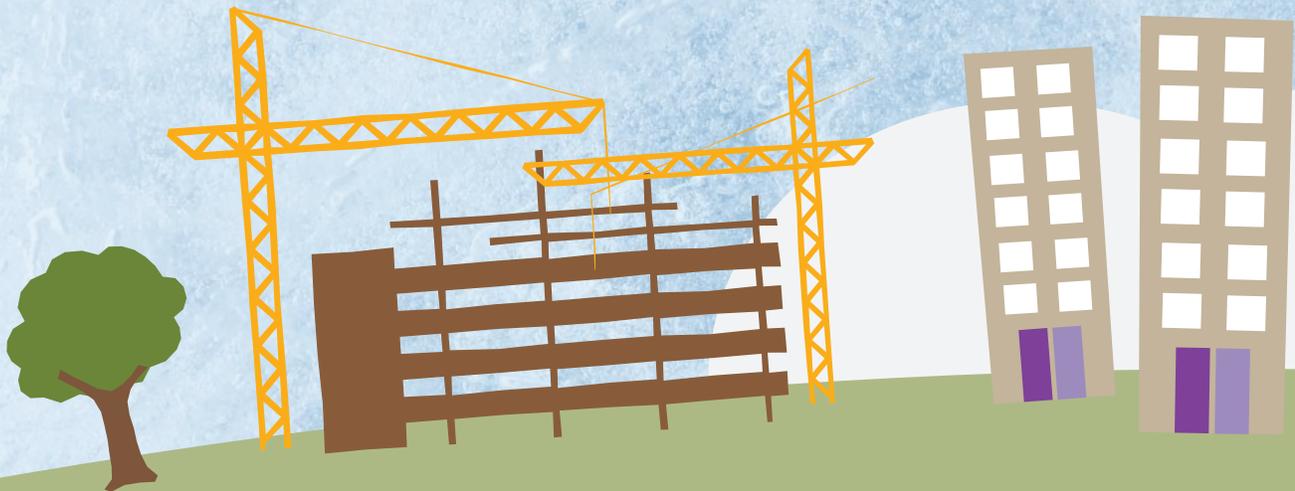


How Anglian Water responded to the 2018 Freeze/Thaw Event



Executive Summary

The 2018 Freeze-Thaw event put significant strain on infrastructure across the UK. In the water sector the rapidity of the thaw following an extended freeze caused unavoidable problems with burst mains and leaks from customer pipes and company networks. The bad weather occurred across the UK: the East of England's exposure was similar to the rest of the country. Indeed, the combination of freeze and rapid thaw caused substantial ground movements and resultant mains bursts, a more significant issue in our region (particularly the Fens) than elsewhere.

However, our actions ensured that customer impacts were minimised. Almost no business customers were significantly affected (so cross-infrastructure effects were eliminated), and only 163 homes were off water for more than 12 hours, mainly in the Cromer area. Over 99.6% of our customers experienced no impact from this event. Where problems did occur they were quickly rectified. Other business priorities continued to be progressed during the event.

Our success in minimising the impact on customers stemmed from a number of factors, including:

- Putting innovation at the heart of what we do: from the work of our Insight and Data Science team and our dashboard information system, which drove our operational response and ensured we targeted our resources to address areas of greatest need, to how we work differently with our supply chain and our customers, to investments in our Integrated Remote Intelligence Service (IRIS) system, including our leading Integrated Pressure and Leakage Management System (ILPM), co-developed with Schneider, to our enhanced telemetry, condition monitoring and modelling and information systems (See sections B,C & F);
- Our industry-leading position on leakage. This means we lose less water from our networks, and so are better placed to cope with spikes in demand that flow from an event like this (Section C);
- Our resilience approach, based on ISO22301, which we have now taken further with Arup in our Resilience Framework, which we used to test the resilience of the company and its partnerships (Sections E, H and I) ;
- Our customer-centric approach of 'restore, repair, recharge' to focus first on meeting customer needs (including redeploying water recycling assets) rather than fault repairs (Sections E,F & G);
- The collaborative approach we have pioneered with our supply chain: our unique alliancing model saw us quickly deploy 119 gangs and over 400 people to address problems (Section F);
- The quality of our customer and stakeholder communications, both proactive and reactive, across all channels to try to reach the widest range possible (Section G);
- Investment in resilience schemes, which has reduced the numbers of customers dependent on a single source of supply, gave us more options to minimise customer impacts in this event. This was combined with strong preparation across the company for this event, to ready ourselves operationally and to ensure proactive communications with customers before the event occurred. We executed our resilience planning systems and incident room approach, before the incident (to ensure we were ready) and during, and showed strong leadership throughout, with a Director heading our response, 24 hours a day.
- Finally, we would praise the resilience and skills of our frontline operational teams, drawn from across Anglian Water, our alliance partners, and our Anglian Work Force volunteers, all of whom worked tirelessly to avert impacts on customers in very challenging conditions.

Table of contents

- Section A:** Why there are problems with freeze/thaw events
 - Section B:** why mains bursts and leaks happen in our region during a freeze-thaw event
 - Section C:** industry-leading leakage performance provides resilience to incidents
 - Section D:** minimal impacts on customers
 - Section E:** how we minimised the impact on our customers
 - Section F:** a speedy and flexible response, helped by our alliancing model
 - Section G:** how we communicated with customers
 - Section H:** delivering on other business priorities during the event
 - Section I:** our resilience framework
- Appendices**

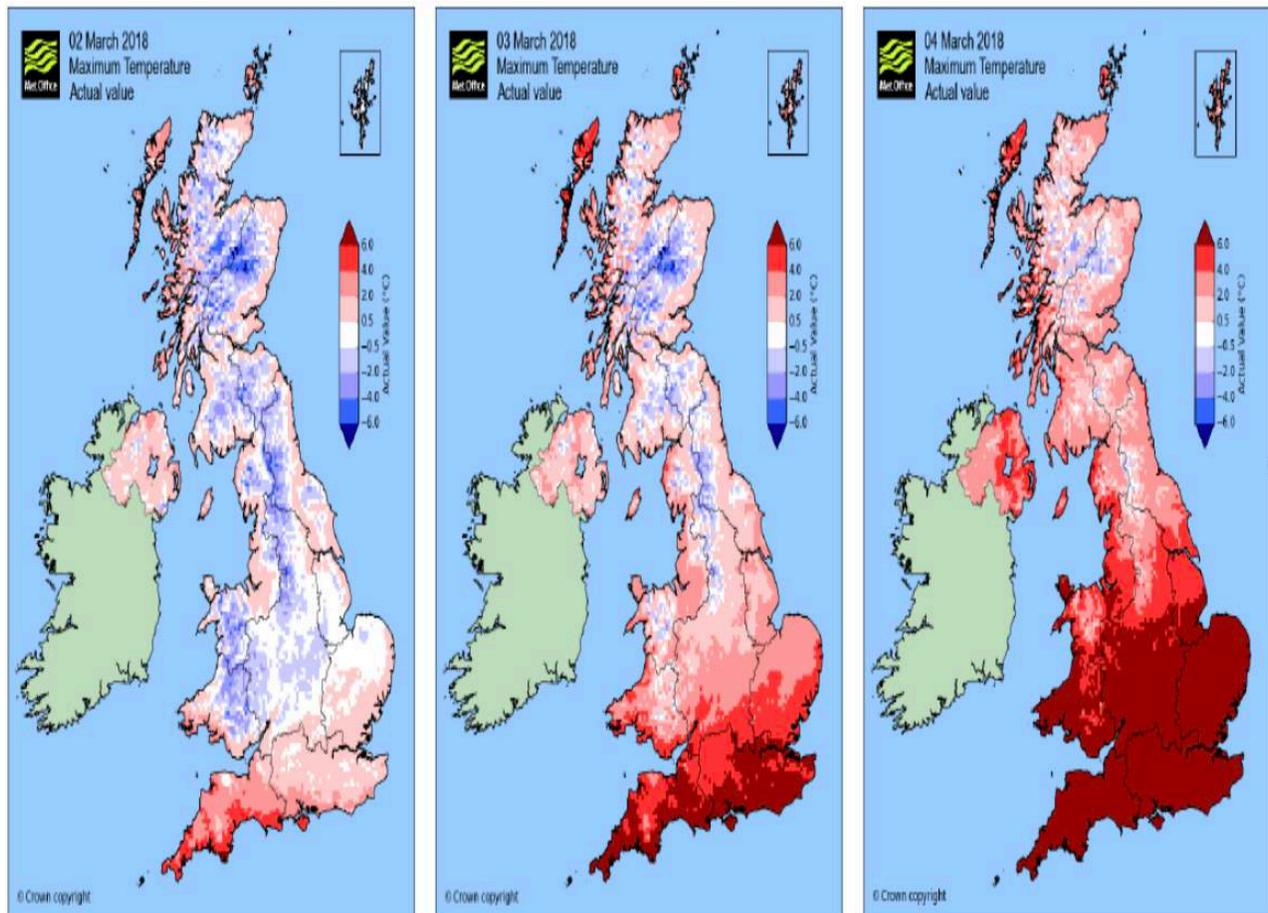
SECTION A: WHY THERE ARE PROBLEMS WITH FREEZE/THAW EVENTS

Weather conditions

We have reviewed information from the Met Office to understand whether there was a differential impact on our region compared to other parts of the UK. This analysis shows that, whilst there was some variance in the specific weather being experienced in different regions, the key parameters of the level of freeze and rapidity of thaw were very similar across the UK.

In essence, the evidence shows that we faced the same difficulties as other companies, the weather conditions were just as bad and the impact on us in terms of soil temperature changes, bursts and leaks just as significant. Indeed as we note below, the position is actually worse for our region given the impact of such events on ground movements in soil types that predominate in the East of England and which contribute to mains bursts and leaks.

The Met Office data shows that our region showed some of the greatest negative temperature anomalies during the freeze event. This was then followed by a very rapid thaw, which affected all regions to the south of the Humber. Within the Anglian Water Region, the Met Office data shows that the 4 day temperature swing of 13.3 degrees Centigrade was the greatest since January 1993. Measured soil temperatures reacted in a similar way, with soil temperatures in the east of England responding in an equivalent way to those in the south of England.



SECTION B: WHY MAINS BURSTS AND LEAKS HAPPEN IN OUR REGION DURING A FREEZE-THAW EVENT

What does the research tell us?

Anglian Water has for some time sought to better understand the phenomenon of ground movement, affected by temperature and levels of precipitation and the consequential impacts on leaks and mains bursts. We therefore undertook some industry-leading research with Cranfield University to:

- Understand exactly how extreme weather impacts AW assets;
- Prove the AW region due to its topography and associated soil types is more vulnerable to ground movement as a result of weather extremes (the shrink-swell effect);
- Build a dynamic model with predictive capability to plan for the impacts of the shrink-swell effect on AW assets.

The research with Cranfield concluded that the Anglian Water region does have high susceptibility to burst mains.

This is as a direct result of significant areas of our region being vulnerable to ground movement, a key factor in weather-related burst mains (known as the shrink/swell effect – see appendix for detail).

Our ability to understand the impacts of weather extremes, and which mains are at greater risk of failure because they are located within soil types more vulnerable to ground movement, now allows us to plan more effectively in terms of anticipating the effects of severe weather.

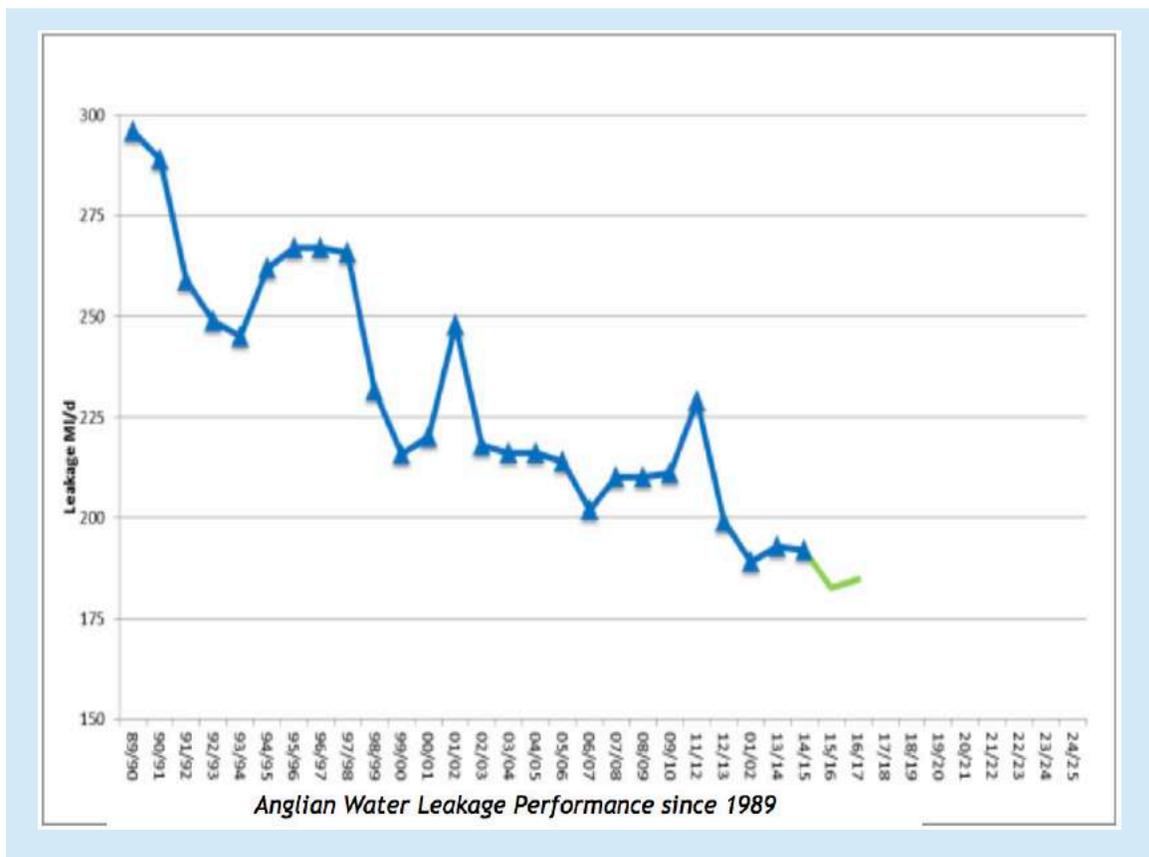
The investment we made in this work gave us a key operational advantage during the freeze-thaw event, and we are continuing to build on this through the development of the next generation WISPA 2 model in preparation for AMP 7.

SECTION C: INDUSTRY-LEADING LEAKAGE PERFORMANCE PROVIDES RESILIENCE TO INCIDENTS

Leakage performance

During the drought of 2011-12, which came just after the severe winter of 2010-11, we took the decision invest more in leakage reduction to take us below our Sustainable Economic Level of Leakage (SELL) of 211 MI/d. We invested in improving our repair run times and we in-sourced our leakage detection teams to ensure stability of the work force which resulted in an 17 MI/d (8%) reduction in leakage by the last year of AMP5 compared with the AMP4 average. In AMP6 we are continuing our leakage reductions targeting 172 MI/d by 2020, which will represent a 20 MI/d reduction (10%) from the position at the start of the AMP. Anglian Water's investors made the decision to forward fund the required investment to deliver the reduction. The costs will only be recouped if we continue to hit our glide path for reward under our ODI mechanism.

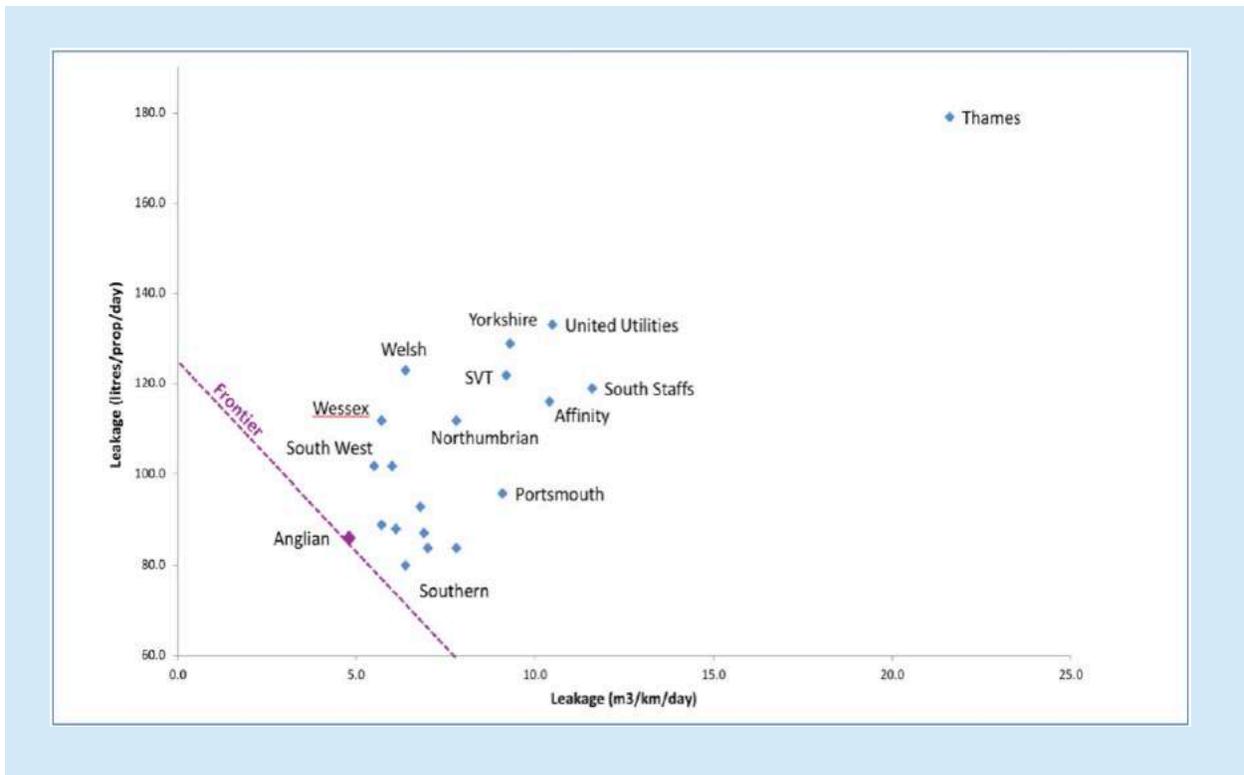
The graphs below shows our leakage performance since the industry was privatised in 1989 and data from Discover Water showing our industry leakage performance in 2016-17. Critically, this strong leakage performance gives us a far stronger starting point at the beginning of an incident like this. In the 2010-11 freeze, more reservoir levels were close to critical. By March 2018, our treated reservoir levels were far higher and gave us more "in the bank" to deal with the peak in demand that resulted from the weather event. Had our starting leakage level being higher in March 18 then the peak in DI would also have been higher.



In the last 2 years we have continued reducing leakage and in 2016-17 reported a figure of 185 MI/d, representing a 7 MI/d drop since the start of the AMP. This is frontier performance. Leakage is now 26 MI/d (12%) lower than in the year before 10/11 which is one of the factors why we did not experience widespread loss of supply the March 2018 freeze/thaw event. In the last year of AMP4 16% of mains bursts were identified by our proactive leak detection teams. In the first three years of AMP6 we now find 29% of mains bursts through proactive detection. Additional measures in development include the following:

- Near-Live” GIS access for NTs via tablets - incorporating Valve Control : The concept in development is a mobile solution that is updated wirelessly so that Technicians have the confidence to always use it to locate valves and to record both what had been altered and how long it was likely to stay altered (including permanently)
- Near Real-Time Modelling : The concept in development is a system which would have flagged all pressures downstream of a burst. After repair the system would identify if all pressures downstream had returned to normal. Together with the ability to generate an elevation map this would have pinpointed potential air locks. Also, throughout the extreme weather event technicians were constantly updating spread sheets for storage points across the company, trying to predict which were falling “significantly” to allow us to carry out predictive analysis and anticipate potential events. Near Real-Time modelling would significantly enhance our capability in this area.

Despite the inevitable short-term spike in leakage caused by this event, we have recovered quickly and the event has not deflected from our downward glidepath towards meeting our ambitious goals for leakage reduction, and our specific targets for the end of the AMP.



SECTION D: MINIMAL IMPACTS ON CUSTOMERS

Over 99.6% of our households saw no material service reduction impacts from this event.

Contact Centre Resilience

Calls into our Operational Contact centre were double their normal levels, and peaked at 500% of normal levels on Sunday 4th March. This was the busiest Sunday for contact on record but we managed these volumes effectively by preparing in advance and then switching contact agents from Billing and Metering teams into Operational contact. Through this and the use of our Anglian Water Force Resilience teams we were able to triple the size of our Operational contact centre. This meant speed of contact for our customers on traditional and digital channels remained at good levels despite the much increased demand. During this period calls to our customers were answered on average in around a minute.

Incident Room

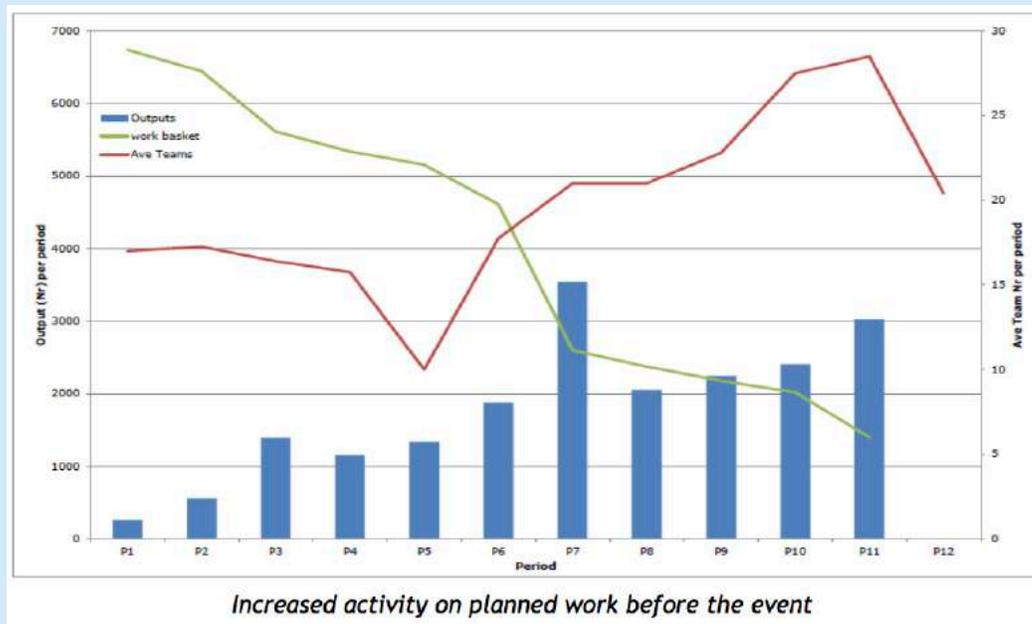
Our incident room opened on Weds 28th February, in order to ensure we were prepared for the events to come and after defined triggers (temperatures not greater than zero degrees Celsius for two days, and lowland snow deposits of >10cm) had been met. The incident room initiated the following actions:

- Enhanced monitoring of key storage points, pressure, flow and leakage in our network
- Increasing levels of field, alliance, contact centre, alarm monitoring teams
- Scenario modelling
- Increasing holding of alternative and bottled water supplies and engagement of bottled water suppliers to increase stock across the region by 150% (usual baseline stock is 100 pallets and increased to 248 pallets of bottled water)
- Liaison with Partner agencies
- Setting up of alternative supplies hub
- Proactive communication to customers about ensuring private pipework is adequately lagged.
- Proactive communication regarding 'Watercare Register'
- Postponing planned activity on our network and treatment works
- We actively participated in Local Resilience Forum teleconferences, Tactical Co-ordination Groups and Strategic Co-ordination Groups across 10 counties; a total of 61 teleconferences across the period.

Targeted contacts with retailers and specific customers

We set up information conference calls with our retail customers throughout the event, recognising the sensitivity of our non-household (NHH) customer base. Feedback from our Retailer customers was extremely positive. Only a handful of NHH customers suffered material interruptions to supply over this period, with only seven customers suffering an interruption of more than 12 hours and no NHH customer suffering an interruption to supply of greater than 24 hours.

Between 28th February and 7th March, 163 customers had a supply interruption of greater than 12 hours, nearly all in the Cromer area. The maximum interruption was 30.75 hours for 4 properties. We prioritised vulnerable customers and delivered bottled water to all affected customers (346 packs in total) and put in place contingency arrangements with local hotels and laundries should the situation have continued. No formal complaints were received and the Parish Council confirmed that it was not seen as a big issue.



We take a dynamic approach to balancing resource levels between reactive and planned work. The drop-off in planned teams in P12 shows the teams who were sent across to assist with reactive work during the burst outbreak. Our business as usual operation is headed by a 24/7 Senior Operations Manager leading a team providing operational and service oversight across our business through our Operational Management Centre.

Benefitting from investment to reduce interruptions to supply

Over recent years we have made significant investments in restoration and a massive step change in moving away from our previous approach of ‘repair first’ towards our new order of priority of ‘restore, repair, recharge’. When supplies are interrupted through a burst or other problem, our priority is to restore that supply, rather than immediately fixing the cause. This “customer first” approach has seen big reductions in the amount of time people are left without water.

This change has been achieved by working with our field teams to co-create new ways of working. Our teams are focused on customer needs: every customer counts, and every second counts, and actions are prioritised accordingly. The new restoration team was introduced in 2015. Now all 21 restoration technicians are trained to drive the water tankers in our newly expanded fleet and to use a variety of equipment and techniques, including temporary overland pipes to keep people supplied. These techniques can keep a number of homes supplied indefinitely during an incident.

The water services teams work closely with other parts of the business to tackle the causes of interruptions, and the effective management of these events when they occur, is vital. The reactive approach is led and managed by the Tactical Operations team. These efforts also complement the pressure management and other proactive work to prevent problems happening in the first place.

During the period from the 4th March to the 9th March, our Restoration team worked a total of 1083 hours maintaining supplies to our customers whilst our repair teams worked on fixing leaks and bursts on our Network.

Case Study, benefits from the Norwich Resilience Scheme

Early 2010 saw the commissioning of the Norwich resilience scheme. The concept was developed in 2005 to provide resilience under average demand conditions should the full output of the Norwich Heigham WTW fail (72% of required supply for 200,000 population). The investment of £16.5M delivered a new raw water mains, a new 24 MI/d Water Treatment works plus trunk main connections from the East Hills WTW to the Norwich water ring main. The solution included a full automation configuration which enables remote control of WTW output and full pressure control. This has been designed to allow optimisation of all the available groundwater assets should Heigham output be catastrophically lost due to a resilience event such as fire or flood.

The scheme and its operation was unpinned by a regular and full maintenance and testing regime and has in the 8 years since commissioning only been required to operate in anger for a continuous period of 5 to 7 days due to the Heigham WTW suffering a water quality challenge due to raw water conditions.

The East Hills scheme is designed to be able to ramp up instantly (unlike a more complex solution such a RO/membrane plant requiring run up time) and the East Hills WTW output can be driven remotely by our central OMC by remote control. It can meet demand by ramping up from its baseline output of 2 to 3 MI/d to the maximum output of circa 24 MI/D in short timeframes.

When demand rose in the Norwich Supply from 53.63MI/d to 73.65MI/d over the period of 4th to 6th March, the East Hill WTW was used to pick up the majority of this increase with its flows rising from 2.57MI/d on 3rd March to 12.26MI/d on 5th and 13.79MI/d on 6th March. Without this resilience capability, the ability of the Heigham WTW to meet this increased demand in such a short timescale would have been questionable. This event showed the value of our resilience investment

Making best use of data

The team use the largest telemetry system in western Europe, with over 750,000 separate points monitored, sophisticated modelling, mapping and analytical tools to ensure a seamless service is maintained to our 6 million customers. Our investment in our Integrated Remote Intelligence Service (IRIS) system, and our leading Integrated Pressure and Leakage Management System (ILPM), co-developed with Schneider gives us high quality information which our data scientists can then use to allow us to target our actions to minimise customer impacts. This is backed up by dedicated field teams whose primary aim is to restore supplies to our customers following an interruption.

Investment in our information capabilities to exploit current technologies and to build a business wide analytics community of practice has enabled us to undertake analysis in an agile way, using expertise from across the business to inform decisions. During the freeze-thaw event, this enabled us to:

- Analyse our current customer issues at scale to identify potentially vulnerable customers and respond accordingly;
- Identify high risk areas using geospatial tools that account for topography /contour height;
- Keep customers informed of our plans and prioritise workloads.

Our dashboard mapping incoming customer contact allows our teams' quick and visual access to emerging issues. We have created a single dashboard view, which provides a single risk dashboard on critical storage point levels, storage points in decline, and hours until those storage points become critical. This allowed for proactive intervention before situations become critical.



Key strategies that were put in place included targeting leakage teams to critical zones, and increasing works output to ensure demand was met and rezoning supplies to affected areas.

Case Study: Supporting neighbouring companies

Resilience and integration of our networks has been a long-term objective for Anglian Water. In the south-west of our region we have an integrated network that allows us to balance supplies and improves resilience in our network. Whilst we saw an increase in demand in this area we did not experience any significant issues which would have negatively affected our customers.

However we were called to support a neighbouring company (Affinity Water) by providing additional supplies to their normal demand. By utilising our integrated network we were able to move supplies from the north of the region to the south to provide this support.

We also partially commissioned our Grafham resilience scheme (a significant resilience project) on 27th February which provided additionally flexibility and allowed us to prioritise supplies to Affinity water whilst still maintaining secure supplies to our customers.

In addition to this we were in the middle of planned work with one of our clarifier units out of service for cleaning and repair. This reduces our works output by 45 MI/d. This work had been part of our routine planned work programme that had been planned 6 months previously in conjunction with Affinity.

In response to the need to support Affinity, we accelerated the completion of this work. Working with our Main Works Alliance and framework partners we completed the remaining work, scheduled to take 3 weeks, within 3 days. This involved additional resources all parties working 18 hour days.

We maintained regular liaison between our operational control rooms and Affinity's to ensure all customers were supported regardless of the providing water company.

¹See Appendix for further examples

SECTION F: A SPEEDY AND FLEXIBLE RESPONSE, HELPED BY OUR ALLIANCING MODEL

We are increasingly seeing the benefits of our alliancing approach in improving our customer experience, our ability to respond quickly and decisively to network incidents and our ability to manage our financial performance.

The freeze-thaw event presented us with some big challenges but also gave us an opportunity to learn about how we can respond with our alliances when under extreme pressure.

Our alliancing models provide long term platforms that allow the delivery partners and extended supply chain to align to, have influence over, gain satisfaction from and be rewarded for achievement of our business goals, SIM and ODI requirements, daily challenges and major incidents.

Through these alliancing models, strong relationships have formed between us and our delivery partners. From Chief Executives to front line operational staff there is a unity and collaborative nature that has developed allowing all parties to take a longer term view of resource requirements, security, stability and commitment required to deliver.

Critically, this models looks beyond the immediate work requirements and stretches for the full period the AMP cycle. Success is measured by total collaborative accomplishment not by individual achievement.

The alliancing model within the Integrated Maintenance and Repair (IMR) alliance was revised in 2017 with a view to ensuring it provided a sustainable and equitable platform for all parties. The alliance model now reflects a position whereby it recognises that resource availability and stability is at its core. There are circa 89 teams of dedicated resources that are dedicated to delivering the mixed basket of work activity across both reactive and planned environments. This provides the IMR with the flexibility of resource it needs to be able to proactively manoeuvre between short-term peaks of reactive work whilst balancing the whole efficiency and productiveness of it resources through the utilisation of a planned work book.

The alliance has also recognised that its success in achieving SIM and ODI delivery requires a flexible and skilled resource base. That it is informed by previous work trends, weather impacts and network challenges, that it looks forward to provide insight and a non-complacent view of how it will robustly manage the network and structure itself for long term benefit and issue mitigation. Working in this way has allowed the alliances to have teams and the mechanisms in place to deploy to the most “in need” areas with immediate effect.

The alliance and its resource needs are aligned to a view of the network condition and potential impacts over a 10+year period. This long-term view that means it is not susceptible to the short-term “boom and bust management” which is often associated with operating in a reactive maintenance and repair arena, and which is challenging to manage under traditional contractual, commercial and operating models.

Additionally we are operating pan-Alliance working methodologies that allow us to recognise where there is an opportunity to have a more joined up and aligned workforce. An example would be the sharing of resources across the IMR and the Integrated Metering and Developer Services Alliance (IMDS). Through the linkages that exist at all levels of these two alliance, the same supply

chain delivery partners, aligned management teams, joint working groups etc there has been the creation of a flexible and multi skilled resource base, each team with capability to deliver the specific needs of each delivery route whilst providing the right training and development of key resources to enable the movement across alliance and geographic boundaries.

Further the alliancing models have also enabled the active deployment of assets, plant and equipment sharing across the entire water network.

Specifically in response to the recent network incident we had the Integrated Main Works (@ one) alliance providing support to our IMR Water colleagues. We had the Integrated Supply Chain function operating out of our Thorpe Wood House site supporting the OMC Incident Room on Alternative Supplies. We had IMR Water Recycling alliance providing additional traffic management to the IMR Water alliance. We had Integrated Operational Services alliance supporting maintenance of existing Traffic Management on planned works that had to be put on hold for a week.

In total, through the alliancing delivery models, rapid access to some 400 plus people were available to Anglian Water to provide support on the ground across all areas of the network and operation to proactively manage our response to the significant issues created by the bout of bad weather.

Further to the direct support enabled by the alliancing models and to help manage large operational incidents the creation of an Anglian Water Force (AWF) incident community has been established.

This is a way in which we recognise that although large operational incidents do not happen often, we can be proactive and plan our approach to them. We have a wide pool of some 350 volunteers who we can call upon when needed to help us address issues and provide support across our geography and operations.

SECTION G: HOW WE COMMUNICATED WITH CUSTOMERS

Before and during the event we communicated across a wide range of channels with customers to ensure we were doing all we could to help them avoid problems in the first place, and explain what we would do to alleviate any issues that did emerge.

Anglian Water’s Keep Your Pipes Cosy campaign

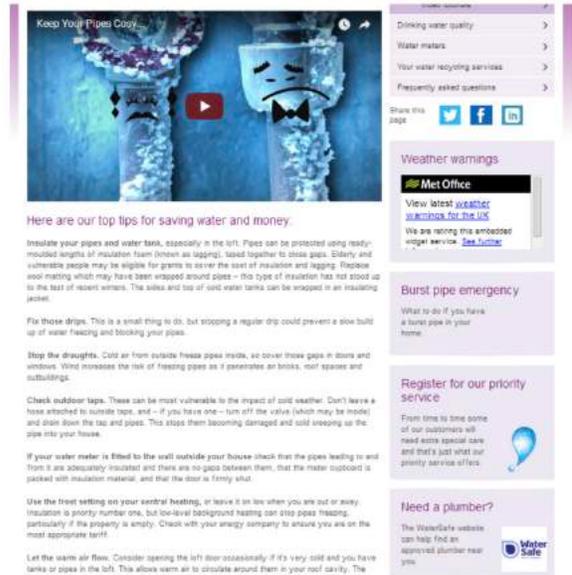
Ahead of any freezing weather conditions each winter we reactivate our Keep your Pipes Cosy (KYPC) campaign via, media, web and social. This is a campaign strand that has run for several years, with notably significant success when distribution of the story is timed to respond to national weather warnings.

Multiple communications assets with a lifespan of several years have been developed since this campaign’s inception. Targeting and appropriate localisation keep these assets fresh each year.



A link to cold weather advice appears on the Anglian Water homepage, while a unique short URL - anglianwater.co.uk/winter - takes customers directly to information on protecting their pipes from cold weather. Further advice is signposted at various stages throughout the customer journey.

Online content is supported by printed collateral, also available for download.



Detailed advice is published on our website, including links to weather warnings, emergency contacts, priority service support, Watersafe accredited plumbers, and how-to videos.

The twin objectives of the campaign are to attract customer attention in the context of what else they may be hearing and seeing in relation to cold weather, and to inform them about how to prepare. How-to videos and creative animations are at its heart.

Engagement with traditional media

Ahead of the freeze which swept the UK in late February, we reactivated this campaign. We issued our Keep Pipes Cosy press release to regional media, radio and TV, offering advice to customers about what action to take ahead of the cold snap to protect homes from burst pipes and flooding.

While initial release on the 26 Feb had a limited amount of pick up, our advice had been lodged with newsrooms, stakeholders and opinion formers. Once the snow began to fall and freeze the following week (and customer contact volumes increased) we reissued the release, with additional guidance for customers should they find their pipes had already frozen.

We proactively contacted all major local radio stations, (BBC and commercial) offering live interviews or pre-recorded advice for their broadcasts.

Every local BBC radio station, and all major local commercial stations, booked interview slots in with us between the 1 and 2 March. While some carried interviews as a feature in daytime programming, others ran it as content in news bulletins.

Channels which ran the story were:

- BBC Radio Cambridgeshire, Lincolnshire, Norfolk, Northampton, Suffolk
- Lincs FM
- Eastern Daily Press
- BBC Look East
- Grimsby Telegraph
- Heart Radio

All of this messaging was consistent with information published to our “In Your Area” website. The thaw of the following week (and operational challenges in other water companies) created a further wave of interest from the media. With such limited customer impact in the Anglian region, our contribution to media debate was largely around:

- explaining why a rapid thaw can cause pipes to burst, and the difference between our infrastructure and domestic plumbing
- offering reassurance to customers that our network was coping well with the conditions and was being monitored closely by our engineers
- encouraging them to report any leaks to our Leakline
- Encouraging the use of Watersafe accredited plumbers

‘Beast from the East II’

Despite the forecast for the second cold snap being less ferocious than the first, we proactively contacted all regional radio stations again, ahead of the 17 March forecast for further snow and ice. BBC Radio Northampton, BBC Radio Lincolnshire and BBC Radio Norfolk ran the piece again. We also reissued the advice as part of our fortnightly supplement in the East Anglian Daily Times, one of the most widely-read regional newspapers in our area, covering Suffolk along with parts of Norfolk and Essex.

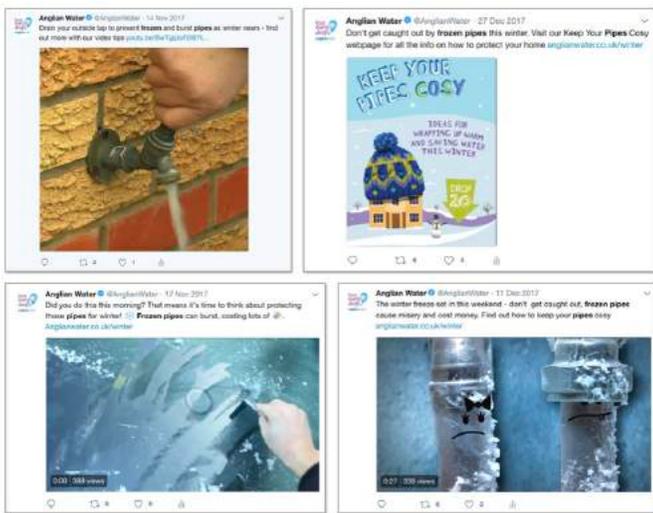
Customer engagement on social media

Anglian Water's social media channels are consistently the most 'followed' or 'liked' in the industry, with correspondingly leading levels of engagement.

Facebook post v's engagement statistics comparing UK water companies, 16/03 - 23/03, showing comparative 'BAU' levels of engagement

| Page | Total Page Likes | From Last Week | Posts This Week | Engagement This Week |
|---|--|----------------|-----------------|--|
| YOU 1  Anglian Water - Love Ev... | 19.7K  | ▲ 2% | 9 | 3.7K  |
| 2  Scottish Water | 17.2K  | ▲ 3.4% | 58 | 1.9K  |
| 3  Yorkshire Water | 16K  | ▲ 3.2% | 10 | 919  |
| 4  Dwr Cymru Welsh Water | 15.7K  | ▲ 33.8% | 35 | 11.9K  |
| 5  Severn Trent | 9.4K  | ▲ 14.9% | 35 | 2.9K  |
| 6  Thames Water | 8.4K  | ▲ 11.7% | 91 | 5.6K  |
| 7  United Utilities | 7.3K  | ▲ 1.8% | 34 | 666  |
| 8  Wessex Water | 5.1K  | ▲ 0.6% | 9 | 329  |
| 9  Southern Water | 3.5K  | ▲ 38.3% | 44 | 3.3K  |
| 10  South East Water UK | 1.9K  | ▲ 46.5% | 125 | 2.7K  |
| 11  Affinity Water | 1.5K  | ▲ 3.2% | 4 | 128  |
| 12  Northumbrian Water | 767  | 0% | 0 | 0  |

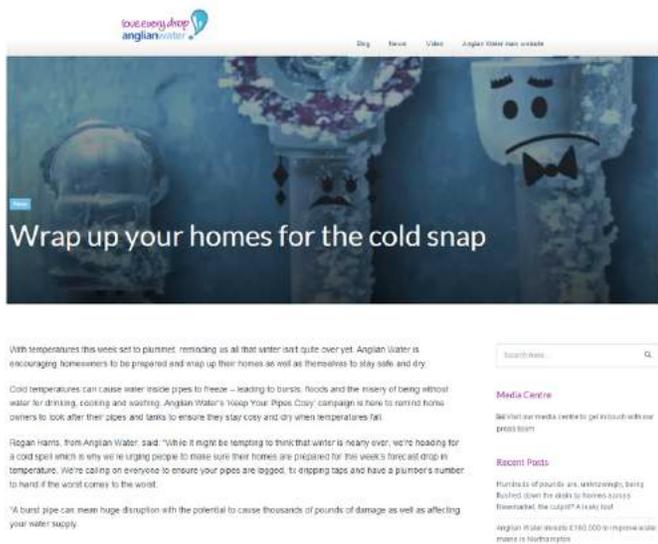
Using campaign collateral, we are able to target customers directly, using our well-established social media channels.



Examples of previous cold weather engagement using Twitter, December 2017

With the cold weather predicted in late February and early March, we again pushed the message out, echoing the messaging of our media release. This was published to our media site on 26 Feb.

The Anglian Water media site provides a central location for all published content, such as press releases, blogs and videos. This story can be found here: <https://media.anglianwater.co.uk/wrap-up-your-homes-for-the-cold-snap/>



Social media traffic began to steadily rise from the start of the week commencing Feb 26. As the temperature thawed and customers started to report leaks and water issues in their properties, contact peaked on late Sunday March 3 and throughout Monday March 4, before returning to normal levels on Wednesday.

During this period we received 2,668 messages and comments on Twitter and Facebook from 1,134 accounts. Of these 553 were customers requiring assistance, information or advice and they all received an individual response from our digital customer services team.

This was the highest level of traffic we have ever received on our social media channels. To ensure we were able to cope with demand we moved shifts to extend our hours of coverage, increased

the number of available seats on our customer service platform by 20, and made preparations to bring in extra staff from other areas of the company to help respond individually to customers online. Ultimately, we were able to deal with demand from within the dedicated team.

Our proactive messages on social media were given over to updates and advice for customers as well as images of our staff out working to keep customers informed and reassured.

We posted 11 Facebook updates during this period: a mixture of general posts for all affected customers, and targeted posts on specific localised issues only visible to those in the affected geographic areas.

Our total combined reach on these posts was around 250,000, with 40,000 people engaging (eg liking, commenting, sharing, clicking on links or watching videos).

The post with the highest reach was posted on March 1, reaching almost 150,000 people, receiving 2,600 likes, comments and shares and was clicked on 23,000 times.

Anglian Water - Love Every Drop
Published by Jane Anglian [?] · March 1 at 10:06am · 🌐

We are currently receiving a high volume of calls from customers with no water due to frozen pipes in their homes. If you have no water please check with a neighbour, if their supply is normal then this means the problem is on your property. You can use a hairdryer to gently and slowly defrost a pipe. If the pipe is at the back of a cupboard or against an outside wall then leave the cupboard doors open to get heat circulating. If the pipes are in the loft, leave the loft hatch open for an hour or two. To prevent pipes from freezing, make sure they are insulated and ensure water moves through them at regular intervals – running the taps in your home for a short period just before bed is a good idea. Keep your heating on low if you are out of the house to prevent pipes freezing. Please be aware of any vulnerable or elderly relatives or neighbours who may have frozen pipes and ensure they have the right advice. There's more tips to help here www.anglianwater.co.uk/winter

146,959 people reached Boost Again

Recent Activity

Boosted on Mar 01
Audience: Bedford, Grantham, Grimsby, Hunting...
By Jane Anglian · Completed
[View Results](#)

Like Comment Share

Margaret Bell, Ann Sprague and 542 others
1,387 Shares

Performance for Your Post

147,393 People Reached

2,676 Reactions, Comments & Shares

| | | |
|------------------------|-------------------------|-------------------------|
| 777 Like | 527 On Post | 250 On Shares |
| 11 Love | 9 On Post | 2 On Shares |
| 10 Haha | 3 On Post | 7 On Shares |
| 11 Wow | 11 On Post | 0 On Shares |
| 3 Sad | 2 On Post | 1 On Shares |
| 461 Comments | 339 On Post | 122 On Shares |
| 1,403 Shares | 1,385 On Post | 18 On Shares |

23,106 Post Clicks

| | | |
|-------------------------|--------------------------|-------------------------------|
| 0 Photo Views | 53 Link Clicks | 23,053 Other Clicks |
|-------------------------|--------------------------|-------------------------------|

NEGATIVE FEEDBACK

| | |
|-------------------------|-------------------------|
| 23 Hide Post | 9 Hide All Posts |
| 0 Report as Spam | 0 Unlike Page |

To contextualise the situation we shared images of work being carried out on the front line. This follows our tried and tested strategy of lifting the lid on the work we do, turning front line colleagues into advocates and ambassadors, showing that the whole business is working in service the customer. Customer responses were typically very supportive.

Similar content was posted on Twitter. Our tweets over this period received more than 240,000 impressions.



As we have built up a large Twitter following as a result of regular and relevant updates targeted at specific communities, our message was reiterated by a large number of independent voices. For instance:



On the following days, posts contained videos from staff giving advice on how to deal with burst pipes in the home, how to contact an approved plumber, and how to inform us of leaks.

As these posts were 'boosted' they reached a larger number of people than they would otherwise (organically) have done. Again, they were fronted by regular staff, emphasising the focus of the whole business being on the customer.

During this period we also posted a number of targeted messages (dark posts) to specific locations, reaching communities affected by bursts, roadworks or potential cloudy water following a repair.

Anglian Water - Love Every Drop
Published by Jane Anglian [?] · March 5 at 2:15pm · @

The hard freeze of last week has now turned into a rapid thaw and this has led to a number of bursts and leaks. In the Felbrigg, West Runton and East Runton area, we have a cluster of around 40 properties affected by a couple of issues on the local pipe network. We appreciate some of these customers have been affected for the past day, and we are really sorry for the longer-than-usual disruption this has caused.
During today, we have hand-delivered bottled water to vulnerabl...
[See More](#)



Reported Leaks | Interruptions | Planned Investments | Events | Streetworks | Private Pumping Stations
In Your Area: Quickly find out what is happening in the Anglian Water area and stay up-to-date with all the latest developments.
[INYOURAREA.DIGDAT.CO.UK](https://inyourarea.digdat.co.uk) [Learn More](#)

8,994 people reached [Boost Again](#)

Recent Activity

Boosted on Mar 05
Audience: United Kingdom: (NR11 8), (NR27 9) ...
By Jane Anglian · Completed
[View Results](#)

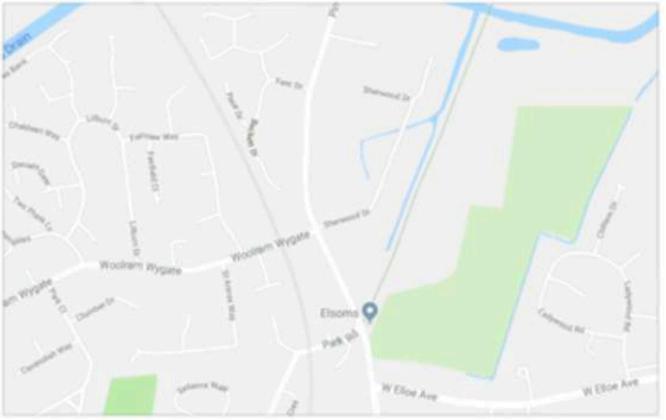
[Like](#) [Comment](#) [Share](#)

Natalie Brown, Alex Barrett and 8 others [Chronological](#)

45 Shares

Anglian Water - Love Every Drop
Published by Jane Anglian [?] · March 1 at 2:04pm · @

Commuters in Spalding please be aware there will be an emergency road closure at the junction of Woolram Wygate and Pinchbeck Road later today (Thursday) until Monday. A water main has burst due to cold temperatures causing ground movement. We will be posting updates at <https://inyourarea.digdat.co.uk/anglianwater/public...>
Work to repair water mains can sometimes result in cloudy or discoloured water. This is harmless and is caused by millions of tiny air bubbles. If you leave the water to clear in a glass or run your tap for a bit it will soon disappear. For more information visit the webpage here www.anglianwater.co.uk/cloudy



12,940 people reached [Boost Again](#)

Recent Activity

Boosted on Mar 01
Audience: United Kingdom: Spalding, Lincolnshir...
By Jane Anglian · Completed
[View Results](#)

[Like](#) [Comment](#) [Share](#)

[Like](#) [Comment](#) [Share](#)

Fatima Soares, Gary Tinkler and 38 others [Chronological](#)

402 Shares

SECTION H: DELIVERING ON OTHER BUSINESS PRIORITIES DURING THE EVENT

Despite the huge pressure and significant additional demand on resources at all levels within the business from the freeze thaw event, Anglian Water was nonetheless able to demonstrate its resilience in the round by continuing to deliver other priorities.

For example, the event coincided with the City Conference, which necessitated immediate and detailed follow-up work with our investors and Board. This included arranging and preparing for two short notice additional Board meetings. In turn this allowed us to make a series of major announcements about changes to our financial structures and governance in early March which responded to the challenges that were set out from Government and Ofwat around transparency and legitimacy of the sector as a whole.

Also in the midst of the weather event, we were concluding sensitive negotiations with national Trades Unions on changes to our pension scheme, and continued with a major Customer Engagement Forum session, an important element of our preparations for the PR19 business plan. Colleagues were able to cover for those otherwise engaged with manning the incident room for example.

Similarly, whilst coping with significant pressures from the severe weather, our water recycling operations were able to continue to operate (albeit with some constraints) and we redeployed assets from the water recycling side of the business to help deal with the more immediate pressures being faced on the water side of the business.

SECTION I: OUR RESILIENCE FRAMEWORK

Anglian Water has developed its approach to resilience over many years. In 2017, we appointed Arup to assist us in bringing together our various resilience streams in to a coherent framework, which we published alongside our refreshed Strategic Direction Statement.

The framework builds on Arup’s resilient cities approach, Cabinet Office guidance, and Ofwat’s guidance in the PR19 methodology and “resilience in the round” thinking. The framework has then been tested against the key shocks, stresses and risks that Anglian Water may face to ensure that the framework, and our implementation of it, will deliver a resilient business and continuity of services for customers and the environment.

We have used the framework to assess our maturity and to identify any gaps, where we could make improvements to further increase resilience. Arup will carry out an independent maturity assessment as part of our PR19 business planning process.

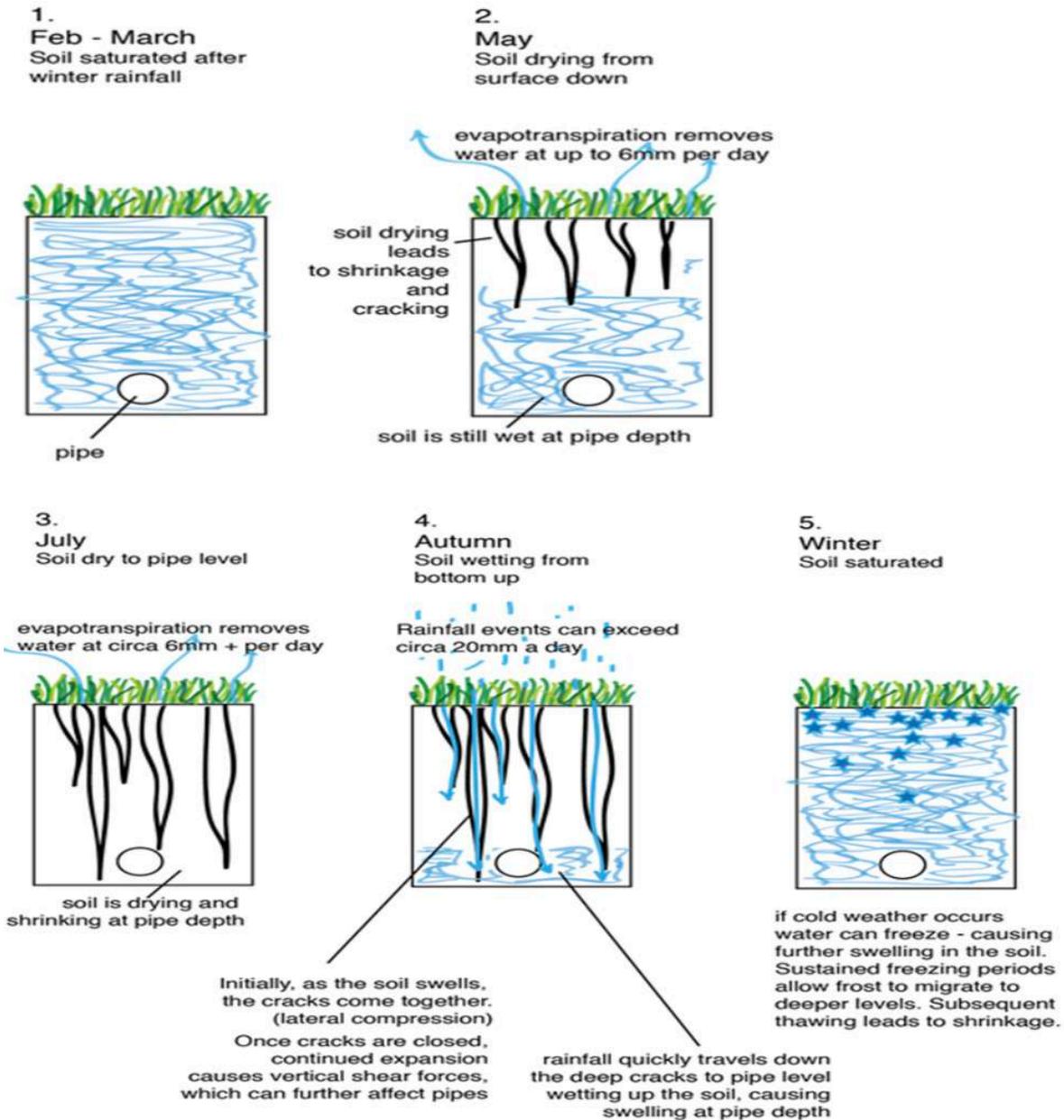
A key part of our approach to being a resilient organisation is learning from others – one such example of recent learning was of direct relevance to our ability to cope with the recent freeze/thaw event. One of the key learning points that we took from the United Utilities’ crypto event last year was the importance of having a readily available workforce that we could deploy in managing customer contact, helping vulnerable customers and deploying alternative water; we have set up AWF (Anglian Water Force) - a widespread network of Anglian Water employees that can be readily deployed across the region to talk to customers and assist them as needed.

²http://www.anglianwater.co.uk/assets/media/55189_AW_Long_Term_Strategy_single_pages.pdf

APPENDICES

Section B

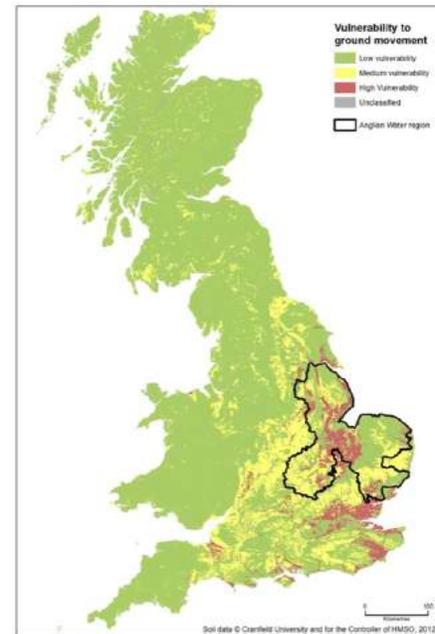
Extremes of weather, either cold or dry have a significant impact on ground movement, which then exerts forces onto mains and increases the likelihood of failure. This stems from the process outlined in the diagrams below taking place.



By assessing the shrink/swell effect and its relationship with burst main levels, we better understand the root causes of this phenomenon, which is directly impacted by soil type and climatic conditions.

Soil Types

- The AW region has a high vulnerability to ground movement due to being made up largely of clay and sandy soil types;
- Ground movement can take place as a result of extremes in weather;
- The presence of frost in soil can cause excessive expansion;
- Sudden thaw or a heat wave can cause excessive contraction / expansion (the shrink / swell effect);
- Persistent cold or hot temperatures causes the ground to expand and contract far more abruptly than in normal conditions.



Climatic Conditions

Soil Moisture Deficit (SMD) – is the amount of water needed to bring the soil moisture content back to field capacity, which is the amount of water the soil can hold against gravity. As SMD changes, the soil expands (saturation / low SMD) and contracts (drying / high SMD). This, in conjunction with temperature and average rainfall, directly impacts burst mains.

Average Rainfall – has a direct impact on SMD in conjunction with temperature. In the summer, even with rainfall, SMD tends to be high due to average temperatures being higher and causing moisture in the ground to evaporate and the ground to shrink. In the Winter, when average temperatures are lower, the ground tends to become saturated causing it to swell.

Average temperature directly impacts SMD. At higher temperatures, moisture in the ground evaporates, causing it to shrink. During Winter where temperatures are much lower and SMD tends to be lower due to the ground being saturated, the ground will swell. Moreover, in very low temperatures where the ground freezes, further swelling can occur. Once temperatures begin to rise and the ground starts to thaw, contraction/shrinking begin to occur.

These factors and their inter-relationships cause significant forces to be applied to mains due to expansion and contraction in ground movement. This causes the Anglian Water region to be more susceptible to higher levels of mains bursts during weather extremes such as experienced in December 2010 and March 2018.

Effects of extreme weather: December 2010 & March 2018

In both December 2010 & March 2018 a large increase in bursts was experienced due to weather extremes. Low Soil Moisture Deficit coupled with sustained low temperatures, and freezing conditions caused significant ground movement. The initial ‘freeze’ phase in both these instances, caused ground movement through swelling, followed by a ‘thaw’ resulting in shrinkage. In both instances, the thawing resulted in a significant increase in burst water mains.

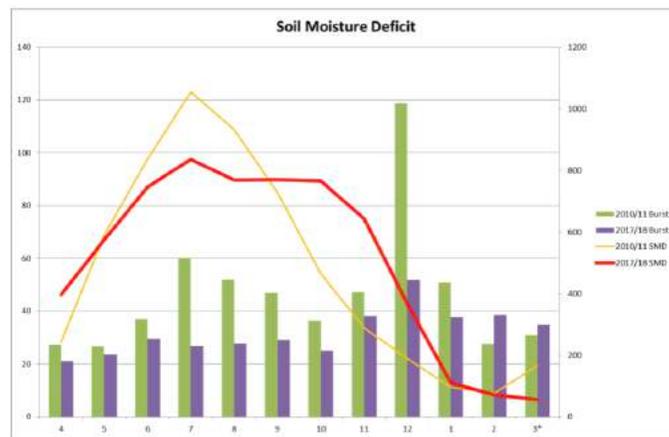
The graphs below are indicative of the interdependencies which exist between SMD, Average Rainfall and Temperature. In March 2018, the same climatic conditions can be observed – rainfall levels causing soil saturation in January and February 2018. This resulted in a downward trend in

Soil Moisture Deficit to very low levels. Freezing minimum temperatures during February with an average of 0°C caused further ground movement due to freezing. This continued into the first week of March 2018 however, it can be observed from the table below that as of the 4th March 2018 the variance in daily temperature between minimum and maximum increased until 10th March 2018 daily temperatures started to get warmer. The consequential thawing from 4th March 2018, experienced within the Anglian region, will have resulted in significant shrinkage and ground movement which resulted in a heightened level of burst mains.

Temperature Levels 1 March to 13 March 2018

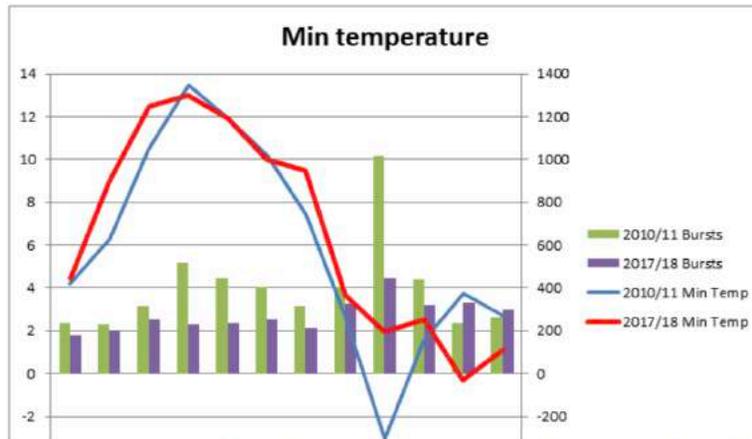
| Date | Min Temp °C | Max Temp °C |
|--------------------|--------------------|--------------------|
| 01/03/2018 | -5.868421053 | -0.715789474 |
| 02/03/2018 | -4.010526316 | 0.321052632 |
| 03/03/2018 | -2.057894737 | 3.394736842 |
| 04/03/2018 | 0.057894737 | 7.342105263 |
| 05/03/2018 | 2.026315789 | 10.11578947 |
| 06/03/2018 | 4.305263158 | 8.905263158 |
| 07/03/2018 | 1.068421053 | 9.526315789 |
| 08/03/2018 | 1.284210526 | 8.431578947 |
| 09/03/2018 | -0.310526316 | 10.67368421 |
| 10/03/2018 | 4.036842105 | 13.36315789 |
| 11/03/2018 | 4.010526316 | 11.34736842 |
| 12/03/2018 | 6.105263158 | 8.189473684 |
| 13/03/2018 | 3.884210526 | 10.45789474 |
| Grand Total | 1.117813765 | 7.796356275 |

Soil Moisture Deficit



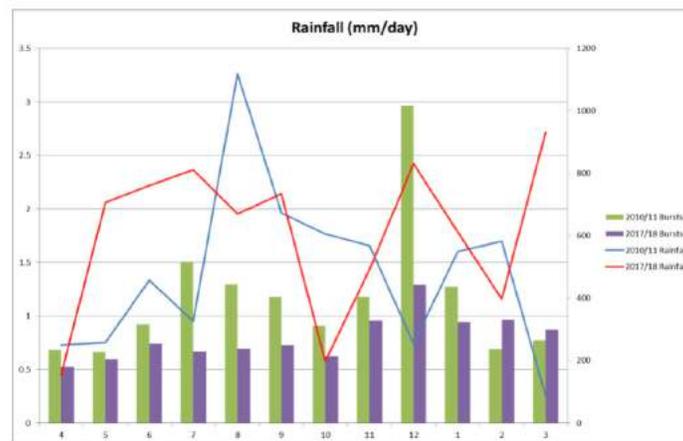
Soil Moisture Deficit (SMD) for 2010/11 and 2017/18 plotted against bursts

Minimum Temperature



Average Min Temperature (°C) for 2010/11 and 2017/18 plotted against bursts

Rainfall



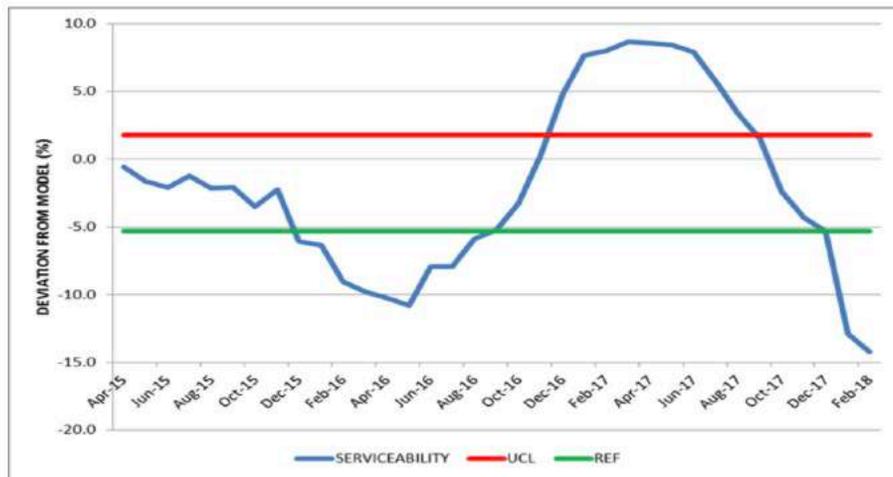
Rainfall for 2010/11 and 2017/18 plotted against bursts

Use of dynamic modelling to improve predictions and preparedness

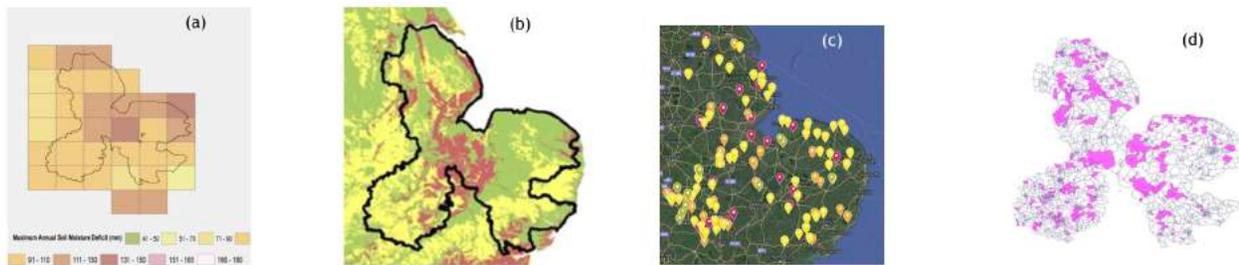
Using the research findings produced in collaboration with Cranfield University, a dynamic model was built and has been running since 2014. The model, known as WISPA (Water Infrastructure Serviceability Performance Assessment) uses our expert knowledge on the impacts of climatic conditions on water mains to predict how many burst mains are likely to occur as a result of the weather and the effects it has on the shrink/swell of soil types in our region. Our Serviceability Performance is then tracked against the model prediction by comparing the number of reactive burst mains we actually have.

The model runs weekly predictions and is reported on monthly. This model was approved by Ofwat for AMP6 to measure Water Infrastructure Serviceability performance. By predicting how many bursts are expected to occur as a result of weather conditions, Anglian Water is expected to remain below a +1.8% tolerance of the model prediction for number of bursts. Performance below this Upper Control Limit is recognised as 'Green' Serviceability status by OFWAT.

Between the 1st March and 8th March we recorded 245 reactive bursts. Whilst Anglian Water saw an increase in the number of burst mains as a result of the extreme weather in March 2018, Serviceability Performance is still forecast to be 'Green' status at the end of the financial year. Anglian Water is currently forecasting a year end position of -14.2% lower than the model prediction for 2017/18.



Whilst used as a tool to report regulatory performance, WISPA is also used as a decision-support tool within both capital investment and operationally. By mapping SMD (a) and vulnerable soil types (b), alongside historic burst history by area, main type, age and condition, we use this data to inform our prioritisation of capital investment.



The correlation can be seen with image (c) which geographically plots capital investment and (d) which shows pressure-managed areas which have been invested in to reduce leakage and bursts.

This is because we use WISPA and our detailed understanding of the impact climatic conditions have on ground movement and therefore burst mains as a decision-support tool within our investment planning. Ground movement and the understanding we have on areas of our water network which are susceptible to shrink/swell is used with root cause analysis undertaken during the promotion of capital investment and to ensure the correct totex solution is promoted and invested in.

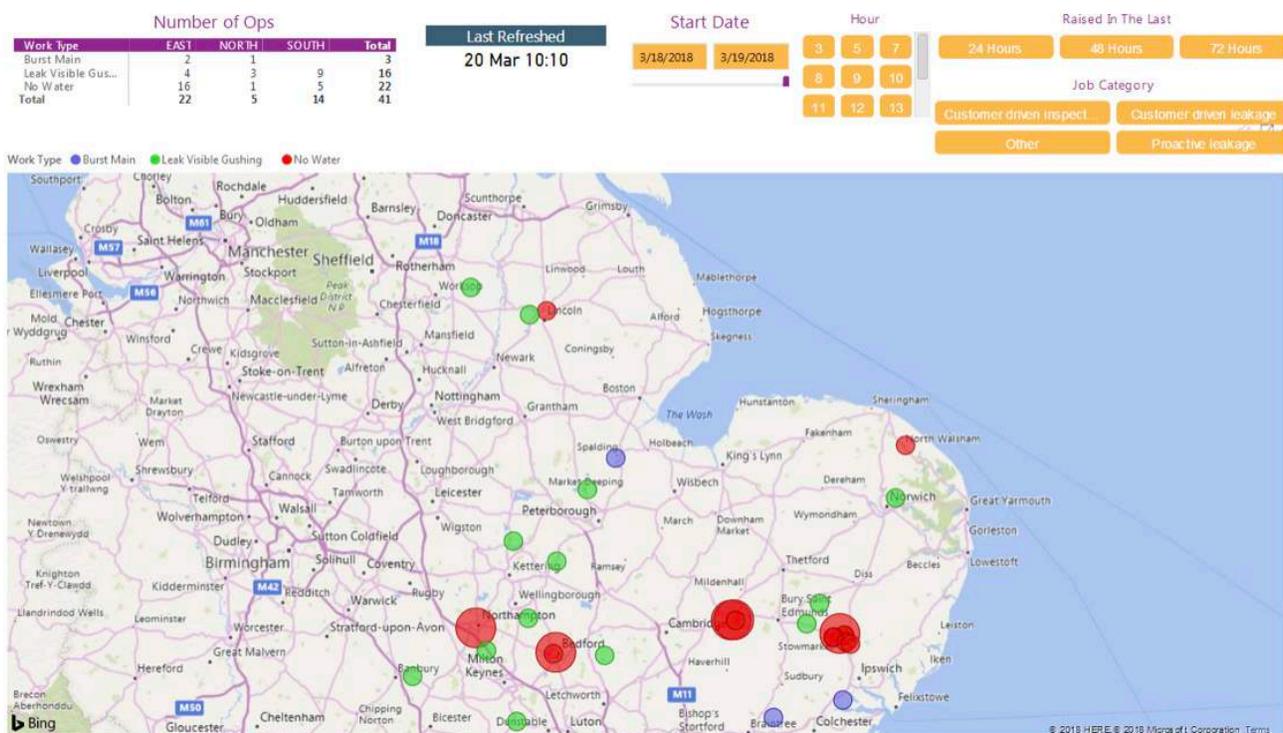
- c.60km of small diameter AC mains replacement in soils with high susceptibility to weather related ground movement resulting in bursts. Targeted investment in PVC, CI and AC mains replacement in areas where burst rates exceed WISPA predictions

- £17m of additional mains replacement was promoted in Year 3 of AMP6 in areas susceptible to mains failures due to climatic conditions
- Pressure management and optimisation schemes targeted in areas with greatest benefit (leakage and bursts) including Peterborough, Bury St Edmunds, Ely – all areas susceptible to significant ground movement. Since 2010, reduction of 564 bursts and 14.5 MLD leakage in pressure managed zones
- Noise Logging – Programme of fixed noise loggers planned to start this year in areas with high leakage and burst rates to detect leaks earlier. Results will also feed into investment planning to reduce burst rates in future.

SECTION D

Making best use of data: Our dashboard mapping tools

Below are examples of our dashboard mapping tools that were at the heart of our operational response.





Anglian Water Services Limited

Lancaster House
Lancaster Way
Ermine Business Park
Huntingdon
Cambridgeshire
PE29 6XU

www.anglianwater.co.uk

LED06/04/18