26th Annual Leakage Conference

BIRMINGHAM
MONDAY 24 NOVEMBER 2025
TUESDAY 25 NOVEMBER 2025

Prevent (PALM)



Organised by
lodestar

Media partner
THE UK WATER REPORT
POLICY | REGULATION | FINANCE

Chair’s welcome



Bob Taylor

Chief Executive Officer

Portsmouth Water

Our exhibitor-supporters and media partner

aqualogic water conservation

arqiva

ATMOS INTERNATIONAL

AVK

BERMAD

CLA-VAL

FYLD

GUTERMANN

HWM Global

OVARRO CONNECTING TECHNOLOGIES

SME WATER

suez

SYNTHOTECH

TECHNOLOG

TETRA TECH

rps A TETRA TECH COMPANY

THE UK WATER REPORT POLICY | REGULATION | FINANCE

GWI GLOBAL WATER INTELLIGENCE

Thank you to last night's Pre-Conference drinks sponsor

TETRA TECH | rps A TETRA TECH COMPANY

Organised by lodestar

Media partner THE UK WATER REPORT POLICY | REGULATION | FINANCE

Housekeeping 1

- Turn **Phones/devices** to silent or off please
- **No fire alarms** expected
- **Q&As** – Raise your questions through:
  - **In the room – Roving microphones**
  - **Livestream – via Slido**
- We will also be **seeking your views through SliDo polls**
  - **Get the slido app – use the handle #4474324 (info sheet on your table)**
- **Feedback forms**
  - **Hard copy within your Event Guide and QR code on your table to access online (editable PDF or online form on Survey Monkey)**



PALM

Four pillars of leakage management:

- **P**revent
- **A**wareness
- **L**ocate
- **M**end

PREVENT (PALM)

Pressure Management: Where to next?

Chair



Tanya Dady
Smart Solutions Director
Dayworth Consulting

Panel



Adam Bose
Pressure Management Technical Specialist
Yorkshire Water



Josh Davies
System Planning Lead
Thames Water



Akshat Sharma
Strategic Business Planning and Programme Manager
Thames Water



Ross Stokes
Head of Strategic Water Networks
Severn Trent Water

Yorkshire's approach to drought related enhanced pressure management

Adam Bose



YorkshireWater

Background…

2022 Drought
over 1200 new AP Controllers installed covering c.1.5m props

How can we quickly drop network pressures

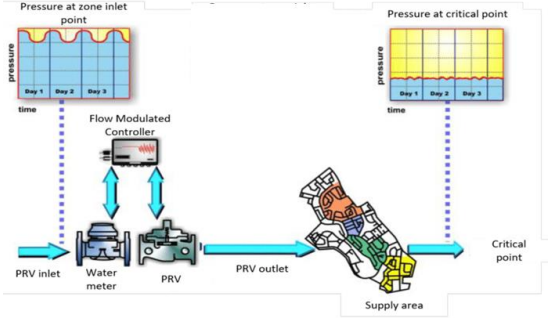


Framework focused on Asset Health for PRVs
Predictive JIT Maintenance of PRVs

98% predictive failures resolved prior to incident

New Pressure Management and ongoing optimisation 21mld savings

Regional Pressure Reduction & Network Calming





Drought 2025

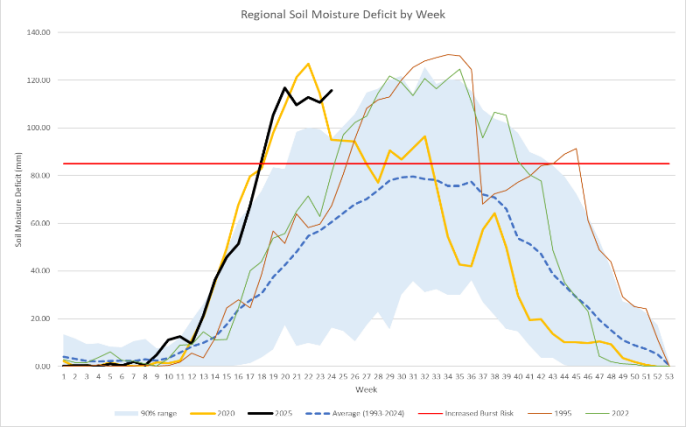
YorkshireWater

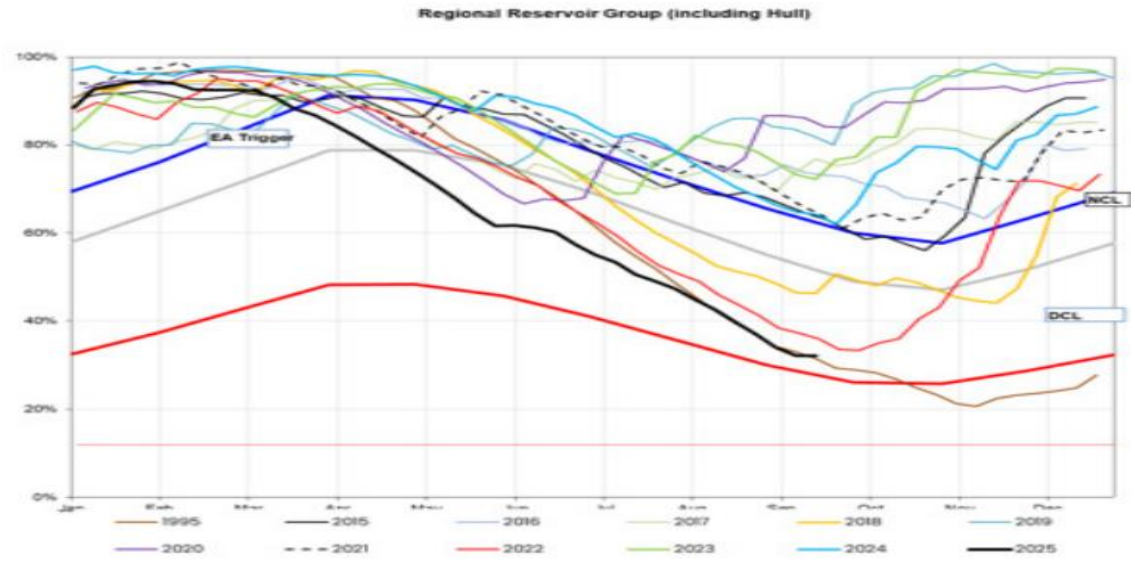
Hosepipe restrictions are in place

Our reservoirs are critically low so we're asking all our customers to hang up the hosepipes.

From 11th July, there are hosepipe restrictions in place across Yorkshire following the driest spring on record.
on 12th June the Environment Agency announced that Yorkshire had entered drought status following the driest spring in 132 years.
Water companies use the EA's drought triggers to identify and plan how to act in different drought conditions.







A Smarter, Calmer more Resilient Network with a robust PRV Framework to ensure Service and Operability is maintained

Our People

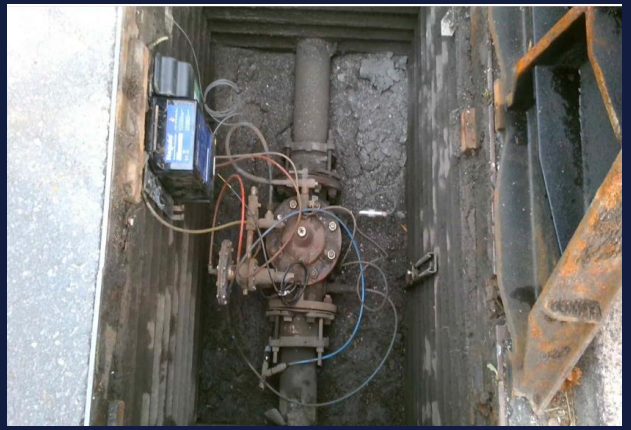
Our Business

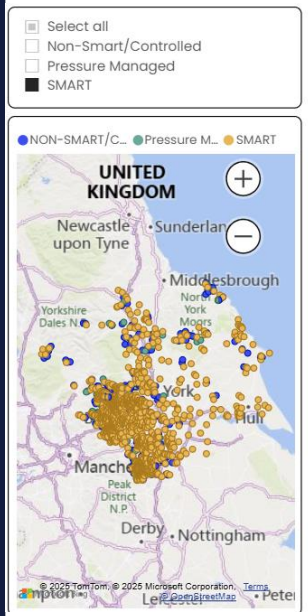
Our Customers

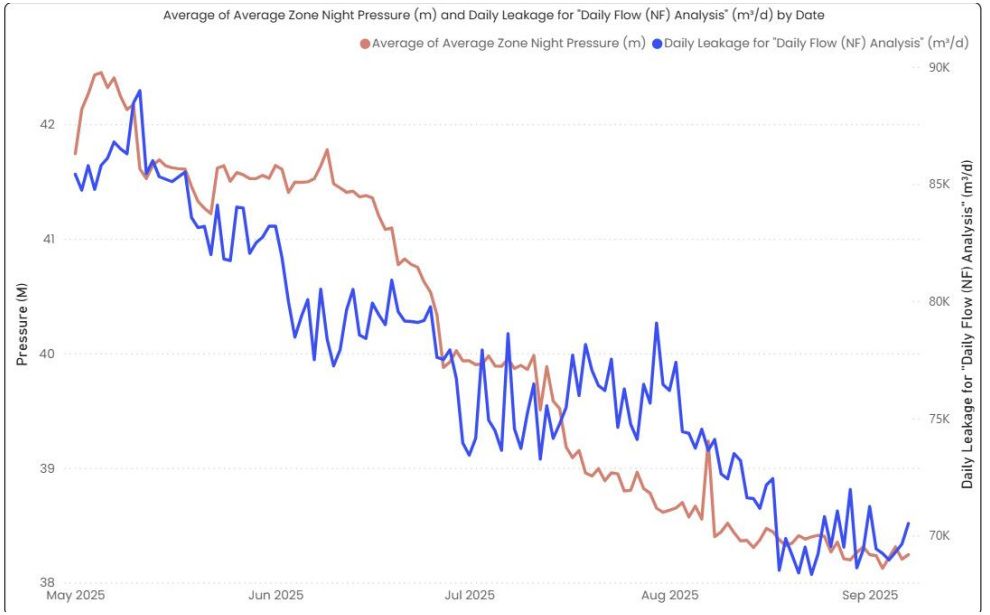
YorkshireWater

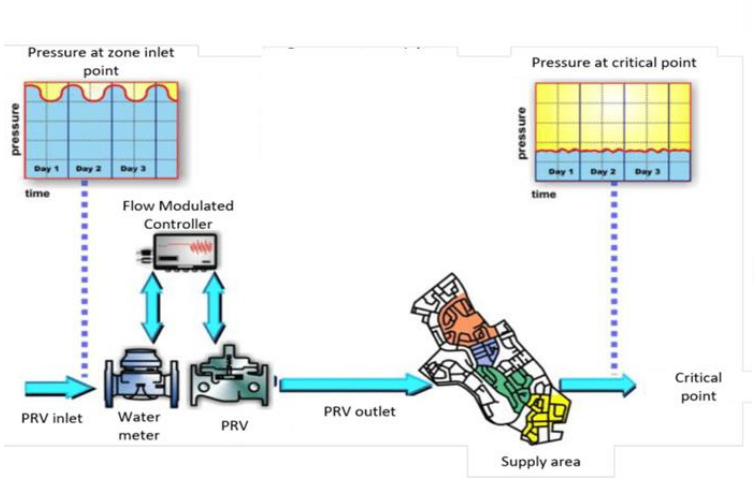
Pressure Management

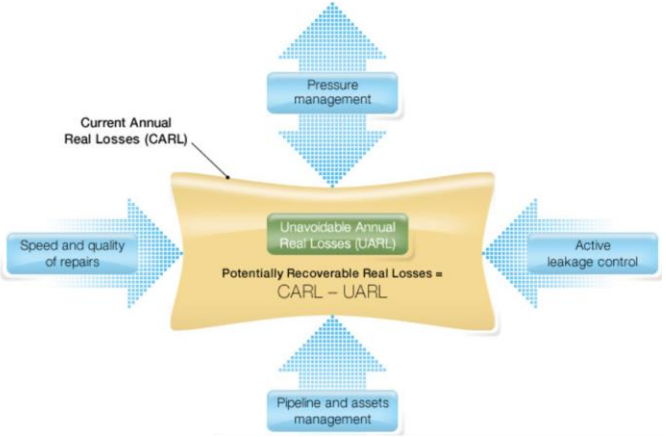
1200 controllers
Modulation
13mh night 16mh day target min CPP
1141 PRV's reduced
5600 individual reductions
840 fully optimised
300 still being optimised
15% increased
10mld leakage reduction
ANZP 45mh down to 41mh







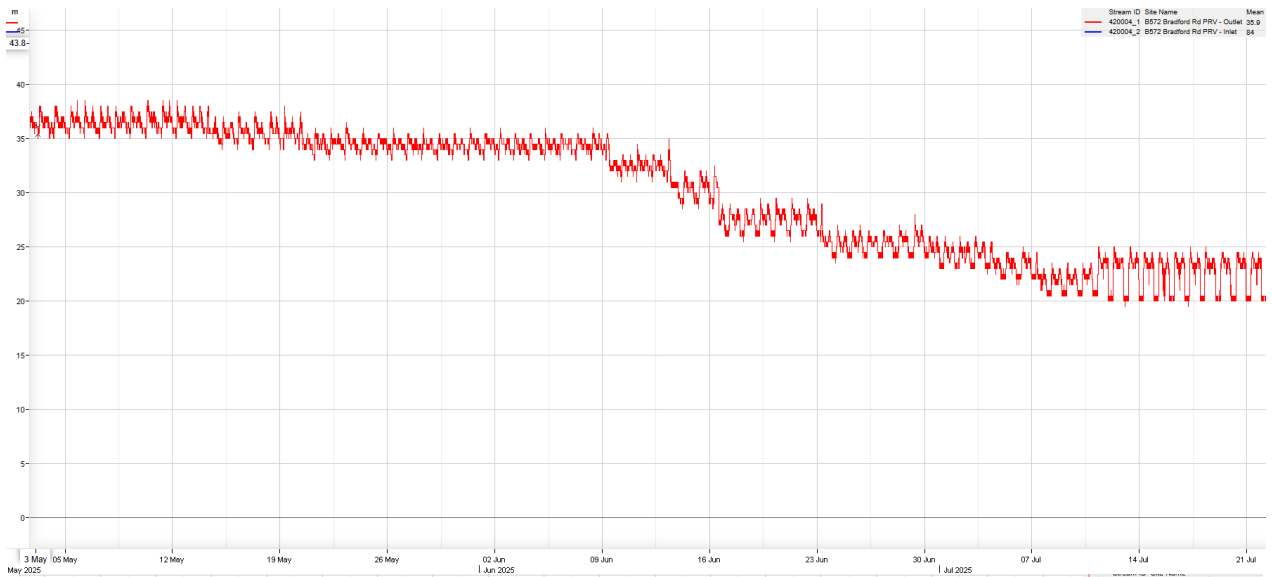


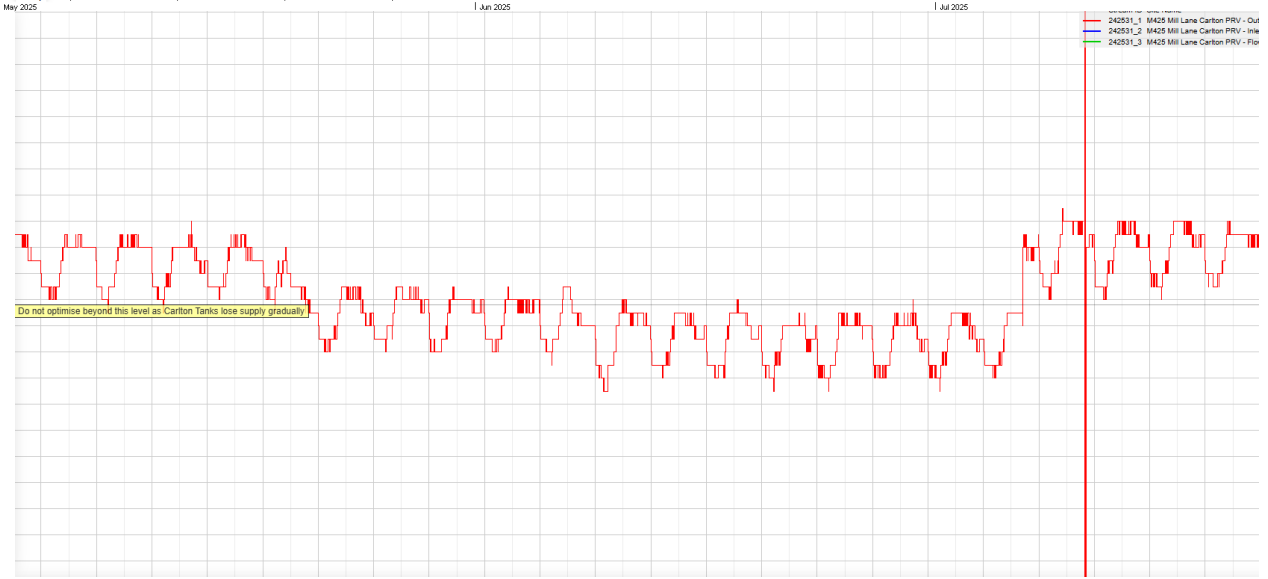


Benefits of Controllers

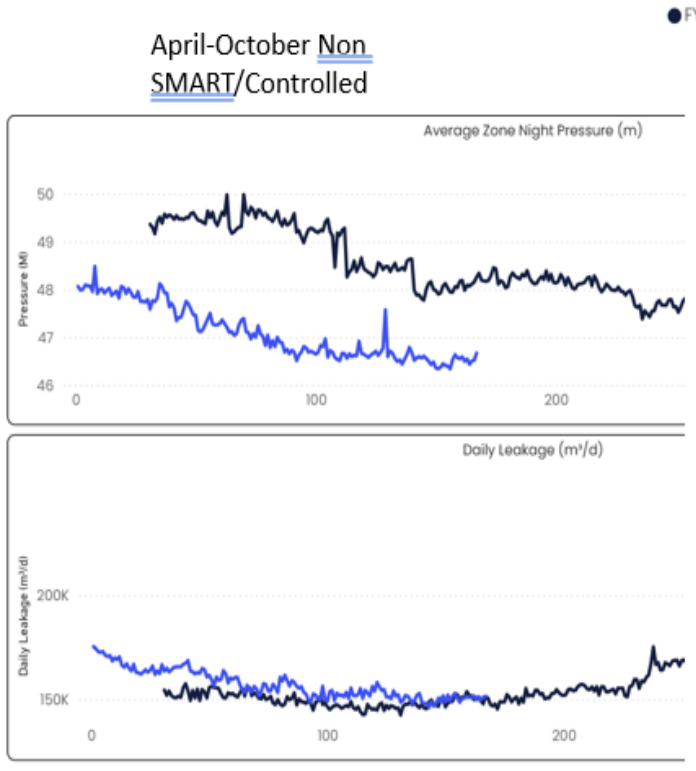
1140 PRV reduced in 6 months
5600 individual remote PRV reductions
Equivalent 9000+ man hours
Cost reduction
No H+S risk
Data visibility
Remote control
Fast response time
Ability to react
Minimise customer impact



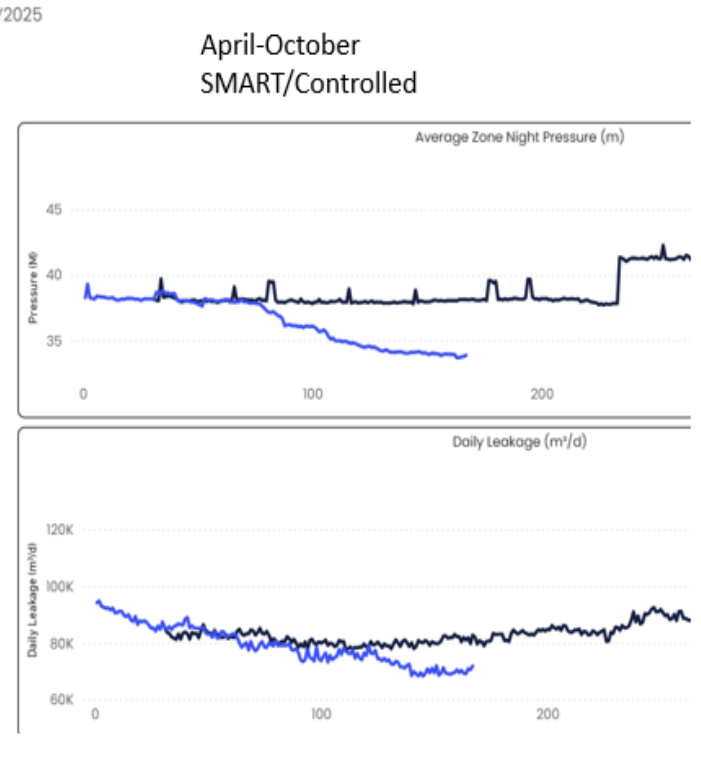




Benefits of enhanced Pressure Optimisation



No change in daily leakage



10mld reduction in daily leakage

- 10mld reduction
- 50% reduction in burst
- Lower customer contacts
- Overall AZNP reduction
- Change in DG2
- Reduced asset failures
- Help to achieve Leakage and CML PC
- 6.8% weekly reported leakage reduction



YorkshireWater

Thank You

YorkshireWater



26th Annual Leakage Conference

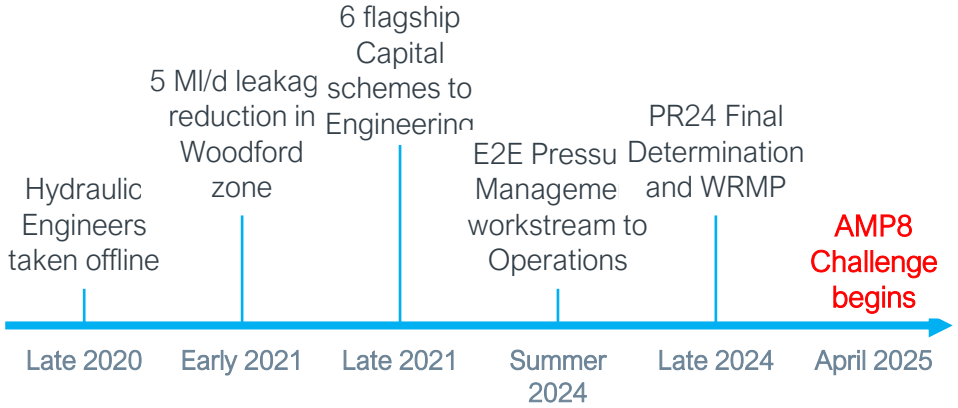
Pressure Management
A holistic approach

Calm Systems Ethos and Strategy

‘Systems’ thinking

Aim and Strategy

- To implement a **wholesale review** driven by data and hydraulic modelling, to enable the **most optimum water supply operation** including holistic risk management and prioritised investment – mitigating risk on:
  - ❖ Firefighting flows & property flooding
  - ❖ Water quality
  - ❖ Customer interruptions & complaints
  - ❖ **Leakage**
  - ❖ Energy usage



Workstreams

- New Pressure Management and Existing Optimisation
- Legacy Pump Control System Upgrades
- System Reconfiguration opportunities
- TM flow imbalances & Proactive metering enhancements



History and AMP8 plan

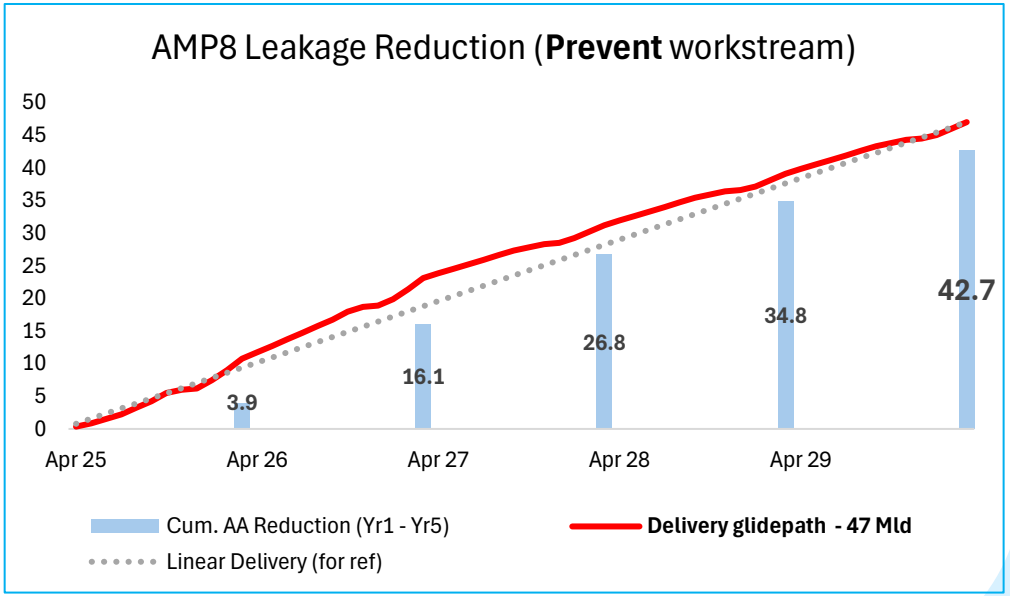
Pressure Management in Thames Water

- **First PRV in the TW area**, was installed in the Cotswolds in 1963.
- **~1200no Pressure Managed Areas (PMA)** across the company – 50% split between London and Thames Valley
- 60% of the properties and 50% of the network is pressure managed
- 860no are Monitored PMAs – ~80% of the leakage maintained is in London alone.

AMP	New PM - Mld	Optimisation – Ml/d (*Calm Systems*)
AMP3	101	
AMP4	67	
AMP5	43	
AMP6	32	31
AMP7	22	29*

AMP8 Challenge

- Forecast to **drop AZP by 3mH** over the AMP
- **47Ml/d leakage** reduction
- 85%-15% London-TV split, enhanced plan aligns with the WRMP



Drought Pressure Management – A necessity, two approaches!

Slough, Wycombe, Aylesbury

1. 123 PMAs optimised by 5mhd
2. ~64% reversed, 51% fully, 13% partial

*Context – 5mhd drop done in one step with no analysis due to supply/demand event. Done in peak of summer. Geographical differences between SWOX and SWA

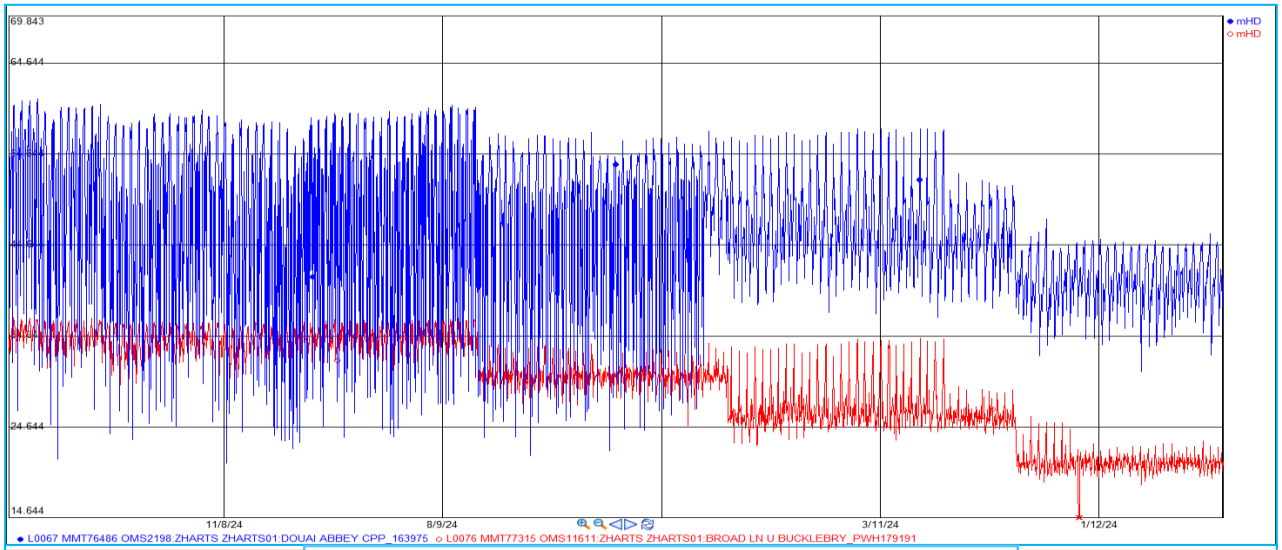
Swindon/Oxford

1. 124 PMAs optimised by 3.4mhd
2. ~13% reversed, 6% fully, 7% partial

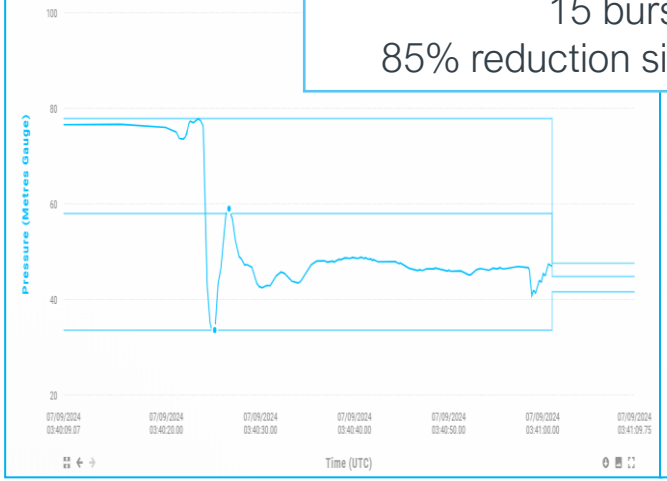
*Context - Analysis carried out targeting 15mhd at highest property. Staged approached in two steps per week

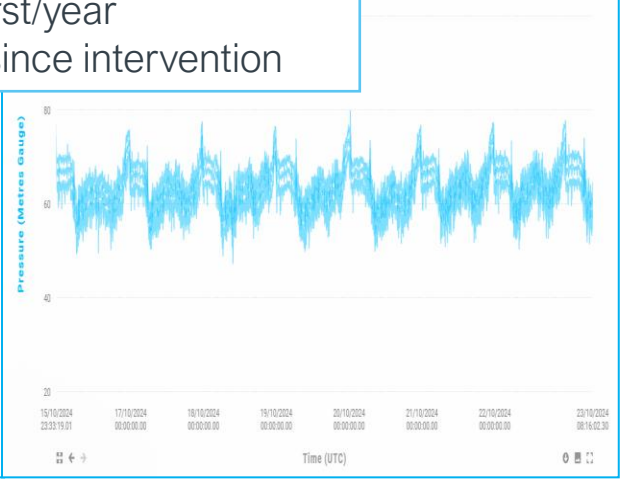
When managed with customer teams, field staff and control teams with single controlling mind via MS Teams groups, chats and internal comms to ensure awareness, timescales & escalations – this work can proceed and succeed!

Harts Hill FMZ Spotlight – Reduction in Leakage, Bursts, Complaints, Supply Interruptions, Energy Costs



15 burst/year
85% reduction since intervention





Issues faced:

- Frequent bursts historically on PVC trunk mains, resulting in widespread supply interruptions incidents and high-level complaints across Bucklebury area in Thames Valley.
- 4.4bar Surge in 1.6s due to private set of pumps
- Area prone to DG2 Low Pressure risks annually, resulting in inflated pressures set by the local Systems Optimisation team.

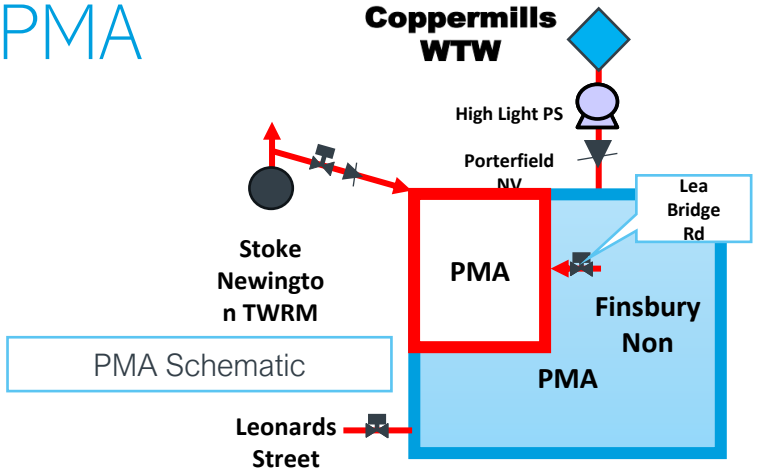
Resolution actions taken:

- Rehab of the critical section of the main carried out, including the relocation of the WBS supplying this area due to growth.
- Opportunity to optimise the WBS delivery pressure by 15mhd.
- Profile at WBS changed from flow to timed profile and 3 amendments made to drop pressure.
- PRV installed on customer's supply on 11th Oct to regulate flow and pressure and remove the usage related surge events.
- Pump speed adjusted inline with optimisation. Max pump speed reduced from approx. 85% to 75%.
- Energy savings = £7k p/a

North East London - Finsbury PMA

15 years of hard work

- Commissioning of Finsbury North PMA after 15years of effort and planning. 27,000 properties re-zoned
- Capital delivery enabled the flushing & commissioning of 36” with overground super HYD combined with Syrinix string and flow meter.
- Restrictions found in South area around Shoreditch being investigated.
- Calming pressure immediately & Ml/d benefit.
- Logging local issues around CP to enable further optimisation which adds a new Phase 2.
- Unlocks opportunity for 200,00 props in lower areas to be optimised with restriction removal (increased reticulation



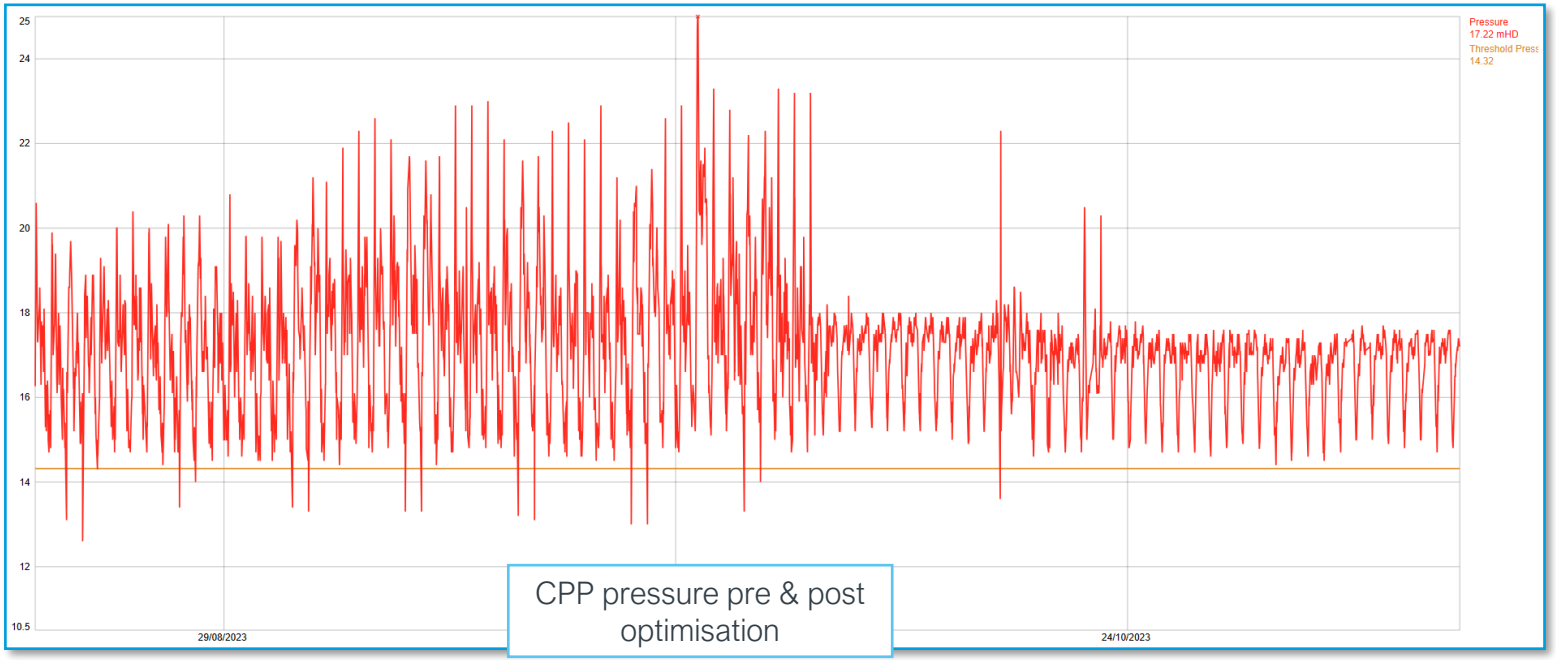
PMA Schematic


PRV & control valve setup

Finsbury PMA Impact

15 years of hard work

- The PMA is fully Scada controlled with extra precautions installed due to the main 36” CI main feeding the area running through the bank of West Reservoir, N4.
- Trunk main monitoring and Non-return valve all signed off and approved by Hackney and Panel Engineer



CPP pressure pre & post optimisation

Future – what keeps me awake

- Growth, Water security and Climate change
- AMP9 strategy?
- People Strategy
- Leaving a Legacy



Thankyou

PRESSURE MANAGEMENT

Ross Stokes – Strategic Networks

SEVERN TRENT

WONDERFUL ON TAP

PRESSURE MANAGEMENT OVERVIEW

- **47,000km** of Water Network
- **30 years** of Pressure Management investment
- **~65%** of Network pressure managed
- **~4700** Pressure Regulating Valves (PRVs)
- **Collaboratively** managed cross directorate
- **ff million investment in AMP8** on Pressure Management



4.6m
households and business served

2.0bn
litres of drinking water supplied each day



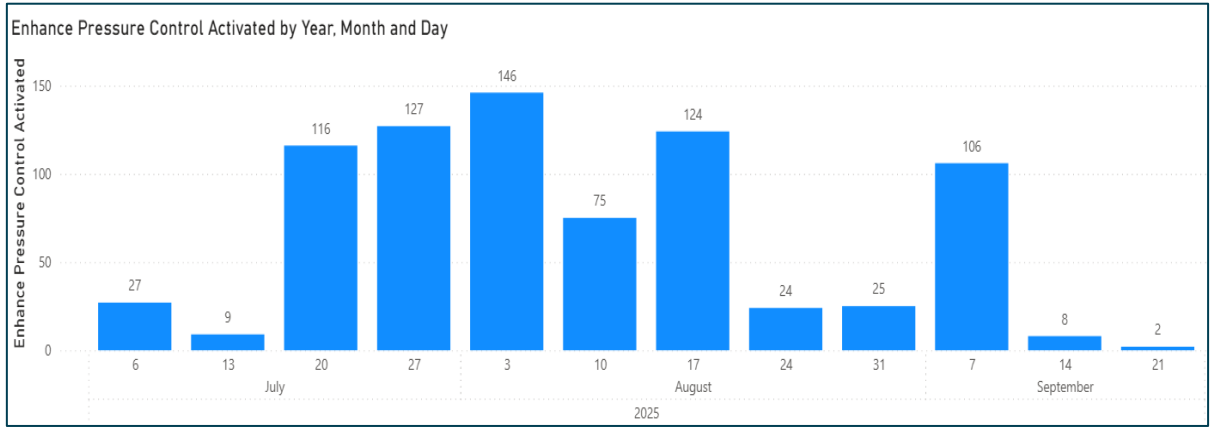
SUMMER OF 25

- We observed rapid **Soil Moisture Deficit** (SMD) increase in late April and triggered summer focus activity
- Our installation of pressure controllers in 2024 allowed us to **Enhanced Pressure Control** (EPC) over the summer period
- ~50% of our pilot operated **Pressure Regulated Valves** (PRV) currently have Controllers, of which **800 are in EPC** settings
- We are now installing further controller units to give us **greater flexibility** in future years

SMD – 7-day forecast



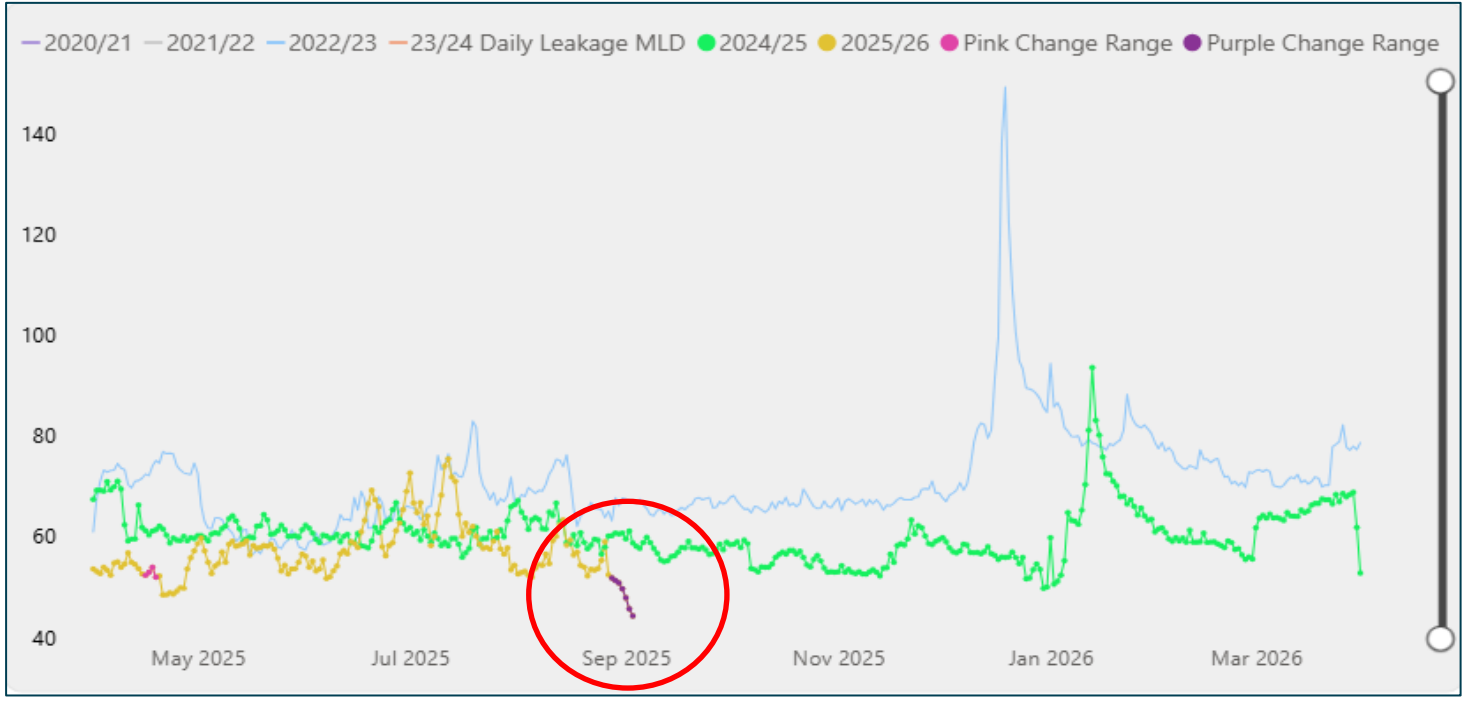
Controllers optimised into EPC Settings



BENEFITS – LEAKAGE & DEMAND REDUCTION

- Night-time demand in EPC Pressure Logged Areas has **dropped below historic levels** and remained
- As a comparison, PLAs in EPC were **10% lower** than the start of the year, whilst those not in EPC were **3% higher**.
- Estimated benefit is **11Mld in reduced demand**.

Nightline demand in DMAs with EPC active

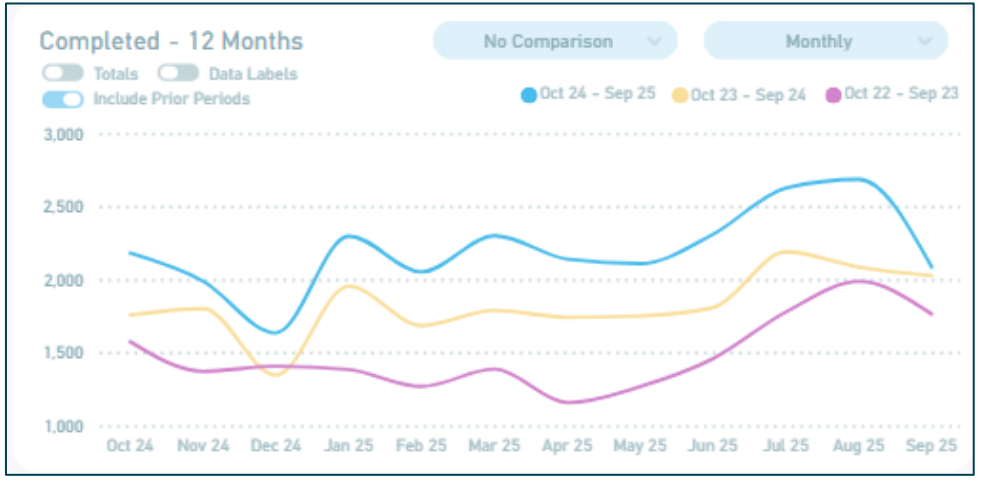




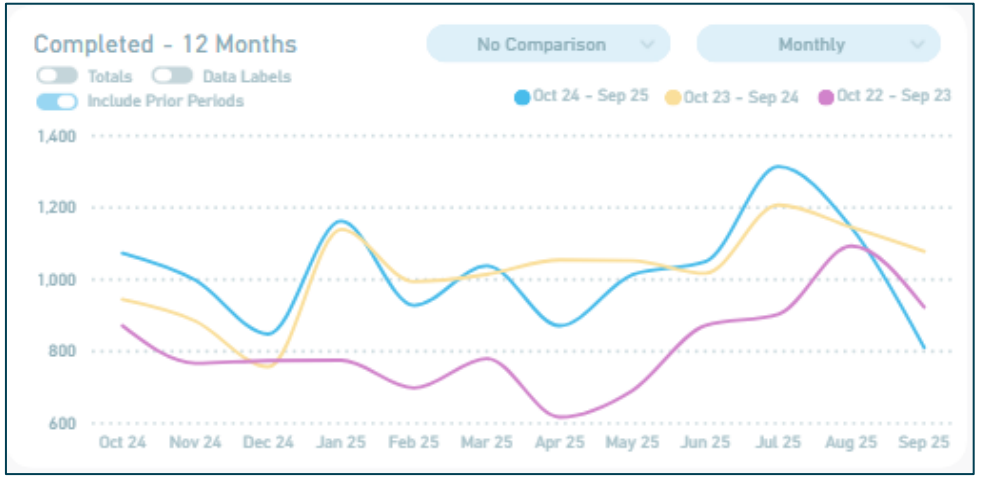
BENEFITS - ASSET HEALTH

- A calmer network is delivering an estimated **~20-30% reduction in Burst Mains** in DMA/PLA
- We have seen a **47% reduction in pressure** variance (10% off max pressure and 4% off min pressure) in areas with controllers.
- We have seen **reduced leakage find hours** in the areas with pressure controllers compared to prior years
- This equates to a **reduction in ~2200 leaks** in DMAs where Pressure variance was reduced
    - We will also see a reduction in **Supply Interruption, PCC and Pollution events**

Fixed Ancillary and Mains - **No Pressure Control DMAs**



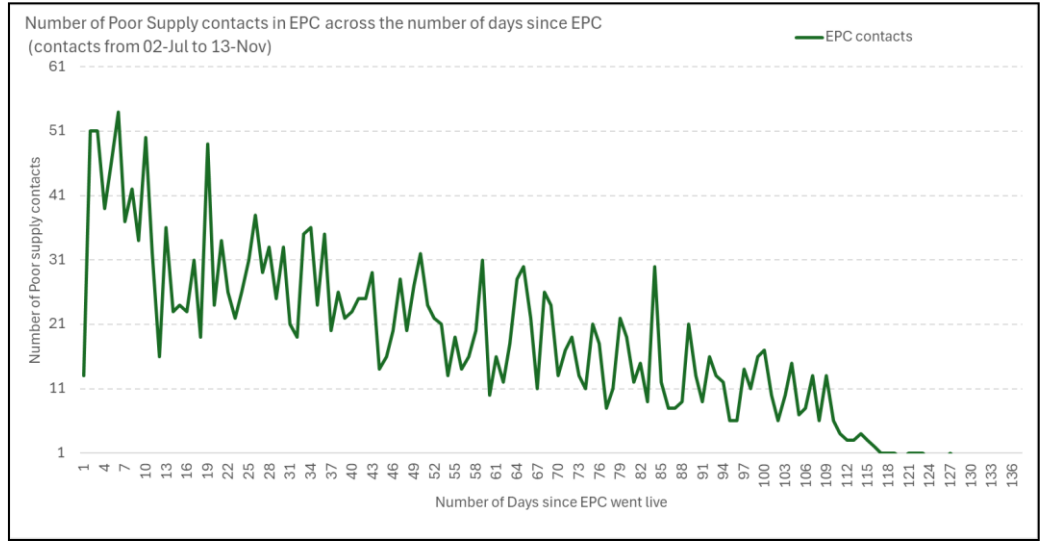
Fixed Ancillary and Mains - **DMAs with Pressure Control**



OUR CUSTOMER JOURNEY

- Nearly **800,000 households** are now on EPC
- **Less than 0.5%** of those customers have contacted us
- We have several steps on our Customer journey;
  1. Customer contacts – initial **triage process**
  2. Follow up call with a **Subject Matter Expert**
  3. Visit from a **Customer Inspector**

Customer contacts received vs time since EPC





- **Integrated showers and baths** are the most common issue we have seen, along with **shift workers** using facilities during the night
- We have shared our journey with **OFWAT**



POINTS TO CONSIDER

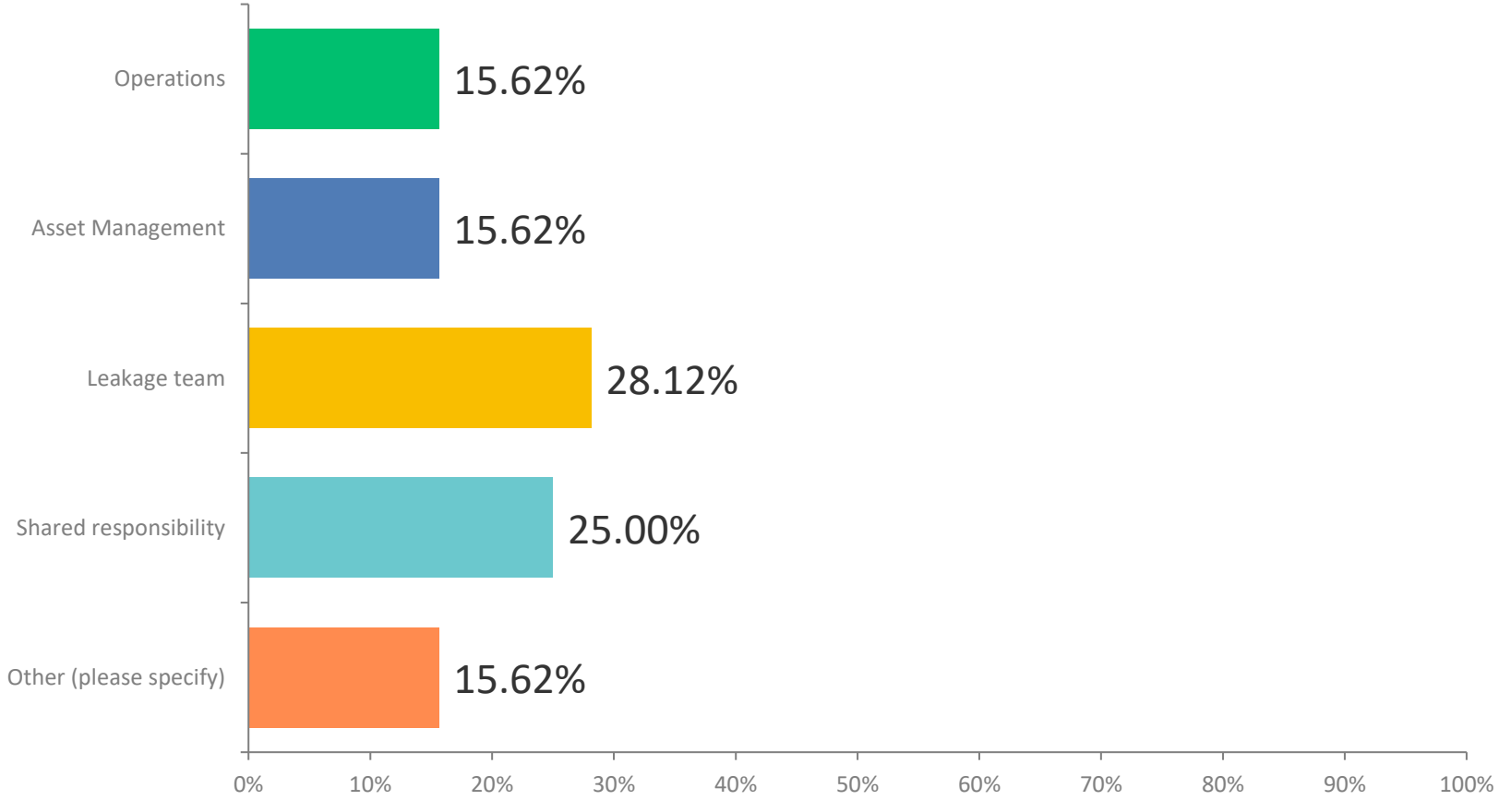
- **How do we become more consistent as a sector with Pressure Management?**
- **How could we collaboratively educate our customers about Water Resource Management?**
- **How do we influence bath/shower suppliers, so that products are sold within the guidelines that we operate to?**

Pressure Management Survey Results

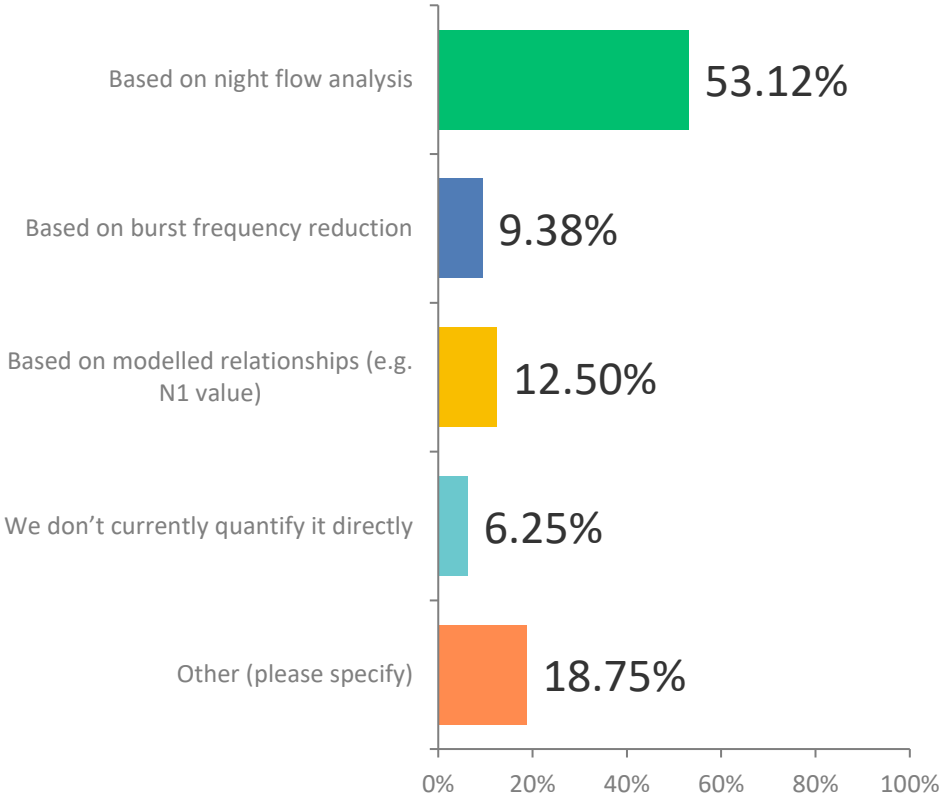
Annual Leakage Conference
25th November 2025

Q: Who “owns” pressure control in your company – Operations, Asset Management, or Leakage teams?

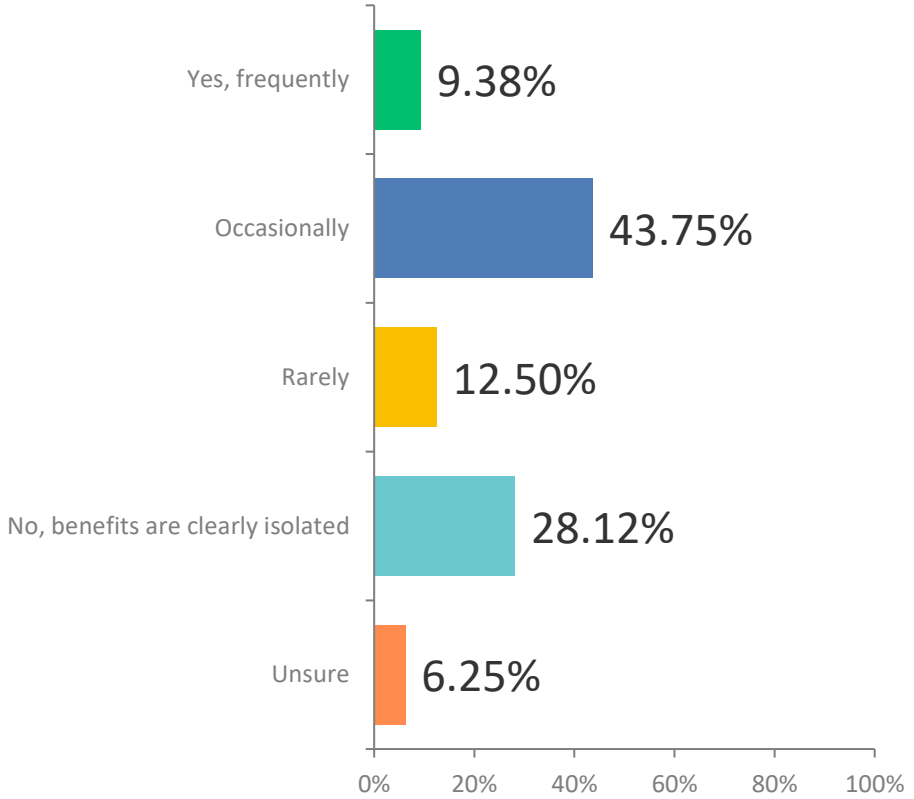
Answered: 32 Skipped: 0



Q: How do you quantify the true leakage benefit from pressure management?



Q: Are we overestimating pressure management benefits due to overlap with other activities?



Answered: 32 Skipped: 0

Thank you

Pressure Management Control Forum
Leakage Network

Adam Bose
Akshat Sharma
Joshua Davies
Ross Stokes

Panel discussion and Q & A

Chair



Tanya Dady
Smart Solutions Director
Dayworth Consulting

Panel



Adam Bose
Pressure Management Technical Specialist
Yorkshire Water



Josh Davies
System Planning Lead
Thames Water



Akshat Sharma
Strategic Business Planning and Programme Manager
Thames Water



Ross Stokes
Head of Strategic Water Networks
Severn Trent Water

Ground conditions, climate change and leakage



Tim Farewell

Director

Maplesky

MapleSky Environment & Infrastructure

Review of the UKWIR National Failures Database (NFD)

&

Understanding ground conditions for enhanced leakage management

Dr Timothy S. Farewell
tim.farewell@maplesky.co.uk

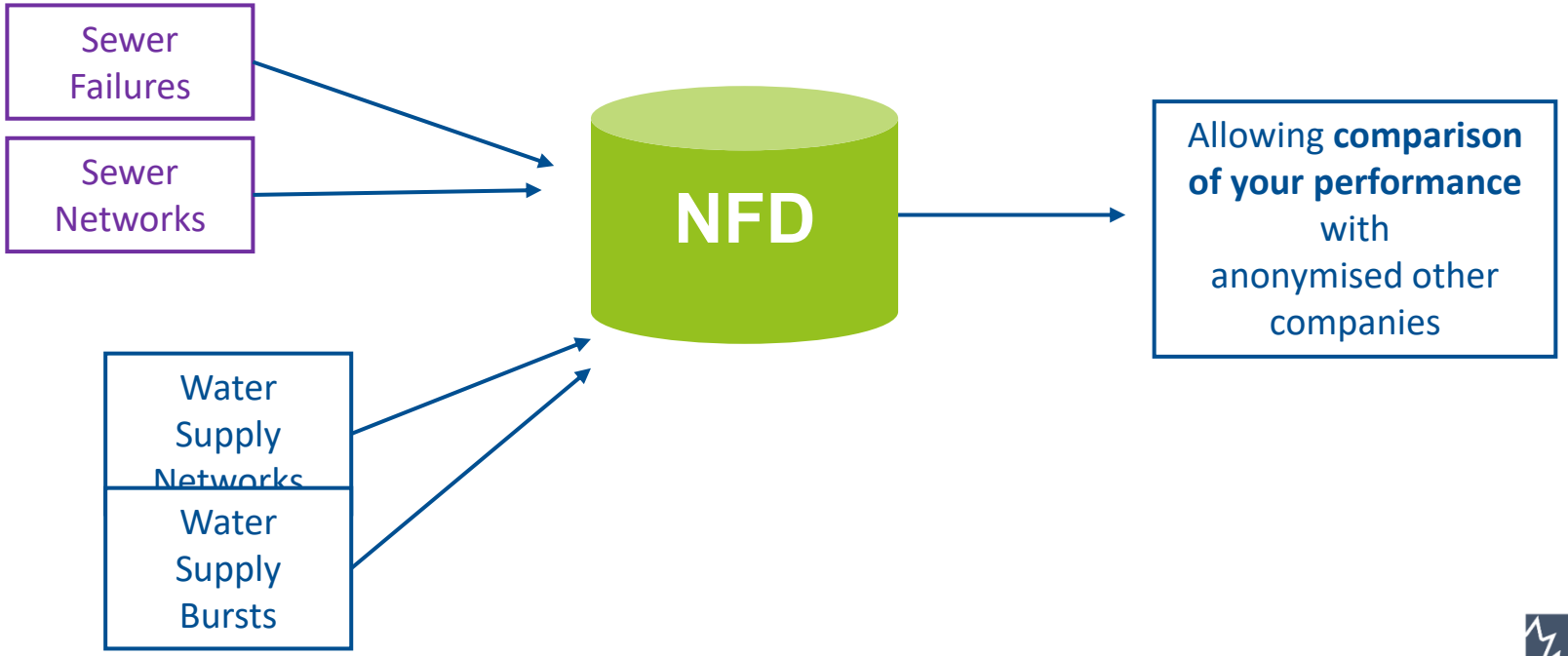
Review of the National Failures Database (NFD)

Dr Tim Farewell - MapleSky Ltd

Sean Burton - Azura Earth

Tim Acland – 5D Data Design

The National Failures Database (NFD)



The old National Failures Database

The data in the NFD is **unique and valuable**

… but …

1) Data was **very hard to access**

2) Data was of **unknown quality**

… so …

3) Data **analysis was limited**

The old National Failures Database

The data in the NFD is **unique and valuable**

… but …

1) Data was **very hard to access**

2) Data was of **unknown quality**

… so …

3) Data **analysis was limited**

The old National Failures Database

The data in the NFD is **unique and valuable**

… but …

1) Data was ~~very hard to access~~ **Data is now accessible and visible**

2) Data was of **unknown quality**

… so …

3) Data **analysis was limited**

Figure 11 - overview of basic mapping dashboard tools

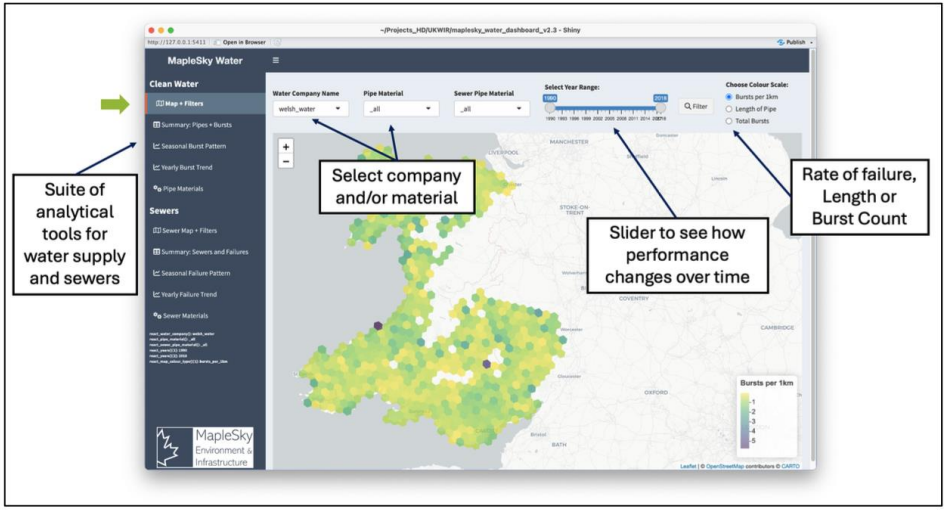


Figure 12 - demonstrating how a single pipe material can be selected

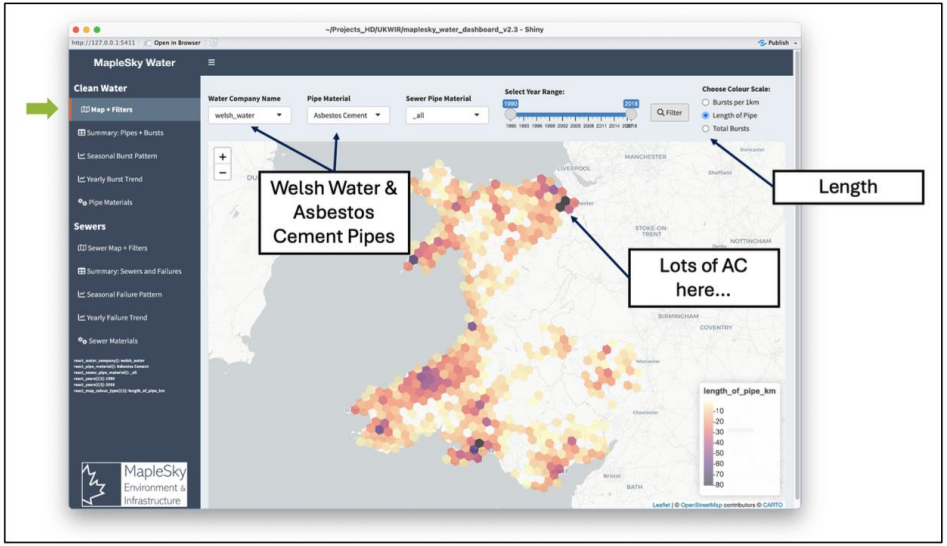


Figure 13 - demonstrating how clicking on map reveals more details

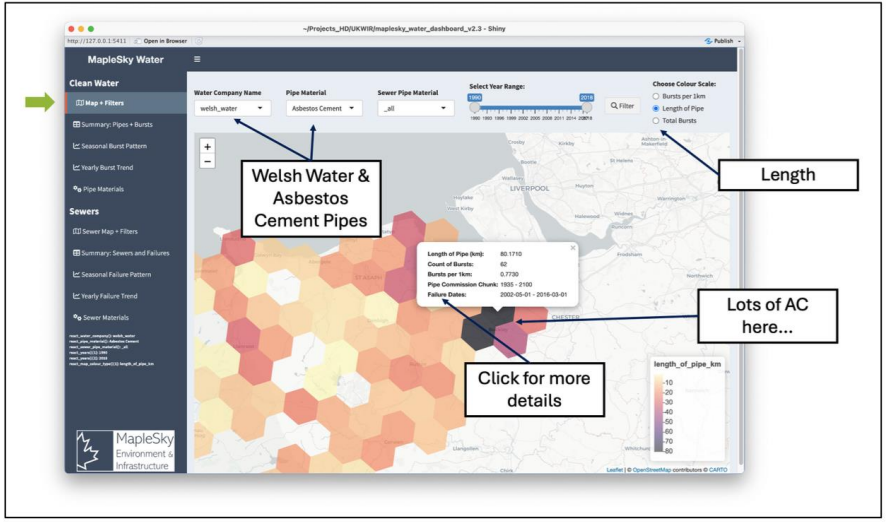
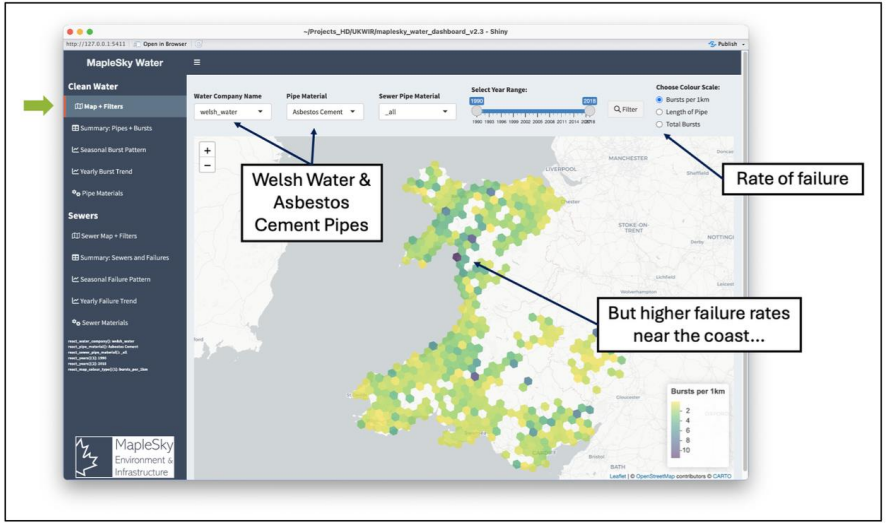
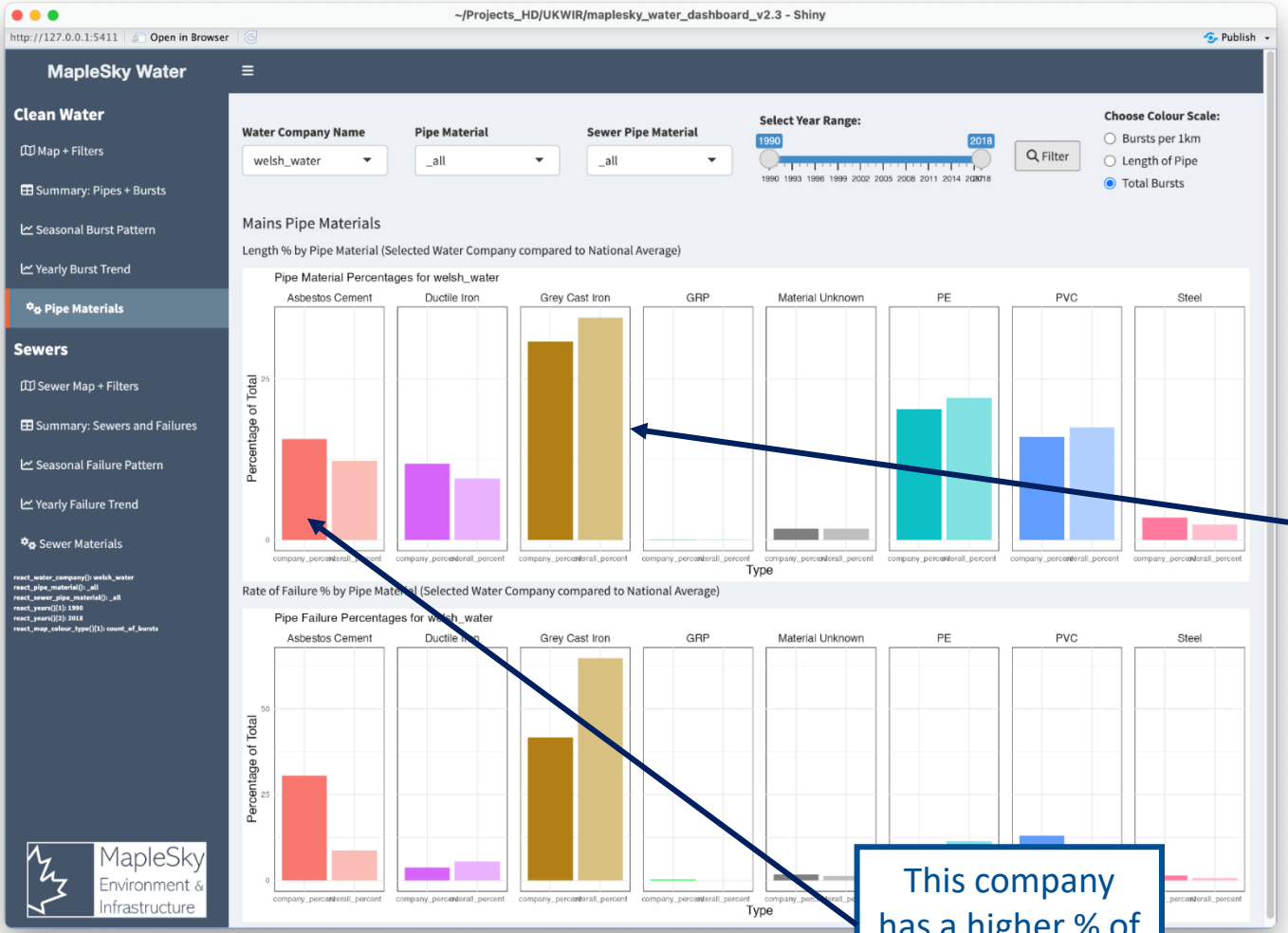


Figure 14 - switching to "rate of failure" mapping





This company has a lower % of Cast Iron than average

This company has a higher % of AC than average

The old National Failures Database

The data in the NFD is **unique and valuable**

… but …

1) Data was ~~very hard to access~~ **Data is now accessible and visible**

2) Data was of **unknown quality**

… so …

3) Data **analysis was limited**

The old National Failures Database

The data in the NFD is **unique and valuable**

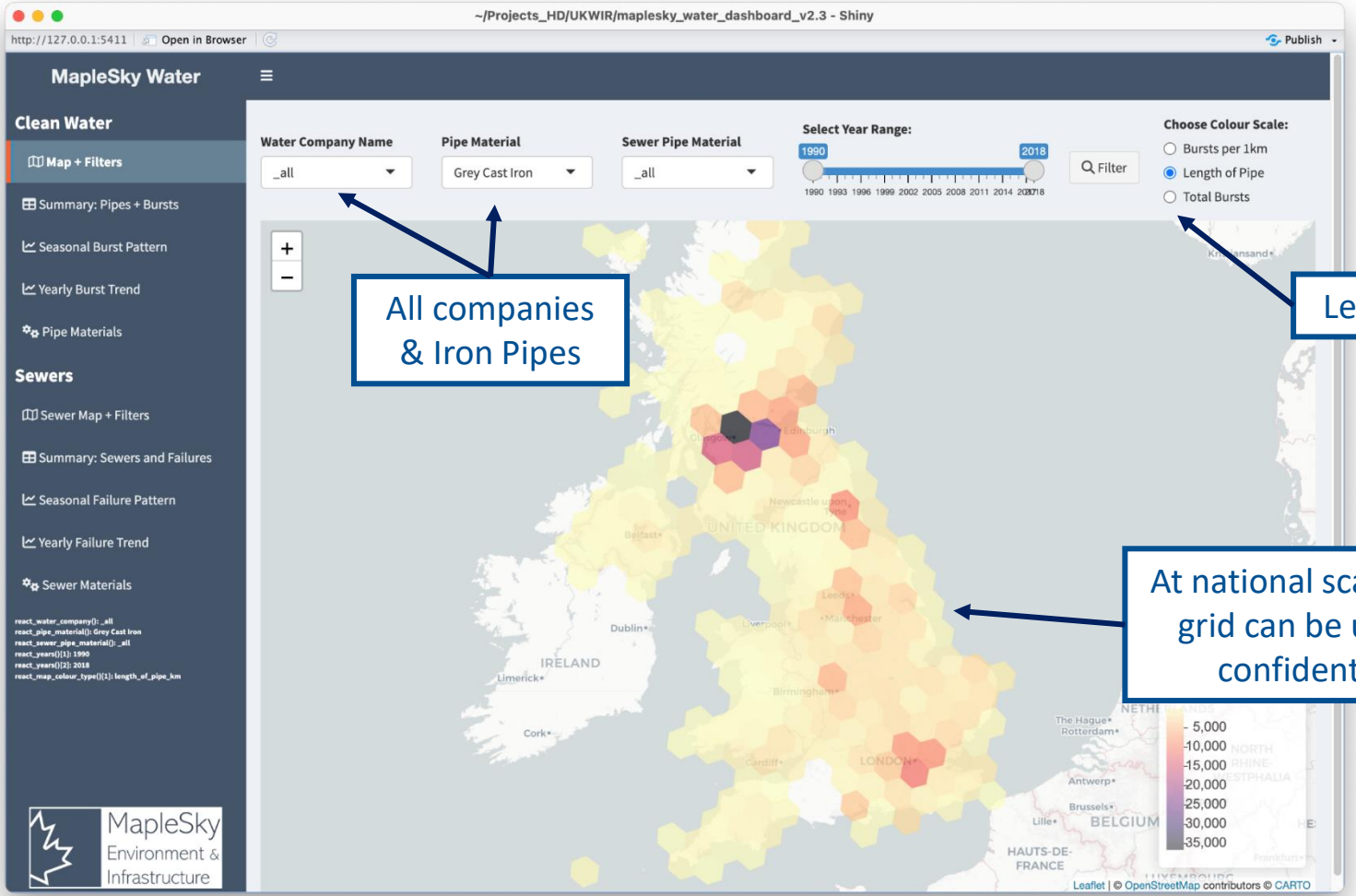
… but …

1) Data was ~~very hard to access~~ **Data is now accessible and visible**

2) Data was of ~~unknown quality~~ **Data's strengths and weaknesses now known**

… so …

3) Data **analysis was limited**


~/Projects_HD/UKWIR/maplesky_water_dashboard_v2.3 - Shiny
http://127.0.0.1:5411
Open in Browser
Publish
MapleSky Water
Clean Water
Map + Filters
Summary: Pipes + Bursts
Seasonal Burst Pattern
Yearly Burst Trend
Pipe Materials
Sewers
Sewer Map + Filters
Summary: Sewers and Failures
Seasonal Failure Pattern
Yearly Failure Trend
Sewer Materials
react_water_company(): _all
react_pipe_material(): Grey Cast Iron
react_sewer_pipe_material(): _all
react_years()[1]: 1990
react_years()[2]: 2018
react_map_colour_type()[1]: length_of_pipe_km
Water Company Name
_all
Pipe Material
Grey Cast Iron
Sewer Pipe Material
_all
Select Year Range:
1990
2018
1990 1993 1996 1999 2002 2005 2008 2011 2014 2018
Filter
Choose Colour Scale:
Bursts per 1km
Length of Pipe
Total Bursts
All companies & Iron Pipes
Length of pipe
At national scale, larger grid can be used for confidentiality
5,000
10,000
15,000
20,000
25,000
30,000
35,000
Leaflet | © OpenStreetMap contributors © CARTO
MapleSky Environment & Infrastructure

3.7.3 Why does “Company 6” have a different trend in burst rates?

As seen above, Company 6 has a markedly different failure rate to other companies. We now dive into the detailed view of the company data in the table_analysis _XXXX__ mains_bursts.html reports for Company 6 and Company 9 as examples. Both are large companies with similar seasonal weather patterns.

Figure 88 - comparing the number of failures by year for the different companies "6" and "9".

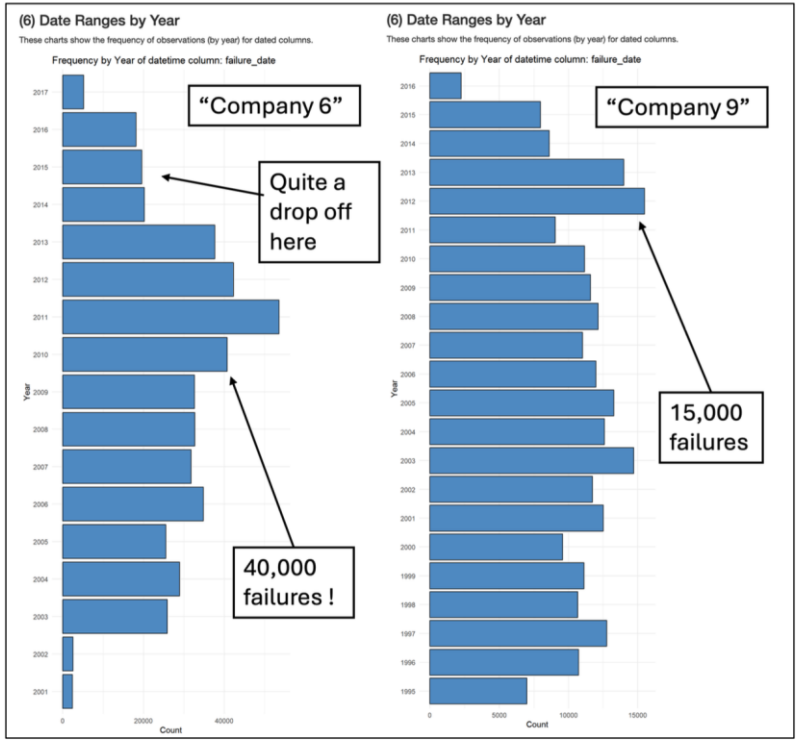


Figure 88 shows the difference in the number of failures uploaded to the NFD by the two companies for each year. “Company 6” has uploaded over 50,000 failures in 2011 alone, which is far more than the maximum of 15,000 for the other large company “9”.

Figure 89 sheds light on this by showing that while “Company 9” has really only uploaded bursts mains (as have most companies), “Company 6” has uploaded far more failures including “Other” which is the most common (possibly leakage jobs?) and works on communication and supply pipes. These both are far more common than the bursts.

Figure 89 - comparing the types of failures by year for the different companies "6" and "9".

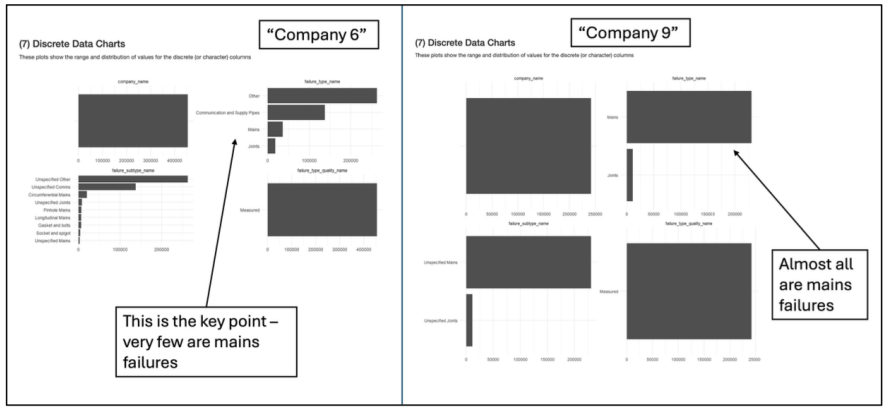
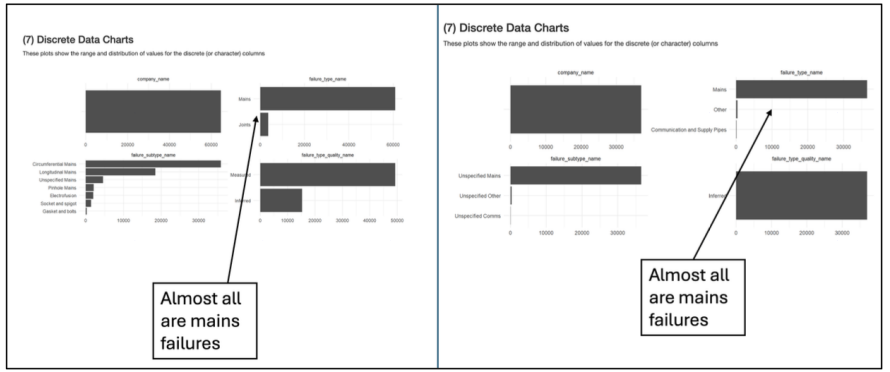


Figure 90 - comparing the types of failures by year for two more companies



Going forward, the NFD dashboard should allow filtering to select the failure type, defaulting to “burst mains” for the clean water supply side. As more failures on communications pipes and perhaps leakage jobs are uploaded, these can be a valuable additional component of the NFD.

Note that this company’s additional failures is going to skew results in the rainfall and days of ground frost analysis as well

The old National Failures Database

The data in the NFD is **unique and valuable**

… but …

1) Data was **very hard to access** **Data is now accessible and visible**

2) Data was of **unknown quality** **Data's strengths and weaknesses now known**

… so …

3) Data **analysis was limited**



The old National Failures Database

The data in the NFD is **unique and valuable**

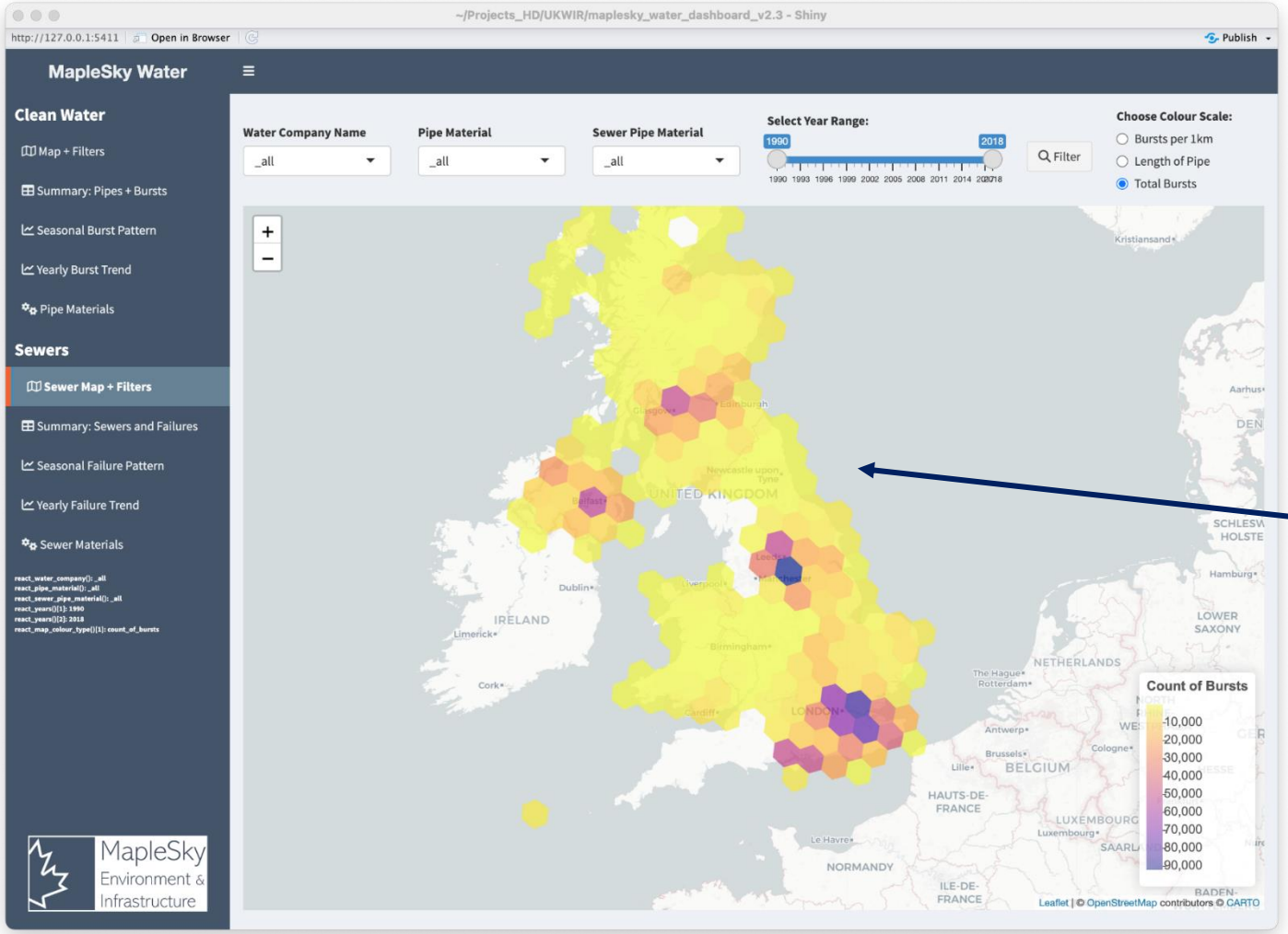
… but …

1) Data was **very hard to access** **Data is now accessible and visible**

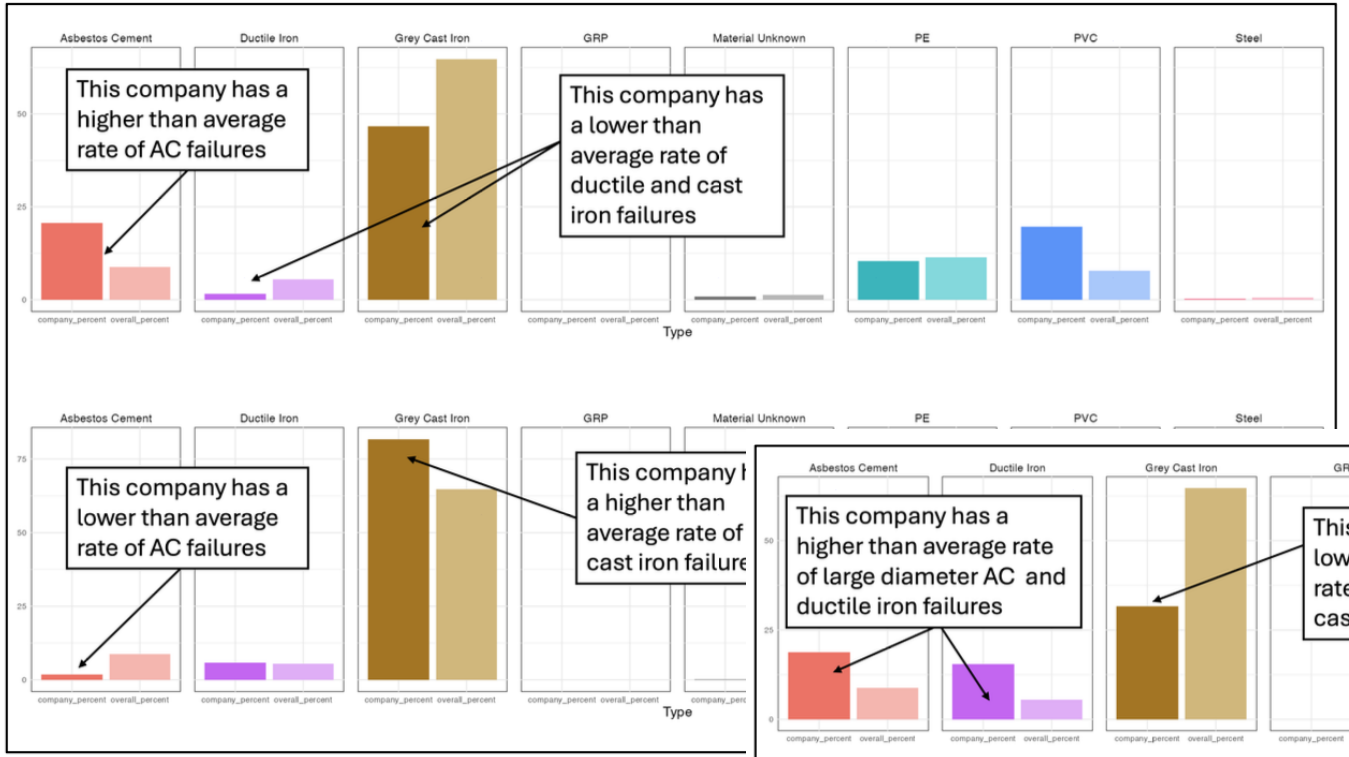
2) Data was of **unknown quality** **Data's strengths and weaknesses now known**

… so …

3) Data **analysis was limited** **Data analysis is now easy undertake**



Where sewer failure data has been uploaded..


Asbestos Cement
Ductile Iron
Grey Cast Iron
GRP
Material Unknown
PE
PVC
Steel
This company has a higher than average rate of AC failures
This company has a lower than average rate of ductile and cast iron failures
company_percent
overall_percent
Type
This company has a lower than average rate of AC failures
This company has a higher than average rate of cast iron failure


Asbestos Cement
Ductile Iron
Grey Cast Iron
GRP
Material Unknown
PE
PVC
Steel
This company has a higher than average rate of large diameter AC and ductile iron failures
This company has a lower than average rate of large diameter cast iron failures
company_percent
overall_percent
Type
About average large diameter iron failure rate
This company has a higher than average rate of large diameter steel failures

The old National Failures Database

The data in the NFD is **unique and valuable**

… but …

1) Data was **very hard to access** **Data is now accessible and visible**

2) Data was of **unknown quality** **Data's strengths and weaknesses now known**

… so …

3) Data **analysis was limited** **Data analysis is now easy undertake**



The old National Failures Database

The data in the NFD is **unique and valuable**

… but …

1) Data was **very hard to access** **Data is now accessible and visible**

2) Data was of **unknown quality** **Data's strengths and weaknesses now known**

… so …

3) Data **analysis was limited** **Data analysis is now easy undertake**

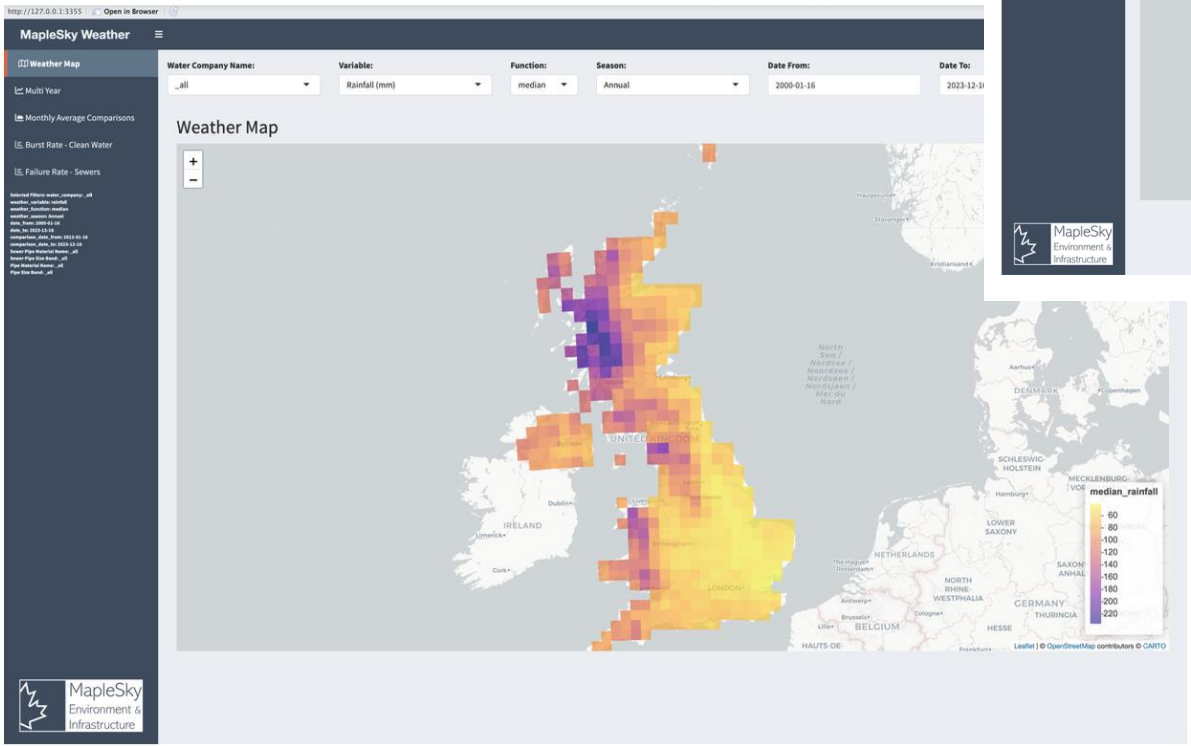
& now expanded to include weather data!

Weather data

Figure 29 - mean annual temperature across the southern UK



Figure 28 - an overview of annual rainfall across the UK

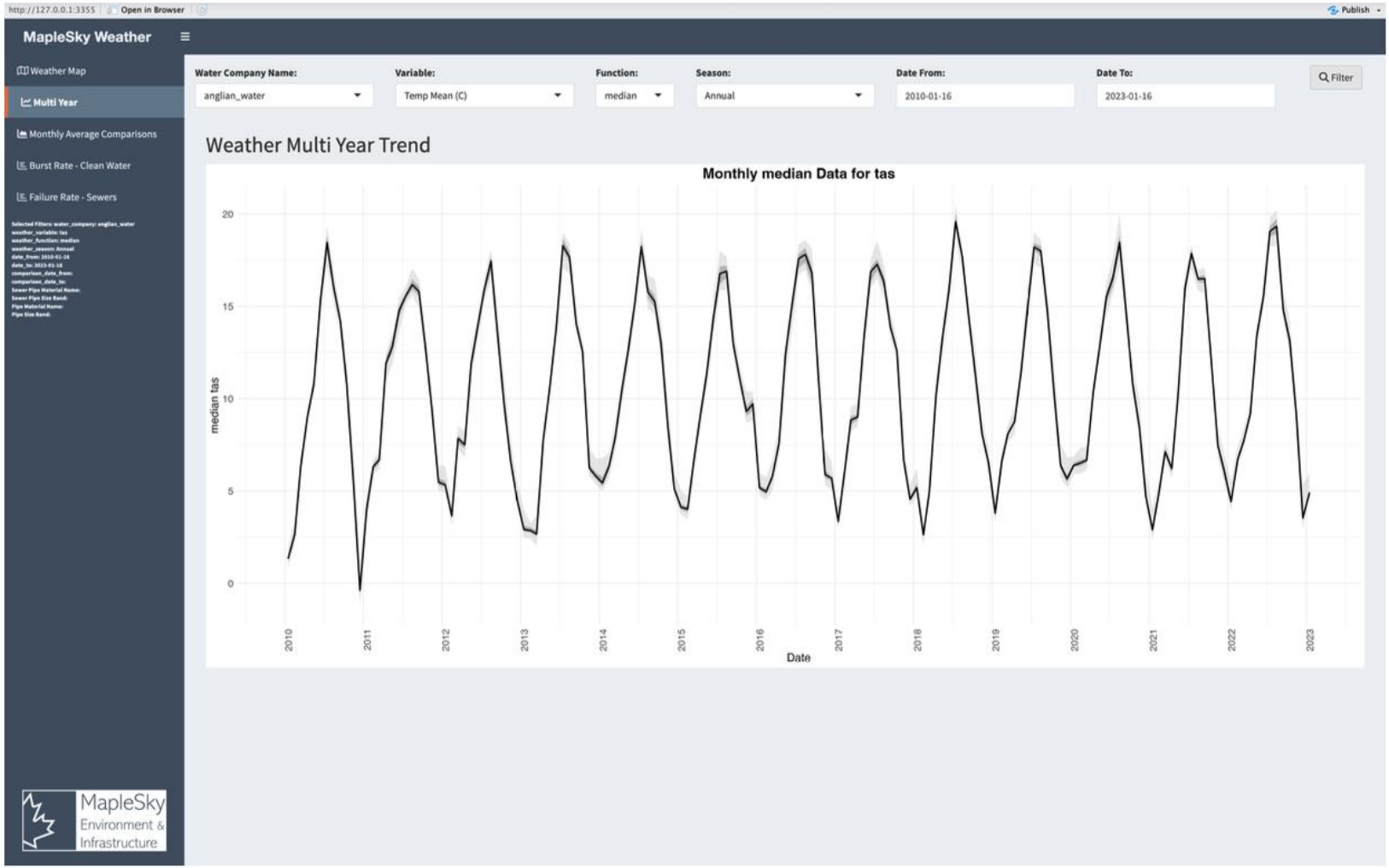


We have included data on

- rainfall
- temperature
- days of ground frost

MapleSky Environment & Infrastructure

Figure 37 - mean monthly temperature for Anglian Water region (only 2010-2023)



MapleSky Environment & Infrastructure

3.7.2 How does temperature impact on the burst rates for different companies, and all materials?

Below we show a range of the same graph by different companies. While most show a typical failure rate like Figure 78, occasionally, there are some which buck this trend like “Company 6” in Figure 84.

Figure 78 - Failure rate by minimum temperature 2004-2014 - Company 1

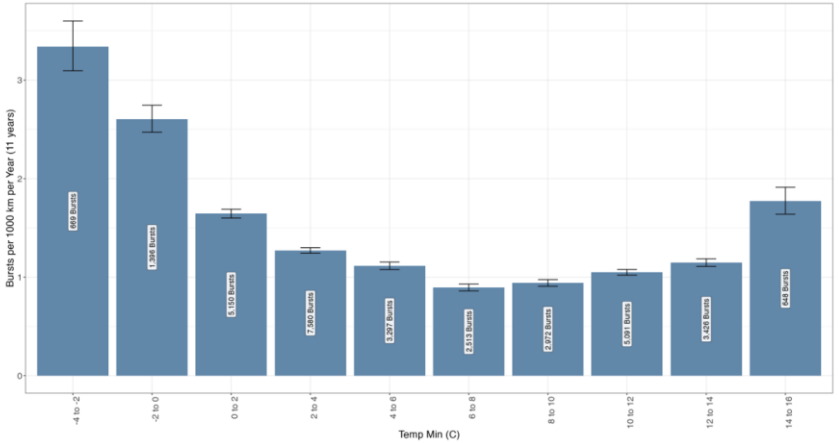


Figure 79 - Failure rate by minimum temperature 2004-2014 - Company 2

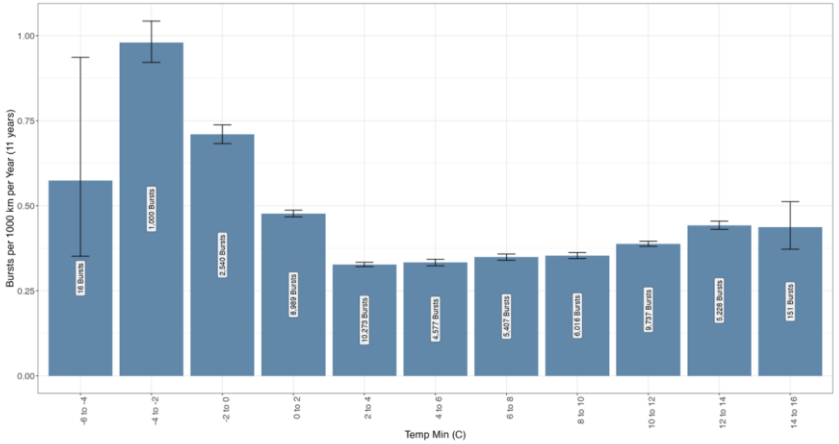


Figure 82 - Failure rate by minimum temperature 2004-2014 - Company 5

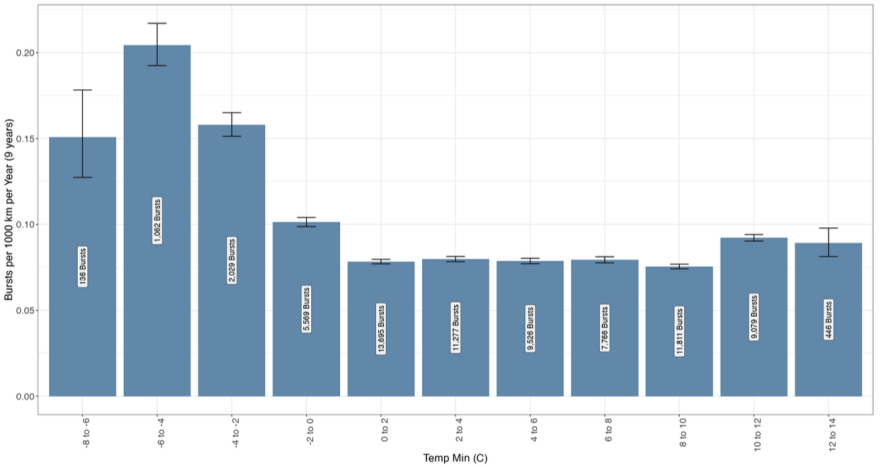
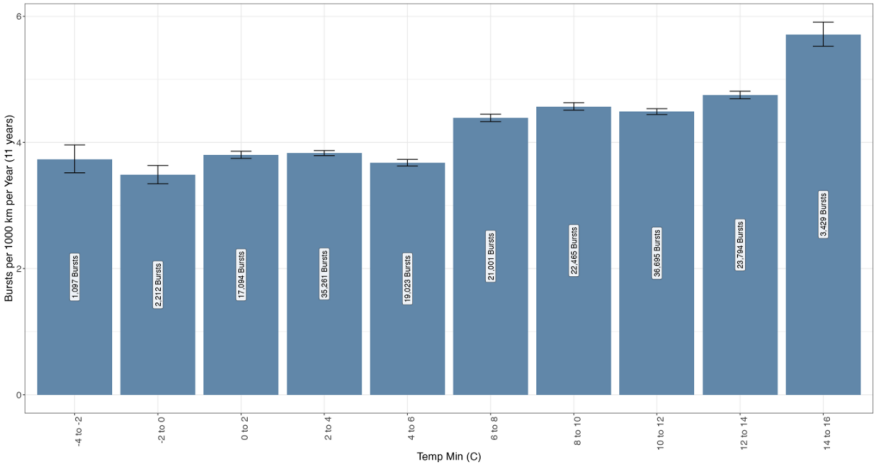


Figure 83 - Failure rate by minimum temperature 2004-2014 - Company 6 (Note: this one has the different trend)



Conclusions

The NFD can offer **great insights**, but **needs to be rebuilt**:

1) It must be **very easy** for users to **contribute** data

2) It must be **curated** to ensure users can **trust** the data and results

3) It must be **simple** for users to **query** the data

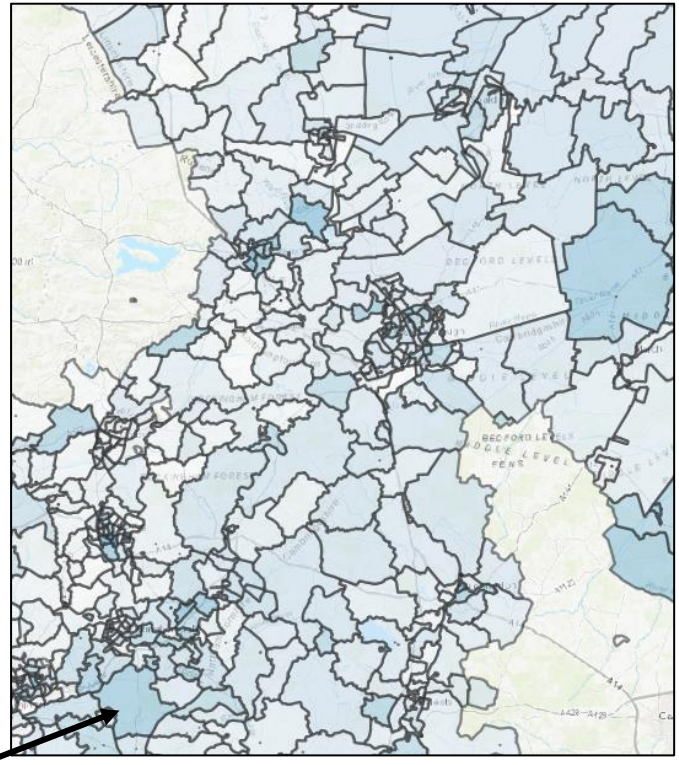
Dr Timothy S. Farewell
tim.farewell@maplesky.co.uk

For those of you with annoying DMAs

MapleSky Environment & Infrastructure

When leakage is high

and leaks are hard to find…



Why are leaks harder to find in some DMAs than others?

Ground Conditions for Leakage

MapleSky Environment & Infrastructure

1) Ground conditions that CAUSE leaks

2) Ground conditions that HIDE leaks

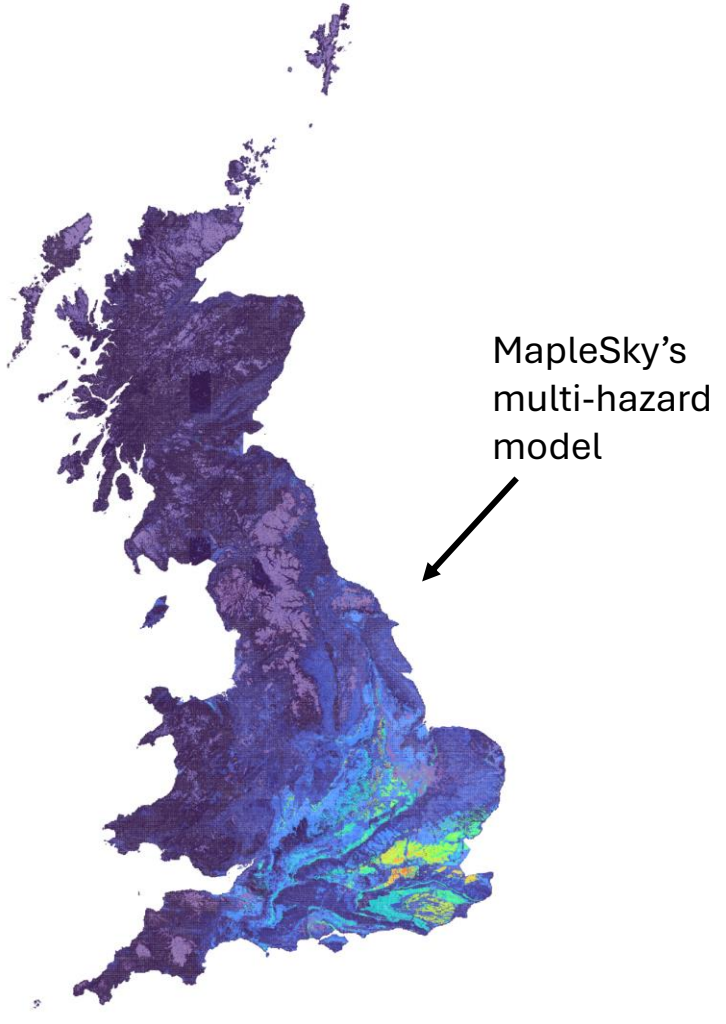
Ground conditions that CAUSE LEAKS

MapleSky Environment & Infrastructure

1) Peat (shrinkage & corrosion)

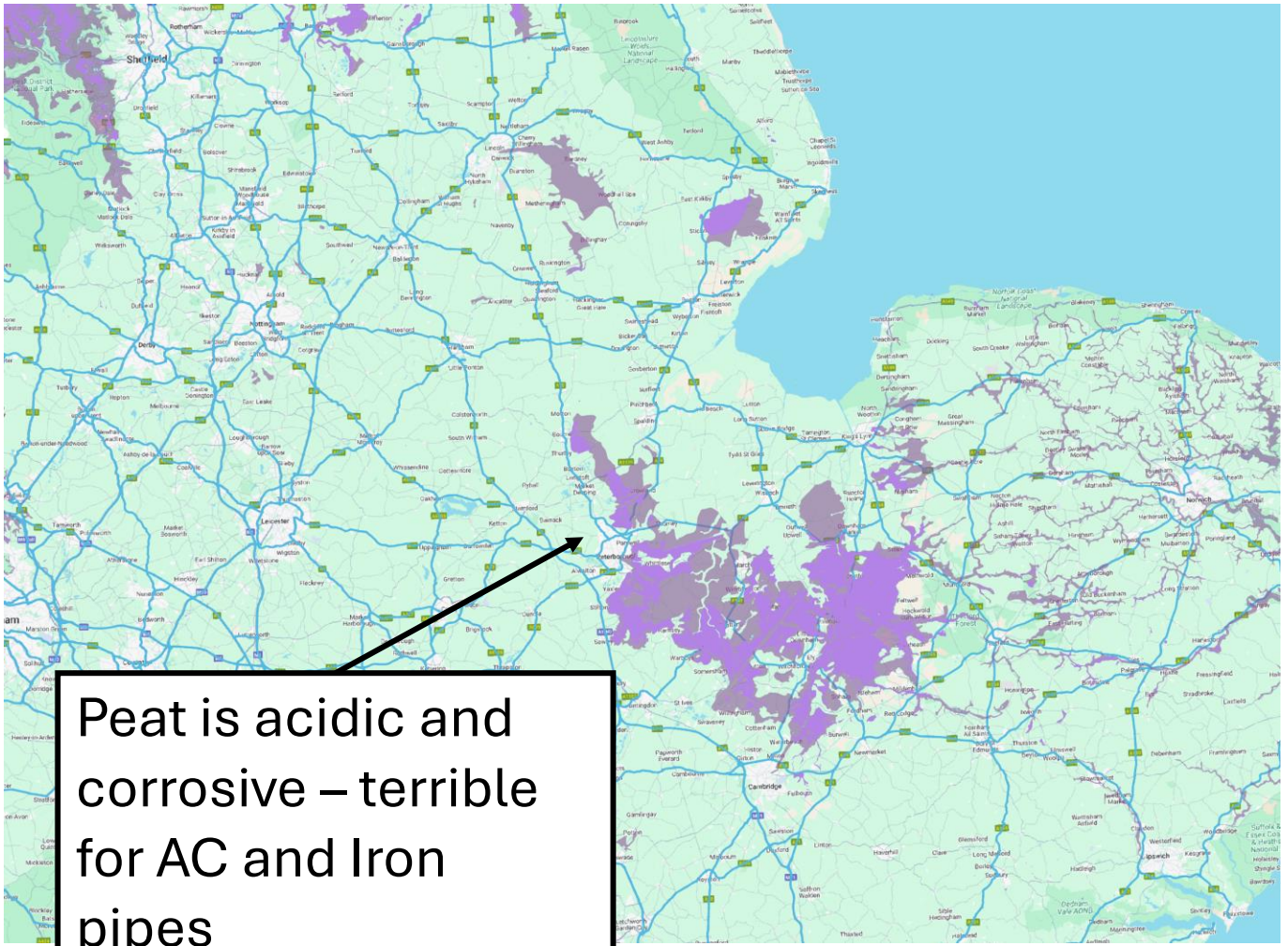
2) Landslides

3) Clay (shrink-swell)



Peat (shrinkage & corrosion)

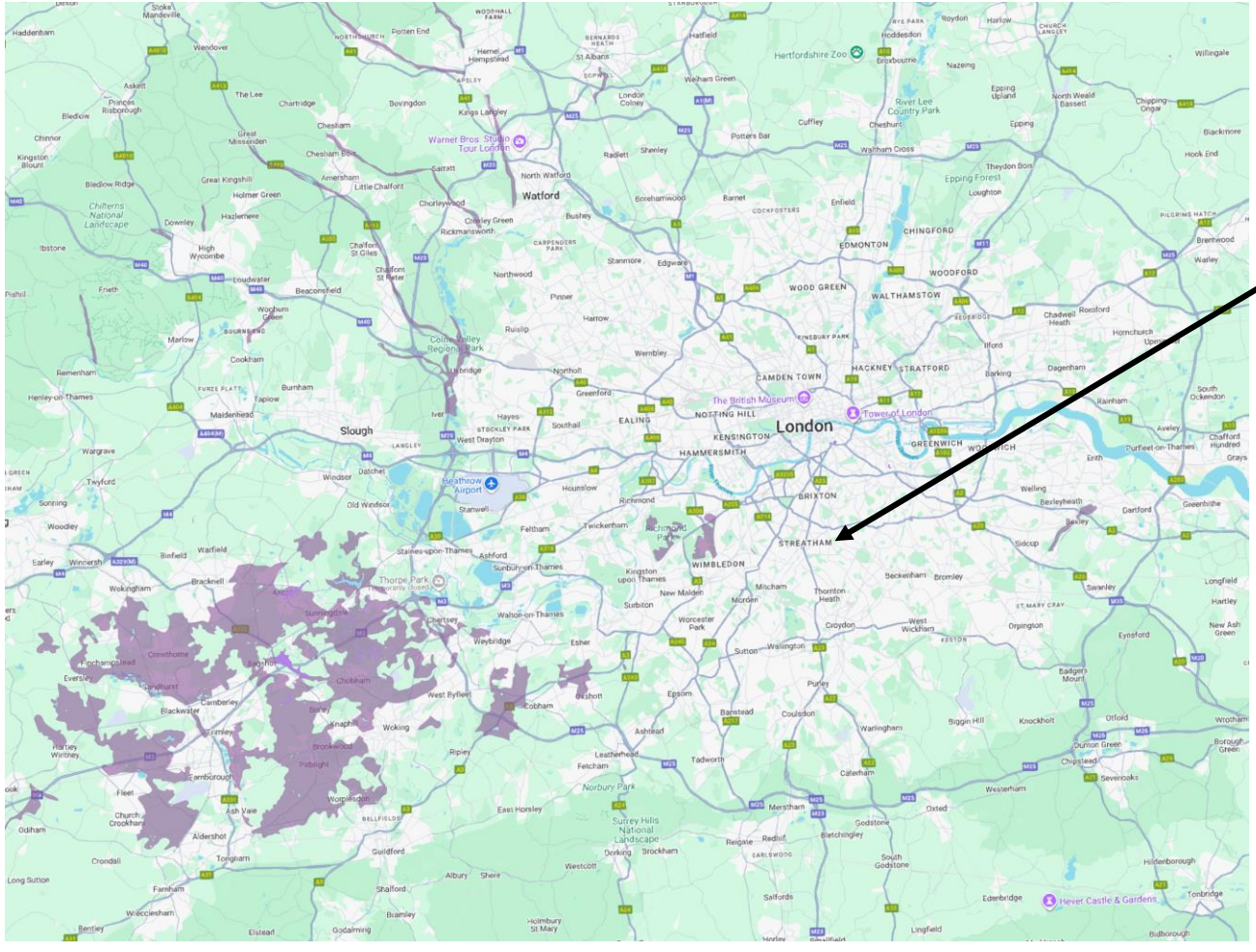
MapleSky Environment & Infrastructure





Peats in residential areas

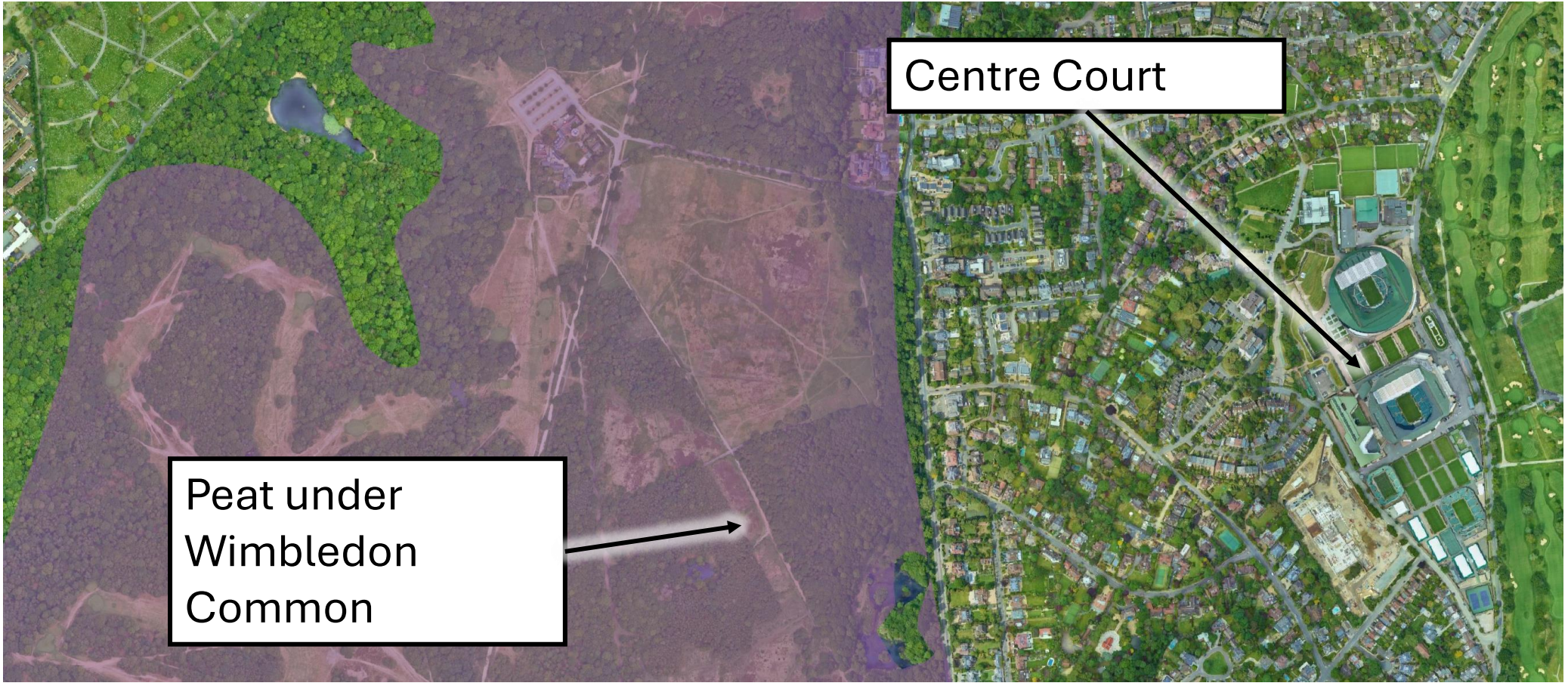
MapleSky Environment & Infrastructure



Not just in the fens / uplands (Southwest London)

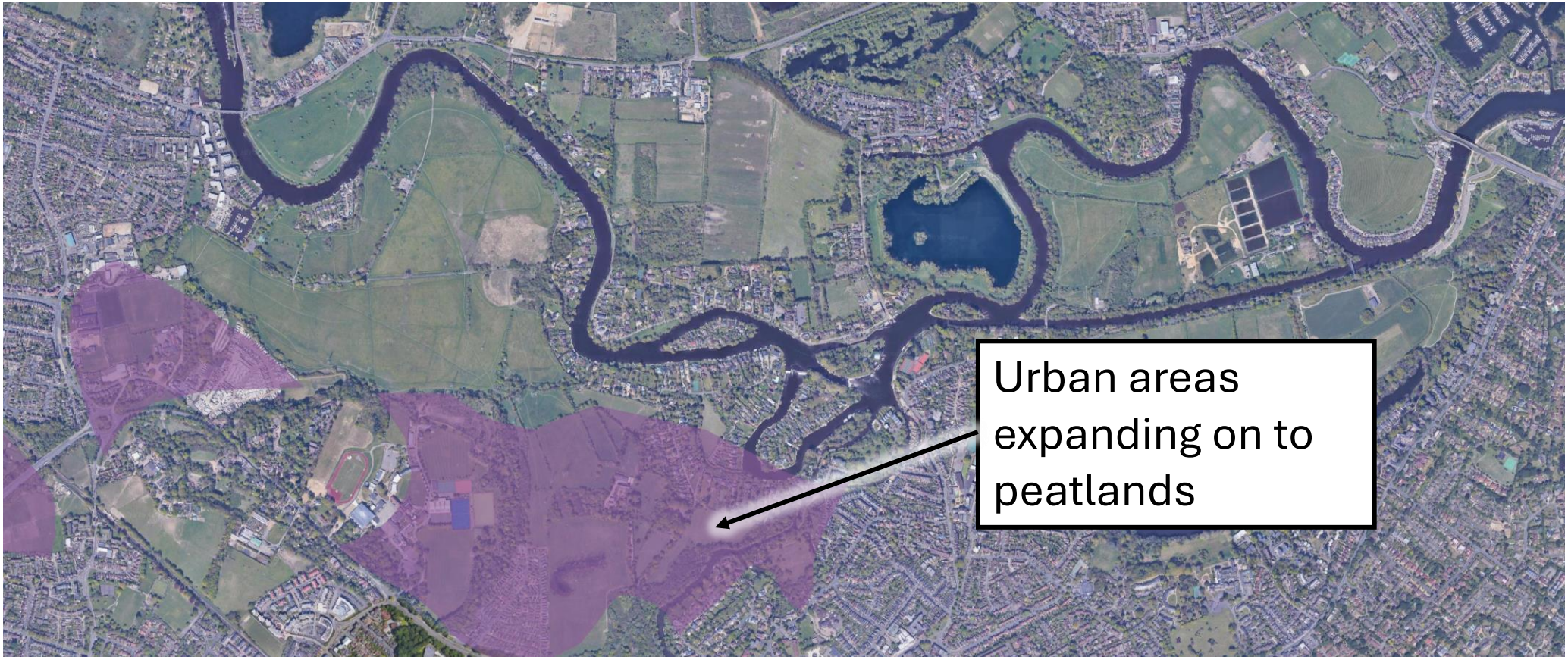
SW19

MapleSky Environment & Infrastructure



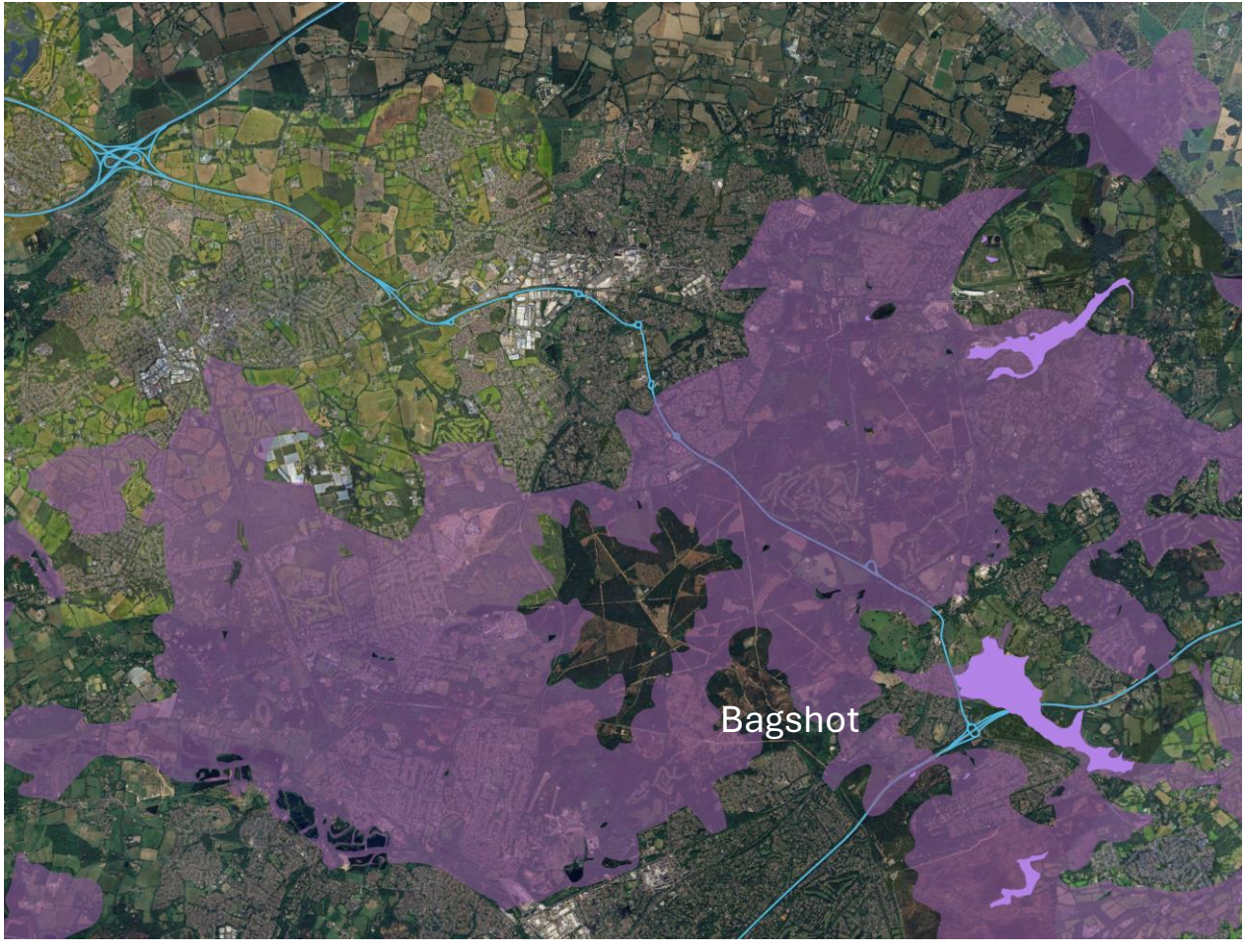
Weybridge

MapleSky Environment & Infrastructure



Peats in residential areas (Bagshot)

MapleSky Environment & Infrastructure



Landslides

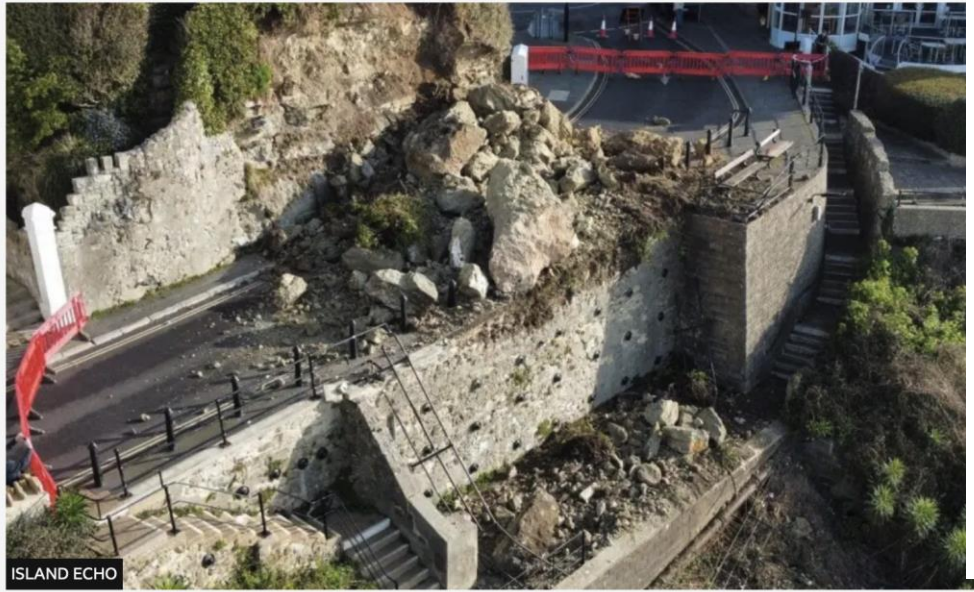
MapleSky Environment & Infrastructure

NEWS

Home | InDepth | Israel-Gaza war | War in Ukraine | Climate | UK | World | Business | Politics | Culture

England | Local News | Hampshire & Isle of Wight

'Significant rockfall' closes Isle of Wight roads

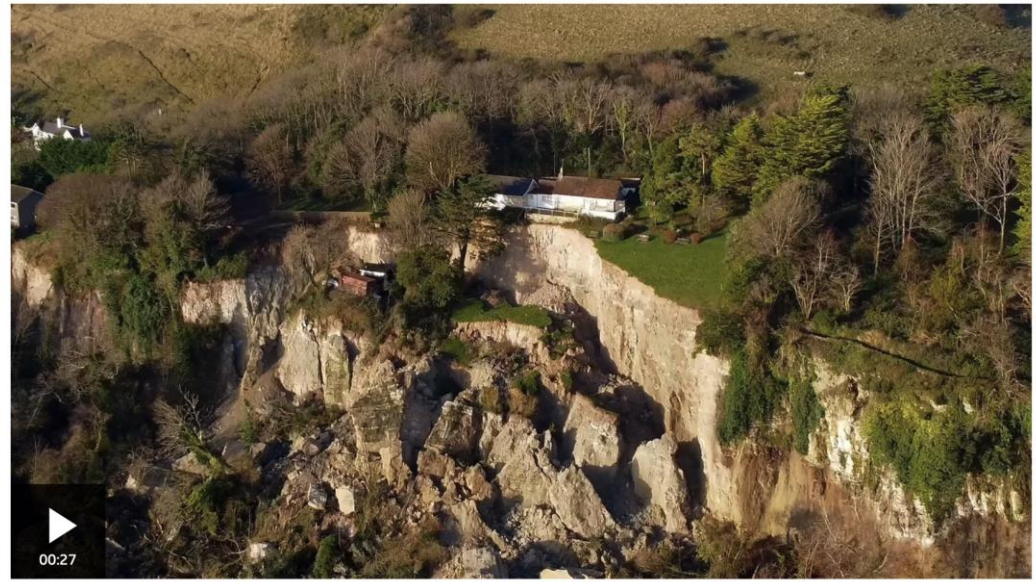


Roads in the area were closed while engineers assess the situation

NEWS

Home | InDepth | Israel-Gaza war | War in Ukraine | Climate | UK | World | Business | Politics | Culture

England | Local News | Hampshire & Isle of Wight



Drone footage shows aftermath of Ventnor landslip

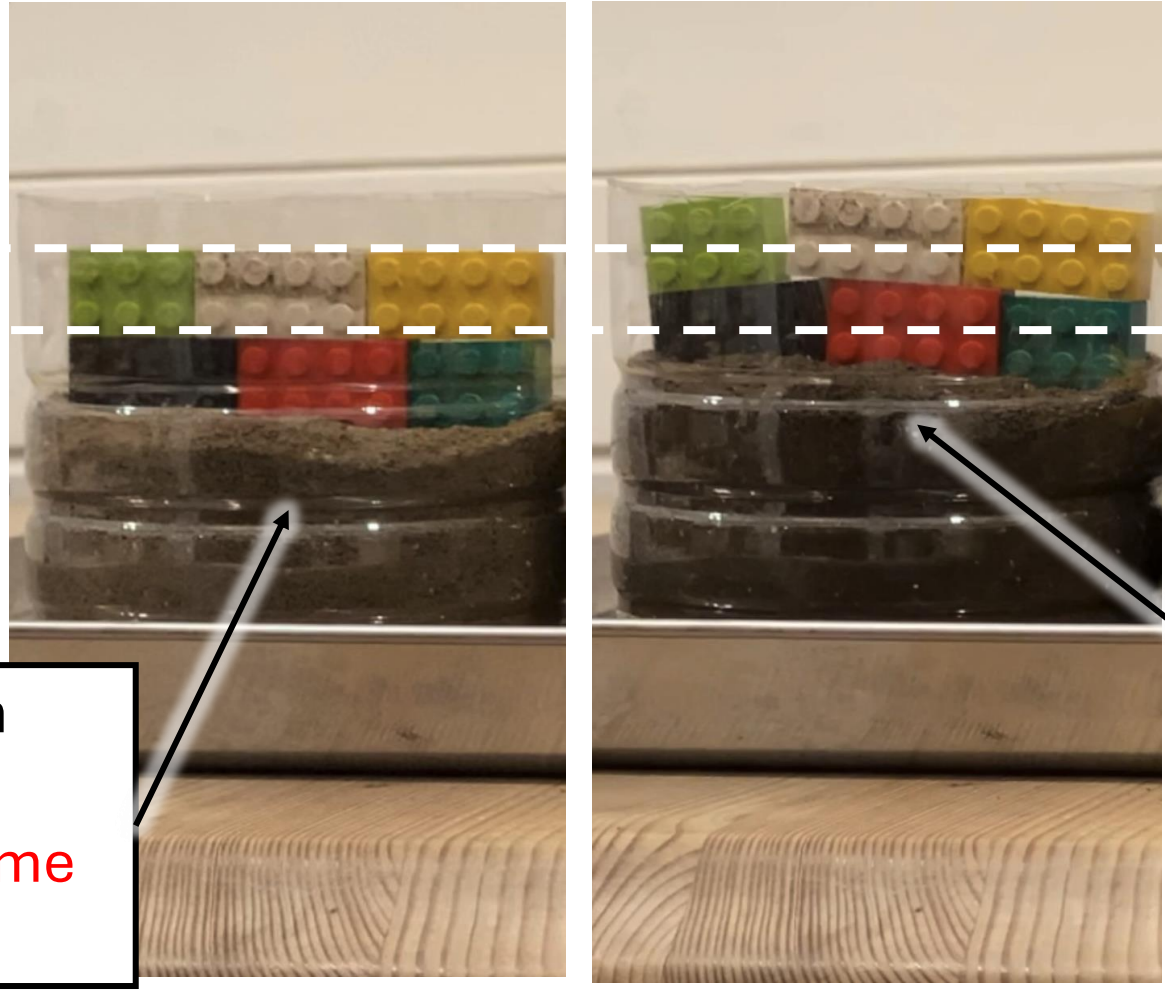
Landslides

MapleSky Environment & Infrastructure



Clay shrink-swell

MapleSky Environment & Infrastructure

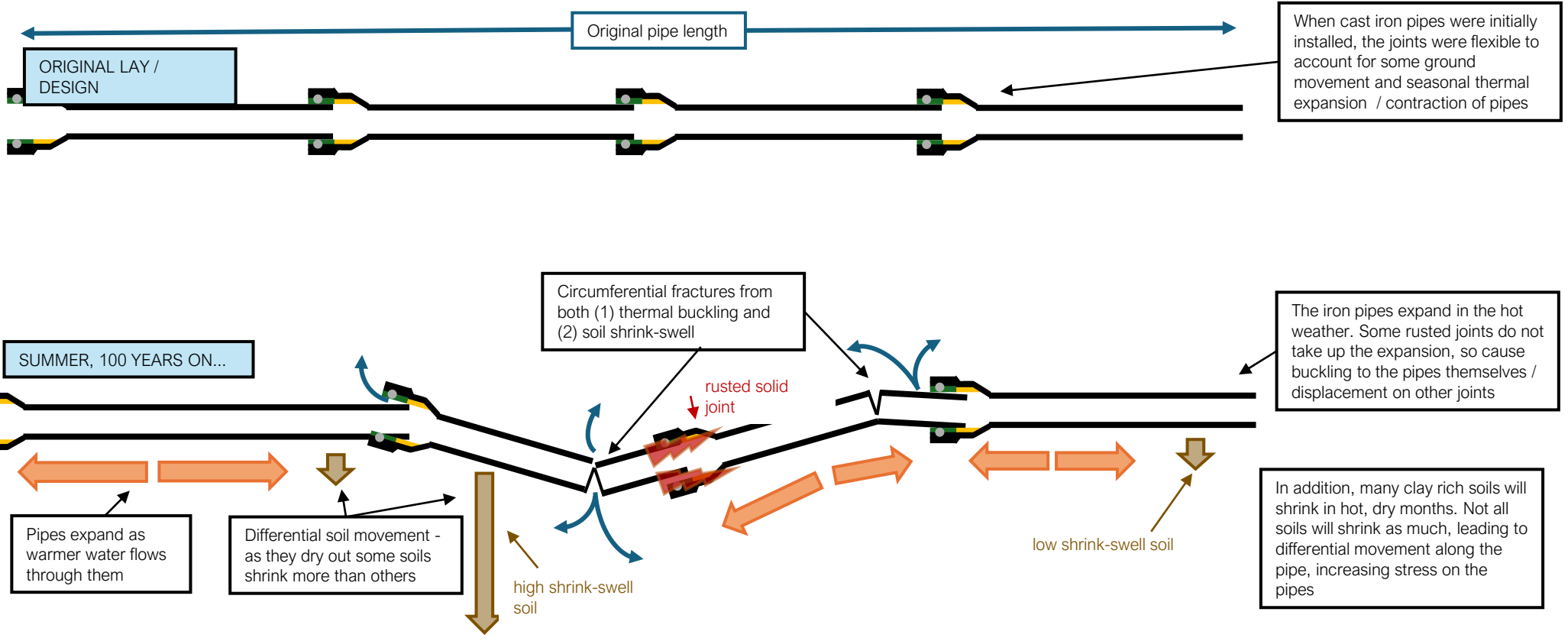


Dry clay loam soil (smaller volume in summer)

Wet clay loam soil (larger volume in winter)

Clay soils

MapleSky Environment & Infrastructure

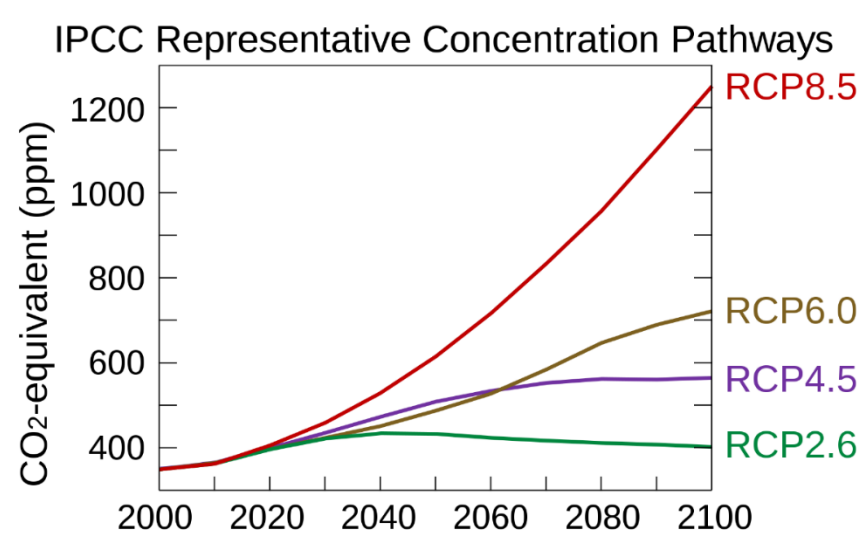


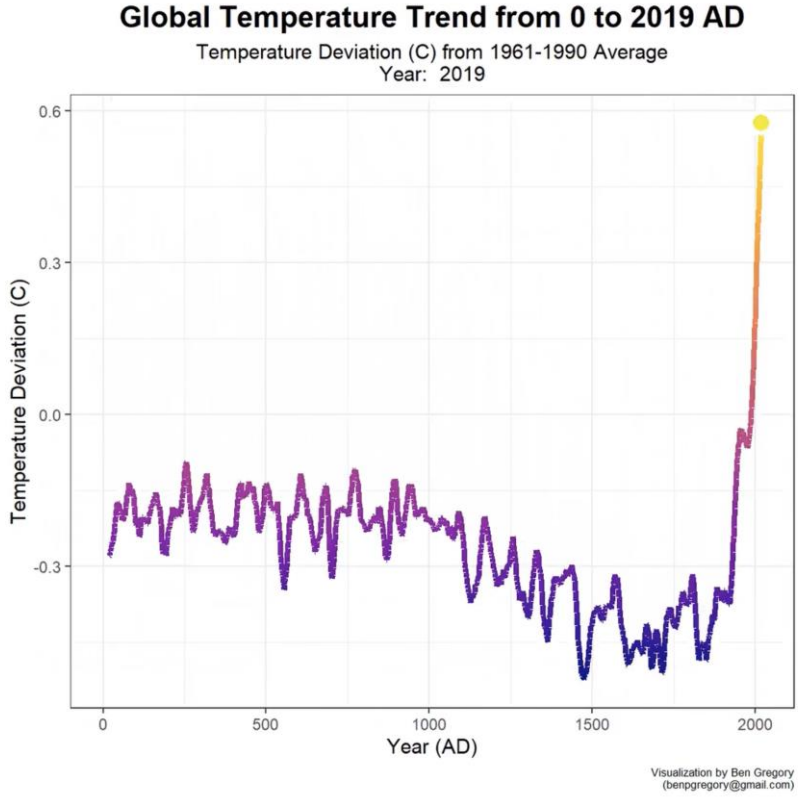
Future Climates (clay shrink-swell)

MapleSky Environment & Infrastructure

1) Modelled shrink-swell risk every decade to 2100

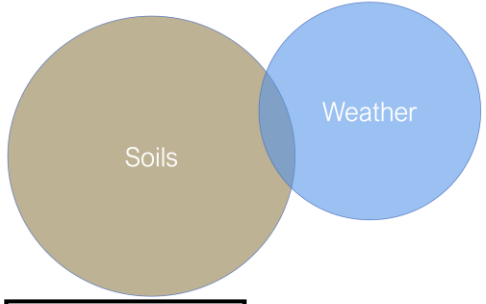
2) 4 climate scenarios





Clay shrink-swell risk

MapleSky Environment & Infrastructure



Cold & Wet

Hot & Dry

Soil Moisture Deficit (Bands)

Shrinkable Clays

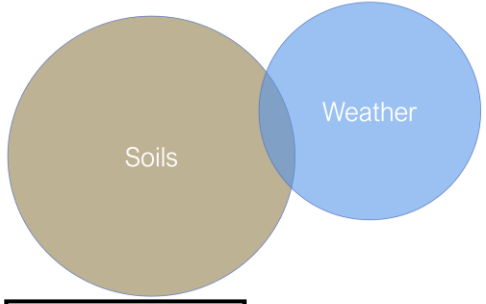
Sands & Gravels

Soil Shrinkability

	1	2	3	4	5	6	7	8	9	10
10	10	20	30	40	50	60	70	80	90	100
9	9	18	27	36	45	54	63	72	81	90
8	8	16	24	32	40	48	56	64	72	80
7	7	14	21	28	35	42	49	56	63	70
6	6	12	18	24	30	36	42	48	54	60
5	5	10	15	20	25	30	35	40	45	50
4	4	8	12	16	20	24	28	32	36	40
3	3	6	9	12	15	18	21	24	27	30
2	2	4	6	8	10	12	14	16	18	20
1	1	2	3	4	5	6	7	8	9	10

Clay shrink-swell risk (current)

MapleSky Environment & Infrastructure



Cold & Wet

Hot & Dry

Soil Moisture Deficit (Bands)

Shrinkable Clays

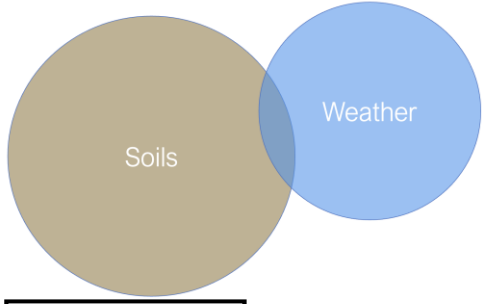
Sands & Gravels

Soil Shrinkability

	1	2	3	4	5	6	7	8	9	10
10	10	20	30	40	50	60	70	80	90	100
9	9	18	27	36	45	54	63	72	81	90
8	8	16	24	32	40	48	56	64	72	80
7	7	14	21	28	35	42	49	56	63	70
6	6	12	18	24	30	36	42	48	54	60
5	5	10	15	20	25	30	35	40	45	50
4	4	8	12	16	20	24	28	32	36	40
3	3	6	9	12	15	18	21	24	27	30
2	2	4	6	8	10	12	14	16	18	20
1	1	2	3	4	5	6	7	8	9	10

Clay shrink-swell risk (future)

MapleSky Environment & Infrastructure



Cold & Wet

Hot & Dry

Shrinkable Clays

Sands & Gravels

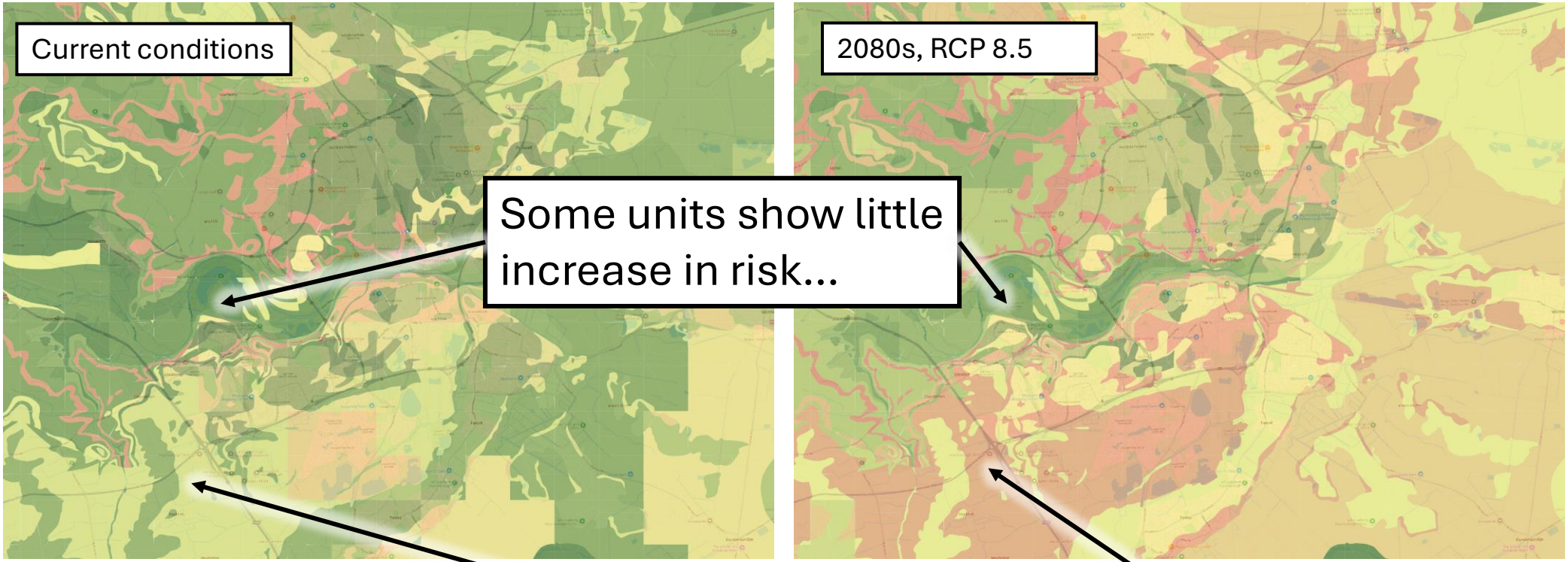
Soil Moisture Deficit (Bands)

Soil Shrinkability

Soil Shrinkability	1	2	3	4	5	6	7	8	9	10
10	10	20	30	40	50	60	70	80	90	100
9	9	18	27	36	45	54	63	72	81	90
8	8	16	24	32	40	48	56	64	72	80
7	7	14	21	28	35	42	49	56	63	70
6	6	12	18	24	30	36	42	48	54	60
5	5	10	15	20	25	30	35	40	45	50
4	4	8	12	16	20	24	28	32	36	40
3	3	6	9	12	15	18	21	24	27	30
2	2	4	6	8	10	12	14	16	18	20
1	1	2	3	4	5	6	7	8	9	10

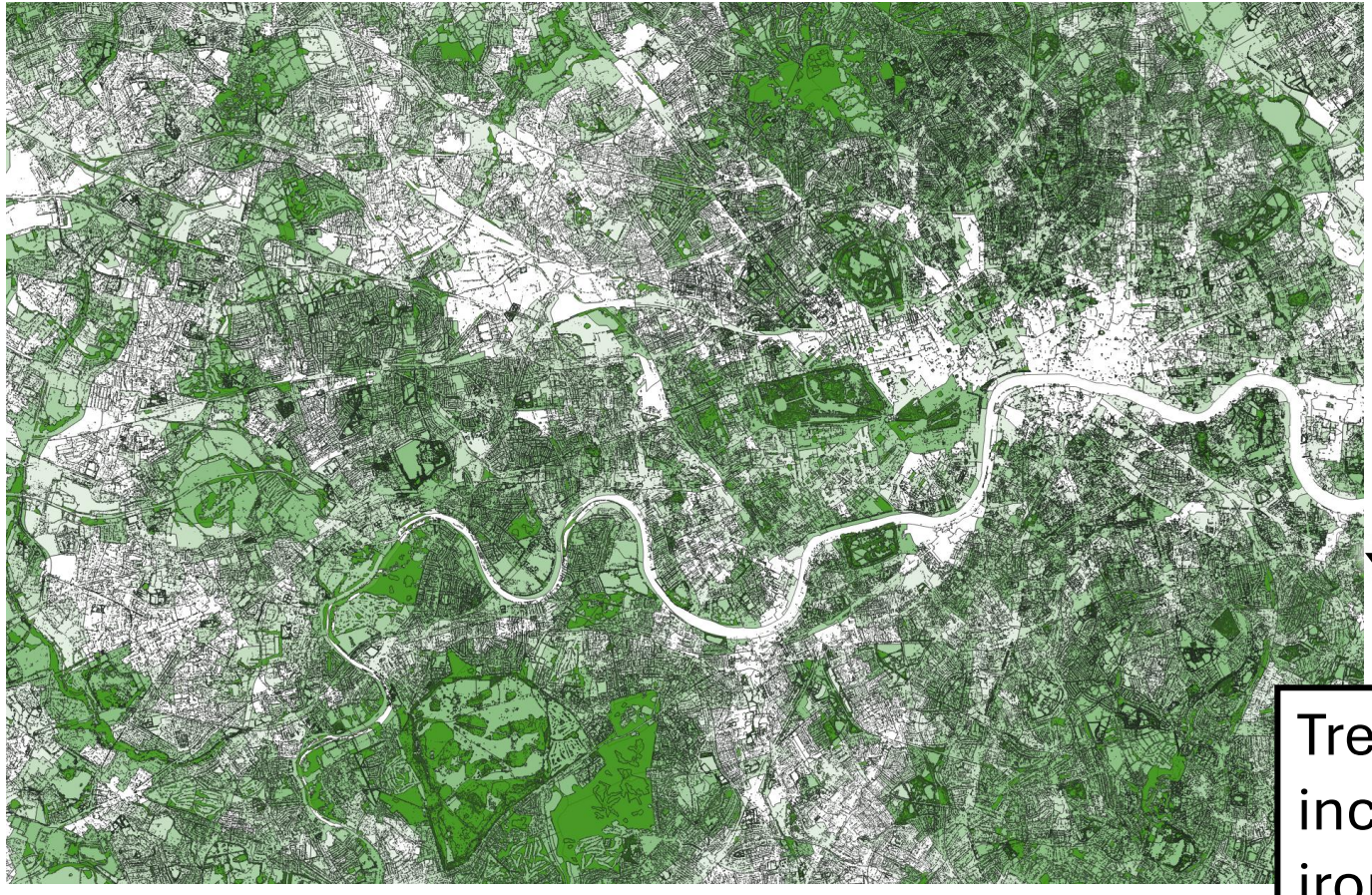
Changing ground movement risk

MapleSky Environment & Infrastructure



Towards a unified tree model

MapleSky Environment & Infrastructure



Tree location

Tree height

Tree species

Trees on clay soil often increase failure rates of iron and AC pipes

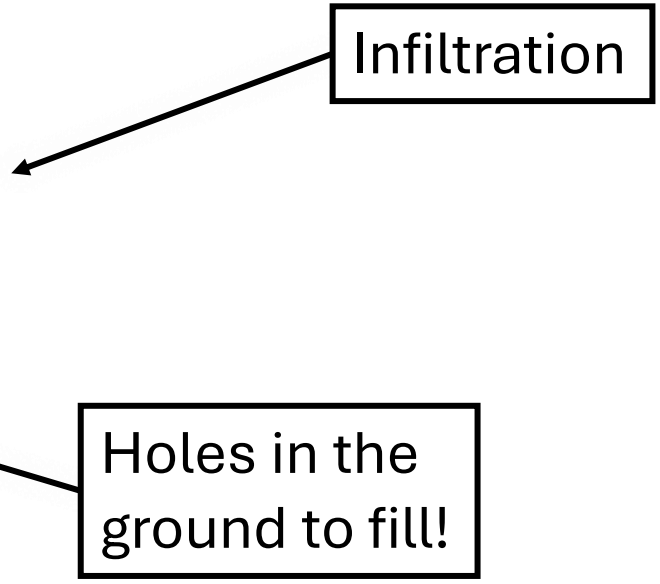
Ground conditions that HIDE LEAKS

MapleSky Environment & Infrastructure

1) Sandy & gravelly soils and geology

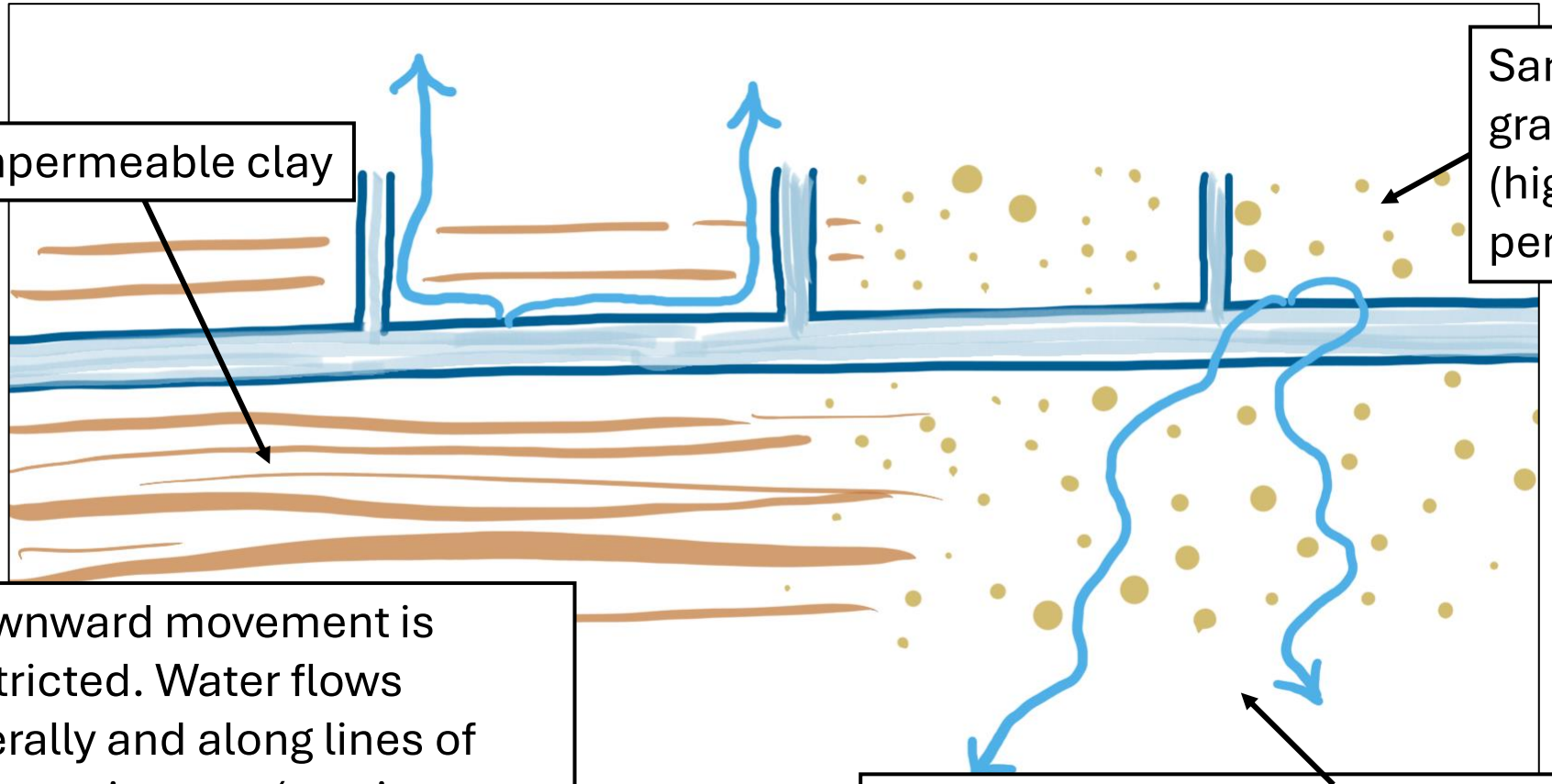
2) Historic mines

3) Caves, cavities and karst



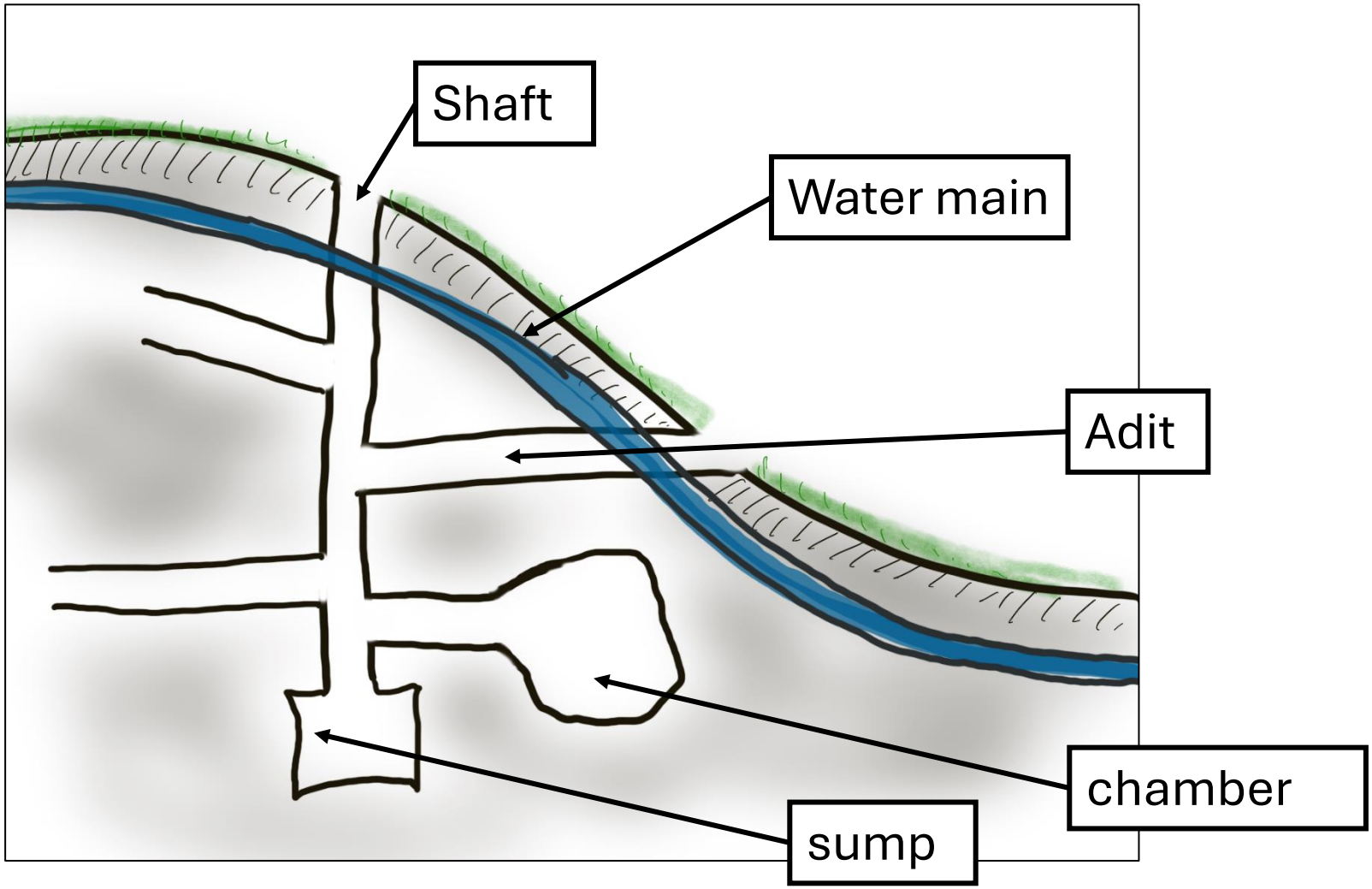
Leakage pathways in clay and sand

MapleSky Environment & Infrastructure



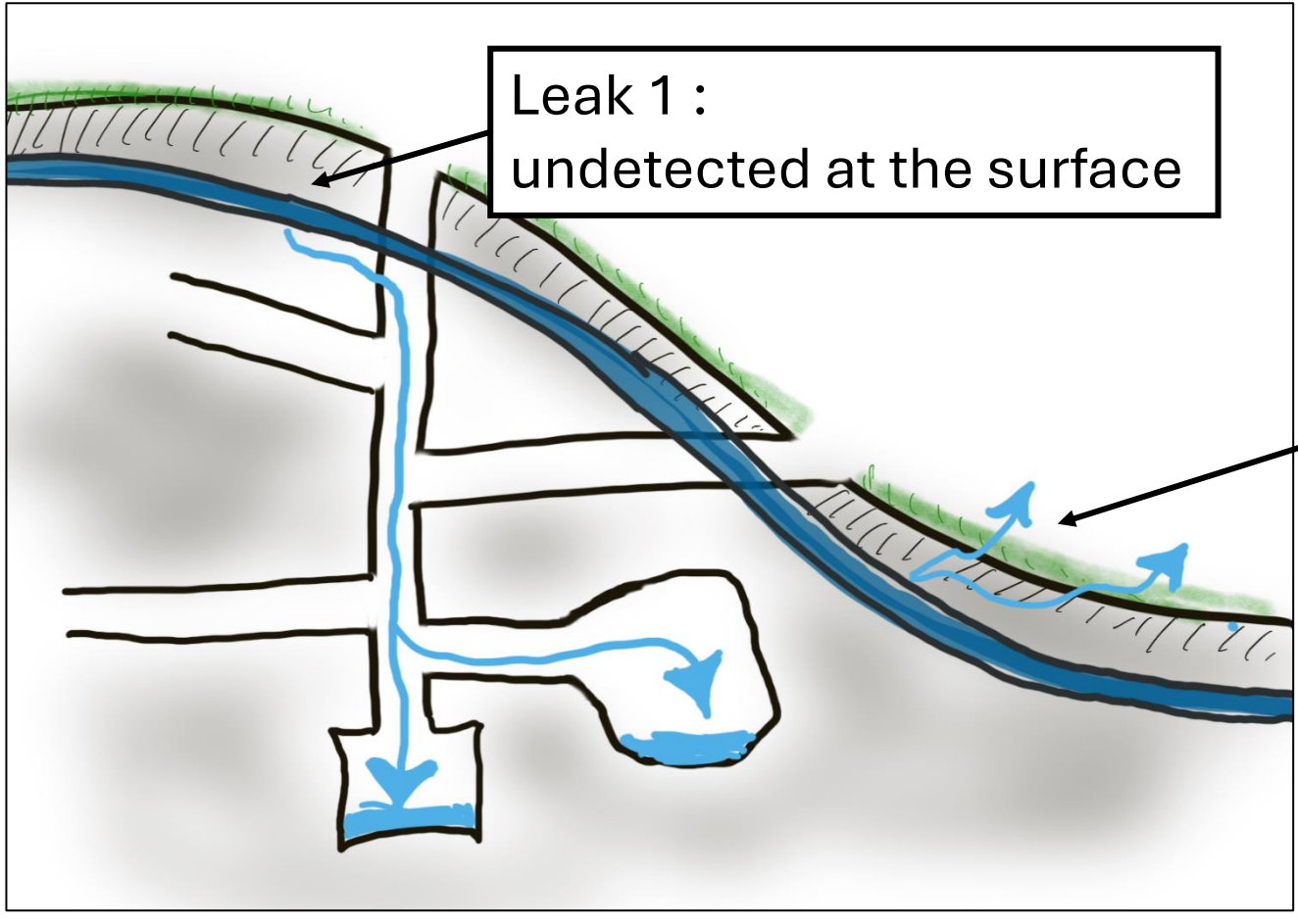
Old mine workings

MapleSky Environment & Infrastructure



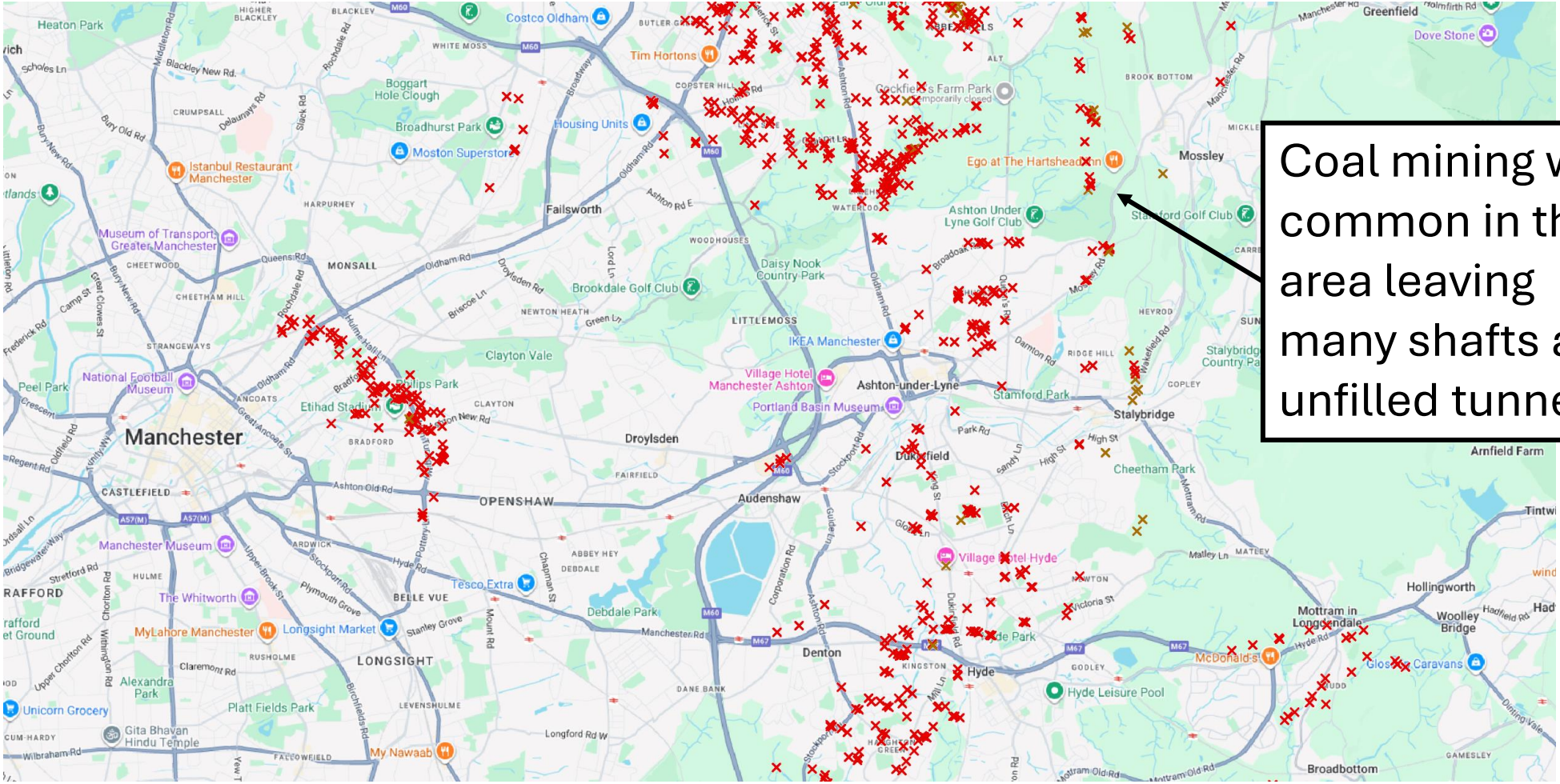
Old mine workings

MapleSky Environment & Infrastructure



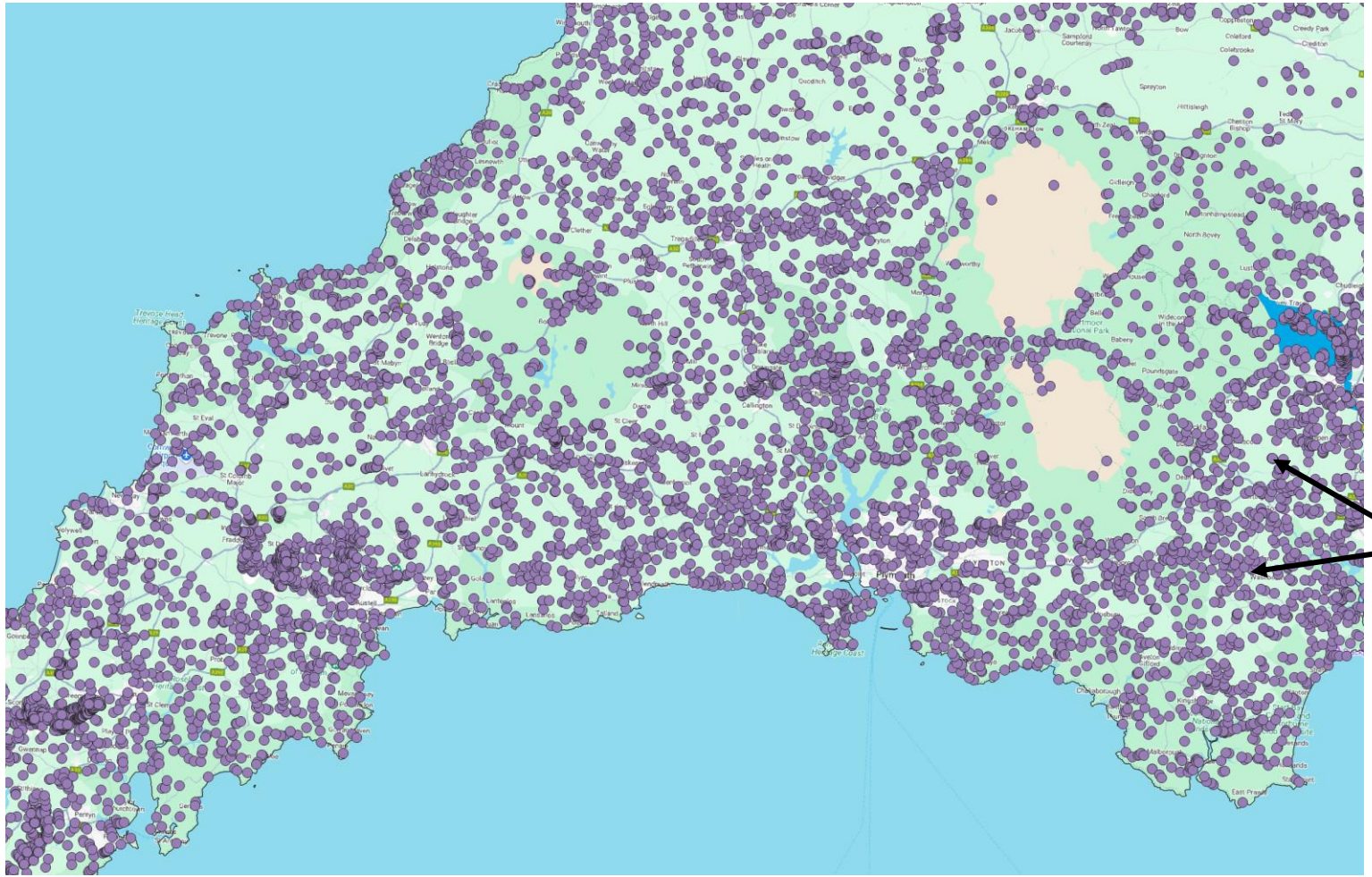
Mine shafts near Manchester

MapleSky Environment & Infrastructure



Just a few mines in the southwest…

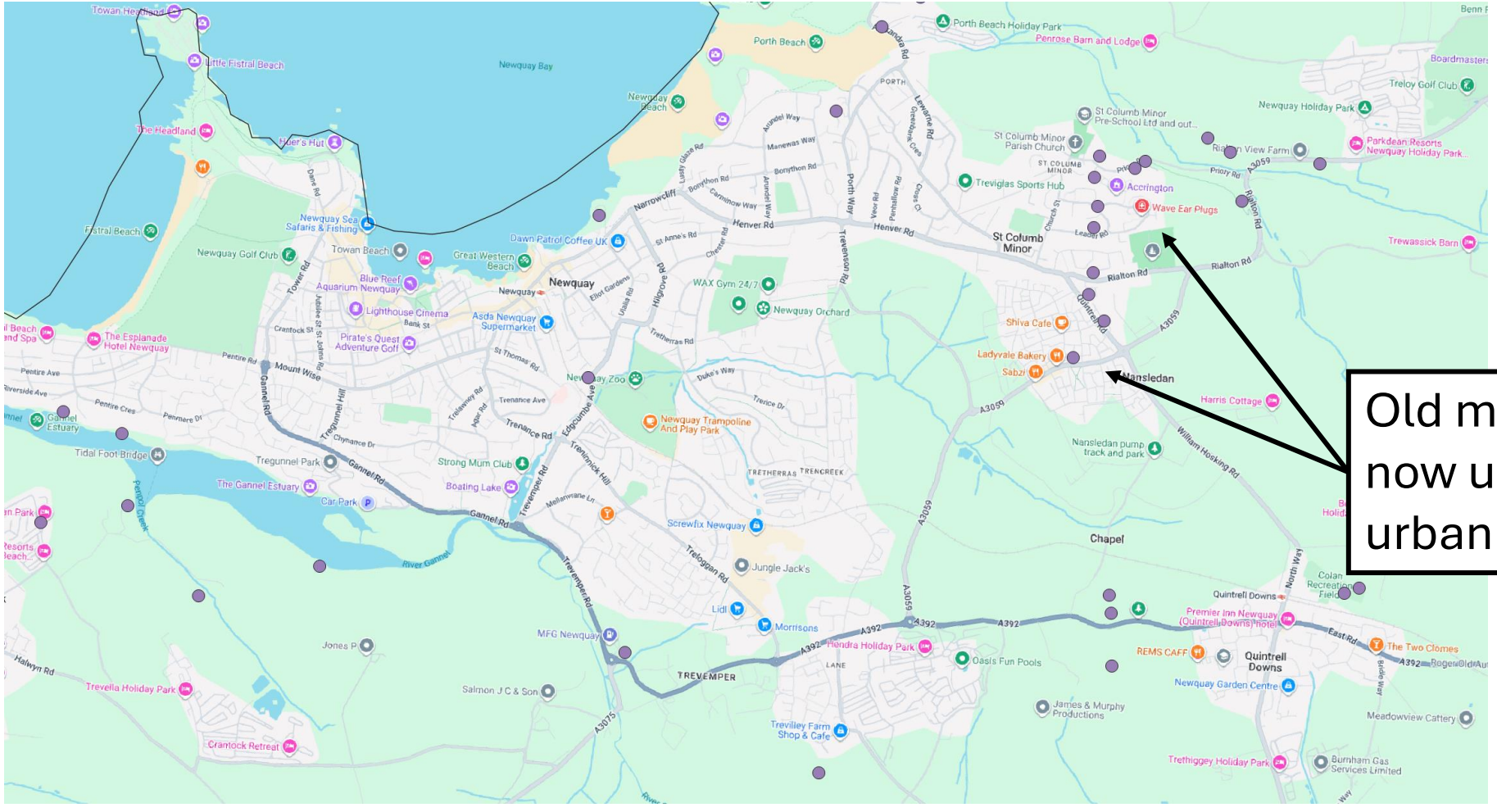
MapleSky Environment & Infrastructure



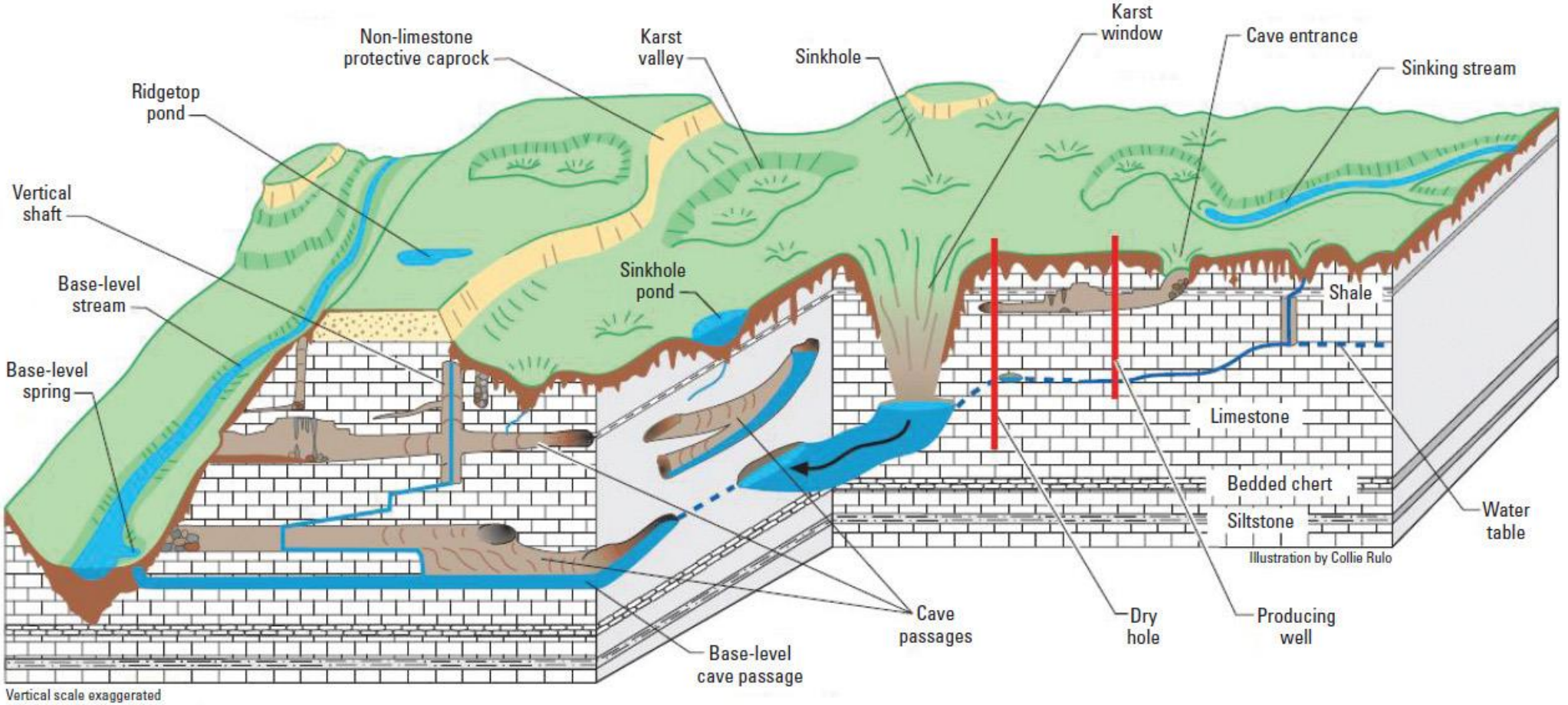
Mining for tin, copper, lead and zinc was widespread in the southwest

Newquay

MapleSky Environment & Infrastructure



Karst (limestone fissures & caves)



https://en.wikipedia.org/wiki/Karst#/media/File:KarstterrainUSGS.jpg

Checklist for annoying DMAs

MapleSky Environment & Infrastructure

Are there ground conditions that **makes leakage more likely?**

- Clay (also consider weather and trees)
- Peat
- Slope issues

Are there ground conditions that **make leaks harder to find?**

- Sandy and gravelly soils
- Mines
- Caves and karst?

Dr Timothy S. Farewell
tim.farewell@maplesky.co.uk



Q & A

Awareness & Locate (PALM)

To BABE or not to BABE, is NOW not the question. But what's the answer?



Ken Cartwright

Senior Associate Engineer

AtkinsRéalis

Upstream Leakage

To BABE or not to BABE, is NOW not the question. But what's the answer?



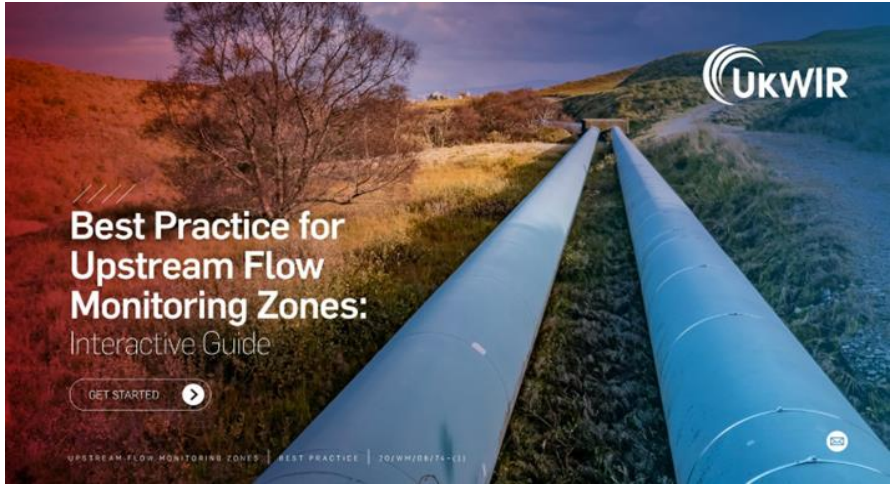
Ken Cartwright
Senior Associate Engineer

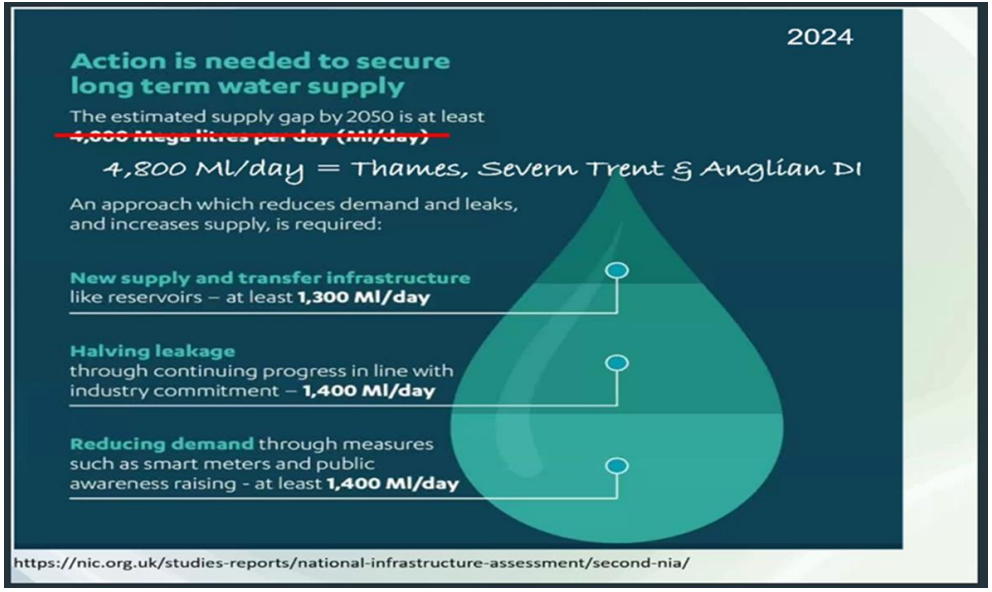
AtkinsRéalis

2025

Leakage Conference 2024

- Ofwat announce
  - The end of BABE or other estimation of Upstream Leakage
  - A need to report on Upstream Leakage by 2030 based on flow measurement

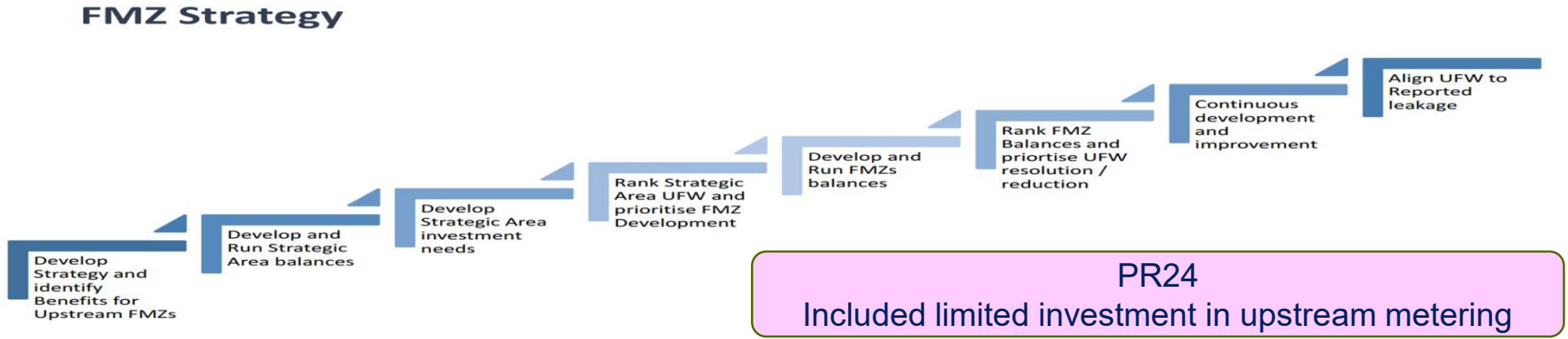




UKWIR Best Practice for UFMZs – 2020

- Historic methods - didn't support upstream monitoring business cases, data improvement and investment
  - Lack of investment in upstream monitoring
  - Lack of maintenance of existing meters
- Benefits far wider – Supply interruptions, WRMP planning, WQ
- Companies in different places
- Data validation is manual – need to update software and analytics

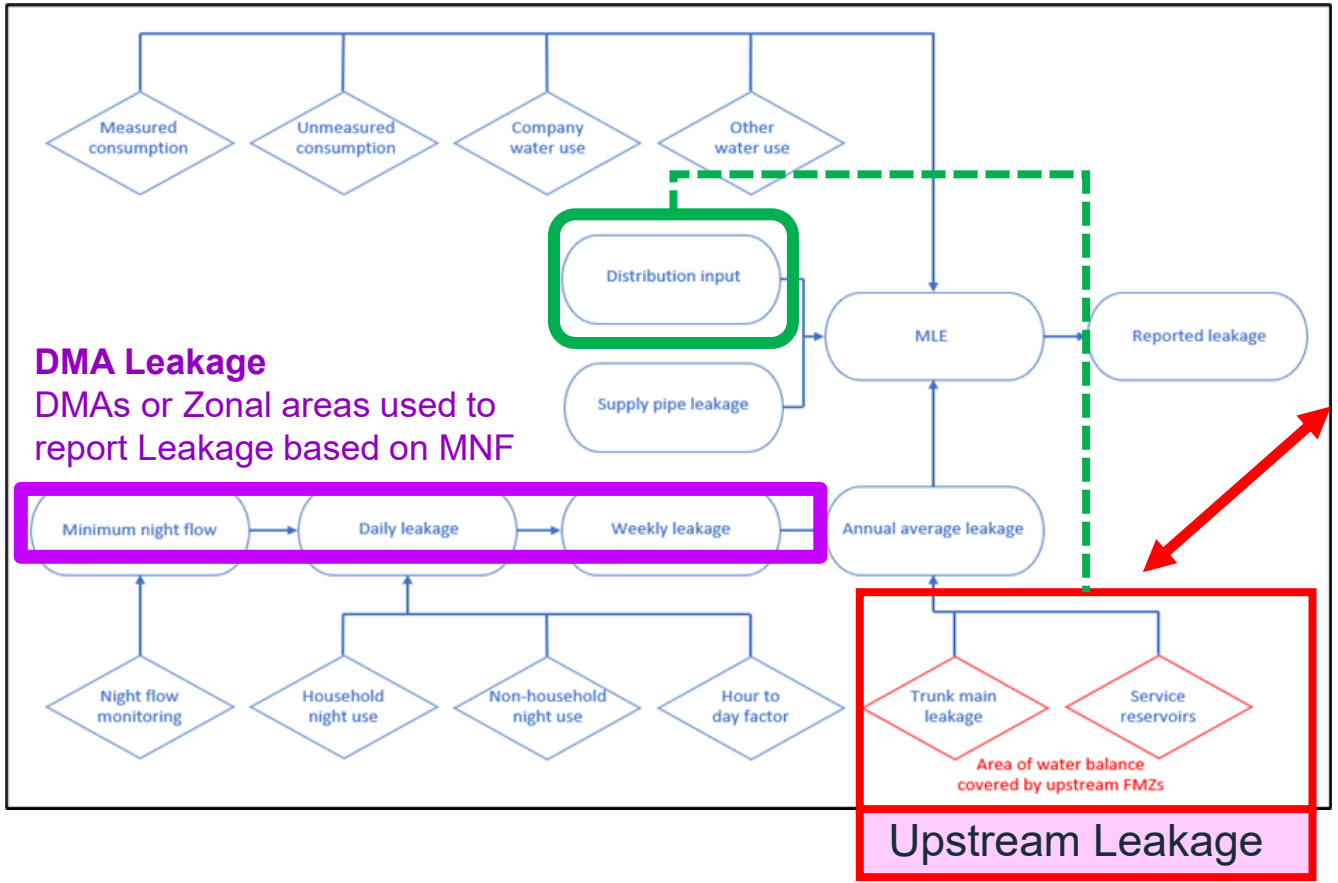
- 'Steps to Success'
- Strategic Balances = Sum of UFMZs
- The development is an iterative approach
- A need to balance coverage, cost and confidence with a need to improve auditability
- Metering needs and meter maintenance must be a risk / need-based approach
- It can be used for reporting (e.g. United Utilities)



PR24
Included limited investment in upstream metering

Ofwat - Workstream 3 - Upstream Leakage

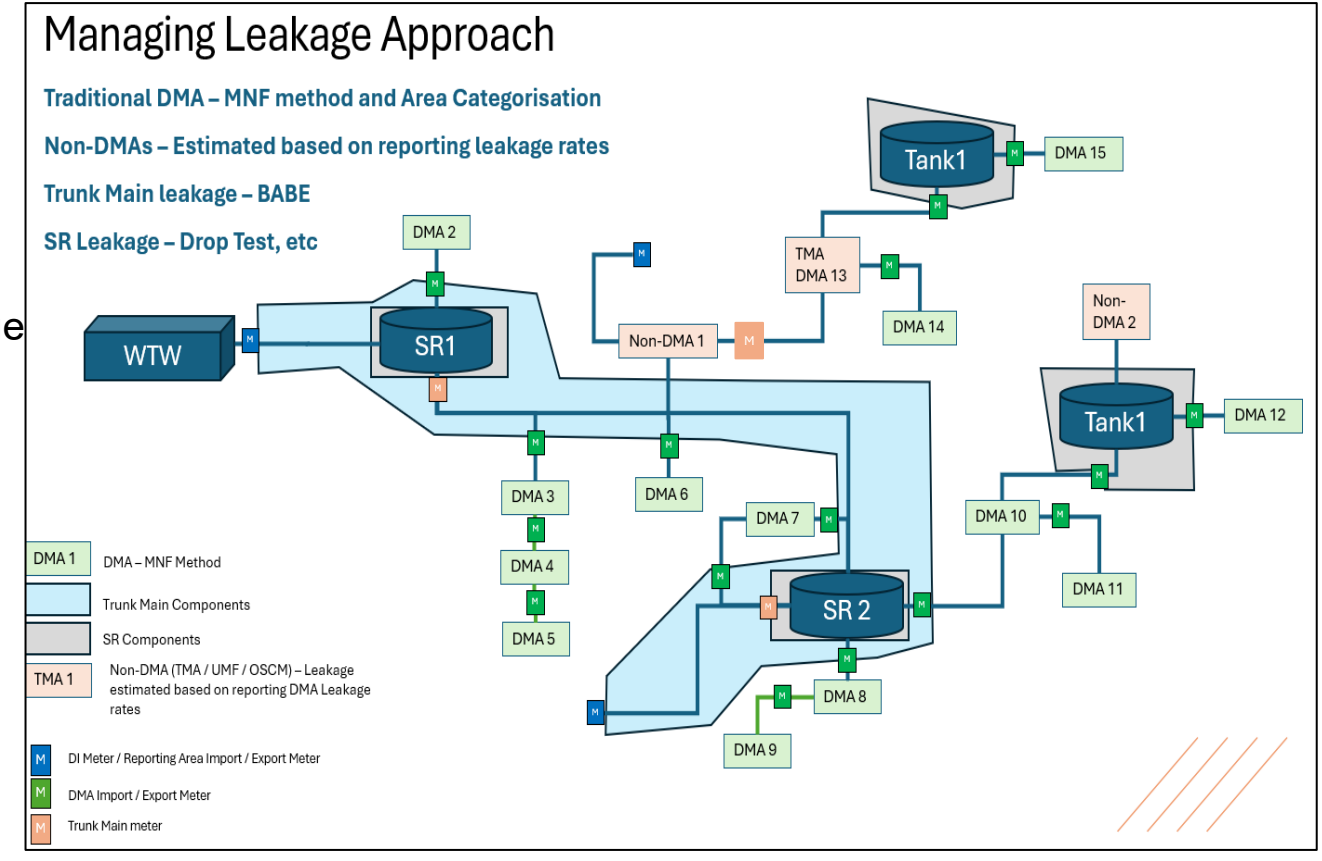
The Water Balance



- How to replace BABE to a method based on continuous monitoring for Upstream Leakage?
- Methodology needed to be aligned to the different approaches taken by companies to report 'DMA or Zonal Leakage' and the cohorts of meters used in this calculation
- Alignment of data and validation for DI flow meters
- Achieved full network coverage and enabled the development of confidence in a cost-effective or Risk based manner
- Process needs to be auditable
- How to report on confidence for the MLE?

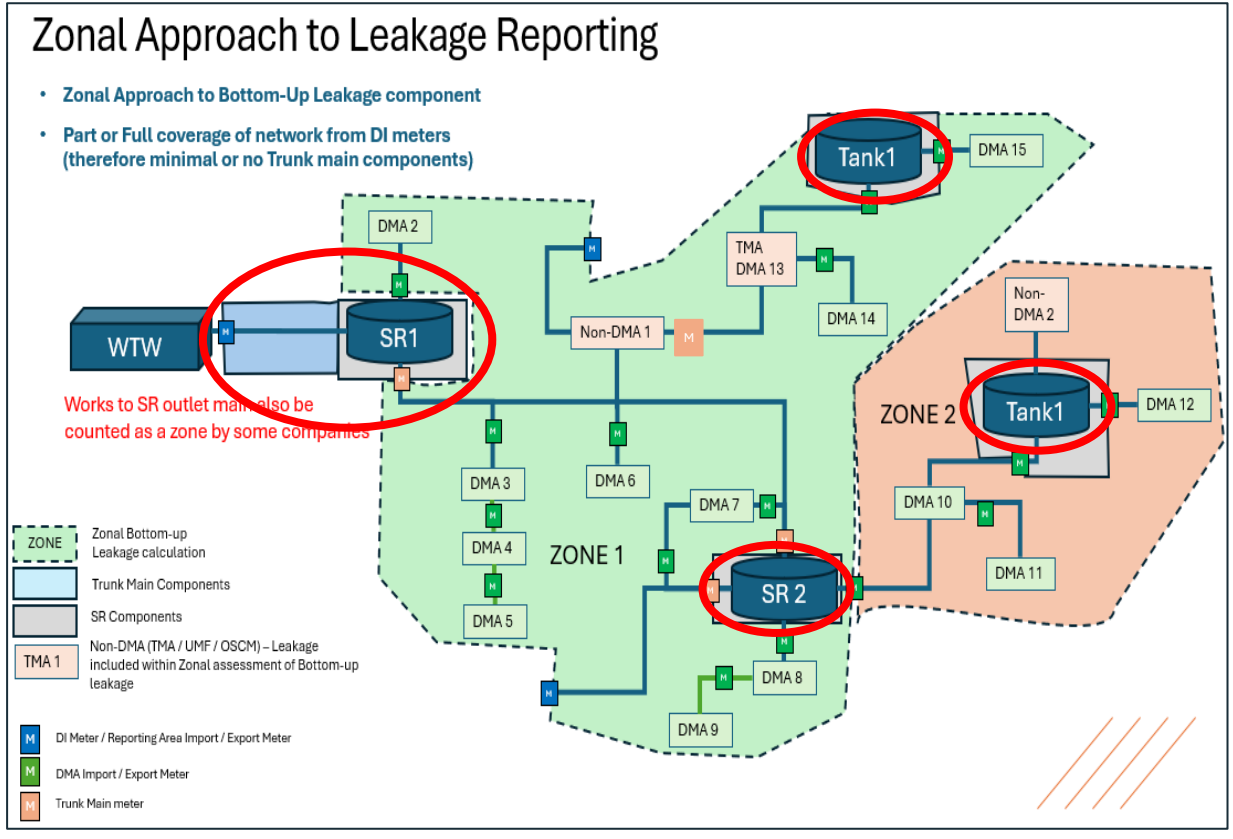
Potential Impact of UMFZs
Companies Reporting DMAs

- **Higher risk** that upstream leakage will increase significantly
- **Longer lengths of mains** outside of reporting areas (DMAs) not being managed and targeted daily for leakage
- **Non-DMAs** area outside of daily targeting and leakage management
- **Non-DMA** demands need to be accounted for correctly
- Increased issue with NAVs



Potential Impact of UMFZs
Companies Reporting Zonally

- **Lower risk** that upstream leakage will increase significantly
- **Shorter lengths of mains** outside of reporting areas not being managed for leakage
- DMAs only used for targeting
- Leakage in ‘trunk mains’ and ‘non-DMA’ areas still picked up in Zonal balance, therefore managed
- NAVs more likely to be picked within a Zonal Area

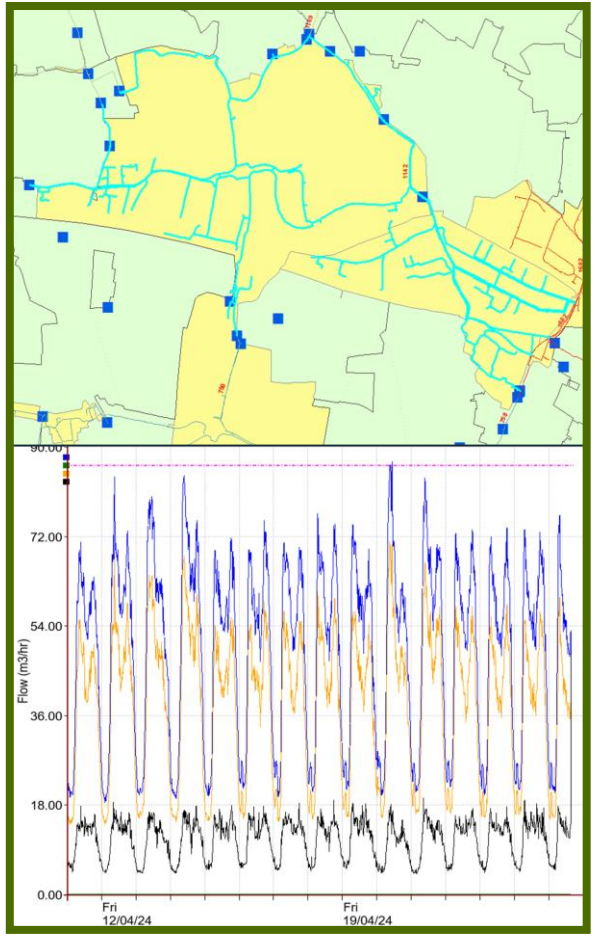


Methods of UFMZ Assessment

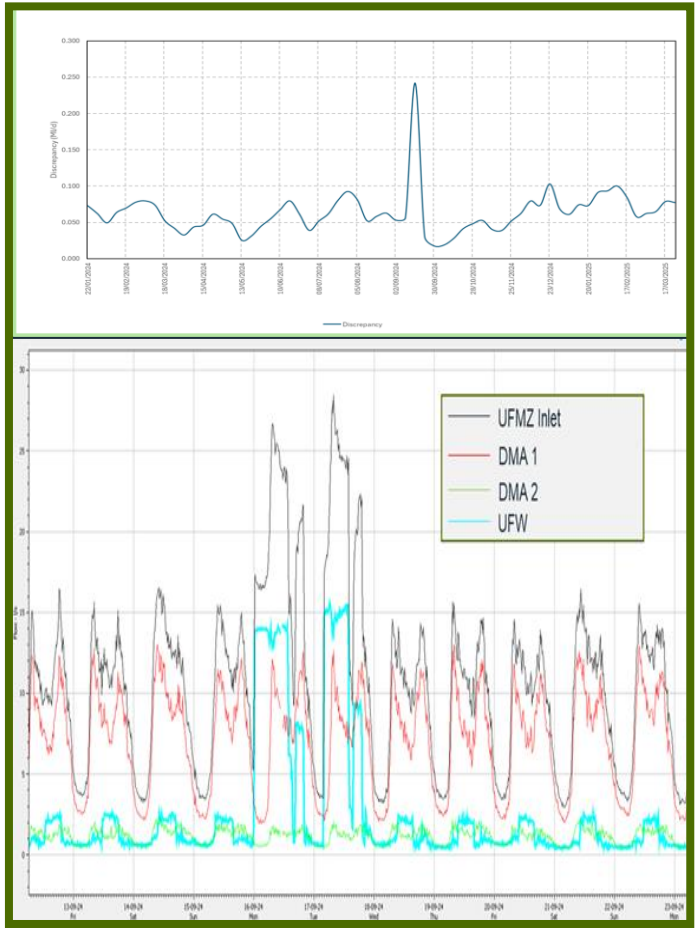
	Method	Summary	Benefits	Concerns	Currently Used for Reporting
1	**Strategic Balances Volumetric**	Volumetric	• Full Coverage • **Data already available (should be)** • **Low investment need**	• **Hard to validate** • No linked to targeting • High levels on uncertainty • **May not support investment in upstream monitoring improvements**	**1**
2	**Sum of all UFMZs (regardless of confidence and value produced) Volumetric**	Volumetric	• Full coverage • Links to targeting • **Risk based approach to effort and investment** • **BP – run with Method 1 to ensure values aligned**	• **Technical acceptance of results – Different to current practices** • Varying levels of balance confidence • Increased cost of new / replacement meter • Time and cost to develop confidence in balances • Increase error caused by Trunk Main Meters	**2**
3	**Valid UFMZs based on Volumetric balances and prorated**	Volumetric	• High confidence in areas used for reporting • Link to targeting and leakage management • **Detailed investigation and validation of each FMZ setup**	• Partial coverage • **Not data lad and subjective** • Cost to achieve high standard • **Doesn't account for gap between DI and DMAs/zonal areas**	**2**
4	**Valid UFMZs assessed based on MNF and prorated**	MNF	• Part coverage • **High level of confidence in valid balances** • Focuses effort	• As 3 • **Increased cost to achieve very high standard** • Doesn't account for gap	**None**
5	**All UFMZs assessed based on MNF**	MNF	• Full coverage • **Potentially most accurate** • High level of confidence in balances	• As 2 • Cost of new / replacement meter • Time and cost to develop confidence in balances • **Maybe not possible**	None
6	**Hybrid – (Volumetric and MNF where applicable)**	Hybrid	• Full coverage • **Best of method 1,2 and 4.**	• **As all the above**	None

Question – If an upstream area is being assessed using MNF – Should it be an upstream area?

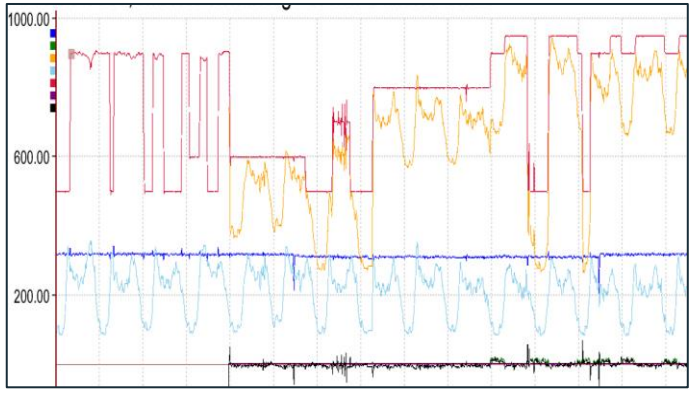
Upstream MNF assessments



Complex flow balance -14 meters



Impact of a Chicken Farm



No demand - no difference between MNF and Volumetric.

MNF is possible on upstream networks

- If areas contain properties and flow balances provides a diurnal flow pattern
- May not adhere to standard operability rules
- Achieving and maintaining this standard comes at a significant cost

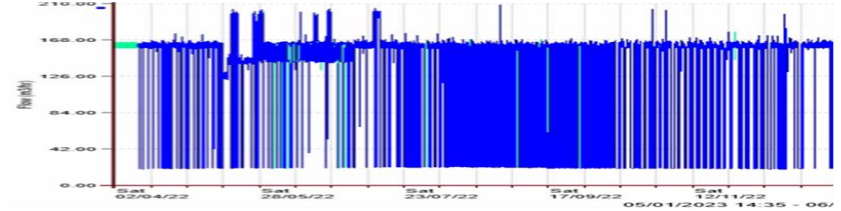
- Should such areas be classed as upstream?
- Is Best Practice about changing such areas to be DMAs in bottom-up reporting

Flow Meters

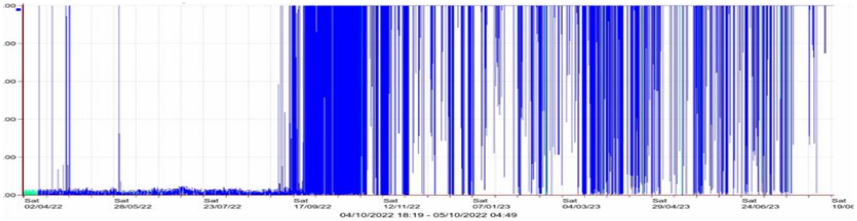
- Meter accuracy and uncertainty impact balances
- Validation of flow data is critical
- UFMZs can help pinpoint problematic / Inaccurate DI, upstream/trunk main or DMA meters
- Some meters don’t even report the same flows across reporting systems

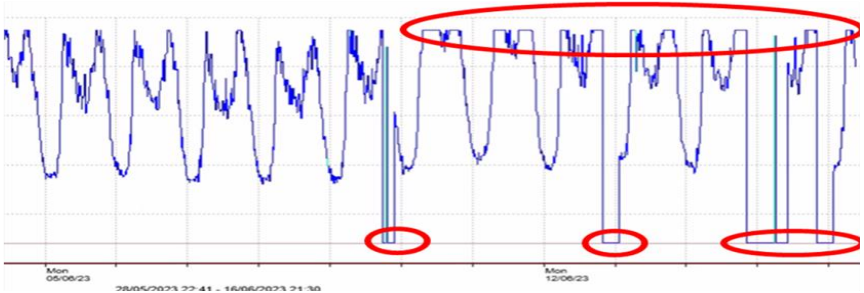
Zero Errors

Over read on DI meter - 0.5Ml/d



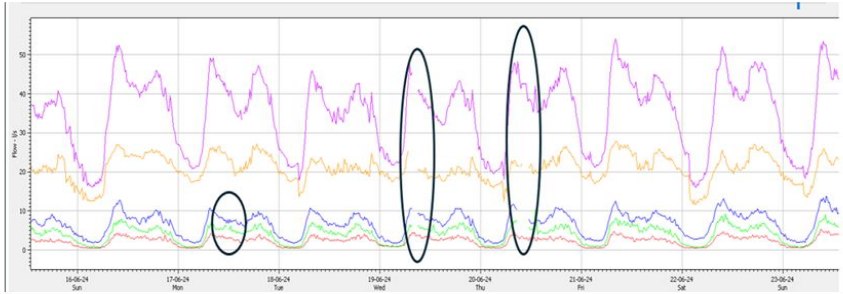
Signal Shorts





Signal Saturation

Flows higher than meter reads, causing dropouts



Missing timesteps

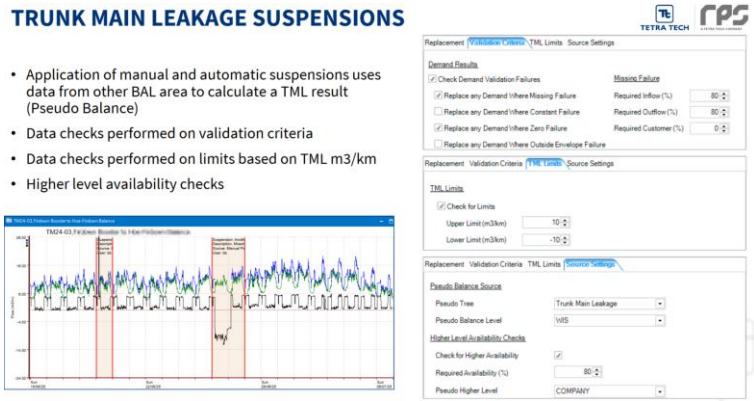
Under reported Total Daily flow on meters

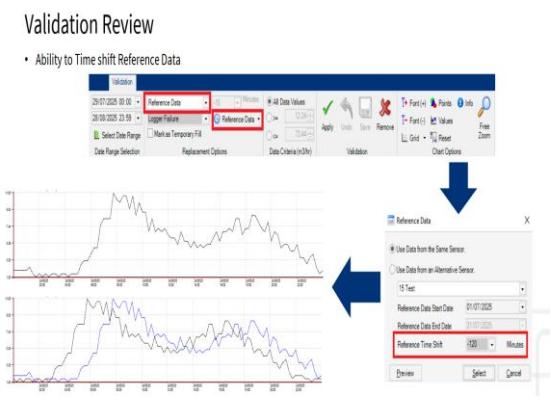
Flow Validation

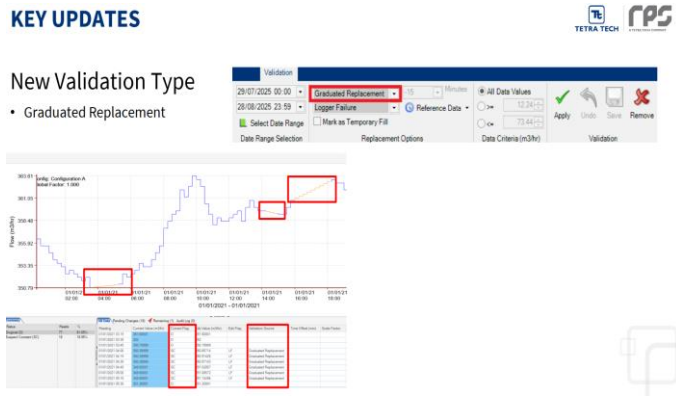
UKWIR study identified that volumetric flows were being amended external to leakage reporting systems due to lack of functionality.

This is starting to be addressed by software suppliers

- Ability to infill missing 15min data timesteps
- Ability to invalidate 15min flow data and overwrite with historic data / manual readings
- Ability to apply timestep changes to 15min data
- Ability to report % of amended timesteps each week for every meter
- Ability to overwrite weekly volumetric flows for each meter / infill with previous week flow data or evidence amended flow volumes (i.e. Higher flow in Hot Weather periods)
- Ability to invalidate a period for a flow balance – and infill with previous week flow data
- Ability to calculate flows automatically / merge balances if meters fail
- All changes must be recorded with a reason code and evidence for Auditability







Components of Upstream Leakage

Component		Potential Data Error / Uncertainties
Net DI (Bulk measured Water in - Bulk Measured Water measured out)		• Meter error – meter install / calibration issues • SCADA data errors – Wiring / config / scaling factors • SCADA data errors – missing time steps / time offsets • Unmetered transfers between reporting areas • Poor validation of data
Water Delivered to DMAs (Method B areas)		• DMA meter error – meter install / calibration issues • SCADA data errors – Wiring / config / scaling factors • SCADA data errors – missing time steps / time offsets • Unmetered transfer to/from DMAs • Impact of operability data rules - If calculating Water delivered to DMAs based on Sum of flow in all DMAs rather than just primary flow meters
Upstream Demand	***Metered & Unmetered Non-Households***	• Property allocations to correct mains • Meter read periods periods and estimation process used • Missing customers • NAVS – meter not installed / not working as only partial site completed
	Metered & Unm*etered Households*	• PCC estimates applied • Leakage estimates applied for comms, services and plumbing losses – But is this double counting as its also included within the UFW values produce by upstream flow balances.
	Other Flow Components (Process and operational use Illegal Use, etc)	• Meter error / unmetered • Not mapped correctly / generic company data set • Incorrect assumptions used
Change in Storage		• Faulty level equipment • SCADA data errors – Wiring / config / scaling factors • 1 level but multiple cells • Incorrect SR characteristics - level / capacity profile / BWL /TWL / overflow levels
Unvalidated Upstream UFW		**Impact of Error / Uncertainty - Apparent Losses** **Validate Upstream Losses**

All companies have

Some companies have, some found difficult to produce

Most companies found it difficult to produce / validate upstream demand

New – few companies could produce

Distribution Input

Based on data ongoing research

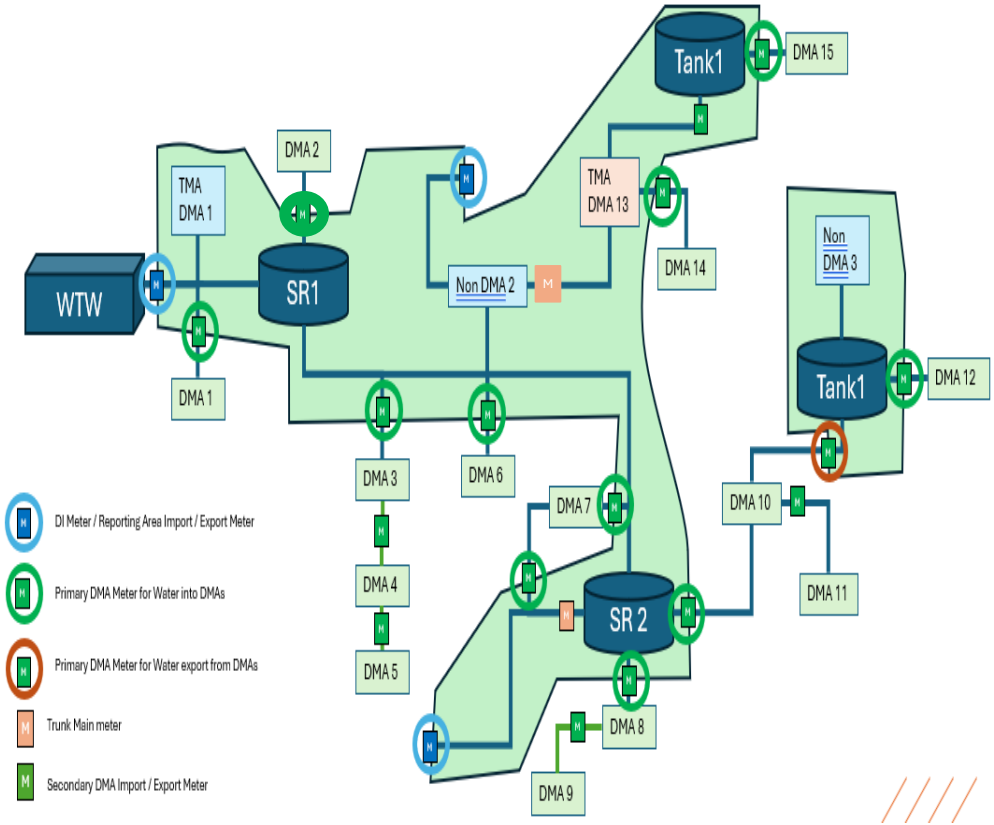
- DI for England, Scotland and Wales over the last 15 years — **16,700Ml/d to 16,900Ml/d**
- Targeted reduction in leakage and demand of **16.5%** of typical DI. — **2,800Ml/d**
- DI Uncertainty within the MLE ranges from **±1% to ±5.09%** — **± 428Ml/d**
  - Typical meter accuracy **± 2%** — **± 327Ml/d**
- Actual DI adjustments applied within the MLE of **-0.005%** of total DI — **-89Ml/d**

- Majority of DI meters installed across our networks are at 'End of Life'
- Conflicts with other ODI drivers means replacement can be costly, or result installations have a reduction in accuracy.
- UFMZs can help to identify the most problematic meters and verify errors in flow data, leading to an improvement in DI Uncertainty are reported DI



- **Innovation Required**
  - **Improve meter accuracy and flow validation while reducing network risk/impact when replaced – Could Ofwat fund this?**

Strategic Balances
Water into DMAs / Zonal Areas

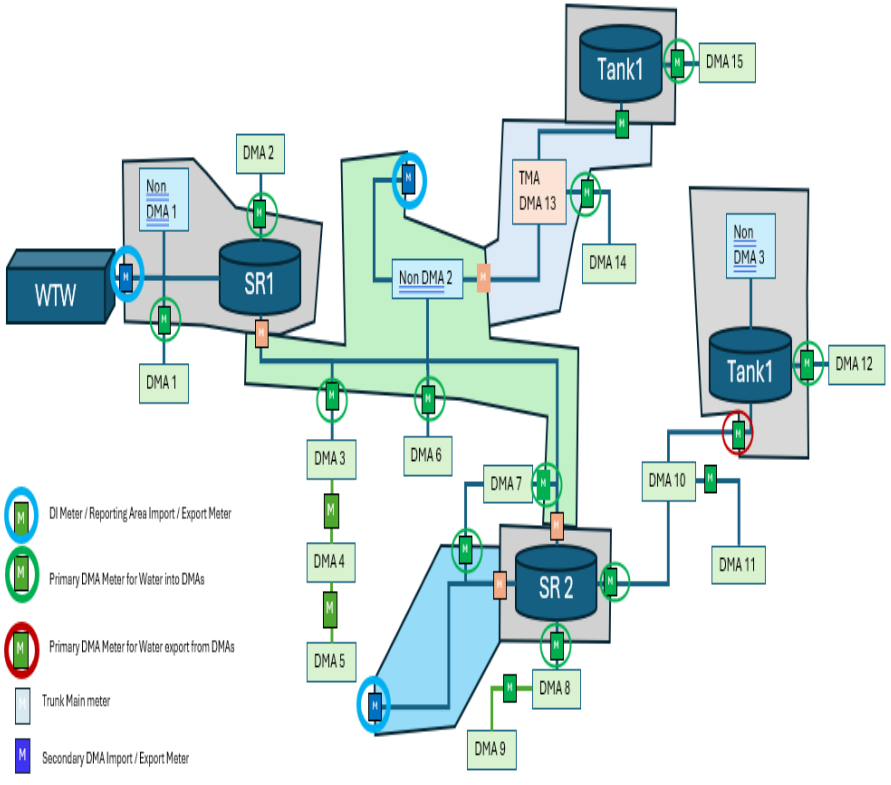


- Water into DMAs / Zonal is measured by **'Primary Meters'** supplied directly off the upstream network into a DMA / Zonal Reporting area.
- Or
- The summation of Net Total Daily Flows for all DMAs within the reporting area.

Impact of Operability rules used for MNF assessments

- Operability rules in some software packages can change the Total Daily Flow value for a DMA from the measured value to a typical value.
- This can mean data / operational issues within DMAs are getting transferred into UFW within the trunk main balance

Methods 2-6
Water into DMAs / Zonal Areas



- Water into DMAs / Zonal is measured by **'Primary Meters'** supplied directly off each UFMZ into a DMA / Zonal Reporting area.

- Easier to see the impact of each flow meter to the reported UFW and improve validation.

0	0.102	0.102	0.095	0.096	0.096	0.080	0.066	0.060	0.064	0.064
0	1.040	0.949	0.977	0.055	0.000	0.000	0.779	0.944	1.031	0.927
Inlet Total	6.218	6.211	6.096	6.324	6.288	6.410	5.849	5.819	6.176	5.858
Demand	5.678	5.629	5.406	4.602	4.519	4.349	5.166	5.254	5.614	5.341
Storage Change										
Tile Cons	0.099	0.099	0.099	0.099	0.099	0.098	0.098	0.098	0.097	0.097
Outlet Total	5.777	5.728	5.504	4.701	4.618	4.447	5.264	5.352	5.711	5.437
Discrepancy	0.442	0.483	0.592	1.623	1.671	1.964	0.585	0.467	0.466	0.421

-1%	0%	2%	-2%	-1%	-1%	-2%
3%	zero flow	zero flow	zero flow	Estimated	15%	-1%
-1%	0%	-1%	-1%	2%	3%	0%

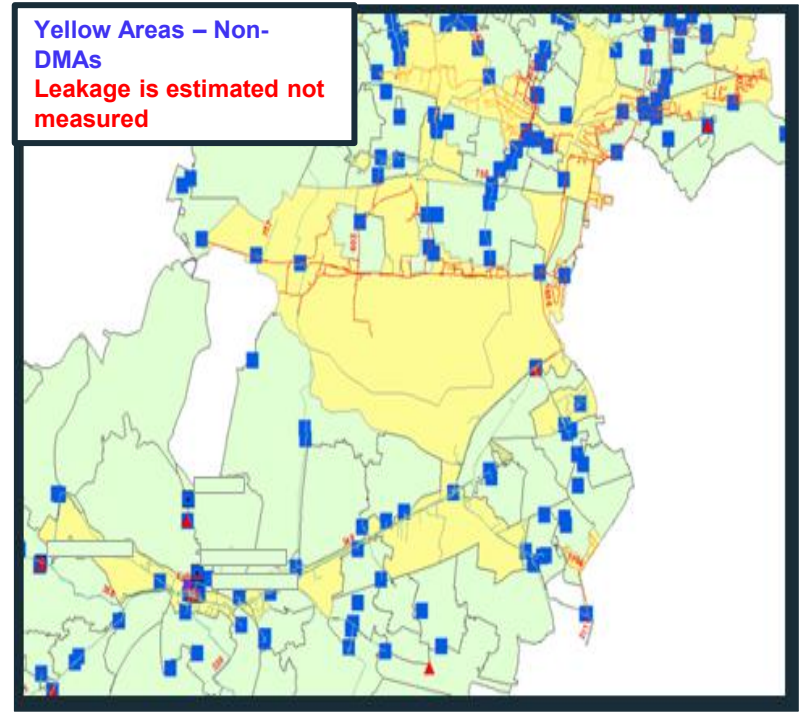
Meter / logger failure transfers 1Ml/d onto Upstream UFW

Upstream Demand

- **NON–DMAs (UMFs, TMA DMAs, OSCMs etc)**
  - Areas and assets across out network which exist in areas which are not continually monitored for leakage
  - Some areas are fully metered, but don't comply with operability rules – so get made NON-DMAs

- **Companies not reporting using UFMZs**
  - Treat such areas as part of the distribution network
  - Leakage in such areas is currently estimated based on a prorated leakage rate per property from reporting areas

- **Companies reporting using UFMZs**
  - treat such areas as part of the upstream network
  - Included in upstream Leakage calculations



UKWIR study identified need to trace UFMZs into GIS and link properties so to enable an estimate of demand to be produced.

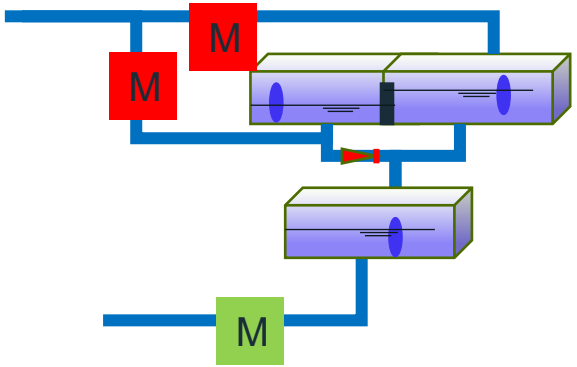
Current Gap - Companies still need to develop this data set and how to report.

SMART meter data will help to transfer upstream demand from being estimated to being measured

Impact of Storage Change

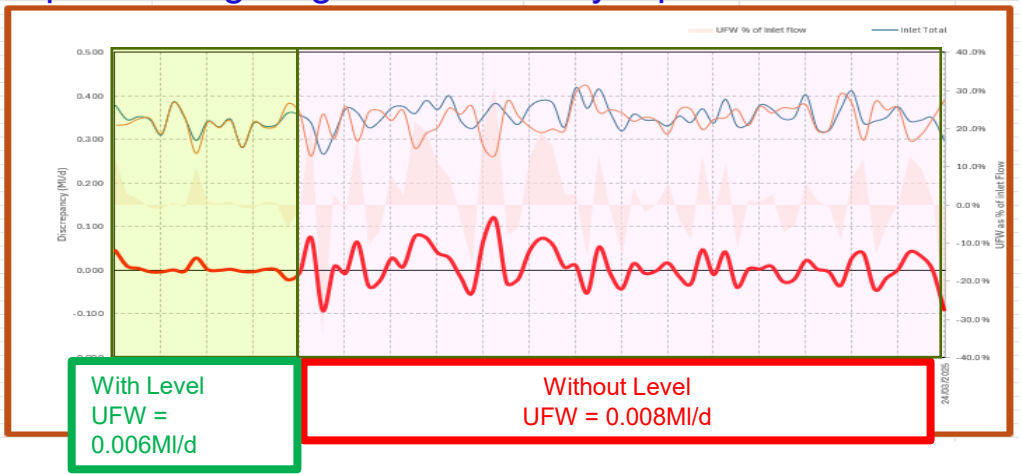
Best Practice:

- Meter all inlet and outlet flows of storage sites



- **UKWIR Recommendations**
- Risk based approach to investment
- Assess using Weekly Volumetrics balances
  - Even out change in storage.
  - Enables storage sites to be included within a UFMZ
- Software development needed
- Nice to have but not critical for reporting on UFMZs

Improves targeting not necessarily reported numbers



Water loss through overflows - missed in current methods



SR overflow – running approx. 30minutes prior to supply pumps turning off when at Top Water level – 2 to 3 time a day - Off level on pumps set to value higher than overflow.

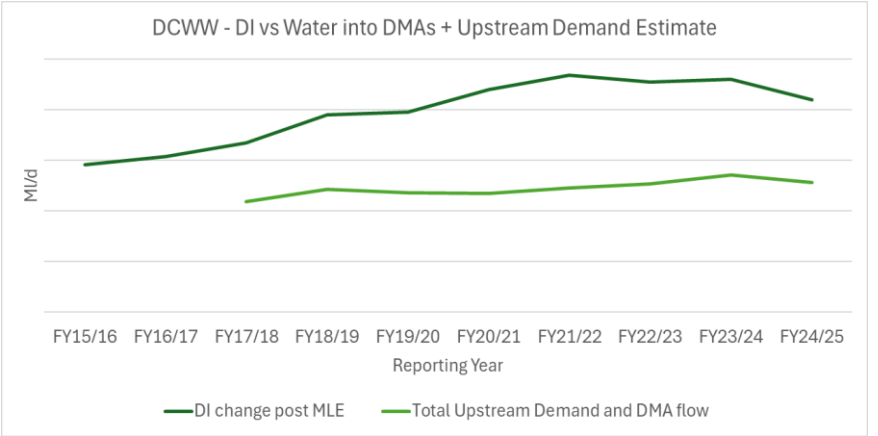
DCWW Case Study
Benefits of Moving from BABE to Flow Balances

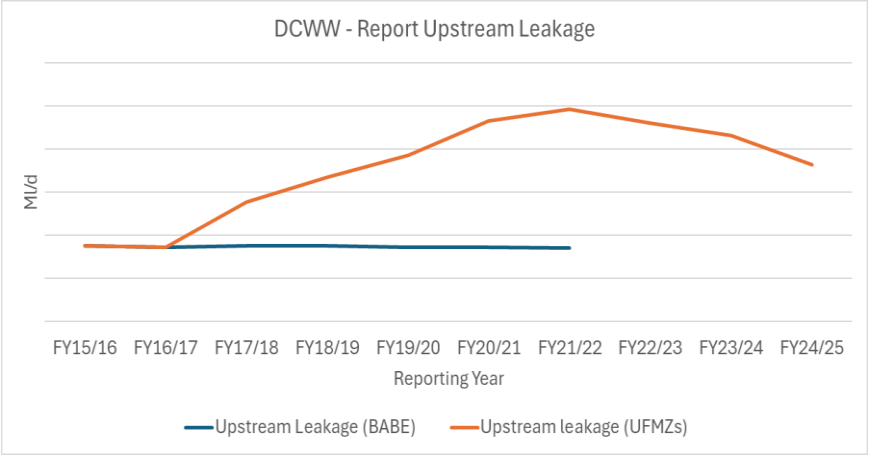
Changes since FY21/22

Reported DI	3% Reduction
DMA Flow + Upstream Demand	0.7% Increase
Reported Upstream Leakage	26% Reduction

- Reduction in upstream leakage equivalent to 75% of the value previously reported using BABE

- Provided focus to:-
  - Validate DI and invest in upstream metering
  - Resolve long term DMA operability issues
    - Improving targeting of unknown DMA leakage
  - Validate demand on the upstream network
  - Deliver actual reductions in water losses
  - Deliver actual DI reductions





Potential Timelines

Presenters current view
Not final OFWAT guidelines

Start accounting for the gap between DI and you DMAs / Zonal Reporting Areas



Follow UFMZ UKWIR Study recommendations

1. **Setup Strategic Balances**
   - Understand current UFW

2. **Setup UFMZs – on existing metering**
   - Understand why UFW exists
   - Understand metering gaps and data issues
     - Risk based approach to resolve
   - Improve the validation of flow meter data

3. Trace and assign properties outside of DMAs to UFMZs and calculate demands

4. Promote meter investment needs in PR29

1. **Report on Strategic Balances**
   - Supported or replaced by UFMZ - Method 2

2. Implement DI and DMA meter verification and maintenance plans following best practice

3. Implement metering improvement programmes

4. Utilise SMART meter flow data

5. Learn, develop and implement updated UFMZ balances



Questions

1. Do you know the volume of Water entering your Network, that isn’t measured entering you DMAs or Zonal areas.
2. Do you understand if this volume of water
   - Is DI Meter error, demand, missing DMA flows or Leakage?

AtkinsRéalis



Q & A



Networking & refreshments
See you back at 11.45

A big thank you to our exhibitors for their ongoing support

Organised by
lodestar

Media partner
THE UK WATER REPORT
POLICY | REGULATION | FINANCE

Our exhibitor-supporters and media partner

aqualogic water conservation

arqiva

ATMOS INTERNATIONAL

AVK

BERMAD

CLA-VAL

FYLD

GUTERMANN

HWM Global

OVARRO CONNECTING TECHNOLOGIES

SME WATER

suez

SYNTHOTECH

TECHNOLOG

TETRA TECH

rps A TETRA TECH COMPANY

THE UK WATER REPORT POLICY | REGULATION | FINANCE

GWI GLOBAL WATER INTELLIGENCE