Operational and Technology Developments Forum – Day 2

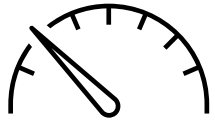
Operational and Technology Developments Forum

- Chaired by Bob Taylor, CEO, Portsmouth Water
- A week to a day: locating leaks on plastic pipes using IoT
  - Alex Barter, Director, B4T
  - Jamie Jones, Leakage and Smart Networks Manager, Portsmouth Water
- Cartref project: a comprehensive way to measure and manager consumption and leakage in high night flow
  - Chris Rees, Leakage Strategy Manager, Dwr Cymru Welsh Water
  - Dr Stephen Tooms, Executive Director, Invenio Systems
- COVID-19 had a huge impact on water demand patterns. What insights are there for how we manage the water network in the future?
  - Dene Marshallsay, Director, Artesia
  - Eldos Then, Asset Manager, Affinity Water
- Creating a practical twin: the symbiosis of technology and technique
  - James Hargrave, Regional Operational Leakage Manager, Anglian Water
  - Jamie Worthington, Planned Works and Asset Health, Anglian Water

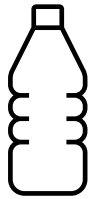
Practical IoT

Finding leaks on plastic pipes using pressure alone

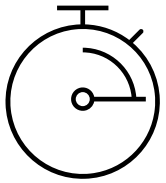
THE RECIPE FOR SUCCESS



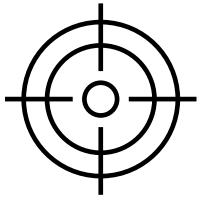
Low false positives alerts



50% plastic pipework

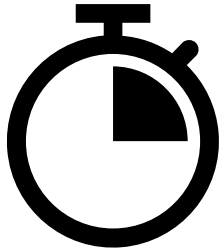


15-minute data low-cost IoT sensors



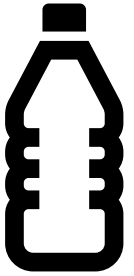
Octant accuracy

WHAT KEEPS JAMIE AWAKE AT NIGHT?

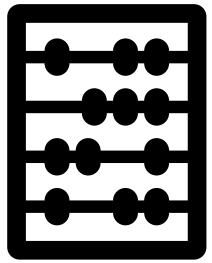


Fast to verify & locate

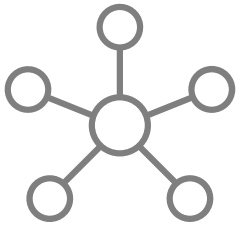
Calm network



Impact on plastic

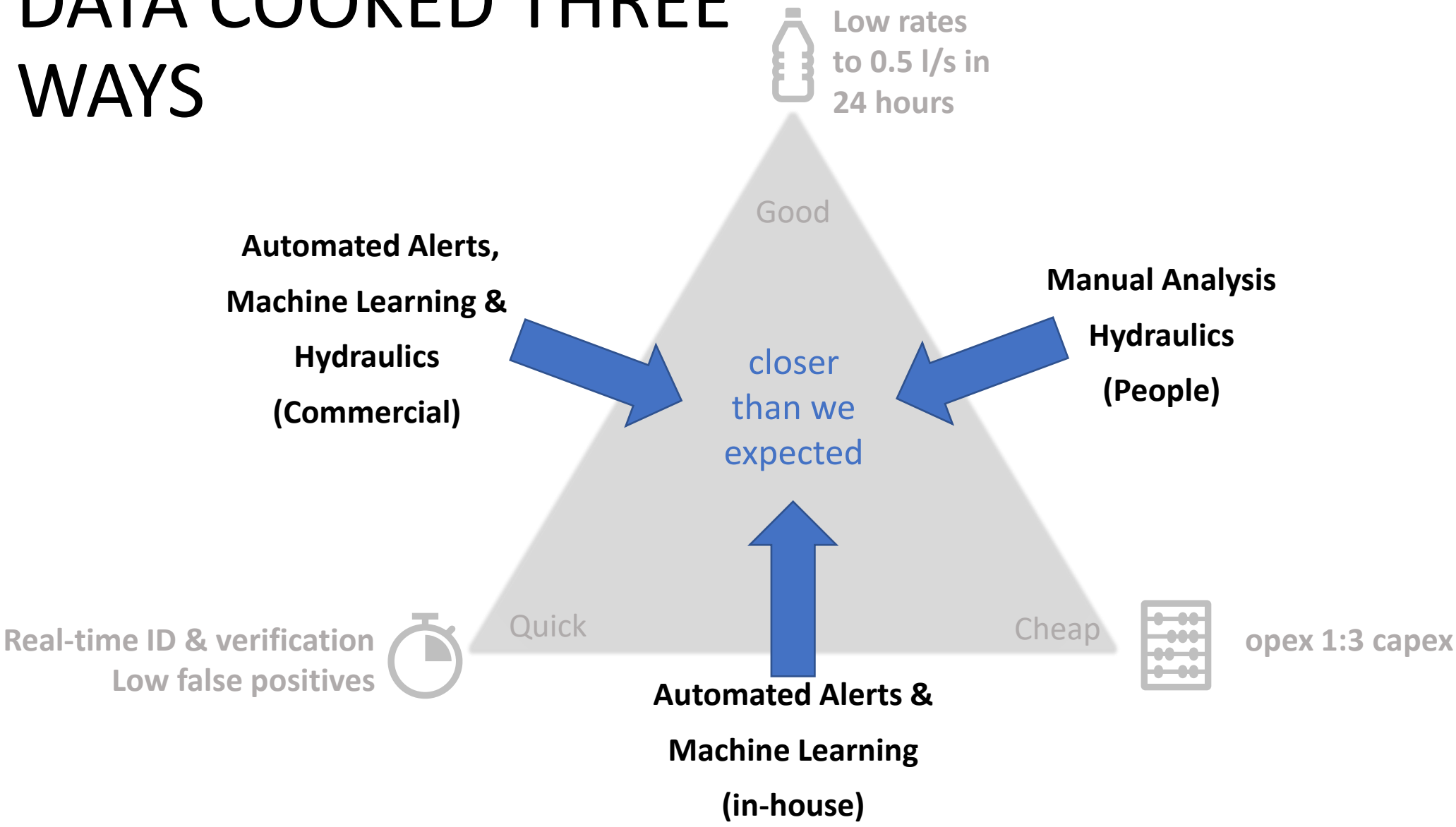


No magical money tree

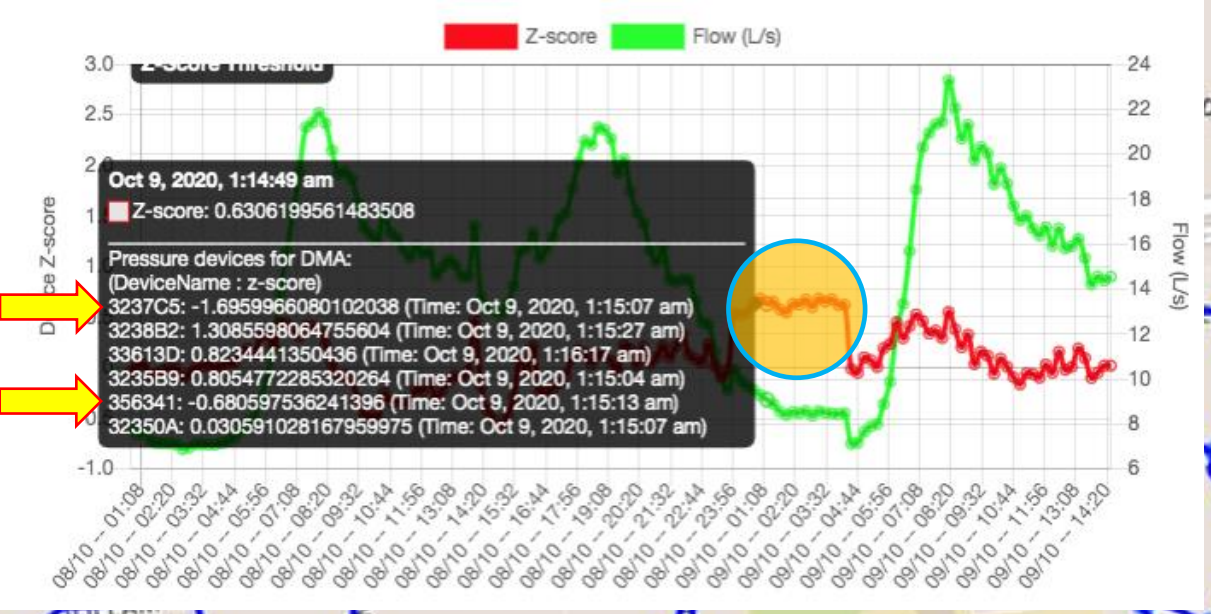


Automated network model

DATA COOKED THREE WAYS



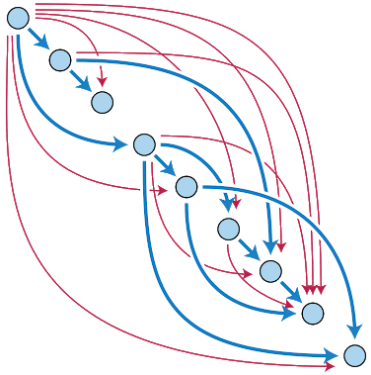
The data **has to be good**.
IoT sensors deliver and are going **down in price**



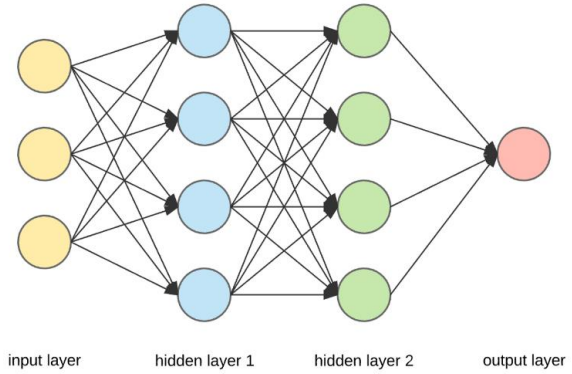
.....WHICH MEANS VERFYING REAL-TIME

.....AND VERFYING MANUALLY

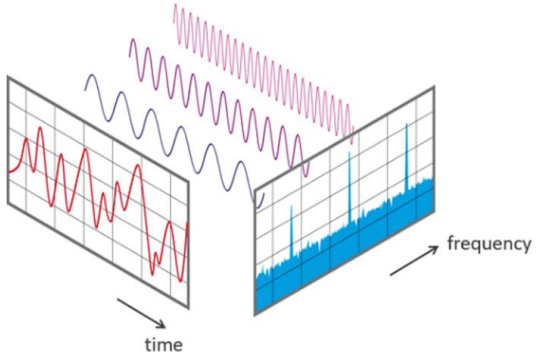
Directed Acyclic Graph



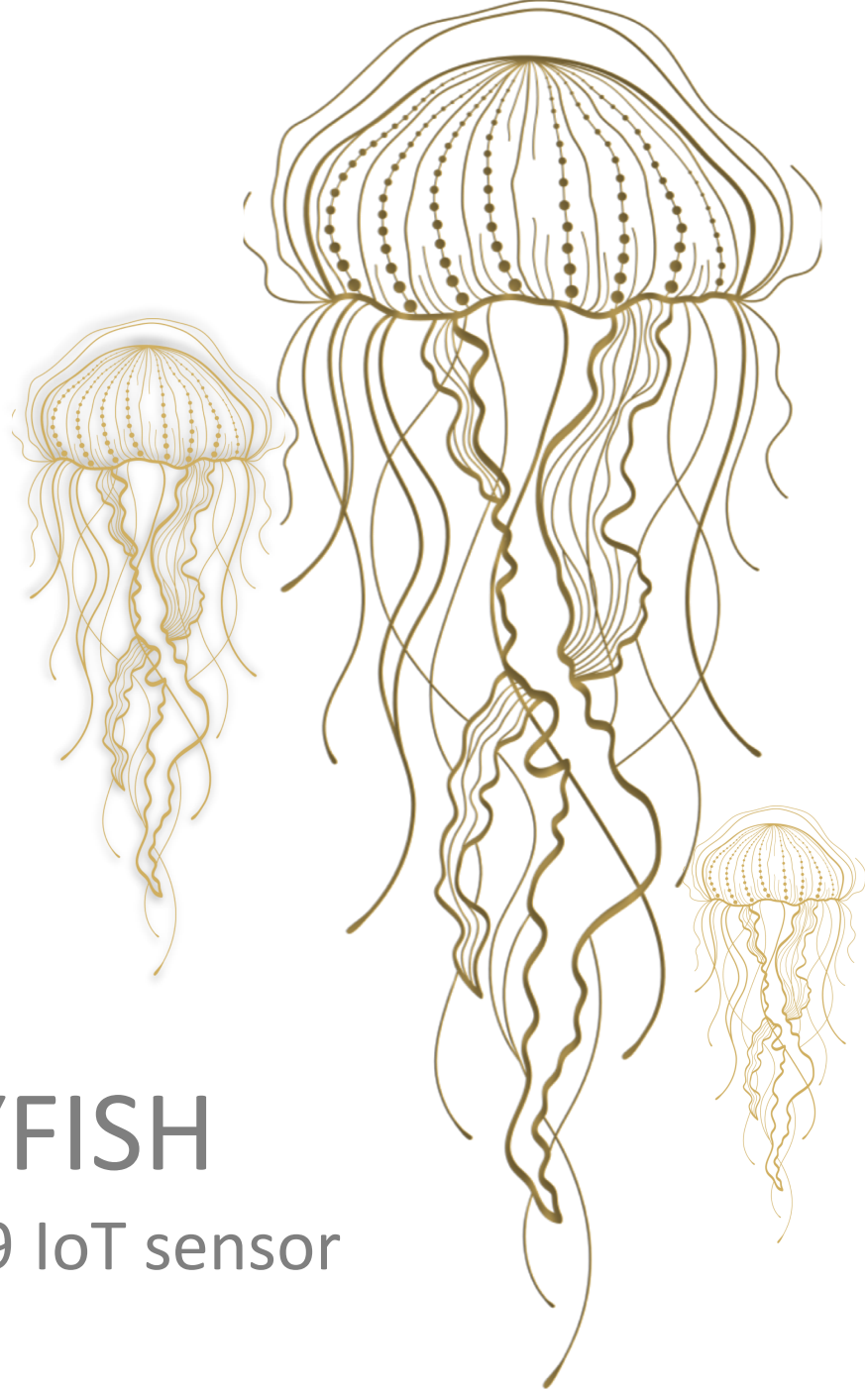
Tensors



Fast Fourier Transforms



WHERE NEXT?



JELLYFISH

Sub-£99 IoT sensor

jamie.jones@portsmouthwater.co.uk

alex@b4tgroup.co.uk

Project Cartref

21st Annual Leakage Conference

Steve Tooms – Director, Invenio Systems

Chris Rees – Leakage Strategy Manager, Dwr Cymru

Overview

Our Vision

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Approaches

Tools and Techniques Used

Customer Side Leakage

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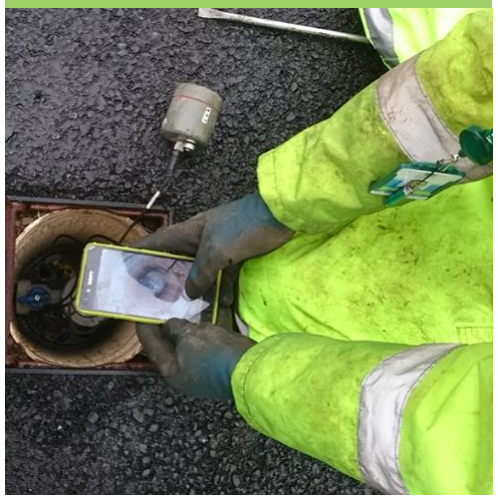
- Free supply pipe repair or replacement
- Free Internal leak repair
- Free water efficiency products



Distribution Leakage

- Fixed and Semi-Fixed Networks
- Lift and Shift acoustics
- Digital surveys
- Traditional active leakage control

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Where's the Leakage?

Distribution Losses

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Addressing Customer Side Losses

- **Proactive Programme**
- **200,000 home surveys**
- **Leakage and Water Efficiency Savings**
- **Customer Conversations**

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Project Cartref

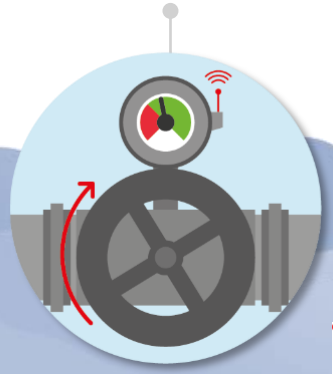
Programme and approach

Step One

Agree a rolling programme of DMAs through the Cartref Programme Group – Areas of interest demonstrate unaccounted for water that traditional ALC has failed to address

Step Two

Initial sweep of DMA and pre survey to clean out stop taps and plan for Stop.Watch deployment. Stop.Watch deployed and monitoring begins.



Step Three

Detailed data analysis of the Stop.Watch survey helps us identify points of interest. These will take the form of leak identification or high use customers.

Step Four

Our targetted communication campaign will advise customers why we are in the area and offer advice on water efficiency, support for repair of leaking loos and dripping taps.

Step Five

Our plumbing team will arrange an appointment with our customers and points of interest to fix any leak or account for high use.

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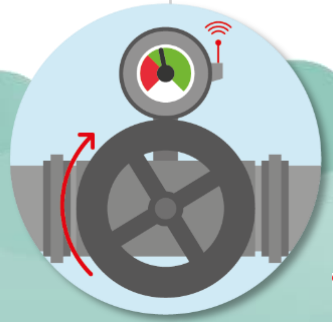

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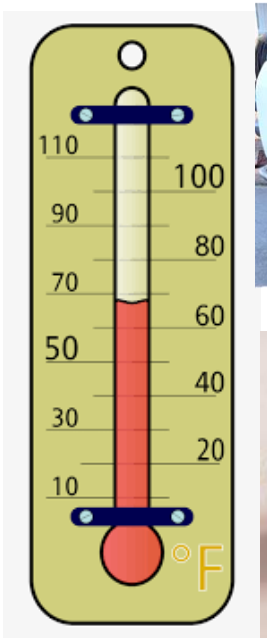

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- Established in 2015
- Pioneered the use of temperature measurements in water distribution systems
- Systems for service connections, distribution mains, and now trunk mains
- Acquired by Halma plc in 2019 and now a sister company of HWM Water
- 20 clients to date both domestically and Internationally.
- Consistent year on year growth expanding from 4 employees in 2015 to over 30 employees by the end of 2020 across 3 offices in Washington, Cromford and Wales

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Cartref Milestones

2015
- Proof of concept consumption pilots in several CMAs
- Trials of proving individual leaks

2016
- Chaplewood DMA surveyed as part of Innovate UK project
- First Understanding of the variability of night use

2017
- First Framework agreement awarded
- Team assembled due to continuity of work

2019
Cartref project a key element of the AMP7 business plan

2020
Framework agreement awarded after competitive tender process

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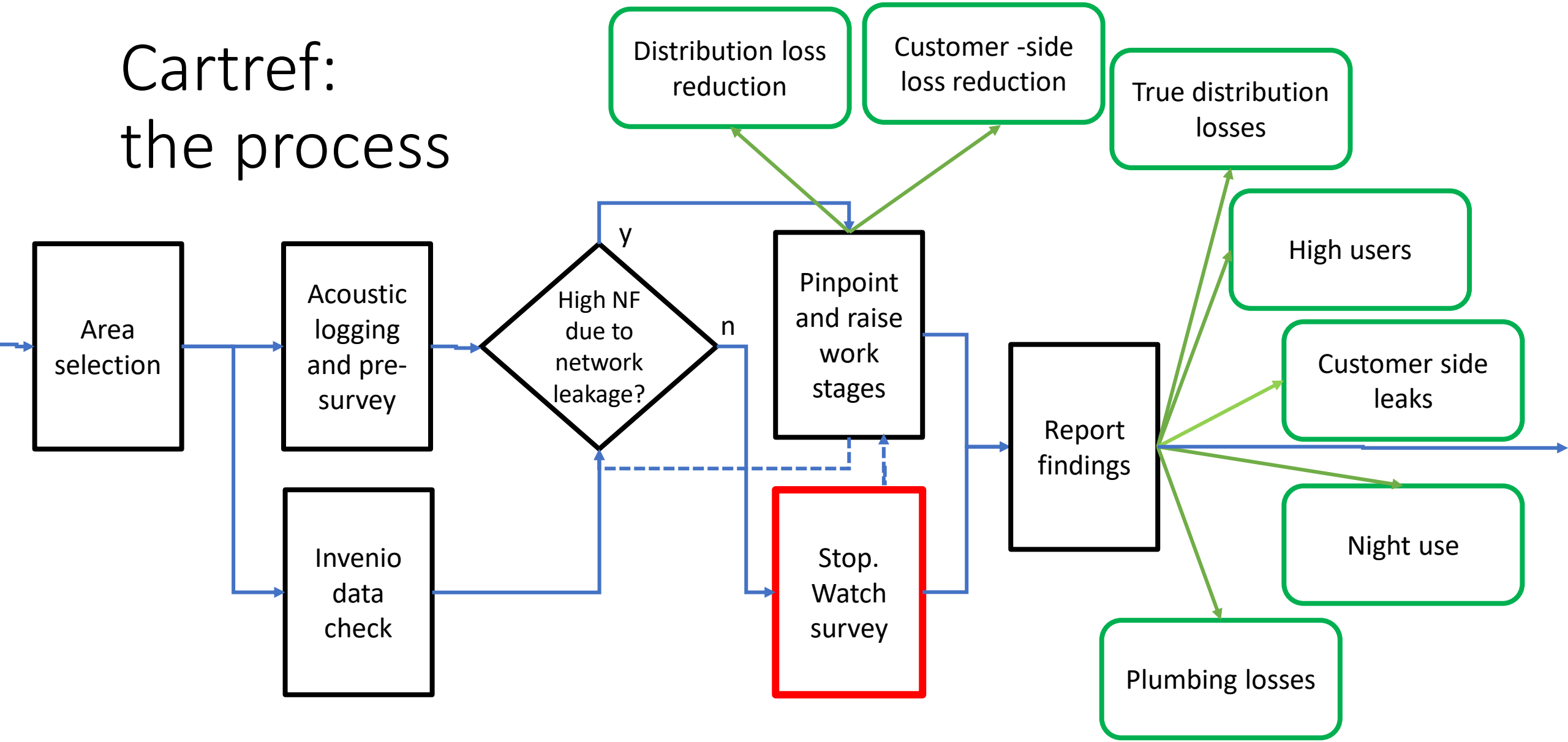
Cartref: the process



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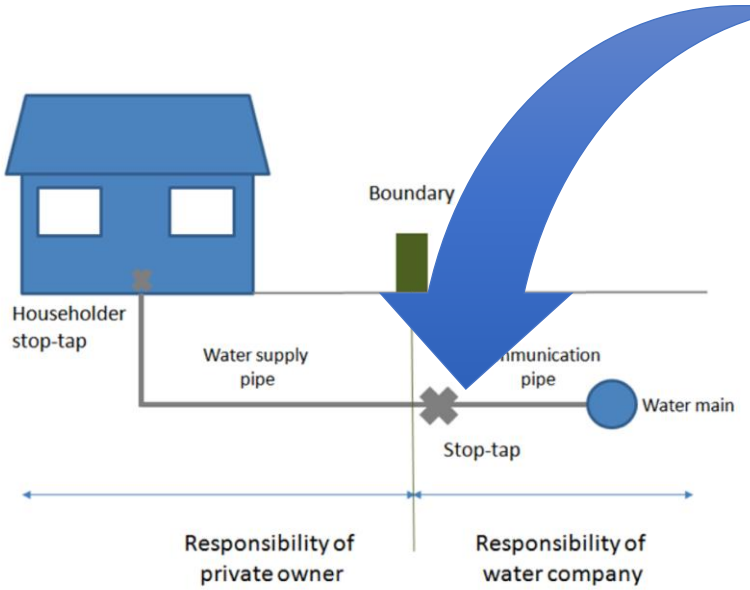
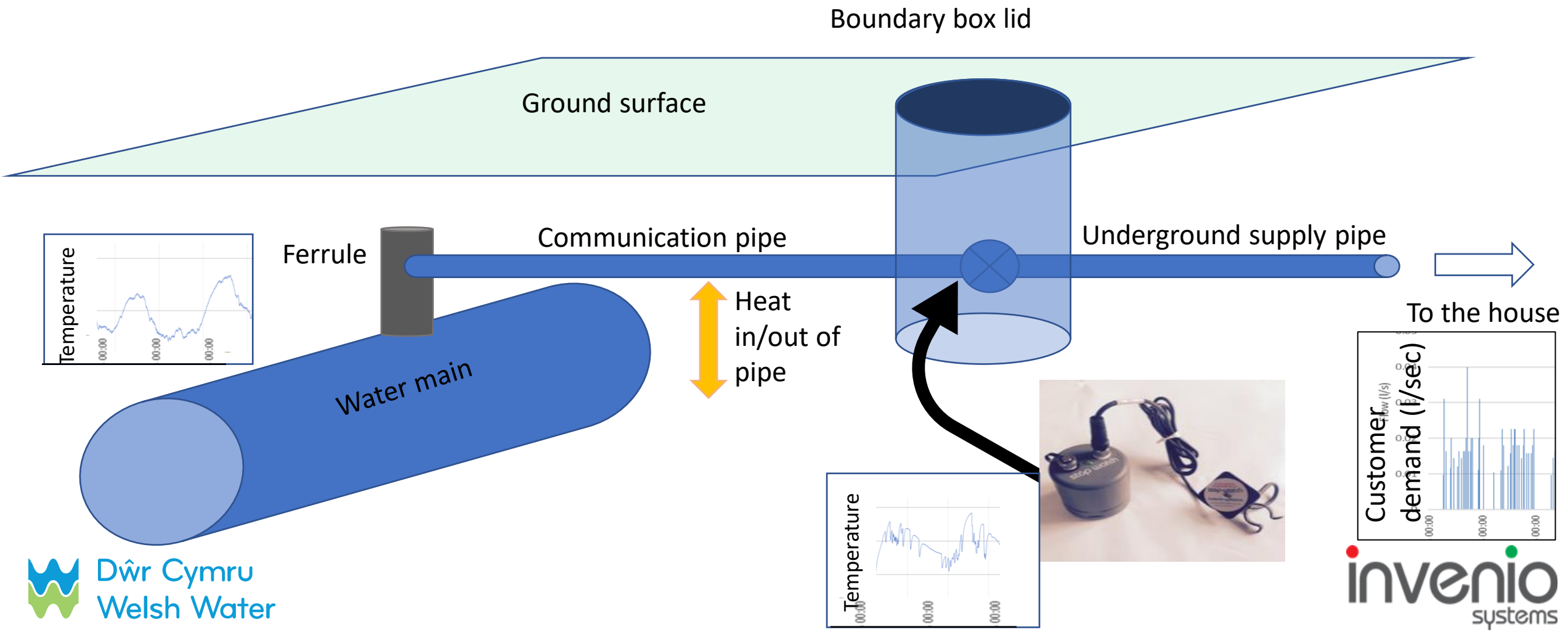
What is Stop.Watch

- High precision temperature measurements on external stop-taps
- Analyse to obtain use profile
- Analyse to identify and quantify leaks



How does StopWatch Work?



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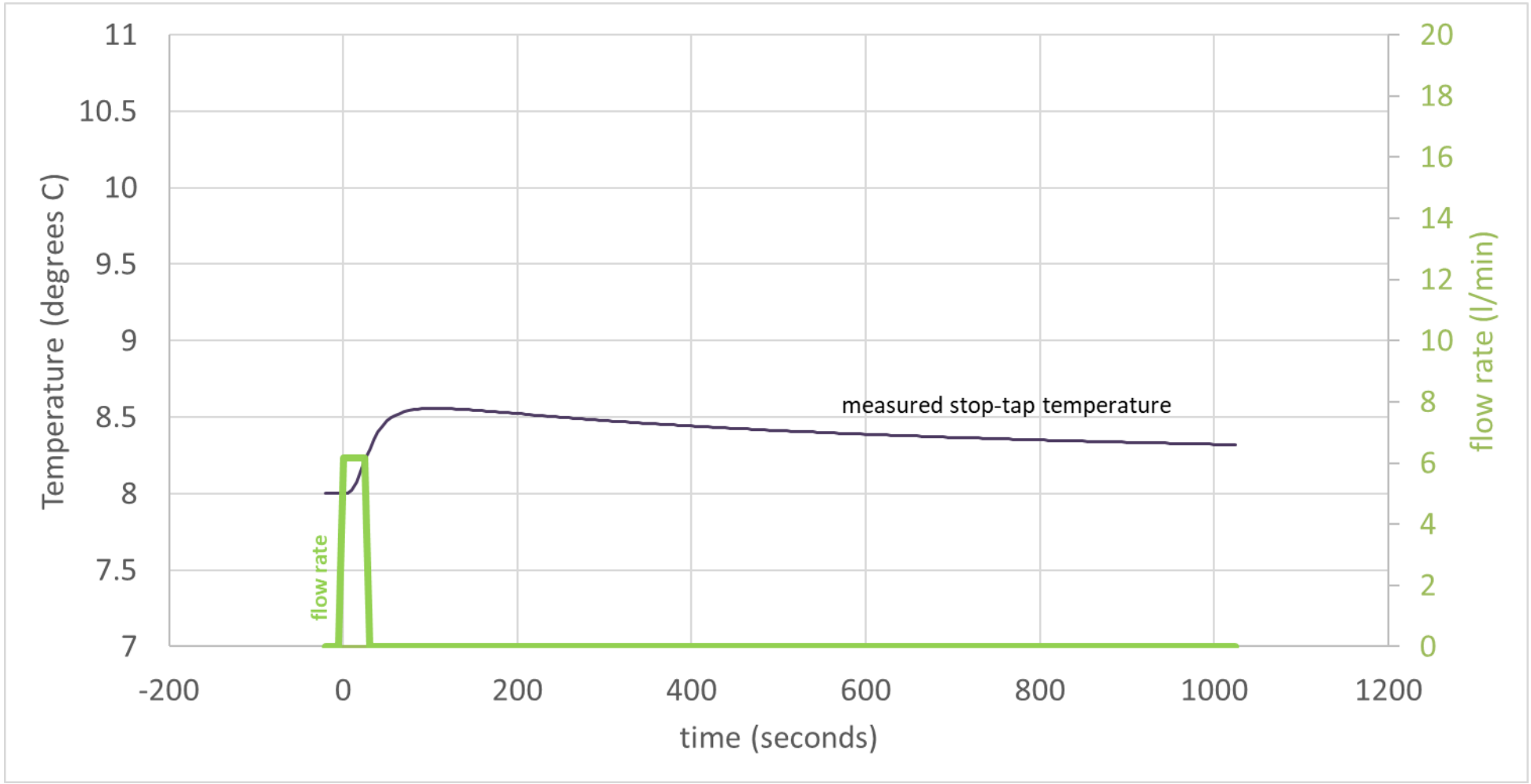
Intermittent flow 6 l/min for 30 seconds



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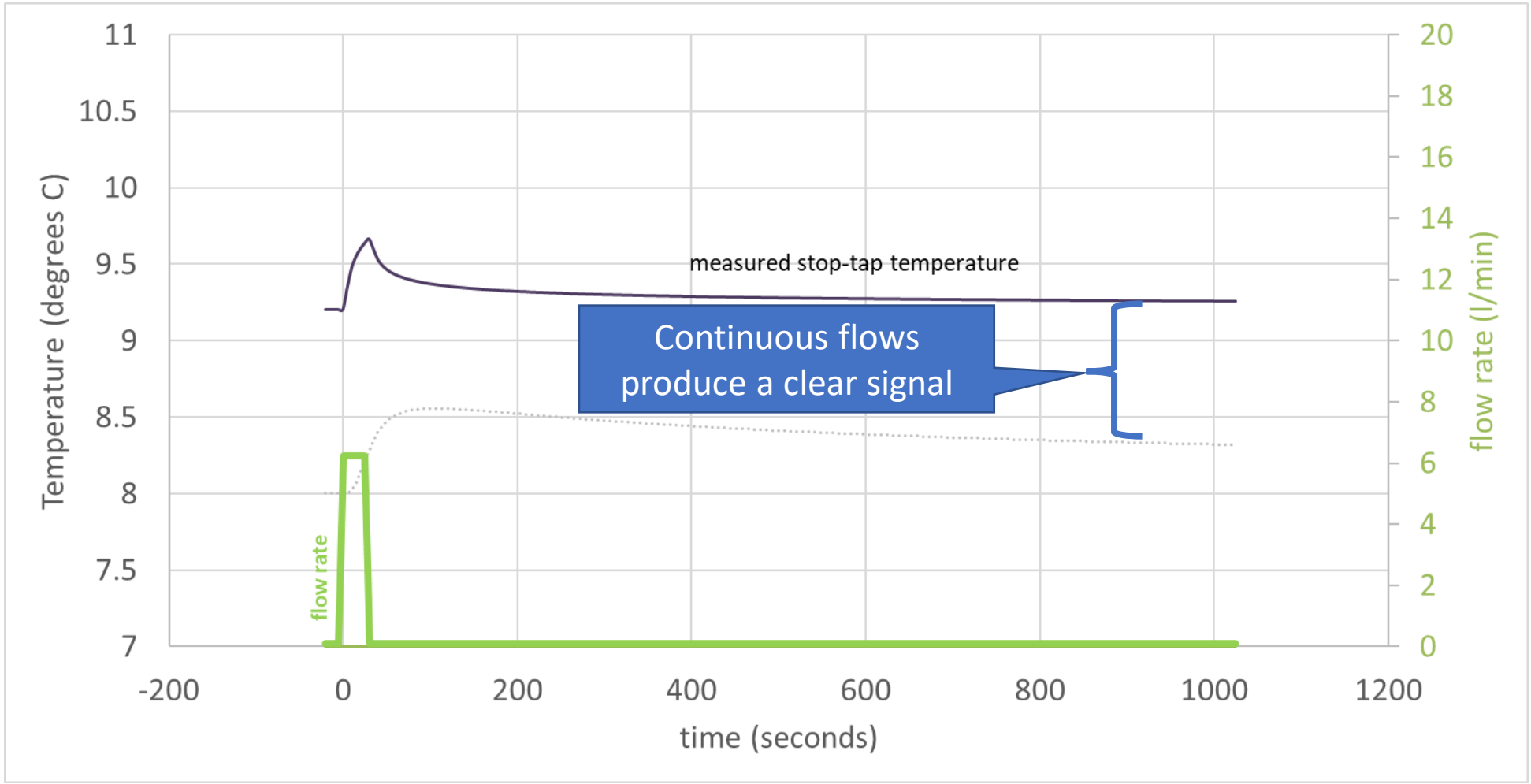
Continuous flow of 5 l/hr (0.08 l/min) with intermittent flow of 6 l/min for 30 seconds



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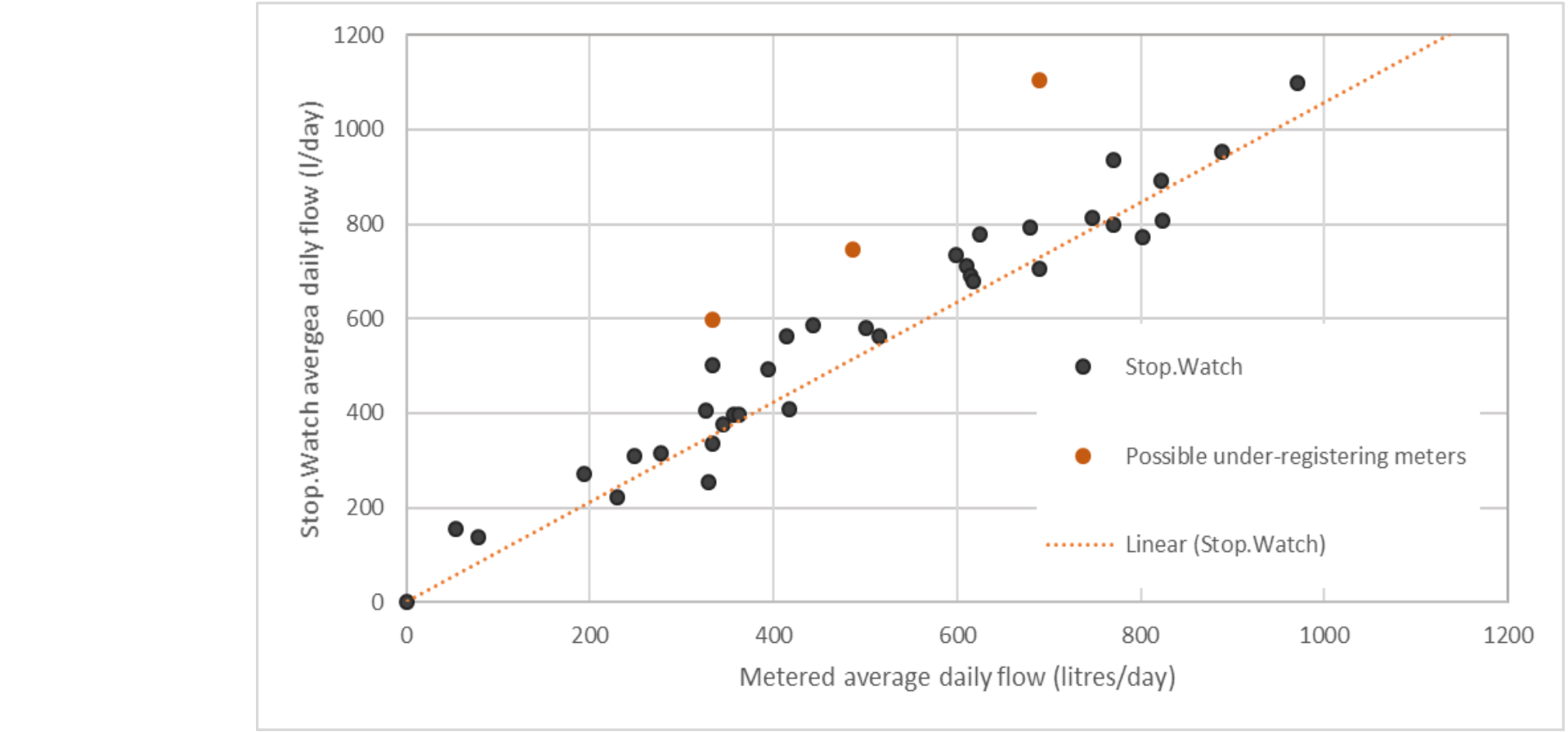
Verification - Stop.Watch vs Customer Meters



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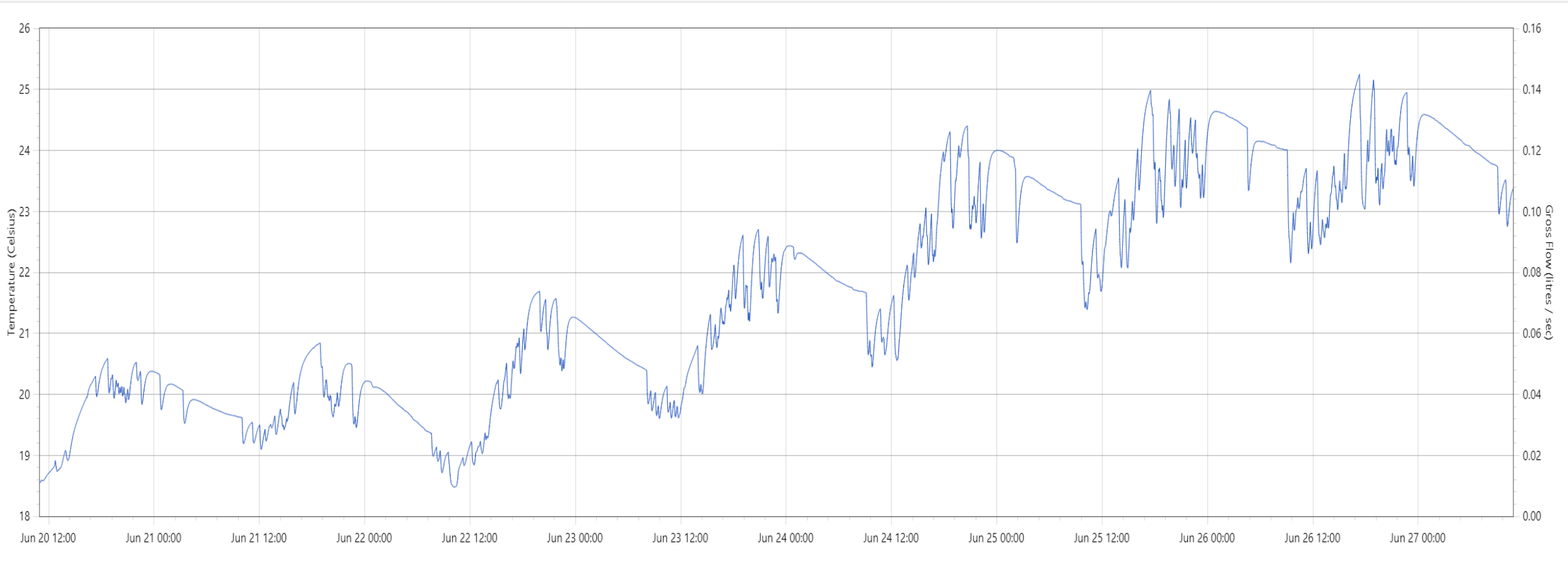
Temperature examples – Normal customer use



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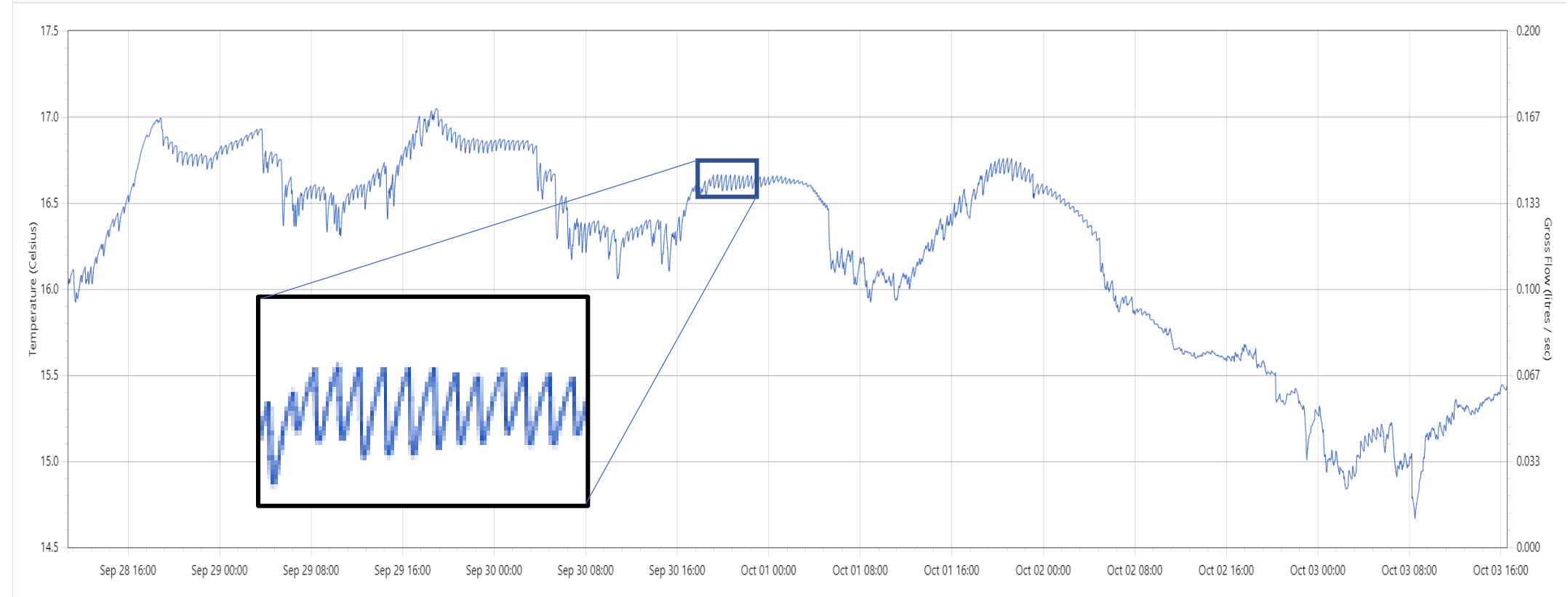
Temperature examples – leaking toilet cistern



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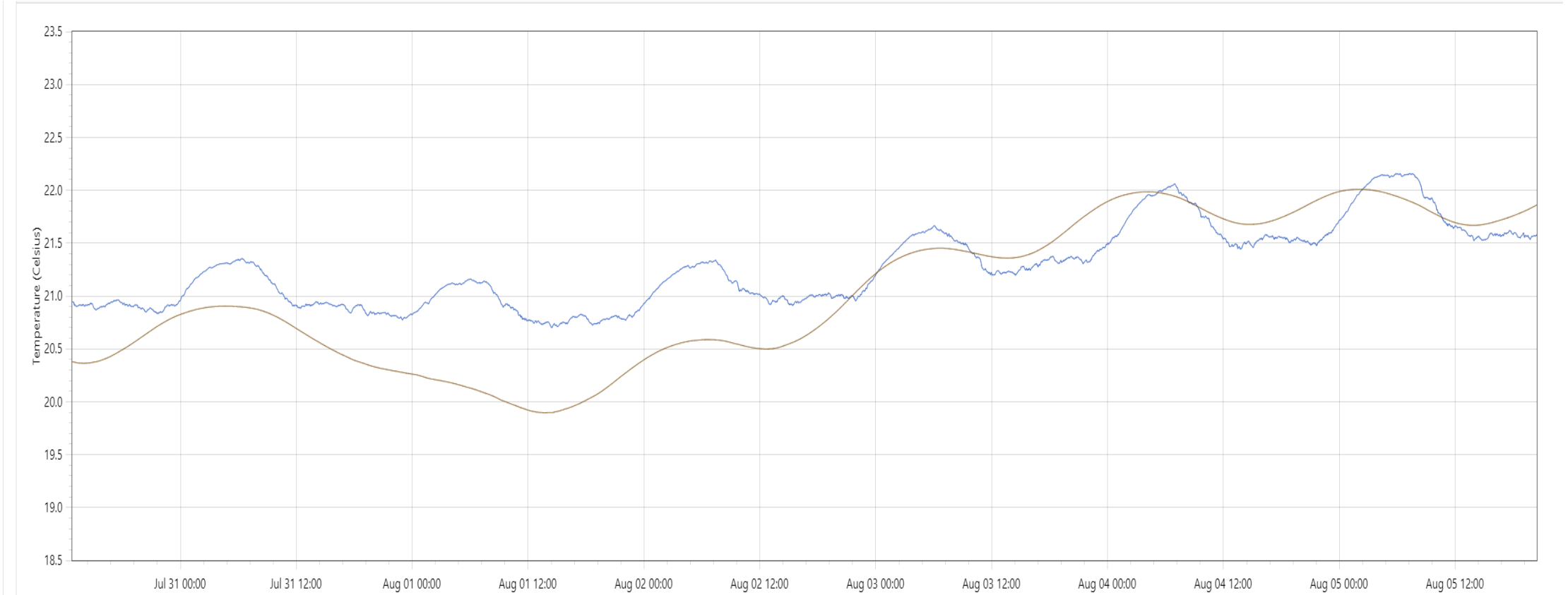
Temperature examples – Large leak



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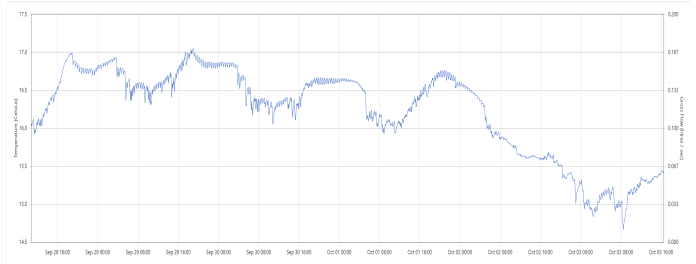
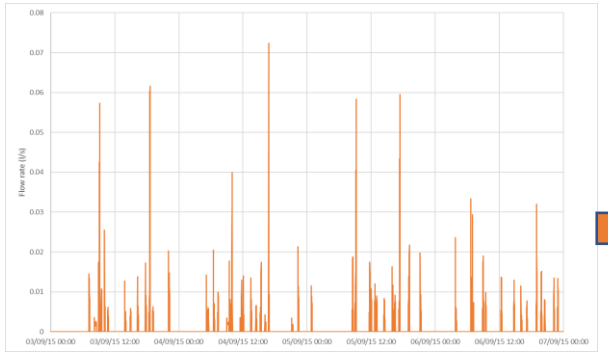
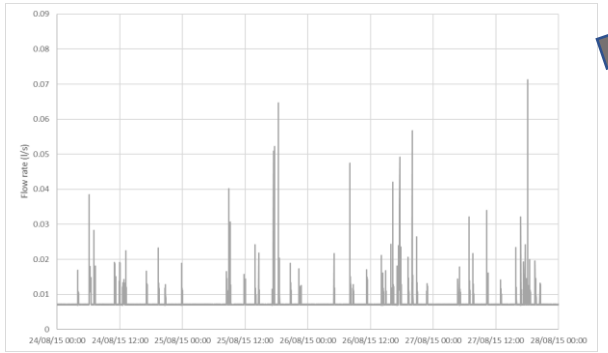
Cartref: Adding the data up - from temperature to DMA flow

STOP TAP TEMPERATURE

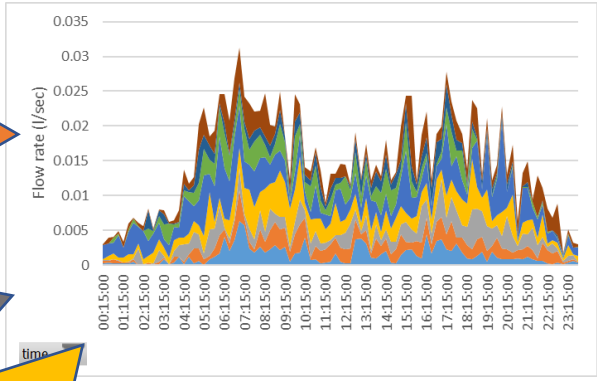


FLOWS THROUGH EACH STOP TAP





DIURNAL FLOW FOR ALL PROPERTIES IN A DMA



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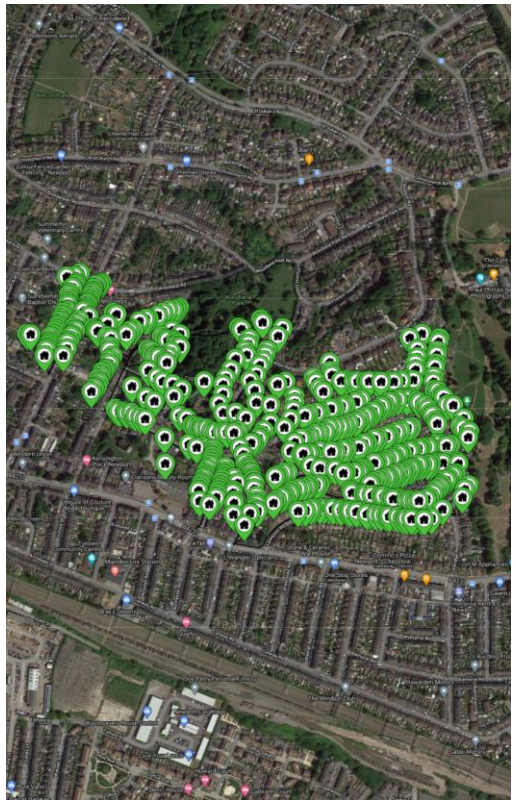
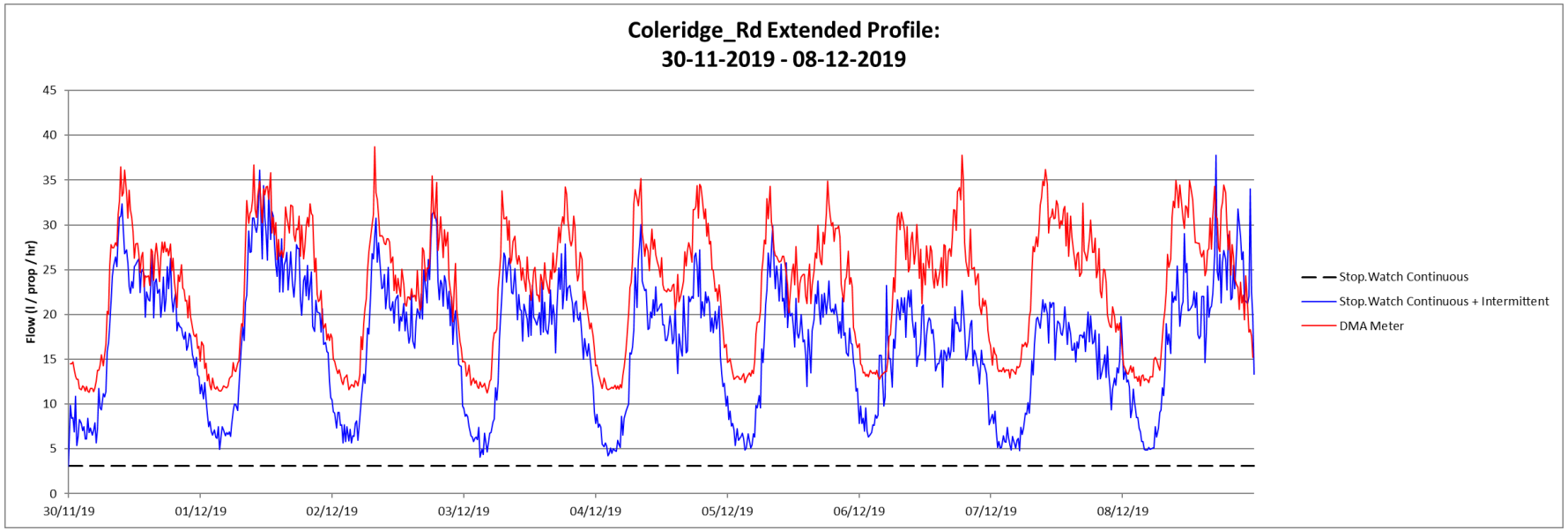
Example DMA – Coleridge Rd Stop.Watch vs DMA meter





Category	Flow rate	Number
Large Leak	215 l/hr	4
Medium Leak	25 l/hr	5
Small Leak	5 l/hr	15
High Users	>550 l/day	12

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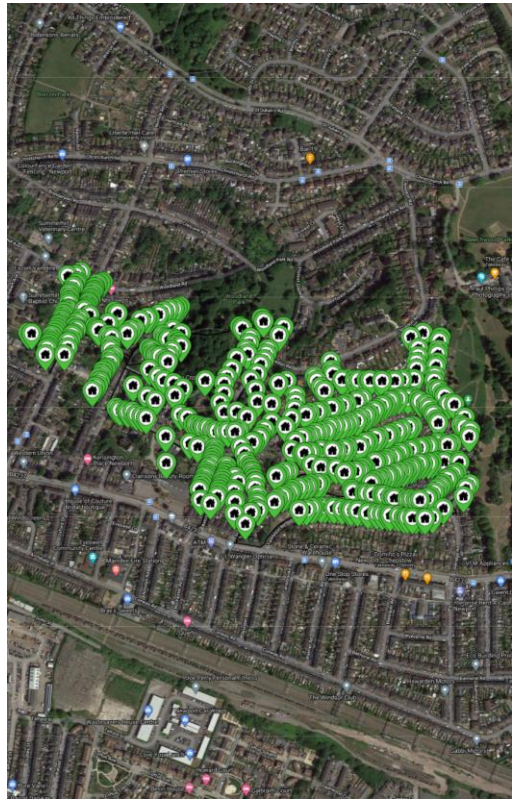
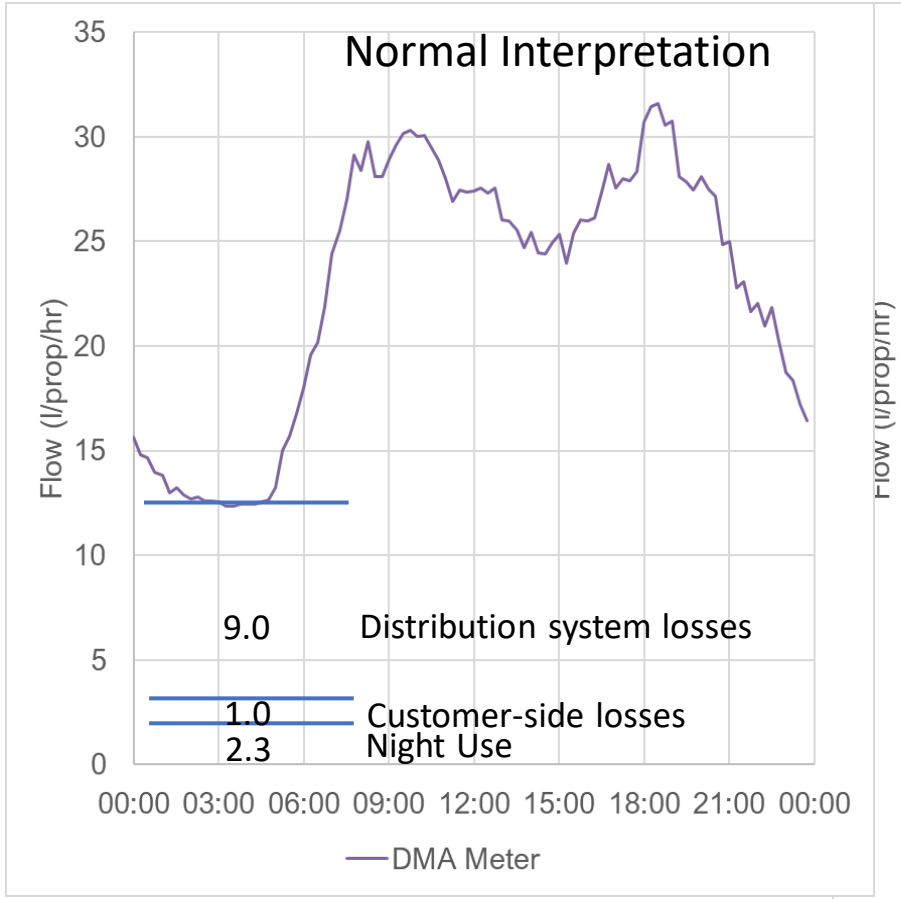
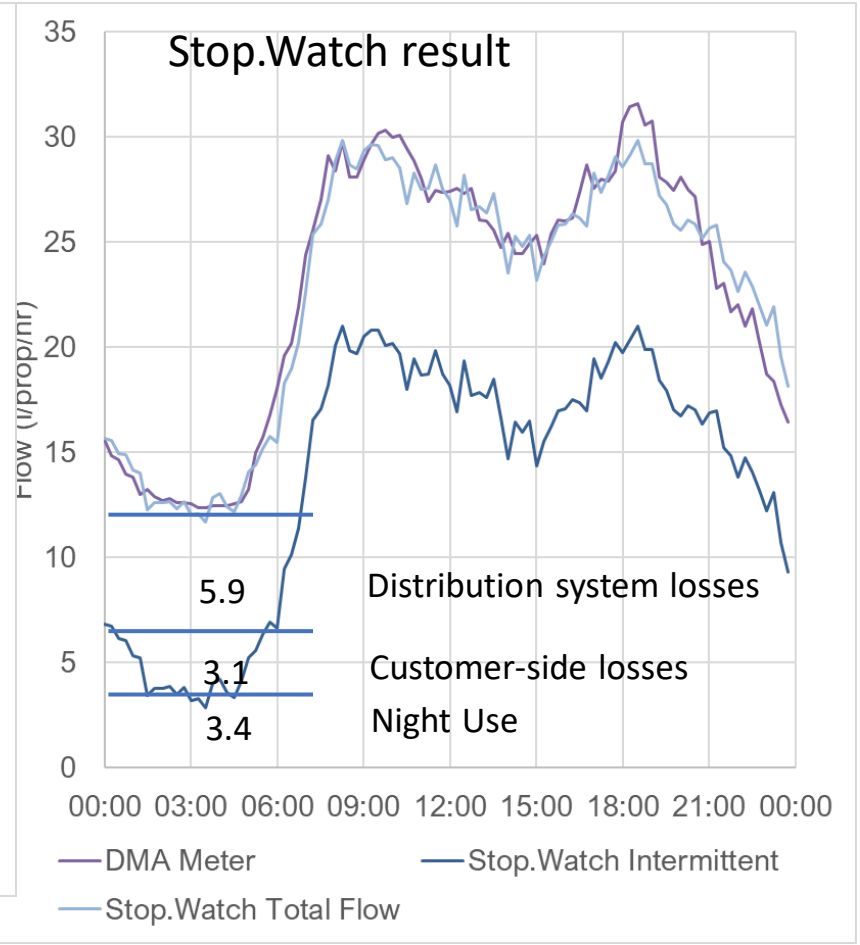
Example DMA – Coleridge Rd- Diurnal pattern







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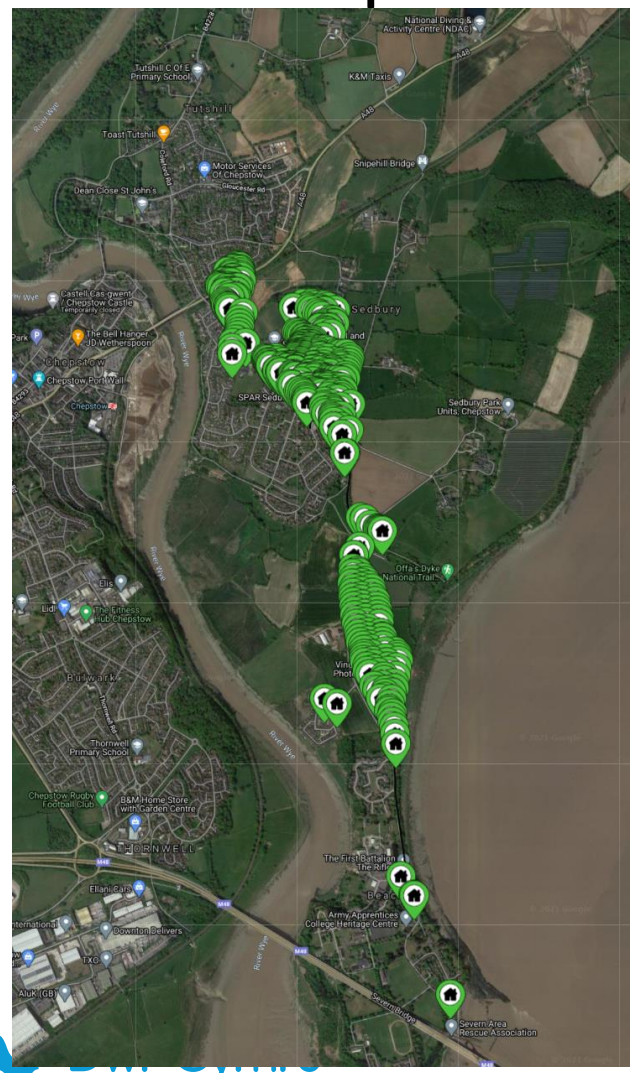
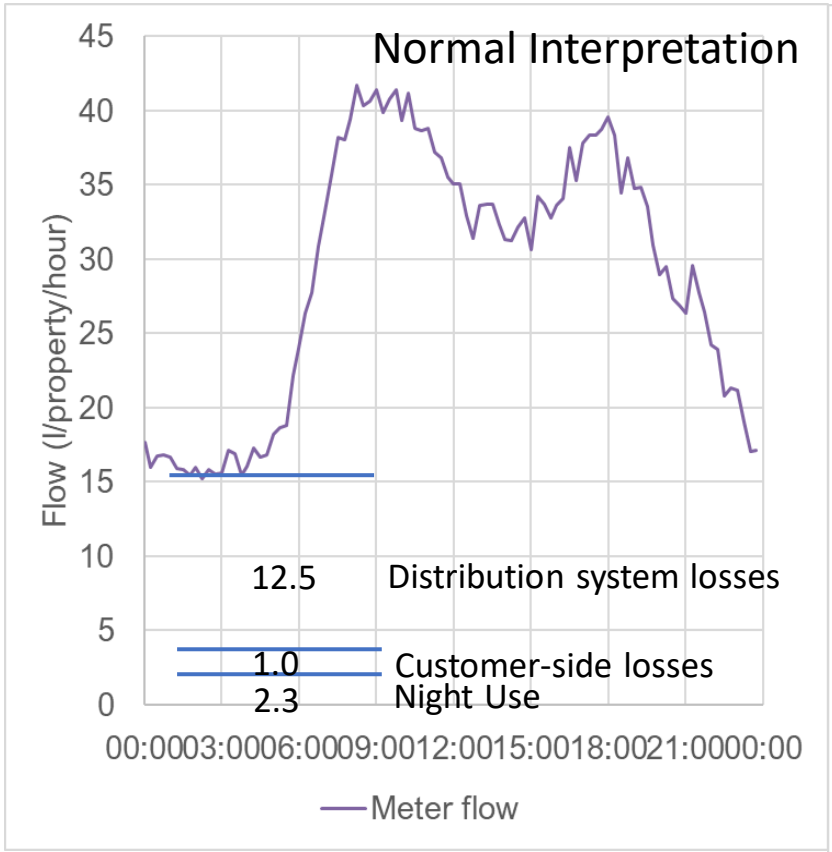
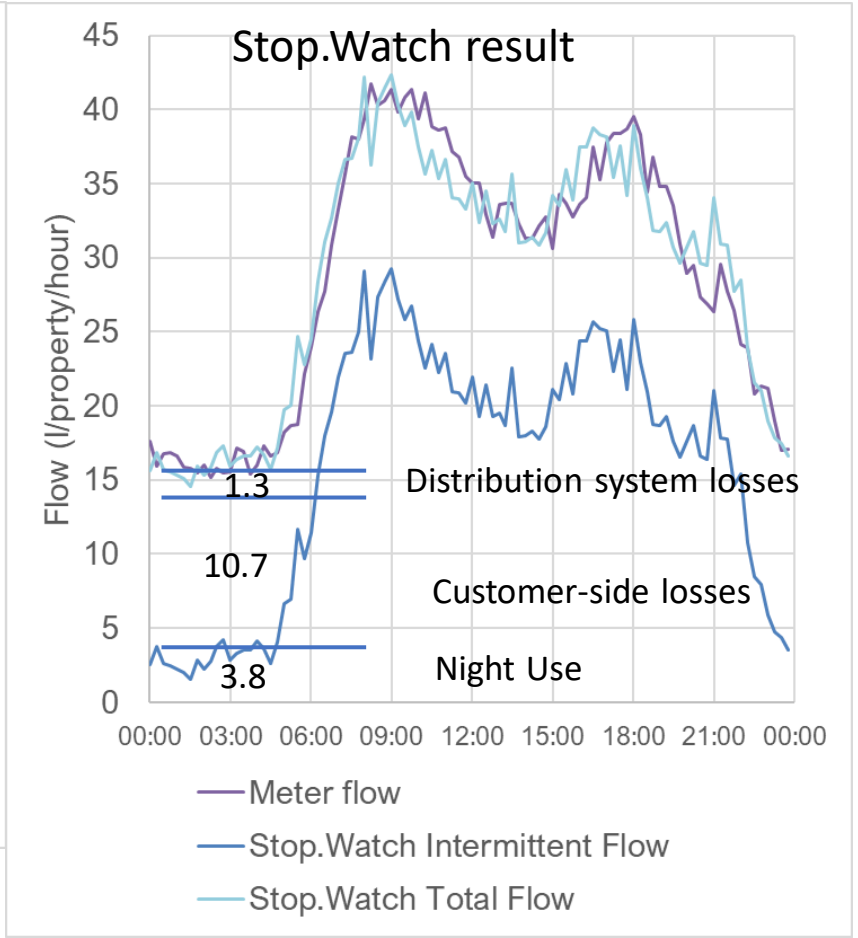
Example DMA – Sedbury







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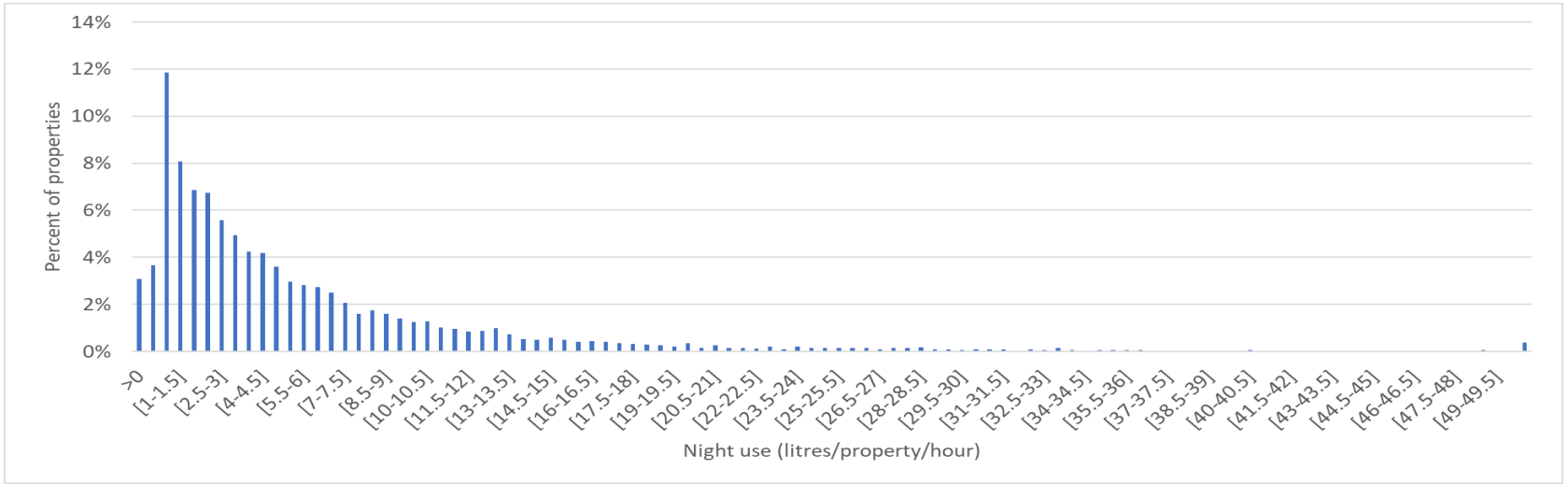
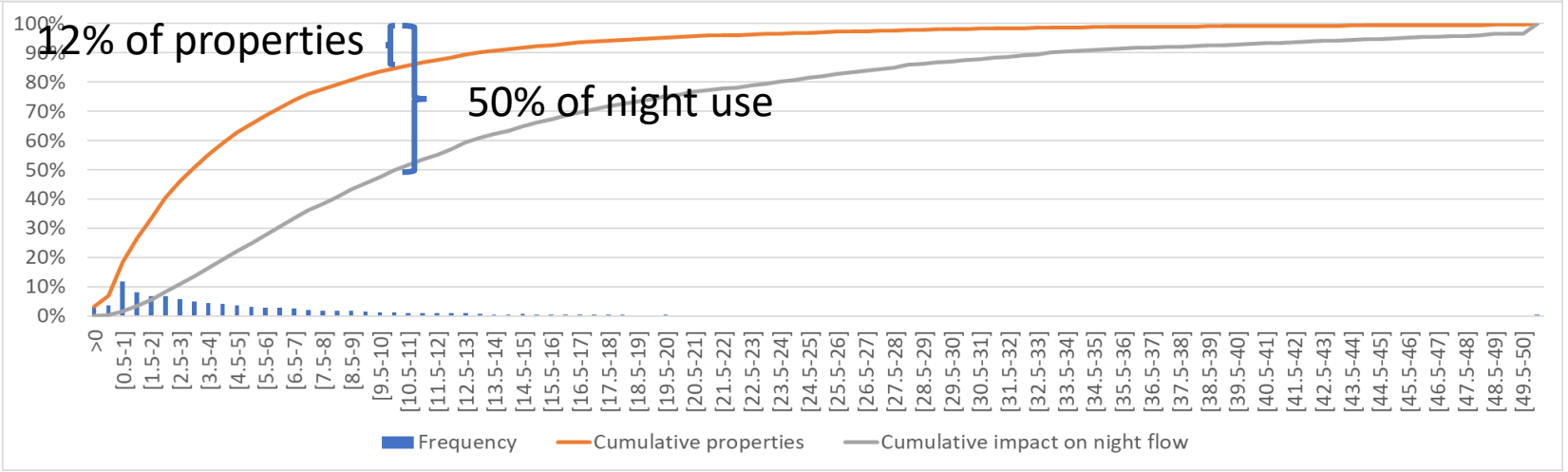
Distribution of household night use by property from Stop.Watch data.





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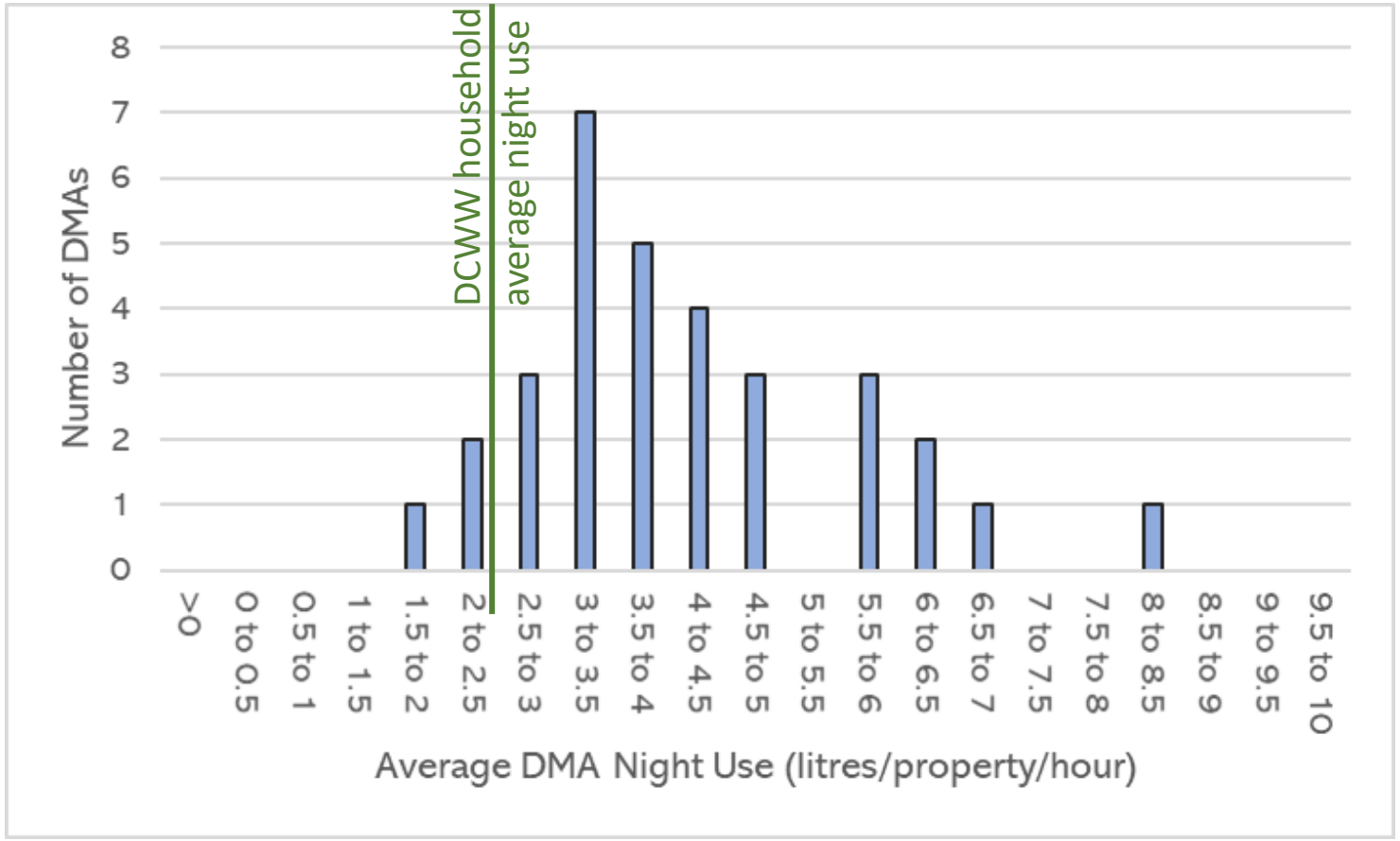
Average household night use distribution in high night flow DMAs



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Headline results from Cartref

- 27,000 properties surveyed through the process in 20/21, 200,000 properties planned for AMP7
- 61 DMAs/LCAs surveyed
- Most high night flow DMAs had higher night use than DCWW average. So night-flow leakage is over-estimated in most cases.
- Customer side losses are often the majority of the leakage
- 5% of properties have USPL or PL that was not detected by acoustic survey but could be detected by Stop.Watch survey – Stop.Watch can detect silent leaks.
- 8.7% of unmeasured properties have PHC twice the average – target for water efficiency
- On course to deliver 25% of DCWW's leakage and demand reduction AMP7 target

Thank you

Steve Tooms – Director, Invenio Systems

Chris Rees – Leakage Strategy Manager, Dwr Cymru

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artesia

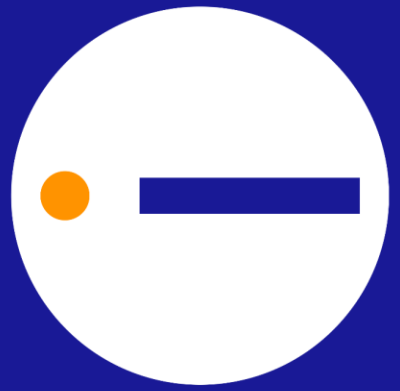
Affinity Water

21st Annual leakage conference

COVID-19:What insights are there for how we manage the water network in the future?

9th February 2021

Dene Marshallsay, Director – Artesia
Eldos Then, Asset Manager – Affinity Water



Introduction to Affinity Water and Artesia

Affinity Water is committed to delivering a high-quality water service to all of our customers.

We provide 900 million litres of water each day to a population of more than 3.6 million people in parts of Bedfordshire, Berkshire, Buckinghamshire, Essex, Hertfordshire, Surrey, the London Boroughs of Harrow and Hillingdon and parts of the London Boroughs of Barnet, Brent, Ealing and Enfield.

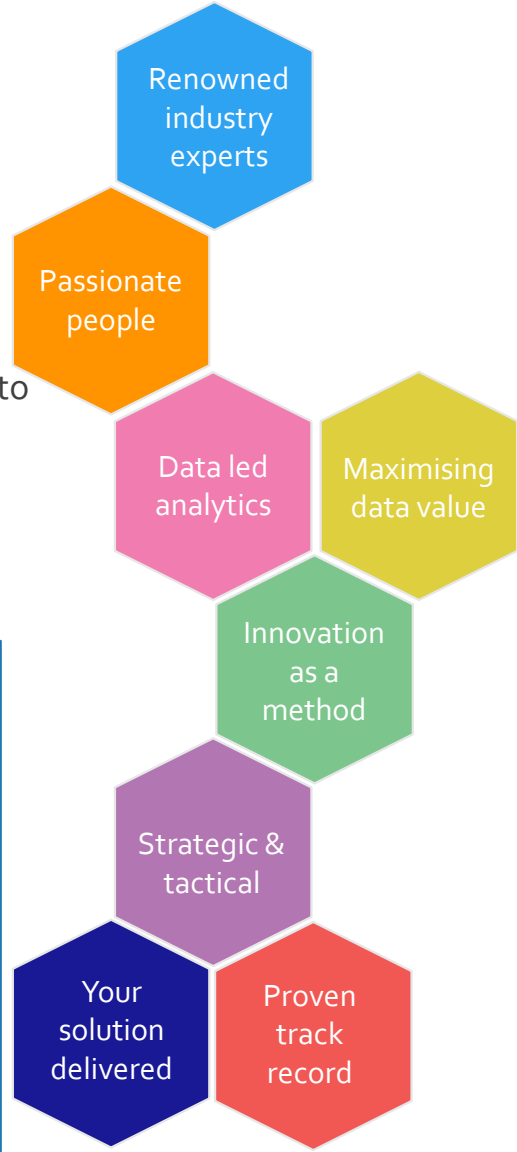
We also supply water to the Tendring peninsula in Essex and the Folkestone and Dover areas of Kent.

Artesia is a dynamic and forward-thinking consultancy based around data science serving the water sector since 2008.

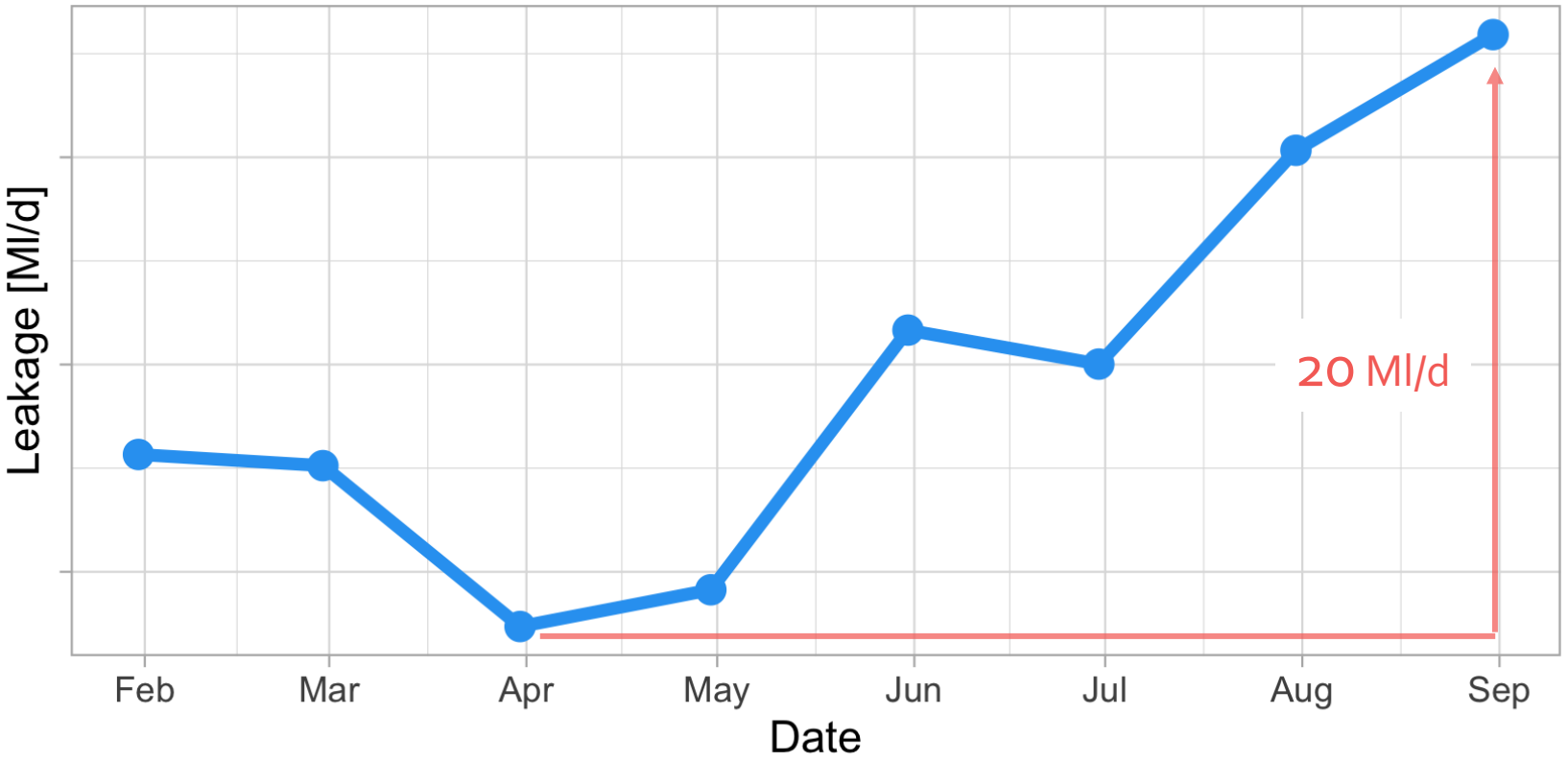
We use a combination of our extensive industry knowledge and data science skills to develop leading edge solutions for leakage management, water resources planning, water conservation, demand forecasting, network and asset management.

Currently doing a collaborative project on the impact of COVID-19 on water consumption

- A collaborative study between 15 water companies (including the EA)
- A deep dive into the data and evidence from the pandemic
- Understanding why water use patterns have changed
- Predicting the future impacts from changes in society



From the start of COVID lockdown to September leakage apparently increased



Having reduced leakage through to the end of March 2020, we saw leakage apparently rising through the summer of 2020 during the COVID-19 pandemic

We saw an increase of about 20 Ml/d – but how much of this was due to increases in night use during COVID?

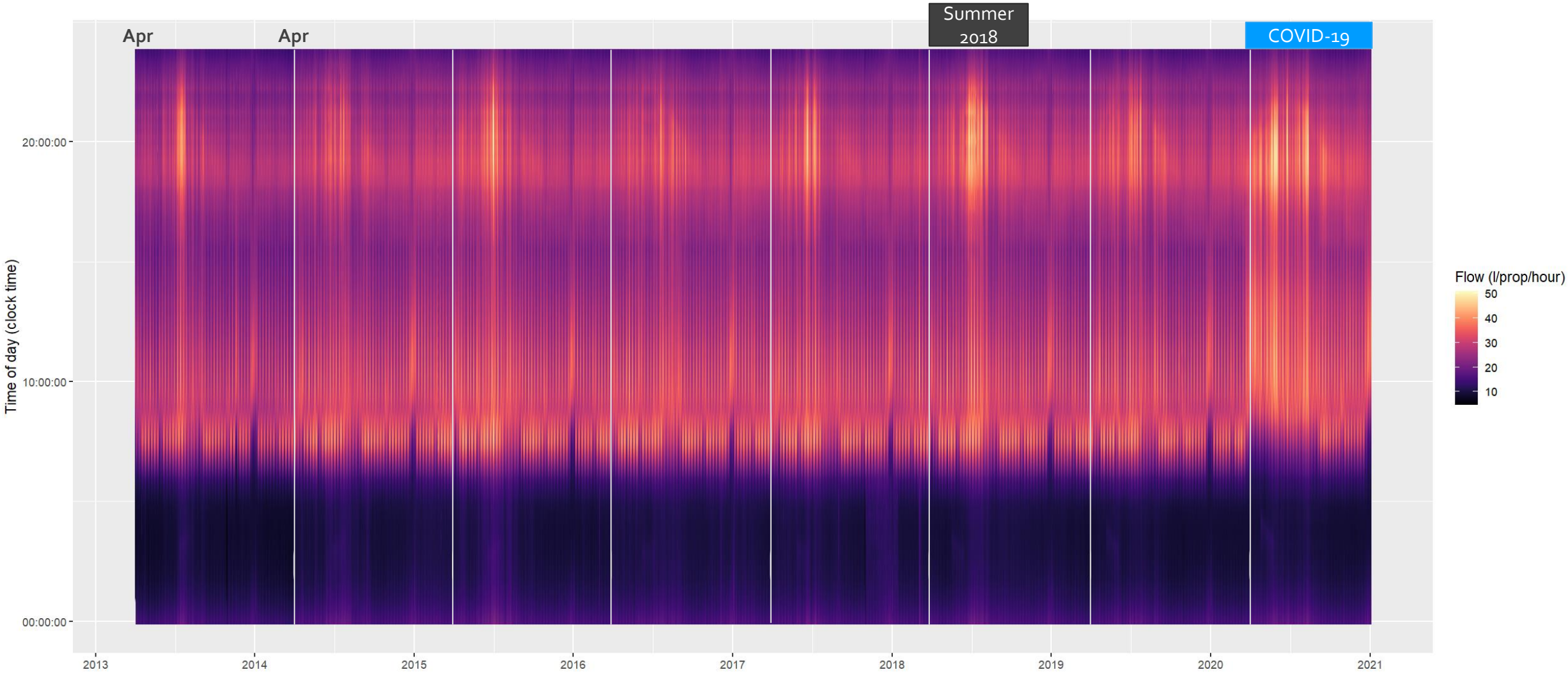
This increase in leakage caused us a number of challenges for day to day leakage management

Difficulty on operational planning since real leakage level is masked by changing behaviour of night use

Challenges to make follow-up plans to bring leakage below the target line

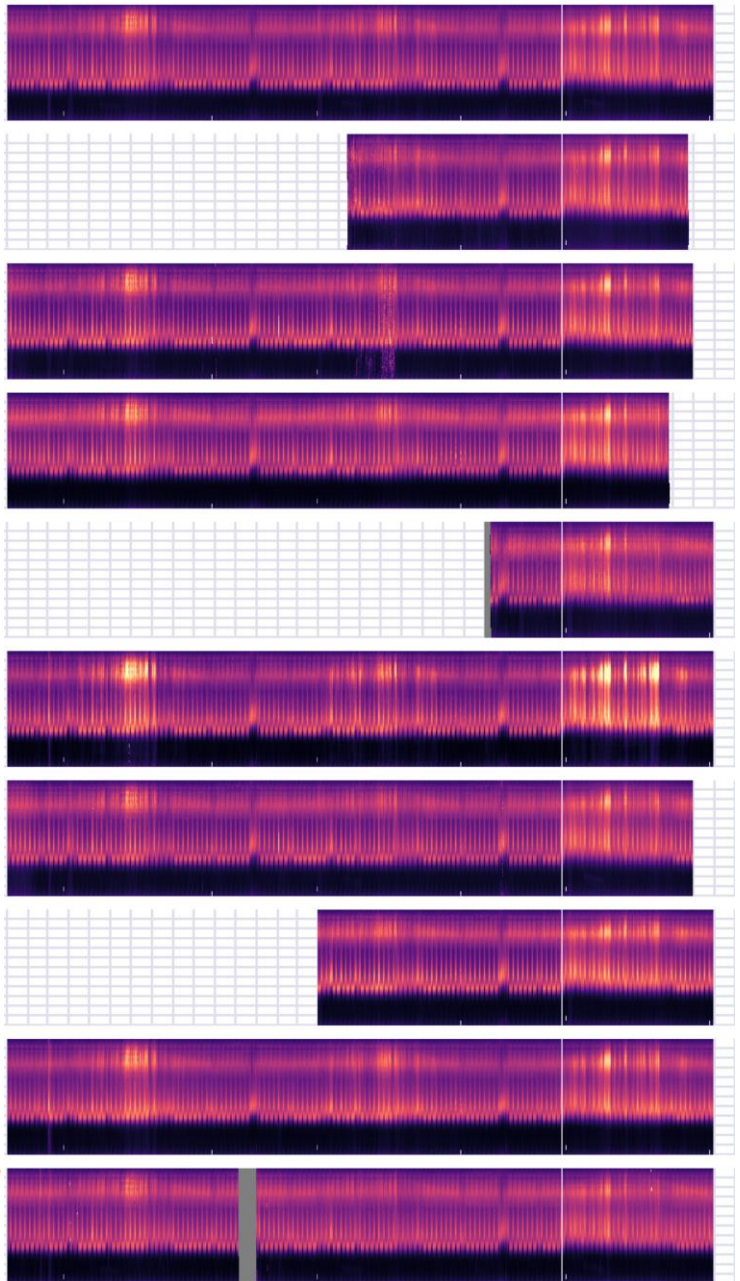
Further complications on closing the water balance due to increased consumption

Network flow patterns show a huge disruption during COVID-19 compared to previous years



When we look at similar plots around the UK the picture is the same

2018 2019 2020



Affinity Water

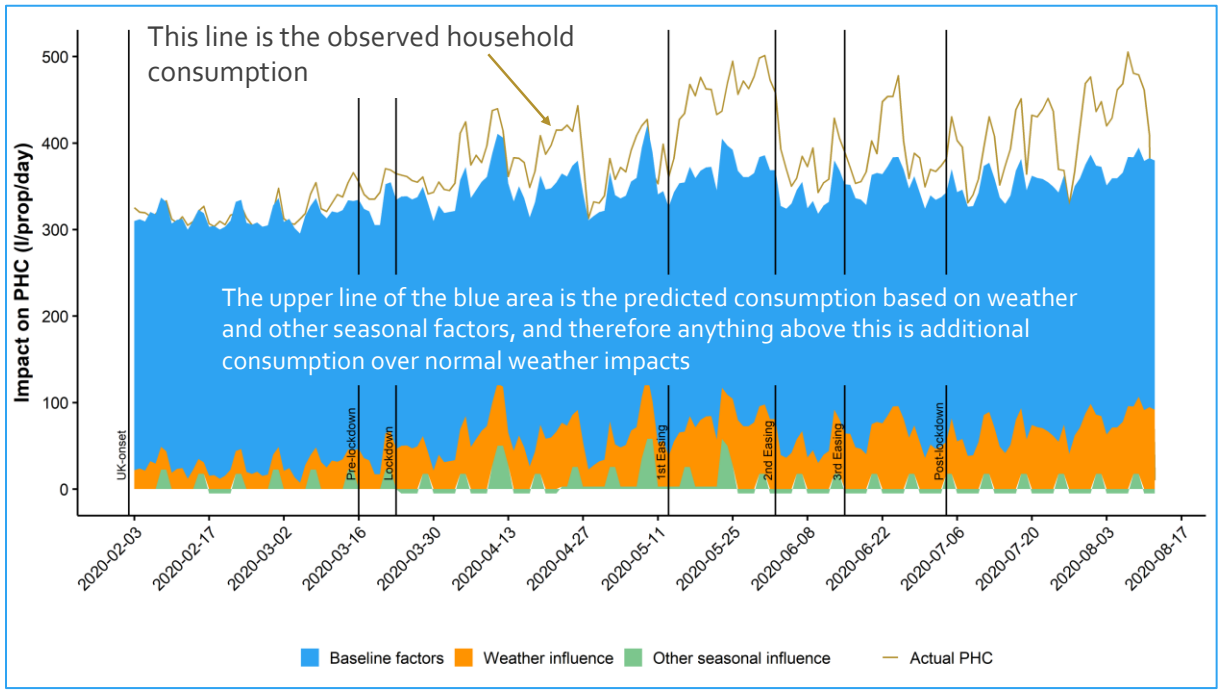
These are groups of single feed DMAs from different companies

The flow scale scale has been normalised to enable us to make comparisons

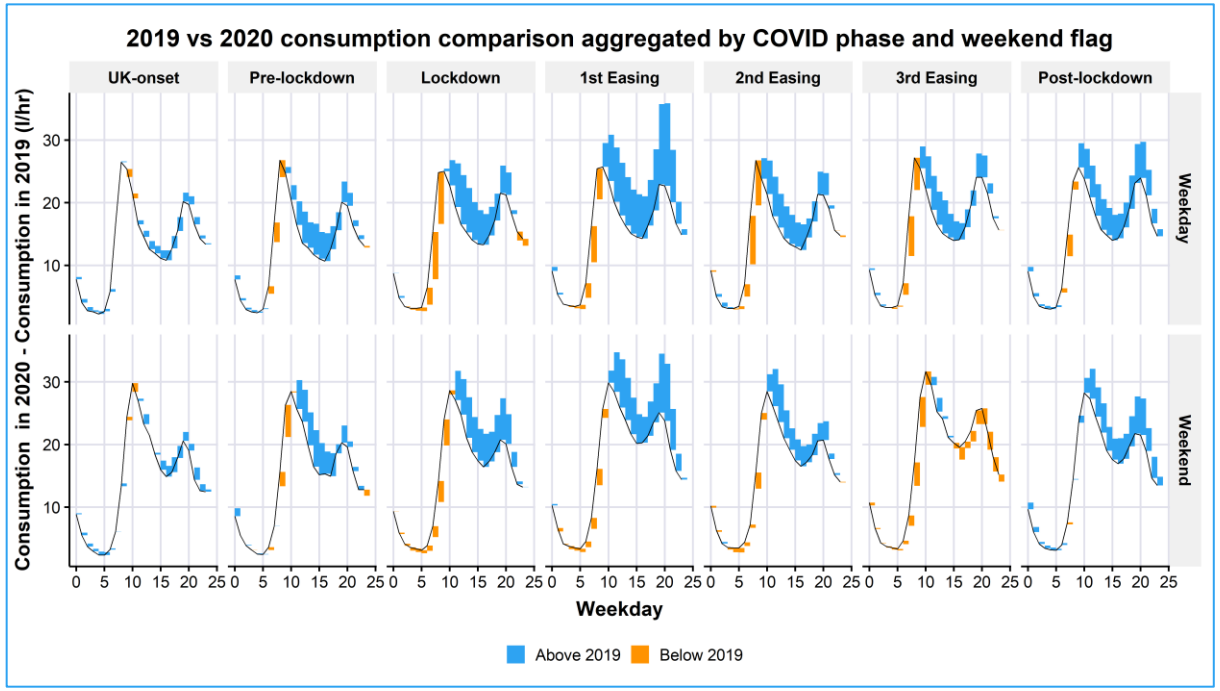
Clearly some companies saw much larger impacts than others

However, all areas see a disruption to the normal patterns of flow

How do we know the changes in household use are due to COVID not simply weather? What's causing of the change in flow patterns?



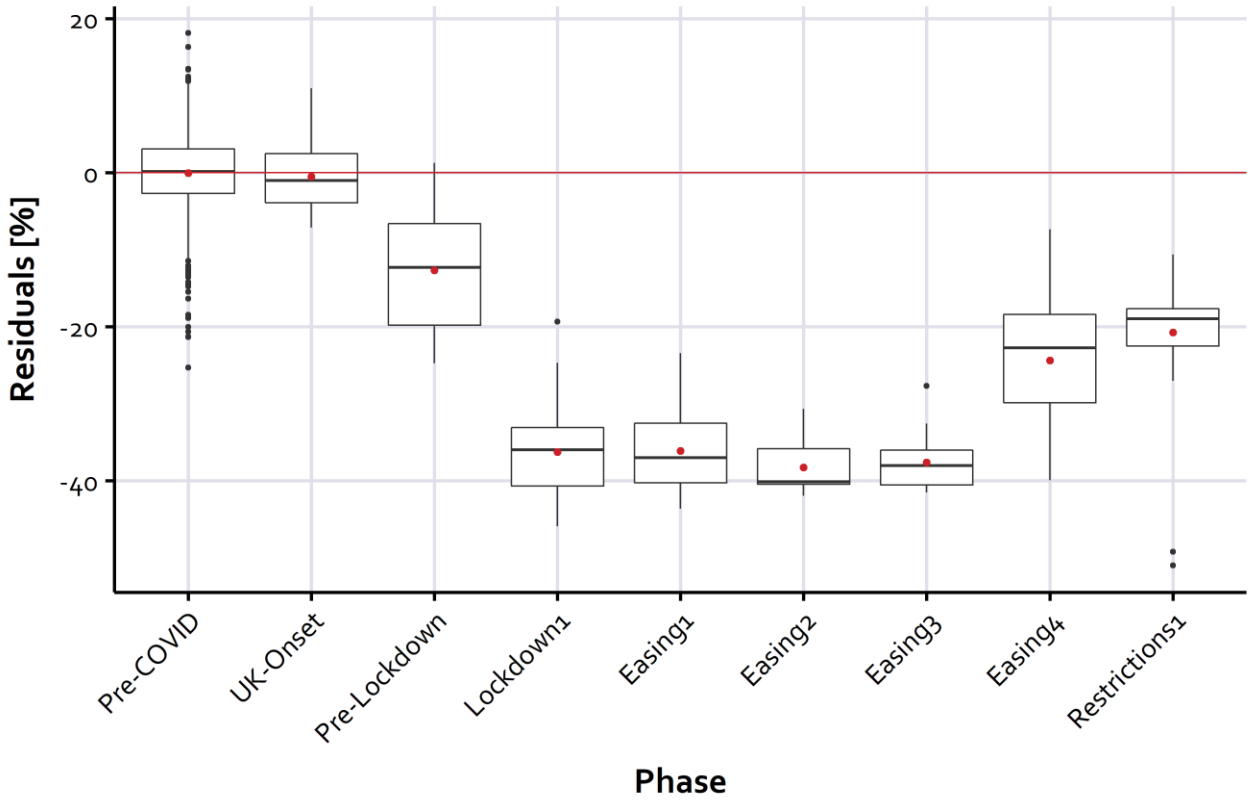
There is an increase in household consumption during 2020 due to changes in the numbers and the amount of time that people are in the home.

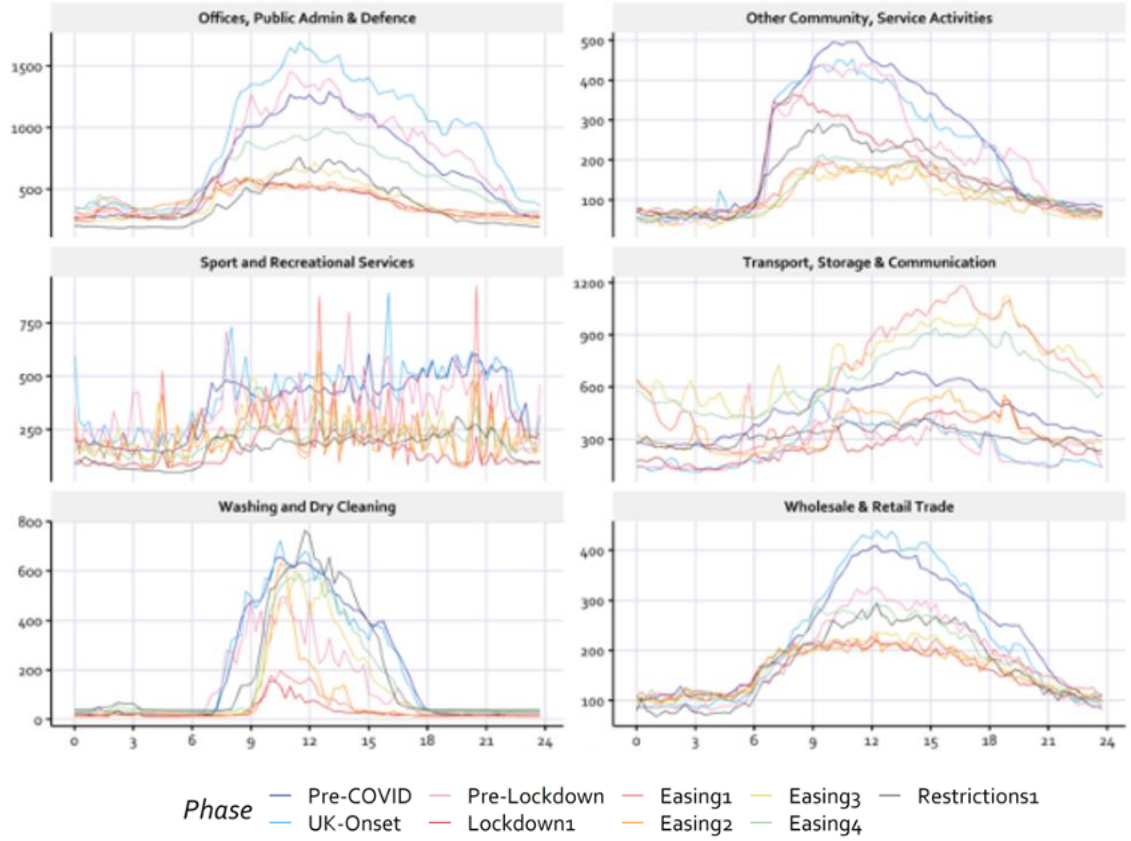


The patterns of water use through the day have changed, due to changes in water use behaviours. This affects internal and external water use.

Overall, we know more water is being used later into the night

How has commercial use changed?

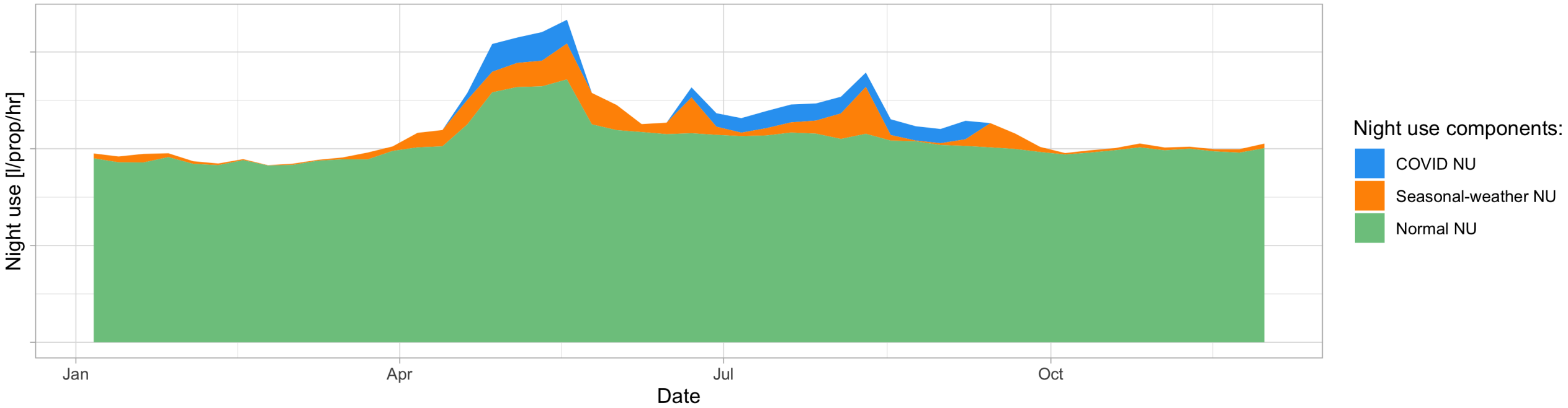




There was a mean ADC decrease of about 38%. Some sectors (Sport and Recreation, and Hotels and Restaurants) saw decreases of around 80% or more.

Some sectors see changes in daily patterns, some see a change in the day use to night use ratio.

Therefore, we worked with Affinity to develop a COVID night use model for their fast-logging night use monitor to identify increases due to COVID-19 and weather



The model shows that there is additional night use arising from the combination of COVID-19 behaviours, some is in conjunction with hot weather.

The modeling has shown that much of the 'apparent' increase in leakage during the COVID-19 period is due to changes in customer night use, rather than leakage.

The impacts from COVID could not have been foreseen, what are the key lessons?

Since the pandemic, the daily patterns of water consumption have changed

During COVID leakage was more difficult to quantify and pressure patterns changed

Daily water use patterns remain uncertain in the short and long term

Future resilience will require more efficient use of data and quicker reaction times to change

Sub-daily household & non-household data helped us understand how & why network flows had changed

Increased visibility & modelling of network data will improve future leakage and pressure management

Anglian Water

Jamie Worthington

Planned Works and Asset Health Manager

James Hargrave

Regional Operational Leakage Manager

WINNER Utility Week AWARDS 2018 Utility of the Year

RESPONSIBLE BUSINESS OF THE YEAR 2017 BUSINESS IN THE COMMUNITY

THE QUEEN'S AWARDS FOR ENTERPRISE: SUSTAINABLE DEVELOPMENT 2015

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Creating a “Practical Twin”

The symbiosis of technology and technique

Overview

Today we will be talking about:

- Our vision for a system that manages societal and system demands and process
- The concept of a practical twin and the symbiosis of detection – repair – maintenance
- An example of the practical twin when used with our advanced leakage sensors
- An example of how these processes are programmed seamlessly.

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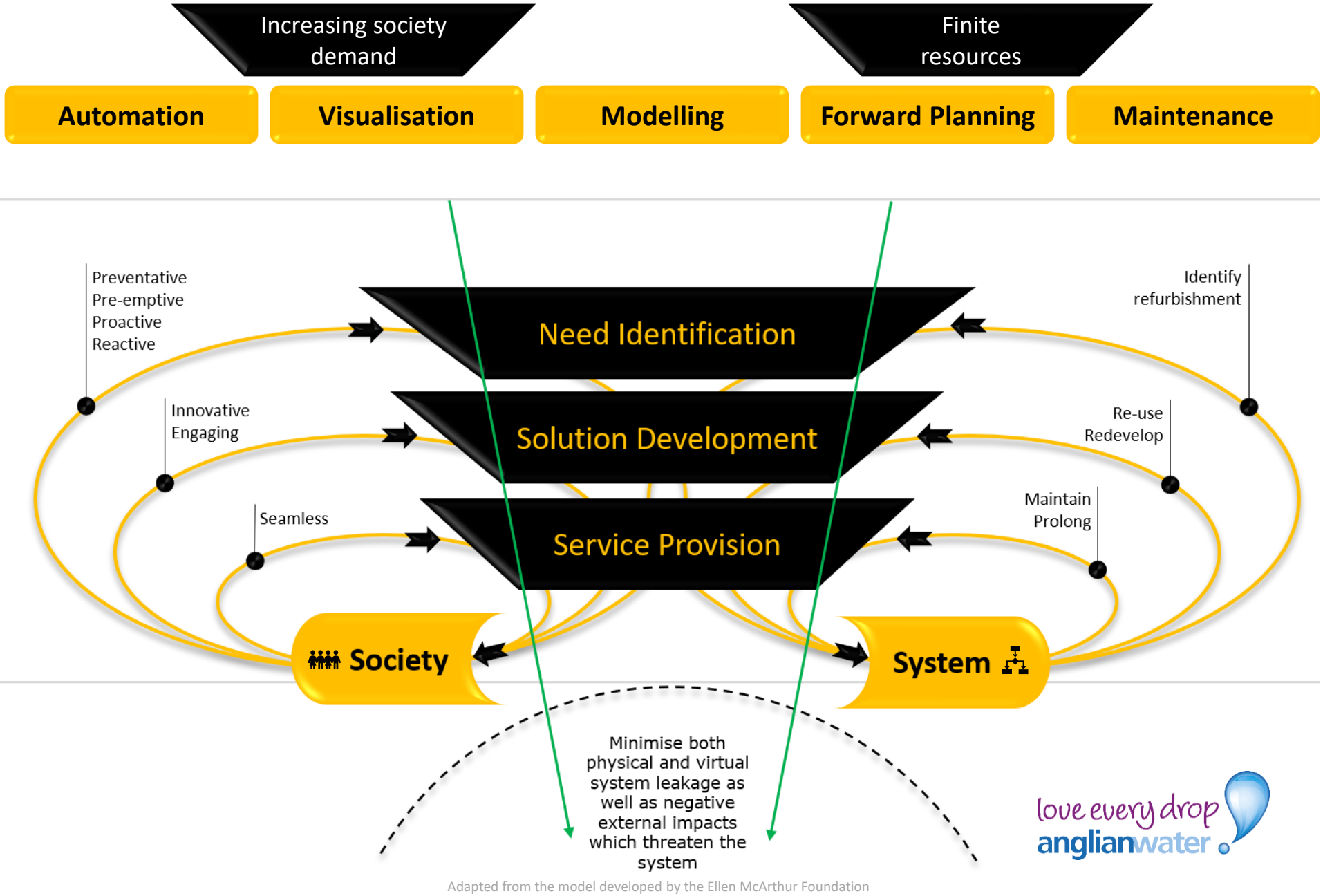
Vision for the system

Principle 1:
Preserve and Enhance natural and financial efficiency by improving the control of finite resources and improving the operating model/processes.

Principle 2:
Optimise service and resource utilisation through re-calibration of delivery emphasis.
Across technical, resource, operation and innovation cycles look to maximise the benefits of prediction, prevention and proactive response to reduce waste, maintain supply and ensure seamless delivery.

Principle 3:
Foster system effectiveness by revealing and designing out negative external impacts and system leakage.



Adapted from the model developed by the Ellen McArthur Foundation

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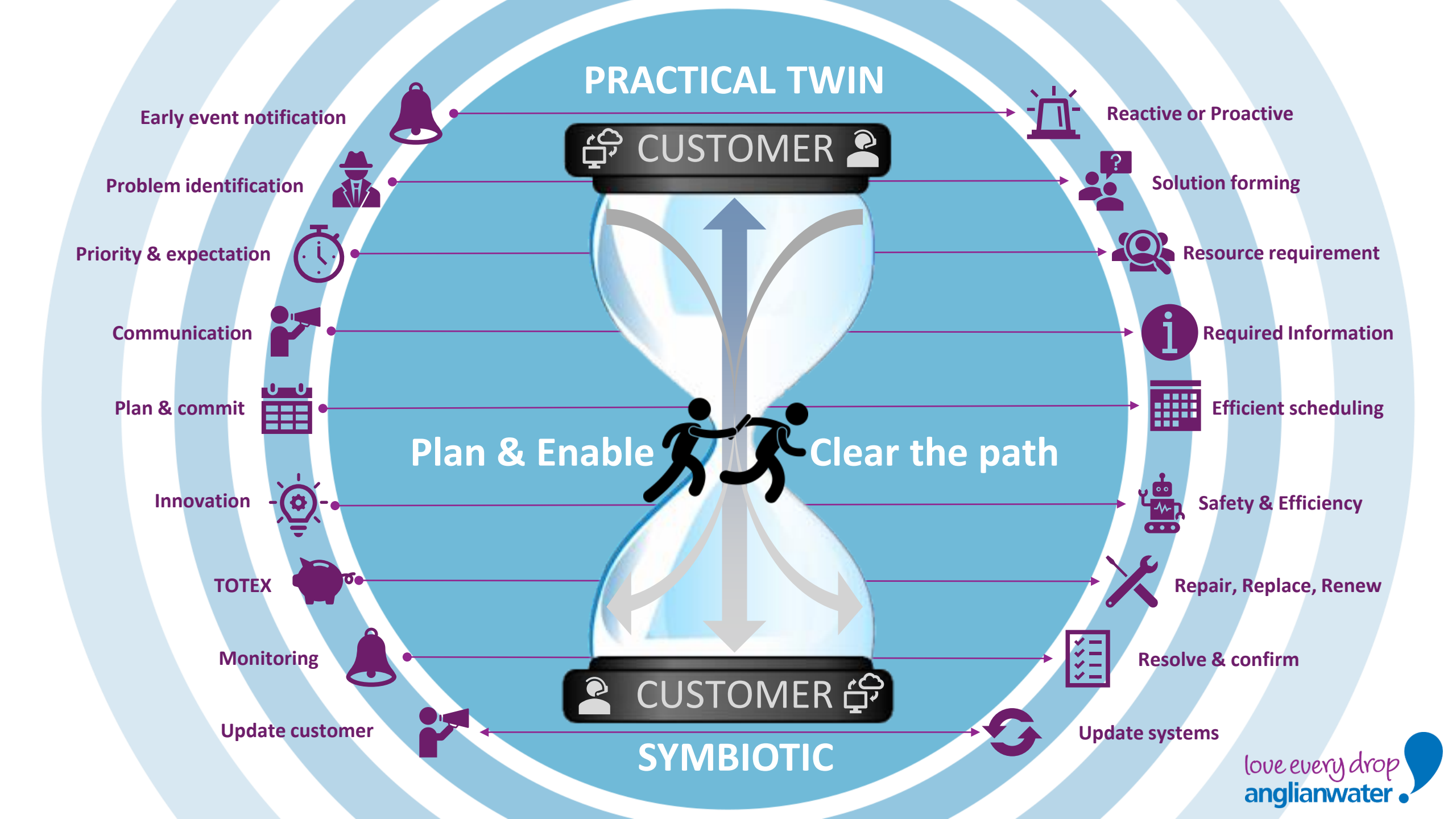

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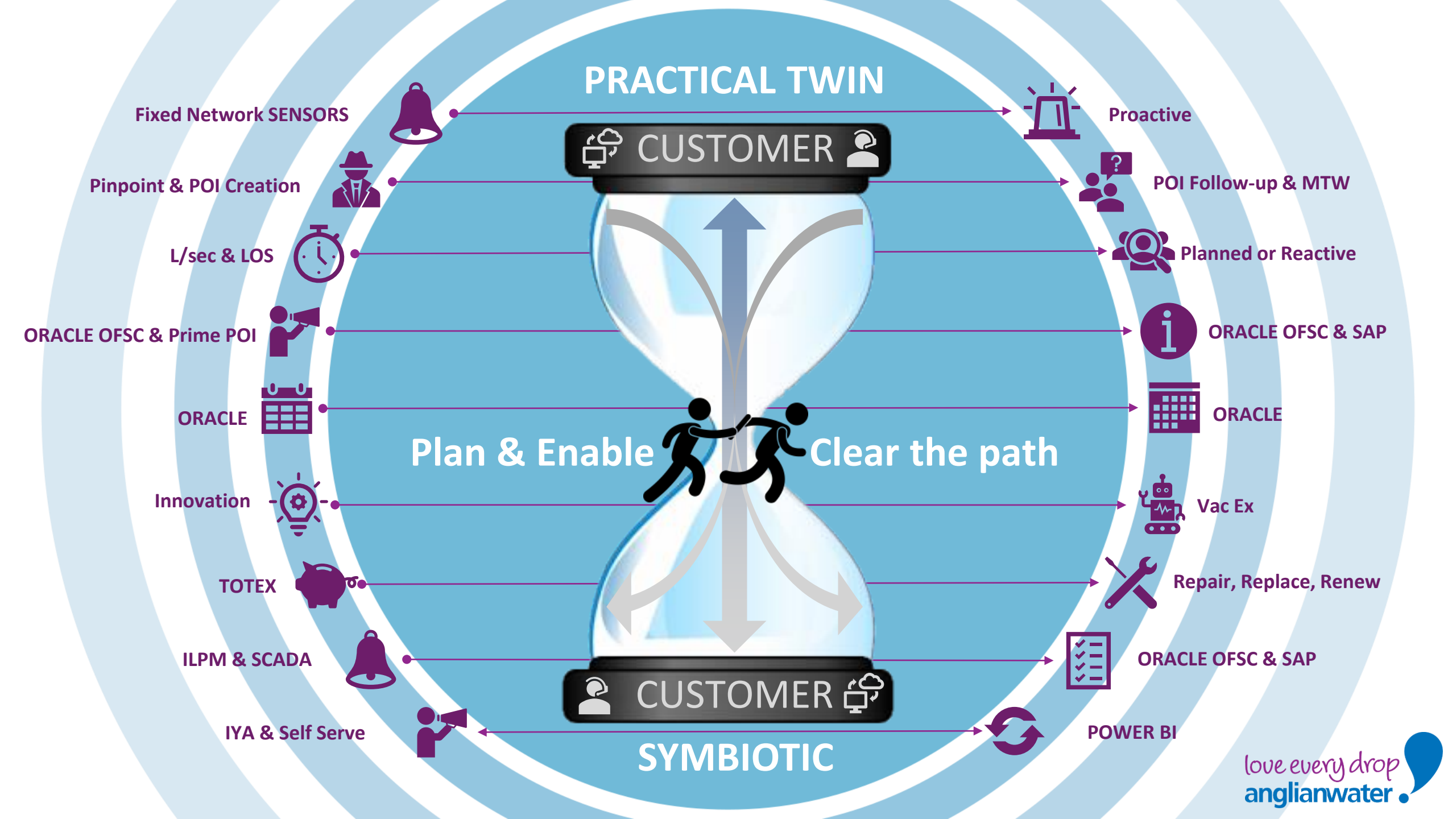

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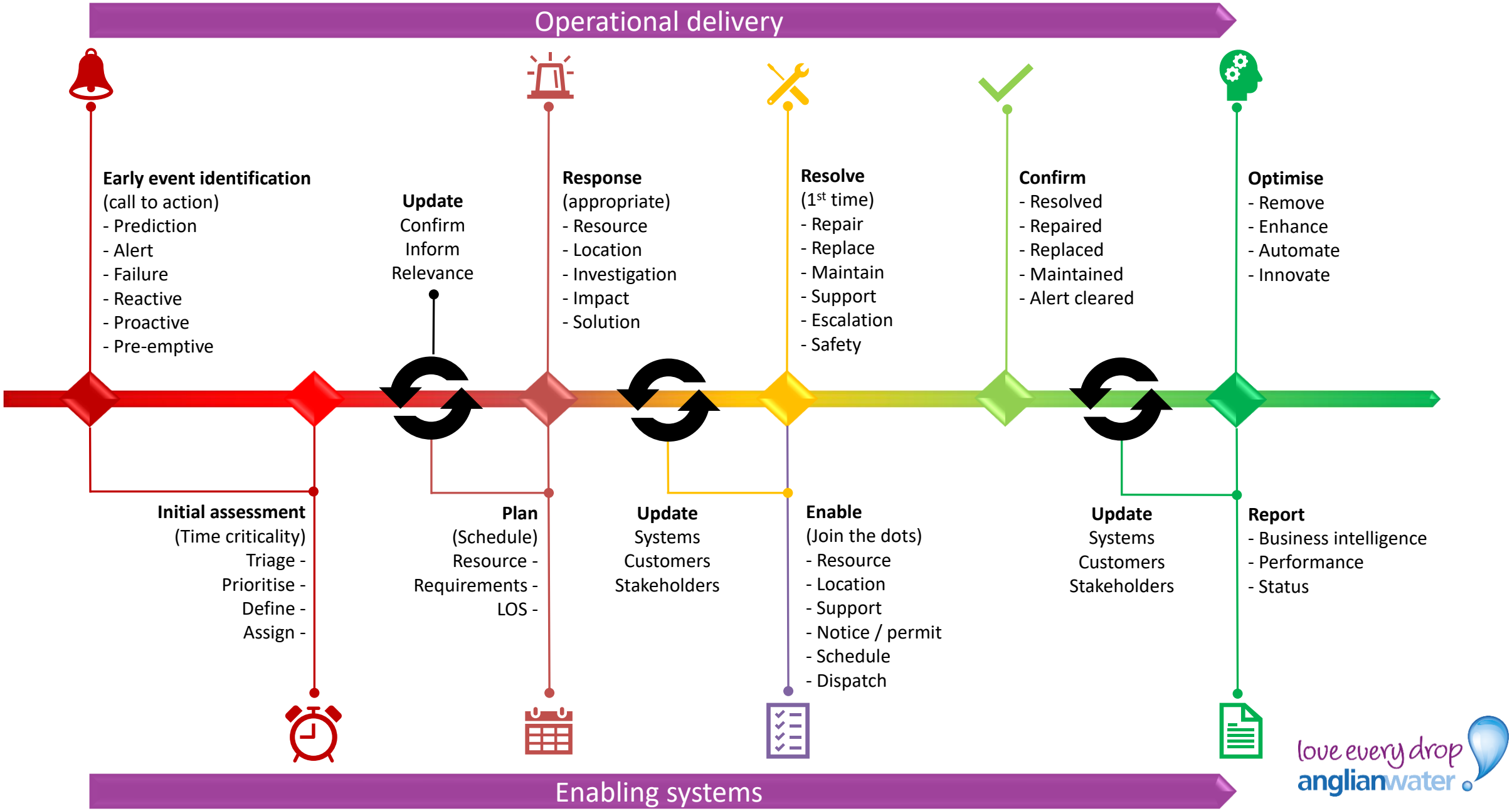

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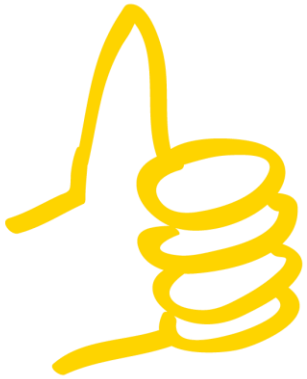
Thank you for listening



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Any questions?

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