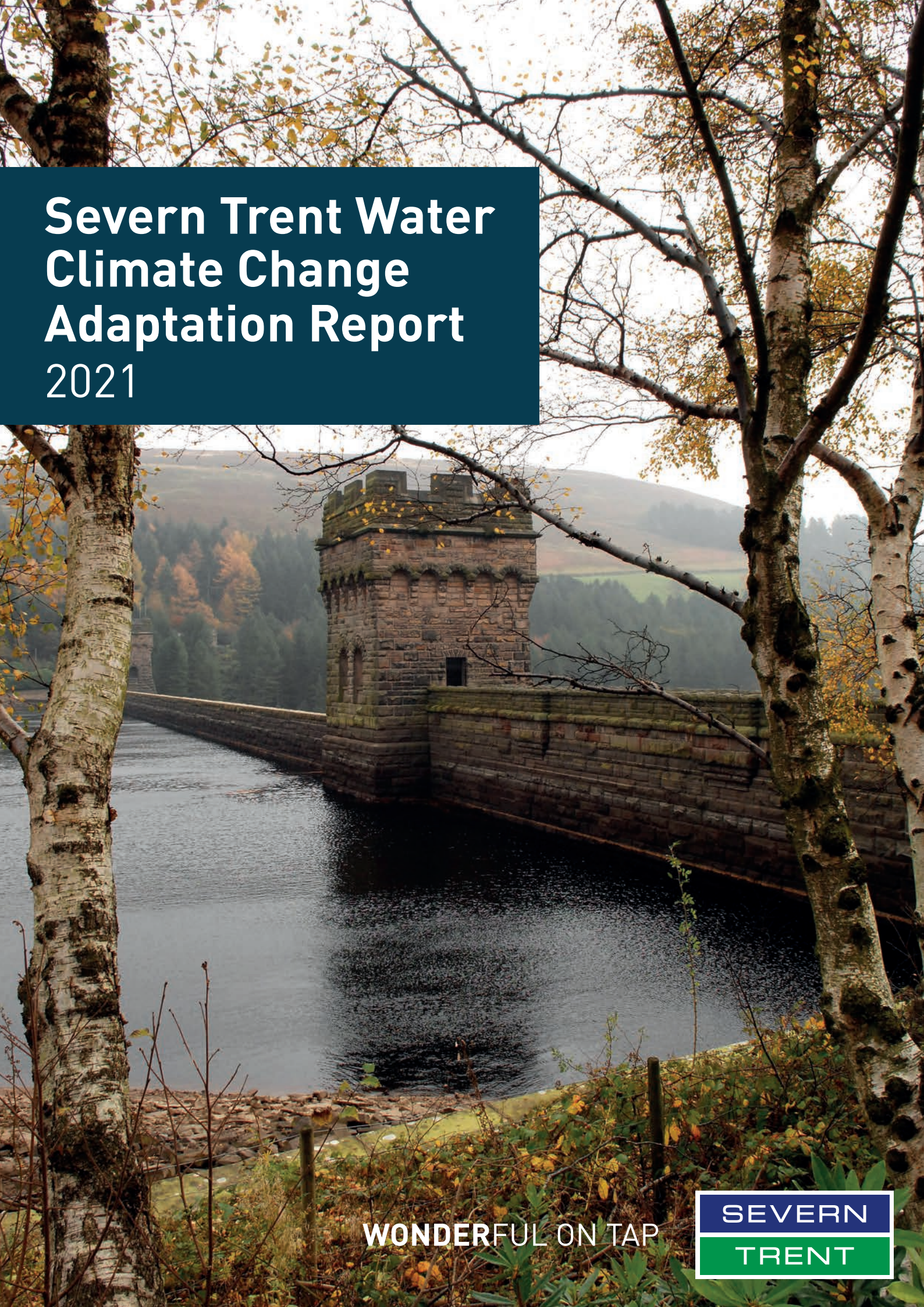
Severn Trent Water Climate Change Adaptation Report 2021



WONDERFUL ON TAP

SEVERN TRENT

Welcome from our CEO

I'm delighted to introduce Severn Trent Water's third Climate Change Adaptation Report, the first of which was published back in 2010. A changing climate is one of the greatest challenges our society will face this century. The latest scientific view, evidenced by national and international climate reports, highlight the scale of the impact we are facing and indicate that as a country we are not moving fast enough to adapt.

The changing climate poses a particular challenge to us as a water company. Our natural environment catches, holds, carries and helps purify our water and the climate drives many of our critical functions; from the filling of our reservoirs to the ways in which our customers use water.

What we do with water is elemental work, carried out on an epic scale. The impact of climate change on our operations will be met at the same scale and on the same terms.

In parallel with our efforts to mitigate climate change by delivering our ambitious carbon targets, it will be important to increase resilience to expected changing climate conditions and more frequent extreme events, in order to deliver a great service to our customers over the long term. To do this it is vital that we understand the risks we face as the climate changes, we need to deal with climate impacts now, and better plan and adapt for the future. We are planning for two degrees but preparing for four.

We are likely to see hotter, drier summers and wetter, stormier winters with more frequent extreme weather events. This will have impacts across the business, with increases in customer demand for water during hot dry spells, greater risk of deterioration in water quality, and greater potential for both low flow, as well as flooding.

The practical implications of this 'resilience planning' cascade across the business. It means, for example, constantly dialling up our efforts on sustainable abstraction, leakage reduction and demand management. It also means challenging and updating design standards, technological innovation and an even greater focus on nature-based solutions in our catchments, with nature-based landscape initiatives slowing the flow of floodwater and reducing the need for expensive hard engineered downstream solutions. Extreme events are set to become more common and therefore our operational mindset has to be one of treating them as something we have to be ready to cope with on a more regular basis.
We cannot control all the risks we are exposed to by ourselves, so we are working with our customers and communities and collaborating with partners, suppliers and other utilities to support wider adaptation measures across our region.

We have a strong understanding of our key climate risks and we use the latest climate models to inform our long-term strategic asset and operational plans. Our plans for ensuring the longevity of the water sources in our region are set out in our comprehensive 25-year Water Resources Management Plans (WRMPs) which you can find HERE.
We are now developing our first Drainage and Wastewater Management Plan (DWMP) the draft of which will be published in 2022.

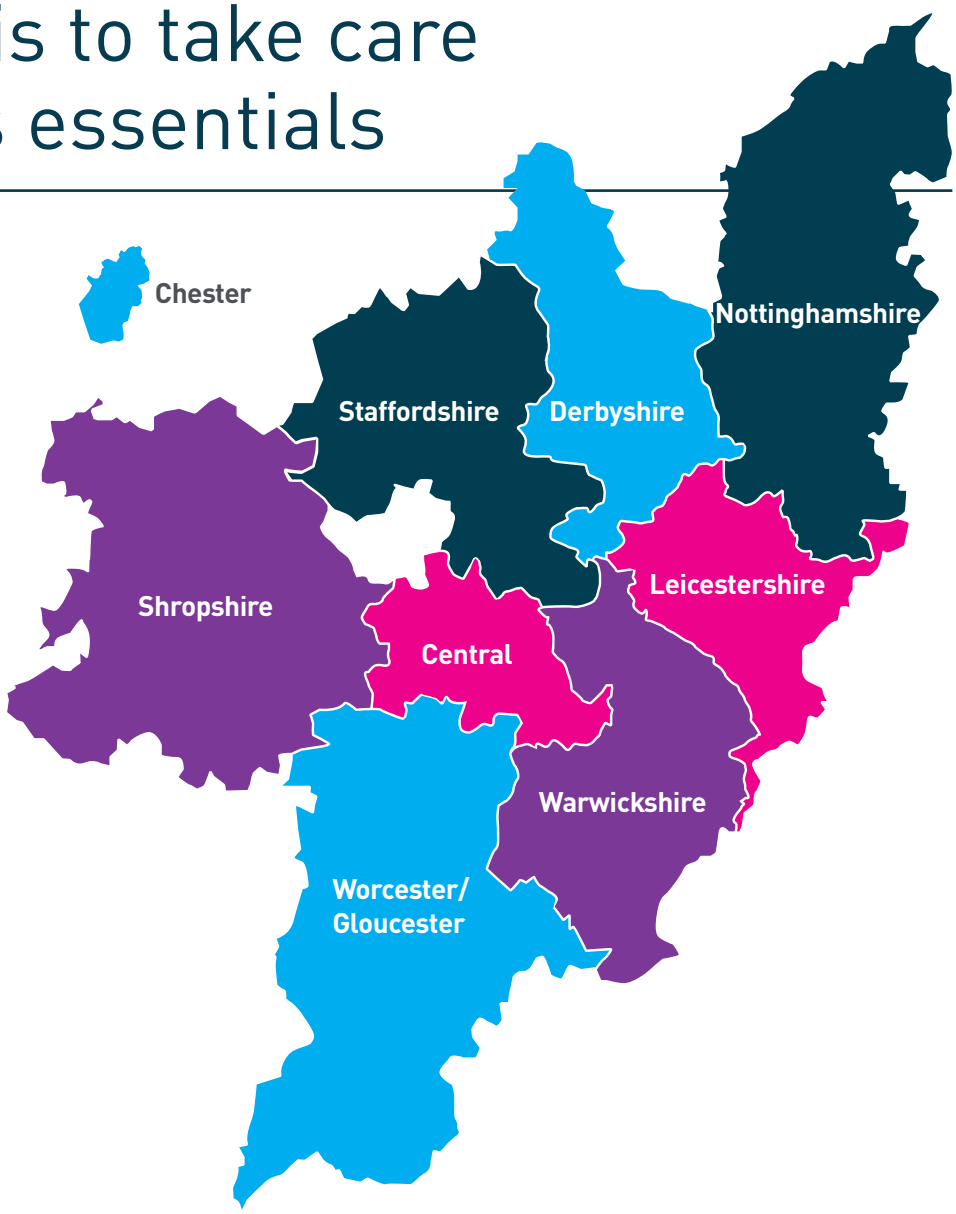
Climate considerations have long been central to our strategies and investment plans and they will remain so long into the future as we keep adapting to the changes around us.

Olivia Garfield, CEO Severn Trent

Our purpose is to take care of one of life's essentials

Severn Trent operates one of the UK's largest regulated water and wastewater businesses in England. We supply 2 billion litres of clean drinking water every day to more than 4.6 million households and businesses, and treat 3.1 billion litres of wastewater. Our region stretches across the heart of the UK, from the Bristol Channel to the Humber, and from Shropshire to the East Midlands.

At Severn Trent, we believe our clear social purpose helps drive the right strategic decisions for our business, our stakeholders and the environment we depend on. It is underpinned by our strong values and borne out in our culture which governs how we think and behave, from fostering a diverse and inclusive working environment to rewarding all of our people fairly.



One of the **largest** of the eleven regulated water and wastewater companies in **England.**

Employ **6,577 skilled** and **dedicated** employees.

Maintain **142,000km of water mains** and **sewers**, sufficient to circumvent the world 3.5 times over.

Remove over **3.1 billion litres** of sewage and drain water every day, enough to fill 1,240 Olympic swimming pools.

Serve **4.6m** homes and businesses.

Rated 4* (out of 4*) by the Environment Agency.

Supply around **2 billion litres** of clean drinking water every day – enough for 25 million baths.

Donate **1% of our profits** to charitable causes each year.

Cost to our customers of around **£1 a day** – one of the lowest in the country.

Comparisons based on 80 litres for an average bath; 2.5m litres for an Olympic swimming pool, and 40,030km as the circumference of the world. £1 a day for an average combined water and waste bill.

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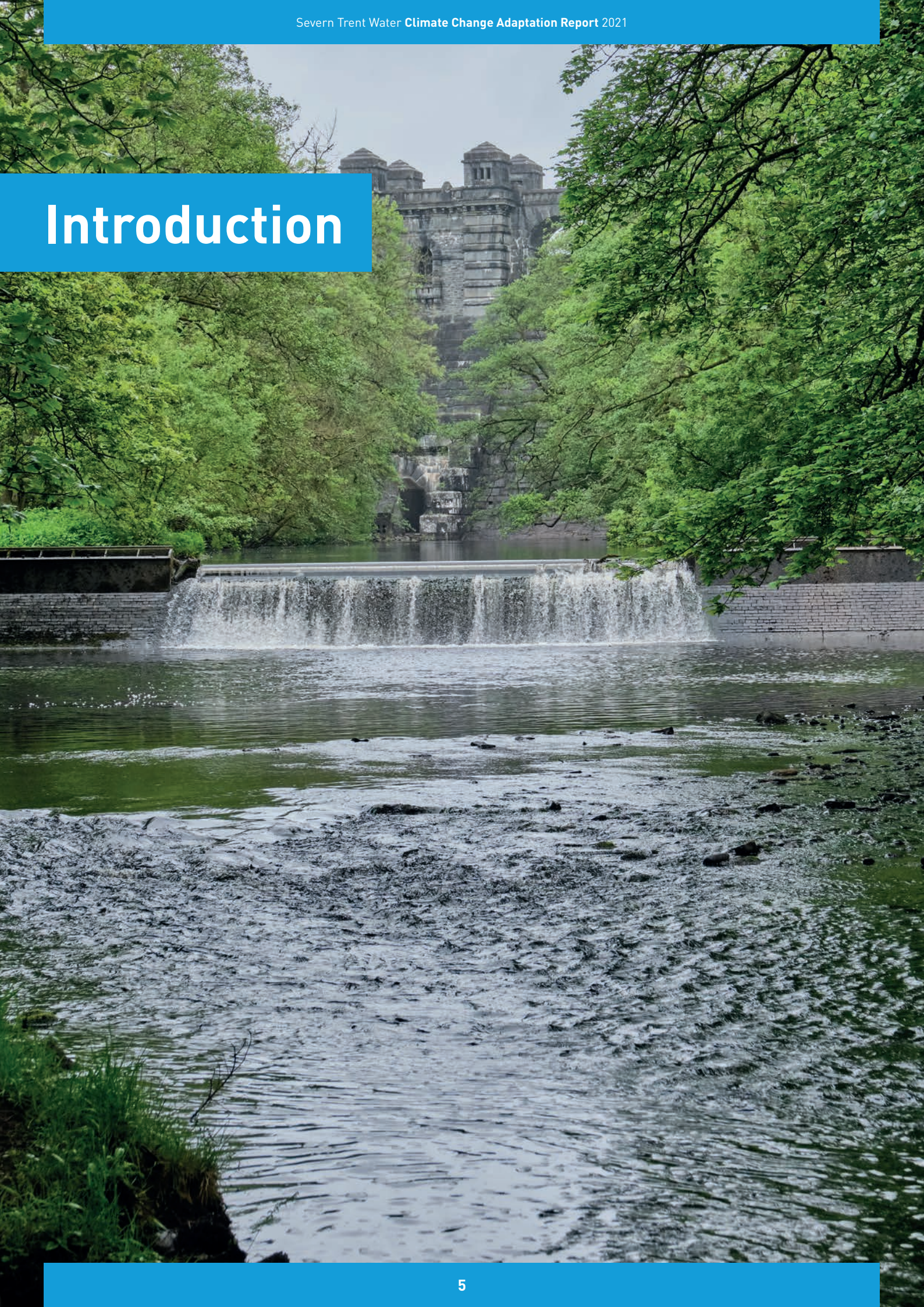


Introduction

This document is produced as a response to the invitation from Defra to report under the Adaptation Reporting Power as set out in the Climate Change Act 2008. Together with reports across a range of sectors, it helps the UK government to understand the level of risk that society is exposed to nationally and inform the level of response being taken to manage these risks. It also provides visibility to our stakeholders of the actions we are taking to understand our risks and the steps we are taking to be resilient to a changing climate.

COP26 served to further highlight the imperative to both mitigate and adapt to climate change at pace. The Glasgow Climate Pact has put science, nature and urgency front and centre, and galvanized global efforts behind 1.5°C, with a focus on the 45% emissions cuts needed this decade. It also called for doubling adaptation finance and acknowledged the importance of addressing loss and damage, an initial step forward for the most climate-vulnerable communities.

In our climate change adaptation report we:

1 Show how the climate impacts our operations

- The climate has very direct impacts on our business and operations
- We have recent experience of the impacts of extreme weather events
- The impacts are felt by our customers and the environment

2 Describe how we assess climate risks and how we plan to manage them

- We have been assessing climate risk for many years and have well established methods for doing so using latest climate scenarios and modelling
- The approaches are tied into our corporate risk processes and inform our TCFD reporting
- This report is our third report and we show progress made on the actions set out in our previous report
- Our scenario modelling uses RCP6.0 and RCP8.5 which correlate approximately to 2°C and 4°C of warming
- We are planning for 2°C of warming but preparing for 4°C

3 Provide a summary of our climate risks

- We have evaluated our climate risks using Defra's water industry climate risk categories
- We also set our risks in terms of how they impact the outcomes that we deliver for customers and the environment

4 Deep dive into our various climate risks, described against the outcomes we provide for our customers and the environment

- Our key risks are explored in more detail
- We share our strategies and plans to manage them
- We outline the future challenges
- **Ensuring that water is always there**
- **Ensuring that water is good to drink**
- **Ensuring that wastewater is safely taken away**
- **Ensuring that we support a thriving environment**
- **Ensuring that we deliver an outstanding experience**

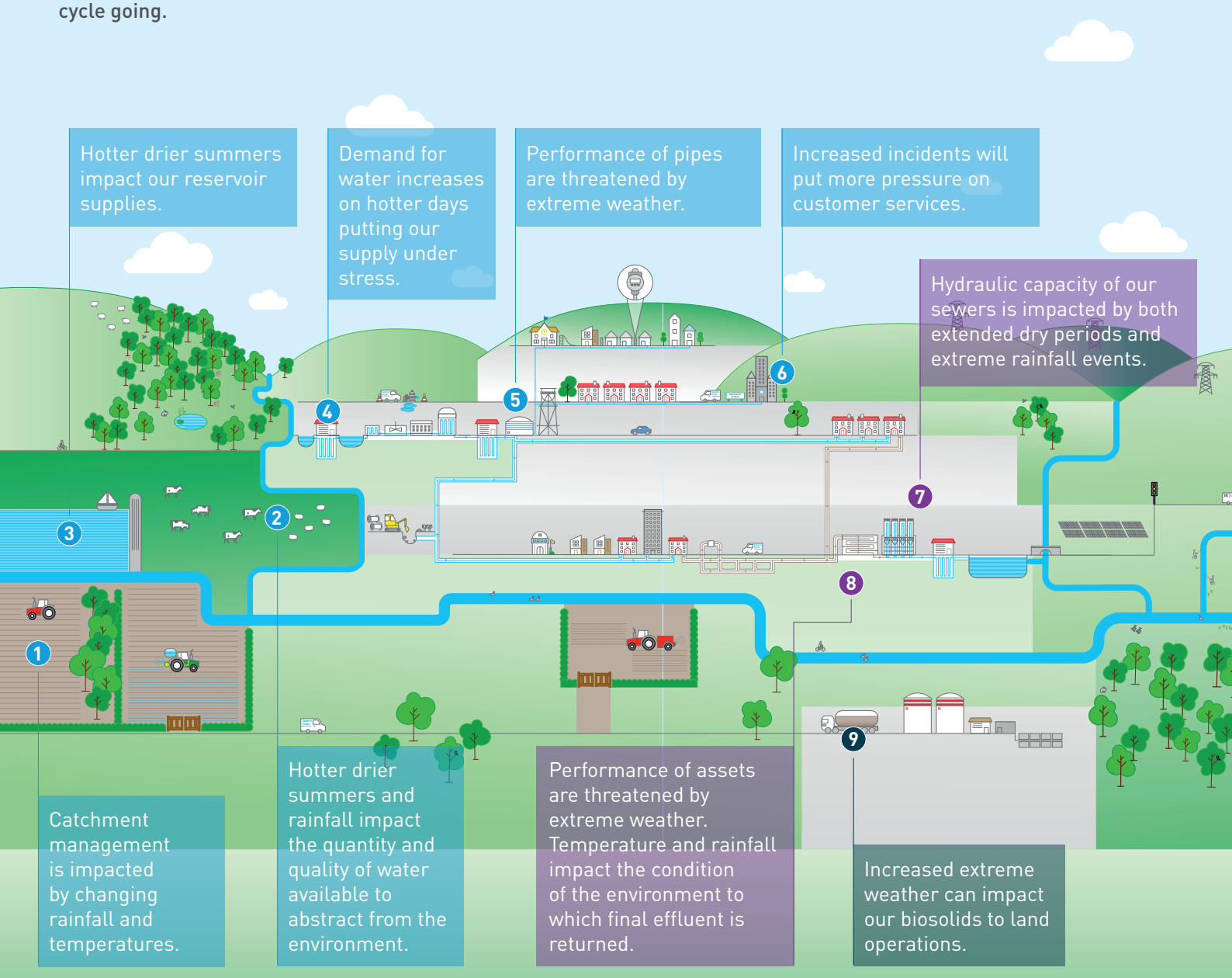
Our outcomes

5 Showcase the work we are doing with others to manage our climate risks

- Our risks can't be managed in isolation
- Our customers, supply chains and energy providers are critical to us being able to adapt
- Innovation holds the key to finding new ways to adapt and build resilience

How the climate **impacts our operations**

The changing climate poses a particular challenge to us as a water company. Our natural environment catches, holds, carries and helps purify our water and the climate drives many of our critical functions; from the filling of our reservoirs to the ways in which our customers use water. We balance our abstractions to protect levels of stored water for drier periods. We are taking action to reduce the amount we abstract in areas where there is a risk of causing environmental harm. After the water has been used by households and businesses across our region, we clean it and return it back into our rivers, keeping the cycle going.



We have recent experience of the impacts of **extreme weather events**

2020

Customer behaviour is changing

During the hot weather periods in 2020 we trialled more targeted customer communications in areas of highest demand where we had the most vulnerability to losing supplies. By using a range of text messages which adjusted messaging as the need to reduce water increased, we were able to show a measurable change in demand as customers, being mindful of the impact on themselves and their neighbours, reduced usage. This has now become a standard part of our toolkit in hot weather events to help mitigate against high water use putting a strain on supplies.

2018 Hot weather summer

Where incidents are of strategic level importance – as in the long duration incidents of 2018, we've quickly mobilised a 'gold level' incident team lead by our Executive Team.

Continuity of service is ensured through increased production, tankering and flexing resources to deliver the best response.

We also work closely with local resilience forums and our logistics partners to provide alternative supplies, and focus on our vulnerable customers to ensure they receive the level of support they expect, including hand delivering alternative supplies where necessary. And throughout, we've kept customers informed, answering queries directly through text messaging and social media 24 hours a day 7 days a week.

2021 2020 2019 2018 2017

2021

Whilst we experienced no less burst mains this year, our customer impact was reduced due to the network response teams that we have created (following learning from extreme events) to provide continuous supplies while mains are repaired.

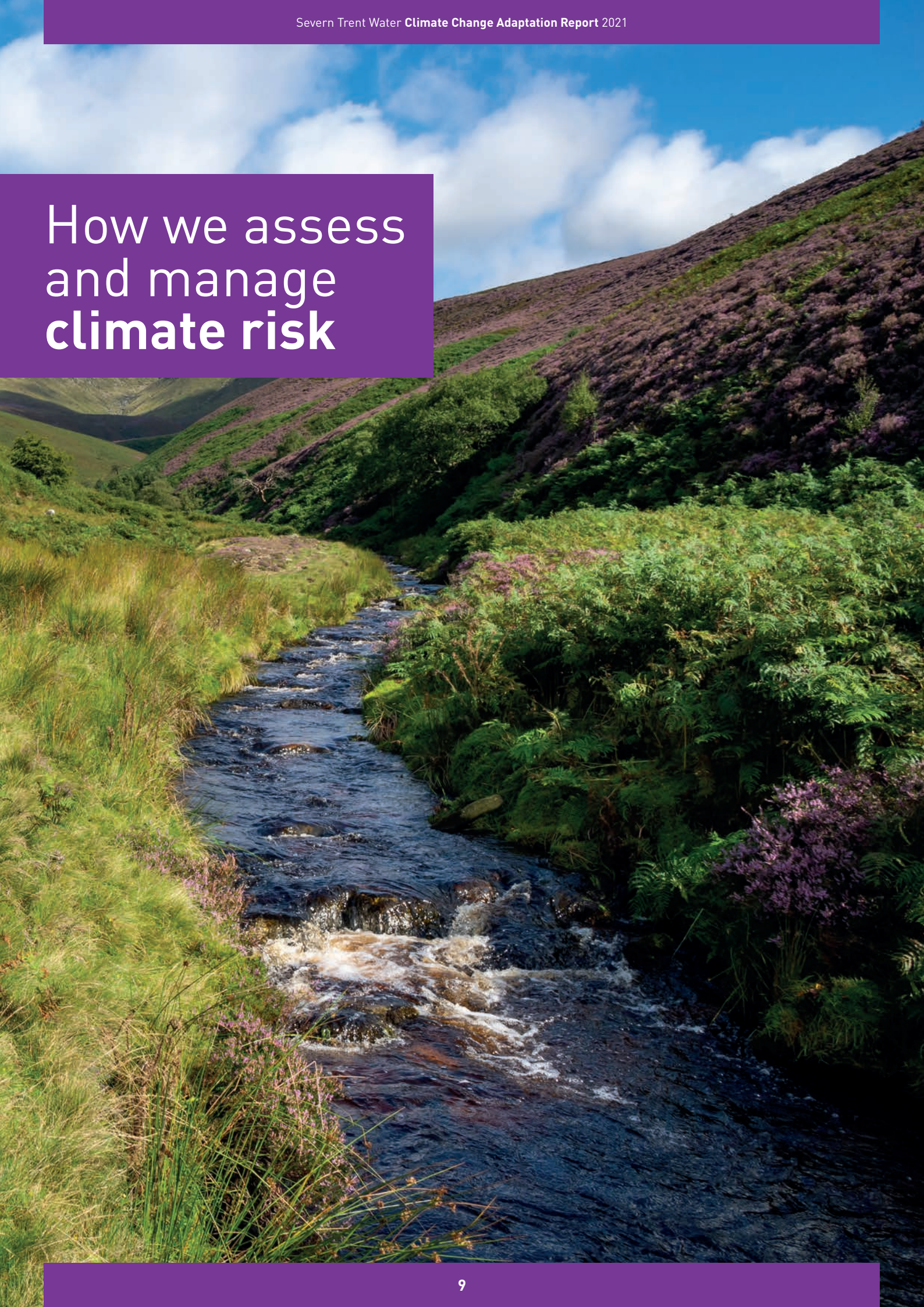
2018 Freeze thaw conditions

The rapid thaw following 11 consecutive days of freezing temperatures led to an increase in leakage of over 70%, mainly driven by an increase in burst pipes resulting in customers experiencing interruptions to supply.

We know the impact of this was significant for many of our customers and during this time they didn't receive the service they expect. The event was a catalyst for a full review of our operational resilience. We used qualitative and quantitative research and continue to actively engage with customers to understand their views better and test and refine our thinking as we've developed our plans. We've also collaborated with the rest of the sector to learn best practice and develop industry-wide solutions in areas where we can further improve operational resilience.

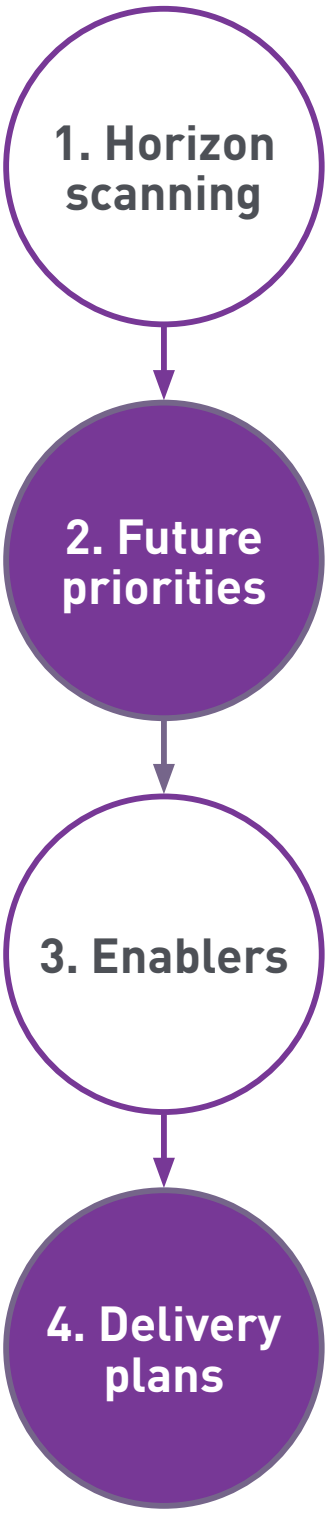
It isn't just specific events that are challenging. The succession of more frequent events also hampers the ability to recover between events. The volatility of high temperatures, extended dry periods, and high levels of rainfall in shorter periods of time can all combine to have a significant impact on our operation.

How we assess and manage **climate risk**



Sustainability, and planning for the long term is at the heart of our business

We recognise that the future is uncertain and that we cannot predict with accuracy what will happen. Therefore, we employ a strategic planning process to understand the risks we may face and identify the most appropriate responses.



Considers key trends and their implications, together with potential market developments, to identify and model alternative versions of the future (scenarios) and the pathways to them.

Describes our future priorities based on the challenges posed by key trends, together with our organisational purpose, the needs of our customers and other stakeholders, and current performance.

Identifies the enablers (activities) which underpin our future priorities, and the level of ambition appropriate for each one.

Allows us to look holistically across our business and ensure we have a coherent overall plan, which balances the needs of different stakeholders.

Creates a plan for each priority area and enabler to deliver on our ambitions, reflecting current commitments, lead times and delivery capabilities.

Includes reference to the implications on our people and IT systems as well as major infrastructure assets.

Climate change is a central consideration in our **long term strategy**

- Our Strategic Direction Statement (SDS) sets out our long-term priorities for Severn Trent Water based on our view of future trends and the areas of importance to our customers, investors, employees and wider society.
- Although we cannot predict the future, the key trends and resultant challenges for our business are clear. As are the future priority areas where we need to do more – to enhance operational performance and resilience, better support our customers, and deliver a positive environmental and social impact.
- Environmental issues feature prominently in our choice of the most influential trends and our biggest challenges for the next 30 years, where we have considered not only the impacts of climate change, but also how people's attitudes and behaviours may shift, and the implications of societies' wider need to decarbonise and become more sustainable.
- As part of this process, we have also considered different alternate visions for how the future might look. These alternate visions consider how the key levers of change (technological, behavioural, and regulatory) may develop and broadly cover a range of warming outcomes between 1.5°C and 4°C by 2050. These visions were used to ensure consistent interpretation across the trends and to understand how our priorities and level of ambition might differ if alternate scenarios were to occur.

Key trends

- Growing population
- Changing demographics
- Evolving customer expectations and attitudes
- Increasing use of maturing technologies
- Rising concerns over environmental pollution
- Mounting concerns over damage to the natural environment
- Greater impact/experiences of climate change
- Adoption of emerging solutions to decarbonise

Biggest challenges

- More demand for water
- Reduced water availability
- Increased risk of flooding and pollution
- Shift in attitudes towards the environment
- Increasing regulation and policy interventions
- Requirement to rapidly decarbonise
- Higher customer bills and impact on affordability

Future priorities

- Guarantee future water supplies
- Ensure water is used wisely
- Deliver a high quality, affordable service
- Lower the risk of flooding and pollution
- Protect and enhance our environment
- Support a more circular economy
- Make a positive social difference
- Maintain a safe, inclusive and fair workplace

We have committed to playing our part in **mitigating climate change**

We recognise the undeniable risks from climate change as set out in the IPCC's sixth assessment report and understand the roles that business, government and communities need to play to mitigate and adapt to our changing world. The water sector is facing significant challenges and will need to ensure resilience against the predicted impacts of increased population growth and climate change. Providing water and treating waste water is an energy-intensive process that requires a sector-wide approach, innovation and long-term strategic thinking to ensure that the risks affecting our ability to provide these services are mitigated. That's why our approach is to:

1) firstly reduce emissions within our control, with our Triple Carbon Pledge of net zero operational emissions, 100% energy coming from renewable sources, and 100% electric fleet (where available) by 2030. Building on this, we have a verified Science Based Targets in line with a 1.5°C pathway to reduce absolute Scope 1 and 2 emissions by 46% by 2031, and are working with our suppliers to measure and reduce emissions along the value chain. We have committed to ensure that 70% of our suppliers by emissions will have set an emissions reduction target in line with Science Based Target criteria by 2026.

2) We will play our part in the UK's Green Recovery and contribute to a clean energy system.

3) And we will maximise the benefits from mitigating and adapting to climate change through our role as a major land owner.

Over the next 25 years, we anticipate a period of increased investment across the sector to build a more resilient and flexible infrastructure that can cope with greater overall demand and volatility and lessen our impact on the natural environment. We are planning for 2 degrees of warming but preparing for 4.

Our key challenges across scope 1, 2 and 3 emissions are our supply chain, process and biogenic emissions. All of these require improved understanding of our emissions, working with and across complex supply chains and the use of new, untested technology to reduce emissions. Market availability of new technologies is still evolving and we will likely have to use offsets to balance those emissions that we can't reduce.

The transition to Net Zero brings with it other **risks and opportunities**

Journey to **Net Zero**

Our **Triple Carbon Pledge** and **Science Based Targets** commitment.

Triple Carbon Pledge

(For scope 1 and 2 offsets included)

by **2030** we have commited to:

Net Zero
carbon emissions across our operational business

100%
Energy from renewable sources

100% electric fleet where available

Science Based Targets

(For scope 1, 2 and 3* offsets not included)

46%

Reduce Scope 1 and 2 emissions by **46%** aligned to the IPCC Paris 1.5°C.

70%

70% of our suppliers, by emissions, to set a science-Based Target by FY2026.

13.5%

Reduce emissions from use of sold products by **13.5%**.

Scope One

Direct emissions from owned or controlled sources.

Scope Two

Indirect emissions from the generation of purchased electricity, steam, heating and cooling consumed.

Scope Three

Includes all other indirect emissions that occur in a company's value chain.

We know that concern about climate will drive a shift in attitudes towards the environment

Our customers will look for us to inform and support their endeavours to use less water and make it cheaper to be more environmentally friendly. We will need to adopt more innovation, more principles of the circular economy and reduce the impact of effluent returned to the environment. We will need to ensure we make the best use of our land and improve natural capital.

Combatting climate change could lead to more regulation and policy interventions

We will need to be prepared for more stringent laws, regulations and standards centred around environmental matters. We will need to ensure resilience around changes to carbon taxes and ensure readiness to act with nature-based solutions or new markets.

Mitigating climate change will require rapid decarbonisation

We will need to focus our efforts to reduce our total annual operational emissions to zero through using less carbon and finding renewable energy alternatives. And the growing demand for renewable energy presents market opportunities.

See the latest understanding and approach to our transition risks in our annual Task Force on Climate-Related Financial Disclosure Report (TCFD) **HERE**.

Climate change is embedded in our company **risk management approach**

Our approach to risk management is designed to enable the business to deliver its strategic objectives while managing the uncertainties that can manifest as both threats and opportunities.

We have an established Enterprise Risk Management ('ERM') process and control framework that enables us to effectively identify, evaluate and manage these risks to inform decision making in support of creation of value in a sustainable way. The Board has overall responsibility for ensuring that risk is managed effectively across the Group and that there is an effective risk management framework in place.

The impacts of climate change are closely linked to many of the key risks of our business and climate related risks are treated in the same way as all our other Company risks, captured by the responsible teams and managed centrally through our established ERM process. Management of climate-related risks is embedded in our everyday business activities and aligns with the way we approach all other Company risks through our ERM framework.

It is implemented through a top-down and bottom-up model of risk management with different groups exploring and examining risks through various lenses, and the recently formed Strategic Risk Forum ('SRF') provides a cross business holistic view of ERM risks, challenging the existing risk landscape as well as identifying new and emerging risks, including climate-related risks.

Our specific approach to managing climate-related risks is shown below, highlighting how we think about climate-related risks over differing time horizons.

Managing climate-related risks

MANAGEMENT CATEGORY	Tactical response	Regulatory review and engagement	Strategy
TIME HORIZONS	**0 – 2 years**	**Up to 5 years** (with considerations for up to 25 years)	**Up to 25 years**
SUMMARY	• Implementing tactical response plans for delivery of our annual performance targets in the face of acute physical risks • Evaluate and make recommendations for future improvements	• Our business plan describes the improvements that we will commit to deliver in the next Asset Management Plan ('AMP') cycle	• Long term plans exploring and accounting for the future potential risks we may face, including climate change uncertainty • How we will meet future challenges, and the steps that need to be considered
APPROACH TO MANAGEMENT	• Incident Management plans and Process Driven response plans • Drought Plan (triggers optimised and aligned with WRMP) • Root Cause Analysis outputs • Localised response strategies • ERM Framework	• Regulator approved Asset Management Plan investment approach • Rolling 5-year Business Planning approach • ERM Framework	• Water Resources Management Plan ('WRMP') produced every five years • Drainage and Waste water Management Plan ('DWMP') – first full publication due 2022/23 • ERM Framework
KEY ELEMENTS	• Undertake a granular and dynamic appraisal of the health of our assets • Data collection to drive longer term approach • Assess operational tasks / operation and maintenance of assets • Localised delivery of improvement plans • Small scale OPEX and CAPEX spending • Asset Health Dashboard	• Engagement with key stakeholders to agree response plans including EA, Ofwat and local communities • Modelling of scenarios to determine response strategies • Capital investment and promotions for delivery of large-scale capital upgrades	• Considers the potential long-term impacts of climate change on our essential services • Analysis of longer-term trends utilising UKCP18 datasets combined with internal modelling • Data-focused review through technical assessments and modelling • Risk strategies
FEEDBACK	⟷ Continuous review and feedback ⟷		

We use a range of methods to **assess and manage** climate risks

Our risk management system incorporates many important climate-related risks. We have recognised and consider the interaction of climate-related risks within our overall risk management system. Consequently, management of climate change related risks is embedded within individual risk control frameworks and mitigation strategies.

As part of the work undertaken for TCFD, the identified climate-related risks and key causes were assessed where the likelihood of the risk materialising could be exacerbated by climate change drivers.

Our established ERM processes ensures that regular review and assessment takes place within existing and emerging ERM risks. Our specific climate-related risk approach can be summarised through our recently developed 3-tiered system to drive appropriate action within our risk management approach **[please see the below illustration]**.

The risks outlined in this report are the climate related elements of our wider ERM risks and sit across different layers of the triangle.

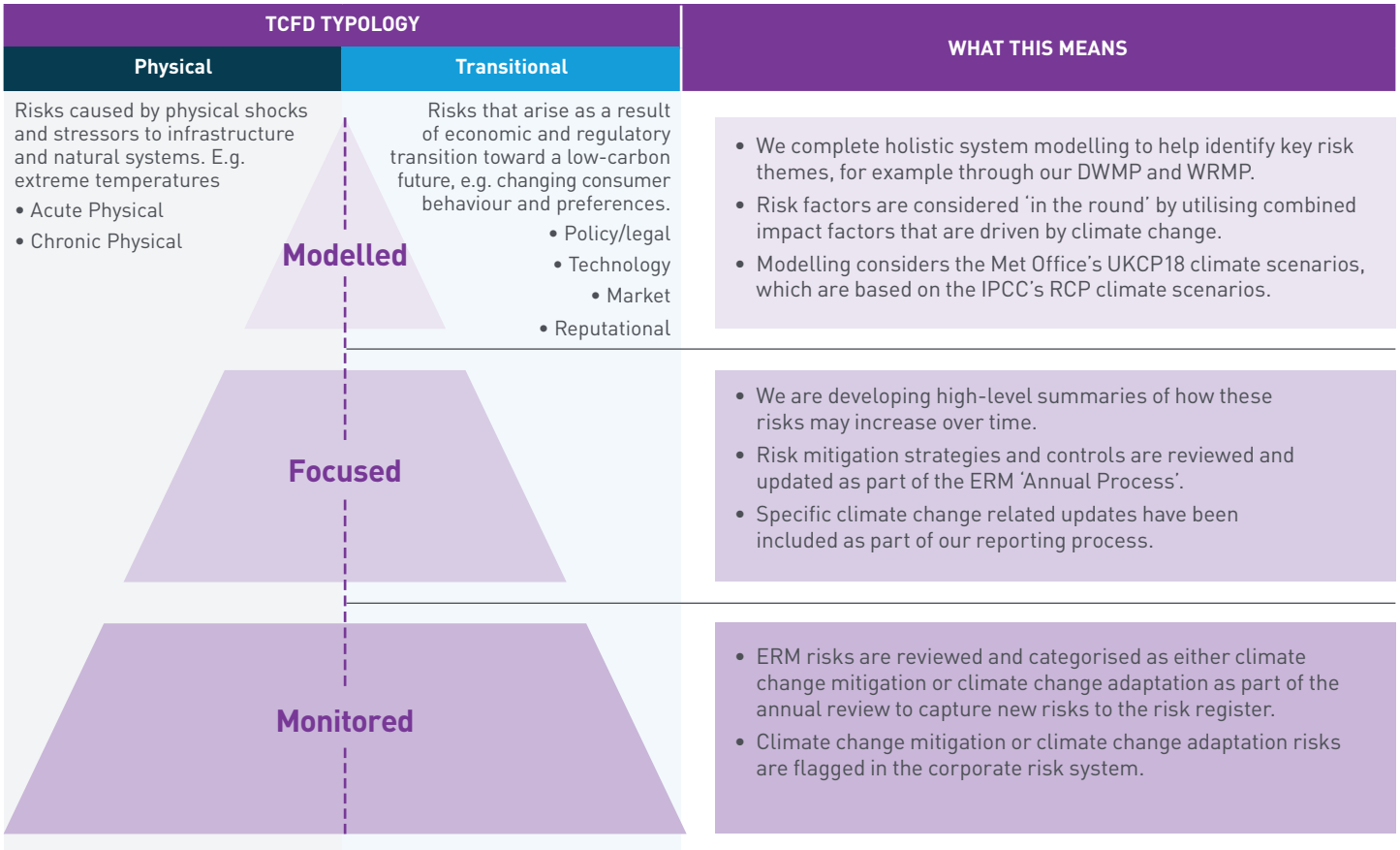
For this report they have been reviewed, assessed and challenged by subject matter experts through a common approach to enable us to compare all our physical climate risks on a like for like basis.

The risks with the highest scores are already modelled, but we will continue to assess and test our risks to ensure we are applying the appropriate level of assessment for the materiality of the risk.

These risks feed into our company wide approach for monitoring and maintaining the continued resilience of our assets and systems, as set out in our Asset Management Framework.

Since around 2004 we have been more formally developing our asset management approach and periodically assessing ourselves against recognised good practice. We have used frameworks such as 'Capital Maintenance Planning – a common framework' (and Ofwat's assessment tool AMA), British standard PAS55 and more recently International Standard ISO55001.

In Ofwat's sector wide assessment of the company responses published in October 2021, Arup independently confirmed our overall asset management maturity to be competent.

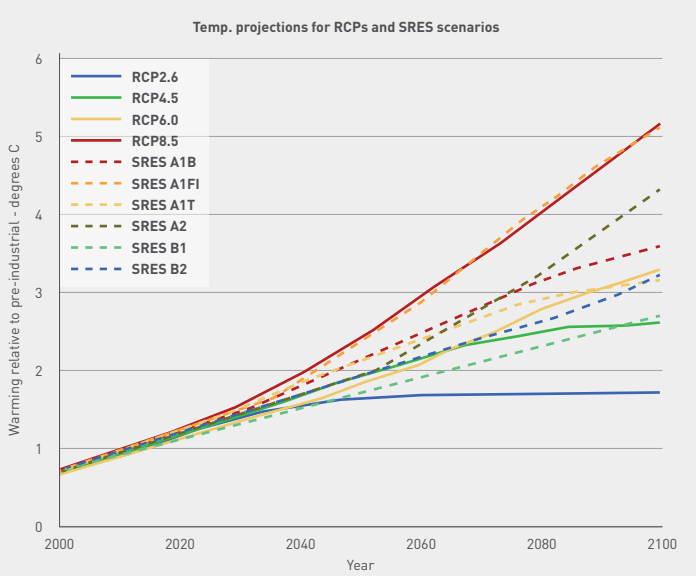


We use the latest **scenario modelling** to inform our climate risk

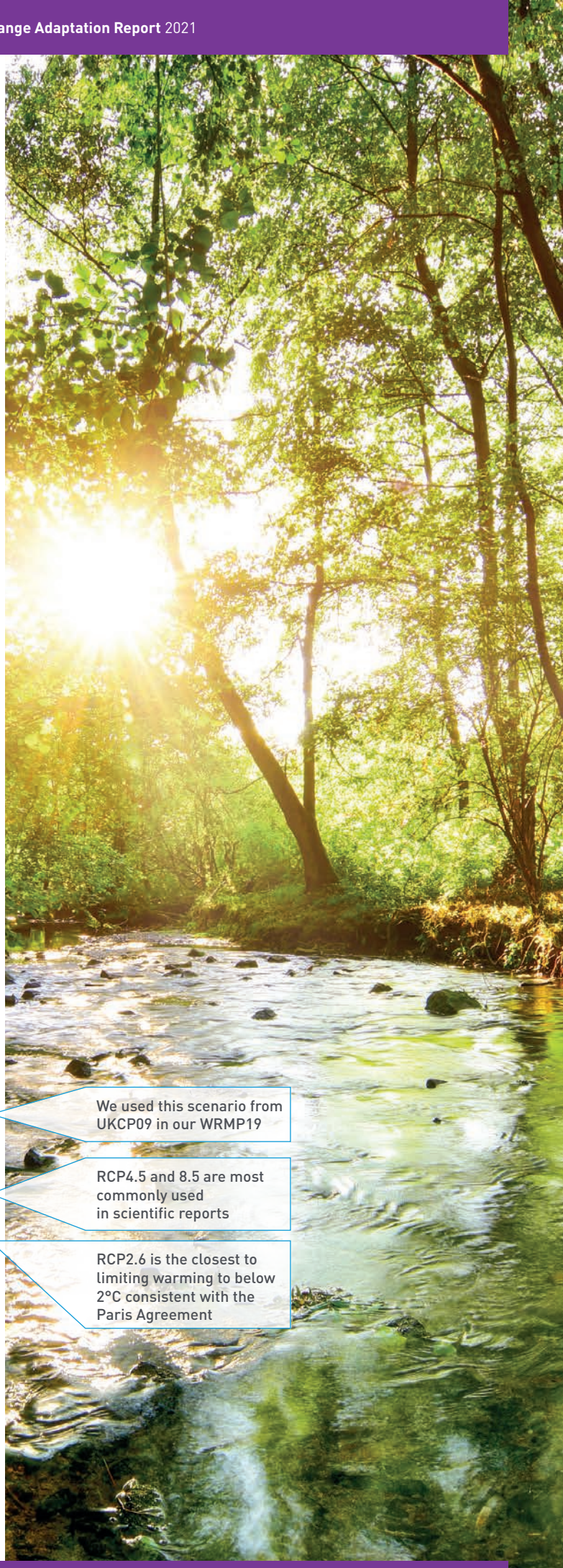
We use scenario analysis to help us understand the potential impact of climate change on our business and what conditions we may have to operate in. For our water resource plans we undertake scenario modelling against RCP6.0 and RCP8.5 which represent different concentrations of greenhouse gases and correlate approximately to 2°C and 4°C of warming to account for the worst case scenario.

The different scenarios alter the magnitude and likelihood of impacts, as well as the timescales that they will occur in. We particularly consider the impact of changing physical risks across our value chain, to ensure that we can continue to provide water and take away waste water for future generations in a world that is likely to see more intense and variable weather. We also consider the implications of different levers of change on our ability to provide services as part of our Strategic Direction Statement.

For the risks that are of potentially greatest vulnerability to climate change, our ability to provide water when it is needed and our ability to take waste water safely away, these are quantitively modelled using UKCP18 data. They also take into account regional complexities and are shared in full, as part of our WRMP and DWMPs. For other risks, we qualitatively assess the impacts, or monitor them.



RCP	Increase in global mean surface temp. (°C) by 2081-2100	Most similar UKCP09 SRES scenario in terms of temp.)
2.6	1.6 (0.9-2.3)	None
4.5	2.4 (1.7-3.2)	SREB1 (low emissions)
6.0	2.8 (2.0-3.7)	SRESB2 (between low and medium emissions scenarios)
8.5	4.3 (3.2-5.4)	SRESAF1 (high emissions)



A summary of our **climate risks**

We've made **good progress** on the actions set out in our last adaptation report

The awareness and urgency of needing to not just mitigate climate change but adapt to the impacts has increased since we published our previous report in 2015. Our business has changed too and climate considerations are fundamental to the decisions we make today.

We are committed to ambitious targets to reduce per capita water consumption in our region, already one of the lowest in the UK, through water efficiency programmes. We are using a combination of hard work and innovation to tackle leakage. We are constantly monitoring abstraction to reduce detrimental impacts on the environment and ensure that we can continue to access water sources in perpetuity. And, in common with other water utilities in the UK, we are working towards 100% treated effluent compliance and reduced rates of sewage discharge into rivers, with a future aspiration of zero pollution incidents.

We have delivered against the actions we committed to in our 2015 report including:

Our ambitious water efficiency programme has already saved around 25 million litres per day between 2015 and 2020 through water efficiency advice for customers.

Investing over £250m improving resilience by providing Birmingham with an alternative water supply and enabling vital maintenance work on the Elan Valley Aqueduct.

Increasing the coverage of our live hydraulic model as part of our Sewerage Management Plans so that 100% of our population are now covered. All our models are now kept up to date to ensure current and future performance of our networks can be assessed and this has proved to be invaluable to supporting with development of our Drainage and Wastewater Management Plans.

Improving customers' levels of service by reducing leakage by 10% and supply interruptions by 26%.

A full list of the actions from our 2015 report and an update on progress can be found in appendix 1.

Key risks and what's changed

Our changing risks

Our key water risks are:

- **Abstraction restrictions** - Hotter drier summers and extended drought will affect aquifer output and result in reduced reservoir and river levels. This can lead to restrictions on the amount we can abstract, and subsequent failure to supply enough water or increase in costs to use alternative sources.
- **Customer demand** - Hotter drier summers and an increased frequency and severity of hot spells impacts customer behaviour causing an increase in short-term peak demand for water leading to loss of pressure or failure to supply enough water.
- **Catchment management challenges** - Wetter winters and increased storminess and drier summers with extreme rainfall events mean greater seasonal variability causing challenges for farming. This may reduce our opportunities to engage with farmers which in turn will reduce catchment management schemes leading to a decrease in raw water quality.
- **Raw water quality** - Increasing temperatures cause an increase in algal blooms in reservoirs affecting water quality, reducing the volume of water that can be abstracted and treated. Treatment works have to work harder to treat the water, reducing the amount of water that can be output into supply to meet customer demand.

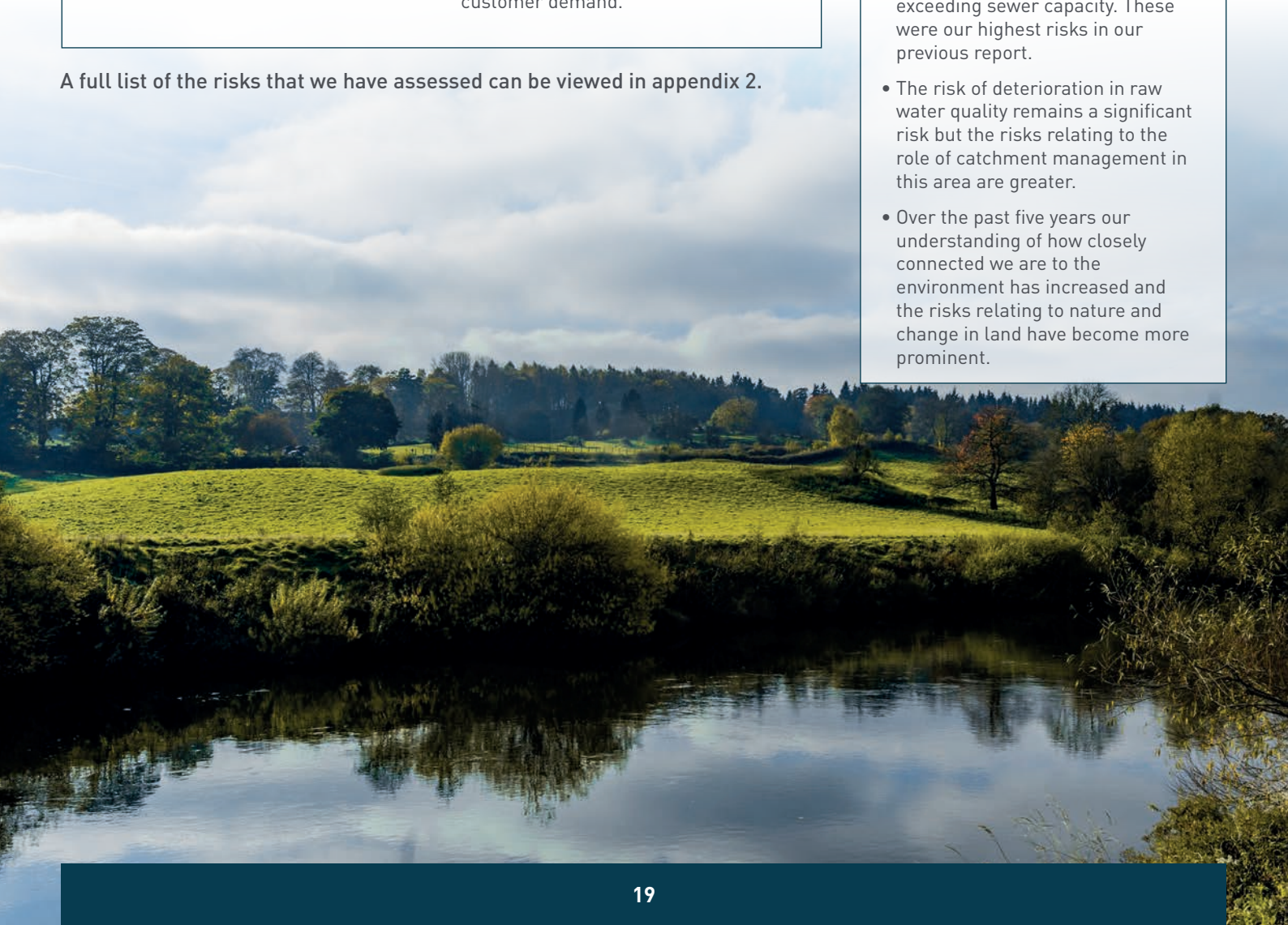
A full list of the risks that we have assessed can be viewed in appendix 2.

Our key waste risks are:

- **Exceeding sewer capacity** - Warmer wetter winters and increased storminess cause increased storm intensity which exceeds the capacity of the wastewater network, resulting in increased flooding and operation of storm overflows.

What's changed since our previous report:

- Our highest water and waste risks in our latest assessment centre around customer demand for water, reduced ability to abstract water from the environment and exceeding sewer capacity. These were our highest risks in our previous report.
- The risk of deterioration in raw water quality remains a significant risk but the risks relating to the role of catchment management in this area are greater.
- Over the past five years our understanding of how closely connected we are to the environment has increased and the risks relating to nature and change in land have become more prominent.

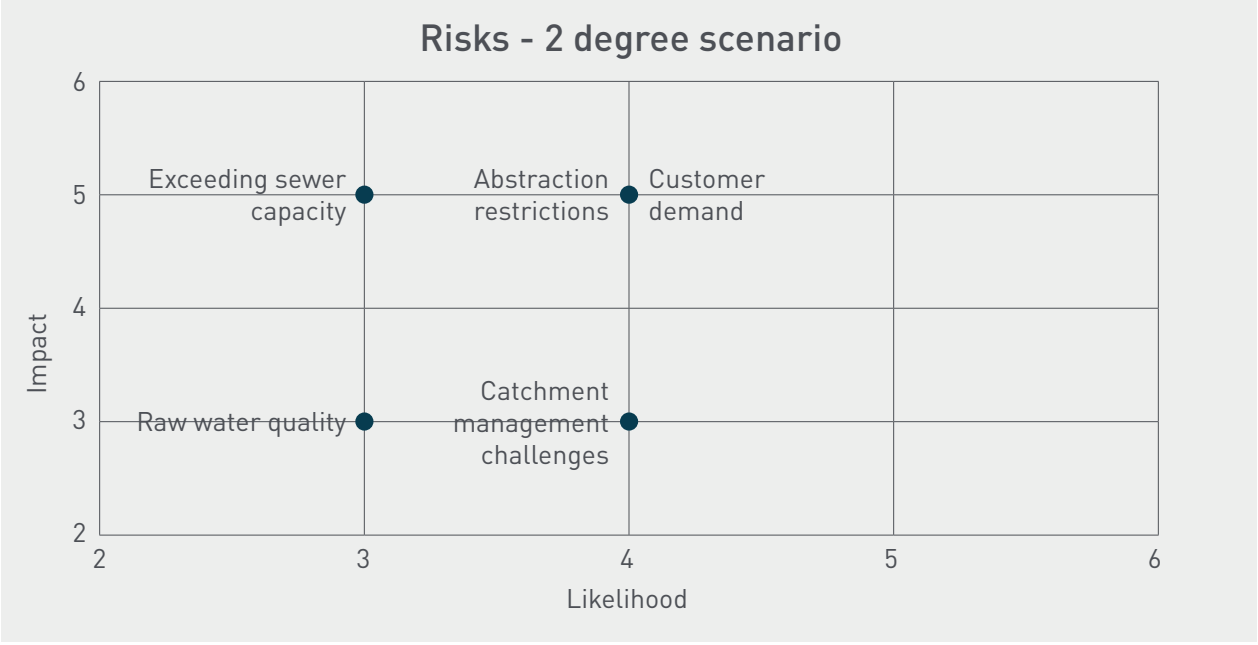


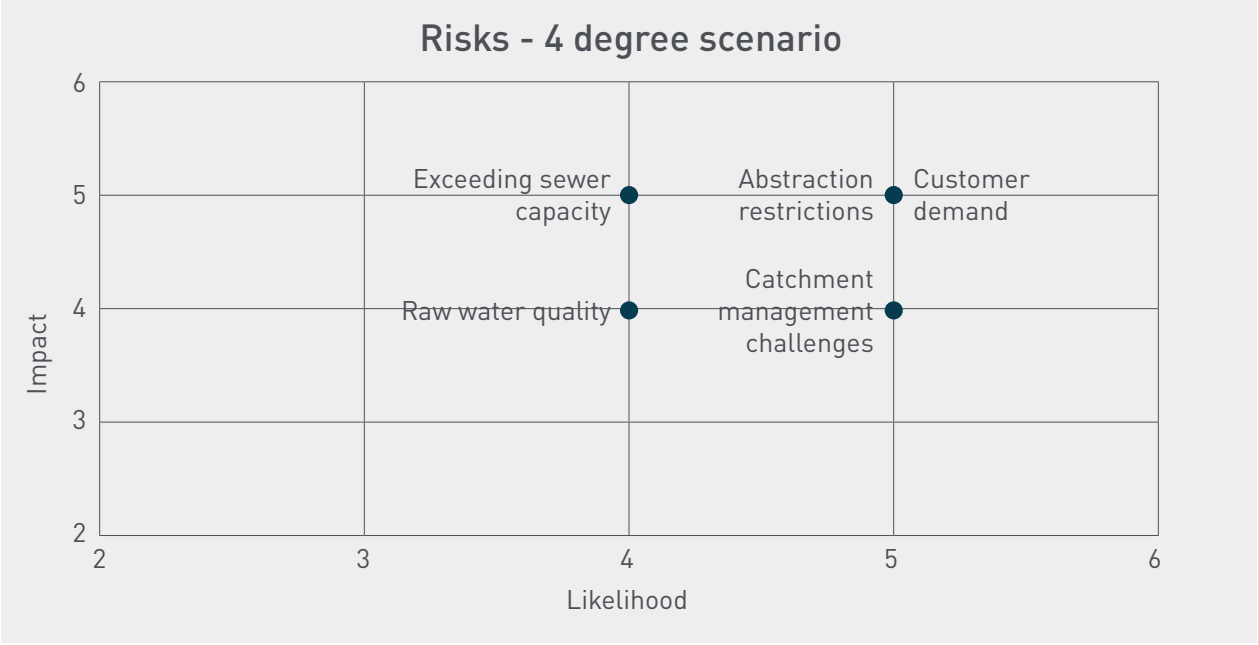
We are planning for **2 degrees** but are preparing for **4 degrees**

We are planning for climate change in line with a two degree scenario but we're preparing for four.

All of the climate risks we have identified have been assessed in terms of likelihood and impact against a 2 degree and 4 degree scenario.

Our assessment indicates that there is a significant shift in risk levels between the two degree and four degree scenario. This demonstrates the importance of considering the potential implications of the higher emissions scenario in our strategies and plans.





A full list of the risks that we have assessed can be viewed in appendix 2.

Our **climate risk summary** using Defra's categories for the water industry

CCRA 2017 Risk	Directly relevant to WaSC?*	Likelihood of risk occurring to WaSC	Magnitude of impact on WaSC service	Risk under-standing	Controls & Actions	Metrics/reporting
In1: Risks of cascading failures from interdependent infrastructure networks	Y	M	M	M	Maintain and improve water production capacity and network connectivity and reduce leakage and water demand. This indirectly impacts our resilience to power outages by giving us more headroom and options in the event of power failures. Energy management; including behind-the-meter generation, efficiency improvement and demand flexibility. These actions reduce the capacity we require from electricity networks and assist grid and distribution networks in managing supply and demand.	Our reporting considers the number of properties and areas benefiting from a reduced risk of flooding from our sewer network achieved by working in collaboration with other Risk Management Authorities ('RMAs') or other organisations.
In2: Risks to infrastructure services from river, surface water and groundwater flooding	Y	H	M	H	Flooding risk assessments at our sites and investment where required to improve flood protection. Improved preparation for incidents and incident response. Our company wide approach for monitoring and maintaining the continued resilience of our assets and systems is set out in our Asset Management Framework ('AMF'). We carry out asset planning over four different time horizons to enable us to align our long term ambitions (30 years ahead) with medium term business plans (5-10 years) and our day to day decisions and delivery. All of which are underpinned by the technical evaluations completed in our water resource and drainage and waste water management plans.	Resilient supplies - We report on the percentage of customers whose service to the tap can be restored within 24 hours of a single failure event in their normal supply route.
In3: Risks to infrastructure services from coastal flooding and erosion	N	L	L	M	Severn Trent is located in the midlands and does not have any coastline.	N/A
In4: Risks of sewer and surface water flooding due to heavy rainfall	Y	H	H	H	Our DWMP is a 25 year plan, and our resulting investment plan and specific actions are set on a five yearly basis in line with the water industry regulatory cycle. We are now carrying our detailed modelling and assessment of the impact of climate change in our Drainage and wastewater Management plan which will be refreshed every five years. This is factored into our solutions and five-year investment plans.	We report around the number of external sewer flooding incidents per year. We report on the number of internal sewer flooding incidents per year, including sewer flooding due to severe weather events per 10,000 sewer connections. Our reporting considers the percentage of the population served that are at risk of sewer flooding in a 1-in-50 year storm, split into 5 vulnerability bands. Our reporting considers the number of properties and areas benefiting from a reduced risk of flooding from our sewer network achieved by working in collaboration with other Risk Management Authorities ('RMAs') or other organisations. We report information relating to the annual operation of storm overflows to the Environment Agency as part of Event Duration Monitoring.
In5: Risks to bridges and pipelines from high river flows and bank erosion	Y	M	M	M	Our company wide approach for monitoring and maintaining the continued resilience of our assets and systems is set out in our Asset Management Framework ('AMF'). We carry out asset planning over four different time horizons to enable us to align our long term ambitions (30 years ahead) with medium term business plans (5-10 years) and our day to day decisions and delivery. All of which are underpinned by the technical evaluations completed in our water resource and drainage and waste water management plans.	The impact of risks to bridges and pipelines is covered by our water supply and waste removal metrics and reporting.
In8: Risks to subterranean and surface infrastructure from subsidence	Y	M	M	M	Our company wide approach for monitoring and maintaining the continued resilience of our assets and systems is set out in our Asset Management Framework ('AMF'). We carry out asset planning over four different time horizons to enable us to align our long term ambitions (30 years ahead) with medium term business plans (5-10 years) and our day to day decisions and delivery. All of which are underpinned by the technical evaluations completed in our water resource and drainage and waste water management plans.	The impact of risks to subterranean and surface infrastructure from is covered by our water supply and waste removal metrics and reporting.
In9: Risks to public water supplies from drought and low river flows	Y	H	H	H	We are working closely with the regional Water Resources planning groups to look out 75 years ahead. Our WRMP iterates within these regional plans. Our WRMP is a 25 year plan, and our resulting investment plan and specific actions are set on a five yearly basis in line with the water industry regulatory cycle. Our Water Resources Management plan is refreshed every five years and contains detailed modelling and assessment of the impact of climate change. This is factored into our solutions and five- year investment plans.	Resilient supplies - We report on the percentage of customers whose service to the tap can be restored within 24 hours of a single failure event in their normal supply route. We report on the percentage of the population that would experience severe supply restrictions (e.g. standpipes or rota cuts) in a 1-in-200 year drought. We report the increase in sustainable water supply capacity needed to maintain our projected end AMP8 supply / demand balance.
In14: Potential benefits to water, transport, digital and energy Infrastructure from reduced extreme cold events	Y	L	M	M	N/A	Benefits of reduced impact on water supply and waste pipes are including in water supply and waste removal metrics.

*WaSC = Water and Sewerage Company

Deep dives into our various climate risks, described against the outcomes we provide for our customers and the environment

Ensuring that...
Water is always there

Our customers can rely on water to start their day, and throughout their day, every day. And we work together to make sure it stays that way for future generations.

Add WTW flood risk	Enough supply	Increased demand
Key risks and impacts	• Reduced reservoir, river and groundwater levels results in restrictions on the amount we can abstract - failure to supply enough water or increase in costs to use alternative sources • More frequent triggering of our emergency drought plan to maintain security of supply - puts the environment at risk, legal compliance with abstraction licenses and failure to supply enough water • The impact of weather on our assets	• Increased frequency, duration and severity of hot dry weather in spring and summer spells leads to a change in customer behaviour and spikes in customer demand • Our fixed capacity assets struggle to deal with these increasingly large and more frequent peak demand events risking loss of pressure or failure to supply enough water
Our commitments	• Reduce leakage by 15% by 2025, and by 50% by 2045 • Increase our supply capacity through delivery of our green recovery project on supply resilience – second source • Environmental commitments in WR plan • WINEP3 – reducing our abstractions where they impact the environment (Restoring Sustainable Abstraction) and complying with Water Framework Directive (environmental measures and no deterioration)	• Reduce per capita consumption by 3.5% by 2025 • Our schools programme will reach 500,000 children, educating on the value of water, responsible sewer use and the importance of hydration to health • We will deliver 35,000 home water efficiency visits • Install 400,000 water meters, provide water saving devices in partnership with Save Water Save Money, and help businesses to recycle their grey water
Challenges	• Changing rainfall patterns including less rainfall in summer and a need to reduce unsustainable abstraction mean that water resources will be scarcer in the future • Investment needed for the alternative sources of supply • Need for further reductions in abstractions to further improve the environment ie set a long term 'Environmental destination' (which may halve our abstraction)	• By 2030, the majority of our customers will have a water meter. We need to help show communities and businesses, in particular farmers, how building water resilience makes practical sense for them • Culture change will mean getting everyone on-board, so at government level we are advocating for legislation that will support mandatory water labelling of 'white goods' (more efficient use of water will help customers save money and reduce greenhouse gases) and minimum standards for building and water fitting regulations

Relates to national risks: In9: Risks to public water supplies from drought and low river flows In2: Risks to infrastructure services from river, surface water and groundwater flooding In5: Risks to bridges and pipelines from high river flows and bank erosion In8: Risks to subterranean and surface infrastructure from subsidence.

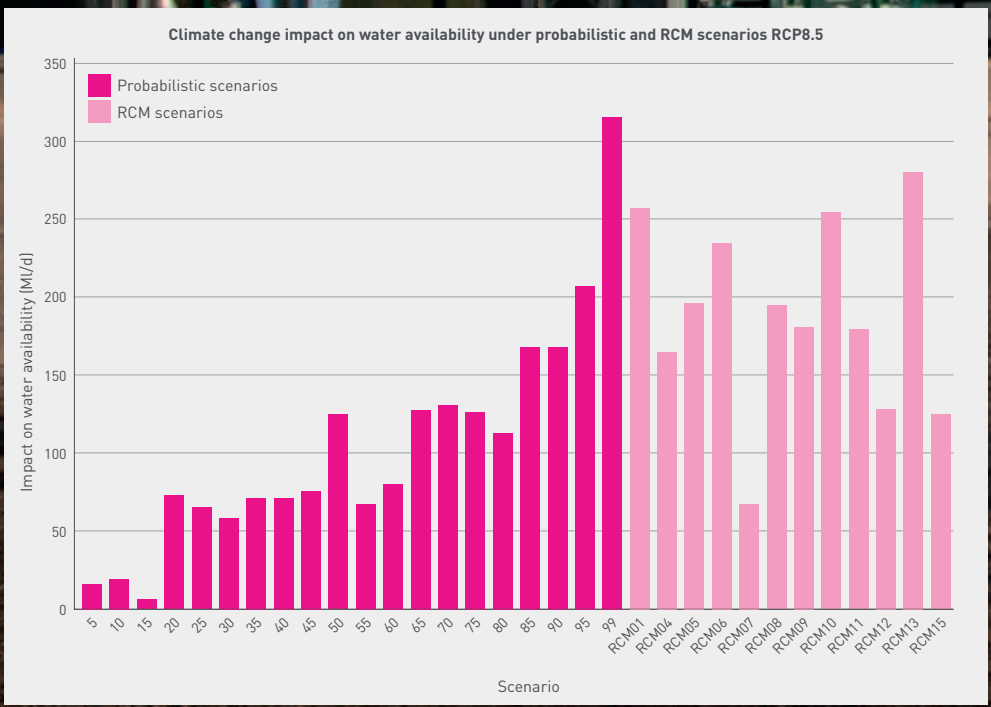
Ensuring that...
Water is always there

Understanding the scale of the challenge

We are in the process of refreshing our climate change analysis using Met Office UKCP18 climate change projections and industry best practice methods to inform our next Water Resource Management Plan and the new regional water resources plans. We carry out water resources systems modelling to assess impacts of stochastic climate change scenarios on our water resources and drought vulnerability using stochastic datasets and the UKCP18 climate projections. Our technical assessments and modelling outputs quantify the current drought risk using stochastic scenarios of historic drought events and then test the expected changes over future years under a range of UKCP18 climate scenarios. We use this analysis to assess our future water supply / demand investment needs and the likelihood of needing drought permits, drought orders and demand savings to mitigate impacts of climate change.

Climate change impacts on our supply capability are material and highly uncertain. While UKCP18 produces multiple, wide ranging climate change projections, our core plan is based on RCP6.0 'medium' global emissions scenario which is an equivalent of a 2° to 3.7°C warming scenario. There is significant uncertainty around the scale and pace of potential impacts and so we sensitivity test against a wide range of alternative scenarios, including RCP 8.5, to understand what choices carry through and residual gaps. This balanced approach allows us to identify 'low regret' investment decisions while also avoiding unnecessary impacts on customers' bills where some decisions may not yet need to be taken.

Our latest analysis suggests that by the 2080s between 130Ml/d and 260Ml/d of deployable output is at risk.



Changing weather is driving changing behaviour

Case study – peak demand

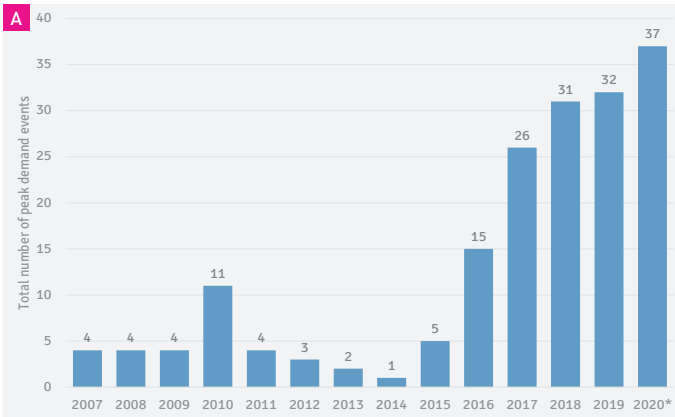
The frequency, size and duration of peak events poses a threat to water supplies
These charts show that the number of peak demand events and the maximum peak have increased significantly since 2015. Absent any response, if the trends in increased severity and persistence of peak demands continue, then eventually these systems would fail to sustain reliable supplies.

Increased peak demand is driven by customer behaviour
The increase in peak demand events (shown in charts A and B) appear to be driven by customers using more water outside the home for recreation. This reflects the increased availability of relatively inexpensive and water inefficient (high-volume) products. For example, a 3-metre diameter, 0.5-meter-deep pool holding 3,500 litres costs £60 to buy and £5.50 to fill.

Although average demand is falling, peak demand is growing
Over the past decade water companies have made in-roads in reducing per capita consumption through the promotion of water efficient products such as shower heads and addressing issues such as leaky loos. The impact of this activity is evident in a reduction in consumption when temperatures are relatively low. However, with the significant uptake in "warm weather" products such as paddling pools and pressure washers, we can observe that demand is significantly higher when temperatures are above 16 degrees, as shown in chart C.

Customers value water in hot weather
In response we have undertaken significant customer demand interventions, with some success. However, it is also apparent customers do value using water in hot, dry weather. For example, when surveyed 40% of customers admit to using more water in hot weather than the previous year. Chart D shows the findings of the research and just how much more high water usage activity our customers said they were doing during the hot weather in 2020.

A



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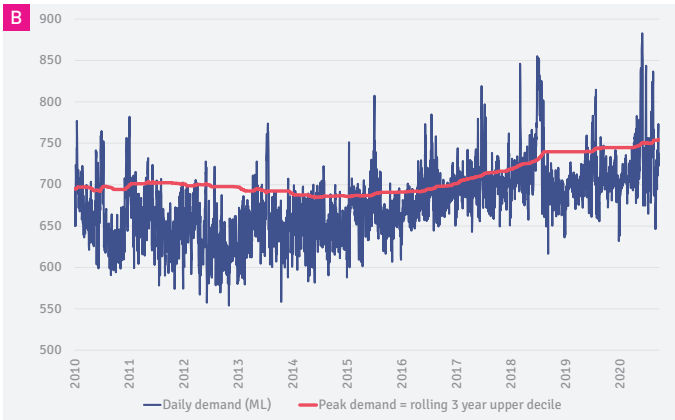

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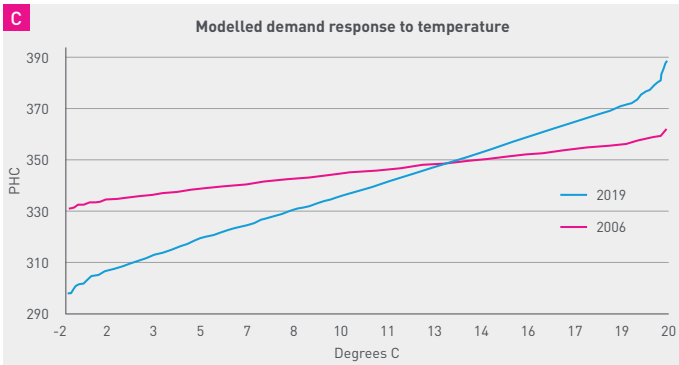

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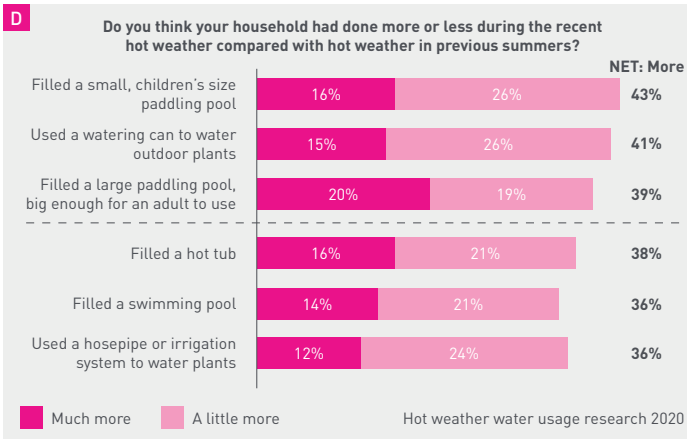


Ensuring that...
Water is always there

Our strategy

We will use demand management measures to reduce the amount of water we need to put into supply by:

- Reducing leakage on our network;
- Helping customers to use less water through water efficiency activities and education; and
- Increasing the coverage of water meters across our network to further reduce consumption and to improve our understanding of water demand patterns.

While making the best use of our sustainable sources of supply by:

- Reducing abstraction from those water sources that have a detrimental impact on the environment;
- Making sure our future water abstractions do not pose a risk of environmental deterioration, as required by the Water Framework Directive;
- Increasing the flexibility and resilience of our supply system;
- Increasing or optimising deployable output from existing, sustainable sources where possible;
- Using catchment restoration techniques to improve habitats and ecological resilience to low flows;
- Using catchment management measures to protect our sources of drinking water supply from pollution risks; and
- Exploring trades in and out of our region to optimise national use of resources.

Our 'find and fix' mode of working has benefited from installing 40,000 data loggers in our network, and we are involved in innovation trials to explore use of fibre optic networks to help us identify leaks. We know that our ambitions to control leaks will require continued innovation, so we have helped to convene the World Water Innovation Fund. This is a group of leading water companies from countries including the USA, Australia, Singapore, Brazil and Spain, who have come together to explore new technologies and best practice, and be part of a global effort to preserve water resources. The scheme now covers 60 million customers and has seven live trials, with many more planned.

The interconnector – balancing water needs across the country

As a nation, we increasingly need to move water from where it's most plentiful to where it's most needed, including between different water companies. For example, not only is Southeast England drier than the North-west, but it has more people and therefore greater water demand. By the mid-2030s, it could be short of around 1,300 million litres a day – or six million people's average consumption. So we're investigating ways of transferring water across the country when it's needed, through an interconnector – a series of pipes, rivers and canals.

Ensuring that...
Water is always there

We have increased our resilience to reduce the risk of our customers experiencing interruptions to their water supply through risk-based quick win, medium and longer term interventions including:

- **Improving the reliability and health of our network** and assets to ensure that they operate at or close to their design maximum during extreme weather events
- **Increasing the capacity of our network** to establish more headroom between average and peak demand through increased water production capacity, increased storage capacity, greater connectivity between assets and freeing up pinch points to unlock network flexibility
- **Reducing demand for water in our system**, for example through stretching leakage targets and associated initiatives and investment such as the installation of 35,000 acoustic loggers (which will also improve our predictive modelling and network control)
- **Increasing technical resource and capability** through additional personnel, a refresh of the technical skills of operational front line roles and investment in our new in-house training academy which opened in 2020 (and which we intend to make available to smaller water companies for the benefit of the sector as a whole)
- **Better preparing for incidents,** for example by updating our emergency plans and escalation triggers and improving visibility of what's happening across our network
- **Improving our incident response** including our tankering operations and provision of alternative supplies
- **Developing tailored communications strategies** for specific customer groups, including improving communications with our non-household customers and retailers
- **Improving our identification of vulnerable customers** (including customers experiencing transient vulnerability) and implementing a wider Priority Service Register
- **Accelerating our recovery from incidents** through minimising and managing backlogs and engaging with customers and stakeholders

We have introduced a new network response team.

Severe and extreme weather events used to drain resource from other departments which negatively impacted their ODI performance

The introduction of the Network Response Team has seen:

- A significant reduction in overspend for contracted services
- Improved performance for the Supply Interruption ODI measure
- An overall reduction of risk during high demand incidents

Ensuring that...
Water is good to drink

Your water is consistently safe, clean and good to drink.

	Catchment	Water treatment
Key risks and impacts	**A deterioration in raw water quality and higher treatment costs.** • Wetter winters and increased storminess and drier summers with extreme rainfall events cause seasonal variability reducing engagement with catchment management schemes • Hotter, drier summers with more intense rainfall events causing a risk of contamination to groundwater • Hotter, drier summers with increased frequency and intensity of hot spells increases evaporation and reduces river levels leading to less dilution of pollutants	**A deterioration in raw water quality and higher treatment costs.** • Increasing temperatures - causing an increase in algal blooms in reservoirs affecting water quality, reducing the volume of water that can be abstracted and treated - more treatment is required, increased operational workload and reducing the volume of water that can be output into supply to meet customer demand • Hot drier summers - switching more frequently between surface water sources (vulnerable to hot weather) and groundwater sources (hot weather resilient) throughout the year may adversely affect the quality of water our customers experience - leading to an increase in customer complaints and dissatisfaction • Flash floods - causing greater loading and water quality issues
What we're doing	• Expanding our industry-leading approach to catchment management. Our farming for water (grant scheme and farm to tap)- 44 catchments, 430,000 ha's and 9,000 farmers • Continuing to use a range of engagement packages • Groundwater treatment – we are continuing to invest in new UV treatment plant at our groundwater sources to the reduce of cryptosporidium contamination from catchments	• Over AMP6 we have followed through on our Good to Drink commitments and delivered additional outputs, and in AMP7 we continue to focus on ensuring our treatment processes are effective and that asset health is maintained - all of which provides added resilience to climate change • We have developed and implemented real-time abstraction monitoring (RTAM) to protect our works from pesticide run-off and maximise supply • We are trialling the use of algal sondes and new treatment technology to better manage algal bloom restrictions - to inform long term planning • Our AMP7 Green Recovery programme gives us the opportunity to learn more about more robust and lower carbon treatment solutions i.e. ceramic membranes
What will be needed	• As the climate changes it will be even more vital to work with the farmers in our catchments. We will need to upskill on diversification - how farmers can and will adapt - so we can tailor our advice and support • More widespread adoption of regenerative farming practices	• Our longer term plans need to make sure that our existing sources and WTWs are more robust and flexible to changing demands and environmental conditions • As well as continuing with catchment management, trends so far show that we will need better control and more treatment solutions to deal with algal blooms, pollution run-off and groundwater contamination

Relates to national risks: H10: Risks to health from poor water quality and household supply interruptions
In9: Risks to public water supplies from drought and low river flows
In2: Risks to infrastructure services from river, surface water and groundwater flooding.

Ensuring that...
Water is good to drink

Understanding the scale of the challenge

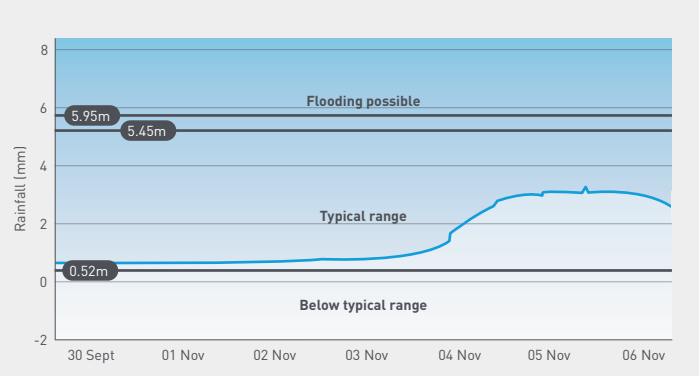
Storm Alex – pesticide spikes at Strensham WTW

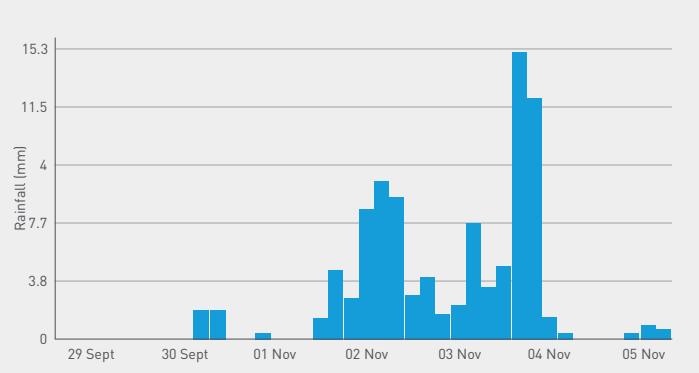
Storm Alex brought stormy conditions with hurricane-force winds to the southern half of the UK on 2nd October 2020, with associated fronts bringing prolonged, and widespread heavy rain on 3rd and 4th. For many areas, this was the wettest October day on record, with over 50mm of rainfall per day in our region!

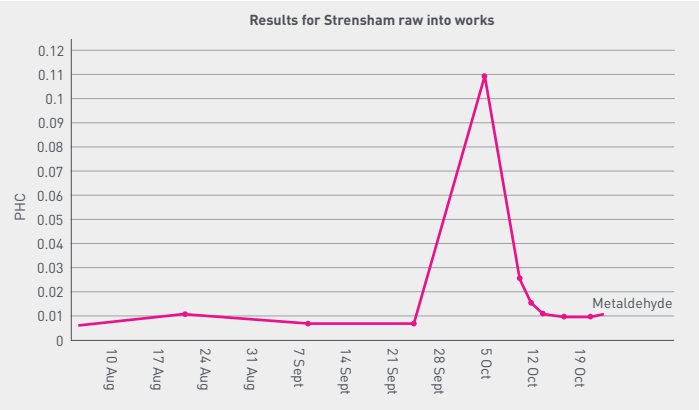
For us, our southerly water treatment works were most impacted, Strensham baring the brunt of the worst, registering a raw water PCV metaldehyde failure of 0.109 ug/l on 5th October.

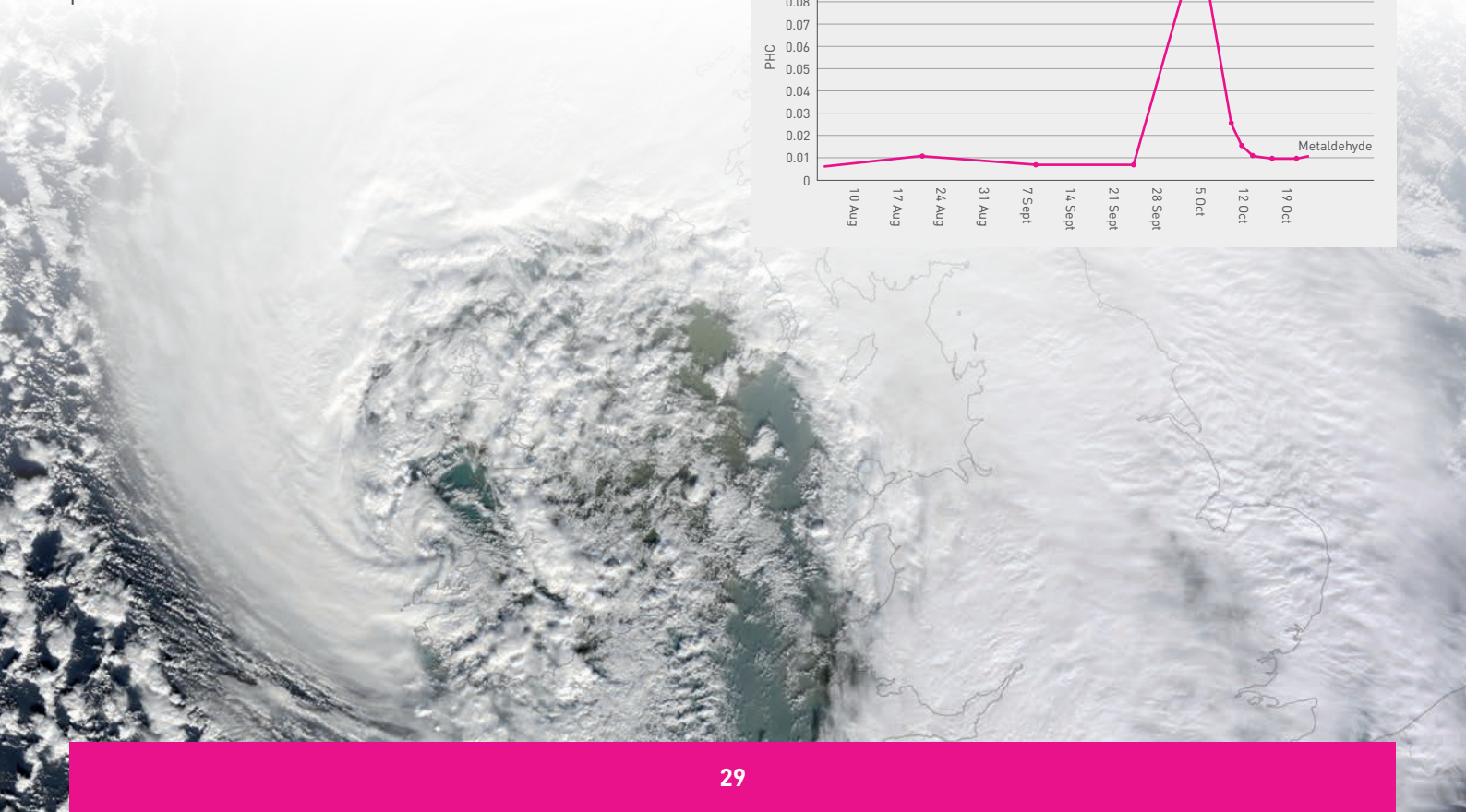
Prior to this, we hadn't been detecting any metaldehyde in catchment samples. In fact, there was 26% less oilseed rape being grown in the catchment, and only 60% of farmers had sown their winter crops by that point, so the amount of metaldehyde that had been applied was far below average.

But the catchment had experienced a long dry period throughout September, and so on the 2nd – 4th October when over 1-months' worth of rain fell in 40 hours, local rivers rapidly rose causing flooding of the surrounding farmlands, causing the little metaldehyde that had been applied to be taken off through overland flow, entering the river system. This illustrates both the vulnerability to such extreme events but also the value in having a strong base position to make us more resilient when such events occur.









Ensuring that...
Water is good to drink

Our catchment strategy
The Farming for Water programme is a 25 year programme of work and is now business as usual for Severn Trent. Catchment management plays an important role in meeting our environmental leadership ambition. Our strategy is to reduce pollution risk at source, through catchment management. This is a more sustainable solution to water treatment as it minimises the need for new carbon hungry treatment processes. Our agricultural advisers engage with farmers, partners and stakeholders to secure agreement and ownership at catchment scale. Proactive catchment management measures also underpin our long term water resources plan by maximising the amount of water we can safely abstract and use. This contributes to our supply-demand balance. Our work helps to protect the wider water environment, with every £1 we spend on catchment management we bring £4 in wider environmental benefits. It is anticipated that our catchment schemes will help to improve 750km of waterways across the Midlands.

Our water treatment strategy
Our strategy set out in our 2015-2020 plan was to reduce the number of drinking water failures in an efficient way by maintaining the asset health of our water treatment works, improving our processes and skills and investing in new treatment solutions where required. It centred around having an effective maintenance programme in place and we noted that resilience to climate change could be built through getting the day-to-day activities right and not necessarily bespoke programmes of work. During 2020 we were moved out of DWI transformation which the Chief Inspector notes as "a highly significant occurrence since it endorses the strategic action at the highest level in a company, to invest and drive action to prioritise their consumers and public health by maintaining and improving drinking water quality as a central strategy. This is a commendable approach and serves as an example to the industry of the necessary qualities in water company leadership." We intend to maintain this momentum and in the face of climate change impacts that we are beginning to understand such as worsening algal blooms limiting our works output, increased risk from catchment run-off and groundwater contamination.

As part of our long-term planning, we are currently investigating and analysing our historic data to determine any impact of climate change specifically on water treatment processes. This is technically challenging using large complex data sets and statistical relationships.

To help with this we have joined other companies in a WRc project which aims provide a risk management framework in relation to assessing how water quality risks associated with climate change and extreme weather may impact on long-term water resources planning. It will provide an overview of the latest scientific papers and research in terms of the potential changes that may be experienced across a range of water quality parameters. The key benefit of this project is in taking some initial key steps towards a more holistic integration of climate change risks associated with water quality, within water resources planning.

Ensuring that...
Wastewater is safely taken away

We safely take wastewater away, ready to be made clean again.

Key risks and impacts	• Increased storm intensity which exceeds the capacity of the wastewater network, resulting increased flooding and operation of storm overflows
What we're doing	• We will work with other flood risk management authorities to develop collaborative solutions to reduce flood risk to 360 properties or areas • We will work with landowners and stakeholders to facilitate the construction of enhanced sustainable drainage systems (SuDS) which will deliver social and natural capital benefit • We will reduce all types of sewer flooding between 2020 -2025 by 8% • We have set an ambition to halve pollution incidents by 2030 • We will work to improve river quality by removing all RNAGs (Reasons for not achieving good environmental status) from our activities by 2030 where we are required to do so and is technically feasible
What will be needed	• An increased focus on surface water management – this will support opportunities to work with other organisations to alleviate other sources of flood risk and deliver wider society benefits • Stronger legislation regarding connection of surface water from future development being connected to the sewerage network and raising awareness of the impact from customers paving over front gardens which can increase rainfall run-off • Improving legislation to address legacy issues regarding building sustainable drainage and ensuring long term funding mechanisms and maintenance responsibilities are fit for purpose • Policy and regulatory guidance to support the role out of Nature Based Solutions wherever they are practical (including to manage surface water), a model we have adopted to tackle sewer flooding, reduce operation of overflows and enhance the environment in Mansfield

Relates to national risks:
In2: Risks to infrastructure services from river, surface water and groundwater flooding
In4: Risks of sewer flooding due to heavy rainfall
In14: Potential benefits to water, transport, digital and energy infrastructure from reduced extreme cold events
In5: Risks to bridges and pipelines from high river flows and bank erosion In8: Risks to subterranean and surface infrastructure from subsidence.

Ensuring that...
Wastewater is safely taken away

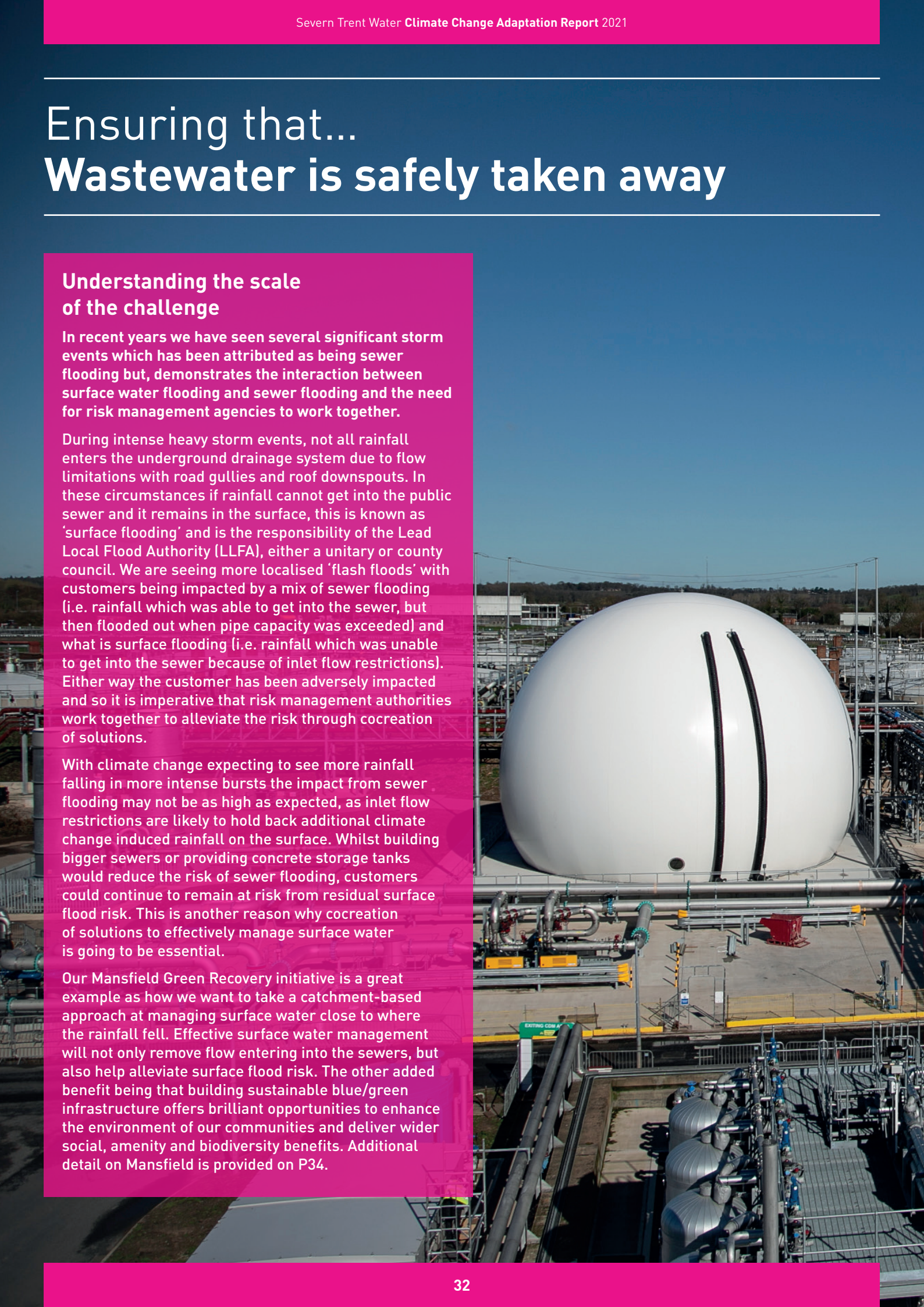
Understanding the scale of the challenge

In recent years we have seen several significant storm events which has been attributed as being sewer flooding but, demonstrates the interaction between surface water flooding and sewer flooding and the need for risk management agencies to work together.

During intense heavy storm events, not all rainfall enters the underground drainage system due to flow limitations with road gullies and roof downspouts. In these circumstances if rainfall cannot get into the public sewer and it remains in the surface, this is known as 'surface flooding' and is the responsibility of the Lead Local Flood Authority (LLFA), either a unitary or county council. We are seeing more localised 'flash floods' with customers being impacted by a mix of sewer flooding (i.e. rainfall which was able to get into the sewer, but then flooded out when pipe capacity was exceeded) and what is surface flooding (i.e. rainfall which was unable to get into the sewer because of inlet flow restrictions). Either way the customer has been adversely impacted and so it is imperative that risk management authorities work together to alleviate the risk through cocreation of solutions.

With climate change expecting to see more rainfall falling in more intense bursts the impact from sewer flooding may not be as high as expected, as inlet flow restrictions are likely to hold back additional climate change induced rainfall on the surface. Whilst building bigger sewers or providing concrete storage tanks would reduce the risk of sewer flooding, customers could continue to remain at risk from residual surface flood risk. This is another reason why cocreation of solutions to effectively manage surface water is going to be essential.

Our Mansfield Green Recovery initiative is a great example as how we want to take a catchment-based approach at managing surface water close to where the rainfall fell. Effective surface water management will not only remove flow entering into the sewers, but also help alleviate surface flood risk. The other added benefit being that building sustainable blue/green infrastructure offers brilliant opportunities to enhance the environment of our communities and deliver wider social, amenity and biodiversity benefits. Additional detail on Mansfield is provided on P34.



Ensuring that...
Wastewater is safely taken away

Understanding the scale of the challenge

Through our Drainage and Wastewater Management Plan (DWMP) we are assessing the impact climate change could have of the performance of our wastewater networks, along with new development and hardstanding creep. Our Draft DWMP is planned to be published by 30th June 2022, ahead of three months consultation, with final publication by 31st March 2023. The findings will be used to support our PR24 Business Plans to ensure our 2025-2030 investment plans align to long term catchment strategic needs.

As part of our modelling, we are planning for a 2°C global warming scenario, whilst preparing for 4°C. This will allow us to quantify the likely impacts on sewer flooding and storm overflow performance and then assess a range of interventions to mitigate the risk as well as look at options to improve baseline performance. Our appraisal of strategic interventions will also include best value appraisal including adaptability to climate uncertainties and optimising wider environmental and drainage opportunities.

Ensuring that...
Wastewater is safely taken away

Our strategy

- Through our Drainage and Wastewater Management Plans (DWMP) we are assessing the long-term impacts on our wastewater catchments up to 2050, arising from climate change, new development and impermeable area creep. As part of assessing interventions to mitigate the future upward pressures, as well as reduce pre-existing risks across our catchments, we are appraising traditional sewer based strategies (i.e. build bigger sewers, and/or provide attenuation storage) alongside options focussed on removing surface water and a mix of hybrid strategies. The benefit of surface water removal strategies are that they also provide wider opportunities to work with other organisations to deliver more effective surface water management. These co-created strategies will not only provide wastewater benefits (reduced sewer flooding, improved storm overflow performance) but also provide reduced risk from surface water flooding and the potential for environmental improvements.
- We will also be continuing to educate customers. Not only to prevent unsuitable material being drained into the sewers which could cause blockages (fats, oils and greases and sanitary items) but also the impacts of paving over from gardens and building patios/extensions without considering the sustainable disposal of surface water.
- We will continue to understand how our network is operating in 'real time' through extended use of sewer network monitors. This will allow us to proactively intervene before a problem occurs and ensure the health of our assets are maintained accordingly.

Green Recovery Project: Homes protected from flooding

Part of our response to the Government's Green Recovery initiative

A key method for reducing flooding is a new 'nature-based' approach, which will create the first catchment-scale flood resilient community. We'll start in the Mansfield area of Nottinghamshire, where we aim to store the equivalent of 58,000m^3 of surface water in 'blue-green' infrastructure – a range of natural surface-flood defences, such as green embankments, rain gardens, drainage ponds, grassed areas and permeable hard paving.

The project involves working with local councils. We're focusing on areas with high proportions of financially vulnerable customers, and aim to protect around 90,000 people. This work will also reduce the broader harm flooding brings to communities and create a more pleasant natural environment for local people to enjoy – around 15 hectares of biodiversity-rich habitat. It will also improve water quality, by targeting a 20 spills per year limit from storm overflows in the area.

Ensuring that...
We support a thriving environment

We safeguard the natural resources we use, and we work in partnership to improve the rivers and habitats that provide them.

	Land and nature	Wastewater treatment
Key risks and impacts	• Hotter drier summers causing changes to habitat composition and distribution and biodiversity loss on land and in rivers • Hotter driver summers increasing risk of non-native invasive species spreading	• Increased rainfall and storminess leads to increased operation of storm overflows • Increased rainfall events result in inundation of sewage treatment works resulting in potential failure of treatment processes, pollution events and increased costs
What we're doing	• Restoring moorland • Bog and peatland restoration • Developing our non-native Invasive Species strategy • Catchment work – reducing algae blooms • Improving biodiversity – making it resilient through management and maintenance plans and strategies	• Investing to improve the ecology of up to 2,100km of rivers in our region • Support the wellbeing of communities downstream by helping protect habitats and improve river flow through public amenity areas and visitor attractions
What will be needed	• We need to ensure we future proof the work that we're doing in our environment– going above and beyond current requirements – building resilience into what we're creating • We will need to work with others to ensure we join up improvements across the landscape	

Relates to national risks:
N1: Risks to terrestrial species and habitats from changing climatic conditions and extreme events, including temperature change, water scarcity, wildfire, flooding, wind, and altered hydrology (including water scarcity, flooding and saline intrusion)
N5: Risks and opportunities for natural carbon stores, carbon sequestration and GHG emissions from changing climatic conditions, including temperature change and water scarcity
N6: Risks to and opportunities for agricultural and forestry productivity from extreme events and changing climatic conditions (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind and saline intrusion).
N11: Risks to freshwater species and habitats from changing climatic conditions and extreme events, including higher water temperatures, flooding, water scarcity and phenological shifts.
In4: Risks of sewer flooding due to heavy rainfall.

Ensuring that... **We support a thriving environment**

We are committed to enhancing our natural environment

This is important, because in the next decades, the health of our environment will be reflected in the health of our business. When they thrive together, they will set our region apart. The actions we take now to protect nature are more important than ever. Globally, we are facing a 'sixth mass extinction', with more than 1 million species at risk. The UK has failed to reach 17 of the 20 biodiversity targets set by the UN in 2010, and 25% of mammals and 50% of birds are in danger of extinction. Climate change is only exacerbating this predicament.

As managers of land and water, we believe we have a part to play alongside our statutory duties, to work with our partners and plot a course to nature recovery. When we look after nature, we look after water. Investing in expanding and improving the natural environment is more than just the right thing to do, it is also a practical business imperative. Our environment is the vital partner to our reservoirs, treatment works, and pipelines; capturing, holding, cleaning, and carrying our water. Without nature, we could not do our job, and a flourishing environment plays an important role in helping us deliver our core activities more effectively and efficiently.

Nature is changing

At Lake Vyrnwy our partner the RSPB has noted that:

- **Climate change is driving merlin and black grouse north**
- **As our springs are warming and coming earlier some of our woodland birds are missing the main caterpillar hatching. E.g. Pied flycatcher, Wood warbler and spotted flycatcher**
- **Hobby's are most likely breeding on reserve, 10 years ago they would have been a rare bird on reserve**
- **Dartford warblers are moving north, they are not breeding on reserve yet but will most likely be a bird of the future.**

Ensuring that...**We support a thriving environment**

Our Strategy

The twin threats of climate change and destruction of natural systems present perhaps the greatest challenges our society will face this century. The one plays into the other, because our natural systems provide some of our best protection against the worst effects of climate change; like extremes of temperature, rainfall or drought.

While these challenges are global, we can take effective, practical action in our own region. We can cut our own impacts, as we are doing with our commitment to get to net zero carbon emissions from our operations by 2030. We can also build resilience by investing in nature. We know that when we improve the health and number of woods, soils, rivers, wetlands we invest in the natural sources and natural water filters. To do this makes clear sense to us and is core to our purpose as a water company – ensuring that water is clean, and there is a secure supply. It also makes sense because it's an investment in our community and environment, where we all live. We are therefore committed to creating and improving at least 5,000 ha of biodiversity by 2027, through our Great Big Nature Boost initiative.

Our Actions

We're embarking on one of the biggest nature projects across the UK, aiming to boost nature across 5000ha of land in the Severn Trent region by 2027. That's an area bigger than Gloucester and a bit smaller than Nottingham. Our 5,000 ha is delivering 1% of the government's Nature Recovery Network of 500,000 ha, which is part of the Government's 25year Environment Plan.

"Serious investment in nature's recovery is good for wildlife, good for communities and good for business. Working in partnership we have the power to address the climate and ecological emergencies through local action and our collaboration with Severn Trent Water embodies the kind of proactive approach needed to achieve national ambitions to create a flourishing Nature Recovery Network created from the ground up, with everyone playing a part.

Together we are making vital progress by improving habitats and supporting threatened species – demonstrating the benefits of industry, farming and conservation working together and we hope that the bold approach taken by Severn Trent Water will encourage and inspire even more local action to deliver real change across the UK."

Paul Wilkinson,
Nottinghamshire Wildlife Trust Chief Executive

Planting over 1.3m trees

We are ensuring that the trees we plant will be sourced and grown from UK nurseries. This will mean that the trees we plant will not only provide homes for our incredible native wildlife, contribute to natural flood management and sequester carbon but also protect the critical role our existing mature woods and trees play, from the threat of imported tree disease.

Restoring moorland

Diverse and dense vegetation on the moors provides important habitat for birds such as curlew and skylark. And along with tree cover in gullies and on valley sides, healthy moorland helps to make soil less prone to erosion, and reduces the impact of flooding along rivers and streams.

Bog and peatland restoration

Healthy peatbogs trap and store millions of tonnes of carbon and absorb vast quantities water, acting like big sponges. In many places, peat has been drained, dried out, and exposed to the elements. This releases carbon back into the atmosphere and allows sediment to be washed into watercourses, where it causes a deterioration in water quality. With restoration we can re-wet and reset the system.

We're deliberatively planning an ecosystem of projects that supports the water cycle. It's no accident that this will reduce the amount we need to clean and treat the water we abstract to provide our wonderful product. Or that it will reduce the need for energy and chemicals, further reducing carbon emissions, helping to keep bills low into the future.

Establishing wildflower meadows

Traditional meadows have acted as flood barriers for centuries, soaking up and slowly releasing water. Their wildflowers encourage beneficial insects and birds, which are natural predators of pests that would otherwise damage farmers' crops. Farmers may then use less pesticide and fungicide, reducing the risk of chemicals running into lakes and rivers.

Ensuring that...
We support a thriving environment

Our Actions

In our AMP7 business plan we have committed to:

- We're already industry leading on permit compliance, but will strive to secure higher levels of compliance by systematically monitoring and managing risks and having a stretching target of 100% compliance
- We've invested in standby capacity and parallel treatment streams at our sewage treatment works, and this inherently provides resilience to individual asset failures. Our works are also designed to remain compliant under worst case operating conditions of high flow and low temperature
- We will invest to extract maximum value from the sewage and sludge that we treat by generating products that can be recycled and will continue to recycle 100% of our sewage sludge

Through our green recovery programme we have committed to:

- Accelerating environmental improvements - £168.872 million, accelerating water quality improvement for 500 kilometres of river
- Creating bathing rivers - £78.484 million, to help to eliminate harm from 25 storm overflows and create two inland bathing water trials

We will continue to:

- Our future vision is to be operating a set of assets that make a positive difference to the environment and deliver our part in meeting the government's 25 year strategic objectives. We expect to have addressed all our Water Framework Directive reasons for failure, where it is cost beneficial to do so, and enhanced biodiversity within the areas that we operate. In order to implement this vision, we'll review how our wastewater treatment asset base is configured to ensure we have optimised the fit between assets, location and discharge points
- Tighter effluent quality standards required to deliver the Water Framework Directive, coupled with demand and climate change pressures on raw water resource availability, could make effluent reuse a more economically viable proposition. We're currently researching the approaches taken worldwide for the beneficial reuse of treated effluent to identify practices and technologies that will be appropriate for future deployment in the UK

Green Recovery Project: Faster environmental improvements

Part of our response to the Government's Green Recovery initiative

We'll support environmental improvements to 500km of river, by fulfilling more quickly our Water Framework Directive statutory obligations and speeding up improvements to storm overflows. Overall, this will involve 35 additional phosphate-removal projects, extra monitoring and investigative measures at 150 sewer overflows, and fasttracking improvements at 100 overflows.

We'll upgrade chemical dosing and invest in new technologies to enhance the removal of tertiary solids. Where possible, we'll use chemical-free methods, such as enhanced biological phosphate removal and, in some cases, constructed wetlands. We'll also increase storm overflow monitoring from 78% to 100% and improve IT to achieve near real-time public reporting of sewer overflows. Other measures will include raising weir heights and increasing pump capacity on short-duration, low-volume sewer overflows.

A wide range of environmental improvements will result from these measures. In particular, we'll see aquatic wildlife thrive. And taking this opportunity to contribute to the Green Recovery means we'll be seeing these benefits five years earlier than we would have done otherwise.

Ensuring that...
We support a thriving environment

Trent Rivers Trust Lowdham Natural Flood Management

You'll know by now that the ethos of the Great Big Nature Boost is "what is good for nature is good for water!". With that in mind, we know there are natural solutions to flood management (NFM), and we are very happy to support our partners to deliver projects implementing some of these solutions. An example of which is this project recently completed at Lowdham.

The works focused on the Cocker Beck catchment located close to the urban areas of Lambley and Lowdham, Nottinghamshire. The project consisted of a series of NFM interventions which were designed to deliver biodiversity gains. The project delivered a reduction in surface flows containing suspended sediment entering the watercourse. Two bunds were built to intercept surface flows and two wetland areas were created. Interventions were seeded with native grass and wetland species seed mixes.
The second part of the project aimed to open a heavily wooded section of the watercourse to allow more light in and by adding large woody material to the channel increase the flow diversity and habitat niches for fish, aquatic invertebrates and plants. 10km of the North Dumble and Cocker Beck have been enhanced by habitat creation and improved water quality.

The RSPB at Lake Vyrnwy

The Lake Vyrnwy estate in Wales is one of our largest sites. It includes over 10,000 hectares of open moorland, blanket bog, farmland and forest surrounding a 7.6km long reservoir that provides water for the people of Liverpool. We're working with United Utilities - who supply the water to Liverpool - the RSPB, Natural Resources Wales and the local community, to develop an ideal model of sustainable water and land management. Our management plan for 2000 hectares of sustainable commercial forestry will also improve biodiversity, water quality and recreation facilities, all for the benefit of the local community and economy and the 200,000 visitors the area receives every year.

Ensuring that...
We deliver an outstanding experience

We consistently exceed our customers' expectations by delivering an outstanding experience.

Key risks and impacts	• Wetter winters and increased storminess mean increased resources required to react to high call volumes more frequently, leading to negative impact on customer experience • Hotter drier summers mean increased resources required to react to high call volumes more frequently, leading to negative impact on customer experience
What we're doing	• **We will be proactive in communicating with our customers** In the lead up to hot weather events we will utilise email and text messaging to communicate directly with those customers we believe to be at risk, providing key information to help reduce demand and protect their supply • **We will communicate regularly at the times when our customers most need us** During a hot weather event we will utilise all of our channels and provide accurate timely information in the customers channel of choice • **We will make it easy for our customers** We have developed services that allow for simple, fast and easy reporting when our customers have a problem • **Better preparing for incidents**, for example by updating our emergency plans and escalation triggers and improving visibility of what's happening across our network
What will be needed	• **Developing tailored communications strategies** for specific customer groups, including improving communications with our non-household customers and retailers • As we continue to explore solutions that will enable our customers to get the support they require in our busiest periods. We will need to be able to access the right data and technology to provide the personalisation our customers expect

Ensuring that...
We deliver an outstanding experience

Our Strategy

We are creating an insight driven service using predictive technologies, interaction analytics and behavioural analytics to understand our customers and pre-empt their needs better than ever.

We provide our service in our customers' channel of choice, but recognise that there is an increasing demand to provide multiple digital touchpoints. In the first instance we provide the opportunity for our customer to easily self serve. Alternatively we provide digital assistance through our multiple asynchronous messaging channels which allow the customer to communicate with us on the time that suits them.

Our multiskilled advisors continue to embrace the 'customer first' culture that is driven throughout our organisation – understanding that how we behave can make a real difference for our customers.

Information at the right time

Recognising that our customers want to communicate with us in their channel of choice we have developed a multitude of services to ensure we provide relevant timely information.

On our phone system we deploy our Incident Ready Messages (IRMS), this system recognises the area from which our customer is calling and plays a recorded message to our customers about the current situation in their part of the region.

On our website we deploy incident banner messaging, as well as Check my Area information for our customers who come to the website to understand what is going on.

Making it Easy

On our messaging channels, we have deployed simple to use Service Bots that provide quick and timely information to our customers.

On our website we have developed our Report a Problem solution that allows our customer to quickly and easily identify their problem and report this to us through a self service channel.

All of our channels be it voice or digital are manned 24 hours 7 days a week, ensuring that we are available whenever our customer need us.

Managing climate risk through **collaboration with others**

We cannot consider our **climate risks in isolation**

We recognise that the impact of climate change affects areas beyond those we have direct control over; however, they are essential to the successful delivery of our operations.

Interdependencies across other sectors such as power networks and ICT/Telecoms infrastructure, transportation and the ability to access key sites are becoming increasingly exposed to climate risk. Not only do we need to deepen our understanding of these in-direct risks, we should continue to engage and work collaboratively with our supply chain to build resilience in each of these areas.

This section highlights how we are addressing risk associated with our supply chain and in particular our energy supply, as well as recognising the far-reaching consequences of the compound climate risks that affect our organisation.

Our Supply Chain

Energy Supply

ICT/Telecoms Infrastructure

Cascading failures/ compound events

Relates to national risks:
In1: Risks of cascading failures from interdependent infrastructure networks.
In13: Risks to digital from high and low temperatures, high winds and lightning.

Our **supply chain risks**

Our supply chain

We spend over £1.2 billion a year through our supply chain and rely on around 2,800 supply chain partners within our associated Group companies to deliver our operations responsibly; from the construction of sewage treatment works through to cleaning and maintaining our sites and offices. Due to the nature of our business activities, over 99% of our supply chain is based within the UK, equating to more than 98% of our total spend.

As an organisation with a diverse supply chain we must consider, negate and adapt to the impact of both economic and physical climate change. For example, in recent years, both Brexit and Covid-19 have impacted our business however our robust resilience plans and close collaboration with our supply chain partners ensured that we were well prepared.

Risk

We recognise that climate change will mean the frequency and severity of events such as extreme weather, flooding, drought, warmer temperatures will increase, and in turn disrupt our supply chain in a number of ways, for example;

- Physical damage to assets and equipment required for manufacturing and storing goods and products
- Availability of water for manufacturing processes
- Ability to procure and transport materials and products due to loss of infrastructure i.e. roads or power

For Severn Trent, this could potentially cause increased costs associated with sourcing alternative products, or an inability to obtain a product or service essential to our operations. To help mitigate against this and increase the resilience of our supply chain we have adopted the following approach.

B6: Risks to business from disruption to supply chains and distribution networks.

Ensuring that...
We mitigate our supply chain risks

Our current approach

A dedicated Commercial Risk Lead manages our overarching approach to supplier heat mapping and contingency planning. This process ensures that all contracted suppliers are assessed to determine the impact and likelihood of failure to supply goods or services required by our processes and projects. Dedicated Contract and Category Managers assess each supplier category, and assessment frequency is dependent upon their risk score; with those identified as low risk reassessed annually, and monthly or even weekly for those suppliers presenting a high risk.

We have reduced our risk exposure by having a more diverse supply chain in terms of having direct relationships with more Tier 2 and Tier 3 suppliers rather than just large Tier 1 suppliers.

Contingency plans are put into place for high-risk suppliers. Plans are reviewed annually and include detailed plans for alternative and preferred sourcing options should the supply of goods or services fail. A dedicated KPI ensures that compliance with this process is tracked and reported monthly to our Head of Procurement. In addition, robust governance is in place to ensure our top 10 high risk suppliers are monitored and reviewed monthly by the Commercial Risk Team, Senior Commercial Managers and our Head of Procurement, including whether effective mitigation measures and contingency plans are in place. For example, across our high-risk supplier categories e.g. Chemicals and Construction, we have diversified our supply chain partners to ensure that we have eliminated supply of good from single entities, and in some cases hold greater stock levels of certain products on site.

This process is further supported by SAP Ariba Risk Module which provides independent insight data on all suppliers from over 600,000 sources including news feeds, government agencies, disaster systems and other private and public sources. This helped us to manage well through the challenges of Brexit and Covid. Alerts are issued to Contract and Category Managers should an incident occur, including across environmental and social issues. Supplier stability is further assessed and monitored through Dun and Bradstreet financial risk and Experian risk analytics. Should an issue be raised through either of these channels that presents a high risk to the continued delivery of or operations, it is escalated to our Senior Commercial Managers and Head of Procurement. We will look to integrate our own supplier risk heatmapping process with SAP Ariba's Risk Module in 2022.

Our suppliers support us in providing for our customers, and we recognise are key not only to delivering this essential service, but also to achieving our ambitious sustainability commitments; making a positive impact on the communities we serve, the people who live here and the environment around us. A dedicated Supply Chain Sustainability Team is responsible for embedding environmental and social considerations through the procurement and contract management life cycle, raising awareness and capability across key sustainability issues (with both suppliers and the teams who engage with them) and seeking collaborative opportunities to address environmental risk and resilience, as well as make a positive impact. Over the last five years, we have stepped up direct engagement with our supply chain across key issues, with a key focus on climate change mitigation. For more information, refer to our Annual Sustainability Report.

Our strategy

The resilience of our supply chain is paramount to us delivering essential services sustainably. Over the next five years we are committed to understanding and addressing the climate change risk that sits within our supply chain, and importantly work with suppliers to raise awareness of this issue, influence their actions to build climate resilience and find joint solutions to adaptation challenges.

We will also insource critical activity where there is a strong business case to do so. For example, we have recently insourced design activity to ensure we have fuller consideration of sustainable design within our capital projects.

Our plans

- **Utilise our partnership with the Supply Chain Sustainability School to increase awareness and build knowledge on climate change resilience with our suppliers and the teams who directly engagement with them i.e. Contract and Category Managers**
- **Hold regular supplier conferences (three were held in 2021) to convey our environmental and sustainability ambitions.**
- **As part of our commitment to adopt the principle of ISO 20400 for Sustainable Procurement, we will complete a high-level risk assessment of supplier categories to identify those vulnerable to the impacts of climate change**
- **For high-risk supplier categories (as identified through the high-level risk assessment) we will explore opportunities to embed climate resilience as a specific consideration within all contingency plans**
- **Test the effectiveness of contingency plans through scenario-based exercises**

Energy supply risks

The Energy Network

Our services are fundamentally reliant on a stable, resilient supply of electricity to our 6,500 powered sites for pumping and treatment. We are also reliant on heat for treating sewage sludge at our bioresources sites and to heat our buildings and we need mobile sources of energy across our region every day to power our transport fleet and mobile operations and to provide backup power provision for the times when the national electricity network fails.

We currently experience approximately 11,000 local power supply interruption events each year; ranging from supply interruptions of a few seconds to several hours. Many of these events are driven by weather, for example summer lightning storms and heavy rainfall. We currently cope with these types of events as business as usual and 70% of the events we currently deal with are 'short' interruptions of less than 10 minutes.

76% of our supply interruptions are on our wastewater sites, which are more numerous and rural, the remainder are on our clean water sites. Our services are vulnerable to rare 'national-level' power interruptions, such as the event on 9 August 2019 where a loss in power frequency on the grid affected about 5% of the UK, focused in the South East. In that event our sites in the area were able to respond with no direct pollution or customer interruptions but other water companies were impacted for longer.

The reliability of the electricity supply in our region has been steadily improving over recent years. The sites in our region are primarily served by the electricity distribution network managed by Western Power Distribution, who report average customer minutes lost of 28 minutes per year, which has fallen c10% over the last four years. Our own net zero plans are likely to increase our reliance on electricity supply and replace our fuel use with biofuels or hydrogen.

I10: Risks to energy from high and low temperatures, high winds and lightning.

Risks

Climate change may directly impact the reliability of UK energy networks, and in turn cause impacts and failures in other areas such as telecommunications. These risks have been assessed by National Grid and the Distribution Network Operators and they present these alongside their own plans to deal with these risks in their Adaptation Reports. Risks identified in their second round of adaptation reports in 2016 include:

- Physical damage to network assets and equipment from a range of hazards including increased temperate (which could affect network assets in multiple ways such as performance of overhead lines); droughts, storms (which are not expected to increase), compound events, erosion, wildfires and sea level rise. Floods are identified as the largest potential risk
- Changes to supply and demand of energy arising from impacts of weather hazards
- Availability of water for power generation and cooling
- Knock-on impacts of climate change on availability of plant, fuel, materials or services

Many of the hazards are projected to increase due to future climate change.

For Severn Trent, increased power failures could cause service interruptions, environmental impacts or increase our costs to respond.

It is too early to say what the learnings are from Storm Arwen in December 2021 but it is likely to reveal how we can strengthen resilience within and between utility companies to mitigate supply risk for customers.

The plan to get to net zero energy networks in the UK as set out by Government's Net Zero plan in October 2021 requires transformation on a large scale. This includes the closure of baseload generation capacity and reliance on new, distributed assets which may have different weather vulnerabilities. This could bring its own risks to energy supply, so effective implementation of the transition is absolutely vital to our services. The increased use of electrification will also increase the impact of any hazards on the electricity network, and therefore increase our vulnerability to any impacts that may occur.

Energy supply risks

Our current approach

We deal with power interruptions driven by weather events as part of business as usual. We have processes in place for local response and larger-scale incident response with appropriate triggers. We invest in electrical protection as standard and backup diesel generation at key sites to improve resilience and we have provision to hire in backup generation where supply interruptions occur.

We review risks to electricity supplies, including by assessing weather and network risks for the week ahead and checking longer-range forecasts. We have a cross-company Power Resilience Group which tracks power interruptions, improves response processes and works with our distribution network operators to minimise disruption from planned work on the network. We also work with Government and local resilience forums to consider the impacts and our response to potential national-level power loss events ('Black start' events).

Our services would be heavily impacted in the event of national-level blackouts and it would be very costly for us (and bill payers) to invest to try to cover these scenarios with no loss of service. We also continue to have a heavy reliance on mobile communication and fuel infrastructure for deploying both normal activities and emergency responses, both of which are likely to be severely limited or absent during a black start scenario.

Links

The National Grid and Distribution Network Operators set out their view of climate change risks and their adaptation plans in their own reports. We will evaluate their third round reports and our interdependencies when they are released.

- **National Grid Second Climate Change Adaptation Report (2016)**
- **Western Power Distribution Second Climate Change Adaptation Report (2015)**
- **Western Power Distribution Climate Resilience Strategy**

Our adaptation strategy

The resilience of our powered assets is critical to our services. Based on the climate change assessments provided by National Grid, local Distribution Network Operators and Government, our central planning assumption is that these networks are adapted over time and that our services remain as reliable as they are today.

It will not be efficient for water bill payers to fund the costs of enabling our sites to operate off-grid and hence be resilient to all potential power outages. Therefore, our strategy is to continue to focus on business as usual response and preparedness, invest to maintain our own assets' health and continually evaluate the risks to the power networks on which we rely. We will scrutinise risk assessments and adaptation plans of our national grid and distribution network operators, keep our interruptions data under scrutiny and evaluate root causes of failures as they arise. This will enable us to pick the best adaptation pathway, responding to any emerging risks. For example, if electrical grid reliability begins to decrease in a certain area, we may then adapt our plans to invest more in backup sources to cope with these events and protect service in those areas.

We do need to maintain and constantly improve our response processes as we may not have warning when risks materialise. We also need to continue to invest to maintain our own assets to ensure the electrical protections required are in place. We also need to ensure our own net zero carbon plans replace the fossil fuels we use as backup today with alternatives which are equally reliable in circumstances of power failure.

In all future scenarios we remain reliant on national energy infrastructure and markets, so it is critical these sectors adapt effectively. We will continue to work together with the energy networks to assist and part of our net zero strategy includes increasing generation, improving efficiency and flexibility, which contribute to this objective.

Our Plans

- Maintain and improve water production capacity and network connectivity and reduce leakage and water demand. This indirectly impacts our resilience to power outages by giving us more headroom and options in the event of power failures.
- Energy management; including behind-the-meter generation, efficiency improvement and demand flexibility. These actions reduce the capacity we require from electricity networks and assist grid and distribution networks in managing supply and demand.
- Maintenance of our power protection and backup equipment and adapting our equipment standards where this is required by local or national infrastructure.
- Maintain and improve our incident response processes. These may have to adapt over time if power supply failures change in type or become more frequent due to climate change.

Climate change presents **risks to our communities**

Risks for our people and the impact on our business and communities.

Climate driver	Risk	Impact
Wetter winters and increased storminess	Disruption to travel - staff not able to get to work or attend incidents	Operational disruption and increased costs due to staff absence
Increase in temperatures	Health and safety of staff Communities want more water at the same time in times of extreme high temperatures	Operational disruption and increased costs due to staff absence Strain on water supplies if demand out-strips supply for an extended period
Wetter winters and increased storminess	Communities may need support during severe weather events due to disruption and damage to assets	Increase in ST resources required during events Less recovery time for communities between incidents (like property flooding)

People are drawn to water in warmer weather.

An increase in hot summer days increases the likelihood of people swimming in our reservoirs. This poses a risk both to their safety and to our staff.

Opportunities to approach the challenge differently: swimming

People are drawn to water in warmer weather. On days over 25 degrees we have to put security out on hot-spot sites to prevent people attempting to enter the water. An increase in hot summer days increases the likelihood of people swimming in our reservoirs.This poses a risk both to their safety and to our staff and emergency services. An increase in warm days can also provide and opportunity to enjoy the water in the right place. We are supporting this with our green recovery project making rivers safe for swimming.

Rivers safe for swimming

Part of our response to the Government's Green Recovery initiative

We're going to make stretches of the River Leam and River Teme healthy enough to swim in. And we'll pass on what we learn to other organisations, as part of our efforts to understand what it takes to achieve bathing quality rivers and also to ensure the UK's rivers can achieve 'good ecological status'.

Reaching our goal will involve working with and encouring other parties in the catchments, such as farmers to prevent pollution getting into rivers. We'll also install ozone effluent disinfection at three sewage treatment works, as well as building new storage and sewer capacity to help us reduce the environmental impact of around 25 storm overflows.

This investment will create more leisure opportunities and improve wellbeing, deliver environmental benefits which includes enhanced biodiversity and healthier aquatic life.

Customers tell us they are **concerned about climate change**

We've carried out research to understand our customers' attitudes to the environment, net zero, and the role that Severn Trent should play in tackling climate change.

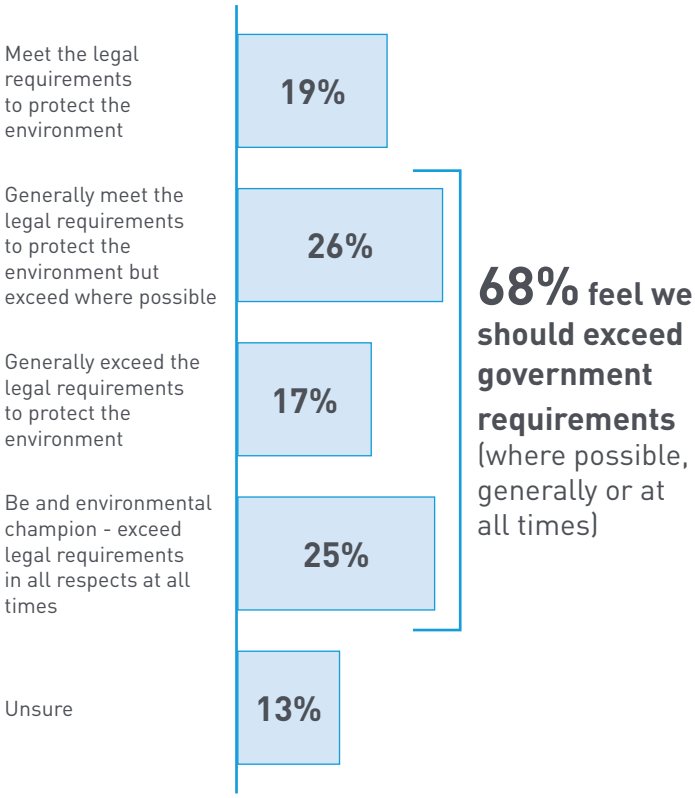
61% of customers are **more concerned** about climate change than they were **2 years ago**

71% of customers believe **climate change** is already having an impact on the UK

Expectations of Severn Trent's environmental responsibility

Overall, opinion is fairly split in terms of how much we should exceed government requirements.

Q: *When it comes to delivering environmental benefit in the course of their work, which of the following statements about Severn Trent would you most agree with?*



68% feel we should exceed government requirements (where possible, generally or at all times)

Our customers express a preference for **going further on climate adaptation**

We have also used tap chat (our customer survey and engagement tool) to ask our customers which areas they think we should focus on in the next 30 years.

Climate change emerged as one of the key themes

What do our customers think?

- Climate change and extreme weather were among the most mentioned themes in the discussion
- A customer wants to lead the industry in minimising the impact of climate change on water supplies
- Customers want us to adapt and plan extensively for climate change and extreme weather
- There has been mention of having a robust and resilient water system, which can cope with climate change
- Customers want us to store more water when it rains for when the weather gets warmer and build more reservoirs
- Customers want us to reduce water wastage to deal with growing demand and the hotter weather as we move forward in time
- Customers have mentioned building a 'national grid' for water transferring or trading between countries to deal with droughts in many comments
- Customers want systems e.g. heating and toilets, in customer properties which use water to have better designs so we can save water to mitigate water shortages
- There has been mention of monitoring the amount of water we abstract very carefully

To mitigate water shortages which might arise from climate change there needs to be water saving, and you could sponsor better designs for all the systems that use water in buildings - storage, heating, toilets etc.

So look after the water supply and levels, the population is constantly growing yet there are no more reservoirs being built and still too much wastage. We are lucky as a nation we get plenty of rain, but this might not always be the case, think of future generations.

STW need to factor in climate change and how they can adapt.

Having a robust and resilient water system which can cope with climate change and weather extremes.

With potential climate change STW need to be able to store more water when it rains so that water is in plentiful supply in warmer times.

We've gained more insight from customer research on **our wastewater plans**

The future impact of climate change is a key concern among customers, and this drives the perception that 'everyone must act now'

Concern for the environment carries through to drainage and wastewater planning. Customers seek environmentally-driven solutions and there is strong support for implementing sustainable solutions in all new building and house developments.

Customers have a sound understanding of the future risks of sewer flooding and pollution. The problems deemed harder to control are a greater cause for concern. However, customers understand that all underlying causes of such problems are important, and interrelated.

In light of this, customers seek investment in long-term, sustainable solutions now before the problems become too big and costly in the future. It is necessary to implement short term solutions for immediate or urgent situations, provided long-term measures are also being put in place.

The role of water companies is perceived to extend further than sewerage. Customers feel that, as experts, water companies are in a position of power to educate and influence the government, businesses and customers, to change behaviours and promote environmentally friendly activities. That said, investment in these activities should focus on issues related to drainage and wastewater, with any benefits to the environment an outcome of this.

> **They have significant power to do something. They cover wide areas...they can lobby government, educate consumers.**
>
> Current customer

Climate change is cited as the top concern among customers, along with the related issues of air and plastic pollution.

Unprompted responses to the question 'what are the biggest challenges facing the UK?' indicate a range of concerns including the use of resources and recycling, the impact of climate change, pollution, and flooding.

Having been prompted with a list of wider environmental challenges faced in the UK, most customers revealed that climate change is the most concerning issue, along with air and plastic pollution. Climate change specifically is deemed a very immediate issue, which must be addressed.

That said, all issues are considered to be important and interrelated. Most customers report that everyone has a responsibility to act in the short term to prevent the longer-term implications of these issues.

Customers perceive businesses as having a responsibility to work in environmentally friendly ways and to manufacture environmentally friendly goods, while the Government is expected to lead on the issues and change the law to ensure everyone is held accountable.

Water companies are considered to be in a powerful position to influence and educate the geographical area which they cover, to encourage behaviour change.

> **I don't think we can halt [climate change], but we underestimate the billions it will take to manage it. We are all responsible.**
>
> Current customer

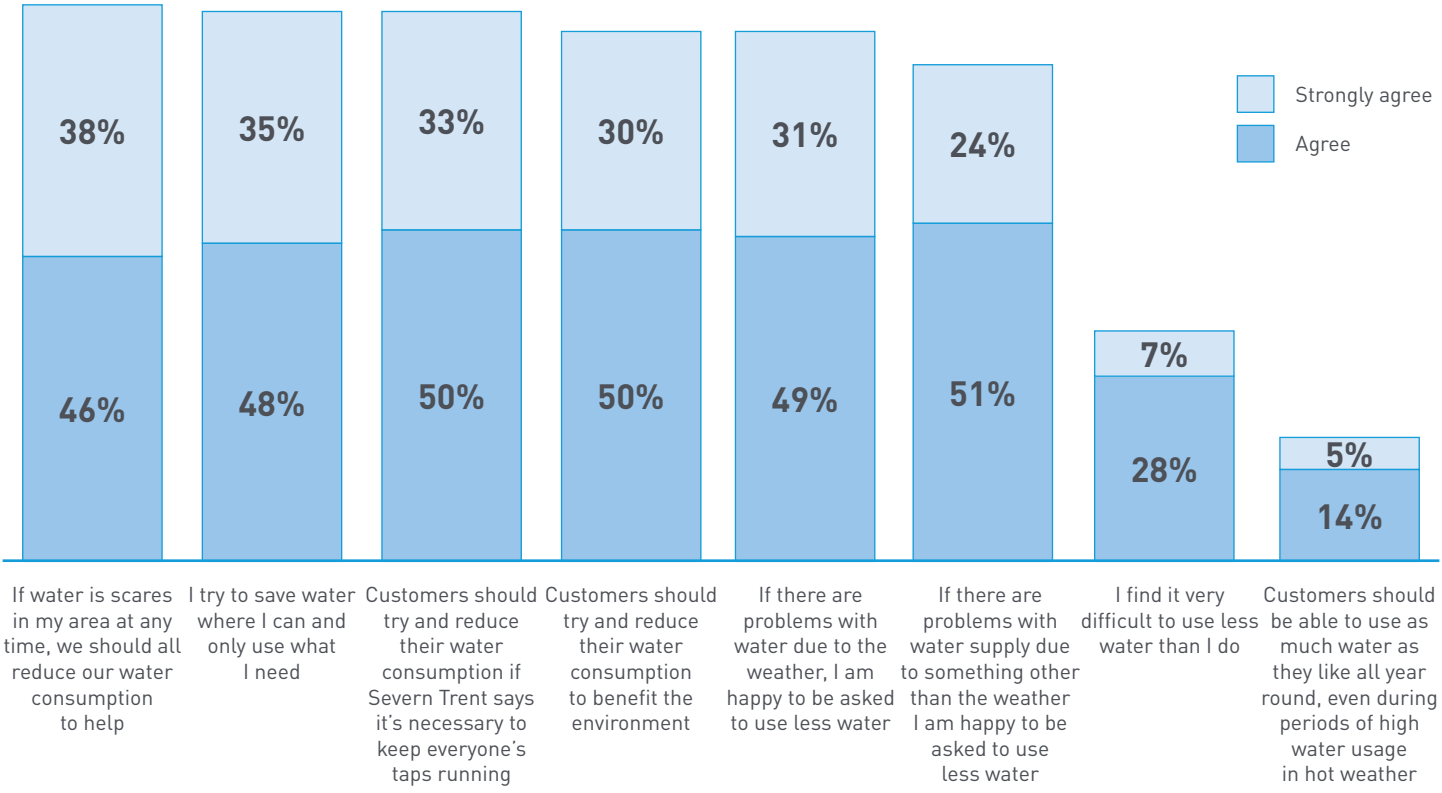
Continuing our customer education key...and **engaging with customers to work together**

Water efficiency

Our ambitious water efficiency programme has already saved around 25 million litres per day between 2015 and 2020 through water efficiency advice for customers, free and subsidised watersaving products on request, and targeted home water efficiency checks.

We will continue to roll out these successful schemes, aiming to reduce per capita consumption by a further 3.5% by 2025. Our schools programme will reach 500,000 children, educating on the value of water, responsible sewer use and the importance of hydration to health. We will deliver 35,000 home water efficiency visits, install 400,000 water meters, provide water saving devices in partnership with Save Water Save Money, and help businesses to recycle their grey water. By 2030, we hope the majority of our customers will have a water meter, and long-term, our goal is to help show communities and businesses, in particular farmers, how building water resilience makes practical sense for them.

Culture change will mean getting everyone on-board, so at government level we are advocating for legislation that will support mandatory water labelling and minimum standards for building and water fitting regulations.



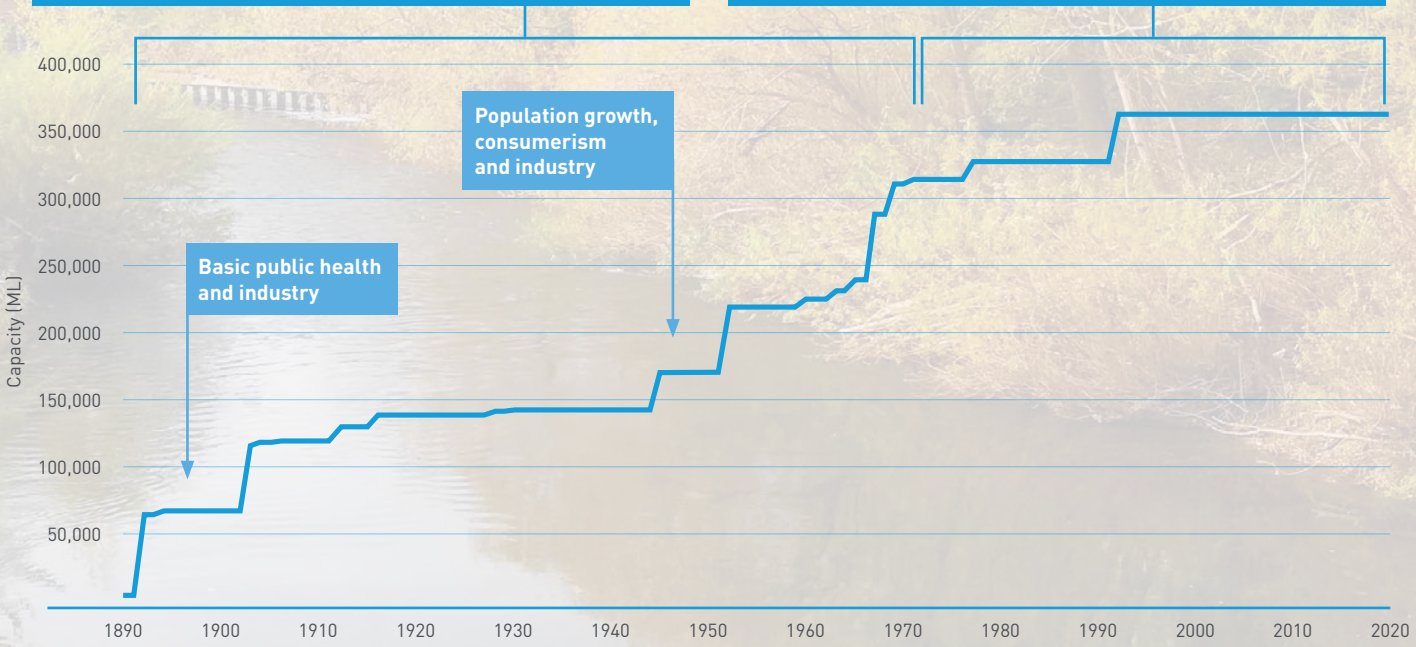
We're working with others to **solve big problems**

We are working with other water companies and our regulators at a national scale to ensure water resources for the future through strategic interconnector projects.

Impounding reservoir storage capacity 1890 to 2020

Before 1974, water resource assets needed for people and industry were developed by city corporations; for example Derby, Nottingham, Sheffield and Leicester collaborated to build the **Derwent Valley reservoirs**.

Since **regional monopolies were formed**, increased consumer demand has broadly been offset by decline in usage by heavy industry and a reduction in **leakage levels**.



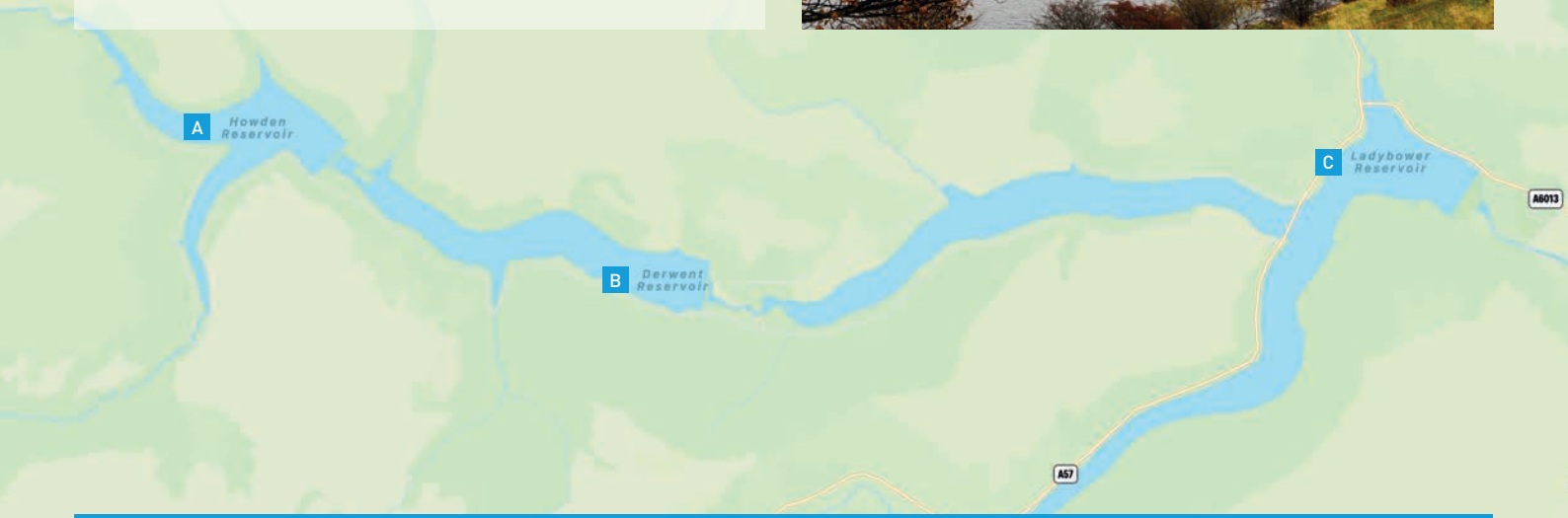
More recently **climate uncertainty, population growth,** the drive to improve the environment and Government sensitivity around drought impact, mean that new **resources are needed**.

The issues are particularly acute in the **South and East** where studies by WaterUK and National Infrastructure Commission estimate the deficit to be **1,300Ml/day by the mid 2030s**.

And finding solutions **to help ourselves as well**

Our WRMP24 plan is identifying a requirement for new large scale water resources to counter climate change and Environmental Destination based reductions – an example of how we are addressing this is, we are investigating expanding the Upper Derwent Valley Reservoirs, working alongside Yorkshire Water.

- Insufficient storage in Howden, Derwent and Ladybower to support Bamford and Rivelin WTWs output at all times – 1976, 1995 and 2018 reservoir levels so low that Derwent village was exposed
- Bamford WTW is one of STW's lower cost sources of treated water which is deployed by gravity so is a great source from a carbon reduction perspective
- Expanding storage in the Upper Derwent Valley would remove the need for Yorkshire to develop new sources of water and construct high carbon, high OPEX new treatment works, pipeline and pumping stations
- The investigations will examine the complex environment around the Upper Derwent Valley reservoirs and on the River Derwent, and identify improvements for the people and nature within the region
- We will work with local stakeholders to understand local needs and help identify opportunities where benefits could be brought
- Increased storage could improve management of flows in the River Derwent. During these investigations we will model how changes in storage and flow can improve flood risk and habitats on the downstream River Derwent



We're working with other land owners and NGOs to **adapt at landscape scale**

The need to improve water quality and deliver environmental improvements

The Bamford Water Treatment Works (WTW) catchment, in the Peak District's Derwent Valley, is affected by high raw water colour. This is difficult to treat due to difficulties in dosing the appropriate amount of coagulant (ferric sulphate), which in turn can lead to the production of disinfection by-products. Of particular concern is the increasing trend in raw water colour since 1989. The WTW catchment has, as a result, been designated as a Safeguard Zone.

Peat soils cover 63% of the catchment and preliminary results of sampling work carried out by the Environment Agency and Severn Trent Water (STWL) show that the peatlands within the catchment are producing large amount of colour, resulting in concentrations in raw water well above the EC Drinking Water Standard of 20 Hazen units.

Due to the increasing colour trend and subsequent challenges to current treatment processes, Severn Trent (ST) has undertaken a catchment based approach improve raw water quality and bring about wider environmental benefits in the Bamford catchment.

In order to address the above, ST worked alongside other partners to support and deliver an EU LIFE project which was led by MFF – The MoorLIFE 2020. This project involved implementing works with a proven success of improving the protection of active blanket bog, together with other associated habitats that have benefits under the Water Framework Directive (e.g. clough woodland, Molinia dominated grasslands, heather moorland on deep peat).

Through partnership working the MoorLIFE 2020 work has delivered:

- 114ha of bare peat revegetation
- 41,672m of gully blocking
- Upland path works to protect 16 hectares of blanket bog and dwarf shrub heath
- 170ha of tree planting as part of the Woodland Clough Project

ST has invested £1,115,040 into the MoorLIFE2020 project. This has been match funded by the EU – for every £1 this was matched by £3 in EU funding.

By undertaking MoorLIFE 2020 the priority habitat under the Habitats Directive (Active Blanket Bog) has improved in condition, moving towards Favourable condition. Its suggested that there has been a 70% reduction of peat erosion in the catchment. It is anticipated that the reduction in peat erosion will save ST around £18M to as we will no longer need to remove sediment from the Derwent Valley reservoirs.

In addition, the extent of the habitat has increased, as land which was dominated by single species has become more active. This has also benefited the wading bird assemblage and hence the area has also been classified as a Special Protection Area under the Birds Directive.

Surface Water Safeguard Zones, priority areas under the Water Framework Directive, are now starting to provide improved water quality water to Bamford water treatment works. On average the MoorLIFE 2020 project has decreased peak colour concentrations by 50% and average concentrations by 12%.

And our approach to innovation will help us **tackle future challenges**

Innovation is critical to a sustainable future
Our success in sustainability depends heavily on innovation, and we've recognised the need for a more wide-ranging, inclusive approach. We've adopted the 'open' innovation model, involving suppliers and industry partners, rather than relying just on our own R&D – and this has supported a number of recent developments.

Our new innovation framework
As an organisation focused on being at the forefront of technology and best practice, our innovation framework creates an effective approach to prioritising projects based upon business outcomes, balances work across different time horizons, and helps us to target initiatives with our wider ecosystem. We have successfully integrated the service, digital, data, physical and biological innovation skills and capabilities from across the business, and redesigned our innovation operating model with a focus on achieving tangible value more effectively and efficiently.

The framework allows us to use better data and new technology that is close to being ready for deployment, while targeting research into new technologies that, if proven, will boost resilience and reduce process emissions in the future. It also allows us to work with the wider organisation to identify the key opportunities for recovering resources and energy across our value chain, aiding the transition to a circular economy.

Ofwat Innovation Fund
In its latest round of funding, Ofwat has reserved £200 million to promote collaborative innovation across the water sector. Bids are invited for large and small projects, and all intellectual property, data and insights developed as a result of a successful bid must be made freely available to all water companies for the benefit of all customers. Our strategy is to produce targeted bids in partnership with other organisations, developing our capability to learn from others. This will ensure we maximise the value we derive from the fund. In April 2021, we were awarded £420,000 funding for two ground-breaking projects in Ofwat's first Innovation in Water Challenge:

- Fibre leak detection is an emerging technique that uses a laser to detect noise at intervals along a fibre inside or alongside a water main or waste-water network. As there's already a significant fibre telecoms network, we could use this to lower the cost of detecting leaks.
- We'll be working with the Consumer Council for Water, South East Water and Thames Water on using behavioural and data science to support customers in vulnerable circumstances. This will include improving contact with hard-to-reach customers and communities during both planned and unplanned events, including help to manage bills and understanding which forms of communication customers prefer.

Future bids will focus on water-sector challenge where we need collaboration, such as reducing process emissions, removing microplastics and pharmaceuticals from waste, chemical-free treatment and managing water resources.

World Water Innovation Fund
We recognise that there is a wealth of creativity, knowledge and experience outside our organisation and outside the UK. This is one of the reasons why we worked with others to develop the World Water Innovation Fund (WWIF), which now has 15 members across South America, North America, Australia, Singapore, Africa, and Europe. Since its inception, over 35 innovative projects have been shared, many of which now form the basis of our own portfolio of innovation trials to test their application in our context. These include Europe's largest trial of anaerobic waste water treatment at our purpose-built resource recovery and innovation centre (R2IC) at Spernal Wastewater Treatment Works. This technology has been used extensively in Brazil by Aegea who are fellow members of WWIF and if proven to be successful in the UK will significantly reduce energy costs and process emissions as well as increasing the opportunities for us to recover resources including ammonia and hydrogen from our wastewater treatment processes.

However, there is still more that we can do to "tap into" external creativity and therefore we are pleased to announce that in January 2022, we will be launching our international scouting programme called Innovation Catalyst. This will complement our wider innovation ecosystem, including WWIF, academia, innovation in the community and our internal colleague creative competition called Challenge Cup. Working with a partner organisation, we will be deploying scouts to technology hot-spots around the globe to identify and short list new opportunities to test and trial solutions to help us to rise to the challenges of water availability, climate change and energy costs as well as driving forward with our commitments to the circular economy by recycling the valuable resources from our end-to-end value chain.

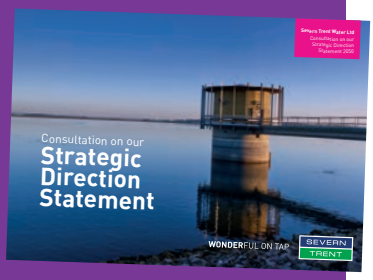
If you'd like to **find out more**

Caring for Our Environment

Outlining how we're working across our business to play our part in tackling the twin global challenges of climate change and biodiversity loss.

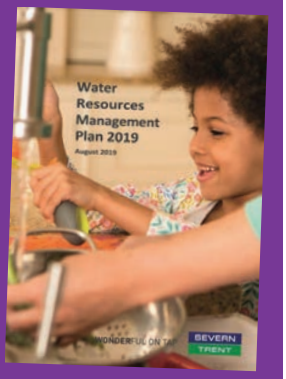
Our Strategic Direction Statement

Setting out our long-term priorities for Severn Trent based on our view of future trends and the areas of importance to our customers, investors, employees and wider society.



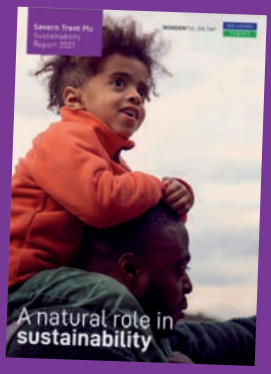
Water Resources Management Plan

Sets out how we intend to provide supplies of water to our customers over the next 25 years and beyond.



Sustainability Report

An overview of our approach, performance and ambitions around sustainability.

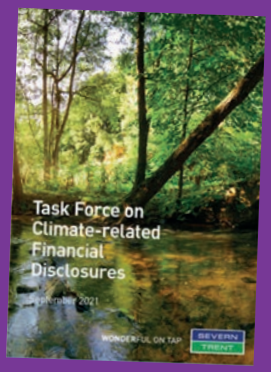


AMP7 Business Plan

Our business plan for 2020-25. It sets out the improvements we're committing to deliver for our customers over that time, including how we'll keep bills lower.

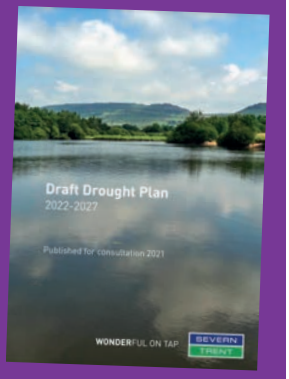
Task Force on Climate-Related Financial Disclosure Report

Outlining our approach to implementing the recommendations of the TCFD.



Drought Plan

Sets out how we will manage our resources and supply system in dry spells to maintain an above standard service to our customers.



Annual Report and Accounts Library

Reporting our latest performance.

Appendix 1: We have delivered the actions we committed to in our last report to ensure that: **Water is always there**

Actions to address the impact of climate change on meeting our supply-demand balance.

What we said	By when	We have
Our water resources management plan ensures we have enough water available over the next 25 years. These statutory plans are produced every five years and signed off by the Secretary of State. We modelled a range of potential deployable outputs from UKCP09 projections to ensure that our resources are resilient to the potential impacts of climate change.	Business as Usual	We published a 25 year strategy for managing risks around water supply and demand, including the impacts and uncertainties around future climate change. This informed our PR19 Business Plan and our current AMP7 delivery plan. WRMP19 is available on our website.
Our drought plan sets actions to provide a continuous water supply during a drought. Drought plans are kept up to date and reviewed every three and a half years.	Business as Usual	We have recently updated and consulted on our statutory drought plan. The latest version is available on our website.
We will reduce leakage by 6%. This includes a commitment to fix all visible leaks within 24 hours.	2020	Across AMP6 we improved customers' levels of service by reducing leakage by 10% and supply interruptions by 26%.
We will save 25Ml/d through our water efficiency programme. This includes increasing the number of people who will benefit from our high quality education programme to 125,000 per year by 2020.	2020	We outperformed against our target for AMP 6 delivering savings of 25.7Ml/d against a target of 25.15Ml/d. This was delivered through a combination of our educational programme, providing free and subsidised water efficiency devices and our home check programme.
We will invest in RandD on water efficient technologies. In total we are investing around £39m in RandD between 2015-20.	Beyond 2020	We undertook our largest R&D programme in AMP6 culminating in us working with others to develop the World Water Innovation Fund (WWIF), which now has 15 members across South America, North America, Australia, Singapore, Africa, and Europe. Since its inception, over 35 innovative projects have been shared, many of which now form the basis of our own portfolio of innovation trials to test their application in our context.
We will improve the flexibility of our supply system allowing us to move water around our network. During AMP6 and 7 we will be increasing the deployable output of our Strategic Grid (serving two thirds of our customers) by around 80Ml/d.	Beyond 2020	Multiple supply resilience improvement schemes delivered across AMP6 have improved supply flexibility. A total of 109Ml/day of new capacity (Deployable Output) will be delivered by our AMP7 schemes (44Ml/day) and our green recovery investment (65Ml/day at two of our water treatment works on our strategic grid).
We will increase household metering at a pace lead by customers. We expect to install around 672,000 meters free of charge over the next 25 years.	Business as Usual	In our WRMP19 we accelerated our commitment to increasing household water metering and our revised plan will achieve near universal metering by 2035. WRMP19 is available on our website. Our Green Recovery business case included acceleration of metering and a trial of Smart meters.
We will improve the resilience and sustainability of our existing water supplies. In AMP6 we will invest around £30m to provide new sustainable sources and associated treatment and distribution to address long term abstraction risks at our groundwater sites.	2020	During AMP6 we carried out our largest ever programme of investigations into the impacts of our water abstractions on the environment. The list of water bodies we are improving and investigated was confirmed at PR14 in the EA's NEP phase 5. The key achievement in 2019/20 was achieving our AMP6 commitment to delivering water body improvements, underlined by our WFD related ODI measure. We delivered 33 ODI points against a target of 31 points across our two Restoring Sustainable Abstraction Implementation and Investigation programmes. We worked with the EA to apply for 31 abstraction licence variations which we agreed to as a result of the 'ongoing' investigations programme by end of AMP6.

Actions to address the impact of weather on our assets.

What we said	By when	We have
We will provide Birmingham with an alternative water supply, investing over £250m, which will allow long term maintenance of the EVA to take place and reduce the threat of flooding and landslides affecting service.	2020	We successfully delivered our investment to provide Birmingham with an alternative water supply which will enable work on the EVA.
We will continue to improve the flexibility of our strategic grid by targeting our maintenance work at areas that deliver the greatest risk reduction.	Business as Usual	In AMP7 we have set out a number of schemes within our strategic grid that will improve the resilience of our customers supplies in the event of a failure in average demand. Additional supplies are planned through our green recovery projects.
We will invest around £67m in three schemes to divert sections of large aqueduct away from communities that could be at risk in the event of a catastrophic failure. Failures could be driven by landslips or other natural hazards.	2020	We delivered these three schemes mitigating this risk to these communities.
Dams and reservoirs are subject to a stringent monitoring, maintenance and governance regime. This includes monitoring of any known ground movement. In addition, design standards are sufficient to accommodate the wider impact of climate change.	Business as Usual	This is an ongoing activity.
Mutual aid is in place to facilitate inter-company borrowing of equipment or services to supplement their own stocks during long duration water supply interruptions.	Business as Usual	This is an ongoing activity.
We will provide resilience to our three highest priority isolated communities. We use a population threshold of 20,000 to guide our prioritisation of schemes.	2020	We have invested to improve resilience to isolated communities but we are now using severity in addition to population to prioritise investment. All three schemes are now complete, two of the schemes were delivered by the end of AMP6.
We will continue to improve our response to no supply incidents (driven by a number risks, including landslides and extreme weather events) and reduce the number of minutes customers go without supply from 15 minutes to 8 minutes.	2020	We have introduced a Network Response Team which has delivered an improved performance for the Supply Interruption measure and an overall reduction of risk during high demand incidents.

Appendix 1: We have delivered the actions we committed to in our last report to ensure that: **Water is good to drink**

Actions to address the impact of climate change on runoff rates and water quality.

What we said	By when	We have
We are building on our leading position in catchment management and investing £21 million across 21 catchments to reduce the number of drinking water quality failures and minimise / delay future expenditure on water treatment whilst supporting wider environmental benefits.	By 2020	Farming for Water (F4W) is ST's main catchment scheme, it aims to reduce diffuse water pollution from agricultural practices and improve biodiversity across the Severn Trent region. Its objectives are to: • Engage with 90% of priority farmers within our catchments • Reduce the loading of diffuse pollution from agriculture - pesticides, nitrate and cryptosporidium by 4,127 kg, 55,277 kg and 19,422 kg respectively • To ensure that greater than 75% of farmers growing high risk crops use integrated pesticide management practices • To help enhance and create 5,000 hectares of biodiversity • Between 2015 – 2020 approximately £21M was invested into working with farmers. In April 2020, the work was extended to include 44 catchments, 430,000 ha and 9,000 farmers
We will offer matched funding grants for small scale infrastructural investment on farms to reduce agricultural run off.	By 2020	The Severn Trent Environmental Protection Scheme - STEPS has been running for 10 years and offers grants to farmers and landowners to undertake works which will help reduce water quality risks at our abstractions. There are a wide variety of grants available to choose from, including innovation options which are designed to deliver reduced runoff of pesticides, nutrients, and sediment to water courses. The maximum amount a farmer can apply for is £10,000 per farm business per year and payment rates for grants are set at 50% of actual costs. To date we have funded 1,986 grants, totalling over £9 million of environmental work being undertaken on farms. This has resulted in reductions of 46,601 kg of nitrate; 468 kg of pesticides; 1,456 kg of phosphate over the last five years.
We will introduce a tool box of catchment schemes to address pesticides and nutrients through a programme of farmer advice, training and support from dedicated catchment officers.	By 2020	Farming for Water is built up of farmer grants - STEPS (Severn Trent Environmental Protection Scheme), farm to Tap (payment for ecosystem services) ,pesticide Management - training, amnesty, low drift nozzle scheme and machine calibration clinics. Farming for Water includes our SOFA (Specialist On-Farm Advice) programme, offering 11 bespoke, specialist farm advice visits, complemented by a further five soil and manure sampling suites to aid farmers in their soil, nutrient, water and pesticide management. Specialist contractors deliver the visits alongside the farm's local Severn Trent agricultural advisor, before providing a comprehensive report and recommendations with links to our funding opportunities and those through our partners.
We have a range of specific actions to reduce metaldehyde, including product substitution; clean runoff rewards, and play an active role in metaldehyde stewardship group.	Business as Usual	In 2013 Severn Trent Water started to explore innovative ways of engaging with farmers and stimulating improvements in water quality. One element of this has been the trial of a 'results orientated' approach, rewarding farmers for improvements in water quality at a catchment scale. This contrasts with paying farmers to adopt specific mitigation methods on an individual farm basis. The approach acknowledges that co-ordinated action is needed across the catchment to see improvements in water quality, and that by stimulating outcomes rather than actions, landowners and farmers may take greater ownership of water quality issues. The Farm to Tap scheme has been hugely successful and has resulted in a 40 – 90% reduction in peak pesticide concentrations coming into our treatment works This has led to a 63% reduction in metaldehyde peaks. As a consequence Severn Trent no longer need to install 5 new nitrate plants and we have shelved plans to introduce pesticide treatment (GAC) at one of our surface water works. You can find out more about the Farm to Tap scheme here: https://onlinelibrary.wiley.com/doi/full/10.1111/wej.12609
We will continue to use vegetation and peat management to slow the flow of water in our catchments.	Business as Usual	Our Water Treatment Works (WTW), in the Peak District's Derwent Valley, is affected by high raw water colour. This is difficult to treat due to difficulties in dosing the appropriate amount of coagulant (ferric sulphate), which in turn can lead to the production of disinfection by-products. Of particular concern is the increasing trend in raw water colour since 1989. The WTW catchment has, as a result, been designated as a Safeguard Zone. Peat soils cover 63% of the catchment and preliminary results of sampling work carried out by the Environment Agency and Severn Trent Water show that the peatlands within the catchment are producing large amount of colour, resulting in concentrations in raw water well above the EC Drinking Water Standard of 20 Hazen units. Due to the increasing colour trend and subsequent challenges to current treatment processes, we have undertaken a catchment based approach improve raw water quality and bring about wider environmental benefits in the Bamford catchment. In order to address the above, ST worked alongside other partners to support and deliver an EU LIFE project which was led by MFF - The MoorLIFE 2020. This project involved implementing works with a proven success of improving the protection of active blanket bog, together with other associated habitats that have benefits under the Water Framework Directive (e.g. clough woodland, Molinia dominated grasslands, heather moorland on deep peat). These interventions not only reduce sediment and colour run-off but they also slow the flow of water off the uplands, acting like more of a sponge to hold the water.

Appendix 1: We have delivered the actions we committed to in our last report to ensure that: **Water is good to drink**

Actions to address the impact of warmer temperatures on water treatment.

What we said	By when	We have
We will develop intelligent abstraction management systems; providing us with real time water quality data to inform abstractions and therefore prevent abstraction during peak concentrations, minimising the impact of runoff on our water quality.	Beyond 2020	Since our PR14 plan we implemented Real Time Abstraction Management (RTAM) at our Draycote water treatment works in Warwickshire. We worked with Sheffield University on developing a predictive model for metaldehyde, a pesticide which cannot be removed by conventional treatment process. Over AMP6 we have successfully controlled our abstractions to avoid metaldehyde entering our drinking water supply and we are currently adapting the model to predict herbicides used in Oilseed rape production within the catchment.
We will invest over £30m in mains cleaning, mains renewals, removal of abandoned assets and optimisation and renewal of chlorine dosing equipment, all contributing to improvements in water quality for customers, which will help to safeguard against future discolouration caused by climate change.	Business as Usual	Since PR14 we increased investment significantly beyond the levels in our 2015-20 business plan for our water quality strategy; tackling sources of discolouration at our treatment works and removing deposits from our networks. Our operational teams have flushed, conditioned and cleaned the largest number of water mains in our network to date. 2020/21 marks the fourth year-on year improvement – a reduction of just under 9% since the previous year and a 34% reduction in complaints since 2016/17. This has been well recognised by our regulator, the DWI, in their latest Chief Inspector's Report 2020. At the start of AMP6 we had 20 DWI legal Notices in place for discoloration. All but one have now been closed thanks to the evidence of reduced water quality complaints. We plan to continue with this approach to reduce the risk of future discoloration.
We will invest over £167m in maintaining and installing key treatment processes at our Water Treatment works.	By 2020	Since our PR14 plan, by continuously monitoring our progress on a wide range of asset health metrics, we could see we were making progress and that performance had significantly improved. But our analysis also showed we needed to do more to sustainably achieve our committed performance levels and improve on the new Compliance Risk Index (CRI) industry measure for drinking water quality. Over AMP6 we increased investment on water quality significantly beyond the levels in our 2015-20 business plan, a large proportion of which came from outperformance. For water treatment works specifically this included: • Additional investment on five additional schemes for refurbishing coagulation and clarification processes at major treatment works • Measures to improve resilience at our five largest/critical works related to power supply, river intake pumping stations and ingress risks in tanks • An extra ultraviolet (UV) scheme where aquifer deterioration was indicated in 2015 • Innovative manganese reduction at treatment works, reducing manganese entering the network by 40% and subsequently reducing discolouration complaints by up to 55% across associated networks.
We will continue to maintain and optimise our coagulation and clarification processes which will improve our ability to remove pollutants and increase our resilience of water treatment to drier weather.	Business as Usual	
We will improve chlorine management in eight of our water supply zones to the mitigate risk of bacteriological growth.	By 2020	Since 2015 we have invested in optimising chlorine management at WTW, GW and DSRs. This, combined with our regular review of chlorine data, has led to a c.30% reduction in bacteriological failures at DSRs and a c.20% reduction in taste and odour customer contacts from 2015 to 2020.
We will continue to use barley straw to successfully control blue green algae growth in our reservoirs.	Business as Usual	Algae growth in our reservoirs is a significant problem for us as it limits the amount of water we can abstract and treat during times of high summer demand. Over AMP6 we have been trialling the use of Algal sondes at reservoir intakes – sensors which are able to measure and detect algae, giving early warning signals to allow operational decisions to minimise risk. As well as continuing the use of barley straw we have undertaken extensive technology scouting of algal control options and are currently trialling a filtration process (full scale) to inform our longer-term plans.

Appendix 1: We have delivered the actions we committed to in our last report to ensure that: **Wastewater is safely taken away**

Actions to address the impact of climate change on sewer performance.

What we said	By when	We have
We will prioritise investment based on flooding severity/impact and likelihood. By verifying historic risks together with hydraulic capacity modelling we have improved on our previous methodology, where properties had to flood before being added to the register that triggered investment.	Business as Usual	We continue to use our Hydraulic Flood Risk Register (HFRR) to record hydraulic flood risk across our region. This new approach superseded the previous DG5 Flood Register which was principally a record of properties/external areas which had flooded but did not consider severity/impact on customers. The HFRR still maintains a record of properties/external areas which had previously reported flooding due to rainfall overloading of the sewerage system but is complemented by additional information from customer questionnaires and hydraulic sewer modelling concerning the severity/impact of residual risk. This methodology was used to support our AMP6 investment programme to reduce incident risk to our customers and continues to be used for AMP7.
We will double the number of sustainable urban drainage solutions. By improving surface water management as part of retrofit solutions we will be able address current capacity issues and improve future resilience in our networks.	By 2020	During AMP6 we constructed several sustainable drainage features and the learning points from this have been used to develop new delivery metrics for AMP7. Rather than just focusing on surface water management our new green communities' indicator also provides wider social/amenity and biodiversity opportunities based on the CIRIA BɆST Tool. We also delivered partnership projects with local authorities to address flood risk to communities where multiple parties had to deliver infrastructure improvements in order to secure the reduced flood risk.
We will continue to proactively manage our waste water assets based on a bespoke weather forecast.	Business as Usual	Our network management teams have 24/7 access to weather forecasting capabilities provided by WeatherQuest. This provides daily weather forecasts as well as direct access to forecasters. This enables us to proactively manage our assets and ensure adequacy of resources. We use preset bronze, silver and gold triggers to prepare our response and contingency plans.
We will invest in RandD focusing on technologies to develop resilient drainage solutions for the future.	Beyond 2020	We have been working with Sheffield University on a wide range of technologies including development of real time in-sewer network monitors which allow us to proactively intervene to avoid asset failures. This has allowed us to significantly reduce the number of blockages which if left unattended would have resulted in flooding and/or pollution incidents.
We will continue to use our asset deterioration model to predict pipes most likely to suffer blockages resulting in sewer flooding and pollution of watercourses. The model suggests proactive interventions, such as cleaning or replacing sewers.	BA	We have used our asset deterioration models, supported by network monitors, to drive down the numbers of sewer blockages across our catchments. This has involved several targeted programmes, such as our 'Blockbuster' initiatives to proactively intervene through sewer cleansing initiatives and sewer replacement.
We are investing over £150m on activities to proactively prevent blockages that could result in sewer flooding; this work includes sewer cleansing, repair and rehabilitation.	Business as Usual	We have exceeded the amount of investment we had planned to reduce the risk of sewer blockages. This has resulted in a significant reduction in the number of sewer flooding incidents experienced by our customers.
We will be rolling out a much wider programme of customer education in AMP6, aiming to reach 125,000 people per year by 2020.	Business as Usual	PR19 Business Plan confirmed that "We're on track to exceed our cumulative target of 700,000 customers across the AMP, and have engaged with over 200,000 customers in 2017/18 alone".
We are installing 1,800 live foul sewer network monitors into our system, allowing us to proactively identify blockages to prevent flooding and pollution.	By 2020	In AMP6 we installed around 2,500 event duration monitors at combined sewer overflow (CSO) locations across our network which allowed us to monitor spills at more than 85% of our CSOs by 2020. We also installed over 1,000 additional network monitors in the most high-risk areas to allow us to monitor the performance of our wastewater network in real time. These monitors are tracked regularly to identify changes in trends so we can intervene quickly if needed. We also ensured there were resources available to respond 24/7 to alarms so we can proactively prevent pollutions from occurring.
We will increase the coverage of our live sewer management plans to 100% of our region, up from 53% coverage in 2015.	By 2020	By 2020, 100% of our population were covered by a live hydraulic model as part of our Sewerage Management Plans. All our models are now kept up to date to ensure current and future performance of our networks can be assessed and this has proved to be invaluable to supporting with development of our Drainage and Wastewater Management Plans.

Appendix 1: We have delivered the actions we committed to in our last report to ensure that: **We have a thriving environment**

Impact of climate change on quality and quantity of water in the environment.

What we said	By when	We have
We will give up 85Ml/d of abstraction licenses as part of the Restoring Sustainable Abstraction programme.	Deliver by 2020	We completed all of our Restoring Sustainable Abstraction WINEP investigations and all of the upfront permitting that was required based on the investigations.
We will increase partnership working by a factor of three compared to AMP 5.	Deliver by 2020	During 2020 we formed 13 strategic partnerships with the regions NGOs e.g. Wildlife Trusts, Rivers Trusts, National Trust and RSPB to deliver biodiversity improvement across the Severn Trent region. In 2021 we have ongoing work with some of these established partners, but we also have new strategic partnership projects agreed. This year we have 25 strategic partnerships contributing towards our Great Big Nature Boost commitment. Some of the key partners that we have brought on board this year are the Canals and Rivers Trust, Cheshire Wildlife Trust and the Butterfly Conservation Trust.
We will invest over £300m to maintain our sewage treatment works. We are also investing in AMP6 to improve river water quality under the Water Framework Directive.	Business as Usual	We delivered our proactive and reactive maintenance programmes at our sewage treatment works as informed by our asset deterioration models and asset care plans. We delivered our Framework Directive and associated WINEP obligations completed with stipulated permit modifications by March 2020.
We will invest in advanced digestion, sludge storage, research and development and improving our end to end sludge route to ensure we can continue to safely dispose of it to land.	Business as Usual	We continue to invest in sludge treatment and research to continue to safely dispose of biosolids to land. We have now completed the installation of our 4th advanced digestion treatment facility. Three of our four sites are in commissioning and will be producing higher quality Biosolids during 2022. In addition, these sites are utilising Ammonia removal technology to improve the quality of our waste liquor returns to the treatment plant. We are focussing now on the feeder sites to these large facilities, to ensure we maximise our high quality biosolids volumes.

Appendix 1: We have delivered the actions we committed to in our last report to ensure that: **Our customers have an outstanding experience**

Impact of adverse weather on our customer experience.

What we said	By when	We have
We will continue to proactively ensure adequate contact centre resource to meet demand by using bespoke weekly weather forecasts.	Business as Usual	We plan our contact schedules in advance, using WeatherQuest to overlay weather forecasts. This informs our tactical plans for using resource planning models and also resourcing when demand is predicted to be high.
We will send out proactive communications to customers during adverse weather and we will make more use of other contact channels such as social media, text messaging and web chat to get information to customers quicker.	Business as Usual	We message customers when demand for water is high to keep them informed and to help us manage peak demand. In incidents we message customers to keep them up to date with progress.
We will continue to have the flexibility of a back up resource pool of contact centre staff to meet high demand, and we will develop a virtual contact centre so we have a better network of skilled advisors to handle calls in all events.	Business as Usual	We flex our tactical plans for shifts, overtime and temps to manage when demand is predicted to be high. We have an established virtual team enabling effective diagnosis which helps us to better diagnose customer jobs remotely, send the right resource and save abortive visits.

Appendix 2: The full list of **climate risks**

Ref.	Climate driver	Risk	Impact	Risk score 2 degrees	Risk score 4 degrees
W1	Hotter drier summers	Reduced reservoir and river levels results in restrictions on the amount we can abstract. (2/3 of our supplies come from reservoirs and rivers, and these would be restricted).	Failure to supply enough water or increase in costs to use alternative sources.	20	25
W2	Hotter drier summers	More frequent triggering of our emergency drought plan measures (drought permits and drought orders) to maintain security of supply.	Puts the environment at risk, legal compliance with abstraction licenses and failure to supply enough water.	12	15
W3	Hotter drier summers	Increased frequency and severity of hot spells increases short-term peak customer demand for water.	Loss of pressure or failure to supply enough water requirement to invest in assets.	20	25
W4	Wetter winters and increased storminess	Flooding of water treatment works impacting operations and damaging assets.	Disruption to supply and increased costs to repair.	9	12
W5	Wetter winters and increased storminess	River scour – increased frequency of high river levels increases river scour and damage to bridges, aqueducts and pipe crossings.	Disruption to supply and increased costs to repair.	4	8
W6	Hotter, drier summers	Pipes can be damaged by shrink and swell in hot temperatures; rapid changes to soil moisture can cause ground movement affecting pipes, resulting in increased leakage.	Disruption to supply and increased costs to repair.	4	6
W7	Wetter winters and increased storminess	Landslides causing damage to infrastructure such as pipes or aqueducts.	Disruption to supply and increased costs to repair.	8	12
W8	Wetter weather and increased storminess	Flooding preventing us accessing our assets.	Disruption to supply.	9	12
G1	Wetter winters and increased storminess, drier summers with extreme rainfall events	Increased run off from fields increases the amount of pesticides and pollutants in water courses.	Decrease in raw water quality and higher treatment costs.	9	12
G2	Wetter winters and increased storminess Drier summers with extreme rainfall events	Seasonal variability reduces engagement with catchment management schemes.	Decrease in raw water quality and higher treatment costs.	12	20
G3	Hotter, drier summers with more intense rainfall events	Risk of contamination to groundwater - desiccation cracks in soil zone creating rapid pathways to groundwater. Increased risk of contamination from bacti, Crypto and turbidity in raw water sources requires increased use of treatment.	Increasing costs of water treatment to mitigate water quality deterioration.	12	15
G4	Hotter, drier summers	Hotter, drier summers with increased frequency and intensity of hot spells increases evaporation and reduces river levels leading to less dilution of pollutants.	Increasing costs of water treatment to mitigate deterioration of water.	8	15
G5	Increase in temperatures	Increasing temperatures provide more favourable conditions and extended growing seasons for invasive species such as Zebra mussels and Himalayan Balsam.	Increased control actions required leading to higher treatment costs.	2	6
G6	Increase in temperatures	Increased bacteriological growth, requires increased use of chlorine or organics removal at treatment works.	Increasing costs of water treatment to mitigate a deterioration of water quality.	4	6
G7	Hotter, drier summers	Hotter, drier summers with increased frequency and intensity of hot spells increases evaporation and reduces river levels leading to less dilution of pollutants.	Increasing costs of water treatment to mitigate deterioration of water.	2	6
G8	Increase in temperature	Increasing temperatures causes an increase in algal blooms in reservoirs affecting water quality, reducing the volume of water that can be abstracted.	More treatment is required, increasing operational workload and reducing the volume of water that can be output into supply to meet customer demand.	9	16
G9	Hotter drier summers	Switching more frequently between surface water (climate impact) and groundwater (hot weather resilient) abstractions throughout the year may impact water quality experience for customers.	Leading to an increase in customer complaints and taste and odour issues.	9	12
D1	Warmer wetter winters and increased storminess	Increased storm intensity which exceeds the capacity of the wastewater network, resulting increased flooding and operation of storm overflows.	Flooding customer properties / premature operation of storm overflows / pollution.	15	20
D2	Warmer wetter winters and increased ground saturation	Prolonged wet weather during winter months results in groundwater table rising and overwhelming wastewater capacity.	Flooding customer properties / premature operation of storm overflows / pollution.	2	4
D3	Hotter drier summers with more intense rainfall	An increase in the number and greater intensity of summer convective thunderstorm) type which overload wastewater capacity.	Flooding customer properties / premature operation of storm overflows / pollution.	6	8
D4	Hotter drier summers with prolonged dry spells	Prolonged dry weather can result in a reduction of flow velocity which increases accumulation of silt deposits. These can increase the risk of blockages which can result in sewer flooding and/or premature operation of storm overflows during dry weather conditions.	Flooding customer properties or environmental damage.	2	4
D5	Warmer wetter winters and increased river and watercourse flood levels	Prolonged wet weather during winter months results in higher/longer rivers and watercourse levels preventing wastewater assets from discharging (surface water, storm overflow and WwTW outfalls) and assets being inundated by river/ watercourse water.	Flooding customer properties / premature operation of storm overflows / pollution.	4	6
E1	Hotter, drier summers	Lower river levels results in an increased risk of deoxygenation and loss of habitat.	Biodiversity loss in rivers, shifts in species distributions, displacement or reduction in fishery resources and expanding algal blooms.	6	9
E2	Hotter, drier summers	Reduced water availability results in increased need for moving water and compensating rivers. This increases the risk of transferring invasive species between river basins and introducing them to protected SSSIs.	The establishment of invasive species known to cause significant habitat degradation or loss of other species.	6	6

Ref.	Climate driver	Risk	Impact	Risk score 2 degrees	Risk score 4 degrees
E3	Hotter, drier summers, Increase in temperature and wetter winters	Water levels will change local hydrological conditions, impacting on habitat suitability and connectivity between habitats and land conditions will change.	Changes to habitat composition and species distribution.	6	9
E4	Drier summers	Lowering of the water table and drying out of upland soils, combined with more frequent extreme rain events, are increasing soil erosion.	Drying out of upland soils such as peatland can release 2-4 tonnes of carbon per hectare per year. Nitrate leaching from upland catchments to surface and groundwaters is more likely under a changing climate with increased runoff events and higher temperatures having implications for water quality.	6	12
E5	Wetter winters and increased storminess	Increased winter rainfall and intense summer rainfall events result in inundation of sewage treatment works.	Failure of treatment processes (prolonged periods treating dilute sewage), pollution events and increased costs.	6	9
E6	Hotter drier summers	Lower water quality in the environment, requires us to compensate and increase the treatment of our effluent to a higher standard.	Tighter discharge consents Additional treatment assets/ technology Increase in operating costs.	4	6
E7	Wetter winters and increased storminess	Reduction in suitability of agricultural land for biosolids product.	Disruption to biosolids route.	6	12
C1	Wetter winters and increased storminess	Increased resources required to react to high call volumes more frequently.	Negative impact on customer experience and more customer complaints.	9	12
C2	Hotter drier summers	Increased resources required to react to high call volumes more frequently.	Negative impact on customer experience and more customer complaints.	9	12

Severn Trent Water Climate Change Adaptation Report 2021

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Registered in England and Wales
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