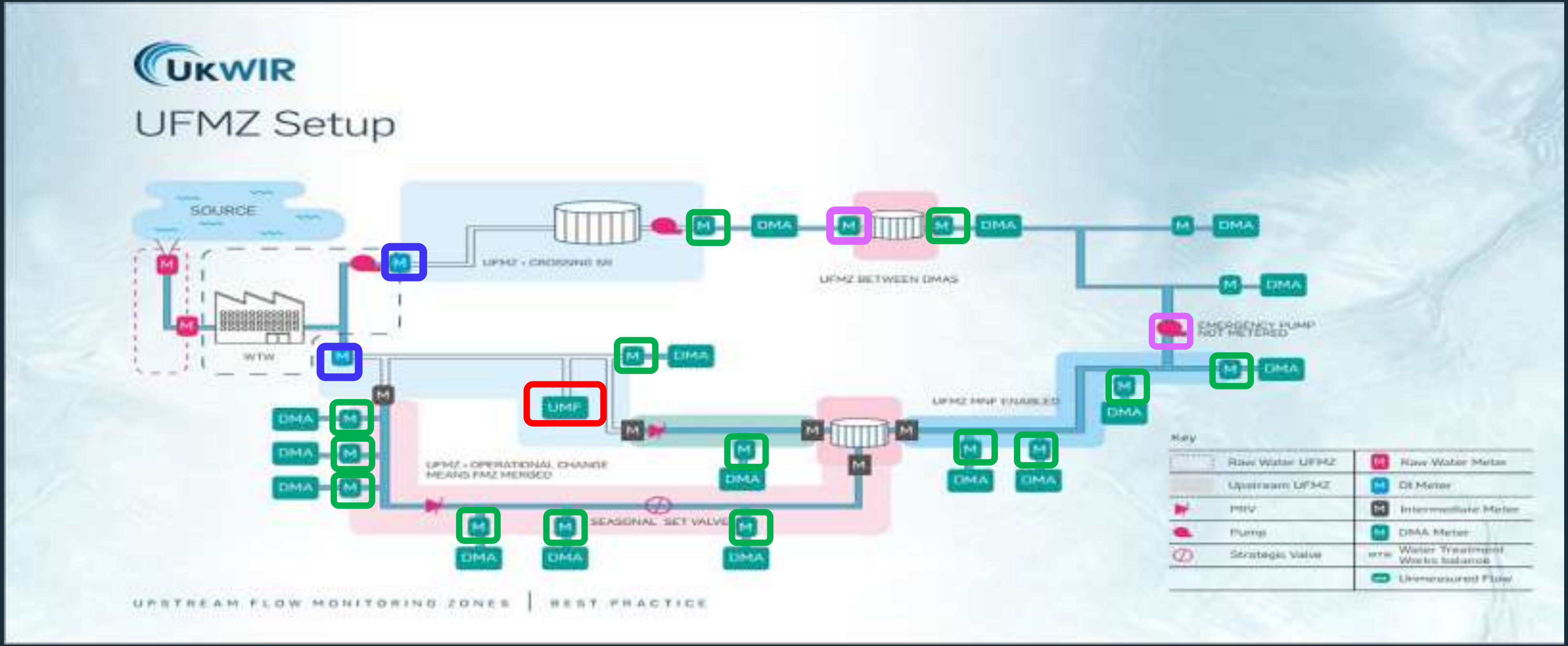
- Includes all potable water mains and assets that exist downstream of the DI (Distribution Input meters), and outside of the cohorts of meters used to produce the DMA or Zonal leakage assessment. Includes Aqueducts, trunk mains, Reservoirs, distribution mains and customer which are not within a DMA

- Upstream leakage covers all leakage currently reported within the ‘Water Balance’ as the ‘Trunk Main’ and ‘Reservoir’ leakage components



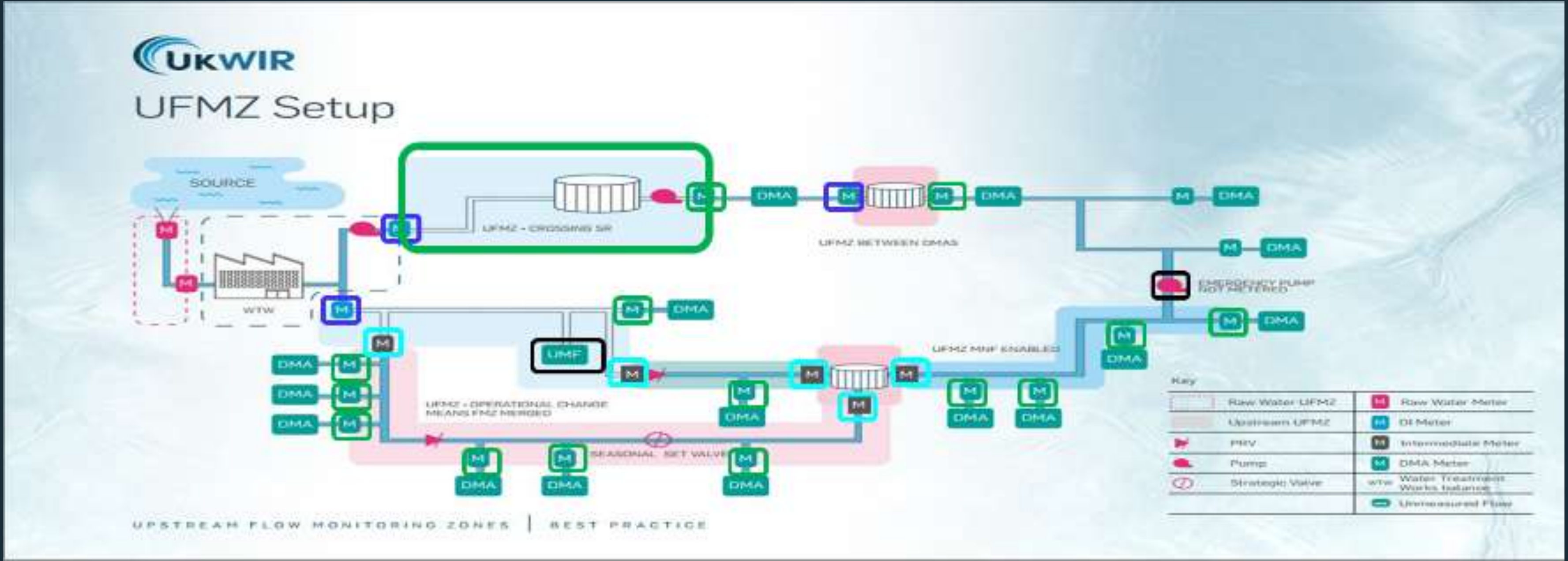
‘Strategic Upstream Balance’ - SUBs

- **Upstream Leakage =** **DI meters** – **Water Into DMAs (Primary DMA meters or DMA TDF)** – Non-DMA demand + DMA exports from a DMA back into a non-DMA area

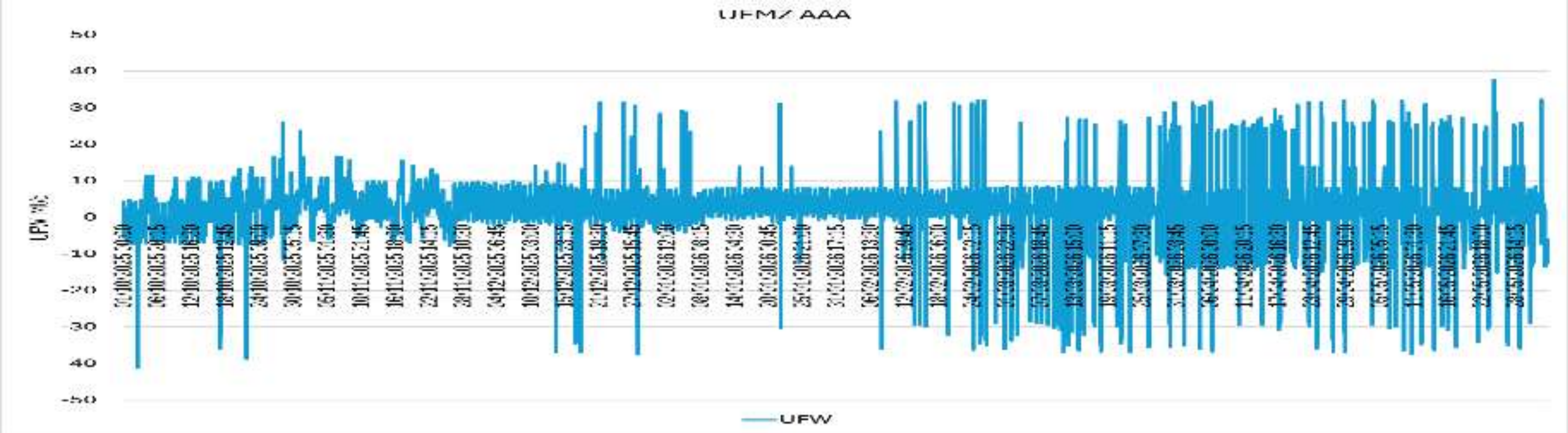


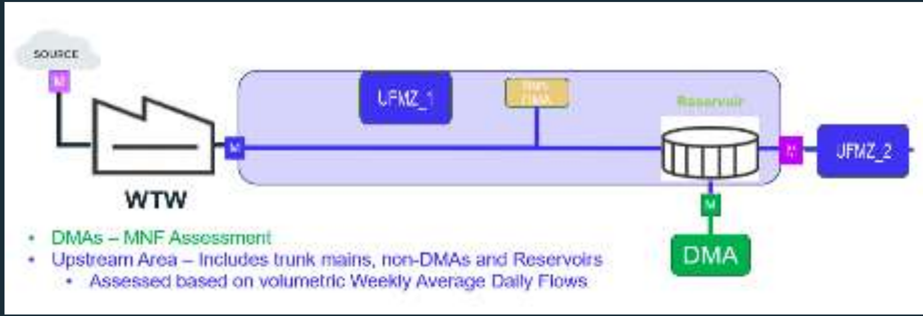
‘Upstream Flow Monitoring Zone’ - UFMZ

- A Section of a SUB which can be broken into a smaller areas using of trunk main meters.
  - Where metering is insufficient, UFMZs combine Trunk Mains and Reservoirs as 1 balance area.
- UFMZs must provide 100% coverage within a SUB
- UFMZs help improved flow validation of DMAs and targeting of upstream leakage activity.



Example flow balance - UFMZs





Balance	In	Out	UFW	Valid
UFMZ_1	36.8	33.2	3.6	Yes, all meters working

What if a DMA Meter Fails

- Direct impact to Upstream UFW

Classification	Inlet/Outlet	43 26/08/2024	44 02/09/2024	45 09/09/2024	46 16/09/2024	47 23/09/2024	48 30/09/2024	49 07/10/2024	50 14/10/2024	51 21/10/2024
TM	I	6.211	6.096	6.324	6.288	6.410	5.849	5.819	6.176	6.183
DM	O	0.152	0.157	0.155	0.154	0.159	0.159	0.159	0.160	0.164
DM	O	0.199	0.194	0.191	0.194	0.197	0.197	0.199	0.200	0.189
DM	O	0.300	0.280	0.266	0.267	0.248	0.285	0.284	0.289	0.310
DM	O	0.545	0.527	0.517	0.519	0.479	0.514	0.471	0.476	0.502
DM	O	0.270	0.236	0.260	0.244	0.272	0.249	0.294	0.265	0.266
DM	O	0.623	0.598	0.646	0.652	0.631	0.626	0.561	0.539	0.579
DM	O	0.102	0.095	0.096	0.096	0.080	0.066	0.060	0.064	0.063
OM	O	0.949	0.977	0.055	0.000	0.000	0.779	0.944	1.031	1.028
SM	O	1.168	1.106	1.197	1.155	1.040	0.983	1.085	1.151	1.059
DM	O	0.126	0.152	0.137	0.137	0.139	0.146	0.148	0.358	0.246
OM	O	1.196	1.083	1.082	1.100	1.105	1.163	1.049	1.082	1.091
Area	U	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Area	U	0.098	0.098	0.098	0.098	0.098	0.098	0.097	0.097	0.095
Area	U	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Inlet Total	6.211	6.096	6.324	6.288	6.410	5.849	5.819	6.176	6.183
	Demand	5.629	5.406	4.602	4.519	4.349	5.166	5.254	5.614	5.497
	Storage Change	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Tile Cons	0.099	0.099	0.099	0.099	0.098	0.098	0.098	0.097	0.095
	Outlet Total	5.728	5.504	[illegible]	[illegible]	[illegible]	[illegible]	5.352	5.711	5.592
	Discrepancy	0.483	0.592	1.623	1.671	1.964	0.585	0.467	0.466	0.591

- Best Practice - Infill the invalid DMA flow data based on the last Valid weeks flow. Review and adjust if season demand factors apply or can profile

Classification	Inlet/Outlet	43 26/08/2024	44 02/09/2024	45 09/09/2024	46 16/09/2024	47 23/09/2024	48 30/09/2024	49 07/10/2024	50 14/10/2024	51 21/10/2024
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DM	O	0.152	0.157	0.155	0.154	0.159	0.159	0.159	0.160	0.164
DM	O	0.199	0.194	0.191	0.194	0.197	0.197	0.199	0.200	0.189
DM	O	0.300	0.280	0.266	0.267	0.248	0.285	0.284	0.289	0.310
DM	O	0.545	0.527	0.517	0.519	0.479	0.514	0.471	0.476	0.502
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DM	O	0.623	0.598	0.646	0.652	0.631	0.626	0.561	0.539	0.579
DM	O	0.102	0.095	[illegible]	[illegible]	[illegible]	[illegible]	0.060	0.064	0.063
OM	O	0.949	0.977	0.971	0.964	0.957	0.951	0.944	1.031	1.028
SM	O	1.168	1.106	1.197	1.155	1.040	0.983	1.085	1.151	1.059
DM	O	0.126	0.152	0.137	0.137	0.139	0.146	0.148	0.358	0.246
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Area	U	0.098	0.098	0.098	0.098	0.098	0.098	0.097	0.097	0.095
Area	U	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Inlet Total	6.211	6.096	6.324	6.288	6.410	5.849	5.819	6.176	6.183
	Demand	5.629	5.406	5.573	5.483	5.306	5.337	5.254	5.614	5.497
	Storage Change	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Tile Cons	0.099	0.099	0.099	0.099	0.098	0.098	0.098	0.097	0.095
	Outlet Total	5.728	5.504	5.671	5.582	5.404	5.436	5.352	5.711	5.592
	mended Discrepanc	0.483	0.592	0.653	0.707	1.006	0.413	0.467	0.466	0.591

Some methods currently applied would invalidate the balance, and apply an estimate leakage rate

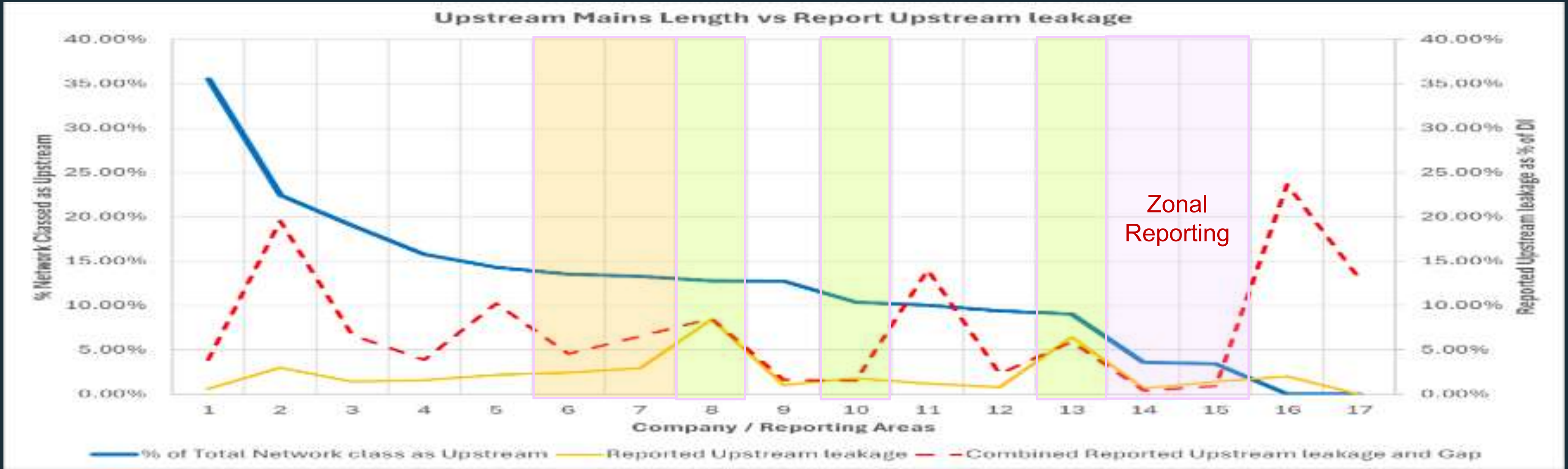
This can cause large swings in reported numbers and miss accounting on our upstream networks

Upstream Leakage – SUB assessment

U/S mains length not provided for review

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Method Of reporting TM Leakage	BABE	Industry rates	BABE	BABE	BABE	25% UFMZ aggregated	25% UFMZ + 75% BABE	SUBs	BABE	SUBs + UFMZ	Rates based on sample	BABE	100% UFMZs	Historic rates	BABE	BABE	Industry rates

Reported Upstream Leakage FY24/25 approx. 281Ml/d



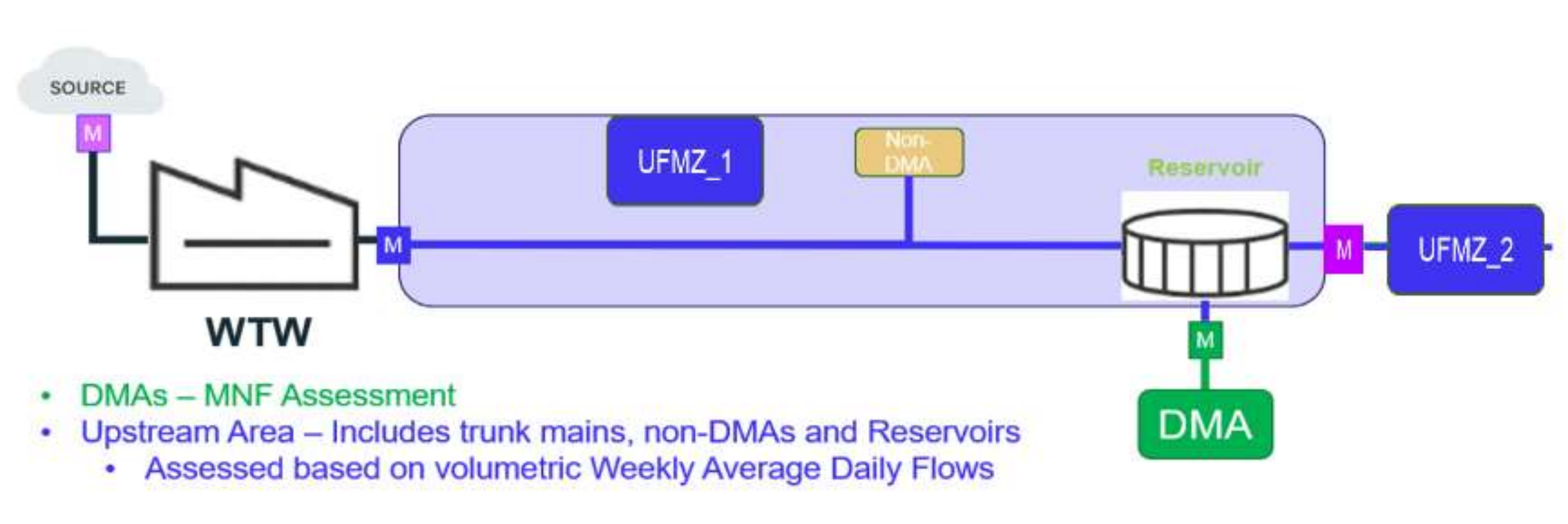
Potential Timeline

Timeline	Green	Amber	Red
From Now (not applicable to leakage reporting)	Recommendation – Use Simple SUBs to track progress toward reporting need from 2030 (Annual review)		
2030-2035 (inc. AMP 8 Shadow reporting)	Full Coverage of SUBs – Company/WRZ No exclusions (Weekly/monthly Assessment)	Simple SUB (Annual review) or Part use of Subs / UFMZs due to exclusions	Not using any sort of flow balance Simple SUBs still missing data
Indicative Level of Uncertainty	20%	40%	60%
2035-2040	Full Coverage of SUBs – Company/WRZ Supported by UFMZs validation No exclusions (Weekly/monthly Assessment)	SUBs with no granularity in validation or part use of Part use of Subs / UFMZs due to exclusions	Simple SUBs (Annual review) or no use of flow balances
Indicative Level of Uncertainty	10%	20-40%	40-60%
2040 onwards	Full Coverage of SUBs – Company/WRZ Supported by UFMZs validation No exclusions (Weekly/monthly Assessment)	SUBs with no granularity in validation No exclusions	Part use of SUBs / UFMZs due to exclusions Simple Subs (Annual review) or no use of flow balances
Indicative Level of Uncertainty	10%	20%	40-60%

Table 3-1 - Summary Table of Simple SUBs Assessments

What Should be Reported?

- Lack of metering into SR or loss of a DMA meter – estimated value to report – 0.15Ml/d
- Based on UMFZ Method, infilling lost DMA flow meter data with last valid flow data – 3.6Ml/d



thank you

AtkinsRéalis

Case Study:
Reducing Leakage on a Performance Based Contract

Tico Kromkamp

7th July 2026

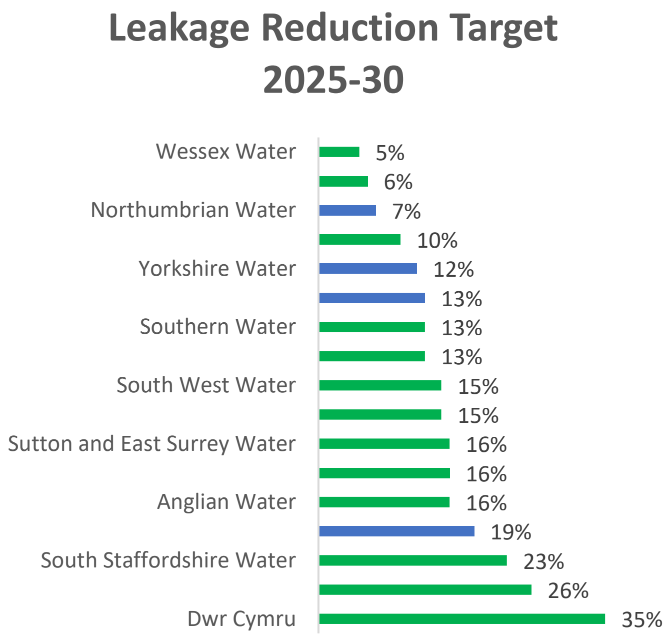
Agenda

- UK Performance Based Contract Overview
- Northumbrian Water PBC Case Study
- Developing a Smart Investigation Process
- Challenges for a PBC
- Leakage Performance Tracking and Results

UK Performance Based Contract Overview

UK Performance Based Contract Overview

- Over the last 6 years we have worked with four UK Water Companies to carry out leakage reduction performance-based contracts.
- PBCs have become appealing due to tough leakage reduction targets
- Always take ownership of DMAs to reduce leakage and then hand back
  - Whole supply zones (will include operability)
  - Or set of problematic/high leakage DMAs
- Several iterations of Performance Splits from 100% performance, to 50/50 and 70/30
- Usually 12-month duration, can move on early if target achieved
- Performance Measurement usually based on DMA Minimum Night Flow or Leakage (Real Losses)



Northumbrian Water Case Study

North Durham Sustainable Leakage Reduction

104
DMAs

1,335
Km of mains

1.75
ILI

83,670
Properties

NetAlytics Total Leakage

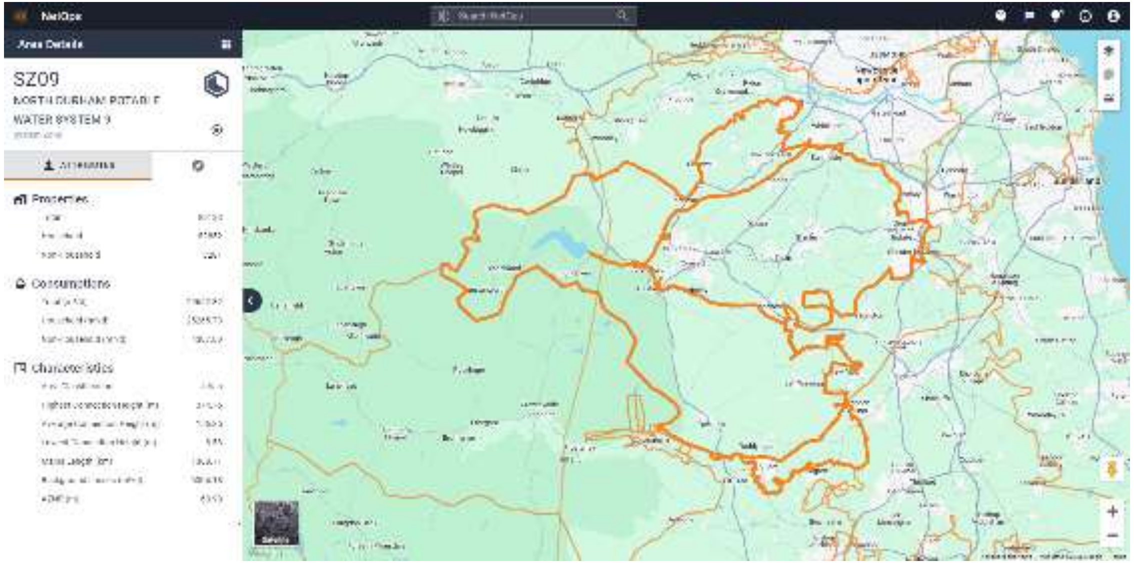
Our latest DMA targeting software is being used to prioritise DMAs, to ensure that DMAs are driven down to their exit levels and maintained at their target leakage position

NetOps Downstream

Our latest Leakage Detection Management Software is being used to plan work for our detection teams, prioritise leaks for repair and calculate savings achieved

Leakmited AI

A highly accurate AI data driven service incorporating machine learning applications is feeding into NetOps to improve the efficiency of leakage detection



¼ x Project Manager

1 x Team Leader

1 x Leakage Engineer

3 x Leakage Technicians

Locate

Highly skilled and competent technicians will locate issues and promote effective resolution in a timely manner. Customer excellence will be inherent to all activities

- Highly efficient technicians
- Accurate promotion
- Appropriate equipment
- Technology led localisation
- A.I. predictive burst locations

Key Requirements for the Framework

Provide an end-to-end active leakage detection service: from data analysis to pinpointing leaks in the field

The capability not only to recover leakage to historic levels, but also to maintain that reduced leakage position over time

A highly accurate, AI and data-driven service that leverages the latest in leak detection technology

Provide own leakage detection equipment and field teams, supported by data analysts and with the capability to deliver engineering assistance where needed

Project Team & Focus

Project Manager	¼ FTE	• Key contact responsible for work delivery. • Provide technical support and coaching to team members. • Organise and participate in project meetings • Oversee activities planning • Invoicing and performance
Leakage Engineer	1 FTE	• Analyse, monitor and target DMAs • Plan leakage detection activities • Validate leakage points of interest • Track repairs and reductions • Plan further work
Team Leader	1 FTE	• Provide leadership, technical support, and supervision to Leakage Technicians • Assist Leakage Engineer with work planning. • Liaise with repair teams and support their work when required. • Carry out leakage detection activities working alongside Project Technicians • Work closely with client operational teams to manage breakouts
Leakage Technicians	3 FTEs	• Deployment and retrieval of correlating noise loggers according • Sounding and correlations of network assets and customer fittings • Investigating POIs

Developing a
Smart Investigation Process

Principles behind Smart Investigation Process

Drive leakage down in set of DMAs; then maintain level

Ensure all the data used in the leakage calculation and targeting is correct

Apply best practice methods for prioritising DMAs for leakage targeting

Optimise efficiency and effectiveness of leakage surveys

Key principles & requirements

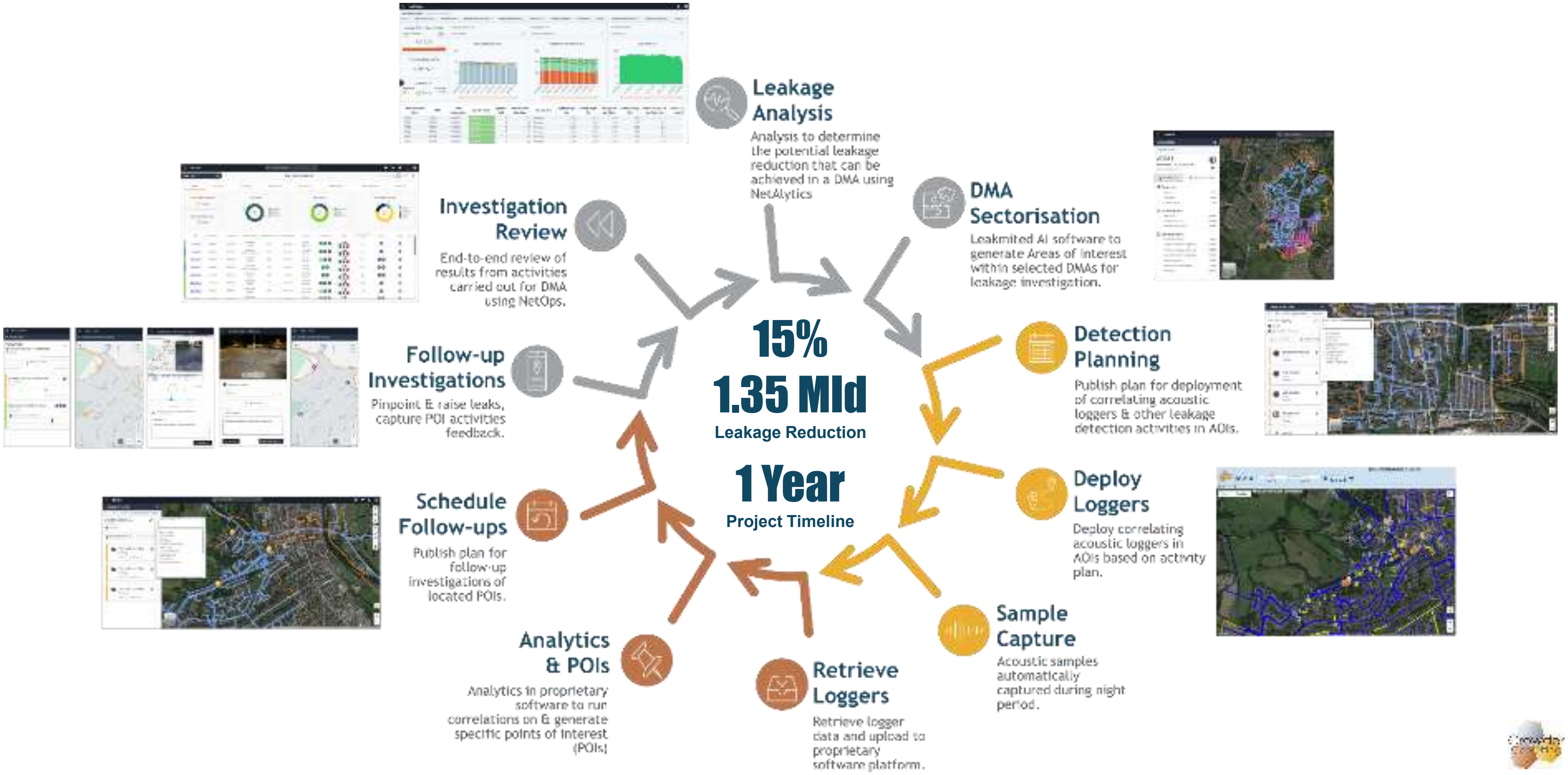
Large customers need accurate continuous monitoring

Adapt relevant processes to suit the company's

Single point of contact for both operational teams and clients. Ownership of areas.

Weekly progress reports for accountability, problem solving and escalations

Smart Investigation Process



Smart Investigation Process

Leakage Analysis	DMA Sectorisation	Detection Planning	Deploy Loggers	Sample Capture	Retrieve Loggers	Analytics & POIs	Schedule Follow-ups	Follow-up Investigations	Investigation Review
			Programme	Leave Overnight	Upload Data	Review Results	Publish POIs	Raise Leaks	
Analysis to determine the potential leakage reduction that can be achieved in DMA.	Leakmited AI software to generate Areas of Interest within selected DMAs for leakage investigation.	Publish plan for deployment of correlating acoustic loggers & other leakage detection activities in AOIs.	Deploy correlating acoustic loggers in AOIs based on activity plan.	Acoustic samples automatically captured during night period.	Retrieve logger data and upload to proprietary software platform.	Analytics in proprietary software to run correlations on & generate specific points of interest (POIs)	Publish plan for follow-up investigations of located POIs.	Pinpoint & raise leaks, capture POI activities feedback.	End-to-end review of results from activities carried out for DMA.

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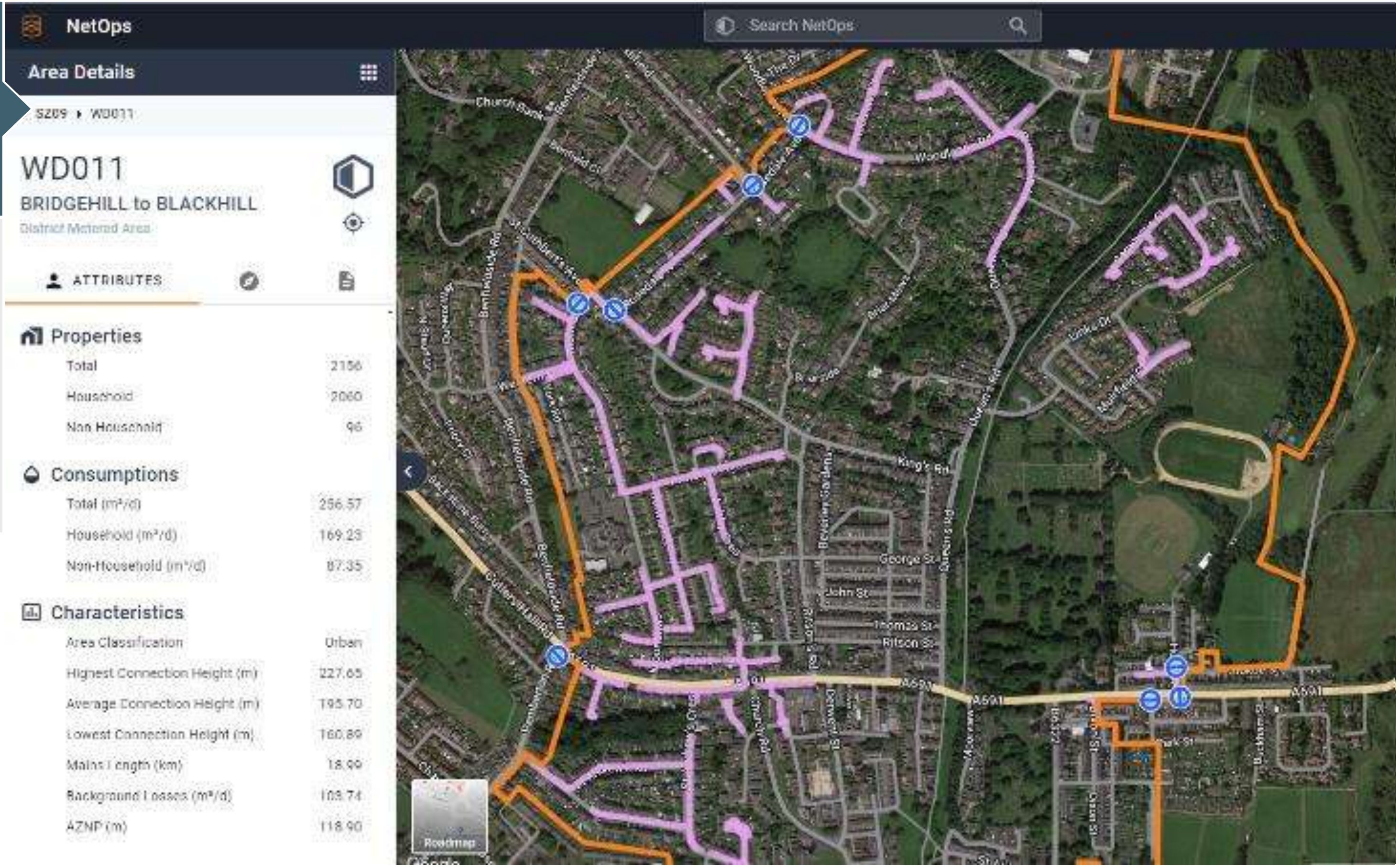
Leakage Analysis

Analysis to determine the potential leakage reduction that can be achieved in DMA.

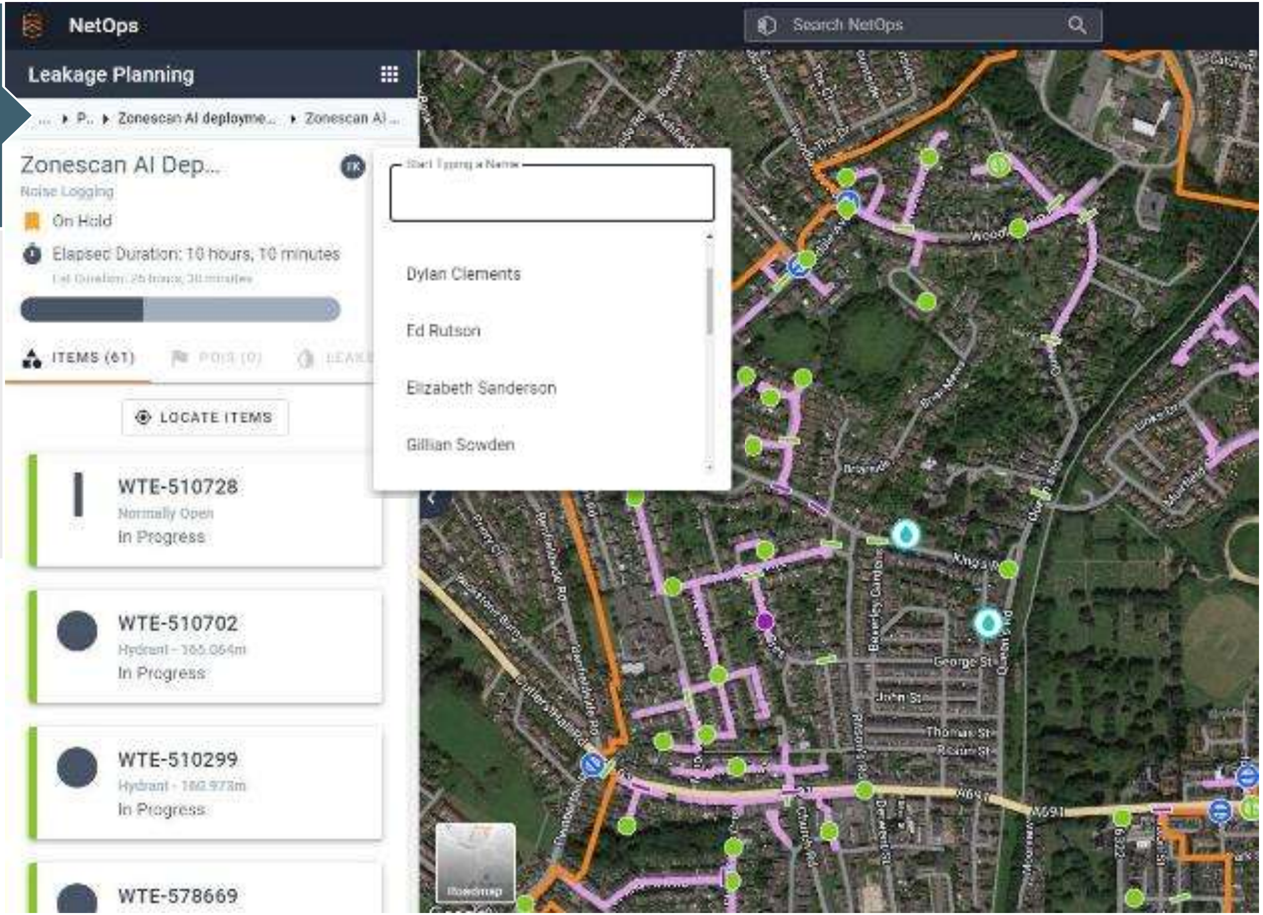
Water Resource Zone	District Metered Area	Week Commencing	Classification	Night Leakage (l/s)	Leakage Target (l/s)	Leakage Exit Level (l/s)	Excess Leakage (l/s)	Excess Leakage per Size Factor (l/s)	Excess Leakage per Property (l/hr)	Excess Leakage per KM (l/hr)	Excess Leakage (%)	Leak Le
WRZ2 - Kielder	WD004 - BEDA ...	25/11/24	Recovery	0.97	0.17	0.07	0.92	6.52	22.45	984.9	94.66	
WRZ2 - Kielder	WD036 - SHIEL...	25/11/24	Recovery	1.57	0.2	0.1	1.51	5.09	12.34	1,423.7	96.28	
WRZ2 - Kielder	WD175 - STANL...	25/11/24	Reduction	0.97	1.22	0.22	0.81	2.73	7.79	530.3	83.23	
WRZ2 - Kielder	WD232 - ...	25/11/24	Recovery	2	1.63	0.48	1.62	2.63	7.3	539.1	81.02	
WRZ2 - Kielder	WD084 - ...	25/11/24	Recovery	0.71	0.55	0.25	0.49	2.52	7.07	507.4	68.99	
WRZ2 - Kielder	WD011 - ...	25/11/24	Recovery	4.81	3.45	1.52	3.55	2.43	5.91	673.1	73.81	
WRZ2 - Kielder	WD187 - EVER ...	25/11/24	Recovery	0.88	0.32	0.08	0.86	2.21	7.21	356.3	97.66	
WRZ2 - Kielder	WD082 - NEW ...	25/11/24	Recovery	2.45	1.68	0.99	1.56	2.15	5.12	633.4	63.67	
WRZ2 - Kielder	WD039 - ESH HI...	25/11/24	Recovery	2.4	1.38	0.53	2.04	2.09	5.23	535.7	84.8	
WRZ2 - Kielder	WD077 - ...	25/11/24	Recovery	1.45	0.63	0.31	1.24	2.04	6.74	323.2	85.92	
WRZ2 - Kielder	WD154 - GRAN...	25/11/24	Recovery	1.59	1.23	0.91	0.73	1.92	5.01	447.3	46.03	

Leakage Analysis	DMA Sectorisation
Analysis to determine the potential leakage reduction that can be achieved in DMA.	Leakmited AI software to generate Areas of Interest within selected DMAs for leakage investigation.



Crowder Consulting

Leakage Analysis	DMA Sectorisation	Detection Planning
Analysis to determine the potential leakage reduction that can be achieved in DMA.	Leakmited AI software to generate Areas of Interest within selected DMAs for leakage investigation.	Publish plan for deployment of correlating acoustic loggers & other leakage detection activities in AOIs.



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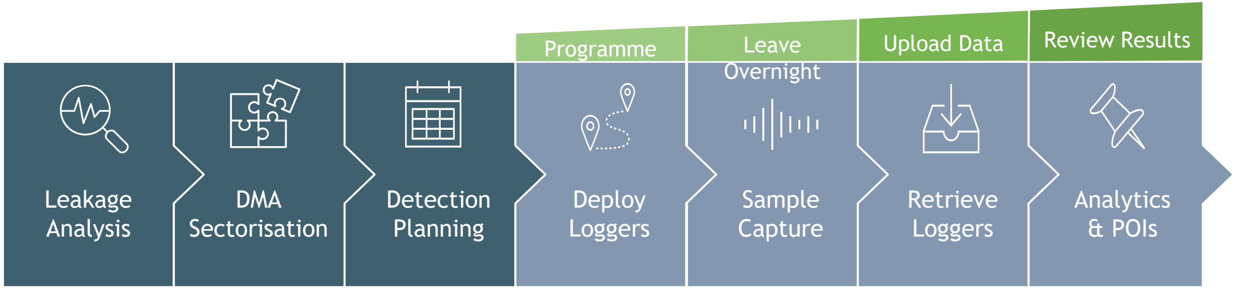
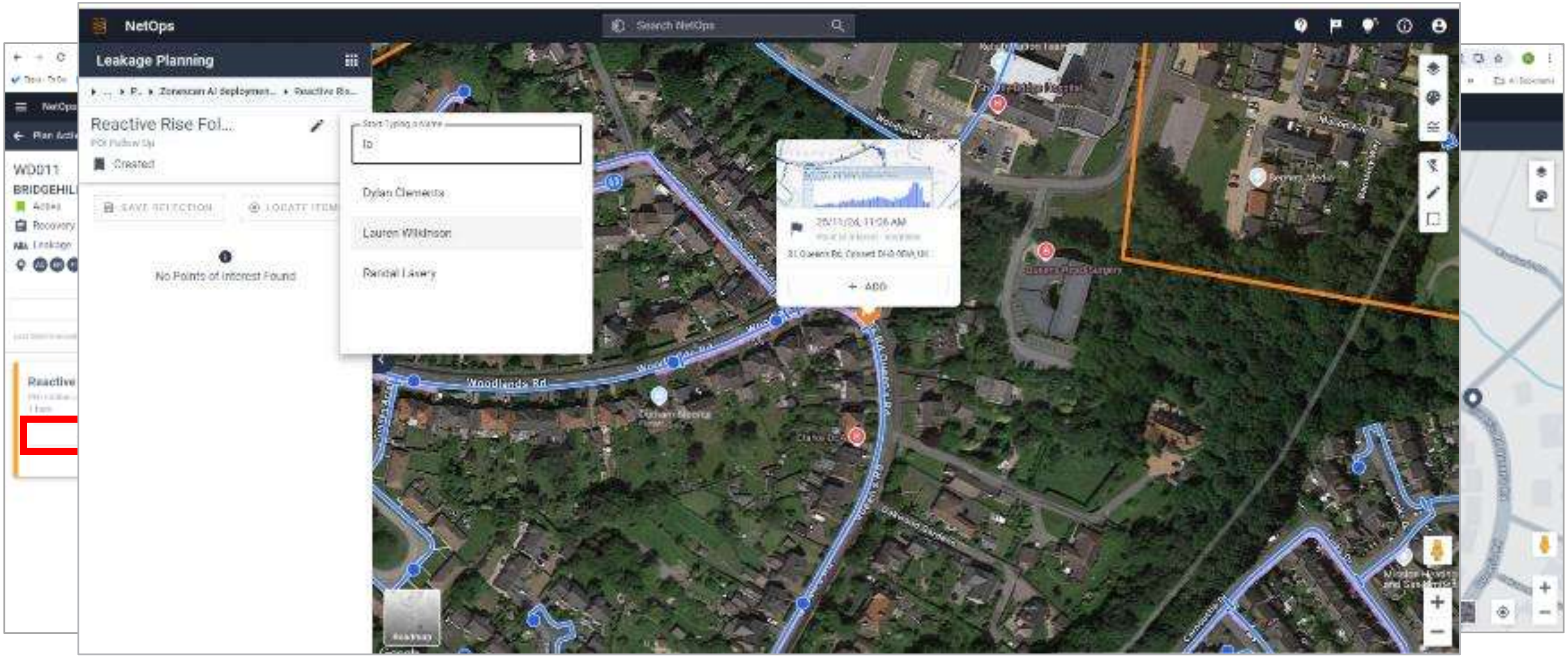

Programme
Leave Overnight
Upload Data
Review Results
Leakage Analysis
DMA Sectorisation
Detection Planning
Deploy Loggers
Sample Capture
Retrieve Loggers
Analytics & POIs


NetOps
Search NetOps
Leakage Planning
25/11/24, 11:06 AM
UPDATE STATUS
UPDATE POINT OF INTEREST
Comments
Increasing DB score since the 19th November on this logger. AI leak score predictor at 45. DB at 23 with a spread of
UPDATE COMMENTS
DELETE POINT OF INTEREST
VIEW INFORMATION

			Programme	Leave Overnight	Upload Data	Review Results	Publish POIs	Raise Leaks
Leakage Analysis	DMA Sectorisation	Detection Planning	Deploy Loggers	Sample Capture	Retrieve Loggers	Analytics & POIs	Schedule Follow-ups	Follow-up Investigations



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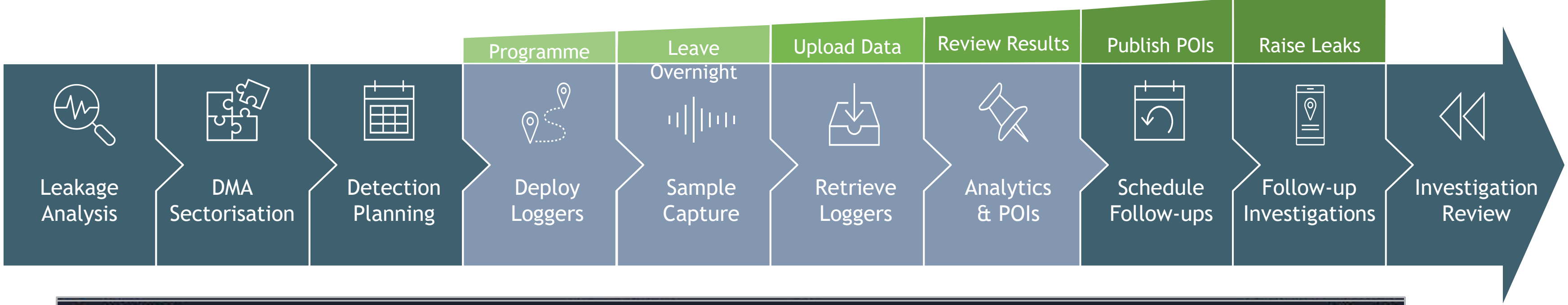
Programme
Leave Overnight
Upload Data
Review Results
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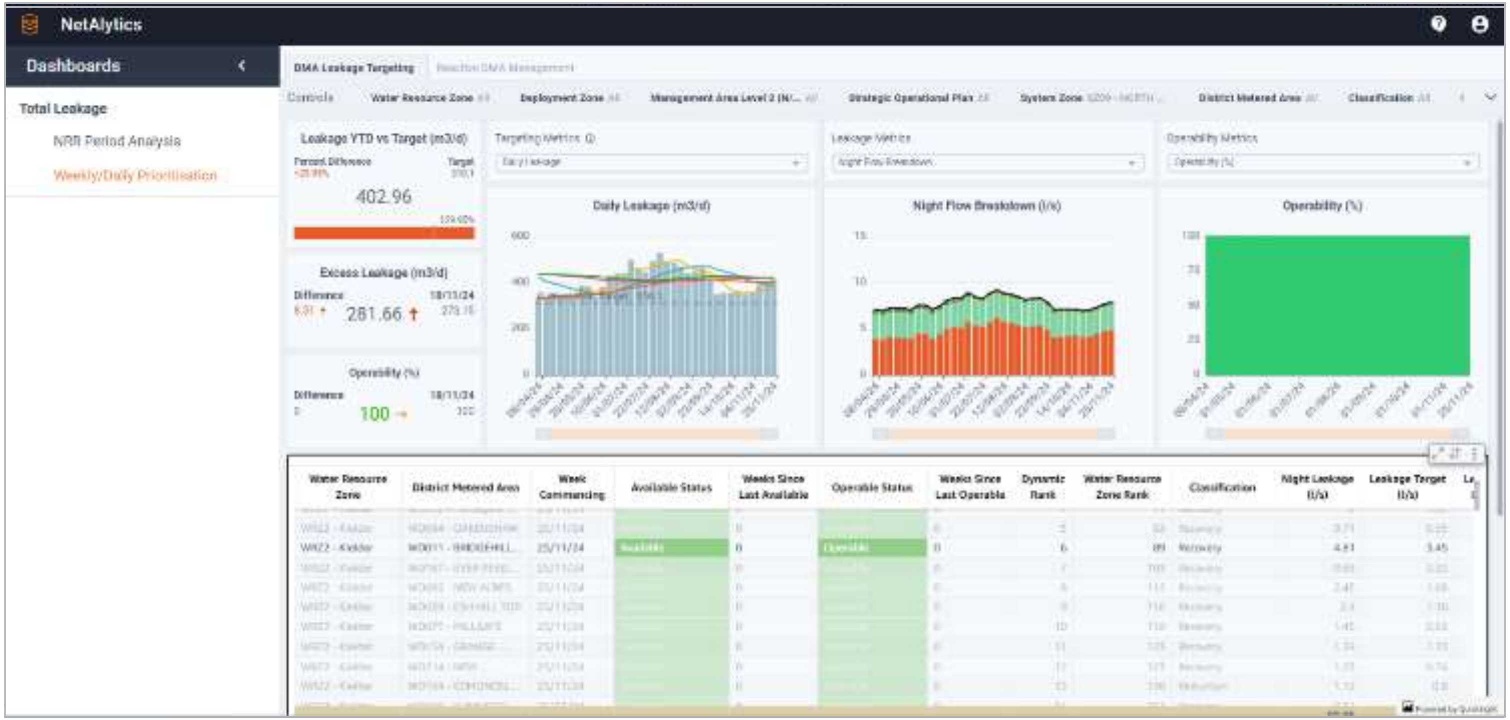
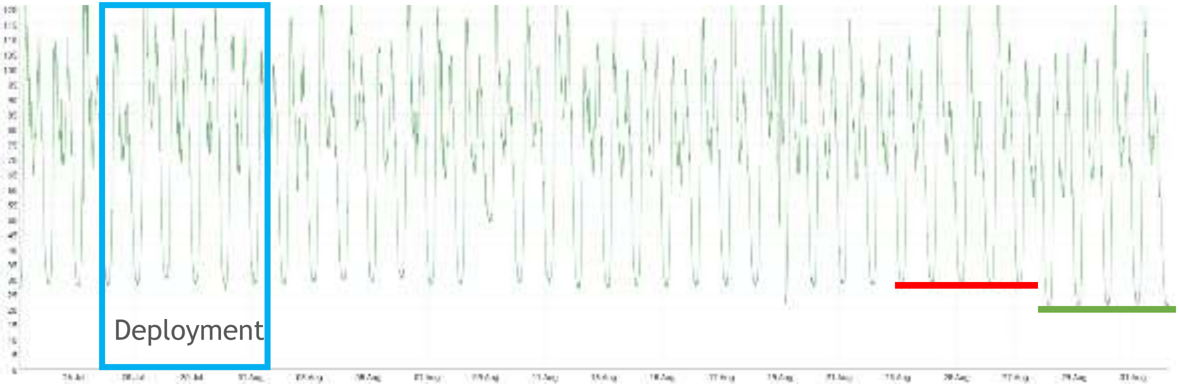

NetAlytics
Dashboards
Total Leakage
NRR Period Analysis
Weekly/Daily Prioritisation
DMA Leakage Targeting
Leakage YTD vs Target (m3/d)
402.96
Excess Leakage (m3/d)
281.66
Operability (%)
100
Daily Leakage (m3/d)
Night Flow Breakdown (l/s)
Operability (%)
Water Resource Zone
District Metered Area
Week Commencing
Available Status
Weeks Since Last Available
Operable Status
Weeks Since Last Operable
Dynamic Rank
Water Resource Zone Rank
Classification
Night Leakage (l/s)
Leakage Target (l/s)

Artificial Intelligence Example

Pipe Sections	% of the Cumulated Leaks	% of the Cumulated Network km
LPI 1 Red Sections	70 to 80%	Less than 30%
LPI 2 Orange Sections	90%	Less than 50%
LPI 3 Blue Sections	100%	100%

LP1 sections were noise logged, POIs generated and investigated, leaks found resulted in 6.5 m3/h reduction. Excess leakage 9.7 m3/h -> 3.2 m3/h



Challenges in a PBC

Challenges in a PBC

All of these have an impact on Performance

- **Customer Side Leaks** – these are on the supply pipe and can be significant. They often take a long time to resolve.
- **Delayed Repairs** – leakage cannot be reduced without repairing the leaks, but this can be challenging in some cases.
- **Repair Quality** – repairs can fail on first attempt for various reasons (pipes deeper than expected, soil shift from reinstatement, unexpected underground obstacles, No Dig attempts, etc.), delaying desired leakage reduction
- **Low Impact of Repairs** – a lot of repairs may need to happen before you see any significant drop in leakage, requires resweeping DMAs once repairs have been carried out.
- **Problematic DMAs** – expect to spend a lot of time investigating problematic DMAs, they have high leakage for a legitimate reason that needs to be unearthed which takes time, perseverance and varied approaches.
- **Leakage Breakouts** – this can ruin all your reductions achieved so far; you need to react quickly and accurately.
- **General Issues** – DMA breaches, lack of pressure management, data issues, busy roads, low numbers of listening points, repeat bursts, aging pipes, archaeological sites etc.

Performance Tracking and Results

Maintenance Baseline Leakage

- A baseline must be agreed to measure leakage reduction
- Baseline based on 2023/24 figures as they are similar to the 3-year average and operability is consistently higher than the previous years

Daily Leakage (Ml/d)						Operability			
Month	Month Name	2021	2022	2023	**Average**	2021	2022	2023	2024
1	June	8.880	7.572	9.341	**8.597**	71%	67%	78%	88%
2	July	8.630	7.207	9.427	**8.421**	67%	73%	77%	81%
3	August	8.333	7.744	9.163	**8.414**	66%	67%	72%	0%
4	September	8.971	7.259	8.913	**8.381**	66%	63%	72%	0%
5	October	9.423	8.225	8.464	**8.704**	64%	55%	78%	0%
6	November	9.635	9.518	8.524	**9.226**	65%	65%	81%	0%
7	December	10.014	11.697	9.275	**10.328**	61%	66%	83%	0%
8	January	9.916	12.468	9.914	**10.766**	60%	70%	85%	0%
9	February	10.295	11.002	10.126	**10.475**	63%	78%	81%	0%
10	March	9.724	10.645	9.661	**10.010**	65%	83%	86%	0%
11	April	7.907	9.725	9.375	**9.002**	63%	79%	88%	0%
12	May	7.820	9.537	9.128	**8.828**	67%	83%	87%	0%
	Average	**9.129**	**9.383**	**9.276**	**9.263**				

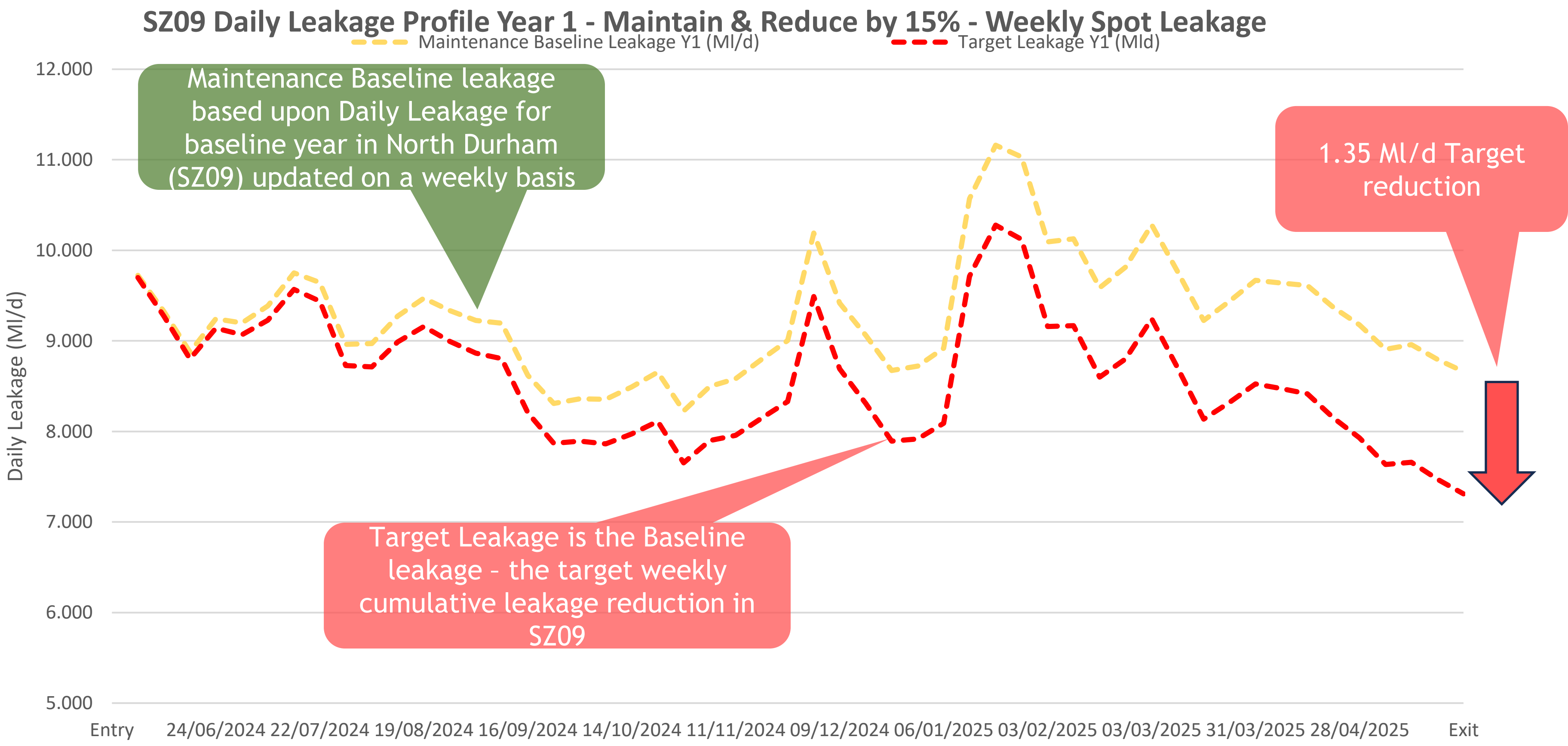
Tracking Leakage Reduction

Leakage tracker for tracking performance that will be linked with payments is shown below

Year 1 Annual Summary	
Leakage Reduction Target Mld	1.350
Maintenance Baseline Leakage (Mld)	9.276
Leakage Reduction Target %	15%
Annual Equivalent %	8%
Annual Target Leakage (Mld)	8.545
Annual Target Leakage Reduction (Ml/d)	0.731
Annual Actual Leakage (Mld)	8.754
Maintenance Level Achieved	Yes
Maintenance Difference Mld	0.522
% Maintenance Achieved	106%
Reported Leakage Reduction	0.049
Leakage Reduction Target Achieved	No
Difference from Target (Mld)	0.682
% Target Achieved	7%
Equivalent Leakage Reduction (Mld)	0.090

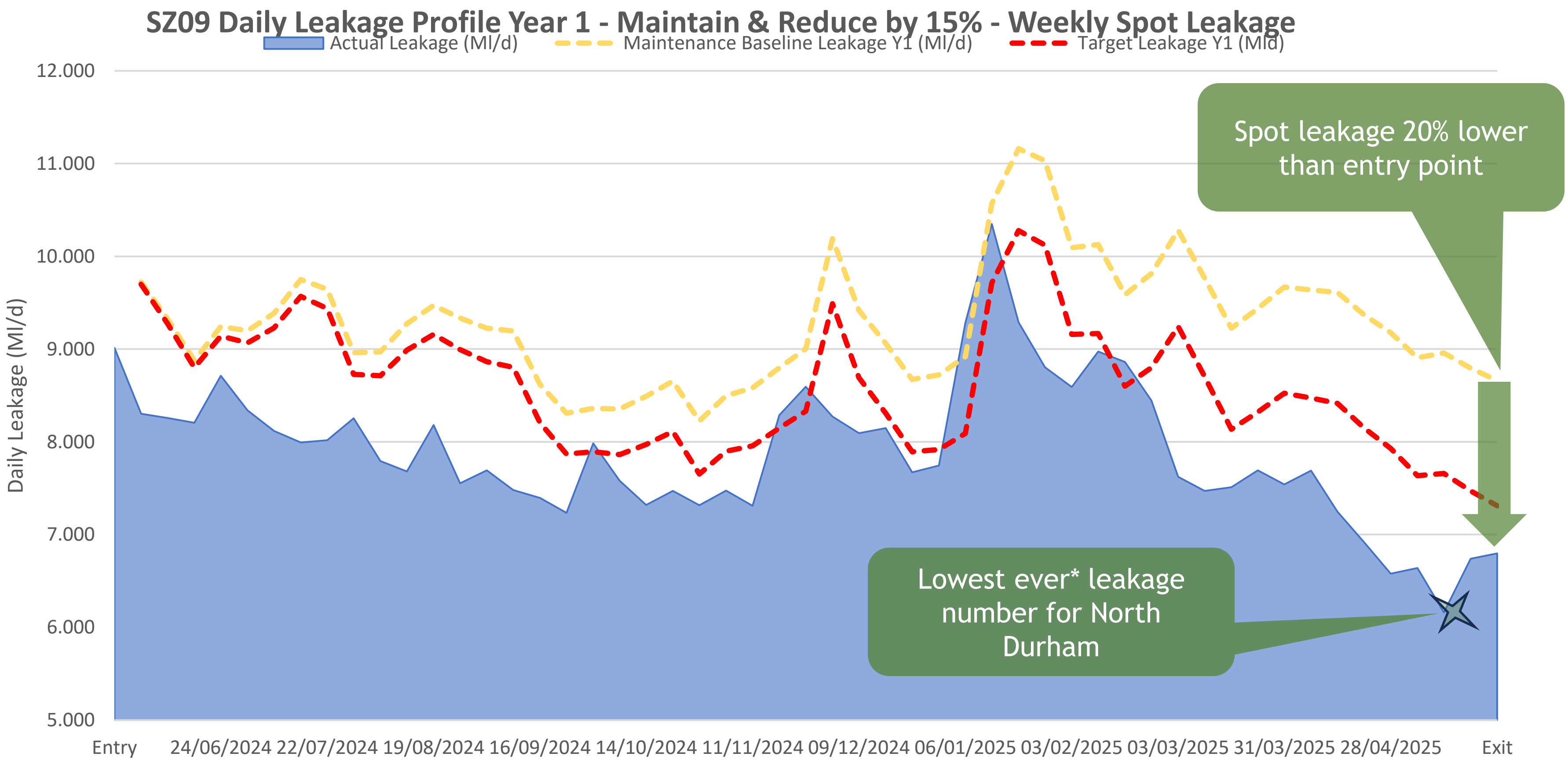
Month Number	Month	Monthly Target Leakage Reduction (Ml/d)	Maintenance Baseline Leakage Y1 (Mld)	Total Target Leakage Reduction Y1 (Ml/d)	Target Leakage Y1 (Mld)	Actual Leakage (Mld)	Reported Leakage Reduction (Ml/d)	Comparison with Target Profile (Mld)	Project Status
1	June	0.113	9.341	0.113	9.228	8.754	0.587	0.474	Green
2	July	0.113	9.427	0.225	9.202		0.000	0.000	Green
3	August	0.113	9.163	0.338	8.825		0.000	0.000	Green
4	September	0.113	8.913	0.450	8.463		0.000	0.000	Green
5	October	0.113	8.464	0.563	7.901		0.000	0.000	Green
6	November	0.113	8.524	0.675	7.849		0.000	0.000	Green
7	December	0.113	9.275	0.788	8.487		0.000	0.000	Green
8	January	0.113	9.914	0.900	9.014		0.000	0.000	Green
9	February	0.113	10.126	1.013	9.114		0.000	0.000	Green
10	March	0.113	9.661	1.125	8.536		0.000	0.000	Green
11	April	0.113	9.375	1.238	8.138		0.000	0.000	Green
12	May	0.113	9.128	1.350	7.778		0.000	0.000	Green
	Reporting Year Total	**1.350**	**9.276**	**0.731**	**8.545**	**8.754**	**0.049**		

Tracking Leakage Reduction



Crowder Consulting

Tracking Leakage Reduction



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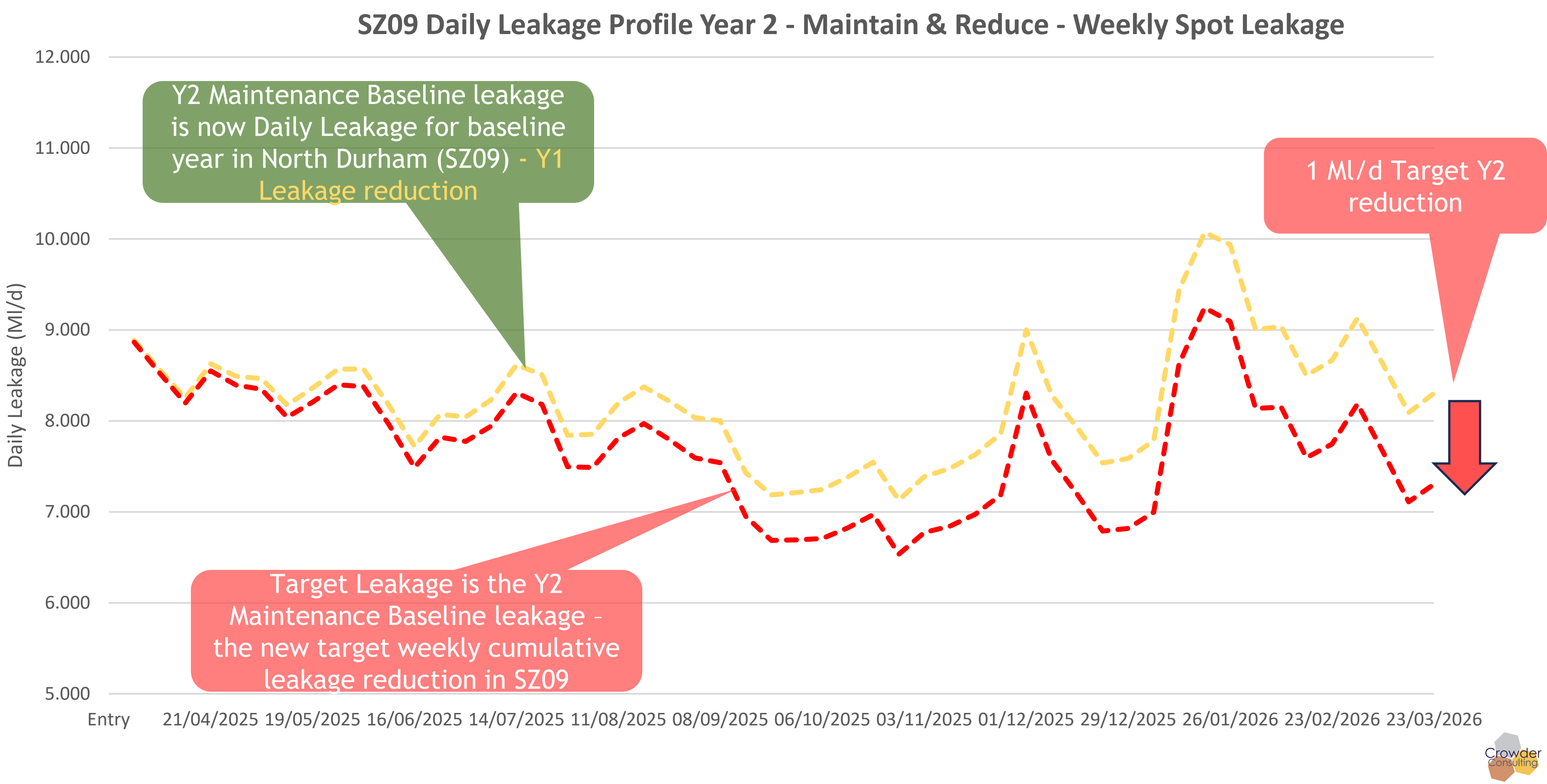
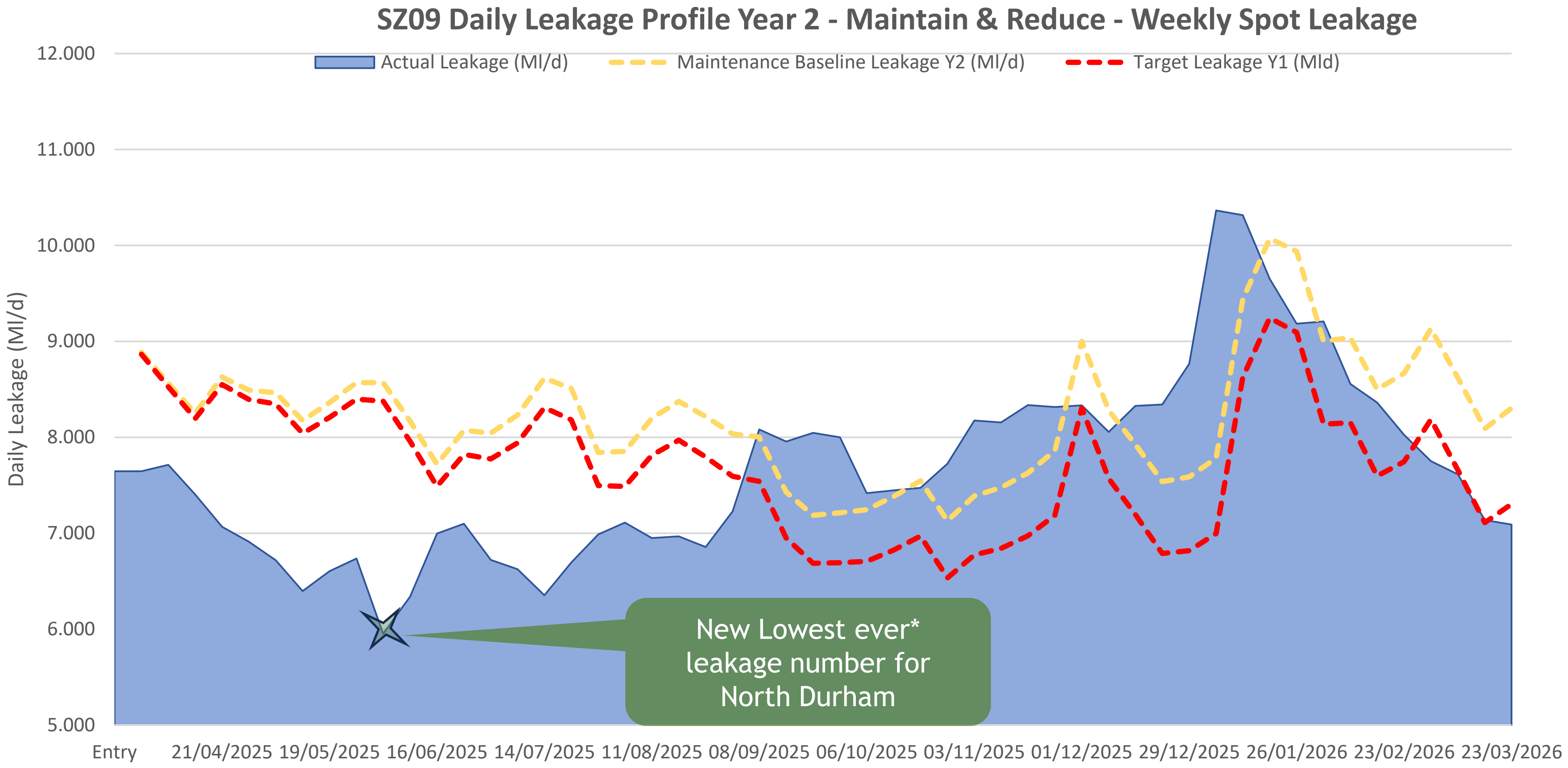
Tracking Leakage Reduction

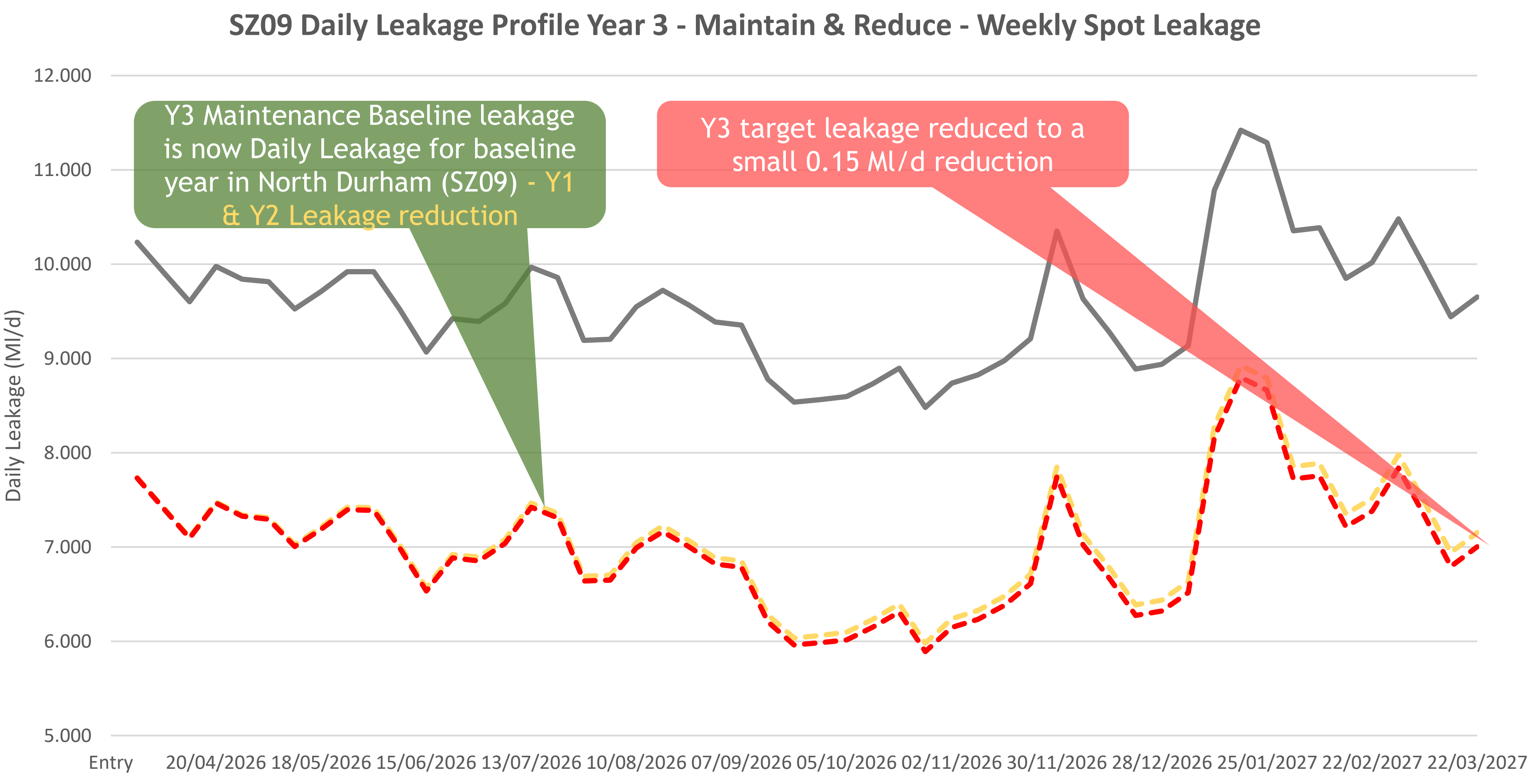


Tracking Leakage Reduction

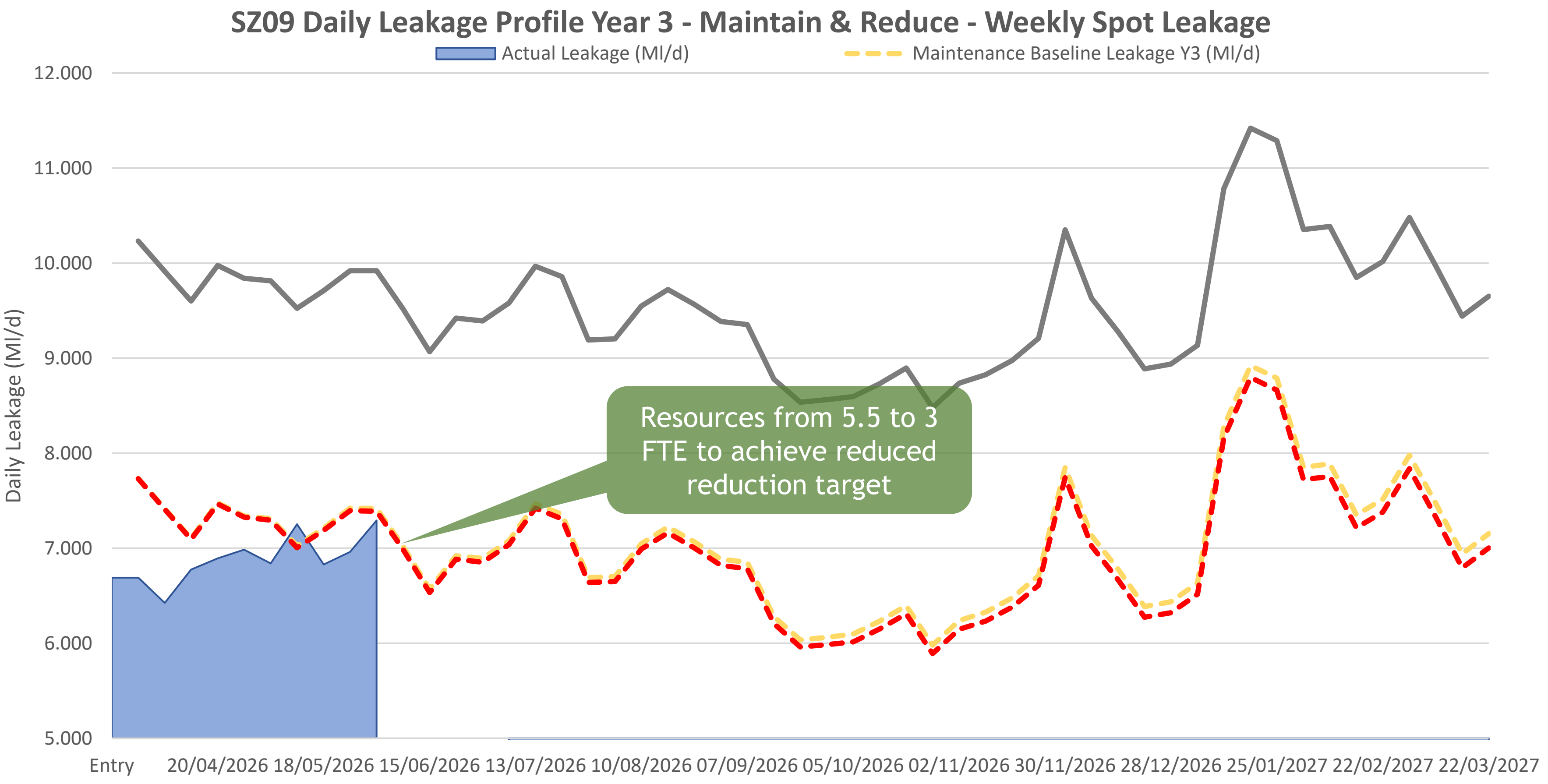


Crowder Consulting

Tracking Leakage Reduction



Tracking Leakage Reduction



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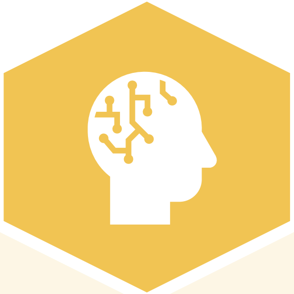
Refined Approach

Target DMAs using Netalytics based on accurate excess leakage levels, then using size factor to prioritise DMAs for detection plans

Use AI and Netops to determine and effectively plan specific areas within DMAs for leakage detection. AI Noise logging technology reduces false positive POIs further reducing leakage investigation cycle time

Cyclical Smart Investigation Process both improves AI accuracy and DMA plan effectiveness. Complementing noise logging deployment and POI investigation tasks enables less experienced technicians to rapidly develop



Complex DMAs may need a different approach. Netops is an effective tool to plan and communicate sectorisation activities to localise larger leaks

Thank you for listening.

Any questions?

Crowder Consulting

ORBIT™ ORIGIN

Presented by: Dr Arlene Arias, Director of Technology

WHO ARE WE

ORIGIN

ORIGIN TECH LTD

- Founded in 2019 in the North-East of England
- Develops novel technologies for network integrity and water loss prevention
- Products “Find” Origin Orbit® and “Fix” Origin No Dig®
- Deployed across most UK water companies and several international territories
- 50+ staff, 40+ specialist field technicians

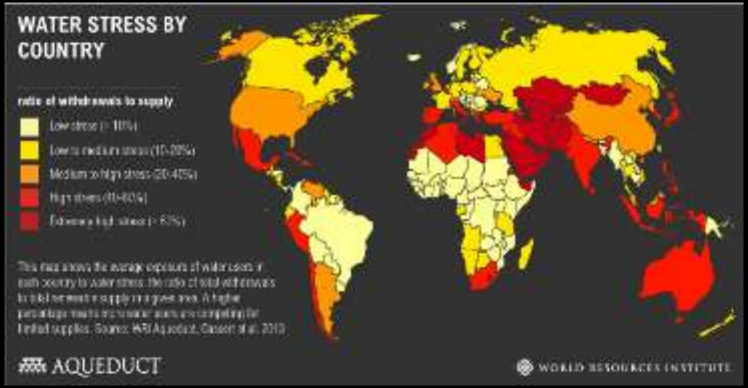
Media Features 11 Features in the Media	**Global Water Awards 2026** Distinction – Breakthrough Technology Company of the Year	**BUSINESS iQ Winner 2026** Innovation Award

THE CHALLENGE

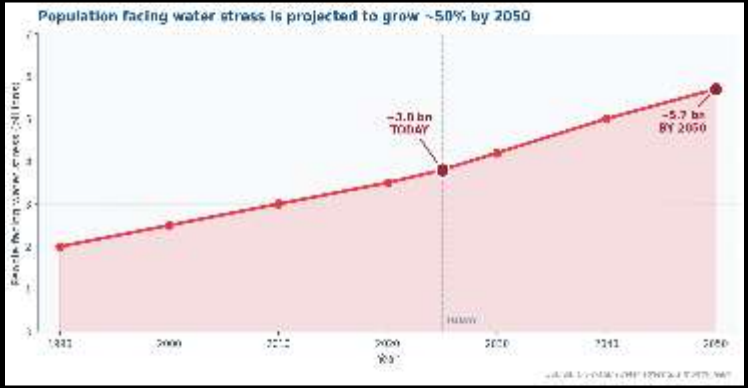
THE GLOBAL WATER LOSS CHALLENGE

Treated water is scarce, and almost a third is lost before it reaches a customer.

Where we are now:



If nothing changes:



~3.8 bn people face water stress today.

$39 bn annual direct cost of non-revenue water

~5.7 bn people projected to face water stress by 2050

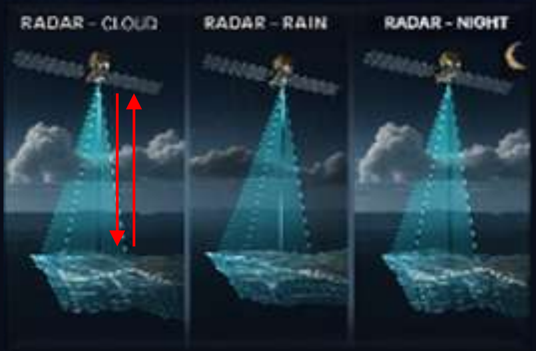
Up to 6% GDP loss in worst affected regions

THE SOLUTION

SYNTHETIC APERTURE RADAR TECHNOLOGY

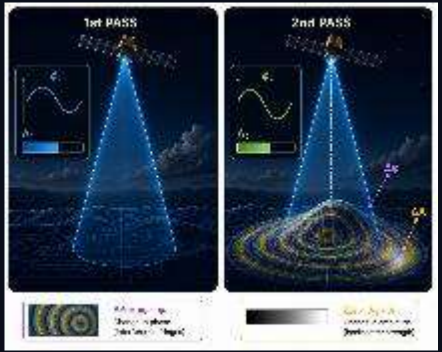
Wide-area view

A single satellite pass covers an area of tens of thousands of square miles.



Uninterrupted sensing

Active radar doesn't depend on sunlight or clear skies. Every revisit returns usable data unlike optical.



Motion & Reflectivity

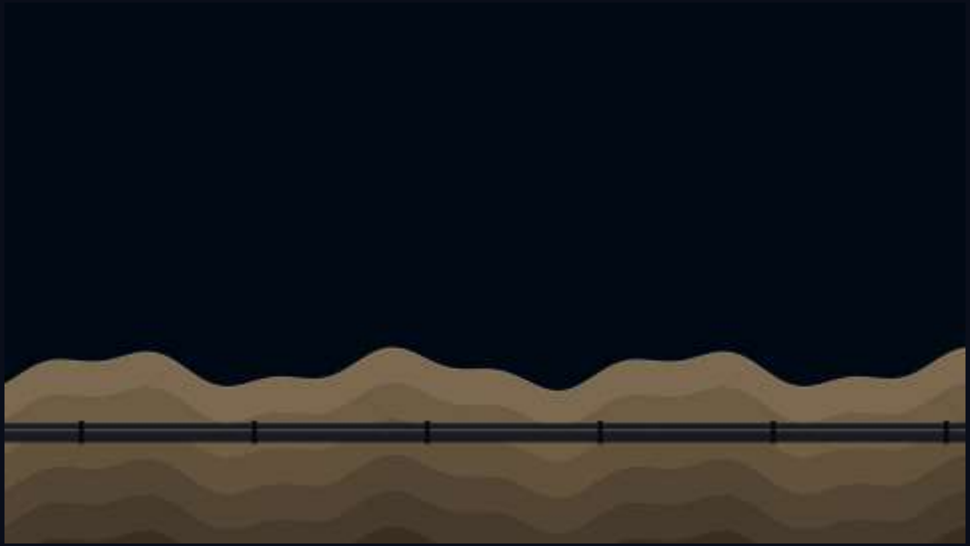
Phase $\Delta\phi$ reveals line of sight ground motion. Amplitude $\Delta\sigma^{o}$ measures backscatter intensity. Sensitivity is governed by acquisition geometry and sensor configuration

KEY INSIGHT • Each pixel is a time series, not a snapshot. Persistent deviations from a multi-year baseline distinguish genuine leakage from noise, the foundation of our ML classifier.

THE SOLUTION

SYNTHETIC APERTURE RADAR TECHNOLOGY

Comparing multi-passes over the same pixel.



SAR Satellite passes over a leaking buried pipe. In practice we take a large number of acquisitions.

$\Delta\phi$ (phase shift) between passes $\propto$ line-of-sight ground motion. InSAR resolves millimetre-scale subsidence and uplift.

$\Delta\sigma^{o}$ (Amplitude change) $\propto$ surface dielectric / moisture. Backscatter may increase or decrease depending on surface roughness and moisture state

THE SOLUTION

AI DRIVEN LEAK DETECTION

1. Data Ingestion

Multi-year SAR time series ingested per pixel. GIS network topology and historical failure data layered in.

2. Feature Extraction

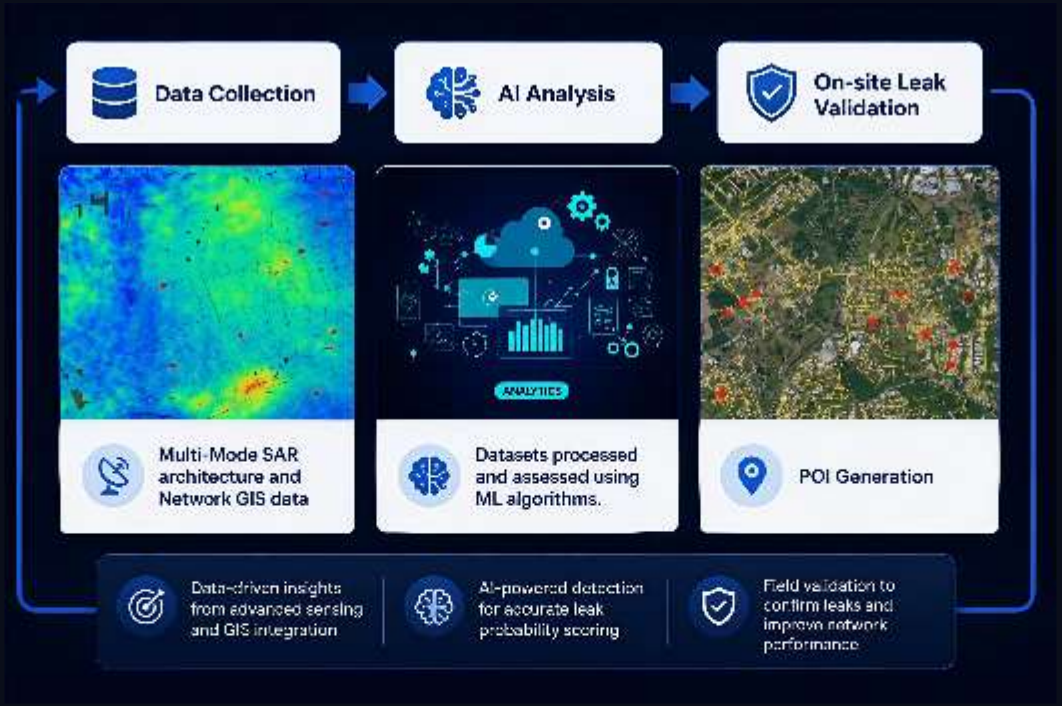
Backscatter amplitude (σ^0) soil moisture proxy. InSAR phase (φ) ground motion. Temporal statistics extracted from both signals.

3. ML Classification

Trained on 5+ years of confirmed failure data. Persistent co-located anomalies scored.

4. Points of Interest

Ranked POIs delivered to field teams. Technicians investigate high-confidence candidates, not just random line walking.



CASE STUDY · UNITED KINGDOM

THAMES WATER

Satellite-Based Network Leak Detection

Duration: 13 Months | **Status:** Ongoing

27,000 km	12,000 km²	Monthly
Pipeline Assessed	Area Covered	Satellite Scans

CHALLENGE & APPROACH

PROJECT SCOPE

Client Challenge

Required identification of potential underground water leaks across a large ageing distribution network

Project Aim

To prioritise field investigations and reduce non-revenue water losses. Targeting at least 1000 confirmed leaks per month.

Methodology

This methodology detects subtle surface deformation and dielectric anomalies indicative of subsurface leakage across all areas of their network.

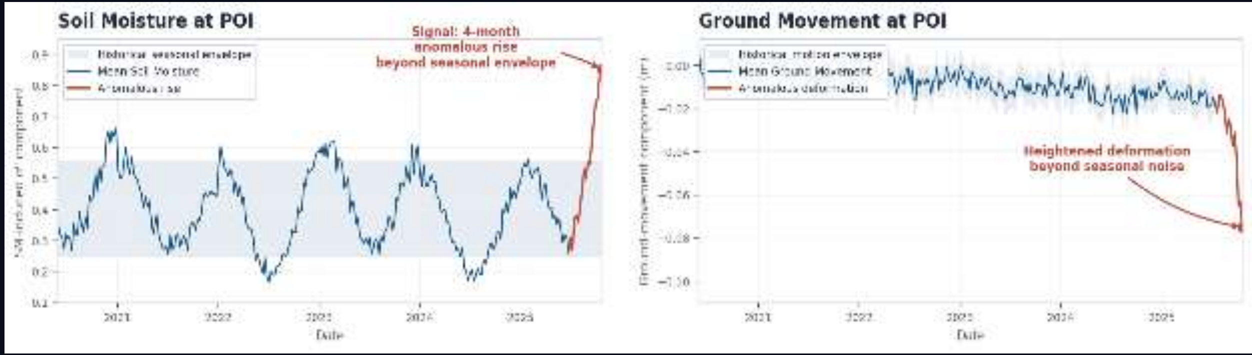
CHALLENGE & APPROACH

POI SIGNAL INTERPRETATION

Persistent anomalies at a location indicate potential leakage.

London, UK

Time series signals at a point of interest



Why it matters

Identifies persistent soil moisture anomalies from SAR backscatter indicative of subsurface water leakage

Why it matters

Independent indicator that, when combined with moisture anomalies, improves detection and reduces false positives

Co-located anomalies in both signals increases confidence in a leak candidate

OUTCOMES & IMPACT

ORBIT ORIGIN

MEASURABLE RESULTS FOR THAMES WATER

4,200
Leaks identified

>1000
Confirmed leaks per month

35 ML/d
Total Leakage Reduction to Date

72–83%
Accuracy

Operational Benefits

- Multiple DMAs supported operational leakage reduction across network.
- Field crews targeted with precision, reducing investigation time.
- Faster outbreak response through rapid turnaround processing.
- Significant non-revenue water reduction across urban, suburban & rural environments.

KEY DELIVERABLES · Route Maps · Detailed Reports · Live Dashboards · GIS Datasets · Field Investigation Support

ORIGIN

CASE STUDY · UNITED KINGDOM

UNITED UTILITES

Satellite-Based Network Leak Detection

Duration: BAU | **Status:** Ongoing

42,000 km	Monthly	12,000 km²	1034	15.1
Pipeline Assessed	Satellite Scans	Area Covered	Leaks Identified to date	ML/d Saved

ORIGIN

THANK YOU

FIND & FIX™ ORIGIN

NO DIG™ ORIGIN

ORBIT™ ORIGIN

SAVI™ ORIGIN

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Pressure Management and Leakage

From Pressure Management to Network Optimisation

July 2026

Chris Rees, Group Commercial Director

Twenty-five years ago, we reduced pressures to reduce leakage and prevent bursts. Today we manage pressure to optimise networks. What next?

Why are we still talking about Pressure?

One operational intervention. Multiple business outcomes:

- Lower leakage
- Fewer bursts
- Fewer customer contacts
- Lower SI risk
- Reduced water quality risk
- Lower PCC (pressure-sensitive demand)
- Longer asset life

The industry has changed.....a little

TECHNOLOG

2000's	2010's	2020's	2025+
PRV Installation	**Optimisation**	**Intelligent Control**	**Network Optimisation**
Thousands of PRVs installed at DMA level and below	Proactive PRV maintenance and optimisation with modulation	A dramatic increase in advanced pressure control through pressure modulation	Use of AI and near real time data for intelligent, actionable insights

Pressure management changes from a specialist leakage activity into an operational strategy

Pressure in Leakage Estimation and Reporting

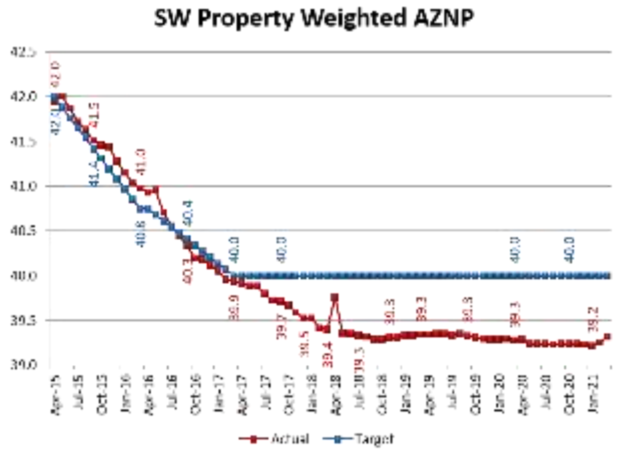
Pressure influences both leakage reduction and leakage reporting. The confidence and granularity we have is crucial to accuracy and efficiency.

- Average Zonal Pressure and Average Zonal Night Pressure
- DMA Specific Hour to Day Factors
- N1 Pressure Correction Factors
- Data Quality and Validation

Question:

How are the pressure dependent components of leakage going to contribute to future leakage reporting?

Three lessons from practice

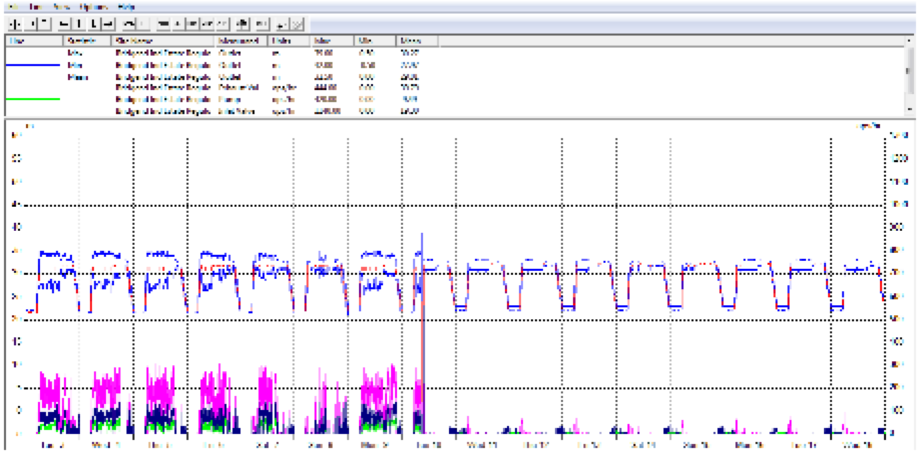


Optimise pressure, trust data, predict failure

Lesson 1: optimisation is more valuable than simply reducing pressure. It’s about finding the lowest pressure that still delivers an excellent customer service and maintaining those benefits.

Three lessons from practice

TECHNOLOG



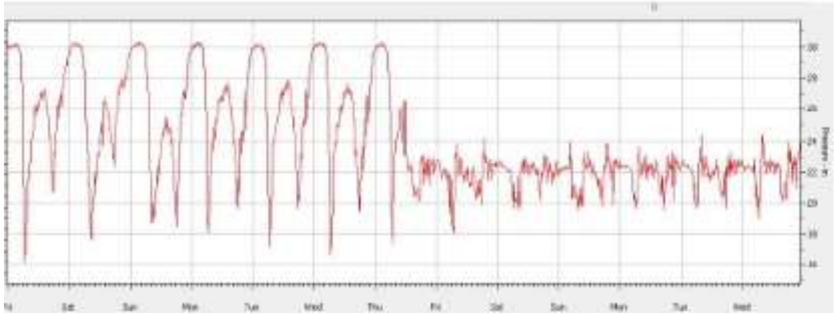
Optimise pressure, trust data, predict failure

Lesson 1: optimisation is more valuable than simply reducing pressure. It's about finding the lowest pressure that still delivers an excellent customer service and maintaining those benefits.

Lesson 2: pressure data is becoming as valuable as pressure control. Increasingly, the data tells us when assets need attention before customers notice a problem.

3 lessons from practice

TECHNOLOG



Optimise pressure, trust data, predict failure

Lesson 1: optimisation is more valuable than simply reducing pressure. It's about finding the lowest pressure that still delivers an excellent customer service and maintaining those benefits.

Lesson 2: pressure data is becoming as valuable as pressure control. Increasingly, the data tells us when assets need attention before customers notice a problem.

Lesson 3: pressure management isn't just about PRVs. Pump optimisation, predictive maintenance and integrated control are all becoming part of the same discipline. We're moving from managing individual assets to managing whole systems

TECHNOLOG

What will define AMP8?

Integrated optimisation rather than isolated interventions

- Continuous optimisation
- Predictive Maintenance
- Integrated Telemetry
- AI-assisted decisions
- Outcome-based operations

To conclude...

Horizon Water Infrastructure

Future Water Association

HUBBELL

SEVERN TRENT

Thank you

Upcoming Events

Become a Member