# Welcome back

**Peter Simpson**

Chief Executive

Anglian Water

# Operational & technical developments forum

# PREVENT: Assessing leakage on PE networks

**Paul Ives**

Senior Consultant – Leakage & Water Resources

WRc

# Assessing Leakage on New PE Networks: UKWIR Project Findings

Paul Ives

5/12/2023

# Overview

Over the past two decades, the water industry has predominantly adopted polyethylene (PE) pipes due to their durability, longevity, and lightweight properties.

Past research has highlighted concerns about electrofusion joints, indicating a higher failure rate compared to butt fusion and mechanical joints.

The unique properties of PE pipes, such as poor sound conductivity, pose challenges in traditional leak detection methods, making it harder to pinpoint leakage sites.

As home construction numbers continue to rise, the influence of PE networks on overall leakage levels within the water industry is set to escalate.

The project aims to collect and analyse leakage and comprehensive evidence identifying root causes and inform on recommendations

# Background

The purpose of the project is to assess leakage in newly installed PE networks, and help with the UK water industry's goal to halve leakage by 2050

This project builds upon the findings of the 2010 report 10/WM/08/43, which highlighted challenges concerning PE pipe joint integrity.

Understanding the root causes behind leakages in newly installed polyethylene (PE) networks holds significant importance in achieving this goal.

# Method

The following steps were agreed as the most beneficial way of deep diving on data from DMAs and questionnaire answers from water companies.

# DMA Shortlist

1

The project team Facilitated two single-day workshops for all partners to help identify the requirements to include

- <20 years
- 100% PE
- Either new network or fully refurbished up to and including boundary boxes

2

Upon further analysis, it was acknowledged that more robust and representative data was needed for the project's accuracy and reliability.

3

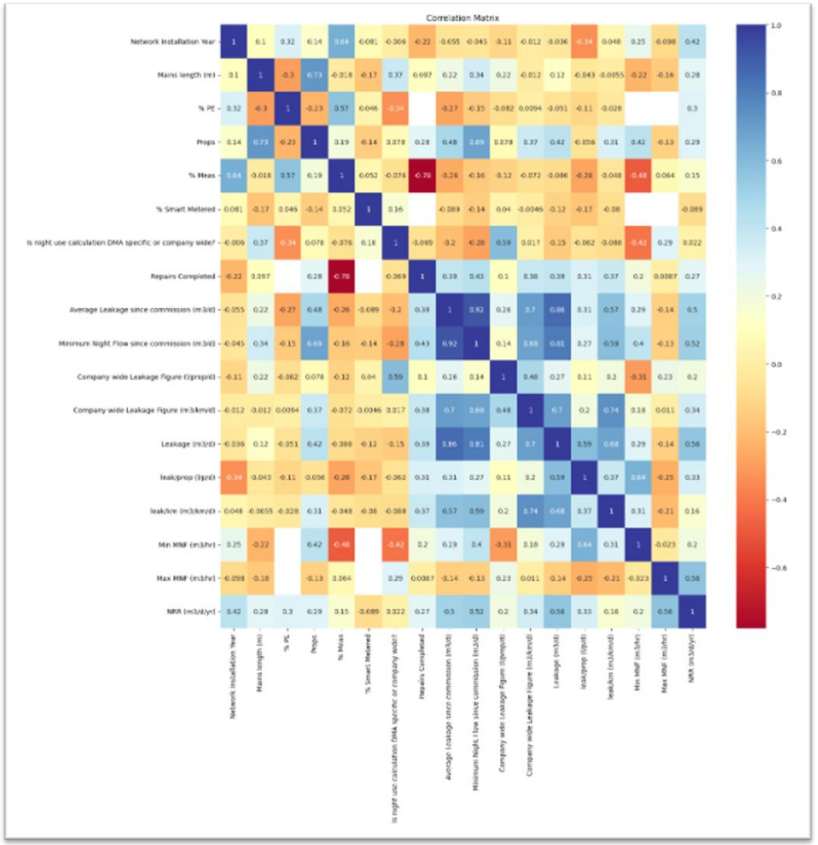
To improve dataset quality and reliability, the project adapted the DMA selection process, aiming to gather comprehensive data for a better understanding of factors contributing to PE network leaks

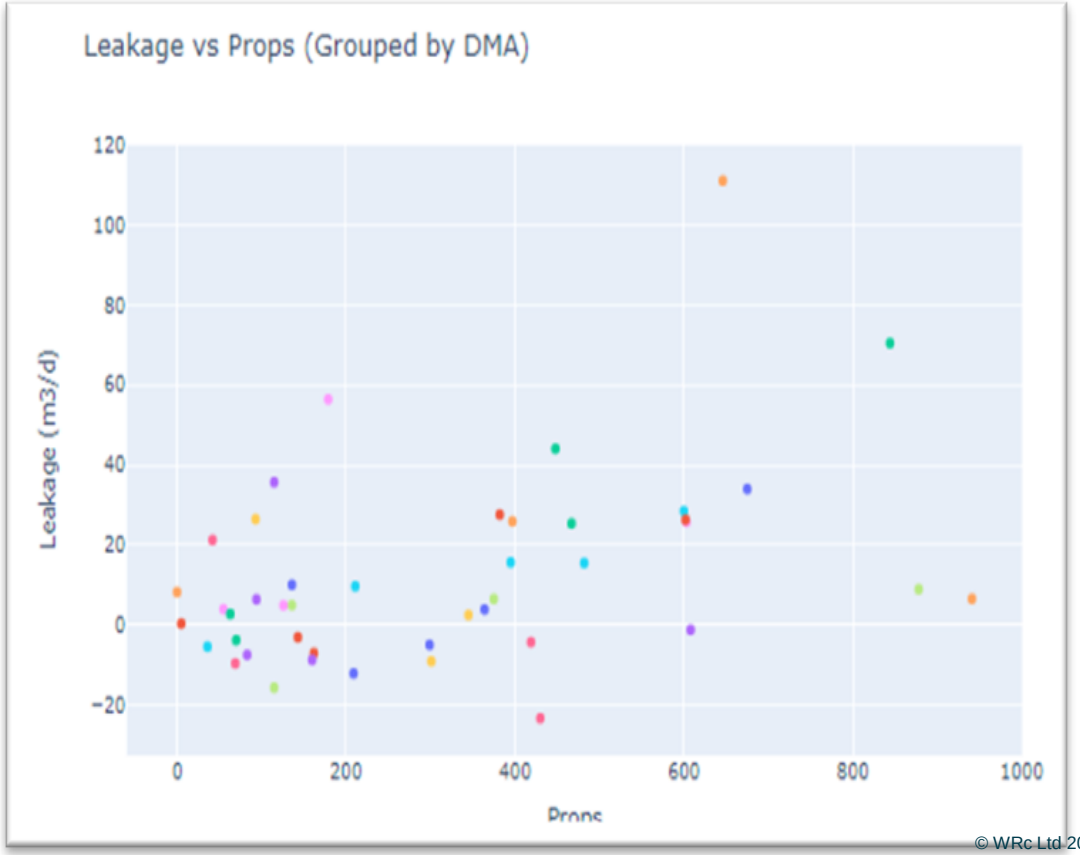
- <15 years
- 100% PE
- 100% Metered

# Data insights and correlations.

## Correlation Matrix



# Questionnaire development

Design

Installation

Quality Assurance

Monitoring

Organisational Practices

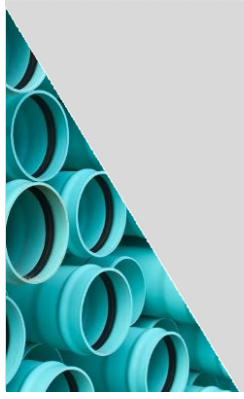
People

Customer Supply

# Interviews

Interviews were conducted across multiple leading water companies to gather diverse perspectives and insights.



The interviews aimed to understand design approaches, installation procedures, quality assurance measures, monitoring practices, and customer supply standards.

Various stakeholders, including internal design teams, supervisors, and framework providers, were engaged in discussions.

Representatives from different departments within the water companies were interviewed to gain comprehensive insights into PE network management.

# Challenges

Project timing

Data

Comprehensive evidence

# Key findings

Comprehensive evidence records

10% increase in first failure pressure testing

Declining knowledge and expertise in design teams

# What Next

Final Report

Recommendations

New industry Standards

UKWIR
UK Water Industry Research

# Questions?

# AWARENESS:
# Monitoring, metering and Monte Carlo Analysis: Understanding trunk main imbalances

**Mikal Willmott**

Leakage Assurance Analyst

Severn Trent Water

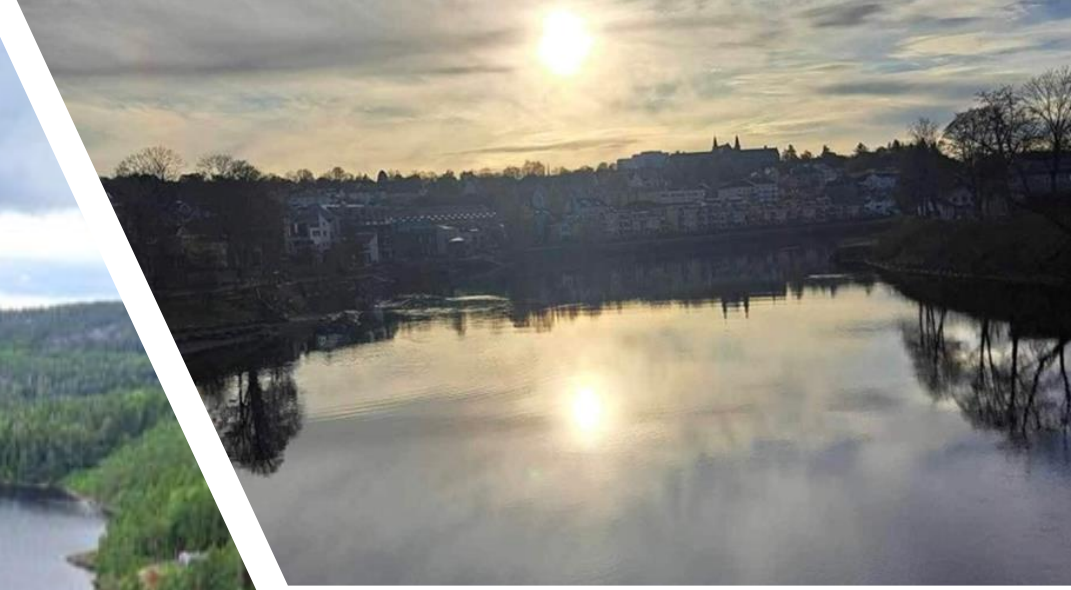
# MONITORING, METERING AND MONTE CARLO ANALYSIS: UNDERSTANDING TRUNK MAIN IMBALANCES

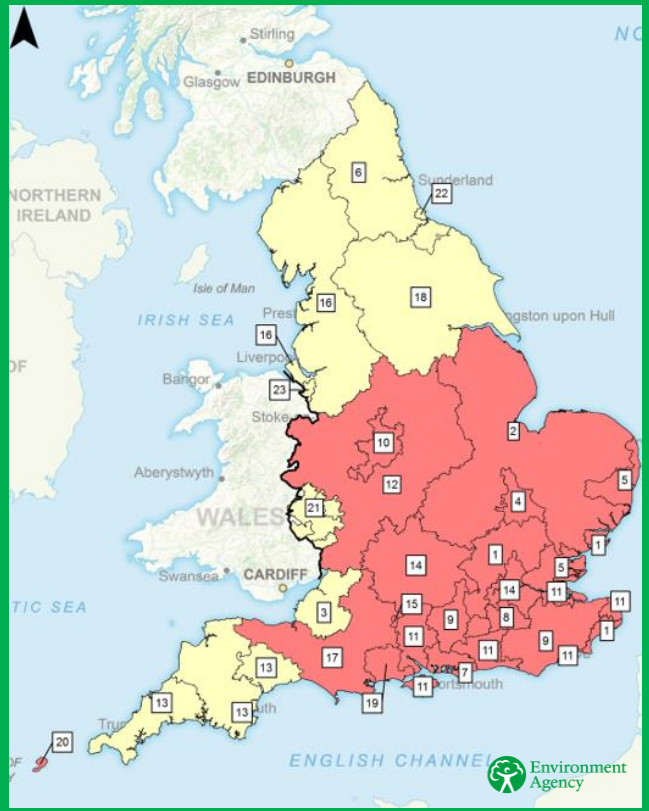
Mikal Willmott, Severn Trent Water
UK Leakage Conference, Birmingham

5th December 2023

WONDERFUL ON TAP

SEVERN TRENT






# “Unless we take action to change things, we will not have enough water to supply our needs.”

Sir James Bevan, EA Chief Executive, 19th March 2019, Waterwise Conference


UKWIR
Best Practice:
Trunk Main Flow Monitoring Zones
GET STARTED
TRUNK MAIN FLOW MONITORING ZONES | BEST PRACTICE

# THERE ARE MANY THINGS THAT AFFECT METER ACCURACY

| | | | | |
|---|---|---|---|---|
| Technology | Age | Size | Velocity | Hydraulics |
| Output | Electrical Interference | Water Temperature | Pipe ovality | Installation |
|  | Air | Pipe condition | Water Quality |  |

# “NO MEASUREMENT IS EVER ABSOLUTE”

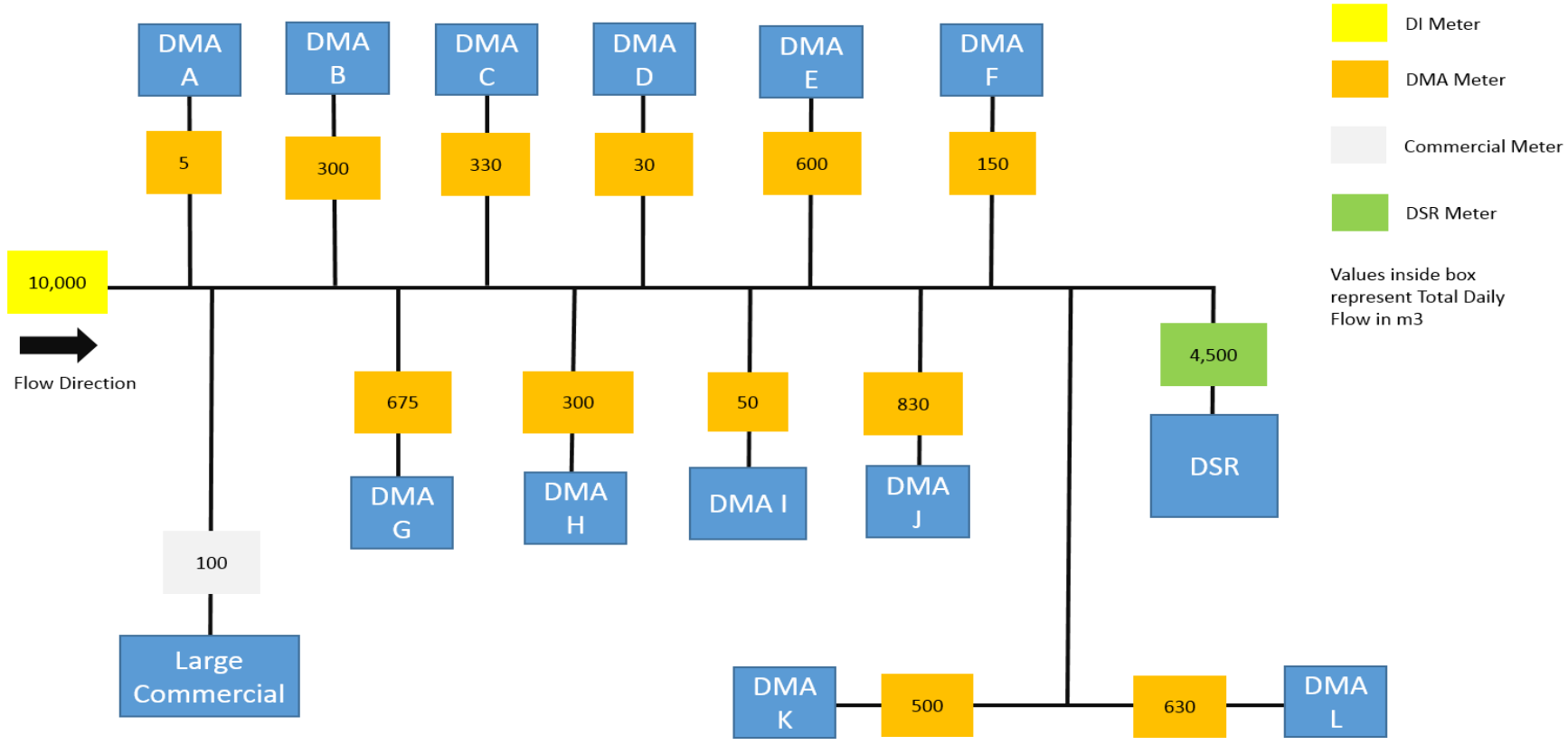
# “ALL INSTRUMENTS ARE LIARS”

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

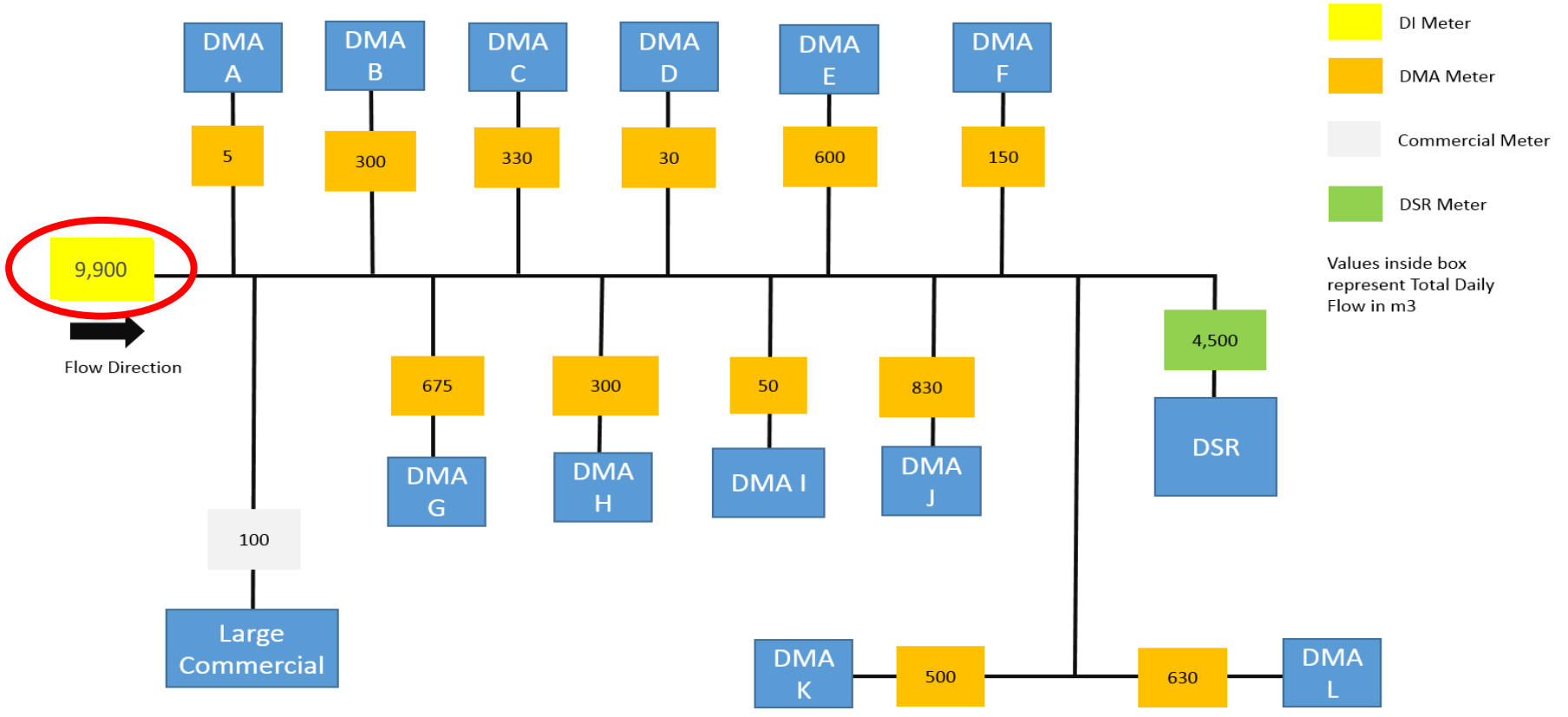
# WHAT IS THE IMPACT OF METER ERROR?

# WE HAVE STARTED TO UNDERSTAND THE IMPACT OF METER ERROR ON TRUNK MAIN BALANCES THROUGH USING MONTE CARLO ANALYSIS

# TM 1 ACTUAL LEAKAGE = 1,000M3



# TM ZONE 2 ACTUAL LEAKAGE = 900M3



| Zone | Actual Leakage (m3/d) |
|---|---|
| TM Zone 1 | 1000 |
| TM Zone 2 | 900 |
| TM Zone 3 | 800 |
| TM Zone 4 | 700 |
| TM Zone 5 | 600 |
| TM Zone 6 | 500 |

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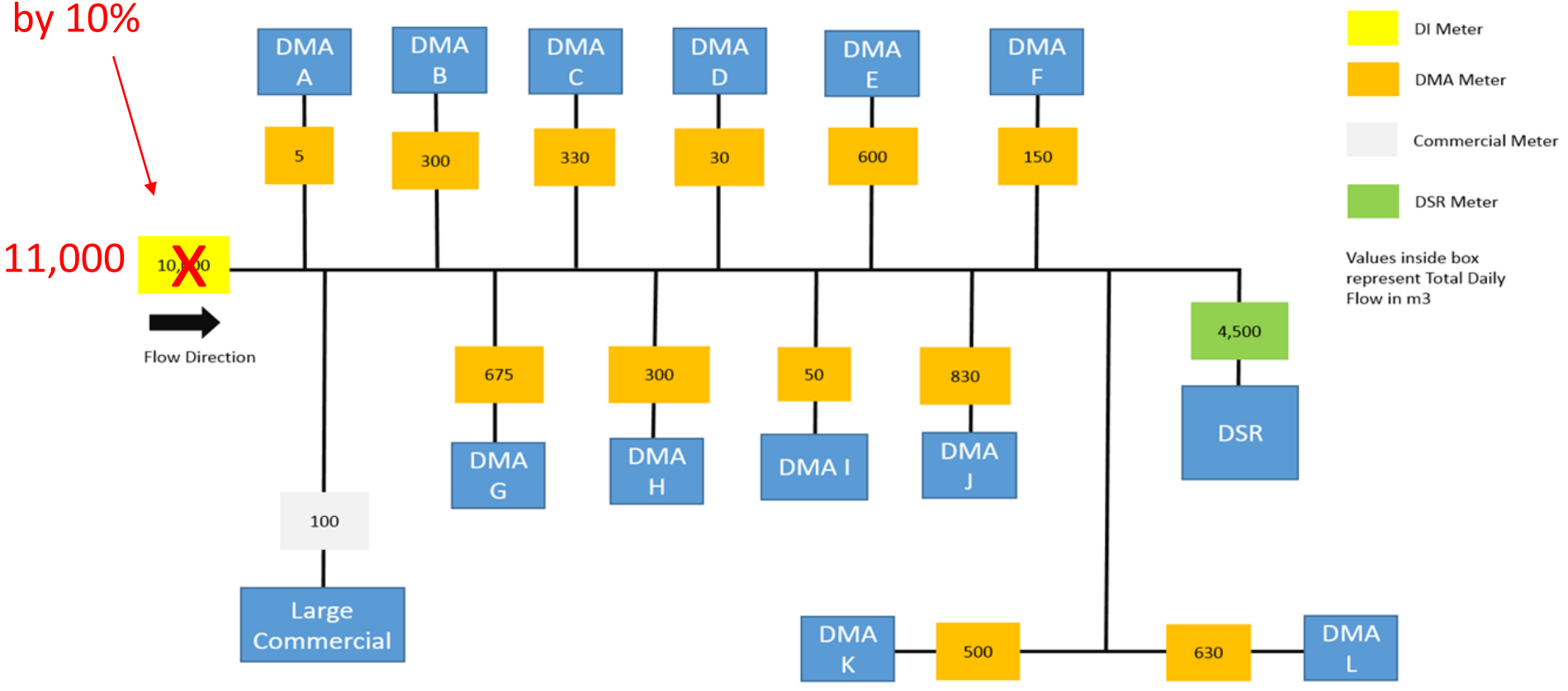
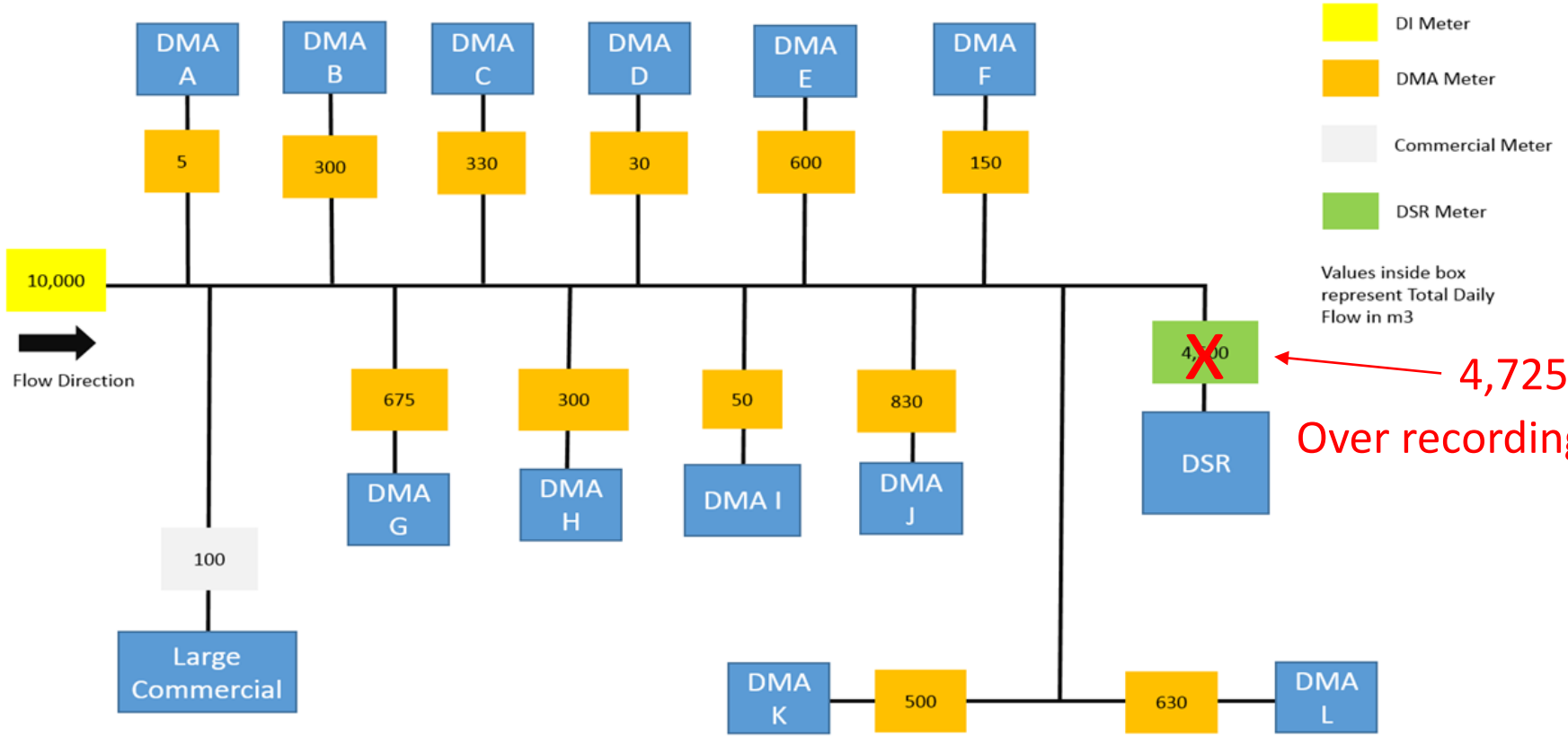
With finite resource TM Zone 1, is the Zone which should be prioritised first.

# TM ZONE 1 REPORTED LEAKAGE = 2,000M3

Over recording by 10%



# TM ZONE 1 REPORTED LEAKAGE = 775M3



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Bradley C. Clawson
Utah State University

Graduate Studies

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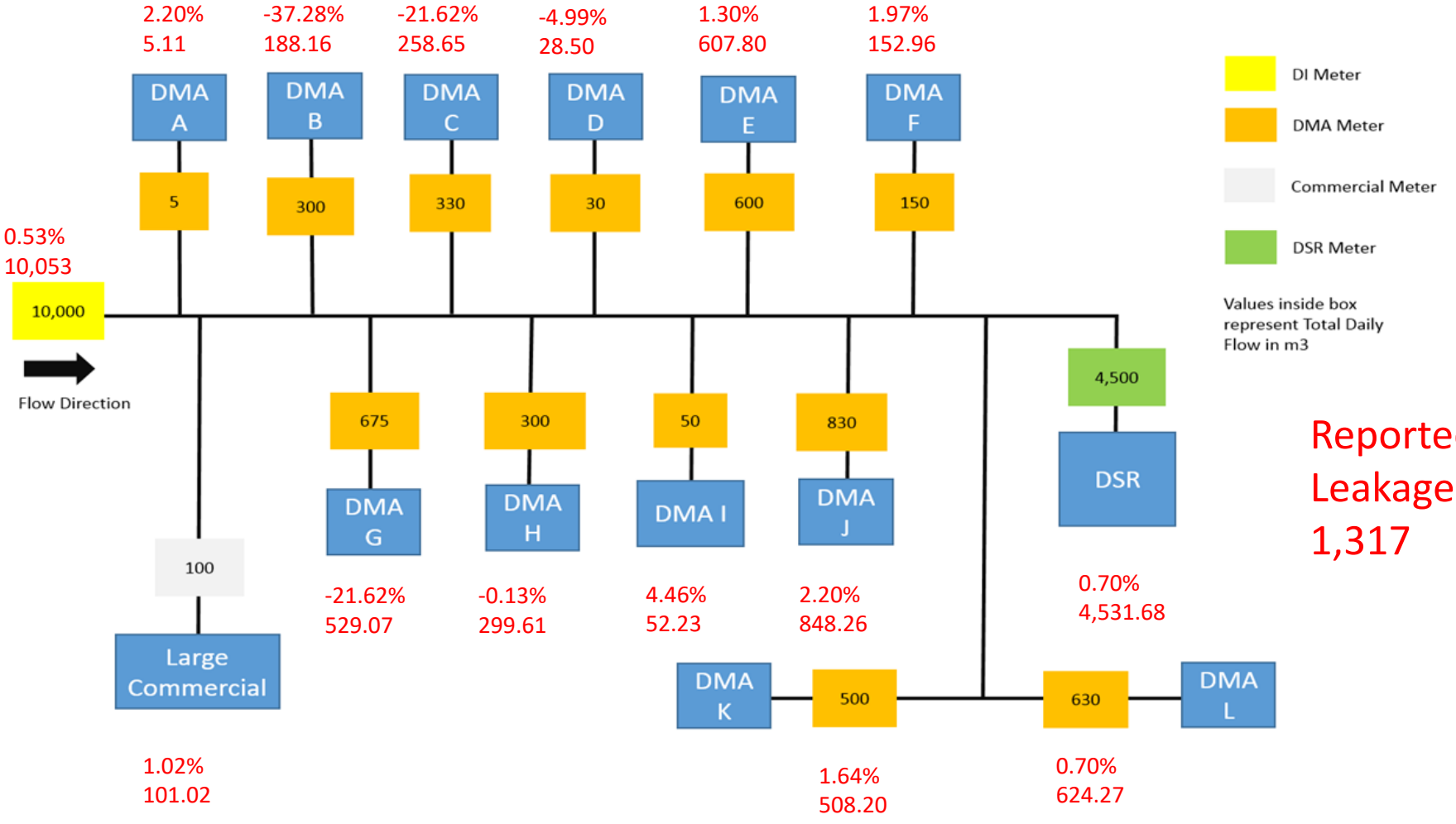
# MONTE CARLO ANALYSIS

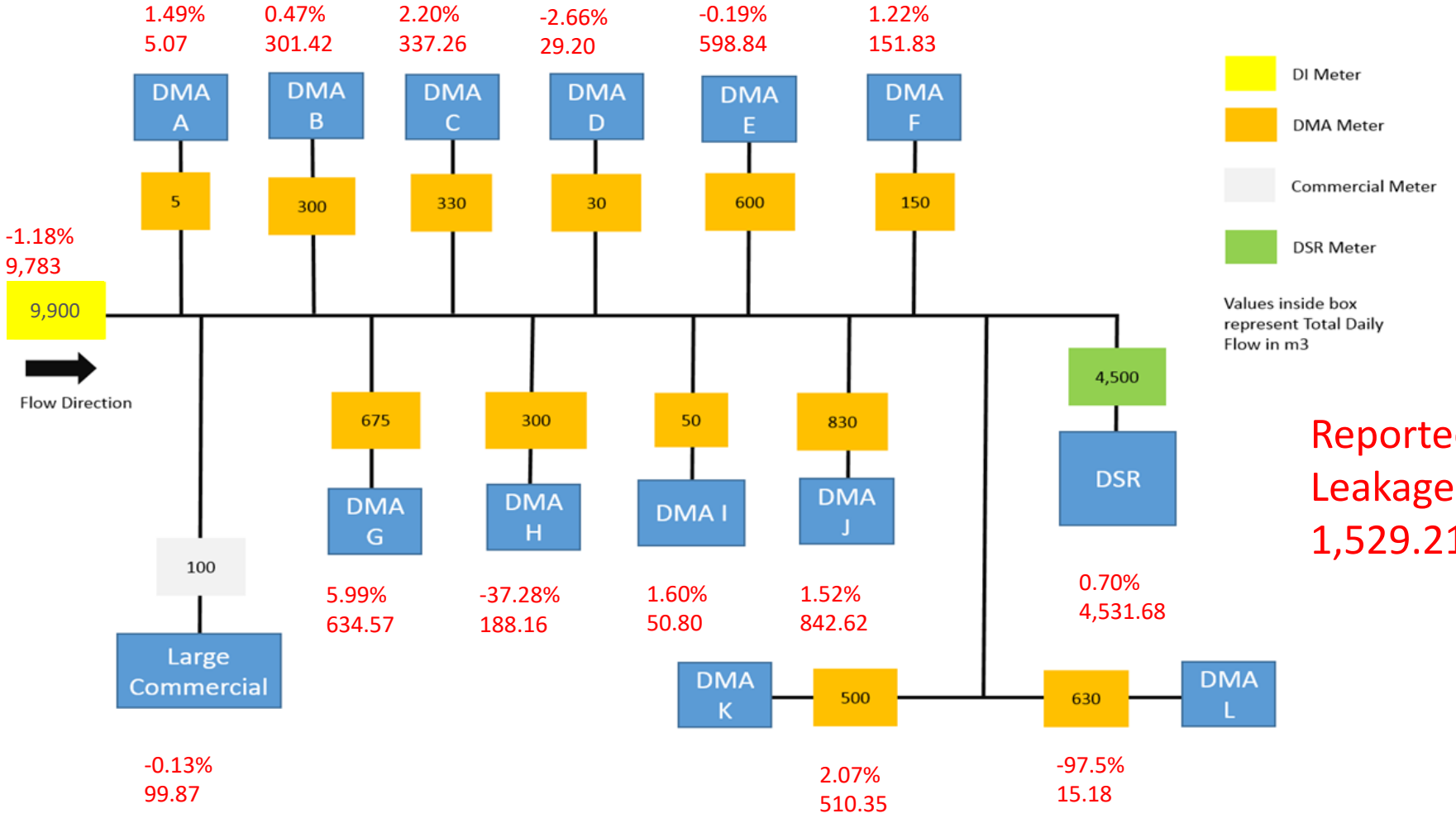
TM Zone 1




Reported Leakage: 1,317

# MONTE CARLO ANALYSIS

TM Zone 2




Reported Leakage: 1,529.21

# SIMULATION 1 RESULTS

| | TM Zone 1 | TM Zone 2 | TM Zone 3 | TM Zone 4 | TM Zone 5 | TM Zone 6 |
|---|---|---|---|---|---|---|
| Simulation 1 | 1,317 | 1,529 | 875 | 933 | 815 | 526 |

# WE DID 10,000 SIMULATIONS

# THE FIRST 6 SIMULATIONS

| | TM Zone 1 | TM Zone 2 | TM Zone 3 | TM Zone 4 | TM Zone 5 | TM Zone 6 |
|---|---|---|---|---|---|---|
| Simulation 1 | 1,317 | 1,529 | 875 | 933 | 815 | 526 |
| Simulation 2 | 1,183 | 1,001 | 1,169 | 625 | 718 | 546 |
| Simulation 3 | 1,125 | 1,530 | 1,457 | 844 | 1,349 | 700 |
| Simulation 4 | 974 | 1,105 | 1,453 | 694 | 1,022 | 528 |
| Simulation 5 | 1,130 | 925 | 980 | 1,099 | 690 | 395 |
| Simulation 6 | 1,372 | 971 | 983 | 518 | 747 | 613 |

# AFTER 10,000 SIMULATIONS

| Zone | Leakage m3/Day | | | | | St Dev | Chance of result being within 10% | Number of times, Zone had highest reported leakage | |
|---|---|---|---|---|---|---|---|---|---|
| | Actual | Average | Median | Max | Min | | | Absolute | Percentage |
| TM Zone 1 | 1000 | 1286 | 1198 | 3191 | 566 | 364 | 31% | 3203 | 32% |
| TM Zone 2 | 900 | 1192 | 1100 | 2986 | 438 | 374 | 27% | 2460 | 25% |
| TM Zone 3 | 800 | 1078 | 979 | 3215 | 382 | 365 | 26% | 1683 | 17% |
| TM Zone 4 | 700 | 980 | 884 | 3198 | 305 | 366 | 23% | 1192 | 12% |
| TM Zone 5 | 600 | 882 | 791 | 3094 | 151 | 363 | 20% | 864 | 9% |
| TM Zone 6 | 500 | 773 | 686 | 2979 | 128 | 358 | 16% | 598 | 6% |

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# WE THEN DID THE ANALYSIS AGAIN EXCLUDING THE MOST EXTREME LARGE METER ERRORS.

# AFTER 10,000 SIMULATIONS
## WITH DMA OUTLIER RESULTS EXCLUDED

| Zone | Leakage m3/Day | | | | | St Dev | Chance of result being within 10% | Number of times, Zone had highest reported leakage | |
|---|---|---|---|---|---|---|---|---|---|
| | Actual | Average | Median | Max | Min | | | Absolute | Percentage |
| TM Zone 1 | 1000 | 1004 | 991 | 1482 | 618 | 115 | 70% | 6927 | 69% |
| TM Zone 2 | 900 | 903 | 893 | 1409 | 541 | 115 | 65% | 2120 | 21% |
| TM Zone 3 | 800 | 803 | 791 | 1302 | 428 | 114 | 59% | 672 | 7% |
| TM Zone 4 | 700 | 702 | 692 | 1186 | 358 | 111 | 55% | 226 | 2% |
| TM Zone 5 | 600 | 604 | 593 | 1056 | 233 | 113 | 47% | 52 | 1% |
| TM Zone 6 | 500 | 503 | 493 | 988 | 148 | 111 | 41% | 3 | 0% |

# WE THEN DID THE ANALYSIS AGAIN. EXCLUDING THE MOST EXTREME LARGE METER ERRORS.

# AFTER 10,000 SIMULATIONS
## WITH DMA OUTLIER RESULTS EXCLUDED
## AND WITH LARGE METER OUTLIER RESULTS EXCLUDED

| Zone | Leakage m3/Day | | | | | St Dev | Chance of result being within 10% | Number of times, Zone had highest reported leakage | |
|---|---|---|---|---|---|---|---|---|---|
| | Actual | Average | Median | Max | Min | | | Absolute | Percentage |
| TM Zone 1 | 1000 | 996 | 993 | 1240 | 833 | 65 | 88% | 8458 | 85% |
| TM Zone 2 | 900 | 898 | 895 | 1123 | 739 | 65 | 83% | 1469 | 15% |
| TM Zone 3 | 800 | 797 | 794 | 1035 | 628 | 64 | 77% | 72 | 1% |
| TM Zone 4 | 700 | 696 | 693 | 903 | 529 | 64 | 70% | 1 | 0% |
| TM Zone 5 | 600 | 597 | 594 | 809 | 429 | 63 | 61% | 0 | 0% |
| TM Zone 6 | 500 | 498 | 496 | 718 | 323 | 63 | 53% | 0 | 0% |

# CONCLUSIONS:

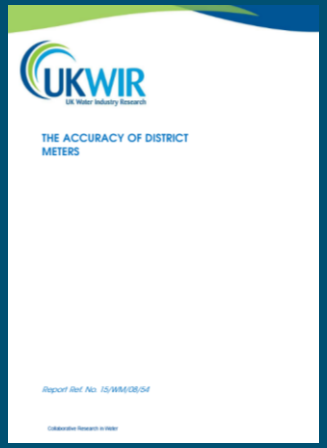
- Meter errors can result in material reporting errors and resources being directed into the “wrong” Trunk Main Zones.
- In this example, eliminating the most significant DMA meter errors more than doubled the likelihood of the correct trunk main zone being prioritised.
- Additionally, once the greatest errors from the larger meters were taken out there was an 85% chance the right zone would be prioritised.

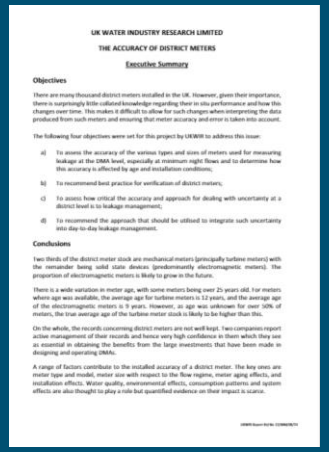
# LIMITATIONS:

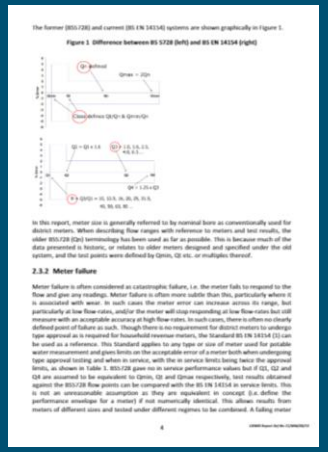
- All Trunk Main Zones are the same size and configuration, this is unrealistic.
- Limited data sets
- Assumed only errors are meter errors

# RECOMMENDATIONS:

- The industry should follow the UKWIR guidance for proactively replacing DMA meters at <u>least</u> every 12 years



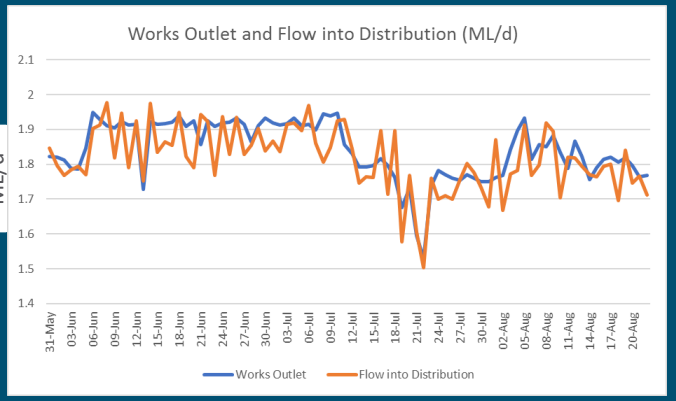





https://ukwir.org/eng/reports/15-WM-08-54/129509/The-Accuracy-of-District-Meters

# RECOMMENDATIONS:

- Mini flow balances, meter audits, electronic verification and flow verifications help identify meter errors.




Picture courtesy of: FLOWLEE METER VERIFICATION LTD

Thank you for listening

mikal.willmott@severntrent.co.uk

# Questions?

# AWARENESS: Lifting the lid on leakage – modelling consumption and night use from smart meter data

**Axel Rendahl**

Water Balance Process and Leakage Reporting Lead

Thames Water

# Lifting the lid on Leakage

## Modelling consumption and night use from smart meter data

24th Annual Leakage Conference, 4-5 Dec 2023

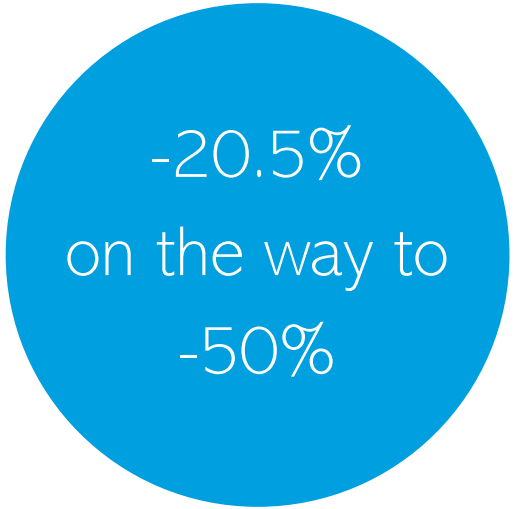
# Agenda

The next 20 mins…

1. Context
2. Modelling usage from smart meter data
3. Application: daily water balance
4. Application: leakage targeting
5. Recap, Q&A

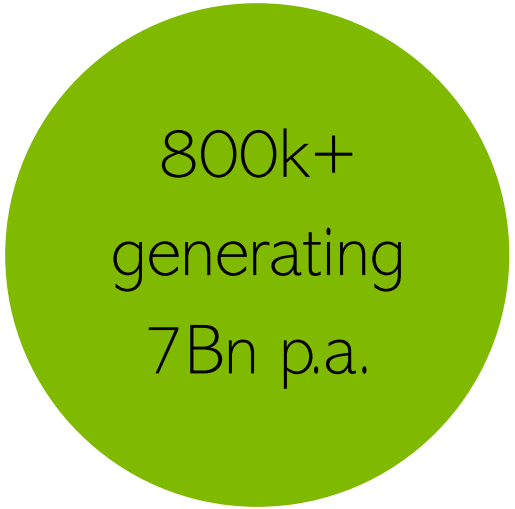
# Context

Why are we here?




A big challenge


Requiring greater precision



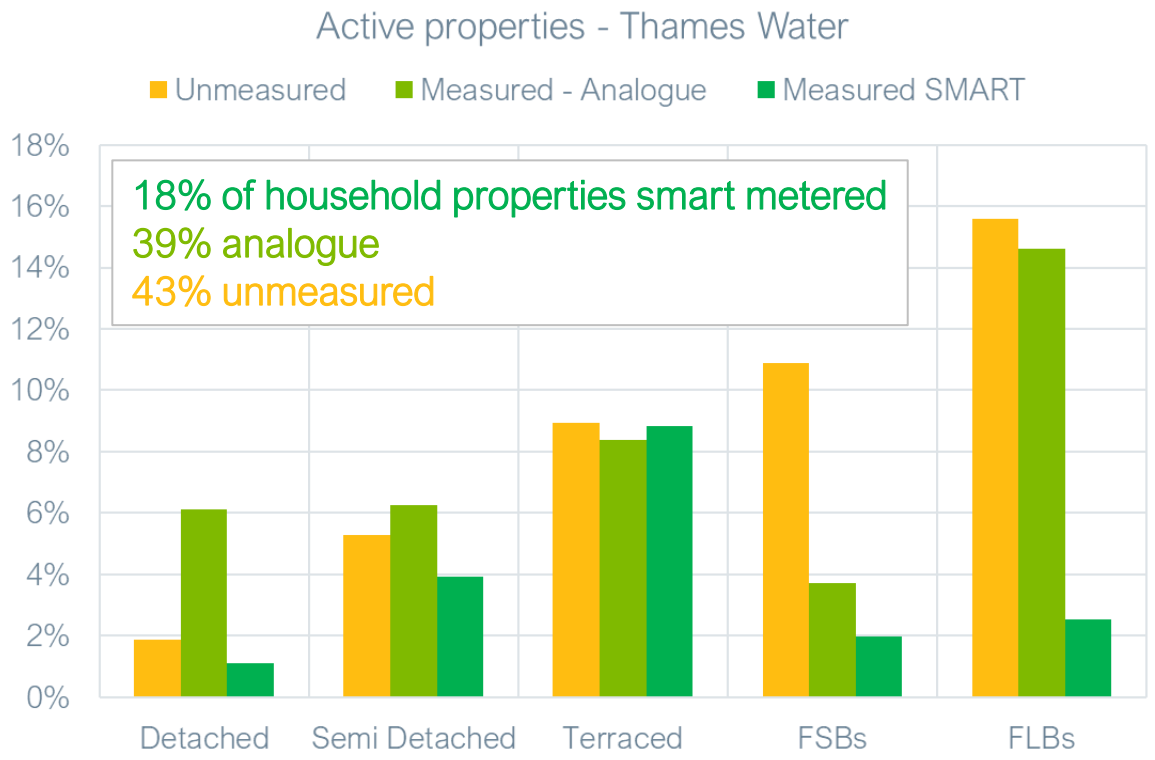

Loads of potential

Opportunity to share and collaborate

# Context

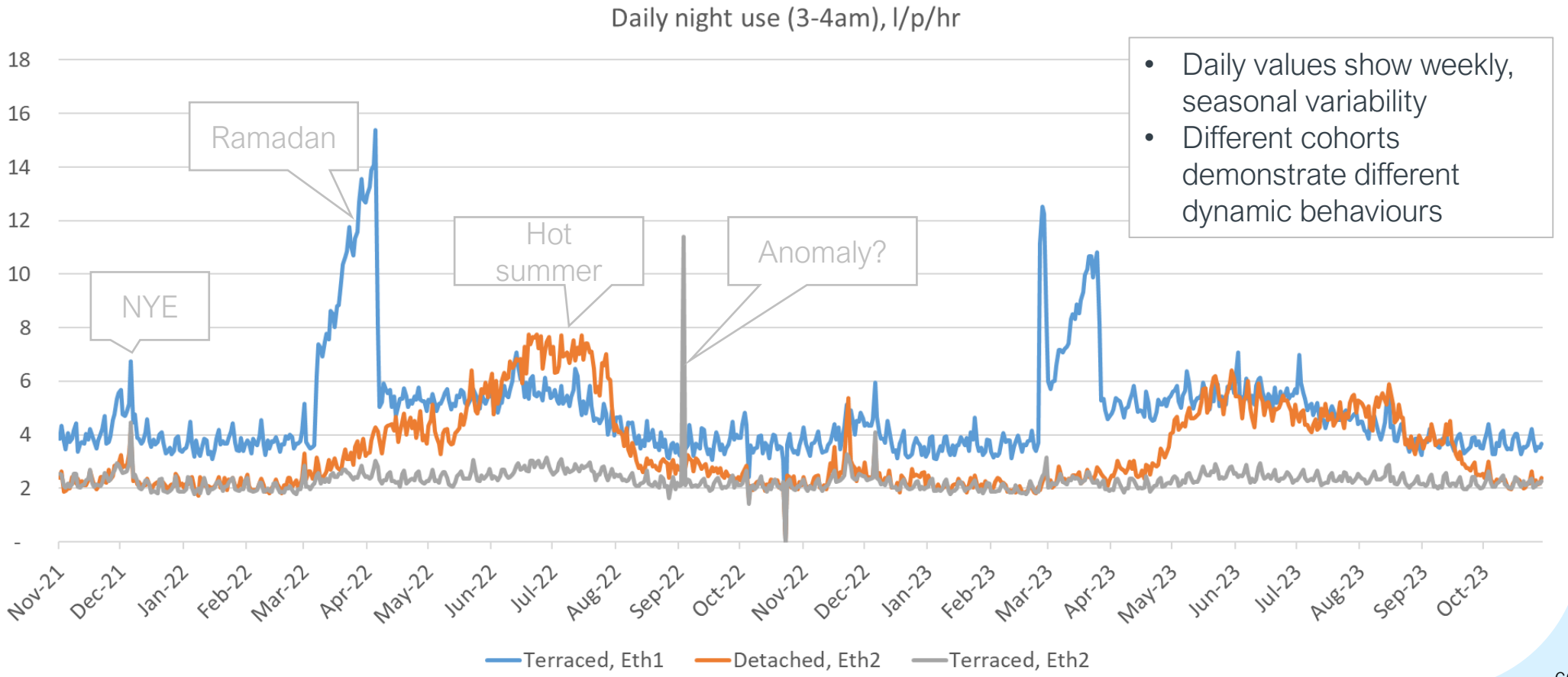
Thames Water has a growing coverage of smart meters, with rollout expected to complete during AMP9

- What can we do in the meantime?
- What about “unmeterable” properties?
- Can we model non-smart customers’ usage from hourly smart meter data?



# Modelling usage from smart meter data

We have derived **dynamic consumption and night use allowances** for 30 different cohorts of customers

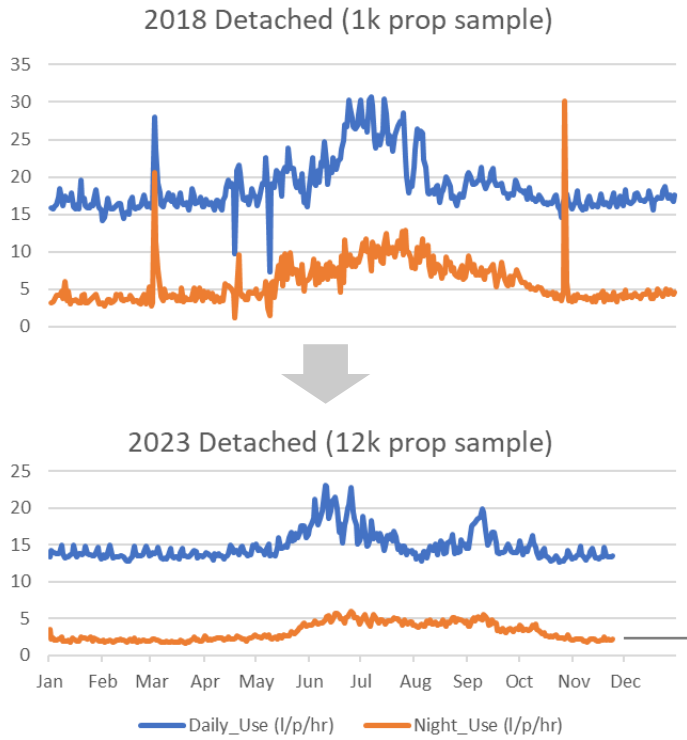



- Daily values show weekly, seasonal variability
- Different cohorts demonstrate different dynamic behaviours

# Modelling usage from smart meter data

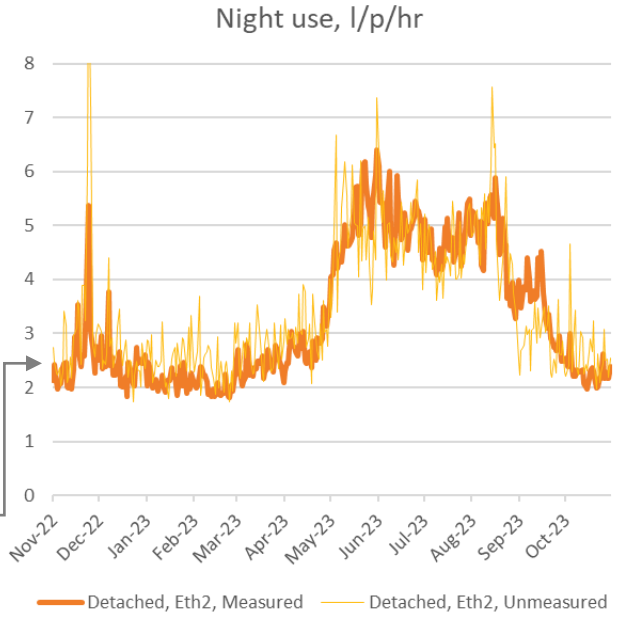
Some insights and pitfalls encountered on the way…

## Sample size matters

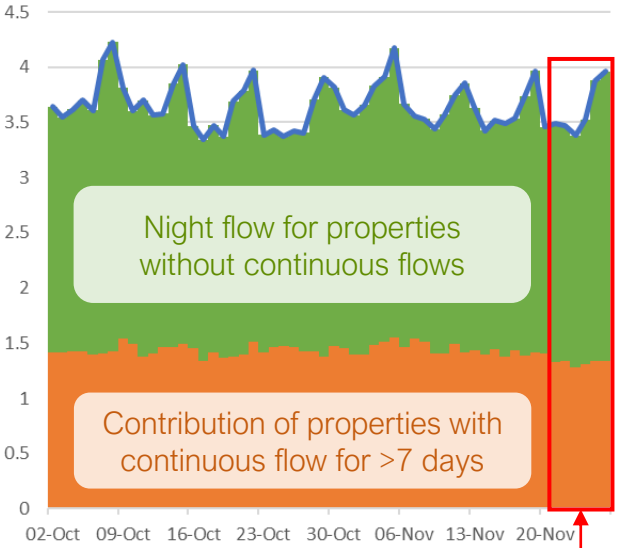



## Combine similar cohorts

- Trade-off between specificity and noise reduction




## Dealing with continuous flows



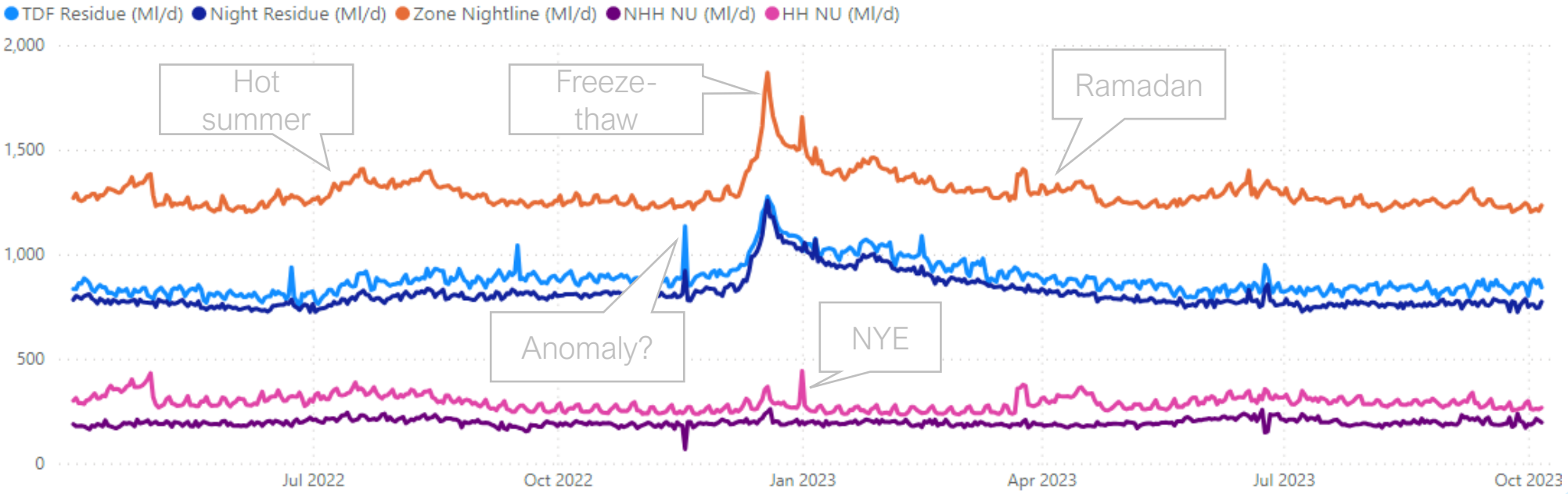

- CF subtracted to remove bias from smart metering
- Method over-estimates night use by ca. 5% in latest week, with implications for “live” reporting

# Application: daily water balance

We have derived total daily night use for household and non-households, and compared to zonal nightlines

- Household night use aggregated by property count
- Using more local sample has improved fit
- Non-household night use extrapolated from billed volumes, plus continuous logging
- Smooth residual reflecting expected leakage trends

Nightline Approach

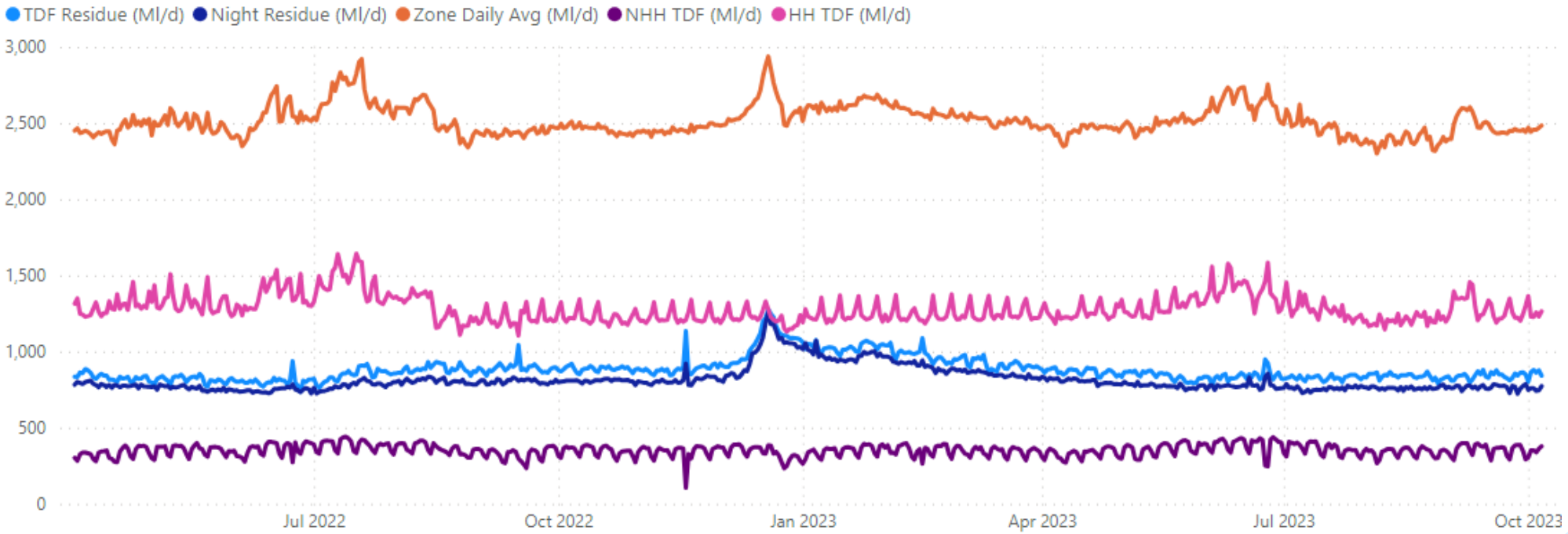


# Application: daily water balance

We have derived total daily consumption for household and non-households, and compared to zonal inputs

- Less noise (24 hrs vs. 1hr), especially when zooming into local areas
- Shape of residual may hint at missing consumption
- Top-down vs. Bottom-up comparison can be used to highlight local issues

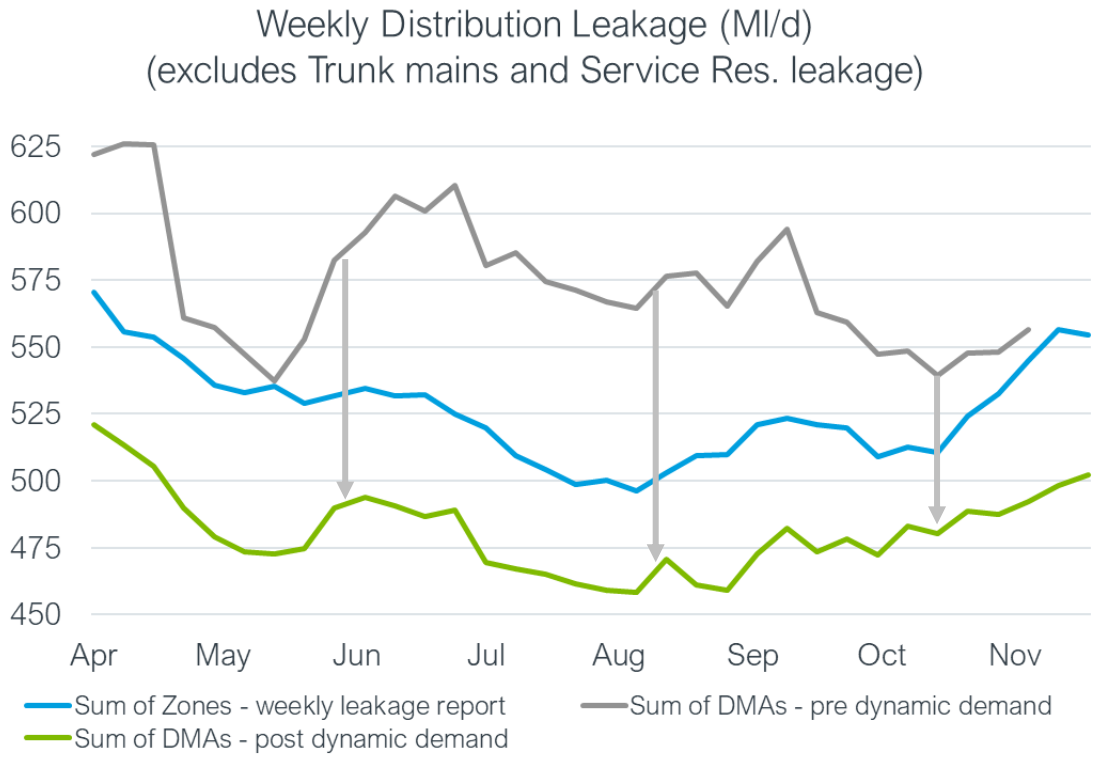
Total Daily Flow Approach



# Application: leakage targeting

We have fed the dynamic demand allowances into Netbase – daily allowances, by WRZ, updated weekly

- Reflects daily and seasonal fluctuations in night use
- Smoother profile, reduced water balance residual
- Updated ranking of DMAs: “false positives” out, “hidden offenders” exposed
- Better alignment with regulatory reporting method
- Spot areas of local disagreement – highlighting errors in data or assumptions



# Recap

What did we just witness?


It's everyone's water

# Q&A

# Questions?

# AWARENESS: Revisiting fundamental leakage basics to gain more insight into DMA current and future performance

**Mark Shepherd**

Product Manager Integrated Water Solutions

GWF

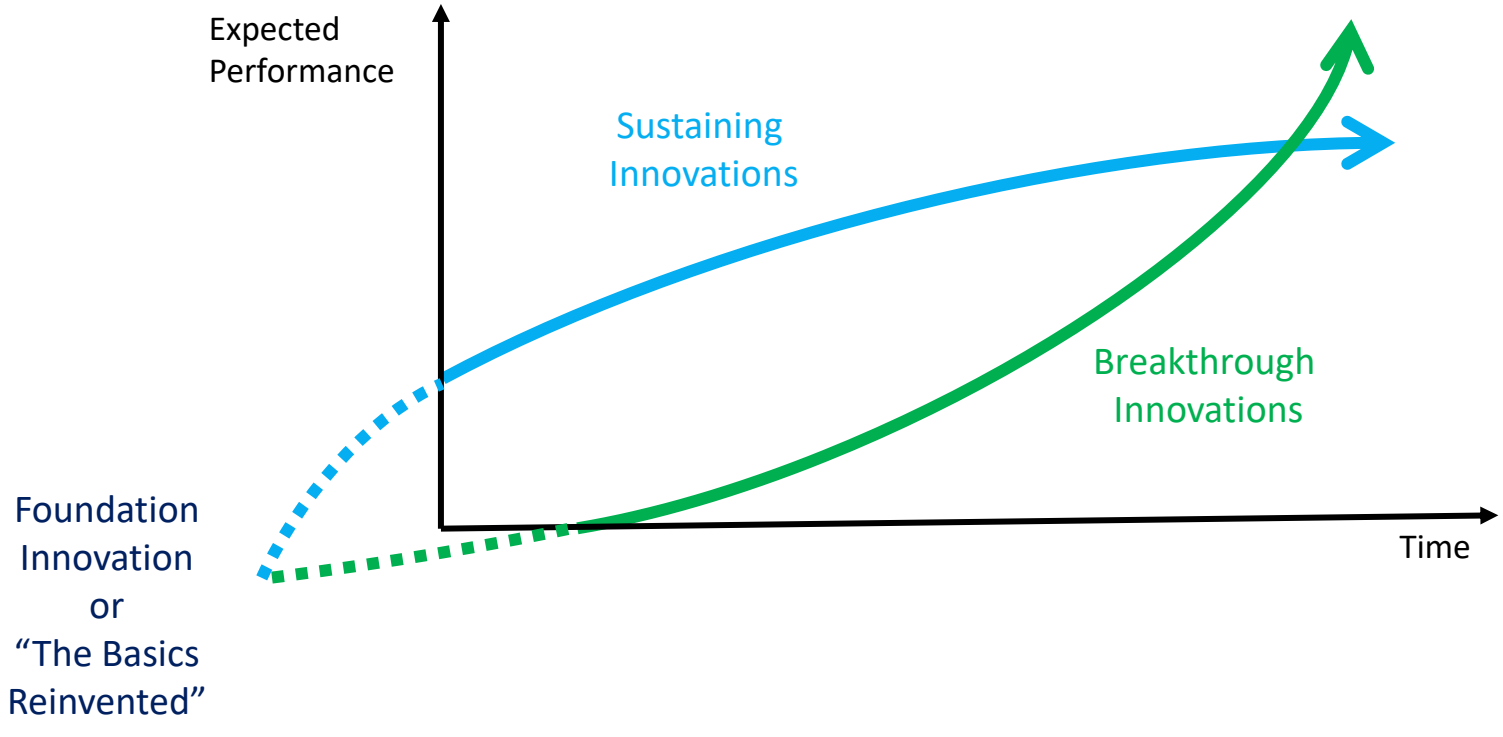
# Revisiting Fundamental Leakage Basics to Gain More Insight into DMA Current and Future Performance

**Mark Shepherd PrEng**

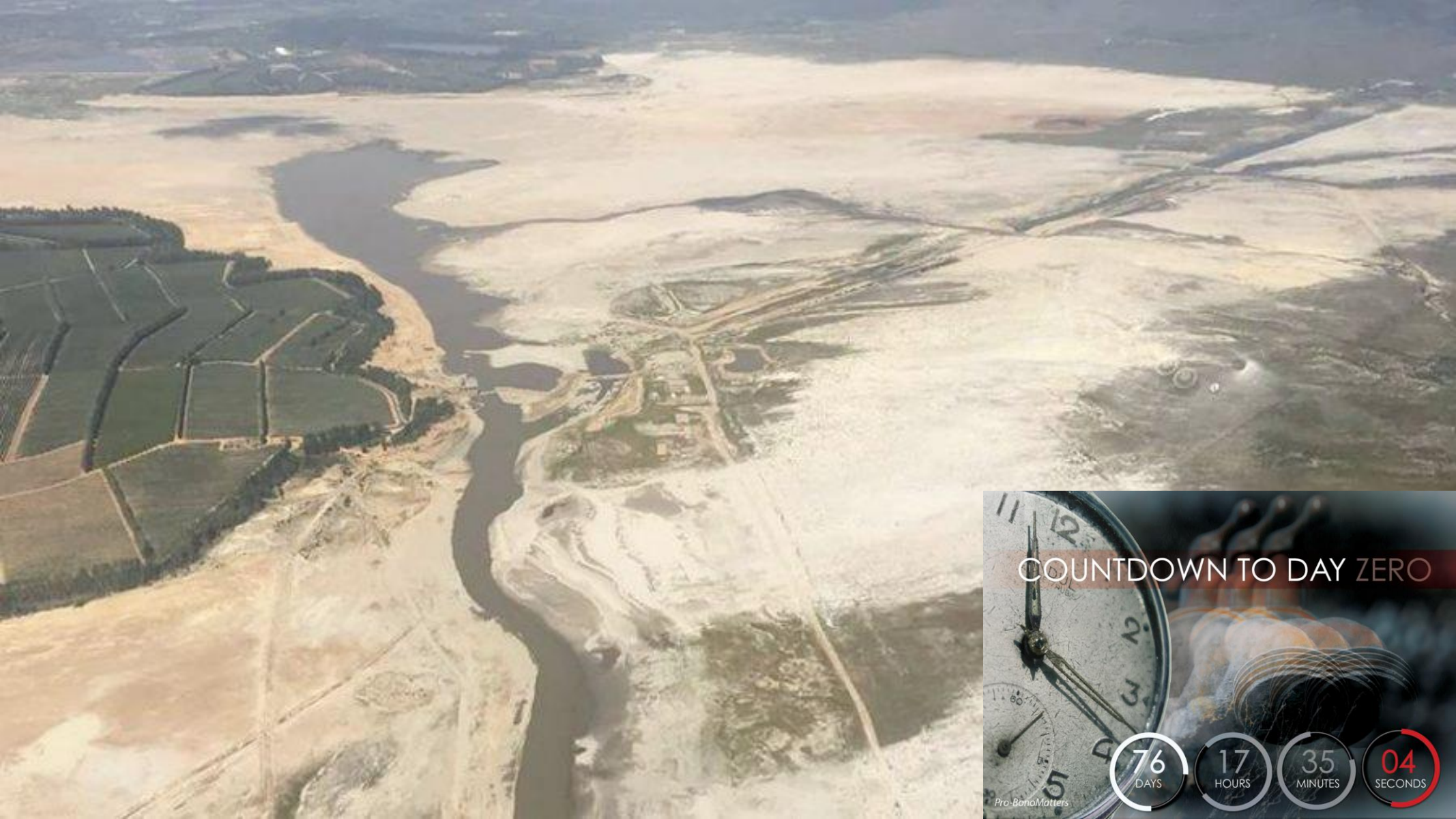
**Product Manager Integrated Water Solutions**

24th Annual Leakage Conference
Birmingham, 4-5 December 2023

# INNOVATION IN LEAKAGE

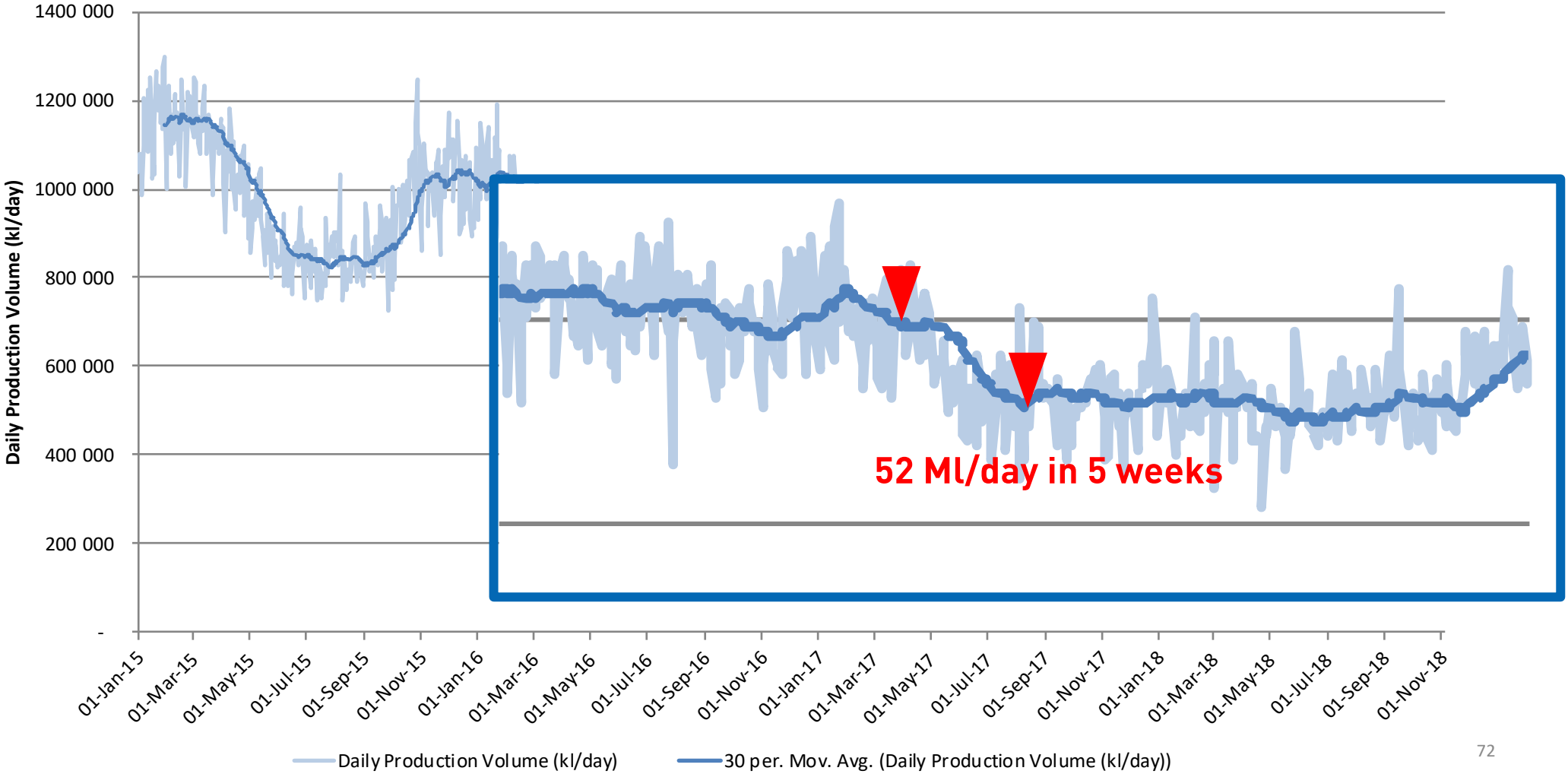



Adapted from *The Innovator’s Dilemma*, Clayton Christenson


COUNTDOWN TO DAY ZERO
76
DAYS
17
HOURS
35
MINUTES
04
SECONDS
Pro-BonoMatters

BALANCE

# City of Cape Town
## Historical Daily Production Volumes



# …SO… WHAT IF…

.. there was a simple, accurate, reliable and effective leakage management tool that points you in the right direction..

..that helps you get your resources in the right place in the right order..

..that ensures your team is working on the right things..

..to get maximum impact on leakage reduction (in most instances more than your target..)

BALANCE

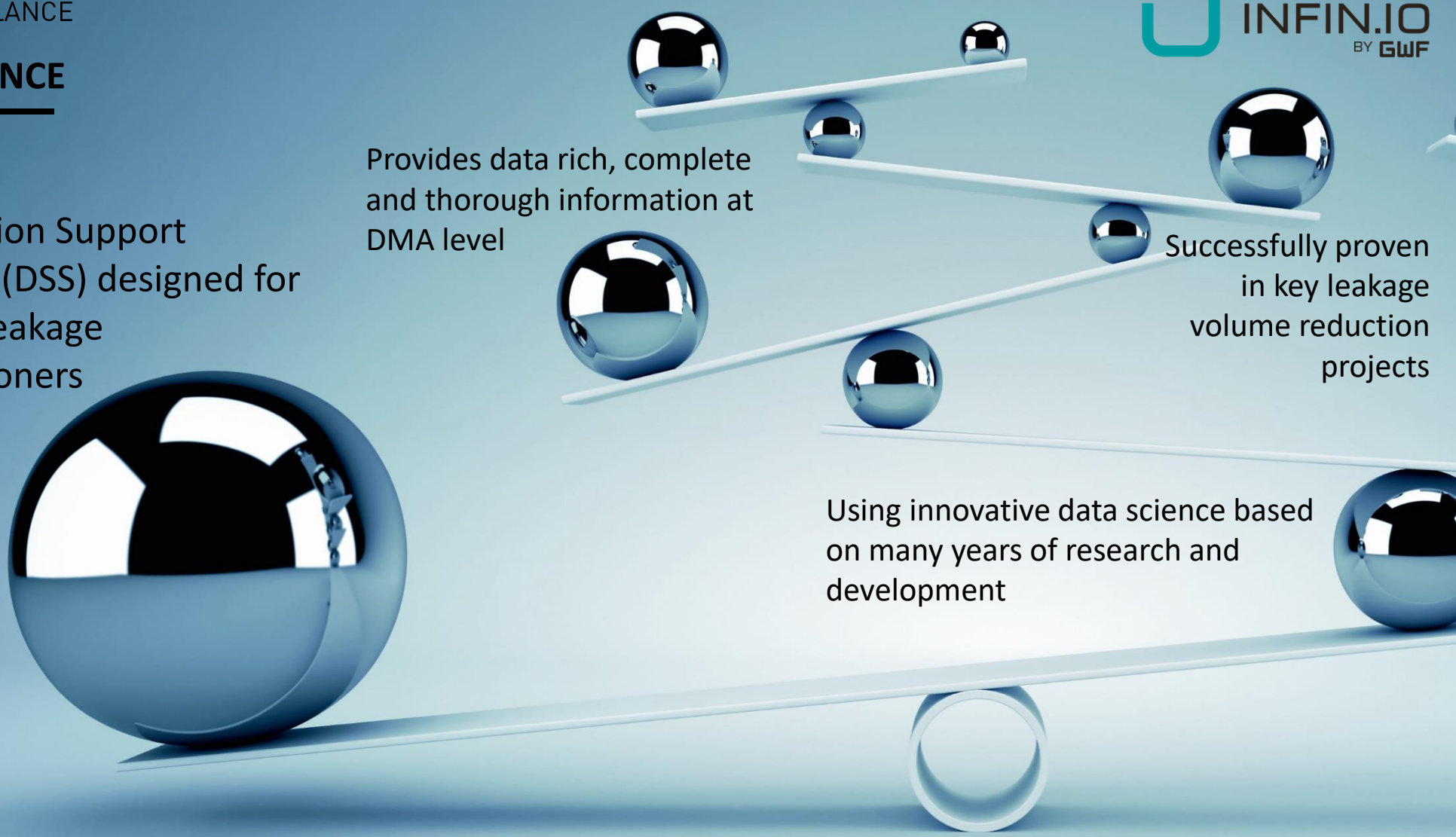
# BALANCE

A Decision Support System (DSS) designed for water leakage practitioners

Provides data rich, complete and thorough information at DMA level

Successfully proven in key leakage volume reduction projects

Using innovative data science based on many years of research and development



# WHO IS BALANCE FOR?

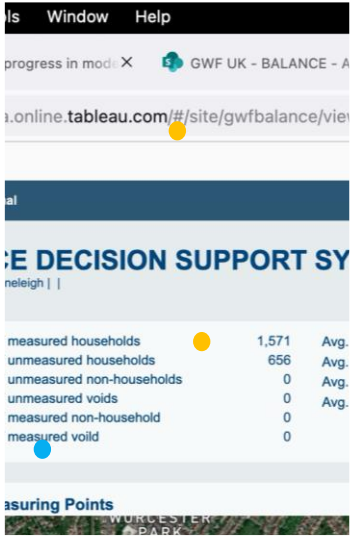
01 **Asset Managers** – obtain quick and reliable overview of reticulation network health

02 **Planners** – confidently develop leakage management strategies and accurate reporting

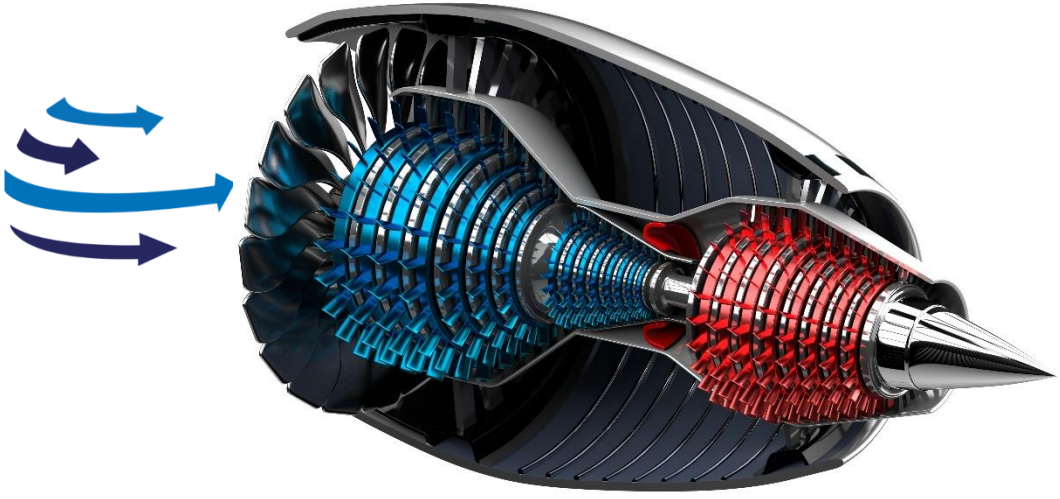
03 **Leakage Managers** – refine leakage reduction activities and prioritise resources more efficiently

04 **Smart Metering Managers** – get insight into Customer Side Leakage to help prioritise smart meter rollouts

# WHAT DOES BALANCE DO?




Measurements from just three points (inflow, AZP and CP)



One 45-minute pressure test

- Provides a comprehensive analysis at DMA level
- Validates leakage volume calculations and nature of leakage
- Determines minimum levels of achievable leakage and targets
- Recommends best intervention(s) to meet targets
- Determines extent of Customer Side Leakage
- Calculates unmetered consumption
- Verifies Assessed Normal Night Use factors
- Identifies why intended results are not being achieved

BALANCE

INFIN.IO BY GWF

# HOW DOES BALANCE WORK?

01 **Prepare** – review DMA data and implement 45-minute pressure step test

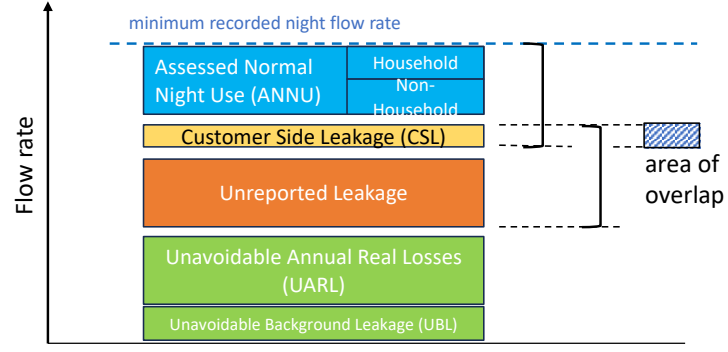
02 **Interpret** – understand what the data analytics are telling you

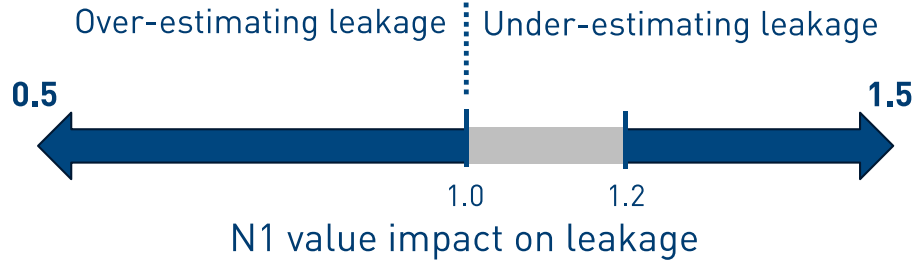
03 **Predict** – determine minimum achievable leakage volume and maximum recoverable leakage

04 **Prioritise** – identify DMA's with highest recoverable leakage according to pressure management or ALC

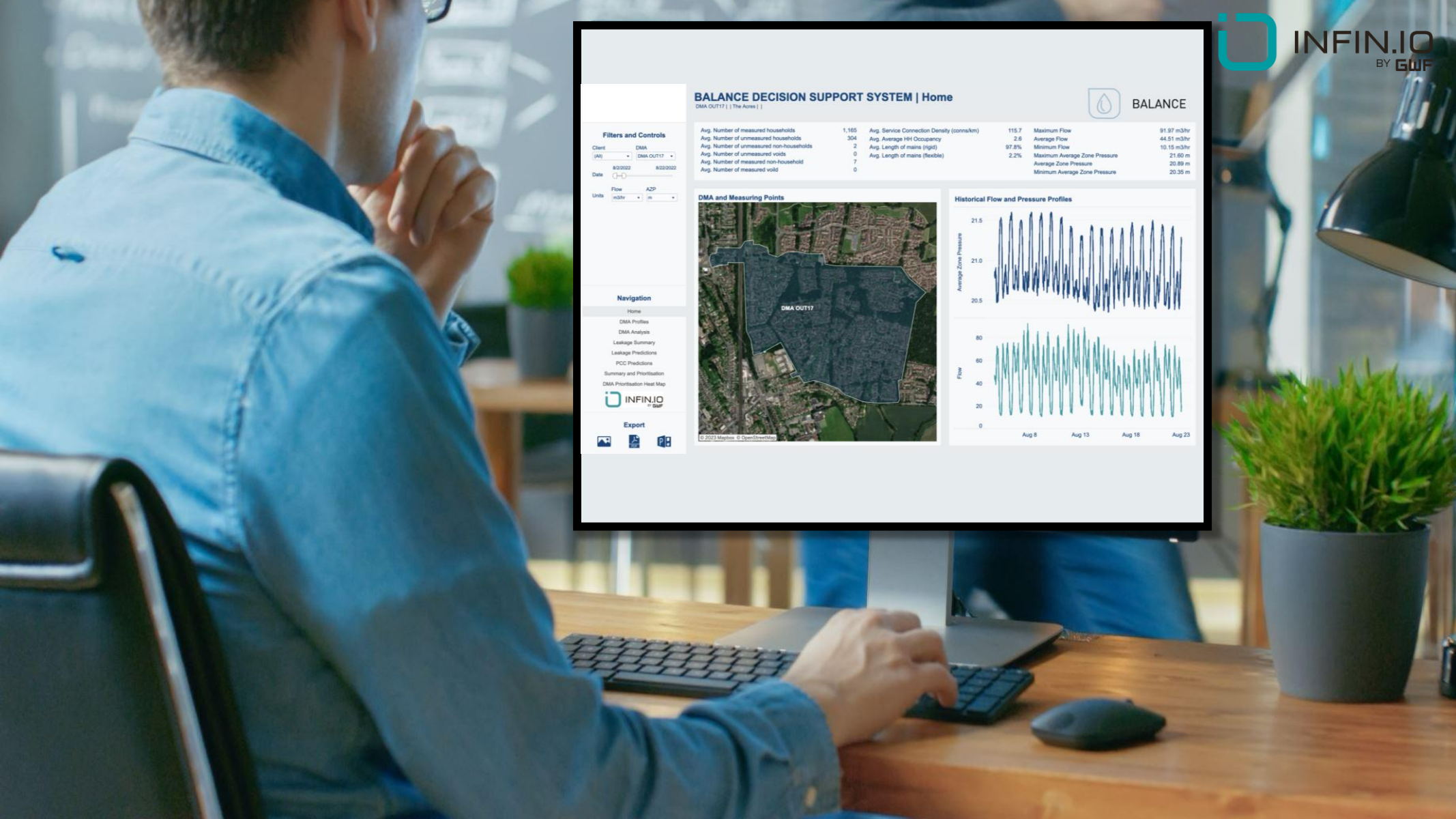
05 **Implement** – targeted intervention in each DMA to achieve maximum impact

06 **Report** – use data analytics, factors and impact to report on results against targets




| Infrastructure Condition Index (ICI) | Classification Band | Generalised Action |
|---|---|---|
| <1.5 | A1 | Proactive leak detection and repair concentrating on service connections |
| 1.5 <= 2.0 | A2 | Proactive leak detection and repair concentrating on mains and service connections |
| 2.0 <= 3.0 | B1 | Rehabilitation of mains, fittings and service connections, approximately street length |
| 3.0 <= 4.0 | B2 | Rehabilitation of mains, fittings and service connections, approximately block length |
| 4.0 <= 6.0 | C1 | Replacement of all pipes older than 50 years |
| 6.0 <= 8.0 | C2 | Replacement/renewal between 25% and 50% of reticulation network |
| >8.0 | D | Replacement/renewal greater than 50% of reticulation network |


BALANCE DECISION SUPPORT SYSTEM | Home
DMA OUT17 | | The Acres | |
BALANCE
Filters and Controls
Client
(All)
DMA
DMA OUT17
Date
8/2/2022
8/22/2022
Units
Flow
m3/hr
AZP
m
Navigation
Home
DMA Profiles
DMA Analysis
Leakage Summary
Leakage Predictions
PCC Predictions
Summary and Prioritisation
DMA Prioritisation Heat Map
INFIN.IO BY GWF
Export
Avg. Number of measured households 1,165
Avg. Number of unmeasured households 304
Avg. Number of unmeasured non-households 2
Avg. Number of unmeasured voids 0
Avg. Number of measured non-household 7
Avg. Number of measured void 0
Avg. Service Connection Density (conns/km) 115.7
Avg. Average HH Occupancy 2.6
Avg. Length of mains (rigid) 97.8%
Avg. Length of mains (flexible) 2.2%
Maximum Flow 91.97 m3/hr
Average Flow 44.51 m3/hr
Minimum Flow 10.15 m3/hr
Maximum Average Zone Pressure 21.60 m
Average Zone Pressure 20.89 m
Minimum Average Zone Pressure 20.35 m
DMA and Measuring Points
DMA OUT17
© 2023 Mapbox © OpenStreetMap
Historical Flow and Pressure Profiles
Average Zone Pressure
21.5
21.0
20.5
Flow
80
60
40
20
0
Aug 8
Aug 13
Aug 18
Aug 23


BALANCE DSS | Average Representative Normalized DMA Profiles
DMA OUT17 | | The Acres | |
BALANCE
Filters and Controls
Client
(All)
DMA
DMA OUT17
Date
8/2/2022
8/22/2022
Time
00:00
23:45
Units
Flow
m3/hr
AZP
m
View
All
Select a date to highlight
10/22/2022
N1 Test Start
21:30
N1 Test End
02:45
Navigation
Home
DMA Profiles
DMA Analysis
Leakage Summary
Leakage Predictions
PCC Predictions
Summary and Prioritisation
DMA Prioritisation Heatmap
INFIN.IO
Export
Variance and Deviation
Off-Peak Period Statistical Variance Average to Maximum Flow
22.03%
Off-Peak Period Statistical Variance Average to Minimum Flow
10.17%
Peak Period Statistical Variance Average to Maximum Flow
14.09%
Peak Period Statistical Variance Average to Minimum Flow
17.33%
Peak Factor Flow
31.08
Off-Peak Period Statistical Variance Average to Maximum AZP
7.68%
Off-Peak Period Statistical Variance Average to Minimum AZP
10.43%
Peak Period Statistical Variance Average to Maximum AZP
0.00%
Peak Period Statistical Variance Average to Minimum AZP
0.00%
Assessed Night Use
Min. Assessed Night Consumption - HH (l/s)
1.10
Min. Assessed Night Consumption - NHH (l/s)
0.20
Min. Exceptional Night Consumption (m3/hr)
0.00
Min. Assessed Customer Side Leakage (l/s)
0.56
Historical Flow and AZP Profiles Thursday, 4 August 2022 to Monday, 22 August 2022
Weekdays
Weekends
Average
N1 Test Window
Average Zone Pressure
21.5
21.0
20.5
Flow
80
60
40
20
0
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00


BALANCE DECISION SUPPORT SYSTEM | DMA Analysis
DMA LAN15 | | Stoneleigh | |
BALANCE
Filters and Controls
Client
(All)
DMA
DMA LAN15
Flow Units
m3/hr
AZP
m
Navigation
Home
DMA Profiles
DMA Analysis
Leakage Summary
Leakage Predictions
PCC Predictions
Summary and Prioritisation
DMA Prioritisation Heatmap
INFIN.IO
Export
Average Representative Water Supplied
41.13 m3/hr
Average Representative Consumption
36.85 m3/hr
Average Representative Leakage Volume
4.24 m3/hr
Fixed Area Leakage
0.54 m3/hr
Variable Area Leakage
0.25 m3/hr
HDF
23.23
N1 Value and Industry Comparison
Over-reporting leakage
Under-reporting leakage
0.5
N1
1.26
1.5
1.0
1.2
Recommended Range
Fixed Area Leakage Rigid Pipes
Variable Area Leakage Flexible Pipes
Type of Leakage
Variable Area
76%
Fixed Area
24%
Simple Water Balance
Leakage
10%
Consumption
90%
Baseline Average Representative DMA Profile
Baseline Average Representative DMA Profile


BALANCE DECISION SUPPORT SYSTEM | Leakage Summary
DMA LAN15 | | Stonelaigh | |
BALANCE
Filters and Controls
Client
(All)
DMA
DMA LAN15
Flow Units
m3/hr
AZP
m
Target Leakage Volume
3.0
m3/hr
Navigation
Home
DMA Profiles
DMA Analysis
Leakage Summary
Leakage Predictions
PCC Predictions
Summary and Prioritisation
DMA Prioritisation Heatmap
INFIN.IO BY GWF
Export
Leakage Key Performance Indicators
Average Representative Leakage Volume 4.24 m3/hr
Average UARL 1.75 m3/hr
Avg. Infrastructure Leakage Index (ILI) + 2.42
Avg. Infrastructure Condition Factor (ICF) + 2.33
System Correction Factor (SCF)
Min. SCF factor 0.62
Min. SCF using FAVAD + Poisson Distribution 0.70
Min. SCF using FAVAD + Poisson + Pressure:Bursts 0.62
System Correction Factor Applied to UARL
Min. When AZP= (m) 20.90
Min. Standard UARL if SCF = 1.0 (m3/day) 45.60
Min. UARL with SCF using FAVAD only (m3/day) 40.80
Min. UARL with SCF using FAVAD + Poisson Distribution 31.70
Min. UARL with SCF using FAVAD + Poisson + Pressure:Bursts 28.10
Leakage Volume and Recoverable Leakage Summary
Progress against regulatory leakage volume target
71%
Progress against maximum recoverable leakag volume
59%
Average Representative Leakage Volume 4.24 m3/hr
Target Leakage Volume 3.00 m3/hr
Maximum Recoverable Leakage 2.49 m3/hr
Average UARL 1.75 m3/hr
Recoverable Leakage Volume by Leakage Type
Variable Area Leakage 0.25 m3/hr
Fixed Area Leakage 0.54 m3/hr
Average UARL 1.75 m3/hr


BALANCE DECISION SUPPORT SYSTEM | Leakage Predictions
DMA OUT17 | | The Acres | |
BALANCE
Filters and Controls
Client
(All)
DMA
DMA OUT17
Flow
Units
m3/hr
AZP
m
Navigation
Home
DMA Profiles
DMA Analysis
Leakage Summary
Leakage Predictions
PCC Predictions
Summary and Prioritisation
DMA Prioritisation Heatmap
INFIN.IO
Export
Select a point on the Total Leakage Volume line to set a target b
Min. Current Leakage Volume
3.47 m3/hr
Desired Leakage Volume Target
m3/hr
Percentage Reduction
%
AZP to be Dropped by
m
Active Leak Detection to Find Approximat
ESPB
Current Leakage Volume
Leak Flow Rate
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Average Zone Pressure
Total Leakage Volume
Fixed Area Leakage
Variable Area Leakage
UARL


BALANCE DECISION SUPPORT SYSTEM | Leakage Predictions
DMA OUT17 | | The Acres | |
BALANCE
Filters and Controls
Client
(All)
DMA
DMA OUT17
Flow
Units
m3/hr
AZP
m
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Leakage Predictions
PCC Predictions
Summary and Prioritisation
DMA Prioritisation Heatmap
INFIN.IO
Export
Select a point on the Total Leakage Volume curve to set a target below
Min. Current Leakage Volume 3.47 m3/hr
Desired Leakage Volume Target 3.23 m3/hr
Percentage Reduction 7.3 %
AZP to be Dropped by 2.00 m
Active Leak Detection to Find Approximately 33 ESPB
Current Leakage Volume
Total Leakage Volume:
Average Zone Pressure:
Leak Flow Rate
Average Zone Pressure
Total Leakage Volume
Fixed Area Leakage
Variable Area Leakage
UARL


BALANCE DECISION SUPPORT SYSTEM | Leakage Predictions
DMA OUT17 | | The Acres | |
BALANCE
Filters and Controls
Client
(All)
DMA
DMA OUT17
Flow
Units
m3/hr
AZP
m
Navigation
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INFIN.IO
Export
Select a point on the Total Leakage Volume curve to set a target leakage
Min. Current Leakage Volume 3.47 m3/hr
Desired Leakage Volume Target 3.09 m3/hr
Percentage Reduction 12.4 %
AZP to be Dropped by 3.25 m
Active Leak Detection to Find Approximately 49 ESPB
Current Leakage Volume
Total Leakage Volume: 3.09 m
Average Zone Pressure: 18.55 m
Leak Flow Rate
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Average Zone Pressure
Total Leakage Volume
Fixed Area Leakage
Variable Area Leakage
UARL


BALANCE DECISION SUPPORT SYSTEM | Leakage Predictions
DMA OUT17 | | The Acres | |
BALANCE
Filters and Controls
Client
(All)
DMA
DMA OUT17
Flow Units
m3/hr
AZP
m
Navigation
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Leakage Predictions
PCC Predictions
Summary and Prioritisation
DMA Prioritisation Heatmap
INFIN.IO
Export
Select a point on the Total Leakage Volume line to set a target leakage
Min. Current Leakage Volume 3.47 m3/hr
Desired Leakage Volume Target 2.96 m3/hr
Percentage Reduction 17.0 %
AZP to be Dropped by 4.25 m
Active Leak Detection to Find Approximately 61 ESPB
Current Leakage Volume
Total Leakage Volume: 2.96 m3/hr
Average Zone Pressure: 17.55 m
Leak Flow Rate
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Average Zone Pressure
Total Leakage Volume
Fixed Area Leakage
Variable Area Leakage
UARL


BALANCE DECISION SUPPORT SYSTEM | Leakage Predictions
DMA OUT17 | | The Acres | |
BALANCE
Filters and Controls
Client
(All)
DMA
DMA OUT17
Flow Units
m3/hr
AZP
m
Navigation
Home
DMA Profiles
DMA Analysis
Leakage Summary
Leakage Predictions
PCC Predictions
Summary and Prioritisation
DMA Prioritisation Heatmap
INFIN.IO
Export
Min. Current Leakage Volume 3.47 m3/hr
Desired Leakage Volume Target 2.84 m3/hr
Percentage Reduction 22.0 %
AZP to be Dropped by 5.25 m
72 ESPB
Current Leakage Volume
Total Leakage Volume: 2.84 m3/hr
Average Zone Pressure: 16.55 m
Leak Flow Rate
Average Zone Pressure
Total Leakage Volume
Fixed Area Leakage
Variable Area Leakage
UARL


BALANCE DECISION SUPPORT SYSTEM | Leakage Predictions
DMA OUT17 | | The Acres | |
BALANCE
Filters and Controls
Client
(All)
DMA
DMA OUT17
Flow Units
m3/hr
AZP
m
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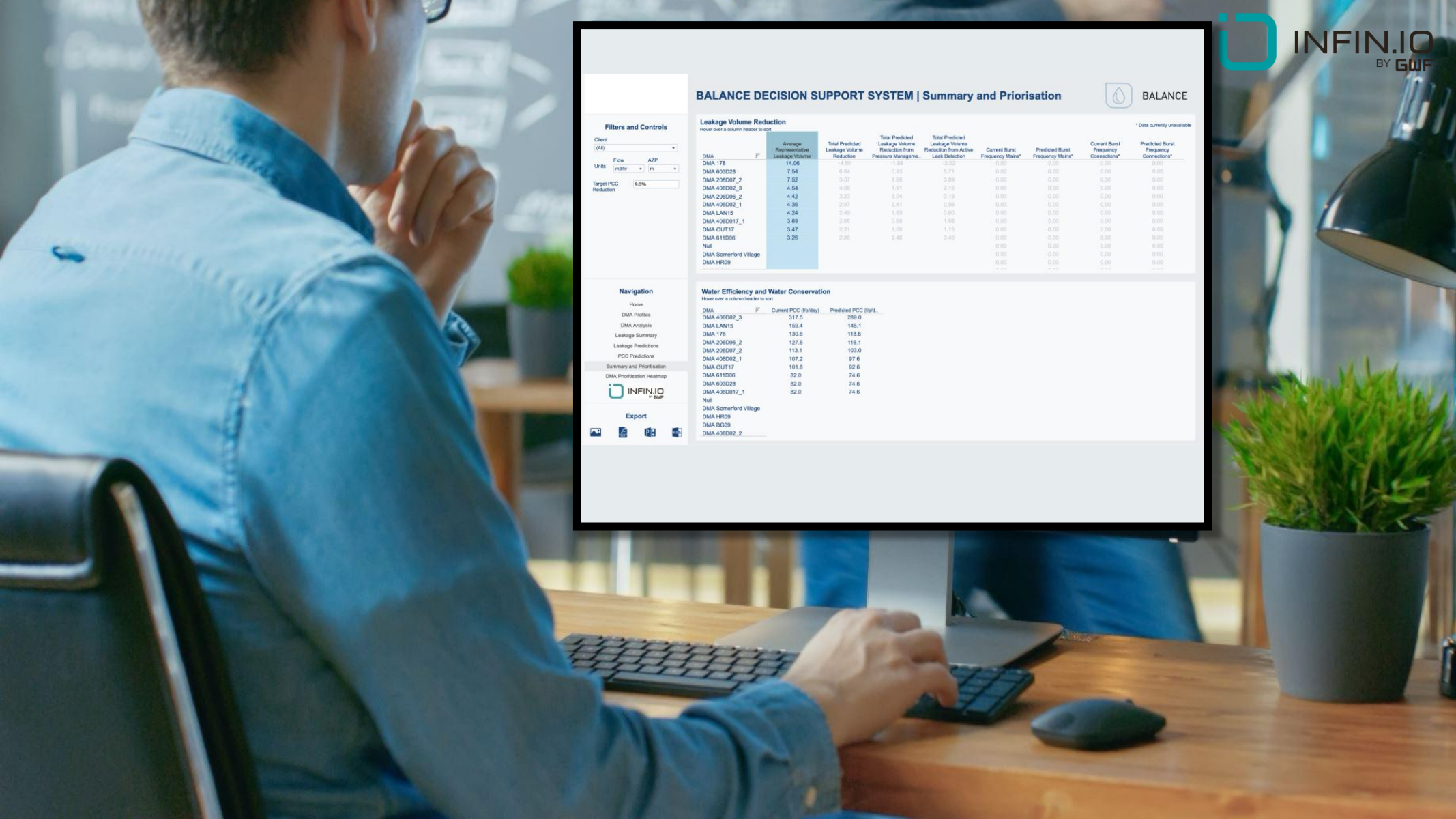
Leakage Summary
Leakage Predictions
PCC Predictions
Summary and Prioritisation
DMA Prioritisation Heatmap
INFIN.IO
Export
Select a point on the Total Leakage Volume curve to set a target below
Min. Current Leakage Volume 3.47 m3/hr
Desired Leakage Volume Target 2.72 m3/hr
Percentage Reduction 27.6 %
AZP to be Dropped by 6.25 m
Active Leak Detection to Find Approximately 81 ESPB
Current Leakage Volume
Total Leakage Volume: 2.72 m3/hr
Average Zone Pressure: 15.55 m
Leak Flow Rate
Average Zone Pressure
Total Leakage Volume
Fixed Area Leakage
Variable Area Leakage
UARL


BALANCE DECISION SUPPORT SYSTEM | Summary and Priorisation
BALANCE
Filters and Controls
Client
(All)
Flow
AZP
Units
m3/hr
m
Target PCC Reduction
9.0%
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PCC Predictions
Summary and Prioritisation
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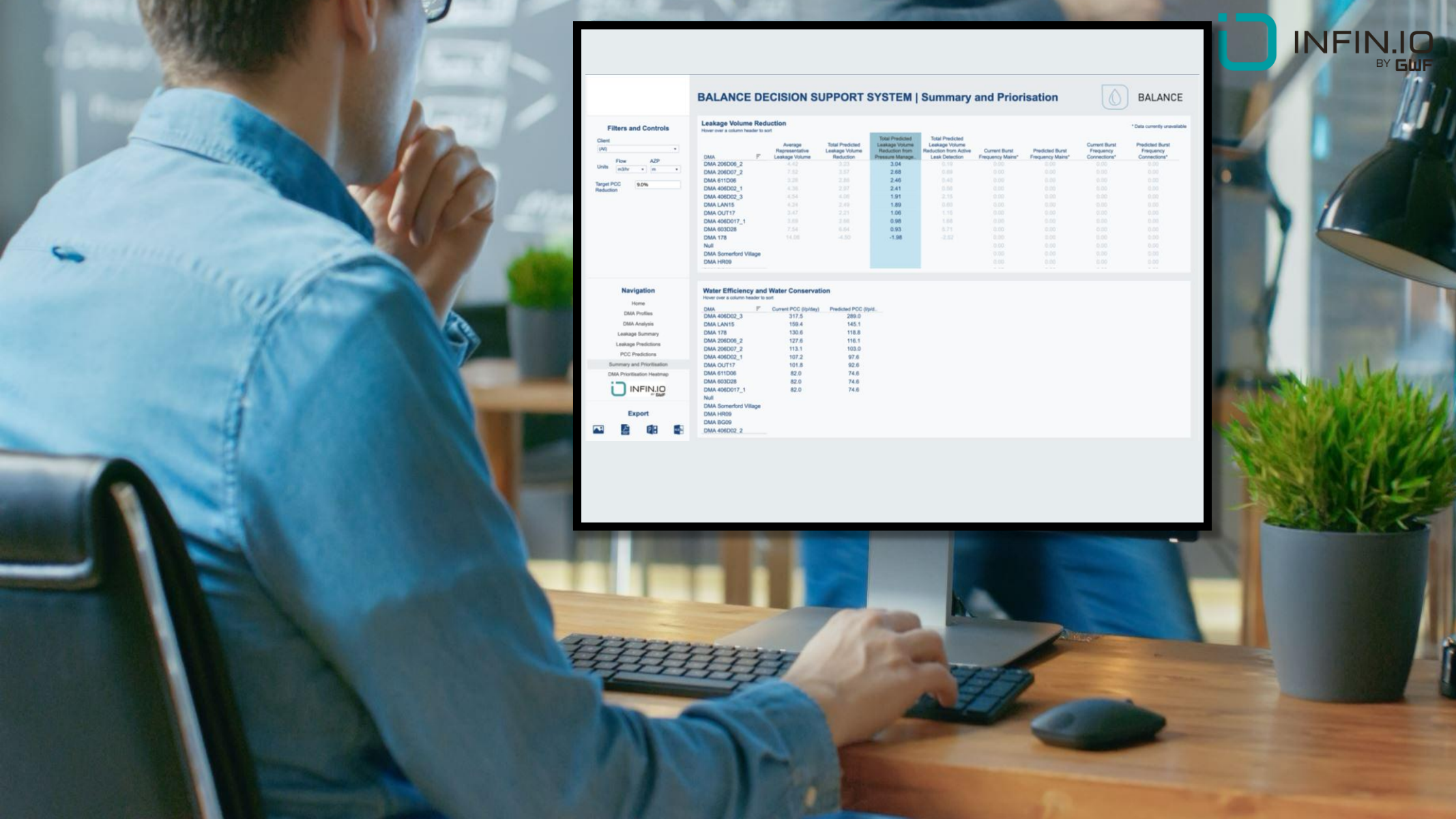
Export
Leakage Volume Reduction
Hover over a column header to sort
* Data currently unavailable
DMA
Average Representative Leakage Volume
Total Predicted Leakage Volume Reduction
Total Predicted Leakage Volume Reduction from Pressure Manageme..
Total Predicted Leakage Volume Reduction from Active Leak Detection
Current Burst Frequency Mains*
Predicted Burst Frequency Mains*
Current Burst Frequency Connections*
Predicted Burst Frequency Connections*
DMA 178 14.06 -4.50 -1.98 -2.52 0.00 0.00 0.00 0.00
DMA 603D28 7.54 0.64 0.93 5.71 0.00 0.00 0.00 0.00
DMA 206D07_2 7.52 3.57 2.68 0.89 0.00 0.00 0.00 0.00
DMA 406D02_3 4.54 4.06 1.91 2.15 0.00 0.00 0.00 0.00
DMA 206D06_2 4.42 3.23 3.04 0.19 0.00 0.00 0.00 0.00
DMA 406D02_1 4.36 2.97 2.41 0.56 0.00 0.00 0.00 0.00
DMA LAN15 4.24 2.49 1.89 0.60 0.00 0.00 0.00 0.00
DMA 406D017_1 3.69 2.68 0.68 1.68 0.00 0.00 0.00 0.00
DMA OUT17 3.47 2.21 1.06 1.15 0.00 0.00 0.00 0.00
DMA 611D06 3.26 2.86 2.46 0.40 0.00 0.00 0.00 0.00
Null 0.00 0.00 0.00 0.00
DMA Somerford Village 0.00 0.00 0.00 0.00
DMA HR09 0.00 0.00 0.00 0.00
Water Efficiency and Water Conservation
Hover over a column header to sort
DMA
Current PCC (l/p/day)
Predicted PCC (l/p/d..
DMA 406D02_3 317.5 289.0
DMA LAN15 159.4 145.1
DMA 178 130.6 118.8
DMA 206D06_2 127.6 116.1
DMA 206D07_2 113.1 103.0
DMA 406D02_1 107.2 97.6
DMA OUT17 101.8 92.6
DMA 611D06 82.0 74.6
DMA 603D28 82.0 74.6
DMA 406D017_1 82.0 74.6
Null
DMA Somerford Village
DMA HR09
DMA BG09
DMA 406D02_2


BALANCE DECISION SUPPORT SYSTEM | Summary and Priorisation
BALANCE
Filters and Controls
Client
(All)
Flow
Units
m3/hr
AZP
m
Target PCC Reduction
9.0%
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Leakage Summary
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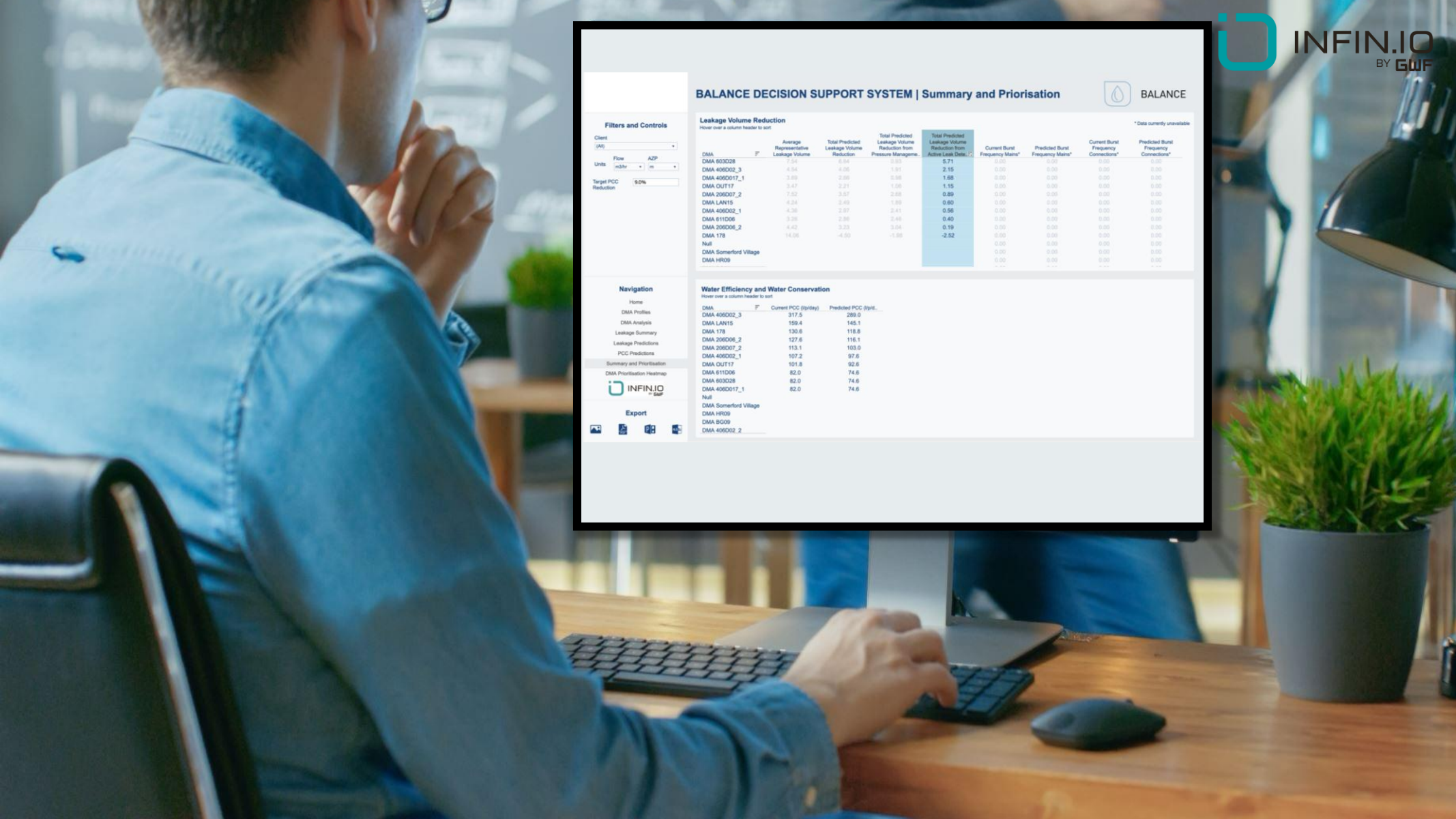
PCC Predictions
Summary and Prioritisation
DMA Prioritisation Heatmap
Export
Leakage Volume Reduction
Hover over a column header to sort
* Data currently unavailable
DMA
Average Representative Leakage Volume
Total Predicted Leakage Volume Reduction
Total Predicted Leakage Volume Reduction from Pressure Manage...
Total Predicted Leakage Volume Reduction from Active Leak Detection
Current Burst Frequency Mains*
Predicted Burst Frequency Mains*
Current Burst Frequency Connections*
Predicted Burst Frequency Connections*
DMA 206D06_2 4.42 3.23 3.04 0.19 0.00 0.00 0.00 0.00
DMA 206D07_2 7.52 3.57 2.68 0.89 0.00 0.00 0.00 0.00
DMA 611D06 3.28 2.86 2.46 0.40 0.00 0.00 0.00 0.00
DMA 406D02_1 4.36 2.97 2.41 0.56 0.00 0.00 0.00 0.00
DMA 406D02_3 4.54 4.06 1.91 2.15 0.00 0.00 0.00 0.00
DMA LAN15 4.24 2.49 1.89 0.60 0.00 0.00 0.00 0.00
DMA OUT17 3.47 2.21 1.06 1.16 0.00 0.00 0.00 0.00
DMA 406D017_1 3.69 2.98 0.98 1.66 0.00 0.00 0.00 0.00
DMA 603D28 7.54 6.64 0.93 5.71 0.00 0.00 0.00 0.00
DMA 178 14.06 -4.50 -1.98 -2.82 0.00 0.00 0.00 0.00
Null 0.00 0.00 0.00 0.00
DMA Somerford Village 0.00 0.00 0.00 0.00
DMA HR09 0.00 0.00 0.00 0.00
Water Efficiency and Water Conservation
Hover over a column header to sort
DMA
Current PCC (l/p/day)
Predicted PCC (l/p/d...
DMA 406D02_3 317.5 289.0
DMA LAN15 159.4 145.1
DMA 178 130.6 118.8
DMA 206D06_2 127.6 116.1
DMA 206D07_2 113.1 103.0
DMA 406D02_1 107.2 97.6
DMA OUT17 101.8 92.6
DMA 611D06 82.0 74.6
DMA 603D28 82.0 74.6
DMA 406D017_1 82.0 74.6
Null
DMA Somerford Village
DMA HR09
DMA BG09
DMA 406D02_2


BALANCE DECISION SUPPORT SYSTEM | Summary and Priorisation
BALANCE
Filters and Controls
Client
(All)
Units
Flow
m3/hr
AZP
m
Target PCC Reduction
9.0%
Navigation
Home
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Leakage Summary
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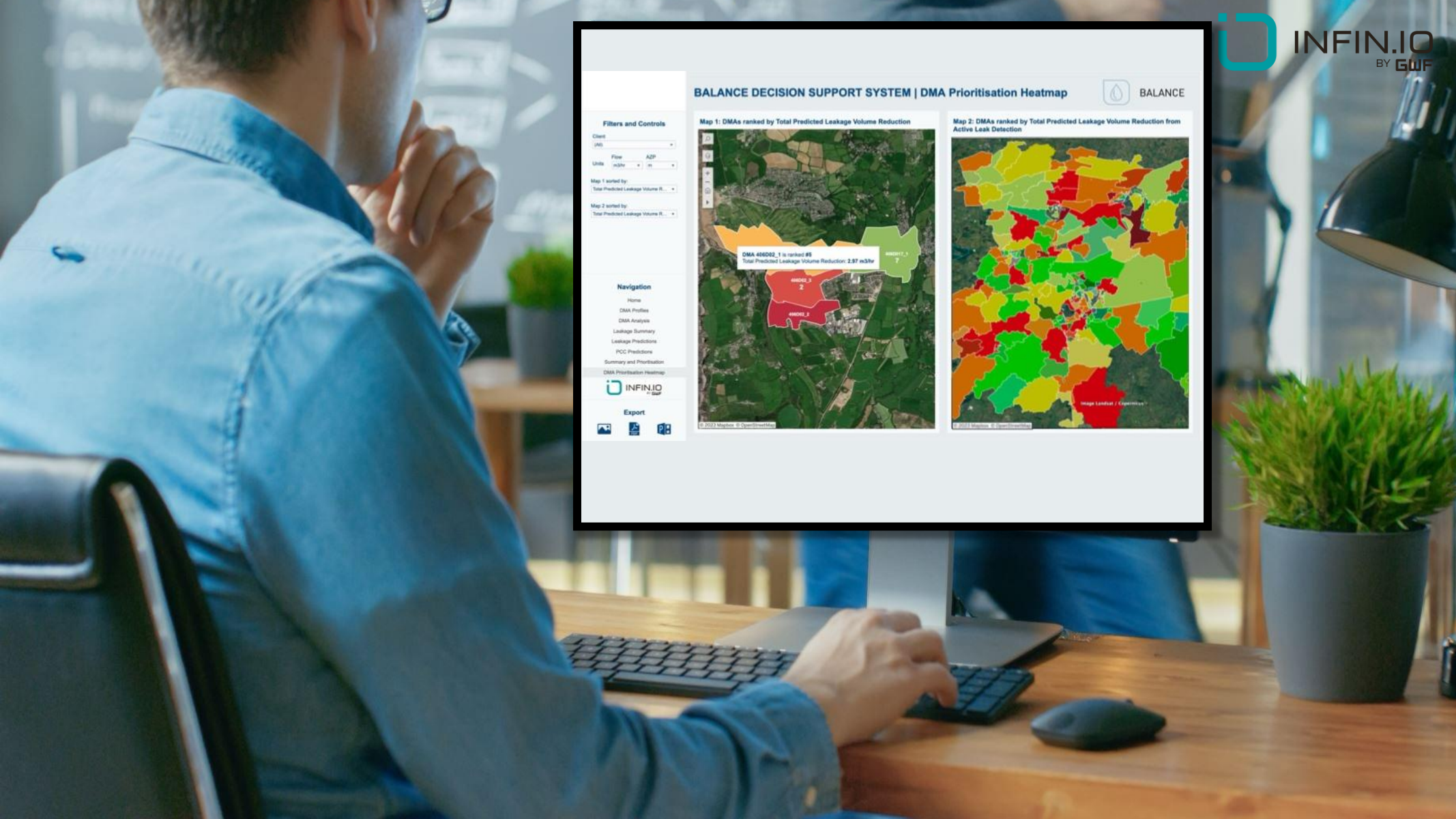
Summary and Prioritisation
DMA Prioritisation Heatmap
Export
Leakage Volume Reduction
Hover over a column header to sort
* Data currently unavailable
DMA
Average Representative Leakage Volume
Total Predicted Leakage Volume Reduction
Total Predicted Leakage Volume Reduction from Pressure Manageme...
Total Predicted Leakage Volume Reduction from Active Leak Dete...
Current Burst Frequency Mains*
Predicted Burst Frequency Mains*
Current Burst Frequency Connections*
Predicted Burst Frequency Connections*
DMA 603D28 4.04 4.04 2.67 5.71 0.00 0.00 0.00 0.00
DMA 406D02_3 4.54 4.06 1.91 2.15 0.00 0.00 0.00 0.00
DMA 406D017_1 3.69 2.66 0.98 1.68 0.00 0.00 0.00 0.00
DMA OUT17 3.47 2.21 1.06 1.15 0.00 0.00 0.00 0.00
DMA 206D07_2 7.52 3.57 2.68 0.89 0.00 0.00 0.00 0.00
DMA LAN15 4.24 2.49 1.89 0.60 0.00 0.00 0.00 0.00
DMA 406D02_1 4.36 2.97 2.41 0.56 0.00 0.00 0.00 0.00
DMA 611D06 3.26 2.86 2.46 0.40 0.00 0.00 0.00 0.00
DMA 206D06_2 4.42 3.23 3.04 0.19 0.00 0.00 0.00 0.00
DMA 178 14.06 -4.50 -1.98 -2.52 0.00 0.00 0.00 0.00
Null 0.00 0.00 0.00 0.00
DMA Somerford Village 0.00 0.00 0.00 0.00
DMA HR09 0.00 0.00 0.00 0.00
Water Efficiency and Water Conservation
Hover over a column header to sort
DMA
Current PCC (l/p/day)
Predicted PCC (l/p/d...
DMA 406D02_3 317.5 289.0
DMA LAN15 159.4 145.1
DMA 178 130.6 118.8
DMA 206D06_2 127.6 116.1
DMA 206D07_2 113.1 103.0
DMA 406D02_1 107.2 97.6
DMA OUT17 101.8 92.6
DMA 611D06 82.0 74.6
DMA 603D28 82.0 74.6
DMA 406D017_1 82.0 74.6
Null
DMA Somerford Village
DMA HR09
DMA BG09
DMA 406D02_2


BALANCE DECISION SUPPORT SYSTEM | DMA Prioritisation Heatmap
BALANCE
Filters and Controls
Client
IAS
Flow
AZP
Units
m3/hr
m
Map 1 sorted by:
Total Predicted Leakage Volume R...
Map 2 sorted by:
Total Predicted Leakage Volume R...
Navigation
Home
DMA Profiles
DMA Analysis
Leakage Summary
Leakage Predictions
PCC Predictions
Summary and Prioritisation
DMA Prioritisation Heatmap
INFIN.IO
Export
Map 1: DMAs ranked by Total Predicted Leakage Volume Reduction
DMA 406D02_1 is ranked #5
Total Predicted Leakage Volume Reduction: 2.97 m3/hr
406D03_3
2
406D02_2
406D17_1
7
© 2023 Mapbox © OpenStreetMap
Map 2: DMAs ranked by Total Predicted Leakage Volume Reduction from Active Leak Detection
Image Landsat / Copernicus
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# BALANCE PROVIDES ACTIONABLE INSIGHT

- Accurately quantifies the leakage reduction achievable from pressure reduction
- Calculates how many equivalent leaks will need to found and fixed in a DMA
- Estimates the volume of Customer Side Leakage, even for unmetered connections
- Indicates condition of network infrastructure for both mains and connections
- Resource management by sending the right people to do the right thing in the right place in the right order

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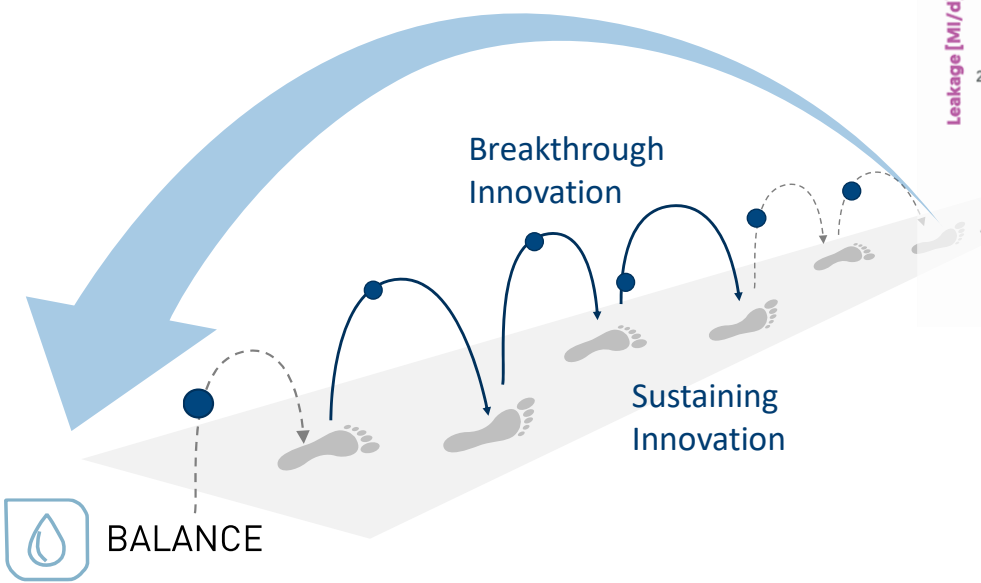
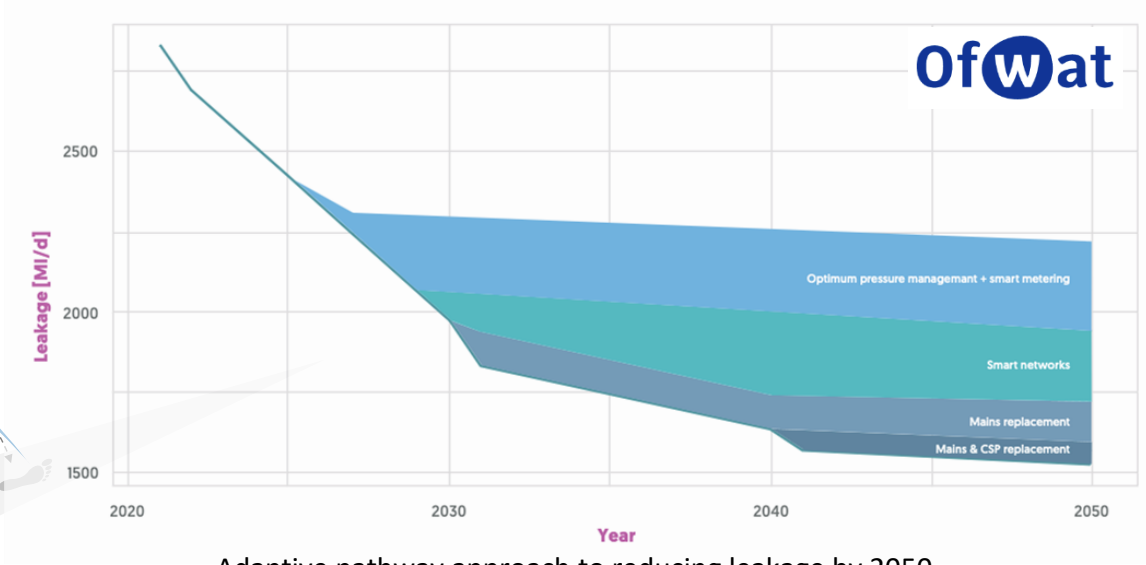
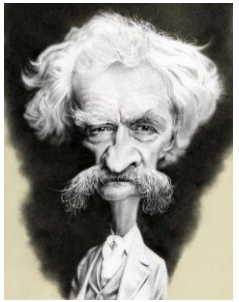
# QUITE SIMPLY, YOU NEED A LITTLE BALANCE IN YOUR LIVES!

"To see the way forward, sometimes it's necessary to look back"




Adaptive pathway approach to reducing leakage by 2050



"Get your facts first, then you can distort them as you please. ..."
Mark Twain 1900

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# Questions?

# Networking lunch
# Resume at 2.30pm

Don’t forget to add your post-it notes to the Thought Wall

# Meet up with our exhibitors and other delegates

aqualogic water conservation

BERMAD

GUTERMANN

HWM

MUELLER

OVARRO CONNECTING TECHNOLOGIES

SME WATER

suez

TECCURA SOFTWARE

TECHNOLOG

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# 24th ANNUAL
# LEAKAGE CONFERENCE

**4 – 5 DECEMBER 2023**

**BIRMINGHAM & LIVESTREAM**