Climate Change Adaptation Report

2021

from Southern Water

Contents

Foreword

This document represents the third round of Climate Adaptation reporting we've made in consultation with our customers and stakeholders, with the last being published in 2015.

Climate change impacts, amplified by population growth, present huge challenges to our industry, particularly in the South East, which is why they are both listed as principal risks to Southern Water's ability to operate. Mitigating their impacts, and adapting to them, will make sure that we're able to maintain high-quality, resilient services for our customers.

We're already experiencing the negative impacts of a changing climate and the latest forecasts predict an escalation in scale. We've responded to the climate emergency by committing to reach net zero carbon for the emissions associated with operating our services by 2030. In addition, we're in the process of including carbon reduction targets within our construction plans.

However, mitigation alone will not ensure resilience to the physical changes that will occur from the future of warmer, wetter winters and hotter, drier summers. Even if we achieve the Paris Commitment goals of limiting global temperature increase to 1.5°C, we'll face significant further changes to our climate to 2050 and beyond, as reported by the United Nations' Intergovernmental Panel on Climate Change (IPCC, 2021). For this we have undertaken a new 'stock take' of where we are and reviewed our adaptation plans for climate resilience.

We recognise that we're at the beginning of a long transformation process, and that there is a gap between where we are and where we need to be in terms of our resilience and preparedness to tackle the issues these challenges represent, such as regional flooding and reduced access to water resources. The comprehensive business-wide assessment carried out to produce this report has highlighted what we must do to address these risks and has informed both our operational planning and long-term strategy development.

We also know the dynamic nature of the challenges that we're facing. The speed and uncertainty around the severity of the impacts that we may experience as a result of climate change may overtake our current regulatory landscape. Over the next four years and beyond, we will need to work with our regulators on how we better understand and address our customers' needs and maintain resilience to the impacts of climate change.

To keep us on track our plans have been aligned under five strategic pillars that bring to life our purpose and vision; these are:

- Engaging and empowering our people
- Transforming the customer experience
- Demonstrating environmental leadership
- Planning for the future
- Building trust and confidence with stakeholders

In terms of environmental leadership, our executive and Board continue to discuss how we focus on critical environmental issues so that we maximise opportunities, learn efficiently from the experience of others, and identify where we are already in a position to lead. The steps we have agreed to take to realise our ambition focus around three core themes:

- **Simplicity** – implementing practical plans and measurable activity to improve performance in terms of pollution and compliance, focusing on the development of a natural capital approach to planning, delivering our Net Zero Plan, enhancing resilience, shifting our focus from traditional engineering solutions to working collaboratively with partners to create long-term sustainable improvements and a focus on building our flagship Target 100 water efficiency programme.
- **Transformation** – delivering a small and carefully chosen number of bold, ambitious programmes, such as our Water for Life Hampshire plans to tackle potential water supply shortages; and
- **Capability** – building, from Board down, a group of skilled environmental leaders and expert practitioners.

This framework will take Southern Water a step further towards achieving its vision of a resilient water future. We will be investing £2 billion in the next four years to improve the resilience of our existing network, improving compliance, capacity and efficiency, while delivering nature-based solutions and environmental net gain.

Our strategy aligns with Defra's 25 Year Environment Plan and sets out our contribution towards its key targets including mitigating and adapting to climate change and reducing the risk of harm from environmental hazards.

Ian McAulay
Chief Executive Officer

Executive summary

This report has been prepared to support the Adaptation Reporting Round 3 (ARP3) update to the Department for Environment, Food and Rural Affairs (Defra), following our last report in 2015.

It includes the findings of our updated risk assessment on the impacts of climate change, as well as an outline of our strategy and progress in adapting to mitigate increasing risk.

We've used the latest scientific climate forecasts (UKCP18) for medium and high emissions scenarios in order to understand how prepared we are to deal with potential climate change shocks and stresses.

We've already put in place a series of plans looking at the long-term impacts of climate change, and how we need to adapt as a business, these are:

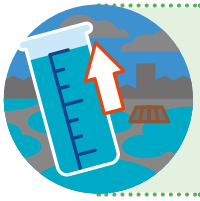
- Resilience Action Plan
- Water Resource Management Plan
- Drought Plan
- Drainage and Wastewater Management Plans.

This report has considered information and modelling gathered for the above plans and updated the overall risk level in a series of chapters on pages 20 to 45. They cover our most significant physical risks: cascading failures from supporting services such as energy, telecoms and transport, public and customer water supply, customer flooding, service disruption from our assets flooding, heat stress or subsidence and other causes, and environmental pollution and natural capital. The summary level of each risk at 2050 (with planned actions) is shown in the diagram on page 5, Figure 1. The insights from this latest risk assessment will inform our future plans and enable us to build climate resilience into our operations.

There are four key climate drivers that we're already experiencing the impacts of, and which we expect to increase in severity and/or frequency over the coming years:

Increased temperature and more extreme variations in temperature

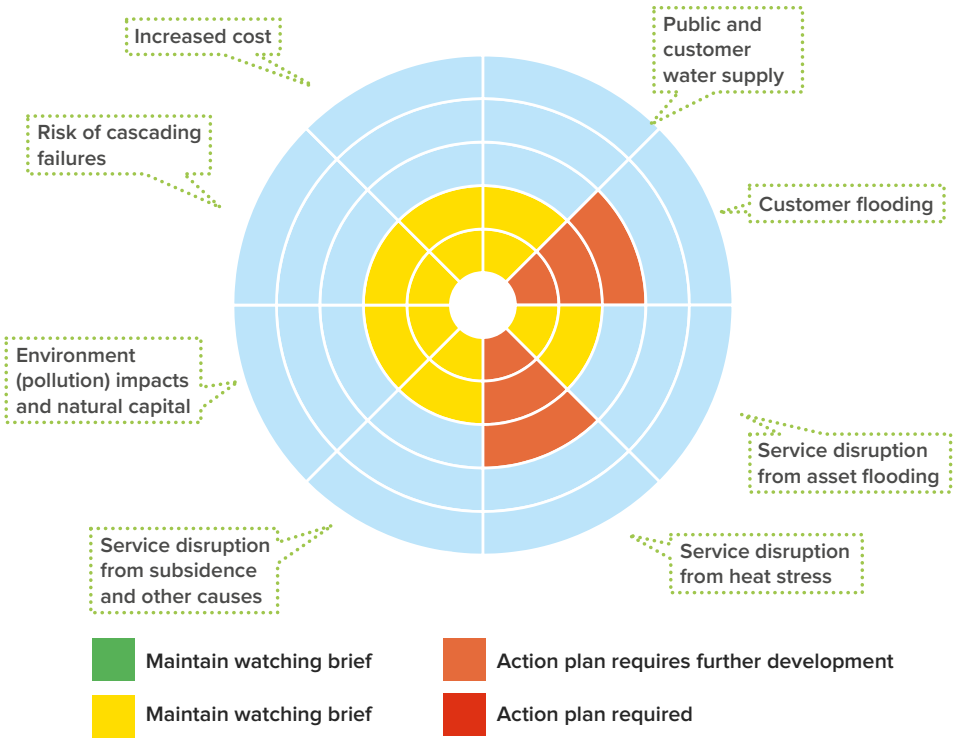
Less rainfall or longer dry periods (drought)



More rainfall, or more intense rainfall (including an increasing number of extreme storms and lightning strikes)

Sea level rise

Figure 1: Our summary of risk exposure at 2050 due to climate change



The main conclusions from this risk assessment are set out below:

1. We're already feeling the impacts of climate change across our business and our provision of water and wastewater services. These impacts present material risks that we need to manage, which are discussed individually later in this document.

2. The impacts of climate change will become more frequent and more severe in the future. We cannot use the past to predict the future. As a result, many of the risks that we assessed in our previous report (ARP2) have increased, either in terms of the probability that impacts will occur and/or the severity of the consequences.

3. Beyond 2050, the risks associated with a two-degree or four-degree scenario start to diverge. We need to prepare for different possible futures in a no regrets approach, but at present it is not possible to fully identify and articulate how risks would change if we considered a 'worst case' scenario. Our decisions will need to factor in uncertainty in how the future climate changes.

4. We have made progress since our last Climate Change Adaptation Report, published in 2015, including assessing resilience across the business and embedding resilience planning into business-as-usual, factoring climate change into our long-term plans (including increasing design standards to take account of changes in expected flood risk, managing demand and enhancing water supply), improving continuity of power supplies, moving towards systems-based approaches and working in partnership to deliver shared outcomes that are beneficial to society and the environment.

5. Our plan to become more climate resilient seeks to reduce the risks of climate impacts, however, there is still more to do; climate resilience will be a continuous process of learning and collaborating in order to deliver water and wastewater services to our customers whilst reducing harm to the environment.

Regional challenges

We serve 2.6 million water and 4.7 million wastewater customers in Kent, Sussex, Hampshire and the Isle of Wight, and cover a large area of coastline, protected and precious natural environments and large urban areas, all of which create different demands on our services.

These include:

- Two National Parks, five Areas of Outstanding Natural Beauty, a heritage coast and two UNESCO world-heritage biosphere reserves.
- 700+ miles of coastline including 83 designated bathing waters.
- 368 Sites of Specific Scientific Interest; 38 Special Areas of Conservation; 17 Special Protection Areas and 13 Ramsar sites – these are wetland areas of international importance under the UNESCO Ramsar Convention, 1971.

The South East is water-stressed and particularly susceptible to the impacts of climate change. Since 1950, average temperatures have risen by around 1°C and are projected to increase by 2 to 4°C by 2100. The latest Met Office UK Climate Projections (UKCP18) suggest that the South East will experience warmer wetter winters and hotter drier summers.

Some of these projections* are outlined in the table below, but for more detail, please refer to Appendix 1:

	2 degrees	4 degrees
UK annual average temperature increase (2080)	0.7 deg	3.0 deg
Average summer temperature increase (South East)	3-4 deg	4-6 deg
UK mean sea level rise (2100)	0.27 – 0.7 m	0.53 – 1.15 m
Average summer rainfall decrease (South East)	20-30%	30-40%
UK heavy rainfall (2100)	+20%	+50-70%
UK heatwave (like 2018) (2100)	50% chance each year	90% chance each year

* Sources: UKCP18, CCC report (2021)

25 years from now we anticipate having lost a third of our water sources in the South East as a result of climate change.

We'll see a reduction in the amount of water we are allowed to take from rivers and underground sources.

Our population is expected to rise by **15%.**

If no action is taken, by 2030 we expect there to be a **50%** deficit between supply and demand for water in the South East so we must find new sources.

Our operating area covers a total of some **4,450 km².**

Our water is supplied from **117** sources along **13,750 km** of mains and treated at **89** water treatment works.

The average amount of water we put into supply is **563** megalitres per day (Ml/d), down from pre-privitisation levels of 730 Ml/d in 1989.

Water resources are already scarce, and rising temperatures will reduce them further, leading to more frequent droughts. At the same time, rising sea levels and more extreme rainfall will also lead to more flooding.

These challenges are amplified by the high rate of population growth in our region – we expect a further 800,000 people living in our area by 2040. With this growth continuing in the areas where supply is most stretched, such as Sussex and Hampshire, the risk of water scarcity and flooding is significant.

Climate change means an uncertain future

Climate change is driven by changes in global temperatures due to our continued release of greenhouse gases. The greenhouse gases trap infrared heat in our atmosphere causing climate systems to be supercharged, resulting in extreme weather events and marked changes in weather patterns not seen in thousands of years.

Our strategy

The key climate-related risks we face are discussed in detail in both Water Futures and our Water for Life Business Plan published in 2017 and 2019 respectively.

These risks are identified through our Enterprise Risk Management process, which forms a core component of our wider governance and internal control framework. We manage, monitor and report on the principal risks identified as part of this process that can impact our ability to deliver our objectives. These reports are shared with our executive and our Board on a regular basis, promoting better decision-making and encouraging the best outcome for the company, our customers and the environment.

Climate change resilience and sustainability are central themes within our current five-year business plan and our long-term strategy to 2040 and beyond. We'll manage the unavoidable impacts of climate change ('adaptation'), while reducing greenhouse gas emissions ('mitigation'), to manage the challenges posed in a sustainable way.

We set out our long-term outcomes in our business plan to help inform our delivery plans – a number of which directly relate to the impacts of climate change. These emerged from customer insights, regulatory expectations, and operational imperatives and included a focus on: recycling; clean rivers, lakes, reservoirs and coasts; collaborating to ensure a resilient economy for the South East; innovating to create sustainable communities and helping our customers recognise the value of water in their daily lives.

Looking to the future we have effective 25-year plans in place for water resources. We look ahead 25 to 50 years to see how much water our customers need and how we can provide it. We share this with them in our water resources management plan (WRMP), updated every five years, so it always reflects new information, advances in technology and any change in customers' views. We also update our Drought Plan every five years, which outlines in detail how we prepare for and respond to water shortages across our region.

In the same way we're planning for the future of drainage, wastewater and environmental water quality. As part of this, we're currently developing 11 Drainage and Wastewater Management Plans (DWMPs) across our entire region; long-term plans – spanning 25 years or more – that will provide an opportunity to improve water quality and drainage systems and will reduce flooding and pollution for the benefit of our customers, communities, businesses, the environment and wildlife.

We're also focused on the delivery of the Water Industry National Environment Programme (WINEP), which provides £500 million of investment to improve the natural environment and ensure that water can be taken from groundwater sources, rivers and reservoirs without any negative impact via investigations and schemes within WINEP. The programme will improve the health of 537 kilometres of rivers in our region.

We know that despite the actions we've already taken or plan to take, set out on pages 12 to 15 of this report and in our previous adaptation reports (published in 2011 and 2015), there is still more to do. The assessments carried out to prepare all of these reports enable us to plan better for an uncertain future, and will inform our next planning cycle 2025–30, as well as our long-term corporate strategy, allowing us to always consider a worst-case scenario in our future plans so we are prepared and resilient.

Our approach to estimating climate change risk

Our last climate risk assessment was undertaken in 2015. We've improved our analysis since then by using the latest climate probability projections (UKCP18) and we've also expanded our risk scoring from a qualitative low, medium and high banding, to a quantitative risk assessment.

We've then scored these risks using a 'heat map' in terms of likelihood (of impact) and impact (consequence). This is consistent with our 'business-as-usual' corporate Enterprise Risk Management (ERM) approach and gives a total risk score between 1 and 25.

Following the scoring of risks, these were assigned to one of four bands, set out below:

Risk bands used to assess level of preparedness

Risk band	Risk Score	Comment
Low (green)	1-5	Maintain current level of action and keep a watching brief.
Low/medium (yellow)	6-10	Action plan in place. Maintain watching brief.
Medium (orange)	11-15	Action plan requires further development.
High (red)	16-25	Action plan required.

Climate Change Committee's Assessment (CCRA3) findings

We've also considered evidence from the Climate Change Committee's most recent assessment (CCRA3) for the UK Government (CCC, 2021).

The key messages for the water sector are:

1. Water infrastructure, such as reservoirs, dams, pipelines, water treatment plants and sewage treatment plants, are all at risk from the impacts of climate change, especially increases in the frequency and intensity of surface water and coastal flooding.
2. Water infrastructure assets represent a key element of the UK infrastructure system and could affect, or be affected by, failures of other assets due to extreme weather, such as energy systems, transport and information and communications technology (ICT).
3. There are also risks to buried infrastructure, such as water pipelines, with damage potentially becoming more frequent in future due to flooding and subsidence.
4. More frequent flooding could also impact on water treatment facilities leading to potential reductions in water quality, in turn impacting upon health.
5. Future projections of more frequent and intense dry periods lead to concerns around the availability of public water supplies in future, especially in England and parts of Wales. Private water supplies are also at risk.
6. Aquifers near the coast could be at greater risk from saltwater intrusion due to sea level rise, though the risk is thought to be low in places where aquifers are important water sources.

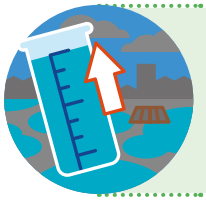
Progress since 2015 against our key climate drivers

The 'climate drivers' identified in our last round of adaptation reporting in 2015 remain valid and we have used these same drivers to help identify risks for this assessment.

These drivers are as follows:

Increased temperature and more extreme variations in temperature

Less rainfall or longer dry periods (drought)



More rainfall, or more intense rainfall (including an increasing number of extreme storms and lightning strikes)

Sea level rise

We've made considerable progress since the publication of our last Adaptation Report in 2015, both assessing how our sites and network can and will respond to the impacts of climate change and embedding these regular assessments into our business-as-usual planning. Climate change is now part of our long-term plans, and we're improving the continuity of power supplies and working in partnership to deliver shared outcomes that are beneficial to our communities and the environment.

See Appendix 2 for more detail of the key pressures identified in 2015 as a result of these climate drivers.

We're working in partnership to deliver shared outcomes that are beneficial to our communities and the environment

How we're working to adapt to the impacts of climate change

Driver	What we have done
 Increased temperature and more extreme variation in temperature	• **Following the Freeze/Thaw event in 2018, a detailed action plan included a new incident management framework and increased capacity at our contact centre by 100%.** **Benefit:** Reduced interruption to essential services. • **Developed technical guidance in order to address heat effects on equipment at our treatment works.** **Benefit:** Clear procedures for our teams to follow. 
 Less rainfall or longer dry periods (drought)	• **Continued to help customers to reduce their water and energy consumption, with individual daily water use getting as low as 126.5 litres by March 2020.*** **Benefit:** Reduced demand on our network and limit drought measures. • **Launched our first Water for Life Hampshire consultation on our plans to explore new sustainable treatment techniques and create a new network of water mains across the region. As part of this programme we have also signed an 80-year bulk supply agreement with Portsmouth Water, under which it will supply us with 21 million litres of water a day. Together, we are developing Havant Thicket Reservoir in Portsmouth Water's supply area.** **Benefit:** Reduced demand on our network and limit drought measures. • **Improved our Drought Plan** based on learnings from the dry and cold winter in 2017, followed by a summer heatwave in 2018 – when demand for water soared. A dry winter followed by a hot summer is one of the many types of drought we're now prepared for.** **Benefit:** Reduced demand on our network and limit drought measures. • **Catchment First is investigating sustainable abstraction (water removal from rivers) methods that reduce impact on the environment and wildlife.** **Benefit:** Reduced environmental impact from abstraction.

* Our most recent water-saving campaigns have focused heavily on the link between water and energy consumption, offering free products and tips to reduce their own, and our, carbon footprint while reducing demand on our network.

** Our Drought Plan is revised every five years and forms part of our long-term resilience planning. It details how we prepare for, manage and mitigate the risks around long periods of dry weather.

What we plan to do	Driver
• **Reduce our leakage by 15% by 2025 and by 50% by 2050.** **Benefit:** Reduced demand on our network and limit drought measures. • **Continue to review the safety and health impacts of operating at extreme temperatures.** **Benefit:** Clear procedures for our teams to follow. 	 Increased temperature and more extreme variation in temperature
• **Continue to help customers to reduce their water and energy consumption. We're aiming to achieve 120 litres per person, per day by 2025 and 100 litres by 2040. One way that we're planning to do this is to introduce smart metering, giving customers access to real-time water usage information. Other levers include: behaviour change campaigns; home visits to install water efficient products and engagement with developers to improve the water efficiency of new homes.** **Benefit:** Reduced demand on our network and limit the risk of the introduction of drought measures (such as hosepipe bans). • **We're part of the Water Resources in the South East group, along with five other water companies, and together we've created a supply plan for the whole region. We're planning to import water from Portsmouth Water and South West Water into Hampshire and from South East Water into Kent.** **Benefit:** Reduced demand on our network and limit drought measures. • **We're installing more pipes to extend our water grid so it's easier to move water to where it's needed most and share it between neighbouring water companies.** **Benefit:** More flexibility to move water where needed in times of drought. • **Our target for long-term supply and demand schemes is to deliver capacity of 182.5 Ml/d by March 2027, as part of our Water for Life Hampshire programme.** **Benefit:** Reduced demand on our network. • **Deliver access to new water sources in water-stressed Hampshire through our Water for Life Hampshire programme, which includes a combination of infrastructure investment, nature-based solutions, land management and customer behaviour change.** **Benefit:** Access to new sources of supply. • **We recycle about 17% of our wastewater at the moment – so there's an opportunity to do more. Our Water for Life Hampshire programme is looking into large-scale water recycling opportunities.** **Benefit:** Access to new sources of supply.	 Less rainfall or longer dry periods (drought)

How we're working to adapt to the impacts of climate change

Driver	What we have done
 More rainfall, or more intense rainfall (including increased storminess and lightning strikes)	• **Expanded our Catchment First programme, investigating potential pollutants which could compromise our drinking water supplies and the environment, working in partnership with farmers and landowners.** Benefit: Raw water quality improved. • **Invested £437m to improve the resilience of our sewer network.** Benefit: Maintain and enhance ageing infrastructure, preventing flooding and pollutions. • **Made significant investments to improve our wastewater treatment and water quality compliance.** Benefit: Reducing the risk of pollutions and reduced drinking water quality. • **Installed flood mitigation measures in 10 towns and cities as part of a targeted investment.** Benefit: Reducing the risk of sewer flooding inside customer properties. • **Published two annual iterations of our Pollution Incident Reduction Plan (PIRP), which includes £8.2m investment to 2025. During 2020 the plan delivered a 10% reduction in the number of pollution incidents.** Benefit: Reducing pollutions.
 Sea level rise	• **We continue to carry out comprehensive flood risk assessments of our sites, exploring suitable options for temporary flood defences to make sure we could continue to deliver essential services during flooding. Flood barriers are stored at strategic sites across our region enabling rapid deployment to protect critical services. As part of our work on our Drainage and Wastewater Management Plans 19 sites have been identified for further investigation.** Benefit: Reducing pollution, erosion and flooding risk 

What we plan to do	Driver
• **Further develop our Drainage and Wastewater Management Plans (DWMP), taking a catchment approach to solve regional issues.** **Benefit:** Reducing pollution, erosion and flooding risk • **A 20% reduction in the number of internal and external sewer flooding incidents affecting customers' homes and outside areas by 2025.** **Benefit:** Reducing pollution, erosion and flooding risk • **Taken action to address the most harmful of our sewer overflows, building on our monitoring programme, and our Beachbuoy service; working with our regional partners to maintain more excellent bathing waters in the South East.** **Benefit:** Reducing pollution, erosion and flooding risk • **Our aim is to reduce pollution incidents to less than 80 by 2025, aiming for zero pollution by 2040.** **Benefit:** Reducing pollution risk • **As part of the WINEP requirements we'll improve the water quality in 537km of river.** **Benefit:** Improving water quality	 More rainfall, or more intense rainfall (including increased storminess and lightning strikes)
• **We've identified sites at high or medium risk of flooding from rivers, the sea or surface water. Detailed flood risk assessments and site surveys will be carried out periodically at these sites to determine whether permanent flood mitigation measures are required or whether temporary flood barriers provide sufficient protection. This will inform investment requirements in future business plans.** **Benefit:** Reducing pollution, erosion and flooding risk  Case Study: **Testwood flood barriers** Following 1 in 200 year plus climate change modelling. This resulted in the installation of flood barriers to protect the resilience of the low lift pumping station at Testwood Water Supply Works.	 Sea level rise

Our preferred future

A successfully implemented climate adaptation strategy will enable us to live and breathe our purpose by delivering against our key strategic pillars; in turn building trust with our key stakeholders and enabling us to work with others to meet the needs of our communities.

Transforming the customer experience

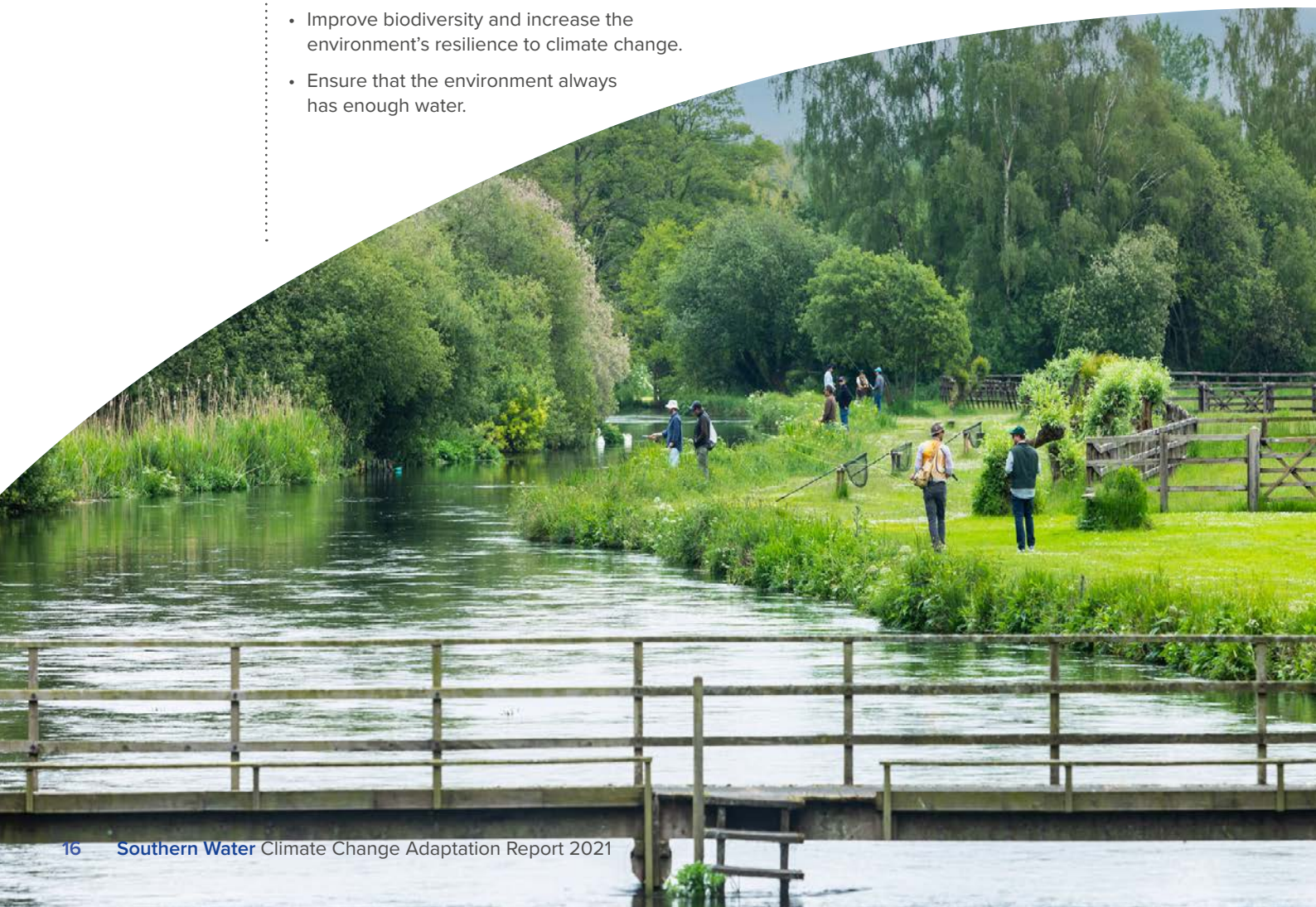
- Reduce the exposure of people to severe weather; enhancing their health and wellbeing.
- Protect the quality of drinking water.
- Reduce the risk of sewer flooding and supply interruptions, improving customer satisfaction.
- Ensure that customers always have enough water.

Environmental leadership

- Protect the environment and serve our customers over the long term through timely investment and more robust management of severe weather events.
- Improve the quality of the water in the environment.
- Use low carbon solutions, increasing value while achieving net-zero carbon by 2030.
- Improve biodiversity and increase the environment's resilience to climate change.
- Ensure that the environment always has enough water.

Planning for the future

- Improve energy security and resilience to power supply failures and reduce exposure to high energy price changes.
- Minimise the cost of dealing with more frequent severe weather events and the costs associated with switching to a low carbon economy.



Our business model

The purpose of this document is to simply explain to our customers and stakeholders how we're embedding adaptation across our business.

Our overarching purpose as an organisation is to deliver water for life to enhance health and wellbeing of our communities, protect and improve the environment and sustain the economy so that we can fulfill our vision of a resilient future for our customers in the South East.

Our business model is structured to create long-term value for customers, employees, investors, business partners and the wider community, while safeguarding our environment.

Climate change is formally recognised as one of Southern Water's principal risks. As such, a number of our short and long-term commitments have been created to balance the needs of our customers and the environment in one of the most water-stressed and highly populated regions of the UK.

Our business model below outlines how we respond to external and internal challenges in partnership with our key stakeholders. It clearly demonstrates how their feedback, monitoring, evaluation and learning is built into our decision-making processes.

Engagement with our many varied stakeholders happens in numerous formal and informal ways, for example during preparation of five-year business plans and through regular updates of our risk registers.

Our external environment

- Regulatory expectations
- Climate change
- Increasing customer expectations
- Securing long-term resilience
- Growth – economic and population
- Affordability and vulnerability
- Transparency and accountability

What we do and how we do it:

Developed following extensive consultation with our customers and stakeholders, our Water for Life Business Plan 2020–25 will deliver significant performance improvements: **Deliver great service; Use water wisely; Protect and improve the environment** and **Fit for the future**

Value delivered:

- We measure value delivered to our stakeholders in a number of ways:
- Operational delivery and service targets
- Customer interactions and engagement with our services and programmes
- Perception audits, surveys, interviews, panels and workshops
- Regulatory audits and assessments, e.g. the Environment Agency's annual Environmental Performance Assessment

Our purpose

- To provide water for life to enhance health and wellbeing, protect and improve the environment and sustain the economy
- Our purpose is why we exist. It drives our long and short-term decision-making and is centred around the value we provide to our customers and stakeholders

Underpinned by our values

Our values are at the centre of everything we do. They govern how we do things and allow us to build a solid decision-making framework.

Embedding risk and value processes into operations

- Our risk and value (R&V) process underpins our way of working. It is improving our decisions about how to invest, build and run our assets, and allows us to collaborate more effectively with suppliers across our business

Seeking and acting on feedback from our stakeholders

- Understanding what matters most to our customers and stakeholders is fundamental if we are truly going to be a purpose-driven organisation. This means consulting with our: customers; communities; regional stakeholders; retailers; employees; suppliers; environment; regulators; investors as often as we can.

Engagement with our key stakeholders

Customer engagement is business-as-usual at Southern Water. This includes regular contact with household customers and future customers, businesses, customers from diverse backgrounds, different cultures, as well as vulnerable audiences.

Our approach is driven by 12 participation principles, which means we triangulate views from:

- The wealth of existing insight available
- Research which looks at attitudes and behaviours in the moment
- Fresh insight using industry best practice running specific engagement through deliberative panels
- Collaboration with our industry partners.

As part of this continuous engagement, we're able to understand both their short and long-term priorities.

We understand more about the customer's relationship with the climate

We have a number of deliberative panels that enable us to bring customers closer to our environmental ambition and key decision makers. Our customers have open conversations about what's important to them for their futures. Below is a list of some of the work that has been undertaken to understand from customers what matters to them:

- **Water Hub** – Focused on what matters to customers for the long term and how we can become an environmental champion.
- **Water Futures 2050** – Understanding of what future customers' priorities are with a major focus on the environmental challenges we face.
- **Water Futures 2030** – Continuous engagement/dialogue with household customers focusing on challenging our thinking throughout our investment planning process.

Protecting the environment and adapting to climate change are seen as key drivers for a significant amount of customers and they are keen to understand more about how we are tackling these issues. This includes challenging our environmental ambition and discussing/challenging key decisions with senior programme leads. We have hosted events with both household and future customers where they have fed back directly on our long-term plans.

One of the other elements to our research is understanding the language we need to use and how to educate customers about behaviour change to help do their bit to support on a number of aspects (water usage, blockages, etc). We're keen to understand how we can tailor our messaging to meet the needs of customers across our operating area and how this differs across the region.

Protecting the environment and adapting to climate change are seen as key drivers for a significant amount of customers and they are keen to understand more about how we are tackling these issues

We're forging partnerships with key stakeholder groups

We're currently working with the Wildlife Trusts to understand the natural capital value and opportunities on our own estate. This includes identifying priorities for protecting stored carbon and opportunities for offsetting by restoring or creating new habitat.

We're supporting a South East local enterprise partnership (LEP) funded project which is exploring the mechanisms and tools needed to accelerate nature-based climate solutions, enhancing the value of our natural habitat (natural capital) while delivering clean growth, jobs and skills across the nature-based sectors. The project is focusing on carbon sequestration, where there is significant demand but less reliable sources of supply.

Our work with Local Nature Partnerships across our region is helping us to understand where the greatest opportunities are for restoring nature while delivering multiple benefits (including protecting carbon stores and offsetting carbon). This is to ensure the right solutions are delivered in the right place and that investment supports emerging government-led initiatives such as Local Nature Recovery Strategies.

Our Strategic Environment Panel helps us to plan for a resilient future

The panel, made up of representatives from regional NGOs and environmental lobbying groups, works with us to help deliver sustainable water and wastewater services, providing strategic advice on the development of our future business plans. The panel acts as a sounding board for existing and new ideas, priorities, options, analysis and emerging issues, provides expertise, insight and challenge on the feasibility of options, offers up views on company policies (e.g. natural capital, shadow pricing) and helps us to identify opportunities for partnership working.

We share our customer insight with the panel to help ensure customer priorities are taken into account at every step in the process. Topics discussed are wide ranging and include: water resources, pollution, sewer flooding, carbon, bathing water, integrated water cycle management.

Working in partnership through our Climate and Environment Group

Our new Climate and Environment Group, including members/employees from organisations with strategic interest and expertise in climate change and the water environment, will help us to develop multi-sector approaches to address future climate and environment challenges, looking ahead to 2050 and beyond.

It will provide independent challenge and advice on the development of our future plans and delivery of our 2020–25 environmental commitments to customers.

The group will provide governance, strategic advice and challenge to the business on the development and delivery of our plans by acting as a sounding board for existing and new ideas, priorities, options, analysis and emerging issues; providing expertise, insight and challenge on the feasibility of delivery approaches; helping to facilitate partnership working and multi-sector approaches and forming part of the governance framework for key strategic programmes and planning activities.

The group will play a vital role in bringing the stakeholder and customer voice to decision making within Southern Water.

Understanding our individual risks

Our individual climate change-related physical risks have been grouped under seven summary categories.

These have been selected to encompass the entirety of climate-related risks, while focusing on outcomes, i.e., how the risks ultimately impact on customers, the environment or society in general.

1. **Risk of supporting service (cascading) failures – e.g. energy, telecoms and transport routes**
2. **Risk to public and customer water supply**
3. **Risk of customer flooding**
4. **Risk of Service disruption from Southern Water asset flooding**
5. **Risk of service disruption from heat stress**
6. **Risk of service disruption from subsidence and other causes**
7. **Risk of environmental (pollution) impacts and natural capital**

A discussion of the assessment carried out for each risk category is set out in the following chapters.

Risk of supporting service failures (cascading failures)

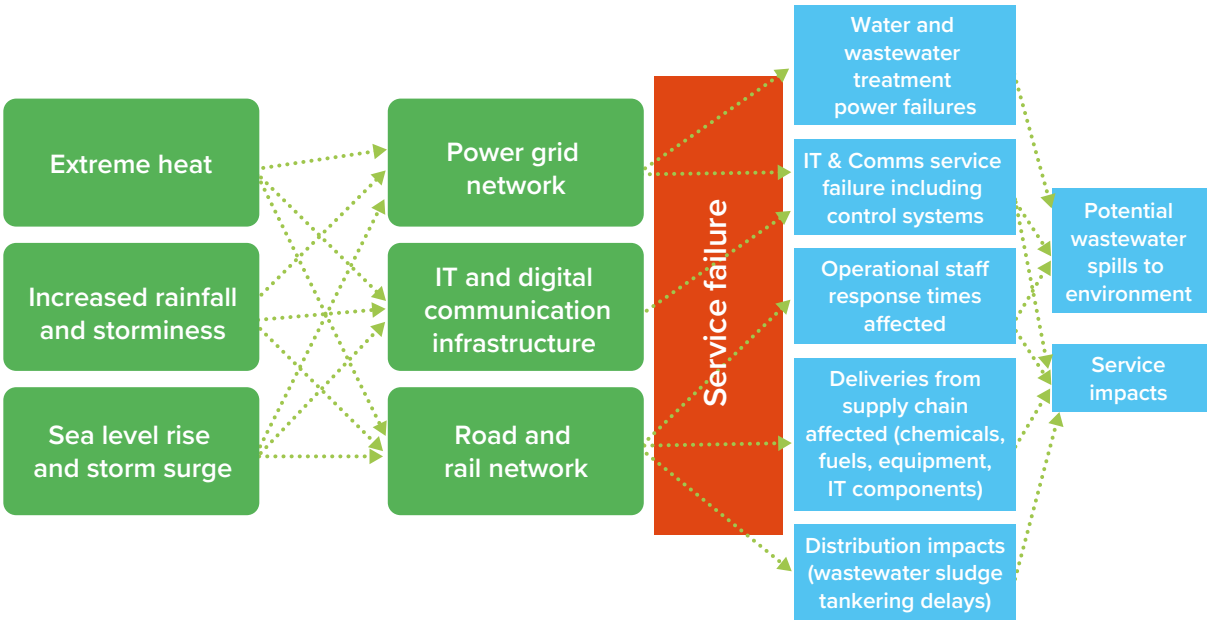
We depend on the infrastructure and the services of many other organisations to deliver our water and wastewater services to our customers.

Climate change will increase the risks that already exist due to complex interdependencies between our own infrastructure and both built and natural systems, as well as creating new risks.

The key dependencies we have identified for our business that impact physical risks are energy, IT and communication and transport routes.

We are also dependent on partnerships, chiefly the failure of services provided by these third parties.

Figure 2: Supporting service failures from interdependent infrastructure



Energy:

We have more than 4,000 sites connected to the electricity grid, with our water and wastewater sites consuming around 549 GWh (gigawatt hours) per year (2020–21 figures).

Wastewater is the largest consumer of energy, accounting for 72% of consumption. Water supply accounts for the remainder of the energy needed to power our operations, with solar generation totalling 3 GWh, helping to ease the need for imported energy at our supply works. We aim to generate 24% of our electricity from renewable sources by 2025.

IT and telecommunications:

We operate a huge telemetry system to help monitor and manage our operations effectively, and respond to problems quickly as they arise. We also rely on telecoms services to maintain contact with our customers and our employees across the region.

Transport:

Extreme weather variations brought on by climate change could impact our ability to deliver key chemicals and fuel to our sites needed for water or wastewater treatment processes. Our teams may also find it difficult to carry out repairs.

Partnerships:

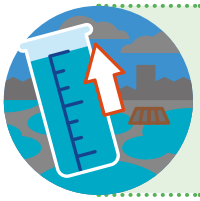
During emergencies, collaborative working with local authority partners helps us to respond quickly and effectively and continue to deliver services to our customers

Risk of supporting service failures (cascading failures) continued

How we're measuring this risk

The latest assessment undertaken for this report confirms that there are four climate drivers and six separate climate risks relating to supporting service failures.

These climate drivers that could create risks from interdependencies across sectors:



More rainfall or more intense rainfall (increased extreme storms) resulting in flooding, leading to a reduction in or loss of power supply and/or IT communications to/from operational sites and networks, or disruption to supply logistics and transport.

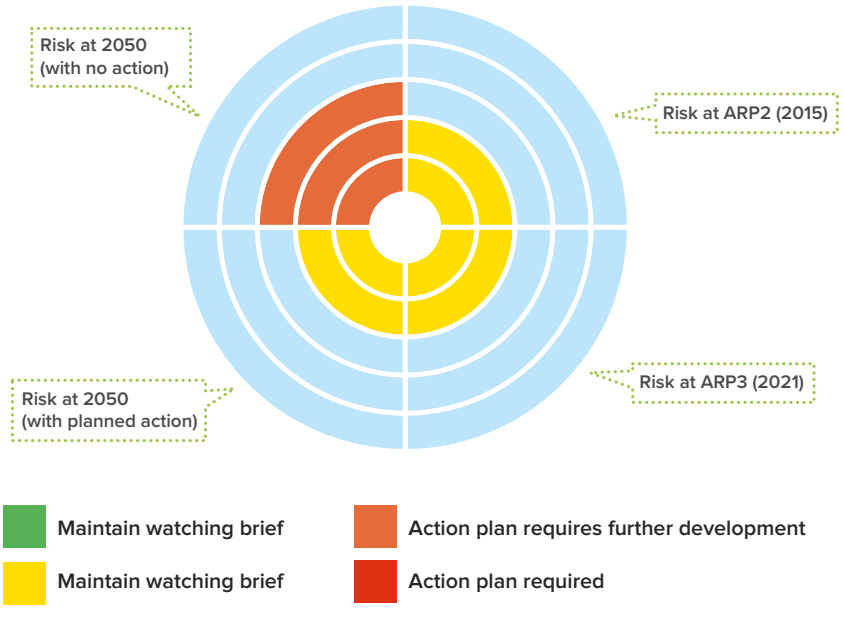
Sea level rise (and increased extreme storms) resulting in flooding and/or coastal erosion and similarly leading leading to loss of power supply and/or IT communications to/from operational sites/networks, or disruption to supply logistics and transport.

Other less obvious interdependency risks that could become more severe over time include:

Increased temperature and more extreme variations in temperature leading to changes in agricultural crops and rural land use, which over time could lead to changes in routes for biosolids recycling.

These risks are not focused in any specific area and cover our entire operating region.

Figure 3: Climate change risks profile from cascading failures from infrastructure we rely on



Actions we've already taken

As part of our broader resilience strategy and action plan, we've invested significantly in increasing the resilience of power supplies at key sites. This includes generating our own power and installing back-up generators.

We've also undertaken a review of resilience in relation to power and communications across all our sites (see case study). As a result, we're developing a programme of improvements across many of our key sites.

In terms of land use, we've developed a sludge recycling strategy, which is reviewed regularly. We achieved a 100% biosolid recycling record during 2020–21. Biosolids (a by-product of the treatment process) is recycled as a fertiliser.

What we're doing now

We're improving our power resilience in three main areas. We're looking broadly at our whole estate to identify any issues with power as we know there are multiple potential causes of service failure, including power supply, site controls or issues with the switch over to backup generation.

We're carrying out a 'deep dive' exercise at four major Water Supply Works and four Wastewater Treatment Works with known power issues. Based on the findings we'll refresh our long-term strategy for power resilience, putting modifications in place, where necessary.

We're planning to install new and efficient Combined Heat and Power (CHP) engines, replacing the oldest nine in our fleet by 2025.

Solar Farms are in place at two sites in Hampshire – Otterbourne and Testwood. These play an important role in providing resilience while helping to reach our renewables target by producing electricity. By 2025, we aim to increase the amount of renewable electricity generated to 24% of our total electricity used.

Energy consumption has increased in recent years, and while energy efficiency work is ongoing to minimise the impact of this, the trend is expected to continue for the short term. Solar power is key to our renewable energy generation. Our Hardham Water Supply Works now has some solar capacity, and we also plan to develop a 0.5MW roof top solar array at Peel Common in the next year. We're also looking at desktop feasibility assessments regarding the suitability of using solar on more of our sites, which could improve our renewable generation by up to 3%.

We'll also be considering our future monitoring requirements to ensure operations receive the information they need to improve service. This includes an overhaul of our corporate networks, providing a faster, more resilient and secure environment, replacing analogue with digital technology on sites, integration of operational asset data into monitoring systems, better access to telemetry data and predictive maintenance.

Risk to public and customer water supply

Climate change in the South East will lead to less rainfall in summer and more in winter, drier summers and lower summer river flows.

This means that there'll be less water available throughout the year. Increasingly hot summers are also likely to increase the demand for water among both household and non-household (commercial) customers.

If we do nothing, a combination of reduced supply and increased demand will present us with one of our most significant climate-related risks, which could lead to low pressure, interruptions to supply and lower quality supplies (in terms of discolouration, taste or odour).

We've been assessing the impact of climate change on our water resources for some time through our statutory Water Resource Management Plan (WRMP) and Drought Plan. Since our last climate adaptation report in 2015, we have carried out a number of actions set out in our WRMP plans, and we've accounted for uncertainty in the future climate by modelling the impact of a range of climate change scenarios on the supply-demand balance.

Figure 4: Potential risks to public and customer water supply as a result of climate change

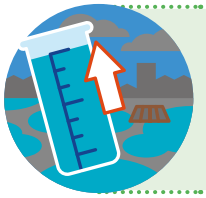
How we're measuring this risk

The latest assessment undertaken for this report confirms that there are four climate drivers and 14 separate climate risks relating to public and customer water supplies.

These climate drivers can affect the demand and the supply aspects of how we manage our water sources.

Increased temperature or more extreme variations in temperature, leading to people moving to less water-stressed areas and/or changes in domestic water use and increased evaporation of water sources and/or increased algae and microbial growth.

Less rainfall (longer drought periods) leading to lower flows during the summer and less water available in groundwater stores.

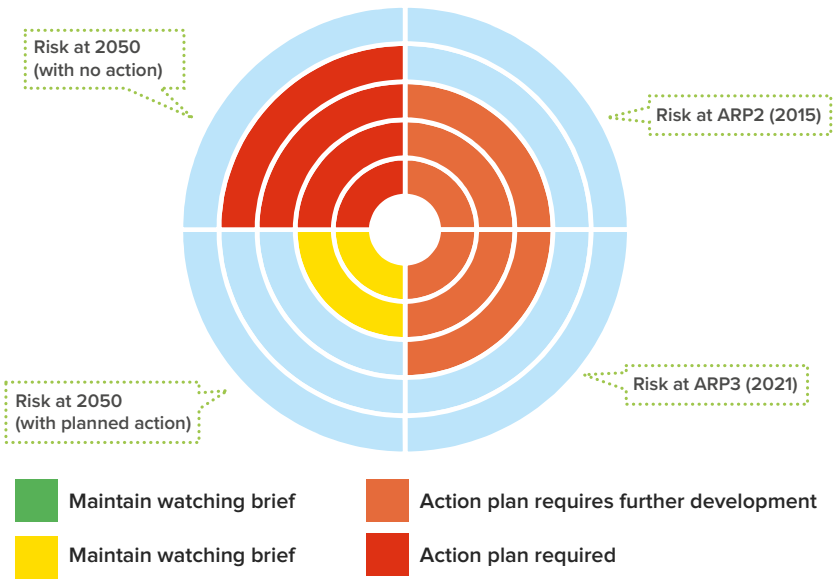


More rainfall or more intense rainfall (increased storminess) leading to poor raw water quality from river sources due to run off pollution.

Sea level rise, leading to salt water intrusion into boreholes, change in tidal limits of rivers and increased saltiness of water sources.

Increasingly hot summers are also likely to increase the demand for water

Figure 5: Risk profile for public and customer water supply



Actions we've already taken

To reduce customer demand on supplies

Our universal metering programme means 88% of our customer base is now metered, delivering more accurate data on demand, encouraging customers to monitor their own water usage.

Our industry-leading Target 100 programme, launched in 2019, has already started to support and incentivise customers to reduce their individual daily usage. Our customers currently use around 139 litres person, per day (below the national average); we're aiming for 100 litres by 2040.

We also have a leakage reduction plan in place to reduce leaks from our network by 15% by 2025. This includes increasing the number of find-and-fix teams and introducing new technology, allowing us to pinpoint areas of concern in our network far more quickly.

During 2020-21, Southern Water installed 7,400 acoustic loggers that allow us to listen for and alert us to leaks on our network before they become a problem, and completed over 20,000 leak repairs with 250 field employees supported by 50 analysts and planners. We're on track to meet our commitment to reduce leakage by 40% by 2040 and 50% by 2050.

We're also installing 100,000 smart meters by 2025 and investing £14 million to support water-saving home visits to help detect leaks in our customers' homes.

We're investing £14 million to support water-saving home visits

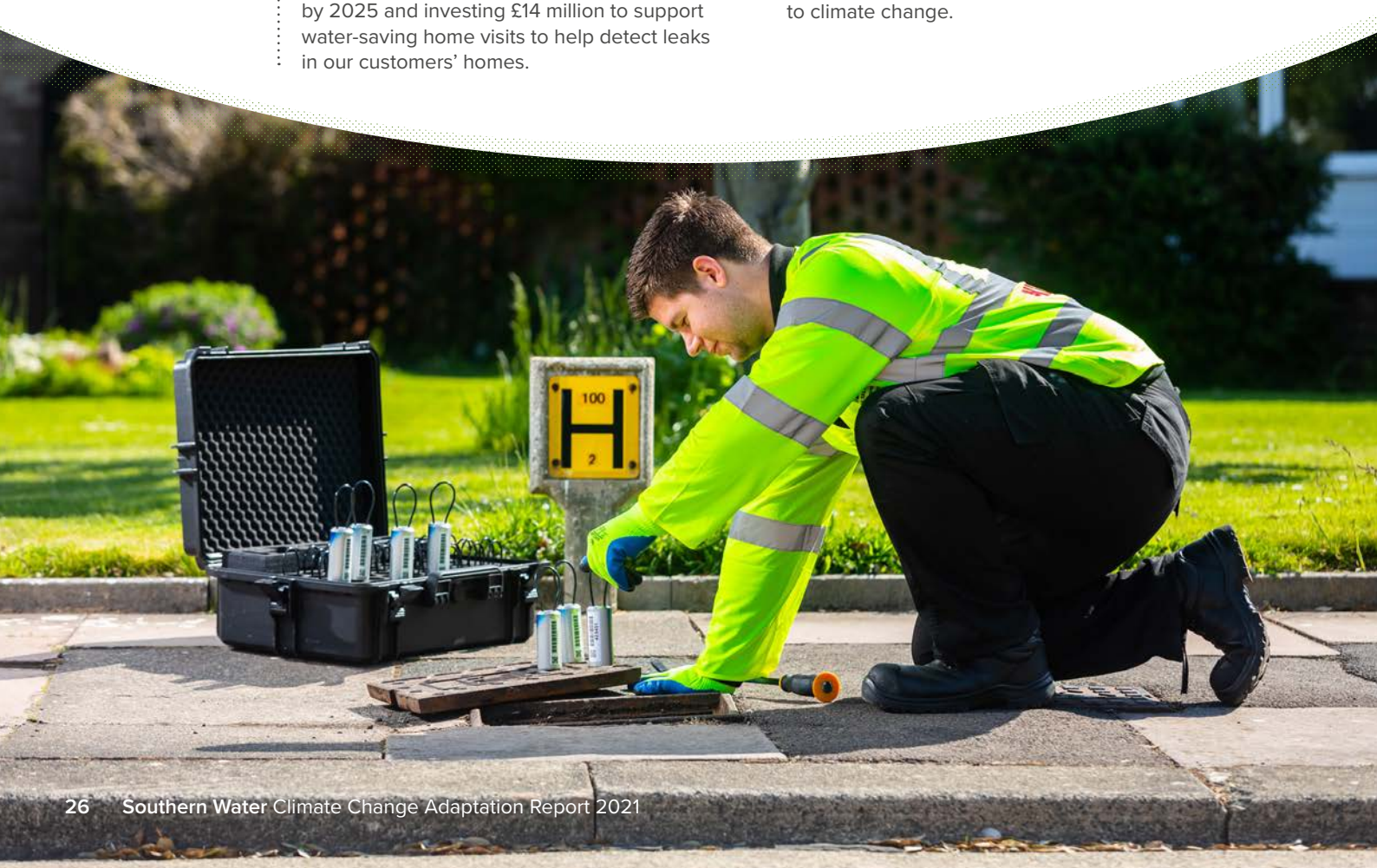
To keep supplies flowing for customers

Our Water Resources Management Plan 2019 (WRMP19) was developed to provide adequate water resources to 2070, including incorporating the impacts of climate change on available water resources and likely customer demand.

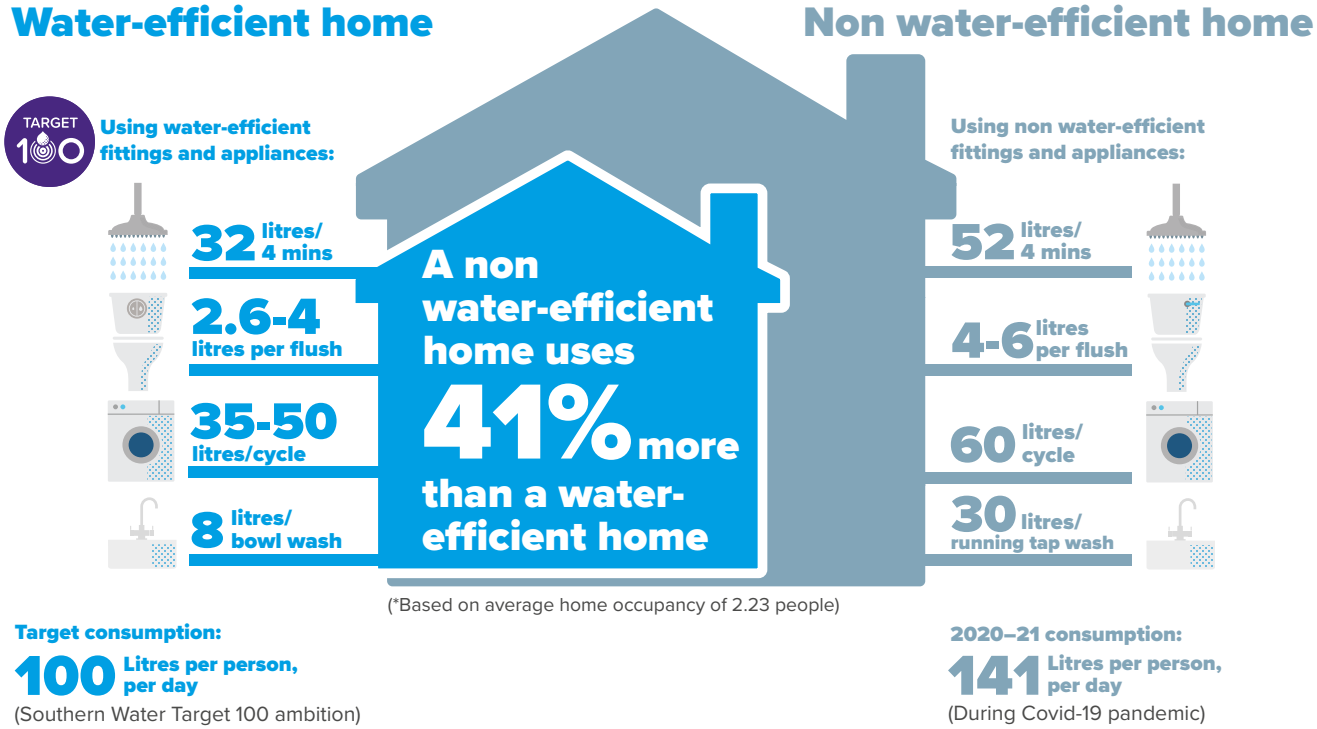
Our Networks 2030 programme has been created to improve network connectivity and reduce the likelihood of supply interruptions by sharing water resources across our water resource zones.

We've also looked at the increased risk of salt water intrusion at key sites including Balsdean and Burpham, while partnering with Imperial College on research projects in the Brighton Chalk Block to minimise the risk from salt water.

In addition, we've changed how we monitor water quality, and have action plans in place to manage hot weather and its impact on water treatment, in order to improve the ability of the network to respond to water quality incidents which could change in both severity and probability due to climate change.



Household water consumption: Target 100 vs non water-efficient home



What we're doing now

To reduce customer demand on supplies

The COVID-19 pandemic has had a profound effect on all aspects of UK society. Since March 2020, normal daily life was suspended, with unprecedented changes to individual and household behaviours. We've used the 'Extra-HOURS' model to improve our understanding of the drivers of changes in water consumption during the COVID-19 lockdowns. Using a combination of published and commercial data sources and intelligence on population mobility and dynamics the model estimates the likely 'extra hours at home per day' that will have resulted at various stages of the pandemic.

In our 14 water resource zones combined, it's estimated that, on average, an extra 6.8 million hours per day were spent in domestic properties, ranging from over 10-11 million per day in April and May 2020 to 3.9 million in the more relaxed conditions of October 2020. In terms of Extra-HOURS per property, the estimates range from over 9-10 hours in April and May 2020, to under 3 hours in October 2020.

This data, combined with our demand data, suggest that, compared to the average for the prior three-year period, 2020–21 has seen an overall 8% uplift in individual daily usage (PCC) and household usage (PHC).

As a result we've reinvigorated our Target 100 water efficiency programme, which aims to support and incentivise customers to reduce their personal use to 100 litres a day by 2040. Levers include: behaviour change campaigns; home visits to install free water efficient products; engagement with developers to improve the water efficiency of new homes; and smart metering, delivering more regular meter readings to customers.

Reducing leaks helps us to keep more water in the water supply and means we need to take less water from the region's rivers and underground aquifers. It also means we need to use less energy to pump this water through our networks.

2020–21 has seen an overall 8% uplift in individual daily water usage.

To keep supplies flowing for customers

Our Water Resource Management Plan that we are preparing for 2024, reassesses water resources availability based on the latest UKCP18 climate change projections from the Met Office. As a result a number of schemes to be delivered during the current investment period to 2020–25 (devised after WRMP19) have been developed further including:

- Developing alternative water sources including water recycling and a review of the viability of desalination plants.
- Planning for a greater degree of environmental protection.
- Delivering a series of catchment management solution schemes (six sources in Hampshire and IoW, nine sources in Sussex, 15 sources in Kent), improving raw water quality.
- Delivering additional water transfers for neighbouring water companies (including South West Water, Thames Water, Portsmouth Water and South East Water).

We're investing in freshwater resources to protect the environment and keep the region's taps and rivers flowing

Plans are also in place to reduce the impact of increasing temperatures on customer supply pipes still containing lead. The replacement of lead customer pipes only applies in the Deal (Kent) water supply zone, where a co-delivery trial is being conducted, offering grants to affected customers.

Water for Life Hampshire

The Rivers Test and Itchen in Hampshire are among the world's finest examples of chalk streams and support a diverse ecosystem. However, the twin pressures of more extreme weather events and a growing population have a put strain on these rivers – threatening the wildlife these unique habitats support.

New rules limit how much water we can take from Hampshire's rivers for local residents. We're investing in freshwater resources to protect the environment and keep the region's taps and rivers flowing.

In order to protect the health of important local rivers in a changing climate, we're reducing how much water is taken from the Rivers Test and Itchen when flows are low. Climate change is contributing to make these low flow periods more severe and more frequent. To replace the need to remove water from these precious habitats, we're investing in new sources for the region.

Our WRMP19 detailed how we would make up a forecast supply shortfall in 2027 through the Water for Life Hampshire programme. This includes investment in:

- Exploring new sources of water including water recycling.
- Building up to 125 kilometres of new pipeline to link key sites and allow additional transfers from neighbouring water companies.
- Teaming up with Portsmouth Water to build a new reservoir at Havant Thicket to be used as a strategic water resource for the region.

This investment complements the additional steps that are being taken across the network to protect and preserve water, such as reducing leakage; working with farmers, businesses and environmental groups on catchment management schemes to reduce pollutants entering watercourses; and supporting and incentivising customers to reduce their use to 100 litres per day.

As well as ensuring a resilient public water supply to Hampshire there are other benefits in terms of environmental improvements, network upgrades and potential carbon benefits in using existing infrastructure and sources via transfers instead of building new works.

Following recent service disruptions as a result of extreme weather events such as the 'Beast from the East' in March 2018, we've taken a number of steps to reduce the impact of these events on the public water supply network:

- More regular and detailed forecasts to assess when severe weather is likely to have significant impact on our water networks.
- A complete overhaul of our incident management system, from identifying the potential for an incident, through preparation stages and actual incident handling to post-event management. This allows us to update our customers faster and in a more targeted way during supply events.
- Major investment to improve the resilience of networks, such as the addition of more remote sensing devices to better monitor flows and help understand how an incident is affecting supplies in real time.
- Working more closely with Local Resilience Forums. For example, sharing lists of customers who might be in vulnerable circumstances when dealing with long-lasting incidents.

To improve our ability to respond to water quality issues, which could be impacted in both severity and probability due to climate change, we also plan to install 2,500 smart water quality sensors by 2030 which will enable us to address any issues more quickly.

Our commitment to customers during a drought

Our customers have told us that they want to know early on about an impending drought and if water restrictions will be brought in. We'll do this through widespread coverage in the media, social media and with emails and text messages. We'll also share lots more detail about a drought on our website – **southernwater.co.uk** – so it's the go-to place for all important information.

We'll keep everyone up-to-date – households, businesses and water retailers, as well as organisations representing the environment, businesses, farmers, golf courses, horticultural trades and others. When a drought starts we'll also work in partnership with other water companies and local authorities, as well as the government and water industry regulators so our messages and actions are clear and joined-up. Looking after our vulnerable customers and making sure the information is accessible to everyone is a priority.

We'll also make sure that households and businesses know how to help save even more water at this time, so we can delay restrictions on using water for as long as possible, and protect the environment.

Engaging with customers to refine our Drought Plans

Following a recent consultation on our Drought Plan, we found that most customers who responded felt the plans to tackle droughts were easy to understand and supported the plans for restrictions and exemptions, including extreme measures in an emergency drought.

Following the consultation the plan will be updated, to include:

- **Further development of the drought flow triggers for the rivers Test and Itchen in Hampshire, which are used to determine when actions to maintain secure supplies during a drought are needed.**
- **More information on the potential environmental impact of drought permits and orders and mitigation plans for them.**

This positive response is important as we can only successfully deal with droughts if we effectively work together. As well as receiving very detailed responses from the water industry regulators, such as the Environment Agency, we also heard from a wide range of organisations who took part in webinars and customers who got involved in online workshops and forums, including young people, households and business customers.

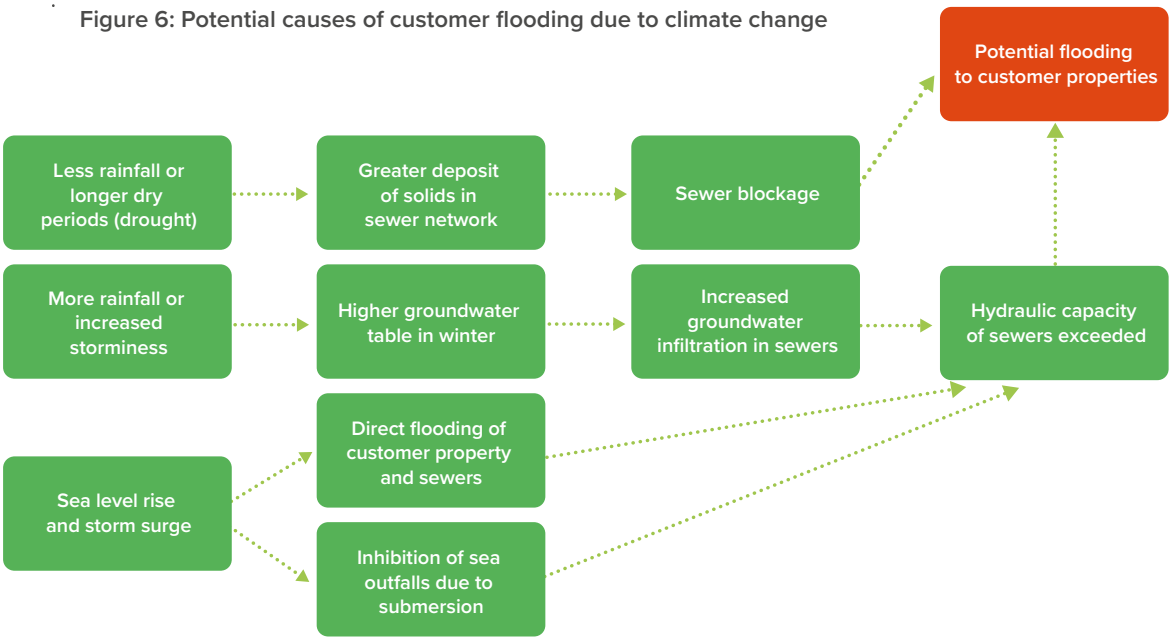
The final version of our plan will be published in 2022 when it has been approved by Defra.

Risk of customer flooding

Each flooding incident is hugely distressing for our customers. As such, it is an area of our performance that we take extremely seriously. By 2040 we want to make flooding from sewers an 'exception'.

Usually caused by hydraulic overload (too much water) or blockages (fat, oil, grease and other 'unflushable' items) sewer flooding can cause damage to homes and business and environmental pollution. Around 80% of flooding is caused by blockages alone.

Figure 6: Potential causes of customer flooding due to climate change

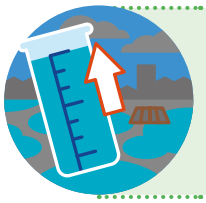


We're already experiencing wetter winters, which is consistent with climate change projections. During the most recent decade from 2009 to 2018, UK winters have been 5% wetter compared to the reference period 1981–2010. The combination of blockages, growth and more heavy rainfall events due to climate change will increase the risk of sewer flooding.

We know long-term planning for drainage and wastewater management is needed to address ongoing climate-related challenges as well as the development of new homes in the South East.

Long-term planning for drainage and wastewater management is needed to address ongoing climate-related challenges

How we're measuring this risk



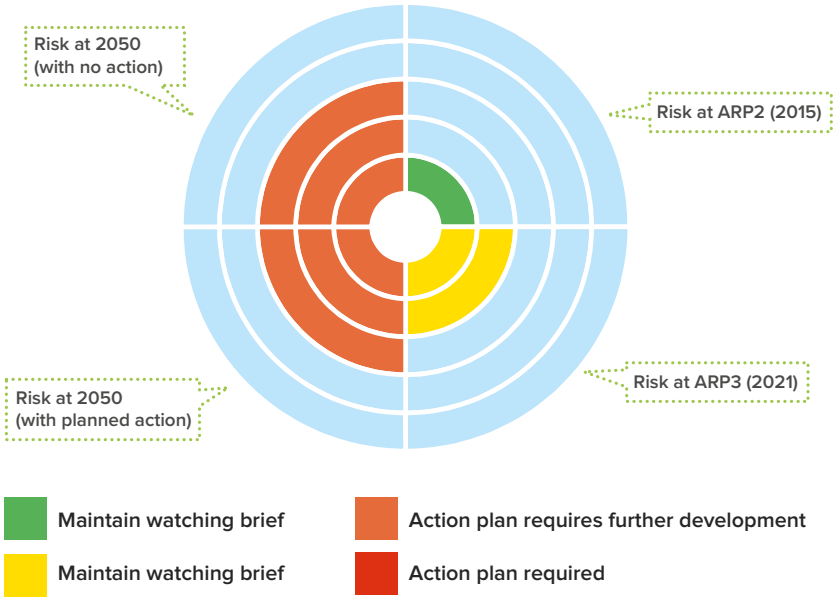
We expect high intensity, short duration, rainfall events to increase. This will have a direct impact on the sewer flooding as a result of too much water, increasing incidents in the future.

Analysis that formed part of our Drainage and Wastewater Plan allowed us to estimate the number of properties at risk of these kinds of events. In 2020 there are 136,753 properties considered to be at risk of sewer flooding from the 1 in 50 year storm event. This increases to 184,824 in 2050, a 35% increase. The percentage of all properties at risk increases from 7% to 10%.

Rising sea levels will also increase the amount of time that some sewer outfalls are submerged preventing free discharge and causing backwater effects, which can result in premature flooding during storm events.

We're already experiencing wetter winters, which is consistent with climate change projections

Figure 7: Risk profile for customer flooding



We've invested nearly £20 million (2010 to 2020) to protect customers from flooding due to high levels of groundwater

Actions we've already taken

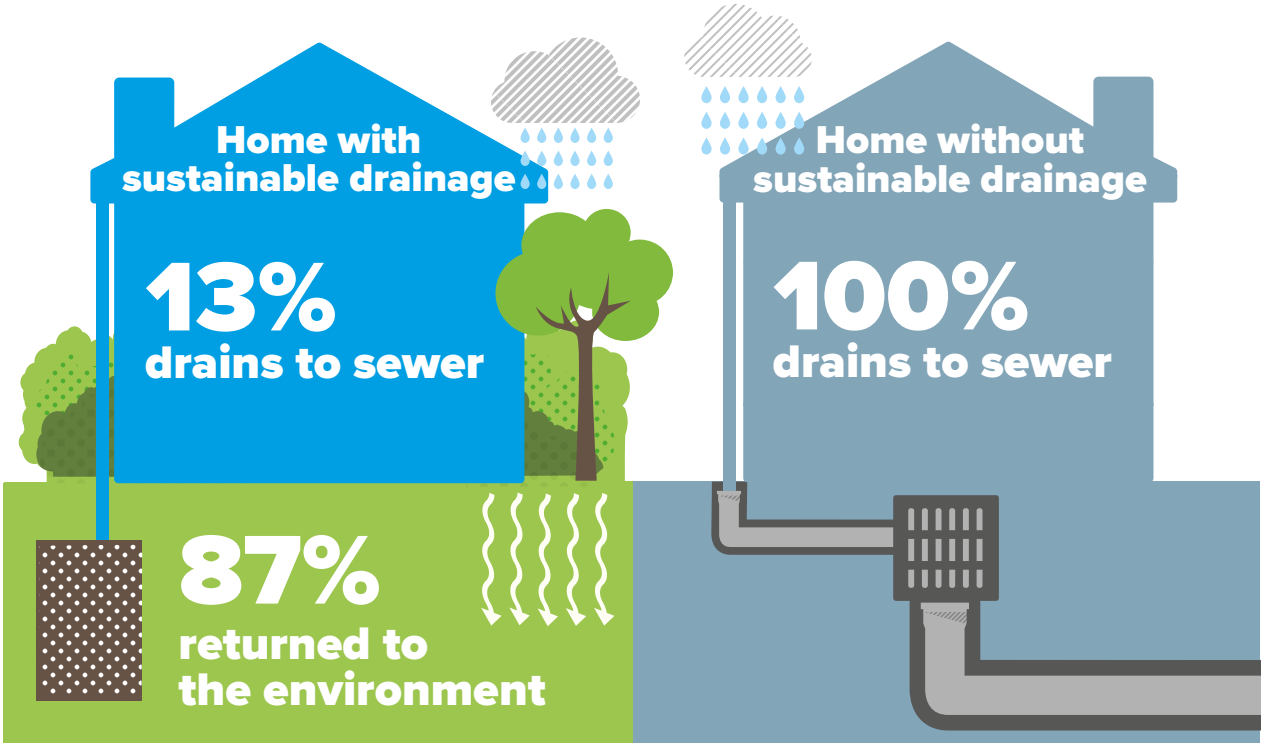
We've developed Drainage Area Plans for the entire region, which identify areas of greatest risk and, where new or enhanced sewerage infrastructure is required to prevent increasing flooding risk. This analysis is being used to develop our detailed Drainage and Wastewater Management Plans.

When designing sewer flooding mitigation schemes we've included a 20% uplift in peak rainfall to allow for climate change. This 'future-proofs' any solutions from a changing climate. An initial desktop review of sites at risk of coastal flooding has also been completed using flood risk maps.

We've invested nearly £20 million (2010 to 2020) to protect customers from flooding due to high levels of groundwater in more than 20 villages and towns located on the North and South Downs chalk or in coastal areas with high groundwater tables, maintaining the capacity of sewers for wastewater and storm water.

We're also trying to reduce the impact of surface water run off on our sewer network to provide better protection from future, more severe, rainfall. During the current investment period 2020–25 we're hoping to disconnect the equivalent of 182,000m^3 of runoff, which is approximately equivalent to disconnecting 39 football pitches. These disconnections are most easily made through retrofitting Sustainable Drainage Systems (SuDS), for example green roofs at schools. SuDS-type solutions can deliver a wide range of co-benefits including enhanced biodiversity, extreme heat protection and increased public health and wellbeing.

Water runoff from homes based on 900mm rainfall per year



What we're doing now

As part of our Drainage and Wastewater Management Planning process we're carrying out detailed site investigations and drafting investment proposals, which will be prioritised based on the threat level from flooding.

We'll also need to consider any changes introduced as a result of the upcoming Environment Bill, e.g. in relation to possible additional requirements to monitor, reduce or stop storm overflows from Combined Sewer Overflows or CSOs through an improvement plan.

Surface water management in Portsmouth

The City of Portsmouth sits on Portsea Island, a low-lying area of land on the south coast. It is artificially drained and relies on its combined sewerage system both for wastewater disposal and flood protection. Capacity of the system is limited and often exceeded during a storm.

Part of our future strategy for managing growth and adapting to climate change is to remove surface water from the combined sewerage system. During the last investment period (2015–20) we completed a large-scale surface water separation (including grass swales) in Portsmouth to reduce flood risk, benefitting approximately 7,000 properties.

Additionally, to delay water reaching sewers during storm events we've been working with the local community and looking at new innovative ways to reduce surface water run-off, such as smart water butts and soakaways* within our region.

This work will support resilience of the city to climate change impacts. It's also delivering other benefits, including carbon reduction, cost savings, partnership working and environmental improvements.

*A soakaway is essentially a hole in the ground that is filled with rubble. It acts like a garden well but in reverse; instead of retaining water, it allows rainwater to gradually seep into the ground rather than remaining on the surface.

Case study

Working together to prevent homes and businesses from flooding

To prevent customer flooding, during very heavy rainfall we sometimes have to release screened stormwater – domestic wastewater heavily diluted by rainwater – into the environment. In May 2021 we launched an updated version of our Beachbuoy service; an online map that shows when and where this has happened so people can make an informed decision before entering the water.

Unlike anything in our industry, the map shows all 83 of our region's designated bathing waters and two non-designated recreation harbours, along with more detail about each release. We originally piloted the service in 2018 for a handful of bathing waters; however, as part of our commitment to improve how we report on our environmental performance, we agreed to develop the system further. We have now linked Beachbuoy directly to our new spill reporting system, Aspire, so updates would show on the map in near real-time.

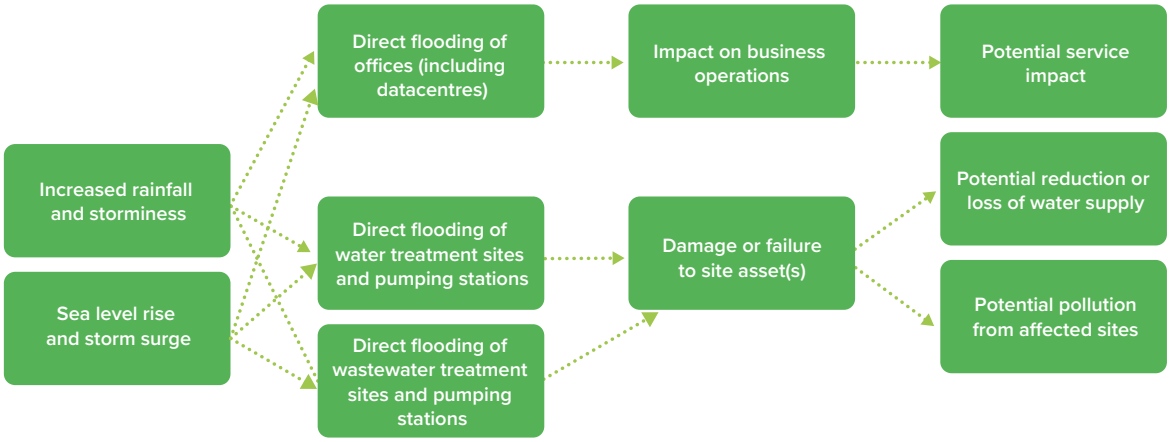
To ensure we were getting it right, we formed a Beachbuoy stakeholder group, which met for the first time in October 2020. The group has met every six to eight weeks since and has grown to include representatives from our entire region. Read more at: **southernwater.co.uk/water-for-life/our-bathing-waters/beachbuoy**

Risk of service disruption from Southern Water asset flooding

Historically, our water and wastewater sites have been built next to or near water, whether that is rivers or the sea, to make it easier for us to access raw water supplies, and then return water safely back to the environment.

This might be an efficient system, but there's also the risk our assets will be overwhelmed by flooding from these water sources. Our sites and networks are also at risk from surface water and groundwater flooding.

Figure 8: Potential impacts of site flooding due to climate change



Flooding of our assets can lead to damage to or failure of our equipment, causing potential disruption to water supplies and/or our wastewater services. These floods can also have wider environmental impacts, as operational damage is often accompanied by pollution events. This can be a direct result of flooding at the operational sites or structural damage as a secondary result of flooding, through erosion and/or subsidence.

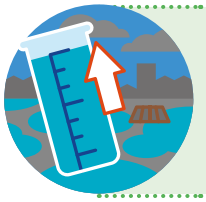
We started a strategic assessment of our assets in 2008 and carried out another detailed assessment in 2012, which identified a total of 18 sites that needed to be investigated further. A 2013 Flood Resilience Report examined these 18 sites, establishing that only five were classed as at risk. These sites all received capital investment during the last investment period to 2020.

The National Infrastructure Commission recommends that the government should set out a strategy to deliver a nationwide standard of resilience to flooding with an annual likelihood of 0.5 per cent by 2050, where this is feasible. It also recommends that a higher standard of 0.1 per cent should be provided for densely populated areas, where the costs per household are lower.

Flooding of our assets can lead to damage to or failure of our equipment, causing potential disruption to water supplies and/or our wastewater services

How we're measuring this risk

Climate drivers of disruption from Southern Water asset flooding include:

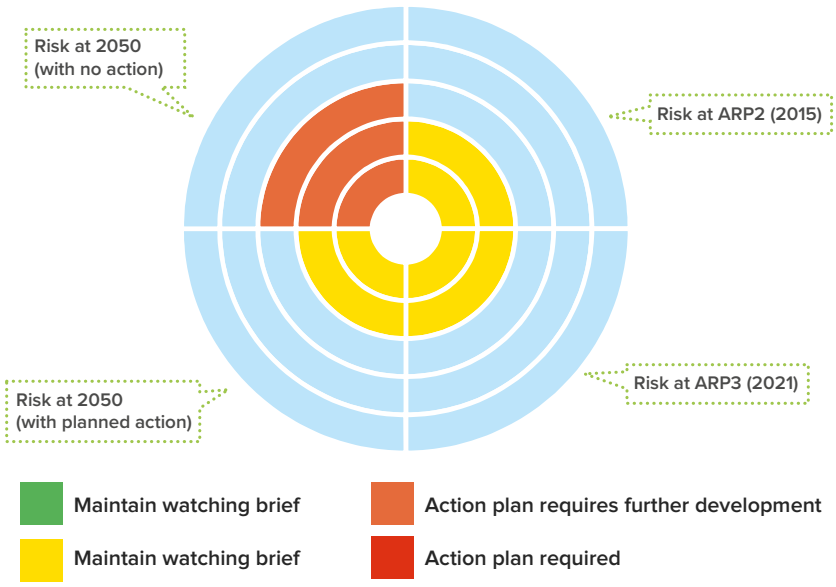


More rainfall or more intense rainfall (increased storminess) leading to direct flooding of water supply/treatment sites from surface or groundwater flooding; and,

Sea level rise leading to asset flooding or erosion at operational sites.

Woolston Wastewater Treatment Works was built to be resilient to future threats from flooding

Figure 9: Risk profile for flooding of our assets and sites



Risk of service disruption from Southern Water asset flooding continued

Actions we've already taken

In our 2015 adaptation report, we identified four sites where we planned to implement measures by 2020, to protect them from a 1:200-year flood event.

These four sites were: Testwood, Bowcombe, Carisbrooke and Hardham. Since then, additional sites have also been identified and flood resilience improvements have been made. The works are summarised in the table below.

What we're doing now

In pulling together our Drainage and Wastewater Management Plans we've further improved our understanding of flood risk across our region, and how this may change as a result of climate change.

This work assessed 3,792 in-service assets and found 891 Wastewater Pumping Stations and 53 Wastewater Treatment works in flood zones. A total of 19 sites have been flagged as potentially at very significant risk and these are the subject of more detailed investigations.

Actions taken at selected treatment works sites since 2015

Site	Actions	Outstanding
Testwood	Service entries in basement sealed. A new diesel pump to be used in the event of flooding. Temporary mitigation strategy implemented in the event of a flood (sandbags and pumps provided). Emergency stop buttons installed to use in the event of a flood. Flood barriers purchased.	None
Bowcombe and Carisbrooke	Flood modelling determined no flood risk. Minor works: service entries sealed and equipment relocated as precaution against rising ground water.	None
Hardham	Flood modelling determined no flood risk.	None
Otterbourne (Boreholes)	Flood mitigation scheme ongoing.	To be completed by 2025.
Martin Gorse	Risk assessment and flood modelling have been completed to support a planning application for a new nitrate removal building, resilient to the 1 in 200 year+ climate change flood event.	None
Flemings	Risk assessment and flood modelling have been completed to support a planning application for a new nitrate removal building, resilient to the 1 in 200 year+ climate change flood event.	None
Newnham Valley	Environment Agency flood model data has been used to ensure the flood resilient design of new infrastructure.	None
Poynings	New works to be relocated or designed differently pending a flood study to be commissioned.	To be completed.
Burham	Risk assessment has been completed to support a planning application for new Motor Control Centre. Environment Agency flood model data has been used to ensure the flood resilient design.	None
Sandown	Detailed Environment Agency flood model used to ensure that new eel screen and high lift pumping station will be resilient to the 1 in 200 year+ climate change flood event.	None

We've further improved our understanding of flood risk across our region, and how this may change as a result of climate change

Risk of service disruption from heat stress

The risks identified in our Water Resource Management Plan and Drought Plan are likely to be exacerbated by high temperatures which can cause equipment to overheat, potentially leading to loss of water supply service for our customers.

Optimal anaerobic digestion (AD) and gas production rates at our wastewater treatment sites are achieved at a temperature of approximately 35°C so increased temperatures creates the potential challenge for our 16 Combined Heat and Power (CHP) installations, which are fuelled by the biogas created through the digestion process.

High temperatures also risk reducing the energy generating efficiency of our solar panels – they're generally tested for maximum efficiency around 25°C.

Figure 10: Potential risks of service disruption from heat stress

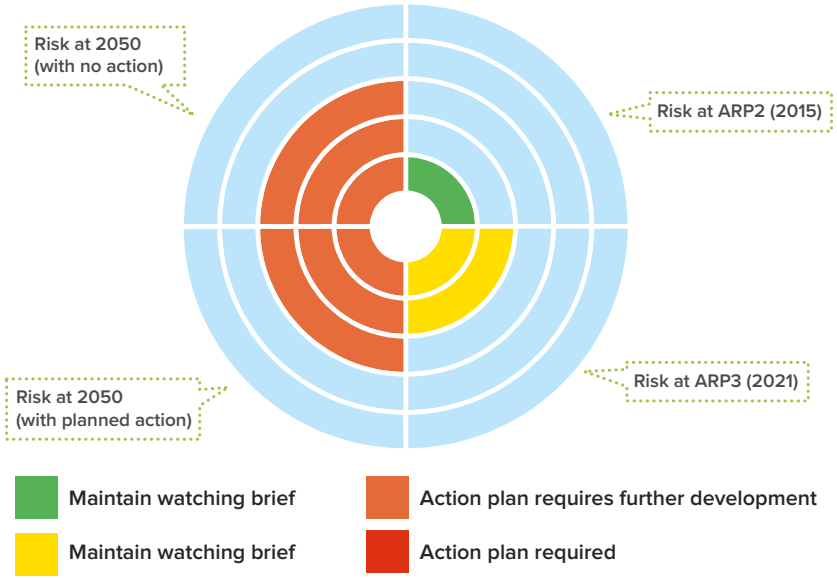
How we're measuring this risk

Climate drivers for disruption from heat stress include: increased temperature and more extreme variations in temperature leading to:

Increased temperature and more extreme variations in temperature leading to:

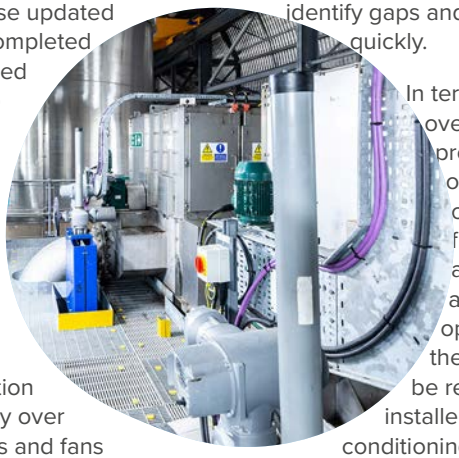
- overheating of electrical equipment
- increased risk of gas explosion at digestion plants and sludge holding tanks due to prolonged heating
- increased microbial action leading to increased odour
- and increased hydrogen sulphide generation affecting structural integrity.

Figure 11: Risk profile of service impact from heat stress



Actions we've already taken

In relation to explosion risk and Dangerous Substances and Explosive Atmospheres Regulations (DSEAR)*, and more specifically in response to the Avonmouth incident, we have completed a six-month programme of work to revisit our six DSEAR sites. These updated assessments have now been completed with focus on ensuring that forced air ventilation is in place and up to standard. These have also now been checked by an independent, external expert.



Where we store chemicals, it's been highlighted that we need to make sure there are appropriate heat reduction controls in place. For example, to mitigate chlorine decomposition if storage rooms are consistently over 25°C, we'll ensure chillers, vents and fans are operating correctly, test thermostats, and may install temporary air conditioning units, if necessary.

In terms of monitoring odour risk, this is part of our day-to-day business as we respond to any complaints from our customers.

What we're doing now

We've launched an 18-month programme relating to DSEAR at our Water Supply Works and Wastewater Treatment Works, which will develop a common data source for all DSEAR assessments going forward. This will allow us to identify gaps and resolve any issues more quickly.

In terms of electrical plant overheating, we have produced a clear set of actions requiring all operators to replace filters and ensure vents, air conditioning systems and thermostats are operating correctly. Where the temperature cannot be reduced by currently installed systems, temporary air conditioning units will be installed.

Sea level rise and/or storm surges may cause erosion and damage to the stability of infrastructure. This may also restrict operation of outfalls. We have reviewed our technical standards for managing corrosion of our infrastructure due to acid gases to ensure that they remain relevant at higher temperatures.

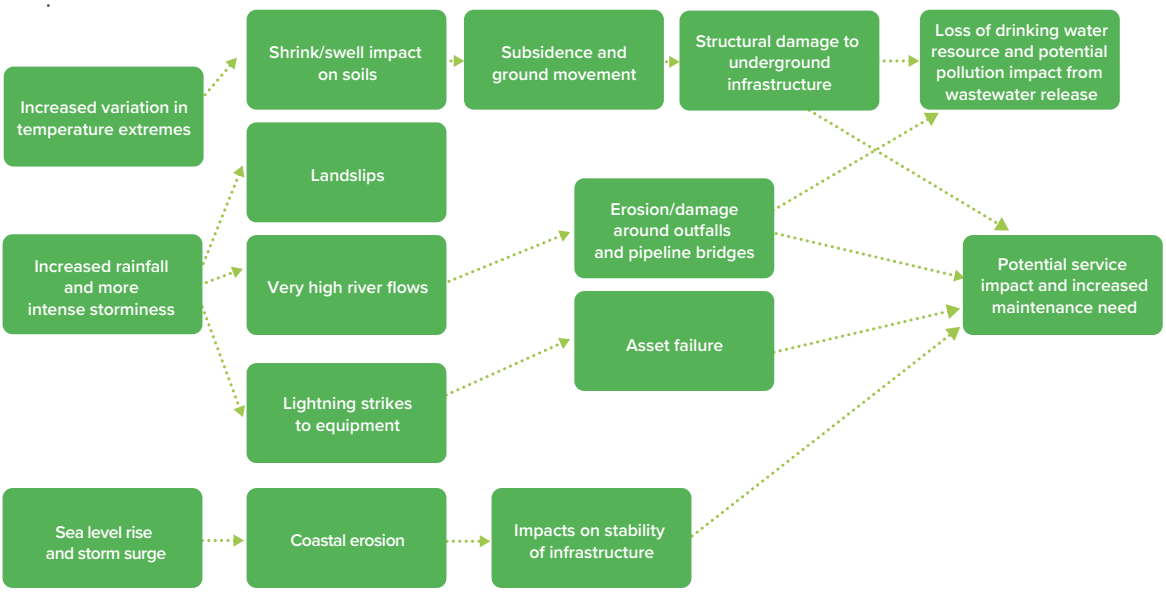
*DSEAR requires that "installations in non-temperate regions must take account of the foreseeable range of ambient temperatures and the flashpoint of the dangerous material. If the flashpoint of the material is within 10°C of the maximum foreseeable ambient temperature, then the material must be considered as being flammable and a hazardous area classification is necessary. Heating from exposure to direct sunlight must also be taken into consideration as high levels of solar radiation can result in metal temperatures greater than 100°C."

Risk of service disruption from subsidence and other causes

This category includes other causes of service disruption (besides flooding and heat stress) such as lightning strikes during storms, erosion from coastal storm surges and high river flows or subsidence (ground movement) as a result of changes in weather, which may lead to a collapse on our sewer network or burst water main.

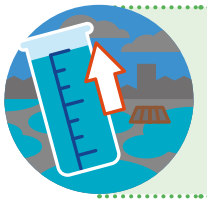
Sewer collapses can have a significant impact on service to customers or and can lead to pollution of the local environment. These collapses often lead to repairs needing to be made before we can get services back online for customers.

Figure 12: Climate change related service impacts from subsidence, erosion and electrical storms



How we're measuring this risk

Climate drivers increasing the risk of service disruption from subsidence and other causes include:

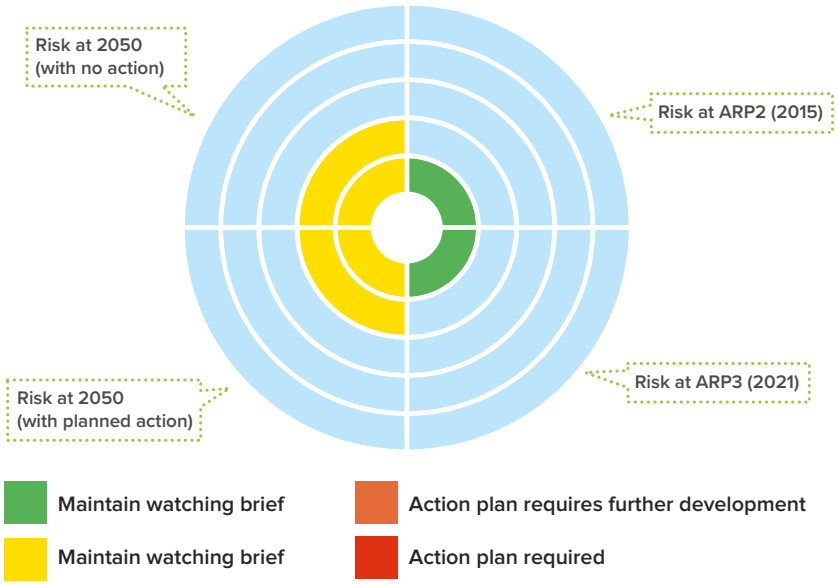


More rainfall or more intense rainfall (increased risk of storms) may lead to: lighting strikes causing fire and/or structural damage; disruption from landslips and high river flows causing erosion around infrastructure; erosion and structural damage to sites and water/sewer networks.

More extreme variations in temperature, leading to increased risk of subsidence (ground movement) causing bursts and additional leakage across our network, and potential damage to both underground and above ground infrastructure. Some areas are likely to be more at risk due to the nature of their geology.

Sea level rise and/or storm surge leading to erosion around infrastructure affecting its operation.

Figure 13: Risk profile from service disruptions (subsidence, landslips, electrical storms and erosion)



Actions we've already taken

We use natural flood management approaches to help reduce the flood risk, and to deliver wider benefits, such as reduced carbon emissions from flood management, for example, from tankering and over-pumping, both of which use diesel as fuel.

We've also improved our weather forecasting, with Red, Amber and Green status for adverse weather developed in conjunction with UK Power Networks, to incorporate planning and preparedness for extreme wind and lightning risks.

What we're doing now

Over the next four years, we're working to identify the locations of 'pipe bridges' so that we're able to carry out surveys and risk assessments to inform flood risk maps and climate change projections. This will help us to better pinpoint areas at risk from flooding and erosion.

Our risk assessment has identified the need to focus on the future risk of subsidence and land slips in areas where clay is a predominant soil.

Case study

Tackling coastal erosion

We have three flood protection schemes planned to 2025, totalling more than £9 million. We'll invest around £4.5 million to reduce the risk of shingle blocking at our Black Rock short sea outfall in Brighton and approximately £5.1 million to reinforce the seawall at Portobello Wastewater Pumping Station, also in Brighton.

We're planning to partially fund the co-delivery of a scheme to increase the resilience of our outfall at Seaford, in East Sussex, pictured, in partnership with the Environment Agency and local council. This will reduce the risk from flooding and increase the resilience of Seaford against coastal erosion.

Risk of environmental impacts (pollution) and risk to natural capital

Water companies both depend on and impact the natural environment. This category encompasses both (i) the risk that our actions will impact on the environment, and (ii) the risk that changes in natural capital will impact on our ability to deliver water and wastewater services sustainably.

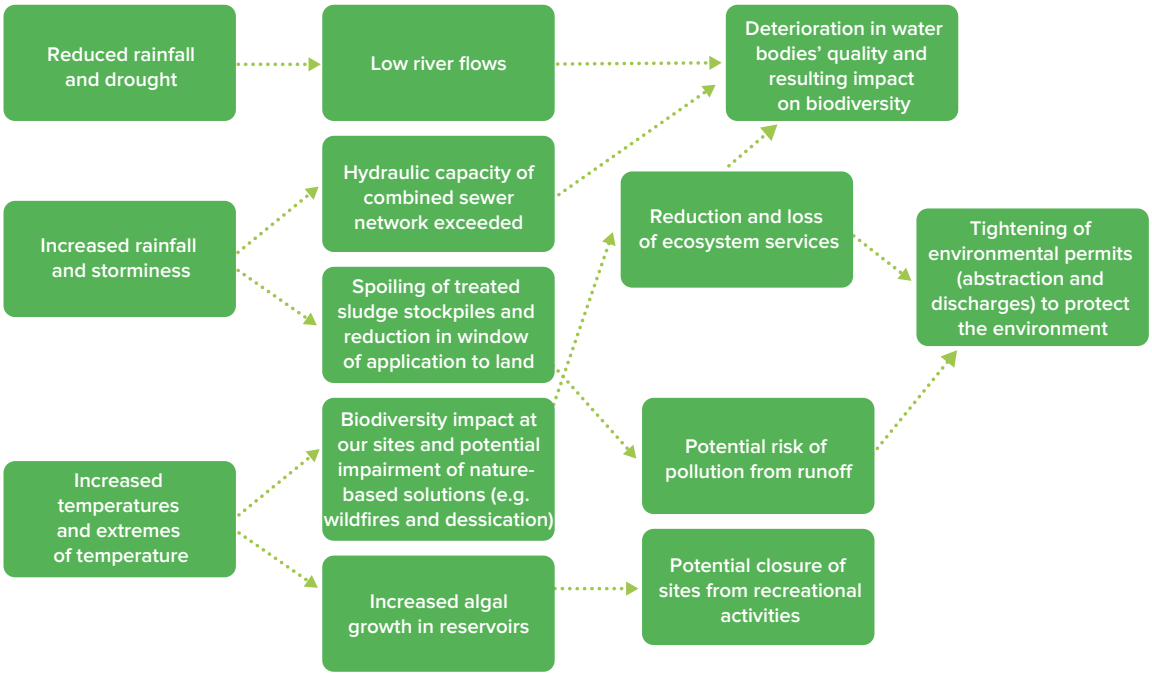
Natural capital refers to natural assets such as water, habitats, soils and biodiversity, which we own or which we rely on to deliver our services to customers, including water quality and opportunities for our customers to enjoy recreational activities. Natural capital is essential to support other types of capital, including human, social and produced.

We also have an impact on the environment and natural capital when we return water to the environment and when we are building new infrastructure.

Following consultation, we have increased the risk score in this category. This reflects the fact that the natural environment is the main receptor for all other risks driven by climate change. Extreme weather events, increased heat, sea level rise and other climate impacts will all affect the potential for natural capital to support the services that we and others provide.

Our region is home to national parks and forests, over 700 miles of coastline including designated bathing and shellfish waters, Sites of Special Scientific Interest (SSSIs), Local Wildlife Sites and numerous Areas of Outstanding Natural Beauty. It also includes most of the chalk streams in the UK, unique and valuable ecosystems that exist in very few places around the world. In fact, there are only 200 chalk streams known globally, 85% of which are found in the UK in southern and eastern England.

Figure 14: Risks to the environment and natural capital



Designated sites in our region and SSSIs that we own:

Statutory protected area type	No. of different named sites
Ramsars	13
SPA	17
SAC	38
SSSI	368

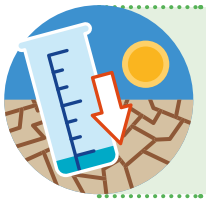
Where we have assets within a SSSI, we have management plans which are assented by Natural England, the Wildlife Regulator for England. There are 10 such sites and associated management plans in place.

Risks in this category are linked to the overall deterioration of habitats and the species they support, a reduction in environmental resilience and adverse impacts on the services provided for people and nature. Specific risks include:

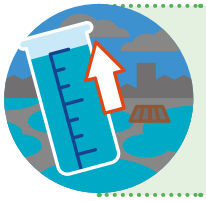
- Increased flooding leading to more pollution incidents (as a result of sewer inundation) and overall reductions in water quality directly impacting the condition of the freshwater, coastal and marine environments and impacting on commercial and recreational users.
- Increased environmental standards surrounding sustainable river flows (i.e. a greater proportion of flow will need to be left for the environment, meaning we can take less water to meet customer demand).
- Higher temperatures and lower flows in watercourses impacting the extent and quality of water dependant habitats.
- Impact from run-off from sludge stockpiles (removed during the water treatment process), due to increased storms and rainfall, causing potential contamination or pollution of the local environment.
- Poor soil health leaves farmland more susceptible to drought and flooding events. This can result in reduced water quality and the siltation of rivers and streams making them less resilient and impacting on recreational users.
- Poor quality, fragmented habitats and the species they support are less able to adapt to the impacts of climate change.
- The potential failure of nature-based solutions that we might put in place (e.g. drying out of constructed wetlands, wildfires impact on planted trees).
- Increased risk of non-native invasive species making native species and habitats more vulnerable to climate change by out-competing them, spreading disease and increasing erosion.

How we're measuring this risk

Climate drivers of environmental impacts and risks to natural capital include:



Less rainfall (longer dry periods) leading to higher chance of drought and lower river flows in summer. This may result in a deterioration in environmental quality and impact adversely on biodiversity.

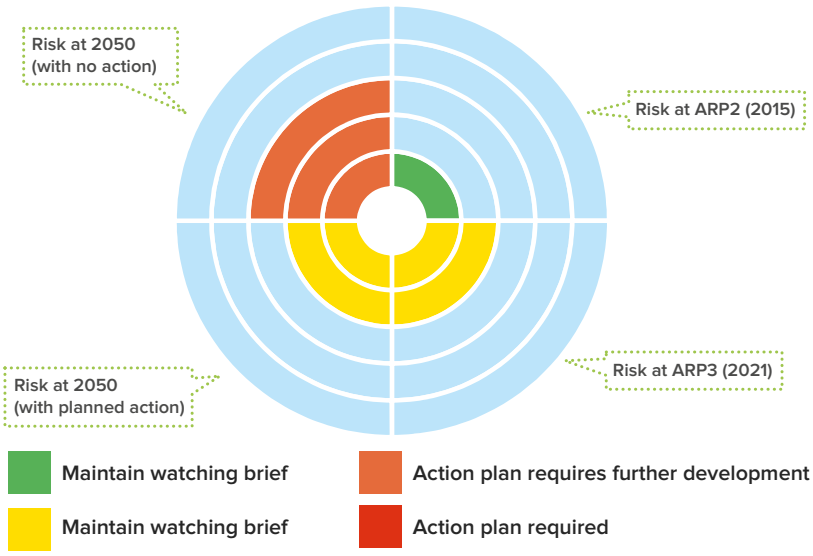


More rainfall or more intense rainfall (increased risk of storms) leading to a deterioration in environmental water quality for example from more frequently operating storm overflows. The application of biosolids to land to enhance soils may also be disrupted by periods of increased rainfall.

Increased temperature or more extreme variations in temperature, leading to increased algal growth or other microbial action, as well as warmer water with less oxygen. There is also an increased risk of wildfires, causing harm to our environment.

Risk of environmental impacts (pollution) and risk to natural capital continued

Figure 15: Risk profile for environmental impacts (pollution) and natural capital



Actions we've already taken

Enhancing biodiversity is a key theme within our business because we understand that we sit within the environment and rely on this natural capital to deliver water and wastewater services to our customers.

This year we developed a Biodiversity policy: **southernwater.co.uk/our-performance/key-policies**.

How we are managing our protected nature sites SSSIs

Our largest SSSI is Weir Wood Reservoir – here we are working with CAbi: Centre for Agriculture and Biosciences International (UK) to remove the invasive non-native species (INNS) Crassula Helmsii (New Zealand Pygmyweed) using an innovative biological control method.

At Weir Wood we're also looking at whether another INNS, Signal Crayfish, can be removed using an innovative castration method. This is in development.

A number of mitigation measures have already been taken, including a pilot trial with South Downs National Park Authority as part of the EU-funded CPES Interreg project to investigate soil health measures with farmers in the Western Rother; 18 new eel screens, pictured, to increase migratory eel habitat length; four fish passage schemes on the Isle of Wight; sewer relining projects; flood risk assessments and river flow monitoring, to name a few.

A number of these are included in the Water Industry Natural Environment Programme (WINEP), which sets out the actions that the Environment Agency requires water companies to complete to meet environmental objectives. Between 2015 and 2020 we delivered over 200 WINEP schemes.

We're working with the Environment Agency and Water Resources South East (WRSE), a group of regional water companies and key stakeholders, to develop an Environmental Destination, ensuring that we agree and work towards common objectives for water quality and environmental flows.

Our pollutions performance, however, is still unacceptable with 400 reportable incidents in 2020–21.

To reduce pollution risk we've developed our Pollution Incident Reduction Plan, under our Environment+ initiative, which aims to deliver zero incidents by 2040 by improving our understanding of pollution, driving appropriate, effective interventions by learning from the evidence base of our historical pollution incidents and industry best practice.

Since the plan was published in 2020, we've seen a 10% reduction in the number of pollution incidents. The plan was updated in 2021 to accelerate this reduction year-on-year.

We're also involved in a range of conservation partnerships, working with experts to run projects to improve the environment and open it up to our communities, for example, we now have active management plans in place at 10 nationally important sites of special scientific interest (SSSIs).

What we're doing now

We'll be working with colleagues and our key environmental stakeholders to embed natural capital assessments and biodiversity 'net gain' as part of our overall approach. This is a key part of WRSE decision making and a requirement under WRMP24 guidance. We've set a target to establish natural capital accounting for three of out of 10 river catchments by 2025.

For example, we're currently working with the Wildlife Trusts across the Southeast to understand the natural capital value and potential of our own estate. This will help us understand current carbon stores and opportunities for carbon sequestration through habitat restoration and/or creation. This work will inform our business sequestration and offsetting strategy as part of our pathway to net zero carbon.

Going further, we'll develop a natural and social capital accounting methodology (linked to our performance commitment for 2020–25) and develop a consistent approach for applying natural capital assessments across the business. This will include protection from hazards through climate regulation and flood and drought regulation. We'll deliver the natural capital baseline for three catchments by March 2025.

We're embedding natural capital into our risk and value process and, as discussed in our Policy on Corporate Responsibility, we'll continue to consider the balance between economic, environmental and social aspects of our business decisions against sustainable development principles.

In our business plan 2020–25 we identified Catchment First as one of our long-term strategic priorities. This places catchments at the centre of our decision-making, and champions investment in nature-based solutions alongside our more traditional engineering options. Investing in the protection, enhancement and recovery of nature will increase its resilience in the face of current and future risks, including climate change.

Following the 'Harbours Summit' convened by Southern Water's Chief Executive in May 2021 and which was chaired by Prof Dieter Helm, we have commissioned a natural capital baseline of Chichester, Langstone and Pagham Harbours and their catchments. This baseline will be used to develop an integrated plan to restore the Harbours and achieve wider benefits including climate resilience and net zero targets.

We'll continue to deliver our Pollution Reduction Plan, which has around 50 separate actions under eight Critical Success Factors and has seen us improve our self-reporting to some of the highest levels across the industry.

Managing our water sources in a holistic way to protect them for the future

The Catchment Systems Thinking Co-operative, a partnership of 12 water and sewerage companies including Southern Water, as well as academia and environmental charities, has been announced as a winner in Ofwat's first Water Breakthrough Challenge*.

The Co-operative aims to transform the way in which essential data about the health of the nation's rivers is gathered and shared and its latest project is focusing on the catchments of the Arun and Rother rivers in West Sussex. The partnership has already contributed towards significant pollutant reduction and flood risk management within the other regions around the country where it has been trialled.

As well as driving significant improvements to water quality at a lower cost to customers, it has also enabled natural capital benefits to be incorporated at a catchment-wide scale, for example, through enhanced biodiversity, soil conservation and tree planting.

The Catchment Systems Thinking Co-operative aims to encourage the management of water in a holistic way, through an understanding of the impact of water management on the local community, as well as the protection of the environment more broadly.

Entries to the Water Breakthrough Challenge were encouraged from water companies in England and Wales in partnerships with organisations in and outside the water sector, including universities and institutes, retailers, start-ups, or small businesses in sectors such as energy, manufacturing, health, or financial services.

*The water industry regulator, Ofwat, has established a £200 million Innovation Fund to grow the water sector's capacity to innovate. The Water Breakthrough Challenge is run by Ofwat and Nesta Challenges in partnership with Arup.

Catchment First

Catchment First is our commitment to putting the well-being of the environment at the centre of the decisions we make and the services we deliver. It means working hand in hand with nature and our partners in the catchments to protect water for our customers and the environment.

We're taking a natural capital approach to better understand the catchments and we're applying methods and tools to provide a variety of benefits while making space for nature:

- Protecting rivers from the impacts of abstractions - ensuring sustainable abstraction levels and appropriate in-stream resilience measures.
- Using nature-based solutions that protect catchments from pollution sources – creating a resilient environment by restoring beneficial habitats and reducing nutrient and pesticide run off from farmland to water courses.
- Undertaking catchment resilience approaches to help mitigate the impact of climate change - reducing flood risk as well as improving water quality and resource availability.
- Delivery of public value and increase liveability of our natural environment. Reconnecting people with their local catchment. Increasing people's wellbeing via access to nature.

Case study

Resilience pilot: River Beult and the Western Rother and Arun catchments

We'll be working with local partners, stakeholders and landowners to implement pilot projects to achieve both environmental sustainability and resource resilience. We've formed partnerships with the South East Rivers Trust (SERT) and Kent Wildlife Trust (KWT) in the Beult catchment, and with Arun & Rother Rivers Trust and Sussex Wildlife Trust in the Arun and Western Rother, as well as working with local organisations and landowners.

The pilots will help mitigate the impact of climate change, reduce flood risk and improve water quality and resource availability. Projects include:

- habitat enhancement
- natural flood management
- catchment management approaches.

On the Arun and Western Rother pilot, we're also undertaking a programme of measures to improve soil health and understand better the role of soil health in:

- supporting agricultural yields
- reducing carbon
- increasing infiltration
- supporting biodiversity.

This pilot project has also been further expanded in scale and scope by a recent successful Ofwat Innovation Fund bid. The funding will increase opportunities for partnership collaboration, as well as placing a key focus on capacity building in water quality monitoring, citizen science and upskilling of partner organisations and stakeholders in the delivery of schemes.

Case study

Western Rother soil health trials and targets

We're working with farmers and a local agronomist in the Petworth/Rother Valley area in West Sussex to raise awareness of the importance of soil health and how to achieve healthier soils. Organic matter levels in the soils of the area tend to be low, which means the soils are vulnerable to being washed off the farm into rivers and onto roads, taking pesticides and nutrients with them. Increasing organic matter levels can reduce soil erosion, and mean the soils are taking up and storing more carbon, contributing to the fight against climate change.

Each farmer worked with a local independent agronomist to set targets for improving soil health and put together a plan for how to achieve the targets. At the end of the project, Southern Water will pay an incentive if the targets are met, and we're also funding the measures being put in place to meet them. This trial aligns with the catchment management principles of addressing the root causes of water quality issues and working collaboratively with farmers and stakeholders to co-develop solutions.

Improving soil health can take many years, but we're hoping to see some positive changes within the life of the project, as well as to gain some useful insights to inform our future work in this area and to raise awareness in the wider farming community.

Healthier soils support healthier crops, reducing both the reliance on artificial fertilisers and how much of that fertiliser is lost to groundwater. Southern Water are working with the Arun to Adur Farmers Group and a local agronomist in the Worthing area in West Sussex to raise awareness of the importance of soil health and the impacts on nutrient pollution.

We've funded five years of soil health monitoring in 28 fields across eight farms, taking over 1,500 soil samples. This will allow us and the Farmers Group to follow the impact of different crops and management strategies on soil health and nutrient availability. We're currently collating the results and planning a workshop for spring 2022 to discuss these findings and what actions farmers in the group can take to help improve soil health.

Glossary

Term	Description
Adaptation	Process of adjusting to the expected effects of climate change.
AMP	Asset Management Plan.
Catchment-based approach	The catchment-based approach was developed by Defra to provide a framework to facilitate partnership working to achieve a better water environment.
Catchment partnership	A multi-stakeholder group working at the river catchment level to agree and deliver strategic priorities for the catchment.
Combined Sewer Overflows	During periods of heavy rainfall the capacity of combined sewer pipes can be exceeded and the combined flows could back up and flood peoples' homes, roads and open spaces, unless it is allowed to spill elsewhere. CSOs were developed as overflow valves to reduce this risk by allowing sewage to enter a separate pipe and flow into a river or the sea.
Combined sewers	A combined sewer collects clean rainwater, run off and waste water from toilets, bathrooms and kitchens in the same pipe and conveys it to a sewage treatment works.
Defra	Department of Environment, Food & Rural Affairs.
DSEAR	Dangerous Substances and Explosive Atmospheres Regulations.
DWMP	Drainage and Wastewater Management Plan: Plans setting out how all water and wastewater companies in England and Wales must extend, improve and maintain a robust and resilient drainage and wastewater system.
Hydraulic overload	Where a sewer pipe is full and spills as a result of a heavy rainfall event with potential to result in flooding or a pollution event where sewage overflows out of a manhole.
Likelihood	The chance of impact occurring.
PCC	Per capita consumption – the amount of water typically used by one domestic household customer, per day.
Resilience (to climate change)	Ability to recover from the effect of climate change.
Risk	Calculation of consequence times likelihood.
SuDS	Sustainable Drainage Systems are designed to manage storm water locally and minimise flood and pollution risks resulting from urban runoff.
TCFD	Task Force on Climate Related Financial Disclosures.
WRMP	Water Resources Management Plan: Published every five years by water companies, a statutory water resources management plan is designed to ensure an effective, long-term balance between supply and demand is maintained whilst keeping customers' bills affordable. The plan sets out a company's intended approach for the next 25 years.
WRSE	Water Resources South East is an alliance of the six water companies that cover the South East region of England with the aim of securing, through a collaborative, regional approach to water resource management, the water supply for future generations.

Appendix 1:

We have reviewed climate change projections for South East from the latest Met Office UK Climate Projections (UKCP18).

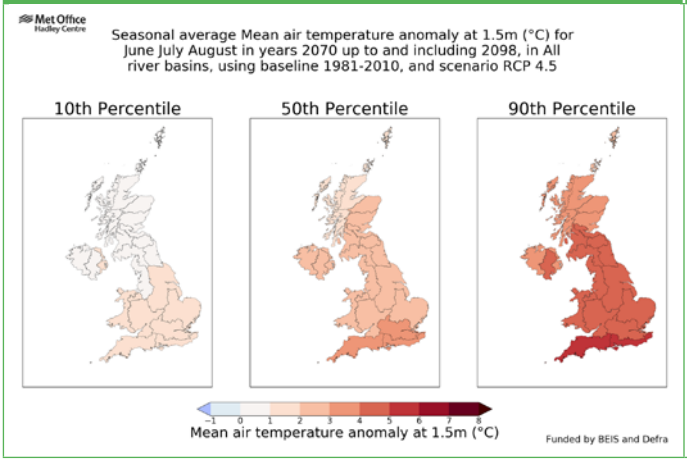
We considered two emissions scenarios:

- RCP4.5 (Medium emissions scenario), this corresponds to a 2°C rise in global mean temperature by 2100
- RCP8.5 (High emissions scenario), this corresponds to a 4°C rise in global mean temperature by 2100

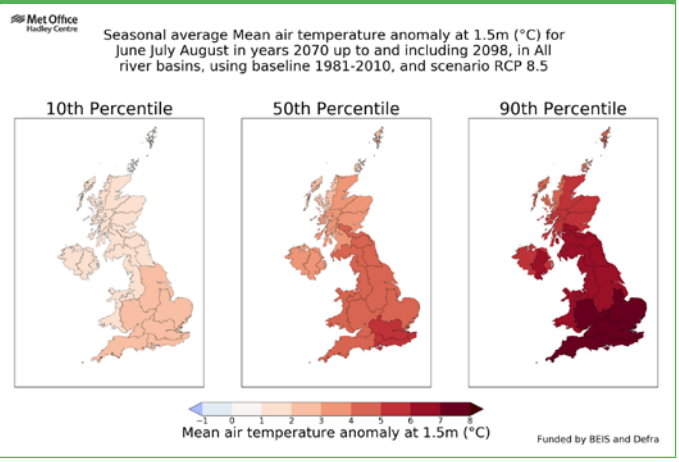
Increase in average temperature

The UKCP18 projections suggest that, in a world of 2°C global mean warming, the UK will experience, on average, 1 to 2°C higher annual temperatures by the end of the century compared to the baseline period (1981–2010). The South East of England will experience higher warming with average summer temperatures increasing by 3 to 4°C relative to the 1981–2010 baseline.

RCP 4.5



RCP 8.5



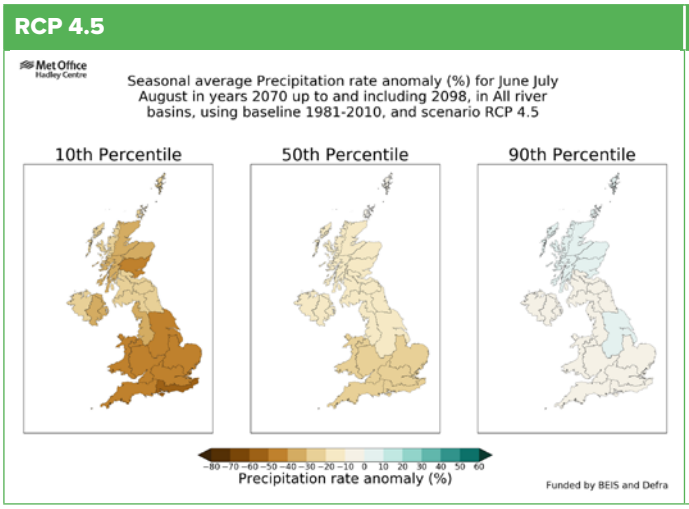
Decrease in summer rainfall (drought)

We expect to see more prolonged periods of reduced rainfall in future, particularly in summer. Changes in seasonal rainfall will potentially affect river levels, with lower river levels in summer impacting water resources and water quality.

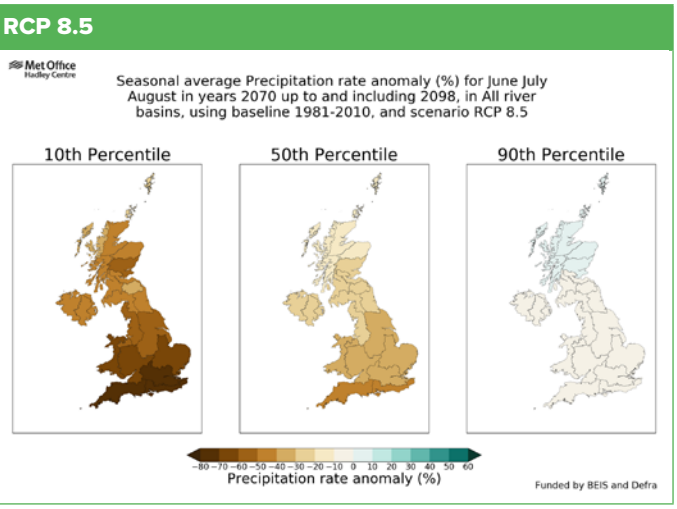
Below shows projected changes to summer rainfall in the RCP4.5 scenario. By the end of the century, there is a:

- 50% chance of a 20-30% drier than average summer
- 10% chance of a 50-60% drier than average summer

RCP 4.5



RCP 8.5



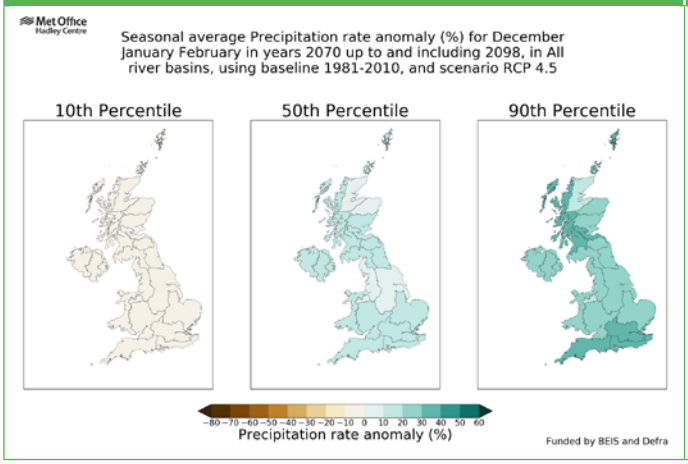
Appendix 1: continued

More rainfall, or more intense rainfall (increased storminess)

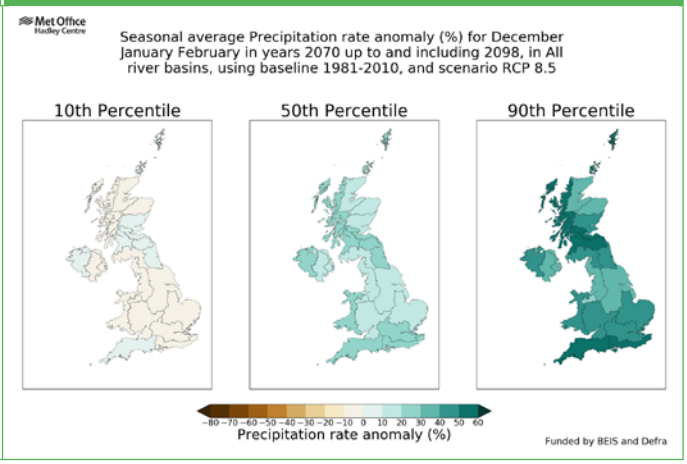
The frequency of short, high-intensity rainfall events is likely to increase in both summer and winter. Overall, winters are likely to be wetter, resulting in higher groundwater levels and associated flooding and increased flows to Wastewater Treatment Works (WTWs).

- The figures below show projected changes to winter rainfall.
- By the end of the century for 2°C. and 4°C. scenarios there is a 50% chance of a 10–20% wetter than average winter and a 10% chance of 50–60% wetter than average winters when compared with the 1981–2010 baseline.

RCP 4.5



RCP 8.5

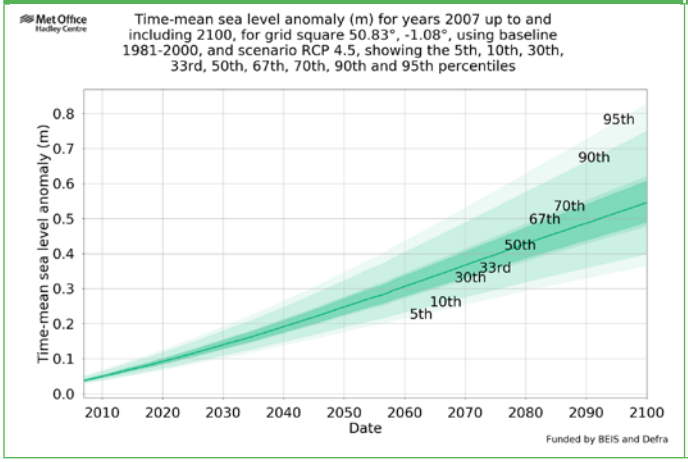


Sea level rise

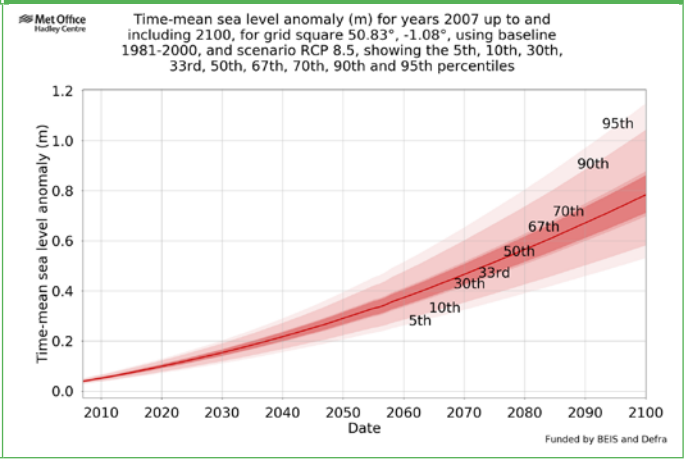
Our region has a long coastline and the main centres of population lie along the coast. Some areas are close to current sea level and in a few cases, below mean high water levels. Several borehole sources are relatively close to the shoreline and in conditions of extreme drought are vulnerable to salt water contamination. Sea-level rise is therefore likely to have an impact on our operations, both water and wastewater.

Sea levels around the UK, including in the South East, will continue to rise well beyond 2050 under all future emissions scenarios.

RCP 4.5



RCP 8.5



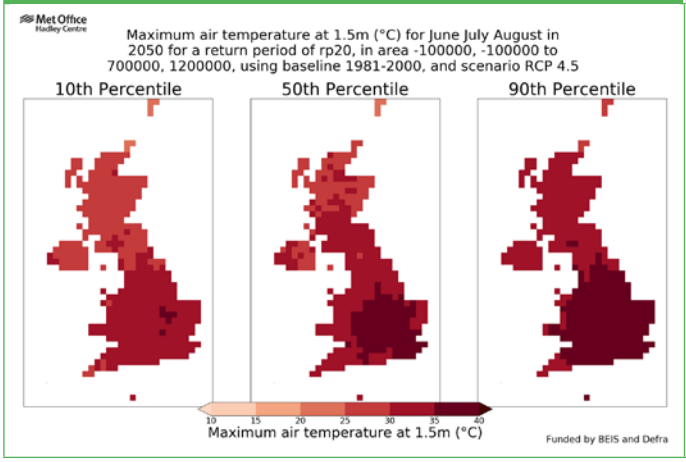
Appendix 1: continued

Heatwave

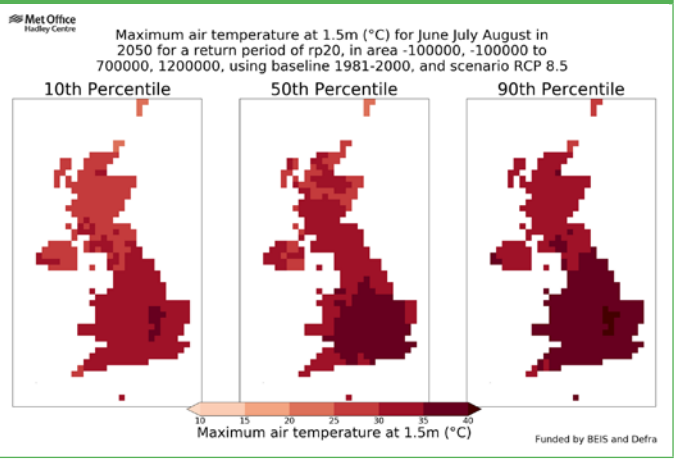
Extreme heatwaves will become more common and intense in the future.

For both climate scenarios, by mid century a normal summer will reach temperatures of 30–35°C.

RCP 4.5



RCP 8.5



Summary of our strategic approach to climate scenarios

Current situation (1°C)	Medium scenario (2°C)	High scenario (4°C)
3 – 4 deg increase (summer)	**Temperature extremes**	**5 – 6 deg increase (summer)**
Heatwave plan	Smarter workplaces	Adaptive buildings
Cold weather plan	Improve underground pipe networks	30-40% less rainfall (summer)
20 – 30% less rainfall (summer)	**Drought**	**30 – 40% less rainfall (summer)**
Leakage and demand reduction	Regional water transfers	Tariffs and incentives to reduce peak demand
	Additional water supplies (e.g. desalination, new reservoir)	Planning for extreme drought
20% increase heavy rainfall	**Flooding**	**50 – 70% increase heavy rainfall**
Temporary flood protection	Integrated catchment planning	Surface water separation
Develop DWMPs	River and floodplain restoration	
Pollution reduction programme		
0.27 – 0.7 m rise	**Sea level rise**	**0.53 – 1.15 m rise**
Identify and protect assets at risk	Move assets inland	

Appendix 2:

Key pressures from climate change, identified in our 2015 (ARP2) Climate Change Adaptation Report

Pressure	Water supply	Wastewater services
Increased temperature and more extreme variations in temperature	**Shared impacts:** • Demographic change (resident/tourist population moving from stressed to less stressed areas) • Changes in water use • Increased algal and other biological growth **Shared consequences:** • Impact on workforce • Transport impacts	
	Impacts: • Increased garden watering • Increased evapotranspiration • Invasive species in rivers and reservoirs **Consequences:** • Potential increased demand • Reduced supply with consequent stress on water resources • Raw water quality reduced • Burst mains and increased leakage • Potential requirement for changes in the storage and treatment of raw water	**Consequences:** • Potential increased peak demand with consequent stress on wastewater collection capacity • Risk of increased odour resulting in customer complaints • Impact on receiving waters oxygenation • Reduced biological treatment capacity • Increased wetting and drying cycles and consequent ground movement
Less rainfall or longer dry periods (drought)	**Shared impacts:** • Changes in daily water use **Shared consequences:** • Increase in peak demand putting stress on water resources, water treatment, supply and collection processes.	
	Impacts: • Seasonal variability leading to less summer rainfall, more winter rainfall • Lower summer river flows • Reduced opportunity for borehole recharge	**Consequences:** • Reduced dilution capacity • Potential for greater deposition of solids and consequent blockages leading to flooding and pollution • May increase the demand for biosolids to improve dry soil
More rainfall, more intense rainfall and electrical storms	**Shared impacts:** • Surface and groundwater flooding of supply and treatment sites • Loss of power supply and IT communications **Shared consequences:** • Structural damage • Supply chain and transport impacts	
	Consequences: • Risk of immediate loss of supply for a period of hours or potentially weeks • Potential contamination of water supply	**Consequences:** • Potential for increased infiltration of sites and network • Sludge to land application window affected
Sea level rise	**Shared impacts:** • Salt water intrusion • Direct flooding of sites	
	Impacts: • Change in tidal limits of rivers and increased salt levels **Consequences:** • Potential reduced supply with consequent stress on water resource • Risk of immediate loss of supply for a period of hours or potentially weeks	**Consequences:** • Restricted use of outfalls • Erosion impacting stability of infrastructure • Increases salt water infiltration

Appendix 3:

Infrastructure Risk Area	Directly relevant to company?	Likelihood of risk occurring	Magnitude of impact on service	Risk understanding (H/M/L)	Actions	Timescales	Metrics/reporting
In1: Risks of cascading failures from interdependent infrastructure networks	Yes	3 (possible)	4 (significant)	L	Strategic review of energy resilience & investment in back up power Incident management planning & response Business Continuity Planning	By 2025	Various performance metrics
In2: Risks to infrastructure services from river, surface water and groundwater flooding	Yes	2 (unlikely)	5 (major)	M	Flood risk assessment update Networks investment Drainage & Wastewater management plans Business Continuity Planning	By 2040	Water supply interruptions reporting Flood and Water Management Act reporting
In3: Risks to infrastructure services from coastal flooding and erosion	Yes	2 (unlikely)	5 (major)	M	Flood risk assessment update Flood prevention investment and collaboration with partners Business Continuity Planning	Ongoing	Water supply interruptions reporting Flood and Water Management Act reporting
In4: Risks of sewer flooding due to heavy rainfall	Yes	3 (possible)	4 (significant)	M	Drainage & Wastewater Management Plan Surface water separation initiatives Pollution Incident Reduction Plan	Ongoing	No. of properties flooded
In5: Risks to bridges and pipelines from high river flows and bank erosion	Yes	2 (unlikely)	5 (major)	L	Pipe bridge assessments	By 2025	No. of surveys undertaken
In8: Risks to subterranean and surface infrastructure from subsidence	Yes	2 (unlikely)	3 (moderate)	L	Risk review	By 2030	No. of surveys undertaken
In9: Risks to public water supplies from drought and low river flows	Yes	3 (possible)	2 (minor)	H	Water Resource Management Plans (25 year plans); Drought Plan; Water for Life Hampshire	By 2050	Supply Demand balance Index (SDBI) Per capita consumption Leakage Metering penetration
In14: Potential benefits to water, transport, digital and energy infrastructure from reduced extreme cold events	Yes	2 (unlikely)	2 (minor)	L	Quantification of benefits monitoring of improvement on leakage reduction due to pipe bursts and reduced health and safety risk from extreme cold events for staff	Ongoing	Leakage reduction

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