

## 4.2 Leakage and Pressure Management

March 2023



# CONTENTS

SECTION	TITLE	PAGE
1	AMP 7 Leakage Activity	3
2	Leakage & Water Loss Activity - Roadford	15

# 1 AMP7 LEAKAGE ACTIVITY – PRE-DROUGHT (2021/22)

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## Background

Leakage is monitored and reported by South West Water in terms of operational areas. There are seven areas, six in the South West and one in Bournemouth (A7). Areas 1 & 2 are the operational areas within the Colliford Water Resource Zone ("WRZ") with the Roadford WRZ being predominantly Area 6\*, with incursions into Area 2 (Launceston) and Area 5 (Exeter).

**Figure 1 – Operational Area 1**

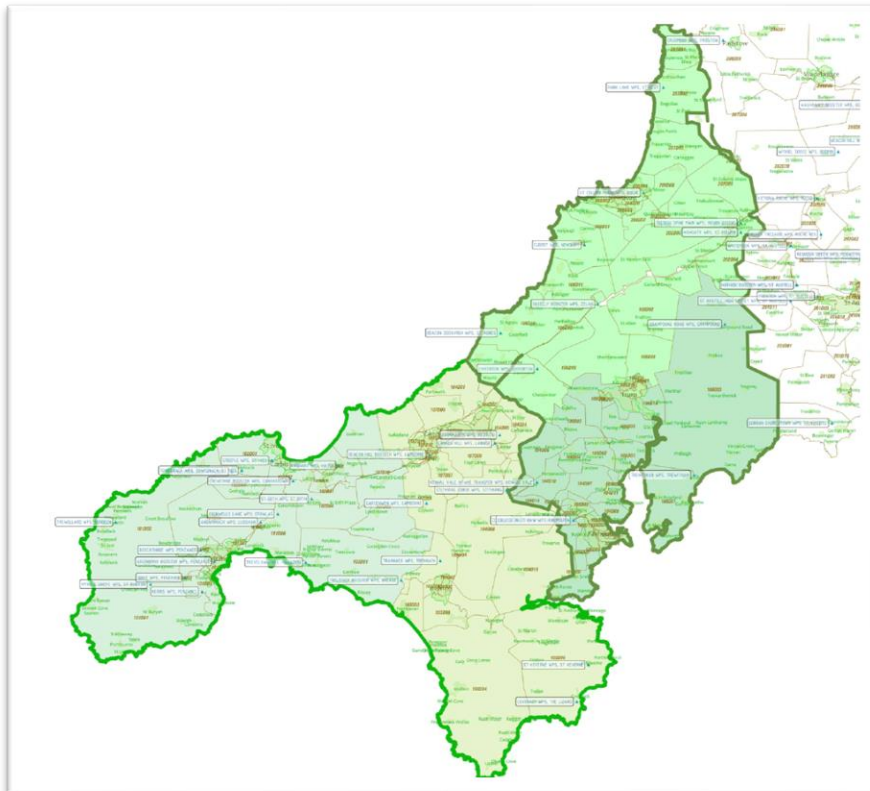


Figure 2 – Operational Area 2

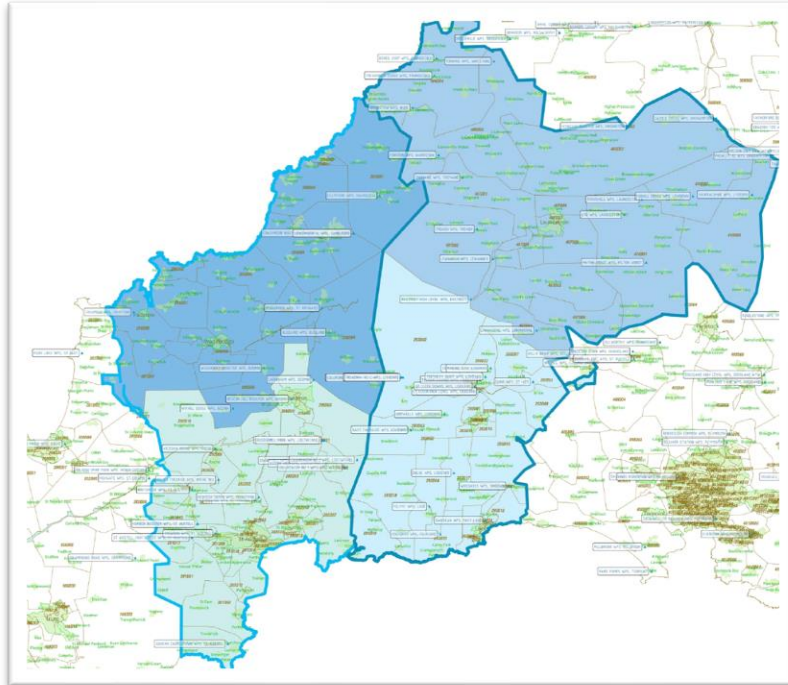
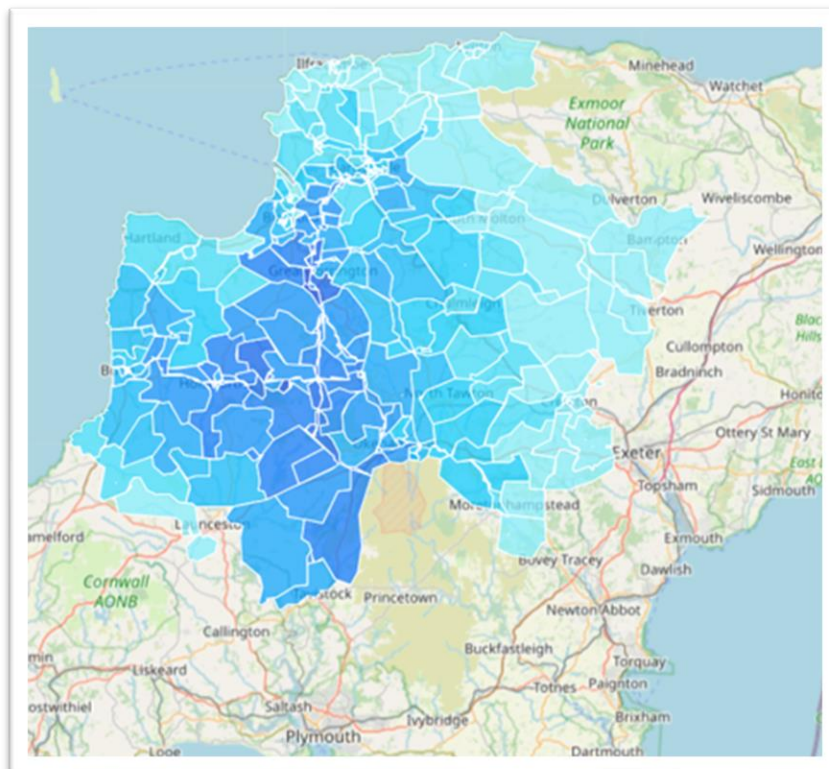


Figure 3 – Operational Area 6\*



### 1.1 Leakage position 2021/22 - pre drought year

South West Water achieved its best ever reported, in-year, leakage performance in 2021/2022, 90.6 Mld. This ensured the three-year rolling target was met, following a deviation from target in the year 2020/21, and aligning performance to the AMP's overall reduction target of 15%. 2021/22 performance improvements were developed through implementing industry best practice, which resulted in the establishment of an in-year leakage recovery plan (Distribution Input Recovery Plan) with enhanced governance and controls including:

- Operational and investment plan to reduce leakage levels
- Pressure management activities
- Increase detection staff / new processes and technology to increase number of leaks found
- Increased leak repair resource to reduce leak repair work basket
- Customer side leakage enhanced processes
- Increased telemetry, data review and analysis
- New /enhanced leakage management and estimation software platforms
- Alignment of leakage operational and reporting teams
- Weekly working group meetings
- PMO approach using project management tool for governance, monitoring, recording of activities within plan
- Commissioning of external reviews by industry experts
- Increasing / improving our coverage of properties within consumption monitors – enhancing individual monitors and expansion of Small Area Monitors (SAM's)
- Review of all reporting inputs, factors and allowances to ensure that demand (consumption) and leakage are reported more accurately.

The activities above focused on operational improvements, network leakage reductions and leakage reporting enhancements, and have delivered significant reductions in leakage with target achievement reported for 2021/22 in-year and 3-year average leakage levels. Continuation of our leakage reduction plans are expected to achieve the targets for the remainder of the AMP7.

The workstreams resulted in a change to reported leakage from an in-year position of 136 Mld 2020/21 to 91 Mld in 2021/22. The reduction leakage can be summarised by the leakage reduction plan workstreams as follows in subsections 1.2 to 1.6 below:

### 1.2 Leak Detection and repair – 20 Mld – 2021/22

Leakage detection and repair in the year 2021/22 was centred providing fast-track leakage reduction with minimal lead times. Significant additional funding was approved and allocated for the delivery of the leakage reduction plan.

An enhanced leadership framework was established:

- 12 new staff were recruited into these teams in leadership roles
- 35 additional partner / contractor roles were created for leak detection
- 24 extra two-man repair crews were employed (again via our partner contractors) to fix the additional leaks identified and reduce the overall leakage workbasket. Additionally, a further 5 support drivers and 4 supervisors were engaged to support the increased number of repair crews
- The additional crews and support staff were brought in from further afield (some from the North-west) meaning that South West Water provided accommodation for them throughout their engagement
- Productivity and performance also increased from the use of new equipment and technology and from enhancing our own performance management.

Leakage detection activities by South West Water are delivered via a blend of direct and subcontracted labour. As part of our enhanced leakage plans, South West Water added 35 additional staff via our partner contractors to increase the volume of leak detection activities.

These teams provided leak-noise survey and Point of Interest ("**POI**") investigation resource, using digital analysis to provide next day issuing of work for leakage technicians to follow-up and carry-out 'pin-point' detection to promote repair jobs.

The assessed benefit of the additional detection (find) resource is 8 Mld, this being assessed from the increase in numbers of leaks detected.

The additional repair crew resource employed to fix leaks enabled a reduction of the overall leakage work basket from 800 open jobs at any given time (equating to volume of 15 - 20Mld) to less than 200 (5 Mld volume), as a result of the additional partner resources deployed. Therefore a 10-15 Mld benefit is derived from this activity (used 12 Mld mid-point for this overall assessment).

In addition to increased resource in traditional leak identification and repair, South West Water used the latest satellite detection techniques to improve performance. Utilis satellite imagery analysis utilises advanced algorithmic analysis to track the spectral signature of potable treated water (chlorine residual) in the ground.

More than 3,300 POIs were identified regionally. In many cases multiple leaks were identified at single POIs, leading to a conversion rate of around 50%. This technique was especially effective over our large stock of rural DMA's and trunk mains which often cover very large geographic areas and are difficult and time-consuming to investigate using traditional people-on-the-ground techniques. Traditional acoustic techniques are also challenging in such DMAs with long pipe lengths and few connections or mains fitting off which to monitor for leakage noise.

Dedicated experts were assigned to POI investigations to help promote success from the detailed analysis of the POIs through to sending detection staff in on-the-ground.

### **1.3 Pressure management activities**

South West Water have extensively invested in pressure management and 'network-calming' activities to control excess pressures that lead to more leaks and bursts and higher leakage.

New pressure control systems as well as undertaking maintenance on existing systems have been constructed. A project team comprising internal and dedicated external resourced enabled us to expedite delivery.

We prioritised no-interruption techniques for installation sites, using under-pressure valves and tees at all sites where more than 50 customers would experience a supply interruption of more than three hours. This enabled simpler planning and faster delivery.

A direct communication with our local highways' authorities' team was established for this workstream which again enabled us to minimise process delays and fast-track delivery.

New and optimised pressure control valves were set to reduce pressure throughout the Diurnal period.

A summary of project outputs is included below:

- 61 new pressure reducing valves ("**PRVs**") (with controllers) installed and optimised (plan continues to run with circa 25 new schemes under construction).
- 131 new controller's retro fitted on existing PRVs and optimised.
- 358 existing PRV controllers optimised.
- 240 PRV's serviced.
- 457 data logging projects carried out for pressure management investigations.

The measured output of the whole pressure management workstream amounted to c.6 Mld.

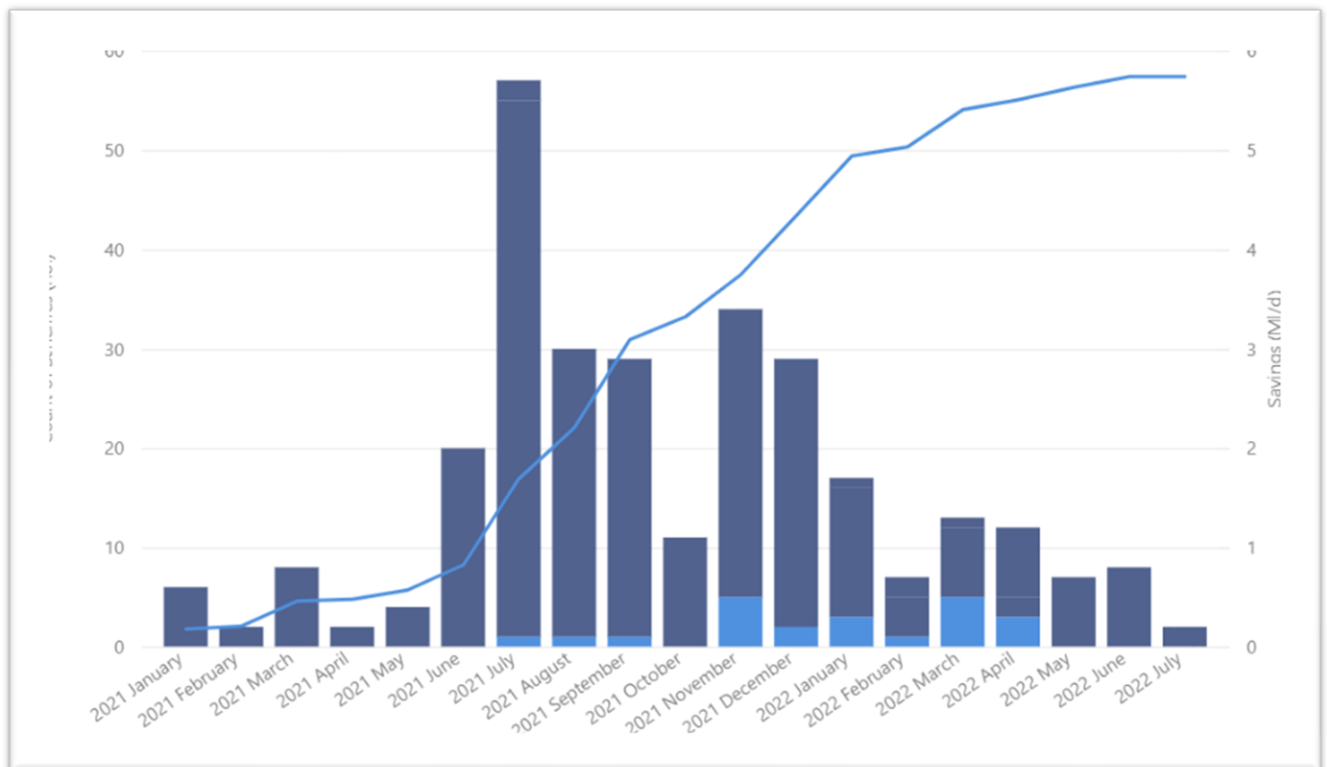
See Figure 3 below showing the relationship between new pressure valves installed and total leakage reduction.

**Figure 3 - Total leakage reduction**

*Blue cumulative Trend line – Total leakage reduction*

*Light blue bars - New Pressure Valve digital Controllers*

*Dark blue bars – new pressure valves installed*





#### **1.4 Trunk Mains**

Specialist suppliers were appointed to provide active leakage control services to upstream assets e.g. trunk mains and service reservoirs. These additional upstream resources supported the location and repair of c.3 Mld from trunk mains.

#### **1.5 Service Reservoirs ("SR")**

South West Water's SR cleaning program had been enhanced, during every SR clean a drop test was conducted. Leakage can be identified by the drop test, as can 'passing' valves. The assessment data from the increased drop test activity was fed into the reporting component, providing a small benefit of c.1 Mld.

#### **1.6 Customer Side leakage**

Losses from customer supply pipes continues to be a significant component of reported water loss. Enhancing active leakage control efforts in this area was also identified as a high-priority, fast-reacting activity.

Three primary routes of identifying private losses exist:

- higher consumption / bill triggers (84% meter coverage in South West Water),
- customer contacts reporting a leak and
- leaks detected via targeted DMA ALC sweeps.

All potential leaks are investigated and, subject to several threshold parameters, an ex-gratia offer can be made to facilitate the fix of the leak. This is the fastest way to ensure a repair is made, with notice and enforcement processes risking protracted leak-run times.

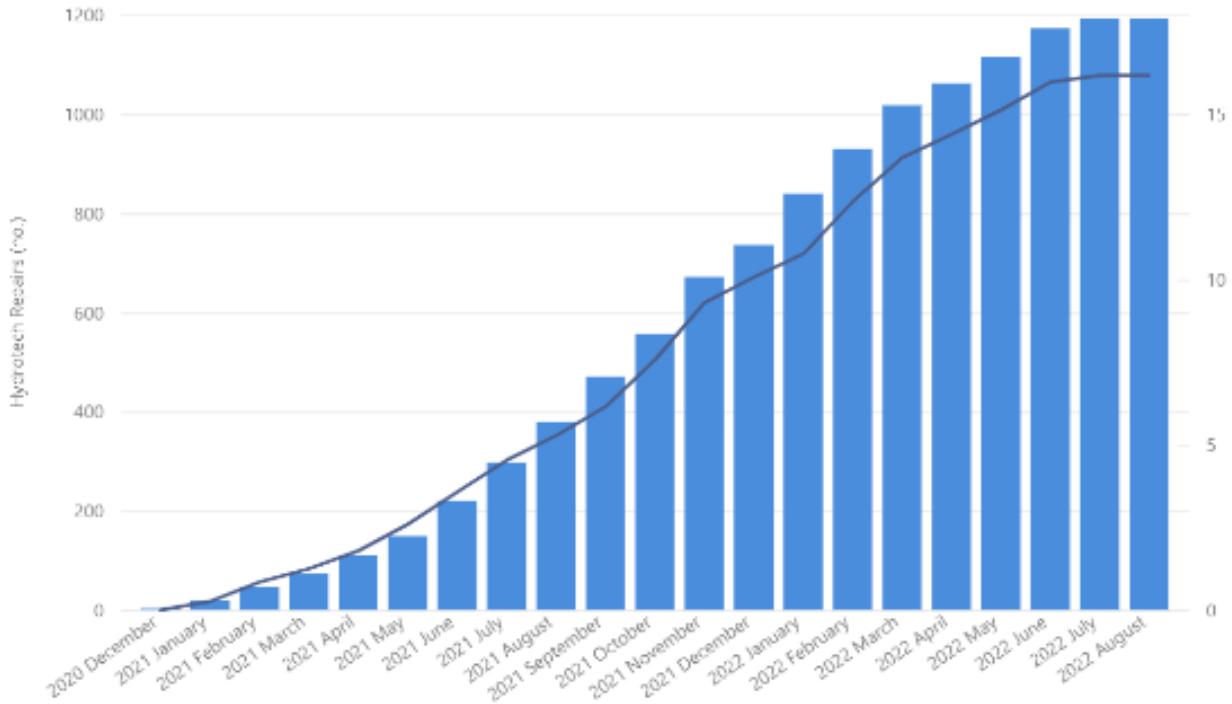
As part of our enhanced leakage strategy, the trigger thresholds for considering an ex-gratia repair / intervention were reduced from 10 litres per minute and over to 5 litres per minute and over.

In addition, our policy preference was changed to pipe renewal rather than spot repair. Where the supply pipe material is one of an identified type, the customer is offered a full renewal free of charge, instead of a spot fix, to reduce the number of repeat private leaks on high-risk pipe types.

With c.84% of customers on measured accounts, and close to 100% having a boundary facility to fit a meter, South West Water can readily determine leak flows. In the year 2021/22 c.14 Mld of leakage reduction was on customer supply pipes, a record high for this activity for SWW.

Figure 4 below represents the total leakage saved (trend) and interventions (customer leak repairs and pipe renewals) required to achieve the leakage reduction.

Figure 4 - Graph showing total leakage saved against leakage repairs



## 2 LEAKAGE & WATER LOSS ACTIVITY AND PERFORMANCE IMPROVEMENTS

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SWW has continued to deliver against its regulatory obligations for leakage performance.

SWW was forecast to achieve, with the potential to over-achieve on the in-year (Three year rolling average) leakage performance commitment target for 2022/23. Regional effort continued to detect leaks, fix leaks expediently, support customer with free supply pipe leakage repairs and/or supply pipe replacement and deliver existing plans to prevent leakage and water losses as business as usual.

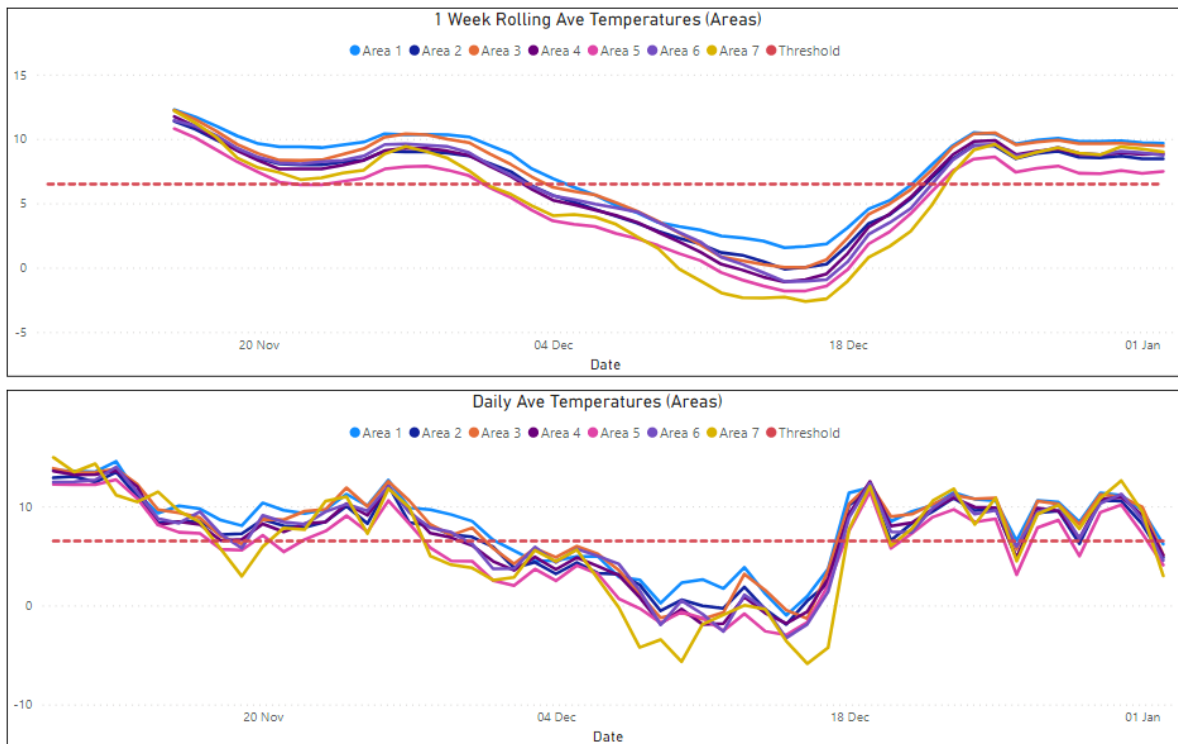
Forecast performance, realised by regionally aimed BAU leakage control operations, were tracking to achieve performance commitments. However, following one of the driest, warmest periods on record, November 2022 brought substantial rainfall and December 2022 exceptionally cold temperatures. This was significantly impactful on measured leakage. The impacts were most notably seen in the Devon and Bournemouth operating areas, with East and North Devon being seeing the highest leakage reaction to weather related soil condition change and temperature difference.

Changes to soil moisture levels can impact on resilience of iron pipes. Iron pipes are less robust in tension forces. Tension in pipes is caused by uneven stresses applied typically by external forces – soils and changes to vertical loadings. The soils capacity to restrain pipes under tension is an aspect of the soils level of moisture. The rapid wetting of soils following an extended period continuous moisture less meant bursts are leaks increased. Similarly, Iron is less able to manage tensile forces as it cools. The crystalline structure of Iron is influenced by temperature – cold means its propensity to see crack propagation increase. As air temperature decreases, so does water temperature, with river sources responding more readily to change.

Water treatment process see no change to water temperature, with pre and post treated water being of the same temperature. Treated water flowing through pipes requires the pipes carrying water to equalise in temperature – water warms and cools pipes. The influence of soil temperature is understood to have less of an impact on thermal transfer. Air temperatures are tracked by the water loss teams, and that change assumed to be relative to water temperature change, and pre-determined intervention triggers are in place relative to temperature drop and duration of drop.

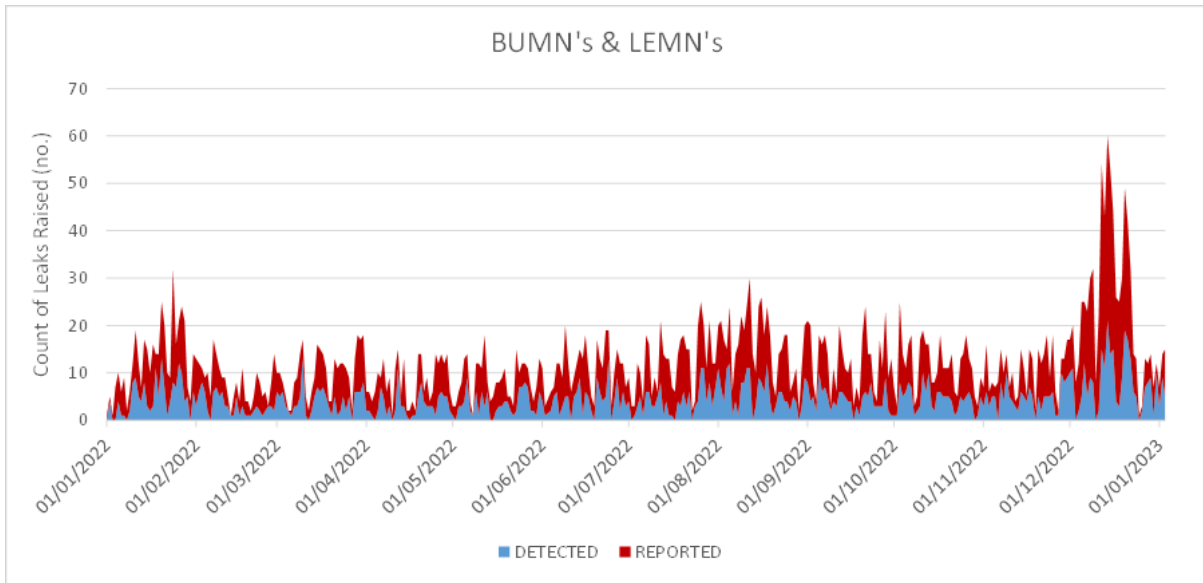
When the trigger temperatures are sustained for a period of time, approximately six days of temperatures below six degrees, the teams shift from proactive leak detection to a 'reactive' mode. The reactive mode sees the traditional mode of monitor leakage level at DMA and target those with rising levels of leakage, to one where the water loss teams are working with network colleagues to respond to reports of bursts and invisible leakage affecting service i.e. contacts reporting no water and/or low pressure. The reactive mode remained in place for a period of two weeks in December.

Temperature data logged at area level:



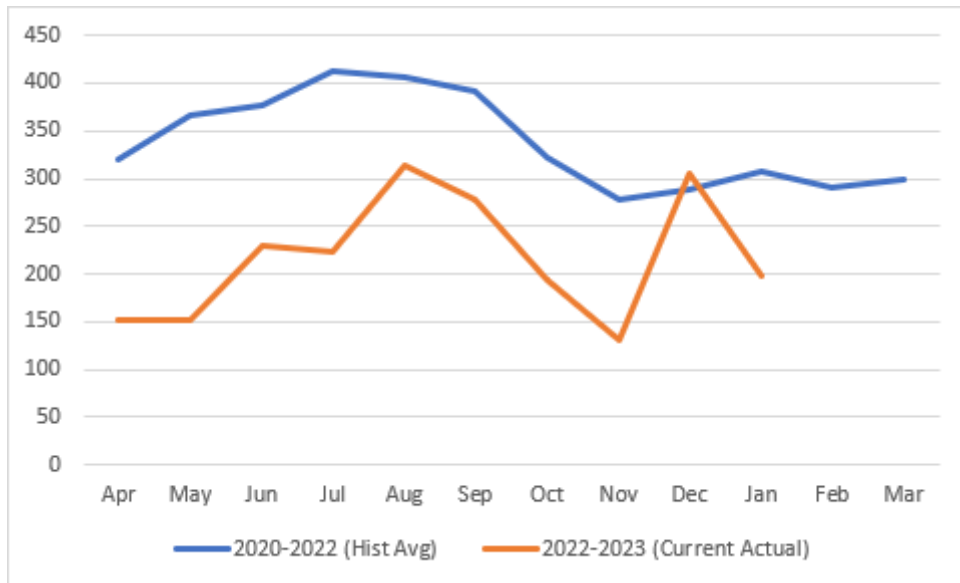
December’s low temperatures added to the November soil moisture change, with a record-breaking period of bursts and leaks. Most notable affected, in order of scale was Bournemouth (A7), East Devon (A5) and North Devon (A6). South, West Devon, Plymouth and all of Cornwall were largely unaffected in terms of cold weather-related outbreak of bursts and leaks.

The numbers of high priority leaks attended to during the cold periods was excessive by evidence. Burst repairs (coded as LUMN and BUMN in work management systems) are see as follows:



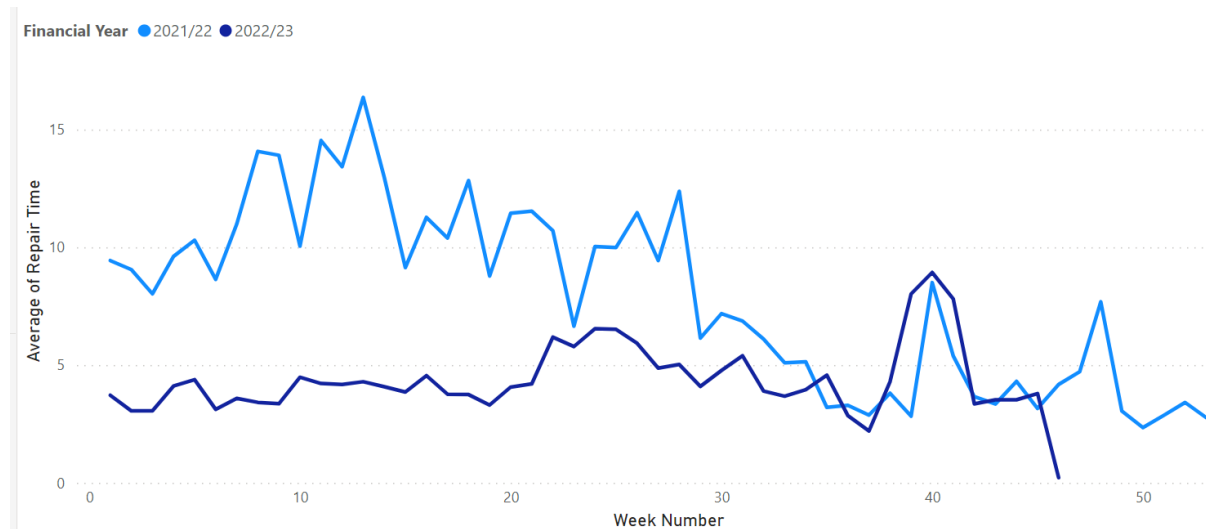
- The 'freeze – thaw' period is noted as:
  - freeze: 9<sup>th</sup> to 17<sup>th</sup> Dec'22 (below 0°C)
  - thaw: 18<sup>th</sup> to 25<sup>th</sup> Dec'22 (~10°C)
- The impact on reported leakage is **an increase of 37.3 ML/D**

This increase in burst and leak activity had a dramatic impact on work basket and lower priority leaks. The following chart indicates the pre drought work basket position (2020 – 2022), the concerted effort to reduce backlogs as drought become apparent, additional detection and repair resources, the impact of wet and cold weather, and then the post wet/freeze/thaw effort recovering the work basket to its targeted max of 200 repairs (c three days of work for the base level of R&M resources).



## Lyd Drought Permit Application 2023

With excess work basket numbers come increased leak run times. The considerable reduction of runs times from pre drought, the peak of increase from wet/freeze/thaw to current position of all leaks being repaired in 3.1 days – achieving service and repair partner performance targets.



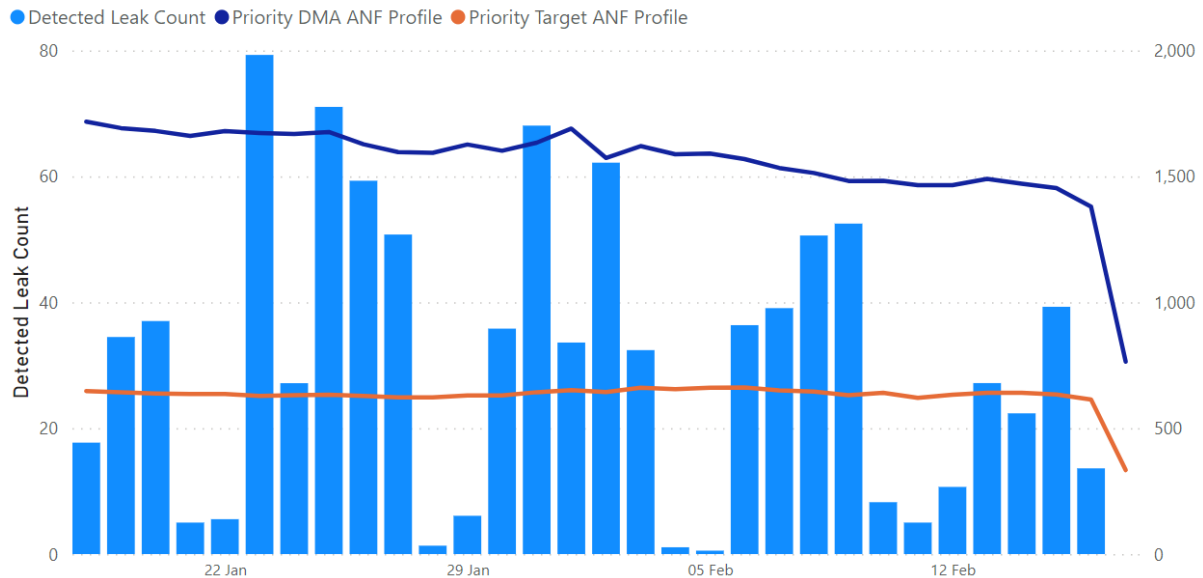
To further support the in-year and three-year rolling targets for leakage performance, a winter recovery project was established. The project was supported at board level, with the sign-off of up to £1500k.

The project identified some 226 DMA's (24 specifically in the Roadford WRZ) that had seen Average Night Flow (ANF) rises since the Wet/Freeze/Thaw events. Each was assigned a specific leak detection policy and targeted ANF reduction, the total amounting to 72.5 Mld (ANF, not reporting leakage – ANF is the value of water measured in the night assessment window and is pre consistency adjustments, accounting for such allowances as household and non-household night use.

	DMA Count	ML/d Vol Step 1 (Apr 22 Position)	ML/d Vol Step 2 (Target - MAL)	
IQ	93	16.2	*14.4	
ALC	93	20.5	9.2	
Optimisation	40		12.2	
	226	36.7	35.8	<b>72.5 ML/day</b>

The recovery framework attached exceptional incentives for incumbent leak detection teams to locate excessive leakage, with time and target bonuses set to encourage out-of-hours working and achievement of DMA's achieving the Minimum Achieved Leakage (MAL).

The project has a dedicated tracking report, indicating leaks found, hours worked and DMA’s achieving their MAL. The project runs for the balance of the reporting year, 31<sup>st</sup> March 2023. Recovery is largely tracking to linear target.



**2.1 Regionally detected leaks**

The Period of reactive leakage is clearly seen in December, with all detection resources supporting network colleagues. The impact of national bank holidays (Christmas and New year) was minimised as a specific and separate incentive, bonus framework was put in place to minimise impacts from absence. The incentive was well supported, with all staff working for most of the holiday period, limited the reduction of detected leaks.

**2.2 North Devon (Roadford Focus)**

With the freeze and thaw leakage recovery plan established and work to deliver to plan, Roadford was given further and specific water scarcity attention. Although BAU leakage was tracking to recover the position for an end of year performance commitment achievement, more effort was considered to support water loss reduction beyond the achievement of leakage performance commitments.

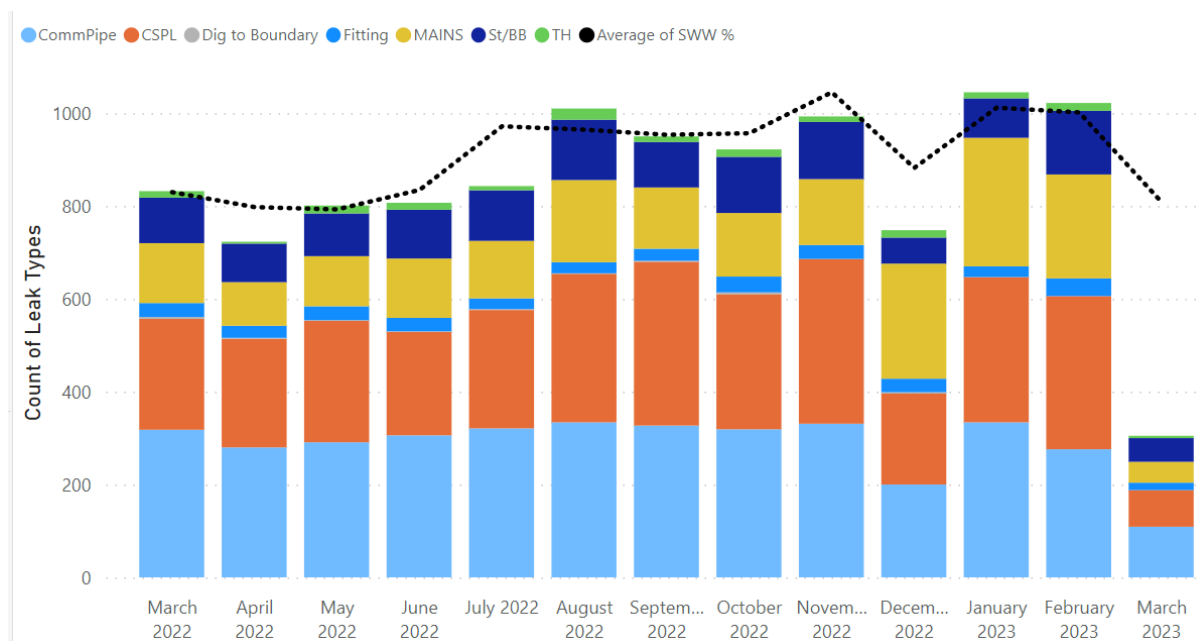
With the acquisition of Bristol water to the Pennon Group; the leakage team operating from the area were considered as a potential additional resource to support with leak location effort.

A plan was established in February that, allowing for logistically mobilisation, would see no fewer than 20 experienced leak detection staff being located in the Roadford zones, resident in the area at appropriate hotels locations and incentives to encourage the most productive working processes and attendance. The plan ran from the 27<sup>th</sup> of February and is currently set to be reviewed at the end of March 2023.

The Roadford supply zone was reviewed at DMA level and optimal selection of which were aligned to the Bristol resources. Leak detection productivity and water loss reduction is tracked independently to BAU leakage and performance activities of SW staff, thus enabling a project specific set of outcome metrics. Week one of the project saw 125 leaks detected by the 8 two-person crews.

February 2023 concluded with another record level of detected and repaired leaks and regional performance is tracking to recovery plan. March is forecast to be comparable to February in detected numbers.

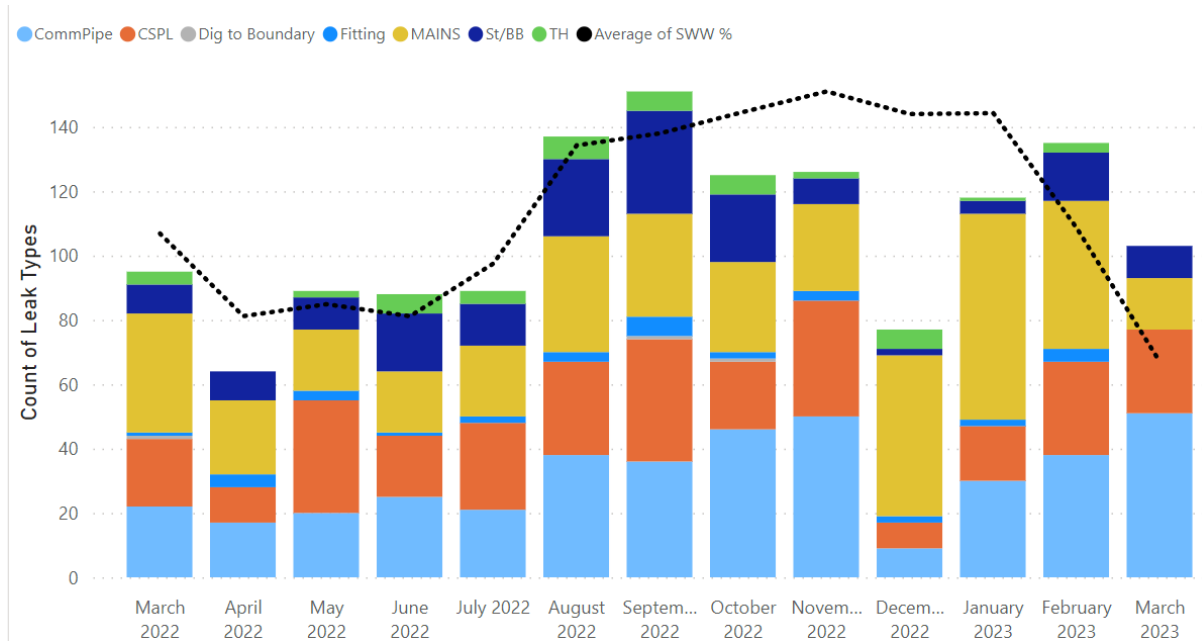
*Regional leak detection numbers:*



Specifically, leak detection and repair performance in the Roadford WRZ continues to dramatically increase and far exceed output needed to only achieve leakage performance commitments as a sub-regional contributing to regional performance. Leaks detected in March are forecast to be three times the number found and fixed in February. Figures to 7<sup>th</sup> March 202 show the detected number of leaks is already 75% that of February. This is attributed to the deployment of Bristol Water detection staff exclusively in the area.

*Roadford leak detection numbers (March being to the 7<sup>th</sup>):*





**2.3 Customer leaks**

South west Water continues to offer free leak repairs and supply pipe renewals across the region, with Colliford remaining a focus, supported by a zero threshold intervention level. Intervention level across the balance of region remains at 5 litres per hour.

Customer leakage outputs for December were negatively affected by the freeze and thaw events. Of the whole Customer Leakage Team 70% were diverted to assist the networks team with reactive network leakage; alongside the core network leakage teams mentioned. In addition, from 14/12/22 our customer leakage repair supplier were suspended from Supply Pipe leakage work to support networks leakage, focussing on network leakage jobs to allow Kier resources to focus on high value, service and performance impacting leaks and bursts. A total of nine gangs moved from Customer Supply Pipe Leaks (CSPL) work to Networks, with a single gang held back to respond to high value customer leaks - those over 2m3 per hour.

Following largely recovering from the CSPL backlog, the teams resumed their focus on the Colliford drought zones. In addition, available resources from the SW and the Bristol water teams were aligned to detect leaks in Roadford zones – including customer leaks. Following the enhanced offering in Colliford, the previously intervention threshold value of 7 LPM was dropped for customer leaks in the Roadford zones. Customer leaks of any value were aligned to a potential free repair or full pipe replacement.

*Customer Supply Pipe Leak - outputs and targets:*

Customer side leaks	Number of repairs	Saving MI/d
Apr-22	69	1.11
May-22	81	1.11
Jun-22	84	1.35
Jul-22	71	1.04
Aug-22	116	2.56
Sep-22	160	2.45
Oct-22	103	1.3
Nov-22	149	2.58
Dec-22	73	1.11
<b>Current YTD</b>	<b>906</b>	<b>14.61</b>
Jan-23	234	3.2
Feb-23	234	3.2
Mar-23	234	3.2
<b>Total</b>	<b>1,608</b>	<b>24.21</b>

Area	Number of repairs	Saving MLX/d
1	182	3.66
2	216	3.92
3	142	1.81
4	124	1.83
5	100	1.56
6	98	1.39
7	44	0.44
<b>Total</b>	<b>906</b>	<b>14.61</b>

## **Lyd Drought Permit Application 2023**

The impact from the extended dry and hot summer, wetting late in November, freeze and thaw of December have significantly impacted on leakage performance. This is replicated across the majority of the south of England water companies, with each reporting huge leakage outbreaks and challenges with recovery. South West Water responded to each challenge, with specific and exhaustive projects to drive water loss reduction and very pinpointed water loss focus in the Roadford zones - Investment has been considerable, with the purchase of new equipment, piloting of innovative water loss reduction methodologies, recruitment of enhanced supply chain resources, in particular the cohort of up to 24 Bristol Water technicians being resident in the Roadford zone from late February – that running alongside an incentivised reward frameworks for internal teams, encouraging maximum effort and output.

These initiatives have given South West Water the opportunity set new records in leak detection and repair in the Roadford zones – contributing to the wider water scarcity resolution plans.