south east water

ADAPTATION REPORTING POWER

CLIMATE CHANGE ADAPTATION ROUND 3, TO 2025

DECEMBER 2021

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OUR PURPOSE

TO PROVIDE TODAY'S PUBLIC WATER SERVICE AND CREATE TOMORROW'S WATER SUPPLY SOLUTIONS, FAIRLY AND RESPONSIBLY, WORKING WITH OTHERS TO HELP SOCIETY AND THE ENVIRONMENT TO THRIVE

CONTENTS

Report prepared by Atkins Limited

EXECUTIVE SUMMARY

Purpose of report

This report outlines the actions which South East Water is taking to adapt to the risks of climate change now and into the future. The report takes us up to 2025 and covers activities undertaken in the period 2015 to 2020. The report has been prepared to submit to Defra in response to their invitation to report under the third round of the Adaptation Reporting Powers, which fall under the Climate Change Act of 2008. The reports received by Defra will contribute to the government's understanding of our level of preparedness for climate change and also feed into the Committee on Climate Change's reports to Parliament. A summary of the Defra CCRA2 risks and their relevance to South East Water can be found in the Appendices in Table A9. This table also shows which section of the report addresses the specific risk.

South East Water overview

Our water supply area covers more than 5,000 square kilometres across parts of Kent, Sussex, Surrey, Berkshire and Hampshire. We provide drinking water only and supply an average of 520 million litres a day of high-quality tap water to a population of around 2.2 million customers. We operate within an area of serious water stress, which is also challenged by significant population and economic growth. We have a high reliance on groundwater and source around 73 per cent of our water supply from 250 boreholes, with the remainder being supplied from rivers.

The creation of this Climate Change Adaptation Report strongly aligns with our company purpose, to provide today's public water service and create tomorrow's water supply solutions, fairly and responsibly, working with others to help society and the environment to thrive. The report ensures we have identified and are mitigating against the key climate change risks which threaten our purpose.

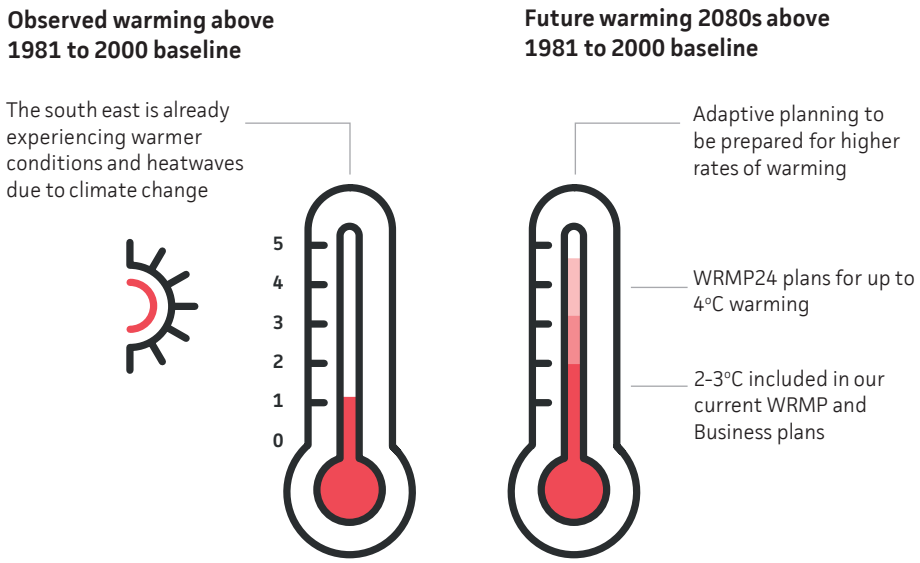
In tandem, we are also co-creating the industry's first 25 Year Environment Plan which supports this report and is based on four environmental principles: clean and plentiful water, climate change resilience and environmental hazards, more sustainable resource use and reducing waste and enhancing nature and protecting heritage. These are shown on page 5.

South East Water Challenges

We have challenges with the character of our land within the south east of England. Over 44 per cent of our supply area is situated within a landscape designation, such as a Site of Special Scientific Interest (SSSI), whereas the national average is 24 per cent. While the existence of so many nationally significant designations presents us with challenges, this also yields opportunities to contribute to a better environment in line with Defra's 25 Year Environment Plan, which addressed the principle of environmental net gain.

We are also a significant local employer and asset operator. Therefore, the risks associated with climate change reach far wider than our water supply.

The key climate change risks which increase our challenge of maintaining reliable supplies are increasing temperatures, changes in rainfall patterns leading to flooding, and reduction in supplies. Average temperatures in the south east of England are already around 1.5°C higher than at the end of the 19th century and we have experienced the impacts of hot summers, like the one in 2018, as well as challenges of successive dry winters that have tested the resilience of our supplies. As a significant custodian of land within a region of rich biological diversity, cultural heritage, protected landscapes and unique but vulnerable chalk aquifers, the risks we face associated with climate change are far reaching and it is our responsibility to ensure that our environment thrives.



This report for Defra summarises our risk based approach, which concentrates on climate effects and biodiversity. To develop this report, we collated 100 climate related risks raised from workshops across the full breadth of business and these have been consolidated into 12 key risk areas which are associated with our four key environmental principles of:

Within this report, we focus on these risks across our four environmental principles and explain the current risk score and our target risk score once the controls are implemented. These key risks are shown on page 6.

SUMMARY TABLE FOR ALL 12 RISKS

Key principles	Risk	Climate drivers	Current risk score	Target risk score
CLEAN AND PLENTIFUL WATER	Risk to supply-demand balance	Less rain Temperature rise	High	Low
	Risk of drought impacts on water quality	Less rain Temperature rise	High	Low
	Risk of increased leakage and pipe bursts	Extreme cold Temperature rise	Medium	Low
CLIMATE CHANGE RESILIENCE AND ENVIRONMENTAL HAZARDS	Flooding and associated infrastructure failure	More rain Sea level rise Intense rainfall Storm surge	High	Low
	Loss of site access through sea level rise, coastal erosion and/or flooding	Sea level rise Storm surge	High	Medium
	Increased sinkhole occurrence	Less rain More rain Temperature rise Intense rainfall	High	Medium
MORE SUSTAINABLE RESOURCE USE AND REDUCING WASTE	Risk of drought and low flow limiting abstraction	Less rain Temperature rise	High	Low
	Risks to sustainable resource use associated with behaviour	Less rain Temperature rise Intense rainfall	Medium	Low
	Rising sea level and saline intrusion risk to abstractions	Sea level rise Storm surge	Medium	Medium
ENHANCING NATURE AND PROTECTING HERITAGE	Risk of SSSI falling into unfavourable conditions	Less rain More rain Temperature rise Intense rainfall Extreme cold	Medium	Low
	Risk to water quality through catchment management and farming practices	Less rain More rain Temperature rise Intense rainfall Extreme cold	Medium	Medium
	Risk of increase in INNS from climate change & flooding	Less rain More rain Temperature rise	Medium	Low

At South East Water we have a high capacity to manage risks; our current plans are incorporating the latest climate change projections and we are already prepared for two to three degrees of warming through our existing strategic planning processes. Resilience is embedded in all areas of our business; we are preparing an industry-leading 25 Year Environment Plan which incorporates elements of the Water Resources Management Plan (WRMP) and climate change actions. This provides an adaptive planning approach, which is applied in our regional water plans and our business planning process approach and looks forward to the 2080s and not just the next five years.

Within each of our four key environmental principles, we are reporting on actions which have already been taken to mitigate these major climate change risks. We are also reporting on the actions we are planning to take in the next few years and further into the future. These actions – both completed and planned – are shown on page 8.

HIGHLIGHTS

Key principles	What we have done	What we plan to do
CLEAN AND PLENTIFUL WATER	**Customer metering has reduced demand by 18 %**	Progress plans to build new reservoirs at Broad Oak, Kent and Arlington, East Sussex from 2025
	Enhanced resilience to maintain supplies in a 1-in-200 year drought	Enhance resilience to 1-in-500 year drought
	Invested £56.2 million maintaining, upgrading and creating new environmental improvements and infrastructure	Trial nature-based solutions to protect our landscape from climate change through our partnership with the cross-border PROWATER project
	Completed the £22 million extension to Keleher water treatment works at Bray in Berkshire	Use behavioural science to engage with customers to reduce groundwater contamination and customer-side leaks as well as encourage a higher take-up of water efficiency devices
CLIMATE CHANGE RESILIENCE AND ENVIRONMENTAL HAZARDS	**Completed a study of flood resilience along our water supply network and initial investment made**	Commitment that all critical sites must be able to withstand flooding from 1-in-1000 year event by 2040 leading to flood prevention work at 92 sites to be completed by 2025, reducing the risk of supply interruptions
	Added alternative and reserve power supplies at sites and implemented lessons learnt from extreme weather events	Continue to monitor and investigate potential risks from sinkholes and subsidence, along with identifying operational sites which may need additional protection
	Developed a beach management plan with stakeholders to manage the risk of coastal flooding and erosion	Monitoring beach and cliffs and undertaking ad-hoc redistribution of beach material which has been moved by the tide
MORE SUSTAINABLE RESOURCE USE AND REDUCING WASTE	**Undertaken investigations and appraisals of adaptive management options within our Restoring Sustainable Abstraction (RSA) programme**	Continue investigations under the RSA programme and engagement with other abstractors
	Proactively engaged with other abstractors to reduce the overall volume of water abstracted in two of our surface water catchments	Implement land use management and our PROWATER schemes to increase the amount of aquifer recharge and improve the quality and quantity of the water in our coastal regions
	Introduced the resilient customer initiative, which is unique to the industry, to give customers tools to become part of the solution	Roll out individual My Water Use reports to all metered customers
ENHANCING NATURE AND PROTECTING HERITAGE	**Improved 1,172 hectares of land protecting wildlife and enhancing biodiversity and completed 10 biodiversity enhancement pilot studies on priority habitats and species**	Provide greater wildlife protection and biodiversity enhancements on 15 operational sites and 11 company owned woodlands
	Completed eight groundwater investigations a part of our award-winning catchment management programme	Target engagement with landowners over regulations, discharges, contamination and best practice land management in areas considered to be a priority as at risk
	Engaged with stakeholders and partnered with Catchment Sensitive Farming, leading to successful amnesty of pesticides and maize crop trials	Prevent water quality deterioration with 28 groundwater schemes and eight surface water schemes

CONSULTATION

In October and November 2021, we consulted with key stakeholders by publishing the draft report and a shorter, non-technical summary document on our website. The feedback gathered is presented in a table within the Appendices, along with our response. These comments have helped us to shape the final version of the report, which will be published on our website in early 2022 along with the final version of the non-technical summary document.

CONCLUSION

We welcome Defra's invitation to report on the actions we are taking to adapt to current climate change risks and also the predicted future impacts from the latest climate change data. We have been actively working on the risks as presented by Defra in the 2017 round of reporting and our progress is also discussed in other company published documents such as WRMP19 and the soon to be released industry-leading 25 Year Environment Plan.

By ongoing investment in our services and by working collaboratively with partners, South East Water will continue to enhance its resilience and adapt to climate change, while delivering outcomes for customers and the environment.

1. INTRODUCTION

Under the Climate Change Act 2008, Defra's Adaptation Reporting Power (ARP) invites water companies to report on the action they are taking to adapt to climate change and how they are addressing current and future climate impacts. The ARP supports reporting organisations to implement adaptive actions by directly engaging with climate risk and promoting climate resilience, while contributing to the Government's understanding on the level of resilience across a range of UK sectors, which feeds into the UK's Climate Change Risk Assessment (CCRA).

ARP reports include consideration of current and future projected impacts of climate change; proposals and policies for adapting to climate change and an assessment of progress towards implementing the policies and proposals set out in previous ARP reports.

This report presents the third round of ARP reporting for South East Water following the first round in 2011 and a voluntary second round in 2015. The report takes us up to 2025.

The creation of this Climate Change Adaptation Report ensures we have identified and are mitigating against the key climate change risks which threaten our company purpose. Alongside this report, we're also co-creating the industry's first 25 Year Environment Plan which is based on four environmental principles (see page 5).

Understanding of our systems, their interdependencies, and the risks that our systems face is embedded within the way we work to build resilience and is central to regulatory policies and our business plan. Therefore, we are pleased to present this ARP which demonstrates that our existing risk assessment procedures are comprehensive and will continue to enable us to deliver resilient services for customers and enhance the environment.

[1] Designated by Defra in 2007; defined by the Environment Agency as an area where current (or future) household demand for water is a high proportion of the current effective rainfall that is available to meet that demand

2. SOUTH EAST WATER OVERVIEW

2.1. WATER RESOURCE REGION

Our water supply area covers 5,657 kilometres squared across parts of Kent, Sussex, Surrey, Berkshire and Hampshire (figure 2-1). We provide an average of 520 million litres of high-quality drinking water to a population of around 2.2 million customers. However, we operate within an area of serious water stress[1], with climate change increasing pressure on resources as temperatures rise and changes in the seasonal reliability of rainfall threaten hydrological drought. Moreover, we have a high reliance on groundwater. We source around 73 per cent of our water supply from 250 boreholes, with the remainder supplied from surface water from six river intakes, and five surface water reservoirs. This reliance on regular replenishment of groundwater presents us with challenges during extended periods of low rainfall, requiring us to rest groundwater sources and operate abstractions conjunctively to meet the requirements of demand and the environment too.

The Environment Agency (EA) has identified that some of the aquifers we rely on may potentially be over-abstracted and failing to meet the Water Framework Directive requirement. Thus, the sustainability of some of these abstractions is uncertain.

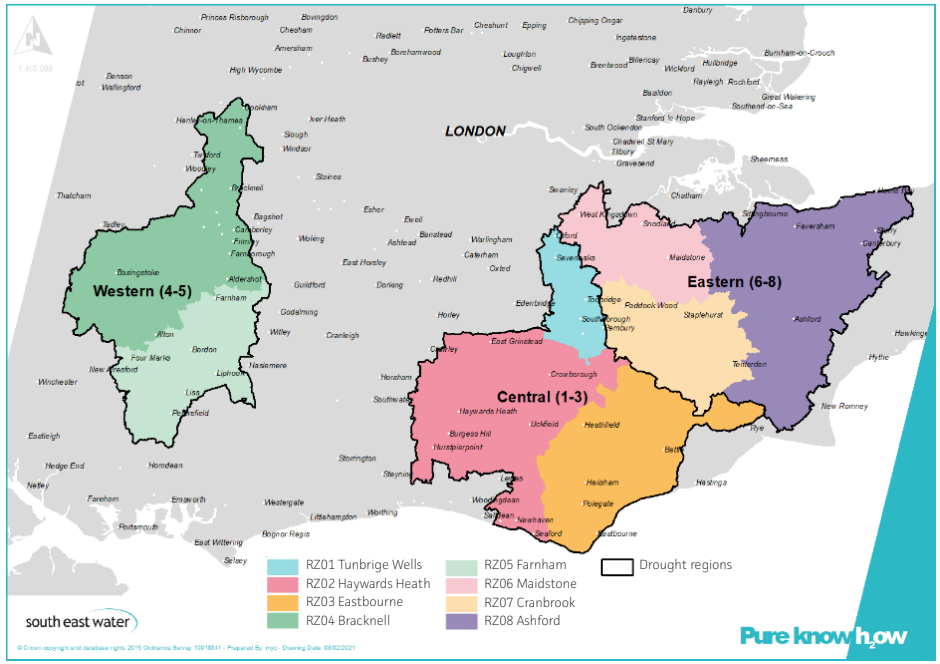
Flooding due to climate change is also a considerable risk. Following the outcomes of the National Flood Resilience Review (NFRR)[2] by the UK Government in 2016, we are addressing flood risk at 92 of our production sites and pumping stations.

The challenge of maintaining reliable supplies is further compounded by the significant population and economic growth within the south east of England. Our supply area serves approximately 26,000 more people in our Water Resource Management Plan 2019 (WRMP19) than WRMP14 forecasts and population is set to increase further.

[2] https://www.gov.uk/government/publications/national-flood-resilience-review

More recently, the Covid-19 pandemic has influenced patterns of water use[3] with some very large increases in household demand during lockdown periods coinciding with warm weather. The need to balance water supply with demand and to provide reliable services for customers continues to drive investment in our business plans and supporting strategies.

Figure 2-1: Map of South East Water's drought management areas
Source: Draft Dry Weather Plan, 2021



Beyond our water supply responsibilities, we are also an organisation that provides environmental services with one overarching environmental outcome: Our Environment Thrives. Our environmental services include:

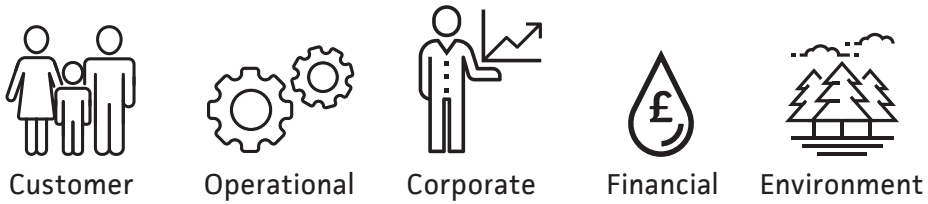
- owning and managing 33 Sites of Special Scientific Interest (SSSI), a National Nature Reserve, two local nature reserves and numerous Areas of Outstanding Natural Beauty (AONB)
- providing recreational facilities at a number of our sites
- enhancing biodiversity
- supporting customers to become more water efficient
- working with farmers, businesses and landowners to improve the quality of water at source and funding sustainable farming solutions

We are a significant local employer and asset operator. Therefore, the risks associated with climate change are much farther reaching than our water supply.

2.2. OUR KEY PRINCIPLES AND APPROACH TO RESILIENCE

We take a holistic approach to resilience in the round across five key areas (figure 2-2). Our approach aligns all areas of our business to the common goal of greater resilience to the threats of climate change and a growing population to ensure safe, reliable and affordable water services.

Figure 2-2: Key areas central to our resilience in the round



Customer resilience

Our customer resilience strategy targets four groups: household customers, business customers, stakeholders and developers to drive change in customer behaviour and help inform business decisions. By engaging and working in partnership with our customers we can: improve water efficiency; reduce the cost to customers; reduce leakage; implement our catchment management strategy and reduce per capita consumption.

[3] Atkins and Frontier Economics, 2020. Economic Impacts of Covid-19 on the Water Sector: Final report Covid-19 (water.org.uk)

Operational resilience

Operational resilience is the ability to cope with, and recover from, disruption to, and variability in, our assets to ensure our services to our customers is maintained. We have a vision to be "the water company people want to be supplied by and want to work for". We are investing in enhancing our operational resilience, detailed in our Asset Management Policy 2020[4], Strategic Asset Management Plan (SAMP)[5], 2020 to 2025 Business Plan[7], to ensure that our assets are effectively managed across the complete life cycle in a safe, resilient, sustainable, collaborative, and innovative way, using our Strategic pillars of the Asset Management Plan[5] (figure 2-3).

Building operational resilience to facilitate a sustainable and sufficient supply of water is essential to meet Ofwat's requirement for 'Resilience in the Round', our Outcome Delivery Incentives (ODIs), our environmental resilience objectives and we also need to comply with the requirements of our regulator. By meeting all these requirements we will ensure resilience to climate related threats which our communities, customers, employees and environment face, both now and in the future (table 2-1).

We are actively reviewing our operational resilience model, which covers resistance, reliability and redundancy of operations and have developed an approach that highlights resilience risks and enables us to develop a number of targeted mitigations[6]. As a direct result, we are investing in enhancing our operational resilience, detailed in our 2020 to 2025 Business Plan[7], including for example, cost effective ways of reducing the risk of low pressure and supply interruptions for our customers by operating calm networks, and ensuring resilience to climate related threats that we face such as building 1-in-1000 year flood protection. Thus, many of the actions stated within this adaptation report act to enhance our operational resilience.

Table 2-1: Key areas of investment to increase our resilience

Area	Benefit	Interventions proposed	Benefit & associated ODI/PC
Extreme weather	Flooding at production sites	Flood prevention work at 92 production sites and pumping stations to provide resilience to 1-in-1000 flood event	Reduce the risk for 866,000 customers of supply interruptions
Infrastructure	Single source of supply – AMP7	Implementation of strategic mains schemes to improve resilience by increased network flexibility through interconnections between zones	Reduce the risk for 47,345 customers of supply interruptions
Infrastructure	Single source of supply – AMP8	Implementation of strategic mains schemes to improve resilience by increased network flexibility through interconnections between zones	Reduce the risk for 29,000 customers of supply interruptions
Infrastructure	Interruptions to supply– AMP7	Improved capacity at Barcombe WTW No. 1 works to provide redundancy for No.2 works which will reduce risk to supply either through process failure or during essential maintenance	Reduce the risk for 18,000 customers of supply Interruptions
Infrastructure	Low pressure	Additional storage at Oakhanger WTW to improve operational resilience of 626 pumped network	Reduce the risk for 4,000 customers of low pressure
Emergency response	Interruptions to supply	Operational risk model for improved planning of activities	Reduce interruption minutes
Resilient customer	Interruptions to supply	Customer resilience though behavioural change, partnership, and innovation toolboxes	Improve customer resilience

[4] South East Water (February 2020). Asset Management Policy

[5] South East Water (July 2021). Strategic Asset Management Plan

[6] Resilience in the Round PR19 Supporting Appendix 9 (South East Water, 2018)

[7] 2020 to 2025 Business Plan (South East Water)

Figure 2-3: Strategic pillars of the Strategic Asset Management Plan

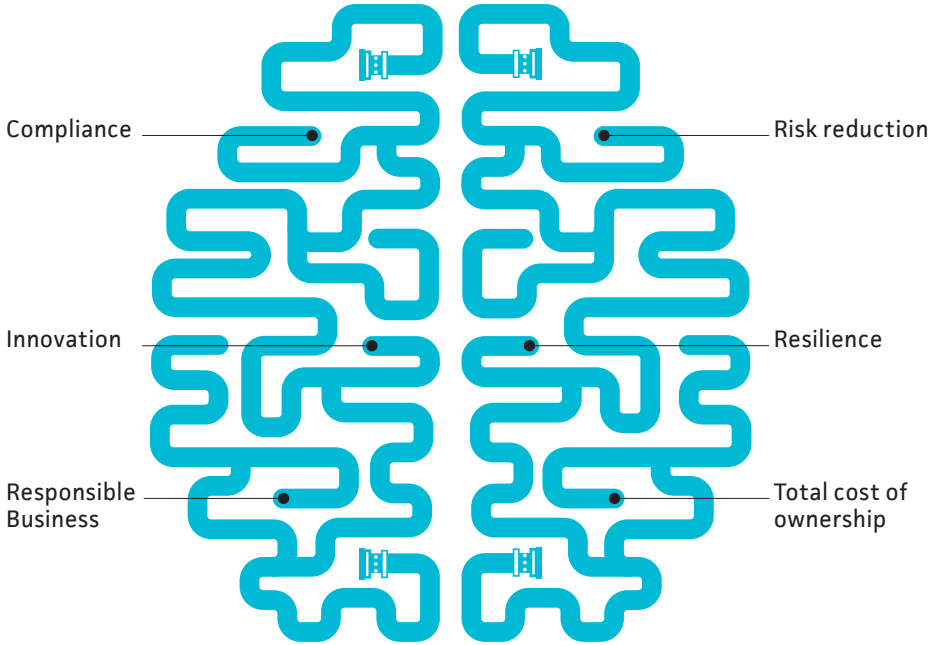
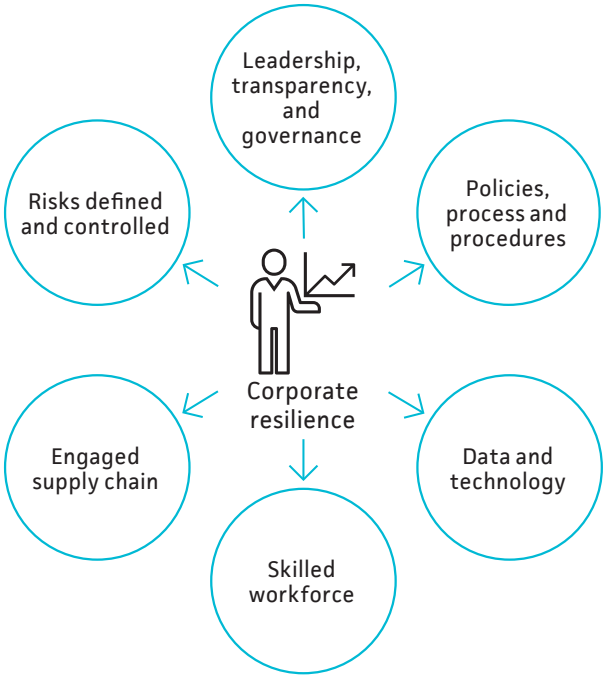


Figure 2-4: Our priorities for corporate resilience



Corporate resilience

Our corporate resilience focuses on three areas: our governance process and policies; our organisational focus and the quality of the data and information we have, and the technology we use (figure 2-4). Our goal is to meet customer and stakeholder priorities whilst maintaining our ability to deliver resilient services in the face of emerging climate risks. Our strategy reflects the areas where enhancement to our business will benefit our customers, our organisation, and our environment.

Financial resilience

Financial resilience underpins all our business activities. We undertake annual financial viability assessments, looking at potential scenarios that could cause financial shocks, ensuring the business can continue to perform without impact to customers and lenders. Further details of financial planning and resilience can be found in our Business Plan[7].

Table 2-2: Environmental resilience themes and related activities[8]

Theme	South East Water activities
Clean and plentiful water	Improving the resilience of our surface water and groundwater catchments to the threats of climate change, ensuring a sufficient and safe supply to meet current and future needs.
Climate change resilience and reducing environmental hazards and carbon	Partnerships with key stakeholders and customers to drive behavioural change to ensure that both the built and natural environment can adapt to the impacts of climate change including floods, droughts and sea level rise. Carbon accounting with targets for increasing our use of renewable energy.
Using resources more sustainably and reducing waste	Maximise the value from, and protect the natural assets we own and manage through sustainable abstraction. Work to reduce our leakage through more resilient infrastructure.
Enhancing nature and protecting heritage in the decisions we make	Managing the risk of invasive non-native species (INNS), protecting wildlife and increasing biodiversity through the use of catchment management and habitat enhancement to ensure that the demands of a growing population and the threat of climate change do not result in the deterioration of our environment. Apply natural capital accounting to ensure we value nature in the decisions we make.

[8] Note: Climate change is a cross-cutting issue that impacts on all environmental resilience themes plus other aspects of customer, operational, financial and governance resilience. In subsequent sections, the second environmental resilience theme focuses on environmental hazards.

Environmental resilience

We are currently co-creating a 25 Year Environment Plan[9] which will set out what we need to deliver as a company over the next 25 years in addition to our principles for our WRMP and future business plans in relation to environmental resilience. Our Corporate Environmental Resilience Policy has four key objectives that we want to achieve (table 2-2) and also provides the framework for this ARP report (see section 2.3).

These objectives are aligned with a number of recently produced key policy documents and programmes along with already established legislation and regulations, including:

- WISER (2017): a priority strategic direction statement from our two environmental regulators, the Environment Agency and Natural England to assist water companies in delivering the overall vision of these regulators and to enable statutory obligations and expectations to be embedded in our undertakings and future plans
- Defra's 25 Year Environment Plan: Defra's goals for improving the environment, within a generation, and leaving it in a better state than we found it
- Biodiversity 2020: a strategy for England's wildlife and ecosystem resilience
- Water Industry National Environment Programme (WINEP): our statutory environmental programme that will continue to be delivered from 2020 to 2025. This programme covers our key environmental activities for restoring sustainable abstractions and improving raw water quality and biodiversity
- Guidance Notes: long term planning for the quality of drinking water supplies, developed by the Drinking Water Inspectorate (DWI) (Sept 2017)
- UN Sustainable Development Goals from the 2030 Agenda for Sustainable Development (2015)

[9] Corporate 25 Year Environment Plan due for publication in December 2021

As a result, our four key Corporate Environmental Resilience Policy objectives and the actions we take to deliver them, encompass our other pillars of resilience.

2.3. OUR APPROACH TO ARP3

The aim of adaptation reporting is to present evidence of how we understand and are adapting to climate change risks. Therefore, we report the risks we address in the context of risk analyses from previous ARPs; national risks identified in the Climate Change Risk Assessments[10] (CCRA); the most recent climate change projections (UKCP18[11]) and statutory reports. Our risk assessment approach follows our standard risk register and horizon scanning approach, so that physical climate change risks are given parity with other risks (including transition to net zero risks) that we face.

To produce this third round ARP, we collated evidence from South East Water policies and reports, some of which form statutory reporting requirements including our WRMP (2019 and 2014); our dry weather plans (formerly known as the drought plan, 2014 and 2021 draft); and our five year business plan (2020 to 2025); in addition to our further reaching 25 year plan and resilience strategy; our annual performance, people and planet reports (2016/17, 2017/18, 2018/19; 2019/20); and documents published on our corporate website including news bulletins and case studies. In addition to South East Water documents, we also utilised CCRA2 and CCRA3 supporting material; and research based on the most recent climate projections, the Climate Change Projections 2018 (UKCP18).

As part of this round of reporting, we conducted a series of workshops with different departments throughout the company and recorded risks by presenting set questions to attendees (provided in Appendices) and asking them to score perceived risk. The resultant 100 risks were collated under our four key environmental resilience principles and aligned asset management strategy objectives:

1) clean and plentiful water;
2) climate change resilience and reducing environmental hazards;
3) using resources more sustainably and reducing waste; and
4) enhancing nature and protecting heritage in the decisions we make – aligning with our environmental resilience strategy.

We then provided further information on the highest risks relevant to each environmental resilience principle. Within this report, we address 12[12] consolidated risks in total; including three risks for clean and plentiful water; three risks for reducing environmental hazards; three risks for using resources more sustainably and three risks for enhancing nature. Within each section, we incorporate information on the physical drivers of each risk; definitions of the risk category and type (physical or transitional, and acute or chronic); we outline the measures we are taking to manage the risks and our targets once controls are implemented.

We have also considered the implications to our outcome delivery incentives (ODIs) in the 2020 to 2025 price control period.

[10] Climate Change Risk Assessment 2022 (Climate Change Committee)

[11] UK Climate Projections (UKCP) - Met Office

[12] Some risks were repeated throughout the risk register, therefore 12 risks reported reflect the consolidation of 55 risks out of 100, with excluded risks exhibiting low risk scores

Key climate change definitions

Adaptation to climate change: the process of adjustment to actual or expected climate change and its effects.[13]

Adaptive management: the process of iteratively planning, implementing and modifying strategies for managing resources in the face of uncertainty and change.[14]

Climate risk: The potential for the occurrence of negative impacts on an organisation resulting from climate change.

- **Physical risks[14]:** emanating from climate change can be event-driven (acute) such as increased severity of extreme weather events (e.g. cyclones, droughts, floods, and fires). They can also relate to longer-term shifts (chronic) in precipitation and temperature and increased variability in weather patterns (e.g. sea level rise)
- **Transition risks[14]:** risks associated with the transition to a low carbon climate resilient global economy – relating to policy and legal actions, technology changes, market responses, and reputational considerations. This report does not cover transition risks

Climate opportunity[14]: The potential for the occurrence of positive impacts on an organisation related to climate change, related to both climate change mitigation (emissions reduction) and climate change adaptation.

2.4 HOW WE CONSULTED

With our draft report, we consulted with stakeholders and staff by sharing the draft document and a shorter, non-technical summary on our website and also presented to our Environmental Scrutiny Group. The summary of the feedback received and our response is presented in the Appendices. Several respondents expressed an interest to collaborate, which we will be pleased to take forward.

[13] Adaptation to climate change – Principles, requirements and guidelines (ISO14090:2019)

[14] TCFD, 2017. Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures https://assets.bbhub.io/company/sites/60/2020/10/FINAL-TCFD-Annex-Amended-121517.pdf

Risk scoring

Risk scores are assessed based on likelihood and impact. The matrix below (table 2-3) illustrates the combinations of likelihood versus impact that generate an overall risk score. Scores range from one through to 25. The colour coding applied to the matrix denotes the categories of risk, from low (green), medium (amber), high (red), through to extreme (purple). Current likelihood versus impact is used to assess the **current risk**, and the **target risk** is based on where we plan to get to by implementing measures to manage the risks and by adapting to climate change. This report focuses on risks that are currently rare but the released climate change data shows that they will become more likely in the future (classified as 'unlikely' and 'remote' likelihoods). In the context of climate change, this means that the scoring focuses on climate change crossing high thresholds with large consequences, rather than dealing with changes that are already evident and that we are already managing on a daily basis. The target risk score is not linked to a specific timescale. Action plans to progress to the target score will be developed and delivered separately. Our aim is to provide an annual update within the Performance, People and Planet report.

Control ratings are assessed based on the extent of processes in place to control risks, including the frequency of measures and how well they are embedded in performance measures and day to day business (see table 2-4). Risk control measures are defined as monitoring, minimising (reducing risk impact) and/or preventative (reducing risk likelihood).

Table 2-3: South East Water Risk scoring matrix

		Impact				
		Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood	Almost	8	15	22	24	25
	Certain	7	14	19	20	23
	Possible	5	9	16	18	21
	Unlikely	3	4	10	13	17
	Remote	1	2	16	11	12

Risk Level Key	Low	Medium	High	Extreme

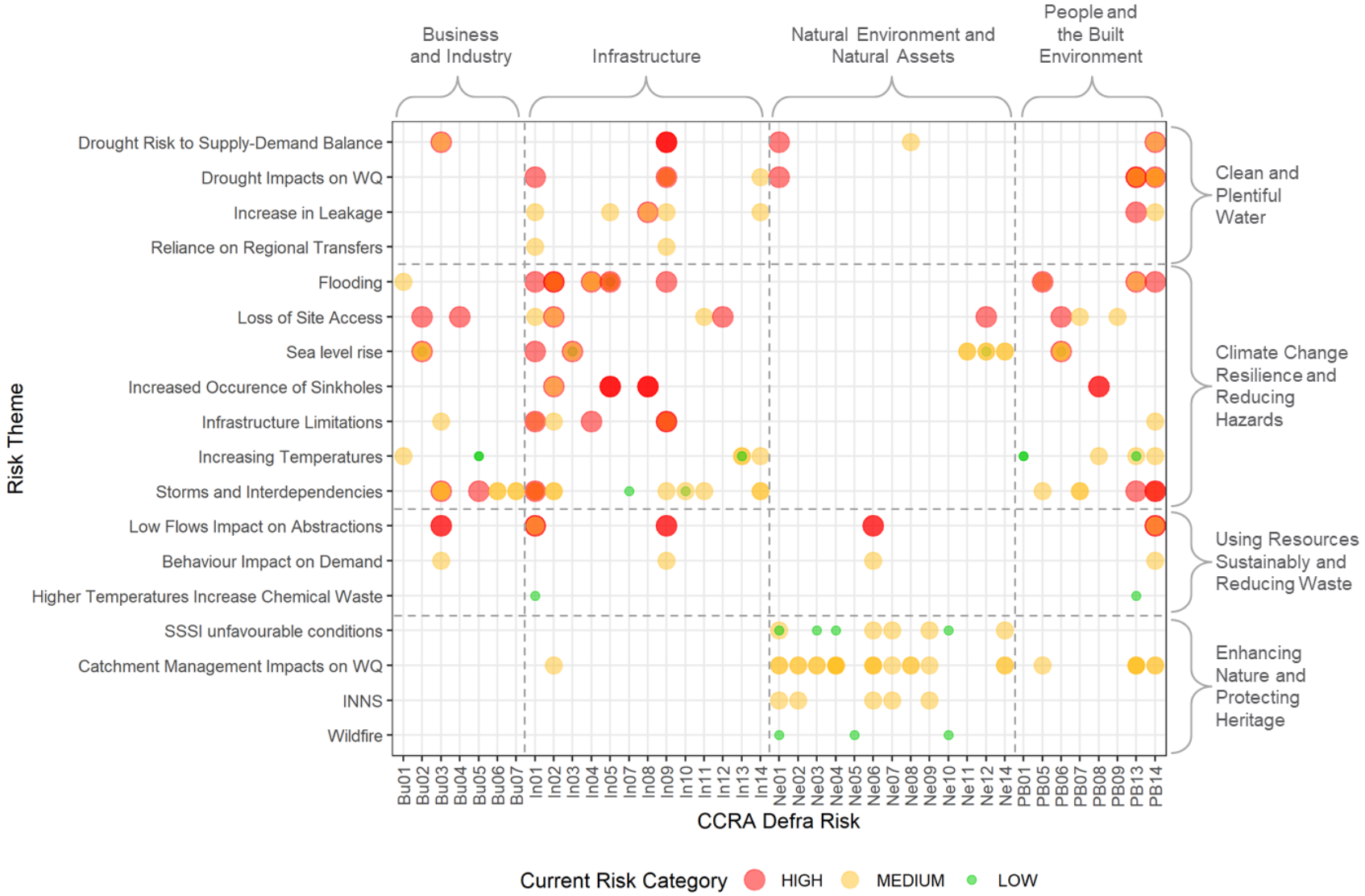
Table 2-4: Risk control rating

Control rating		
1	No/little control	Business is aware of a need for control process, but no formal process is in place Ad Hoc management
2	Minimal	Minimal control process in place within the department, but it is repeatable across the department Little consistency between departments
3	Adequate	Centrally controlled process in place across entire business Senior management consistently engaged
4	Effective	Routine use of metrics and quantitative methods to measure the performance and quality of the control Top management are committed to seek out innovative ways to achieve goals
5	Highly effective	Control is fully embedded in day to day business. Native controls are flexible and adaptive to changing requirements Risk and Controls are seen as part of the businesses continuous improvement process

Relating to CCRA risks

As part of this ARP, we have considered how the risks we face are associated with risks from the UK government's CCRA2 (2017) and its overarching themes, in addition to our own environmental resilience themes. This is visualised in figure 2-5, and demonstrates the risk landscape and overlap between our resilience themes and Defra's climate risks from CCRA2. The primary areas with higher risks, and of most importance to ourselves are related to our main purpose to provide clean and plentiful water to our customers, which requires resilience to environmental hazards, particularly for critical infrastructure as well as the people and enabling environment that allows us, as a business to operate successfully. We summarise the CCRA2 risks and their relevance to South East Water in table A9, which can be found in the Appendices. The table also shows where further information on the risks can be found in the report.

Figure 2-5: Our risks, their current risk category, and how they map onto our resilience principles and Defra's CCRA2 risks and risk themes



3. PREVIOUS ARP REPORTS

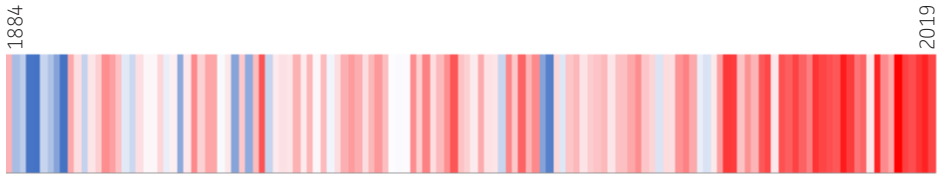
This report represents the third round of reporting on our resilience and adaptation to the risks that climate change presents, following the first round in 2011 and a voluntary second round in 2015. Within this round we identified one new risk; the increasing occurrence of sinkholes. We have also removed one risk identified in earlier ARP reports – regional competition – because this risk is managed through the Water Resources South East (WRSE) regional group, which requires companies to work more closely in managing shared resources, resulting in a more integrated strategy in recent years that has seen a reduction in the risk. The full list of climate risks across all three ARP rounds is provided in the Appendices.

4. FUTURE CLIMATE CHANGE AND IMPACTS IN THE UK

Climate trends

The climate is already changing; over the last decade the UK has experienced warmer conditions, with four high temperature records, an increase in sunshine hours and some significant flood events[15].

Figure 4-1: Climate stripes for the south east of England[16]



Taking a longer term view, the UK has warmed by more than 1°C since pre-industrial times (figure 4-1), sea levels have risen by 16cm since 1900 and the likelihood of hot summers has doubled[17].

Average annual temperatures in the south east of England are already around 1.5°C higher in the 21st century compared with the end of the 19th century[18].

Climate change in our existing plans

Our previous risk assessments and long term plans have incorporated climate change based on the UK Climate Projections 2009 (UKCP09). This includes the translation of UKCP09 scenarios into national guidelines for water resources management and flood and coastal erosion risk management. In broad terms, our WRMP19 considers warming of around 3°C by the end of the century, because it was based on the UKCP09 Medium Emissions scenario, plus some additional allowances for climate change uncertainty. The EA flood risk guidelines, which we also adopt for our flood resilience work, are more precautionary and incorporate 3°C to 4°C warming by the end of the century. In addition, in all of our plans we adopt an adaptive approach, including sensitivity analysis of more extreme scenarios, so that we are ready to adjust our plans to incorporate the latest scientific evidence and take necessary action.

The UK Climate Projections 2018

The UK Climate Projections 2018 present a significant upgrade to the UK climate projection tools, superseding UKCP09 projections[19]. The headline findings are similar to UKCP09, with wetter winters and drier summers, except that sea level rise is higher and there are some differences at the extremes, particularly for summer temperatures and heavy rainfall.

[15] State of the UK Climate – Met Office and Kendon, E. et al., 2019. State of the UK Climate 2019. Int J Climatol

[16] Source: Met Office Had UK data, showing relative warming above the 1884-1900 average

[17] UK Climate Risk (Climate Change Committee, 2021)

[18] Based on Met Office HadUK data using annual average temperatures for 2001-2019 minus the average for 1884-1900

[19] About UKCP18 – Met Office

In London and the south east of England:

- hot summers are expected to become more common. By 2050 there is a 50 per cent chance of summers being as hot as it was in 2018 (one of the warmest UK summers to date)
- under the high emissions pathway, the frequency of hot spells rise from an average of once every four years to about four times per year by 2070
- although the trend is for drier summers in the future, the latest UKCP18 data suggests possible increases in the intensity of heavy summer rainfall events
- sea levels will continue to rise under all emission pathways

As part of our regional water resources planning activities, we have contributed to the water industry studies on Regional Climate Data Tools that have provided a very detailed review of UKCP18 climate change projections and the implications of adopting different emissions pathways and Met Office climate modelling products. Further details on UKCP18 and comparative data are included in Appendices.

The UK Climate Change Risk Assessments

The Climate Change Act 2008 requires a five-yearly assessment of the UK's risks due to the current and projected impacts of climate change. The Climate Change Risk Assessments (CCRA) published in 2012 (CCRA1), 2017 (CCRA2) and due to be published 2022 (CCRA3) fulfil this requirement. Published research and supporting analysis for technical chapters within CCRA3 is summarised for the UK below and in Appendices, which considers the impact of climate change on flooding[20], water availability[21], behavioural responses[22], the natural environment[23], and the built environment[24].

- **Flooding** – Flooding presents the greatest risks to society and the most need for action in the next five years of all climate related risks identified in the UK Government's National Risk Register. Expected annual damages for the UK are set to rise from £2 billion to £4 billion by 2080 under a 4°C future[20]
- **Sea level rise** – Rates of relative sea level rise (SLR) in the south east of England are amongst the highest in the UK owing to the isostatic rebound driving South East England to sink and Scotland to rise. SLR of 0.76 meters is projected by 2100 under 4°C future in the south east of England[20]
- **Water availability** – If no action is taken to adapt to climate change, the UK is projected to be in a water deficit of between 800-3,000 million litres per day in the 2050s and by 1,400-5,900 million litres per day in the 2080s (based on comparing low population growth and a low emissions scenario with high population growth and high emissions)[21]
- **Natural environment** – Temperature increases in the south east of England are set to be the second highest in the country after London, placing pressure on the environment. The annual economic impact of algal blooms is projected to be £77 million in 4°C future in the south east of England (£481 million for the UK)[23]

Further supporting information on the CCRA is summarised in the Appendices.

[20] Third UK Climate Change Risk Assessment (CCRA3) Future Flood Risk. Main Report. (Sayers et al., 2020)

[21] Updated projections of future water availability for the third UK Climate Change Risk Assessment. Technical Report (HR Wallingford, 2020)

[22] Understanding how behaviours can influence climate change risks. Main report of research findings. UK Committee on Climate Change (AECOM and Sniffer, 2020)

[23] Climate driven threshold effects in the natural environment (UK Centre for Ecology and Hydrology et al., 2020)

[24] Interacting risks in infrastructure and the built and natural environments. (WSP, 2020)

5. CLEAN AND PLENTIFUL WATER

Climate change poses risks to our water resources and aquatic environments where water is taken from, as well as risks to our ability to provide reliable and safe water services to our customers. We are taking action to enhance our resilience across our catchments and our operations to ensure customers today, and in the future, benefit from plentiful and wholesome water supplies.

Under our key principle of clean and plentiful water, we address three climate risks: risks to the supply-demand balance of water within our region; risks to the quality of water that we deliver; and risks to the frequency and magnitude of leakage. These risks have been associated with risks identified in CCRA2[25] in table 5-1.

Table 5-1: Our climate risks associated with clean and plentiful water and related CCRA2 risks

South East Water risk	Keys associated risk CCRA2 risk	Other related CCRA2 risks
Risk to supply-demand balance	**In09:** Risks to public water supplies from drought and low river flows	• **PB14:** Risk of household water supply interruptions
Risk of drought impacts on water quality	**PB13:** Risks to health from poor water quality	• **PB14:** Risk of household water supply interruptions • **In01:** Risks of cascading infrastructure failures across interdependent networks • **Bu03:** Risks to business operations from water scarcity • **In09:** Risks to public water supplies from drought and low river flows • **Ne1:** Risks to species and habitats from changing climate space
Risk of increased leakage through ground movement and winter freeze-thaw	**In08:** Subsidence risks to buried/ surface infrastructure	• **PB14:** Risk of household water supply interruptions • **In5:** Risks to bridges and pipelines from high river flows/erosion • **In09:** Risks to public water supplies from drought and low river flows • **In14:** Benefits for infrastructure from reduced extreme cold events

[25] UK Climate Change Risk Assessment (HM Government, 2017)

5.1. RISK LEVEL, PERFORMANCE METRICS AND COMMITMENTS

Our assessment of the level of risk and our associated performance metrics and commitments are shown in the table below.

Table 5-2: Risks identified under our 'clean and plentiful water' key principle, their climate drivers, risk categories and types, the current and target risk scores and control rating scores using the matrix and methodology outlined in section 2.3, and performance metrics, measures and commitments made through WINEP, ODI, KPI or performance commitment (PC) set internally. *Target risk is defined as the risk once all adaptation measures have been implemented

Risk	Climate driver	Category/ type	Current risk	Target risk*	Control type	Control rating	Performance metrics				
							Description	Current performance	2025 commitment	2045 ambition	2080 ambition
Resilience to severe drought restrictions (ODI)	• Less rain • Temperature rise	Physical chronic (acute for heatwaves)	High 17	Low 6	Monitoring, minimising and preventative	Effective 4	Ensure zero deficit in the company supply demand balance in any year (ODI)	Pass	Pass	Pass	Pass
Risk of drought impacts on water quality	• Less rain • Temperature rise	Physical chronic	High 17	Low 6	Monitoring, minimising	Highly Effective 5	Groundwater investigations (WINEP, ODI)	✓	✓	–	–
							Surface water investigations (WINEP, ODI)	✓	✓	–	–
							Compliance Risk Index, based on current regulations and standards and as reported to the Drinking Water Inspectorate (DWI)	2.26	0	0	0
							Number of pollution Incidents (category 1-2) (ODI, PC)	0	0	0	0
							Customer contacts regarding water appearance (per 1,000 population) (ODI)	1.00	0.79	–	–
							*see section 8.3 for additional catchment management for water quality metrics				
Risk of increased leakage and pipe bursts	• Extreme cold • Temperature rise	Physical acute	Medium 10	Low 6	Monitoring, minimising and preventative	Highly Effective 5	Leakage levels (million l/day) (ODI, PC)[26]	92.67	81.0	54.6	48.0
							Water mains repairs	2,751	–	–	–
							Mains repairs per 1000km of entire water main network (PC)	185.3 per 1000km	185.3 per 1000km	192 per 1000km	–

[26] Leakage targets and performance values based on Ofwat's new leakage methodology, which South East Water transitioned to in April 2021

5.2. RISK TO SUPPLY-DEMAND BALANCE

5.2.1. UNDERSTANDING THE RISK

Maintaining a resilient supply-demand balance requires a twin track approach as detailed in our WRMP19[27]. In this section we address the risk associated with the direct impact of climate change on our supply, although our current controls and planned actions target multiple components of the supply-demand balance. We address risks to other components of the supply-demand balance within other sections of this report (leakage – section 5.4; household demand and behaviour – section 7.3; sustainable abstractions – section 7.1; saline intrusion – section 7.4; catchment management – section 8.3).

Additionally, these issues may require further mains to be laid within each resource zone to move available water to local supply/demand deficits and improve network resilience.

Currently, we operate in an area of water stress; there are long-term chronic risks to supply due to temperature rise and population growth, in addition to longer, hotter summers with reduced rainfall resulting in increased demand with both regional and local effects. Climate change will result in changes in the distribution of rainfall throughout the year, with up to 50 per cent increased rainfall in winter and 70 per cent decreased rainfall in summer based on UKCP18 Regional Climate Models. Low capacity for surface water storage within the South East Water operational area exacerbates these risks. As identified in our WRMP19[27], three of our eight Water Resource Zones (WRZ) in the South East Water operational area are considered to be high risk. Whilst there remains a surplus in the supply-demand balance, it is anticipated that by 2044/45 under both dry year annual average and summer peak period scenarios there will be a 63.4 to 94.2 million litres per day deficit in available resource compared to demand (table 5-3); the decline in supply is the most influential factor.

[27] Water Resource Management Plan 2020 to 2080 (South East Water, 2019)

Table 5-3: Current and projected supply-demand forecast at a company level

	Dry year annual average (million l/d)			Summer peak period (million l/d)		
	2019/20	2024/25	2044/45	2019/20	2024/25	2044/45
Supply forecast	629.2	615.8	560.5	756.2	739.1	683.2
Demand forecast	522.0	528.5	564.1	643.3	653.5	707.3
Target headroom[28]	32.4	39.0	59.8	36.1	44.2	70.2
Supply-demand balance	74.8	48.3	-63.4	76.7	41.4	-94.2

We've allocated a high-risk rating of 17 to supply-demand and a medium-risk rating of 10 to population growth which will exacerbate supply-demand deficits. The target risk ratings for these are six and seven, respectively. Long-term temperature rises and population growth in addition to the limited capacity of Barcombe Water Treatment Works and changes to abstraction licences are key threats to managing this risk. Changes in working locations and patterns due to Covid-19 also created a significant short-term summer demand in 2020.

5.2.2. ADDRESSING THE RISK – ACTIONS TAKEN

Resilient to 1-in-200 year drought

Since our 2014 WRMP and following industry guidance, we have enhanced our drought resilience so that we can maintain supplies in a range of 1-in-200 year hydrological droughts (a substantive improvement from the previous 1-in-100 year drought resilience). The level of service under a 1-in-200 year level of resilience incorporates the use of temporary water use restrictions, and less frequently, non-essential water use restrictions and severe restrictions. Reducing the reliance on such restrictions has been achieved through a range of measures detailed in our WRMP19[27] and Drought Plan 2018[29].

[28] Target headroom is an allowance to manage a number of uncertainties on the supply- and demand-side of the balance. It includes an allowance for climate change broadly equivalent to the impacts of around 3°C warming above pre-industrial temperatures

[29] Drought Plan 2018 – 2023 (South East Water, 2019)

Demand management schemes account for over 50 per cent of our future new water savings and include leakage reduction, customer metering and influencing customer behaviours. In our last investment period water efficiency has been improved by 2 per cent and £7 million has been invested in detecting leaks with 90 per cent of reported leaks fixed within 48 hours. Customer metering has reduced demand for water by 18 per cent in metered homes. Further details for leakage reduction and customer metering and behaviours are detailed in sections 5.4 and 7.3, respectively.

Increasing supply

We have undertaken the following actions to increase our water supply, and ensure that our supplies are sustainable and sufficient now and in the future:

- we completed six surface water catchment investigations by March 2017 and further pilot projects were completed by March 2020
- we completed eight statutory groundwater management investigations by March 2020
- we're delivering two catchment management schemes providing 3.3 million litres per day of existing groundwater sources by the end of 2025 as part of the WINEP3 programme
- we've retained the option to deliver the Aylesford water re-use scheme if necessary in the future. Further work has been deferred because an existing large third party groundwater licence has become recently available
- we have collaborated with the University of Antwerp, South East Rivers Trust, South West Rivers Trust, Environment Agency, Natural England and Affinity Water to enhance ecosystems to improve groundwater recharge
- we have deferred desalination and effluent reuse options to later in the current planning period to allow for further study on the environmental impacts and potential mitigations
- our Restoring Sustainable Abstraction programme and bespoke Abstraction Incentive Mechanism (AIM) ensure sustainability at 12 sources with investigations, options appraisals, and/or adaptive management (see section 7.2)

Climate change modelling and optioneering

As detailed in out WRMP19[27] we have carried out climate change modelling for three scenarios: low impact (wet), mid-range (central case) and high impact (dry scenario), using the mid-range as a baseline and using low and high impact cases to test our WRMP uncertainty and our understanding of the composition and timing of options selected. Our supply-demand balance model with 108 future scenarios produced ranges from a surplus of 144 million l/d (most optimistic low demand case) to a deficit of 785 million litres per day (most severe high demand case). All demand management schemes within our best value plan were selected at least 50 per cent of the time. As scenario severity worsens, more supply-side schemes are included. Across all scenarios the Aylesford Newsprint and Bewl Water Treatment Works (WTW) expansion (Darwell replacement) schemes were selected on a consistent basis at the same dates of 2023 and 2025 respectively. All options considered are presented in table 5-4.

Table 5-4: Option types within our WRMP

Option group	Option type	
Demand management	Leakage reduction	Assessment and repair of pipelines to reduce leakage
	Pressure management	Pressure reduction programmes
	Metering	Installation of water meters
	Recycling and re-use	Recycling and re-use of grey water
	Water efficiency	Methods of reducing water wastage
Drought measures	Drought permit	Use of permits or orders during drought conditions to provide additional sources of water or increase abstraction
	Drought order	
Groundwater	Aquifer storage recharge	Store water in aquifers for extraction during high demand
	Groundwater enhancement	'Closing the gap' – increase abstraction within licence by addressing constraints
	New groundwater	Extend existing licence or new source
	Groundwater catchment management	Catchment management to prevent outages or DO reductions
Licensing	Licence trading	Underused licences
Water treatment works	WTW expansion	Improve WTW capacity
	WTW process loss	Improve WTW efficiency to reduce losses
Water transfer	Inter-company/regional transfer	Transfers from/to outside of the company
	Company transfer	Transfers within South East Water
	National transfer	National bulk transfers
	International import	International importing of water

Lessons from 2010 to 2012 dry winters

We experienced dry winters from 2010 to early 2012, which resulted in historically low levels in groundwater sources. We introduced a Temporary Use Ban in early spring 2012, while gaining insights into how groundwater sources respond and behave under consecutive dry winters and using this knowledge to improve resilience within our WRMP for 2020 to 2080. As a result, we have a better understanding of extreme drought events, including those more severe than observed in the historical record. We have improved the connectivity of our pipe network to strategically make best use of our most resilient sources of supply, and we have developed a more diverse mix of water sources to reduce any over-reliance on one particular type of source. These adaptive actions have increased our supply-demand resilience to groundwater droughts.

5.2.3. ADDRESSING THE RISK – PLANNED ACTIONS

For the 2020 to 2025 period, demand management alone is insufficient to ensure a net surplus of water. We are addressing this by constructing a new water treatment works at the former Aylesford Newsprint site with a new licence trade arrangement. The preferred options for achieving 1-in-200 year drought resilience were developed. However, the government has signaled the intention for water companies to increase the level of resilience to a 1-in-500 year drought, requiring further increases in supply. Below we outline the actions we plan to take to increase our water supply.

Water treatment works – We have planned improvements to existing water treatment works at Bewl to deliver 8 million litres per day of new water by 2025 allowing for increased abstraction from Bewl Reservoir.

Reservoirs – We are progressing plans to build a new reservoir a new reservoir at Broad Oak (Kent) with an intake on the Great Stour which will contribute 19.6 million litres per day by 2033. We have already undertaken further detailed work that has been shared and discussed with the local community, Environment Agency and Natural England. We are also developing plans to build an additional reservoir adjacent to the existing

Arlington Reservoir (East Sussex) with an intake on the River Ouse which will contribute 16.1 million litres per day by 2035. Site investigations, survey work and preliminary discussions with the landowner have already been carried out for the Arlington Reservoir extension. We consider that, in addition to addressing the risks to supply-demand balance and infrastructure limitations, the new reservoirs will provide significant benefits including new habitats and recreational opportunities.

Water transfers – We are developing[27] a regional water transfer scheme from SES Water to provide an additional 9 million litres per day. This transfer will use water from Bough Beech Reservoir source and transfer to our existing reservoir at Riverhill (WRZ1) commencing in 2042. We are also developing three in-house company transfers between WRZs which will provide an additional inter-zonal transfer capacity of 19 million litres per day by 2025. Additional water from Bewl Reservoir will be transferred to WRZ3 (Eastbourne) to be used in place of the existing Southern Water Bewl-Darwell bulk supply which terminates in 2025. We also have five improvement schemes planned for our pipe network to improve connectivity across our supply area.

Re-use schemes – We have partnered with the University of Brighton to complete modelling studies and planned feasibility work for the Peacehaven water re-use scheme as an alternative scheme to Arlington Reservoir expansion. We have also recently discussed the scope for a joint promotion of a large water re-use scheme with Southern Water. We will continue further investigations for the Peacehaven re-use scheme during the 2020 to 2025 period as there is uncertainty surrounding our ability to maintain the supply demand balance from 2028/29 without the addition of this scheme. We have deferred a water re-use scheme at Aylesford which has potential to increase supply. We have also been able to defer less environmentally friendly desalination and effluent re-use options in the period up to 2025 by collaborating with the supply chain, research establishments and stakeholders to provide increased supply through water quality improvements (see section 8.3).

New groundwater abstraction – Although there are sustainability constraints surrounding groundwater development options, our preferred plan does include one groundwater scheme. A major scheme on the former Aylesford Newsprint site (Maidstone) should be completed in 2023. This scheme will deliver a yield of 18.2 million litres per day for WRZ6 (Maidstone).

PROWATER

We are a partner in the PROWATER project alongside SE Rivers Trust and Kent County Council to understand how nature-based solutions can protect our landscape against the effects of climate change. The aim of the project is to build resilience within catchments against droughts and extreme rainfall events through trialling ecosystem-based adaptation measures for landscape scale change. This includes three pilots for the Little Stour and East Kent Chalk, Friston Forest, and the River Beult, each of which will entail a long term assessment and vision on water demand and supply challenges. The objectives of the three pilots are as follows[30]:

- **Little Stour and East Kent chalk** – Changing land use and increasing infiltration is key to improve water quality and quantity in the chalk aquifer, and alleviate flooding through slowing river flows and improving water residence times
- **Friston Forest** – Changes in land management could increase recharge and reduce saline intrusion risk. We will learn from previous tree planting activities (forest established in 1920s), which was thought to increase rainfall percolation and protect groundwater quality but actually decreased groundwater recharge by approximately 0.22 million gallons per day
- **The River Beult** – The scheme aims to slow the rate of discharge to increase residence time to enhance hydrological resilience, quality and quantity. This will increase the window for discharge abstraction and reduce the risk of downstream flooding in the quick surface water draining clay basin

[30]Environmental Resilience PR19 Supporting Appendix 10 (South East Water, 2018)

5.3. RISK OF DROUGHT IMPACTS ON WATER QUALITY

5.3.1. UNDERSTANDING THE RISK

Poor water quality, due to drought conditions can be attributed to primary consequences such as algal growth in reservoirs and storage facilities, increased turbidity and sediment deposition, as well as secondary consequences such as depressurisation of the network and reliance on tankered water. Further impacts include: eutrophication associated with low dissolved oxygen and increased temperature; and increased mobilisation of metals associated with the reservoir beds and reduced reservoir volume and depth at Ardingly reservoir, which could impact fish stocks, invertebrates and vegetation.

Under Level 3 severe droughts, detailed in our Drought Plan 2018[29], there is an increased risk to water quality, which could lead to a reduction in lake water quality due to decreased water volume and dilution capacity, increased concentration of algal biomass and effects associated with higher summer water temperatures. Level 3 droughts also pose depressurisation risks and water quality risks associated with contamination and time-based deterioration within tanker cargo transportation and sea tankering.

We've assessed the risk as high with a rating of 17 to reservoir water quality and storage, and algae; the target risk rating for these is six. Within this report we address risks to water quality through other types of extreme weather and climate risks, including pipe bursts associated with cold weather or dry soils (see section 5.4); saline intrusion driven by sea level rise (see section 7.4); and high runoff of pesticides and fertilisers and turbidity and high rainfall events and/or flooding (see section 8.3).

5.3.2. ADDRESSING THE RISK – ACTIONS TAKEN

Our daily procedures and performance

We supply water through 83 water treatment works (WTW) to ensure our water meets the highest quality standards. We undertake a range of actions daily to meet our Compliance Risk Index target of 0, including: ongoing management and review of water treatment works; alarms linked to our 24/7 control room and WTW shut down if readings are outside of the agreed levels. Our drinking water safety plan provides a risk assessment of each of our water supply systems from catchment to customer tap. We have a state-of-the-art laboratory in Farnborough, Hampshire that operates 24 hours a day, 365 days a year, to conduct over 500,000 water quality tests each year. As a result, we maintained high overall water quality with 99.96 per cent of samples passing standards set by the Drinking Water Inspectorate in 2020. Our overall Compliance Risk Index performance for 2020 was 2.26, in comparison with an industry average performance of 2.62. Performance was also better than average for each of the individual constituent components, treatment works, reservoir and customer tap sampling and we had zero enforcement incidents.

Investment in our assets

In 2020/21, we invested £90.6 million in capital expenditure to improve both our infrastructure and non-infrastructure and provide better water quality and reliability for customers. This included:

- £56.2 million to maintain, upgrade and provide new water treatment works, boreholes, drinking water storage reservoirs and pumping stations as well as supply and demand management and environmental improvements
- £34.4 million to renew and replace our underground pipelines infrastructure and provide new water mains, all of which delivers drinking water direct to our customers
- purchase of a brownfield site to build a treatment works that will in the future provide additional water to the Maidstone area
- completed our five year investment programme and £22 million extension of our Keleher WTW at Bray, Berkshire which extracts water from the River Thames. This scheme increases treatment capacity from 45 million litres per day to 68 million litres per day

These schemes are vital to secure water supplies for current and future customers by increasing our capacity to deliver high water quality standards through all climatic conditions. We are committed to continuing this level of investment.

Catchment management

In addition to the pressures on water quality driven by drought, our investigations found that raw water quality in a number of our surface water catchments is at risk of decline from increasing levels of pesticides, including Metaldehyde, turbidity (caused by soil erosion and sediment run off) and excessive levels of nutrients. While we can justify investment in our WTWs to tackle the risks to our supply during drought periods, we don't consider it acceptable for our customers to bear the costs of additional treatment for risks associated with increased levels of pollution. Increased water treatment also results in increased usage of chemicals and energy with associated carbon emissions. We take a 'source to tap' approach when it comes to engaging with our regulators by implementing Drinking Water Protected Area Safeguard Zones and our Catchment Sensitive Farming programmes. See section 8.3 for more detail on how we manage the risk to water quality through catchment management. The environmental issue is related to energy use and carbon but also how we manage the discharge/waste product which is generated from the process and is very saline. Much of our coast is designated as marine nature conservation zones (ie protected) and the environmental impact of this brine discharge would have a significant negative impact on the marine environment. For this reason we have discounted this as an option at this stage & until technology develops to mitigate this environmental impact.

5.3.3. ADDRESSING THE RISK – PLANNED ACTIONS

Water quality monitoring

A crucial requirement to combatting the risks to water quality, including the risks associated with climate change and drought, is to provide robust monitoring and analysis of our water. In addition to our regular daily monitoring processes, we analyse data to identify emerging water quality risks, for example, a number of our groundwater sources are subject to increasing nitrate levels. We are currently investigating the sources and possible catchment solutions to this problem. During 2020 to 2025, 28 of our abstractions are under investigation with trials being undertaken on a number of them to establish whether nature based solutions could reverse risks to raw water quality.

Dry Weather Plan actions for water quality

Table 5-5: Actions within our dry weather plan relating to water quality at different levels of drought severity

Drought Severity	Actions relating to water quality
Level 1 Developing drought	• Additional treatment to maintain dissolved oxygen in case of deteriorating water quality at surface water sites • Continued proactive catchment management approach to help ensure minimal deterioration of raw water quality • Talk to the EA about river quality and consider a joint communication to other land managers and discharge consent licence holders within the water catchments about actions that can be taken to protect water quality and prevent eutrophication
Level 2 Moderate drought	• Mobile treatment plants would be redeployed from engineering project works to sites where it might be helpful to ensure a resilient supply in the face of possibly lowering raw water quality • Flushing – do not 'flush' the system as part of any repair procedure. Inform customers proactively. Assess water quality impact on a case by case basis
Level 3 Severe drought	• Discharges – consider the impact of deteriorating raw water quality on the ability to meet the conditions of discharge consent conditions. May require increased frequency of sampling and analysis

Our approach to seawater desalination

Should desalination become an increasingly more important component of our supply-demand balance, it is essential that we also consider the associated risks to water quality. We assume all sea tankered water is raw water in quality and additional treatment is applied. Remineralisation will also be key to control the possibly significant water quality risks, as well as taste and odour issues caused by introducing desalinated water into an existing water distribution network. Desalination technology also needs to become more adaptive so that usage can be more easily switched on and off for peak lopping and short term high impact events. The environmental issue is related to energy use and carbon but also how we manage the discharge/waste product which is generated from the process and is very saline. Much of our coast is designated as marine nature conservation zones (ie protected) and the environmental impact of this brine discharge would have a significant negative impact on the marine environment. For this reason we have discounted this as an option at this stage and until technology develops to mitigate this environmental impact.

East Key at Newhaven has been identified as a site suitable for mobile treatment of a containerised desalination plant. A previous one-year containerised pilot plant was successful in relation to water quality, but not put into operation as it would require 1.5km sea outfall for discharge and a discharge consent. The environmental issues around desalination are related to the high energy use and the disposal of a waste product which is very saline. Much of our coast is designated as marine nature conservation zones which are protected and the discharge of this brine would have a significant negative impact on the marine environment. For this reason, we have discounted this as an option at this stage and until there have been technology developments which mitigate this environmental impact.

5.4. RISK OF INCREASED LEAKAGE AND PIPE BURSTS

5.4.1. UNDERSTANDING THE RISK

Leakage is the amount of water lost from pipes across the water network, including customers' supply pipes. Three main factors affect leakage:

1) aging sections of pipe amongst our 14,500 kilometer network of water mains and six million joints which have to withstand high pressure resulting in pipe and joint failure

2) colder winter temperatures increase leakage due to pipes shrinking and joints opening

3) extreme weather events such as freeze followed by a rapid thaw can over-stress pipes causing them to burst, or prolonged hot dry periods can shrink the earth that supports pipes, causing them to move and break

Under future climate change scenarios, frost days could decrease and reduce risk of burst frequencies and leakage through freeze-thaw weathering, however, leakage can increase due to increased projected dry spells and associated damage to pipes caused by subsidence.

Leakage and pipe bursts can disrupt water supply, put pressure on water resources, and reduce water quality. Failure to meet our targets on leakage and pipe bursts could lead to financial penalties, negative reputational impacts, and customer dissatisfaction. Hence, our leakage reduction strategy forms an important component of our WRMP19[27], Dry Weather Plan[29] and Business Plan[7]. We also focus on customer leakage under resource use and behaviour in section 7.3.

We allocate a high-risk rating of 17 to increased pipe bursts, and a medium risk rating of 10 to increased leakage due to ground movement (see section 5.1); the target risk rating for these are eight and six, respectively.

5.4.2. ADDRESSING THE RISK – ACTIONS TAKEN

Leading performance in leakage

As part of Ofwat's regulation of the water industry, we undertake annual performance reporting, monitoring a wide range of business activities such as leakage. We have met our leakage target for 18 consecutive years[31] and our performance places us among the top five water companies in the UK and in the upper quartile level of industry performance. Table 5-6 outlines some of our performance achievements.

During 2020/21 our leakage was reported at 92.67 million litres per day, outperforming our target of 95.2 million litres per day and represents 1.9 per cent improvement on our 2019/20 leakage levels under the new reporting methodology[32].

Table 5-6: Our leakage strategy achievements

Category	Description of leakage achievements
Investment	Between 2015 and 2020 we will have invested an additional £5 million in the very latest technology to help us find more of our invisible smaller leaks
Reduced repair time	We have reduced the time it takes us to repair leaks, so that 90 per cent of reported leaks are now fixed within 48 hours. Our digital "in your area" map on our website enables customers to report leaks and track our progress on repairing them
Leakage million l/d performance	We outperformed commitments to reduce leakage to 90.0 million litres per day by 2017/18, reported leakage figure for 2017/18 was 87.7 million litres per day*
Metering	Initiated in 2011, we have successfully rolled out our customer metering programme (CMP), compulsorily installing 298,000 household meters. In 2011, ~40 per cent of homes were metered, now that figure is around 90 per cent
Leakage Index	Our Infrastructure Leakage Index of 1.27 places us as being amongst the best in the world
WRMP deferred scheme	Water saved from leakage reductions activity has allowed us to defer two groundwater schemes proposed in WRMP14, which we know would have had environmental impacts

*Methodology to calculate leakage changed in 2020/21 and we continue to outperform our targets

[31]Performance, People, Planet 2019/2020 – Annual Performance Summary and Corporate Social Responsibility Report (South East Water, 2021)

[32] https://performance.southeastwater.co.uk/odi/leakage/

Award winning and innovative Smart Water Network trial

Thanks to our Smart Water Network trial, in 2020 we were three-times Water Industry awards winners for: 'Data Project of the Year', 'Water Innovation Project of the Year' and 'Most Innovative New Technology of the Year'[33]. The Smart Water Network trial is an industry first – it merges innovative new technologies with metering to visualise, analyse, monitor, predict and improve the real-time performance of our water network. The smart networks have the potential to alert us to the smallest leaks on both our pipes and our customers' pipes soon after they occur, and could even enable us to predict and prevent pipeline failure before it happens via an analytics engine and artificial intelligence. Moreover, we expect the provision of data to customers and associated customer initiatives will benefit water saving through behavioural change (discussed further in section 7.3). This will deliver large savings for us, our customers and the environment. Following completion of the Smart Water Network trial, we are now looking at implementing this technology into our longer-term plans for upgrading our network.

Beast from the East – Lessons from disruption to supply in 2018

The Met Office issued a weather warning for snow in the South East on 26 February 2018. Following this, our incident team assembled to prepare for what the press dubbed "the Beast from the East". The storm brought significant snowfall and temperatures dropping below -11°C and remained below freezing for a number of days, followed by a rapid rise in temperature and thaw. This led to a significant water supply incident of unexpected magnitude due to a large number of pipe bursts and leaks. We saw unprecedented increases in the demand for water over the period of one day (515.0 million litres per day before the thaw to 634.7 million litres per day once the thaw began), which depleted a number of our treated water reservoirs and disrupted supply. 18 million litres per day leakage was attributed to bursts and leaks on our network, leaving approximately 100 million litres per day unaccounted. We believe demand was driven by the impact of the event on our customer's pipes, with 1,700 customers reporting frozen pipes.

We have carried out a full investigation into the incident and while there are a number of areas of good practice in the way we prepared for the severe weather, there are also lessons learned, which we've incorporated into our Emergency Management Plan. We used various channels of communication with customers and stakeholders before the cold weather set in to encourage people to protect their plumbing from the cold; this messaging and advice increased once the snow arrived. Following the incident, we have enhanced our practices to ensure that stocks of bottled water are in place where required, focussing on protecting vulnerable customers and critical infrastructure such as hospitals. We have also undertaken and completed a number of infrastructure upgrades in the areas most affected by the incident. We have worked hard to keep interruptions to supply to a minimum through our "every minute counts" campaign and we continue to focus on minimising interruptions to supply for our customers, on both our planned engineering works and in response to unplanned events such as burst mains.

[33] Meet the 2020 Winners (Water Industry Awards, 2020)

5.4.3. ADDRESSING THE RISK – PLANNED ACTIONS

Setting more challenging targets and addressing customer preferences

Within their PR19 price review, Ofwat included a direct requirement for water companies to either include a reduction in leakage by 15 per cent from current levels by 2025 or for performance to be within the upper quartile ranking of the industry, using the industry comparator of litres per property per day. Additionally, the National Infrastructure Commissions' report recommended that Defra set a target for water companies to halve leakage from current levels by 2050 and to reduce current national average water consumption from 141 litres per head per day (l/h/d) to 118 l/h/d. Relative to the rest of the industry, we are already within the upper quartile, and our leakage level is 22.6 million litres per day below our sustainable level of leakage of 112.2 million litres per day. Reducing leakage by the 50 per cent target level will require new technology and approaches and in future, it will require extensive replacement of our oldest water mains. Thus, identifying a more cost effective solution to repairing or replacing large existing mains for leakage reduction is an important industry wide and global challenge. Our customers indicated that they are most willing to pay extra on their water bills to reduce leakage further and promote greater water efficiency[27] and they expect to see us us prioritising the fixing of leaks, particularly during droughts. Therefore, we have set ourselves the challenging target of reducing leakage by 15 per cent by 2025 and by 2050 we expect leakage to be halved from the current level.

WRMP19 Innovation and Building on our Smart Water Network Trial and Calm Water Network

Reducing leakage is difficult as most of the leaks that occur are small and not visible. Advancing our technological and system advances will make it possible to find more, smaller invisible leaks by:

- trialling smart network technology and exploring the results to understand how we can utilise technology as part of our plan to reduce leakage both on the customers' and company pipework
- using analytics forums such as the hAQUAthon which we sponsored in 2017 where we seek to bring together experts in leakage, process and analytics to derive new solutions to old problems using big data
- supporting the 'resilient customer' approach through extending behavioural science to engage with customers to reduce groundwater contamination, reduce internal leakage and improve the uptake of water efficiency devices (see section 7.3) working with Centrica on their Hive home leak detector that provides real time data and a WiFi connected application to reduce per capita consumption of 3-5 litres per person per day, possible through the targeting of plumbing losses
- instigating calm network (intelligent pressure management) operation training and optimising our pressure management equipment, monitoring, and pumping technologies, including equipment trials for burst reduction and installation of surge anticipation valves across some ten sites to reduce bursts[34]

[34] https://cdn.southeastwater.co.uk/Publications/Water+resources+management+plan+2019/appendix-5d-wrmp19-leakage-190813-v30.pdf

Our Smart Water Network trial and the calm water network support our ambitious leakage targets by identifying leaks and stabilising water pressures. These form a large component of our shorter term available leakage strategy options, accounting for 50 per cent of leakage savings 2020 to 2025 until longer term infrastructure solutions provide larger savings by 2080[27].

Risk of meeting leakage targets

Over 50 per cent of the new water we need from 2020 to 2025 comes through reducing leakage and reducing water consumption, which will also help us meet 73 per cent of new water demand by 2080[7]. Despite our actions taken and planned actions to achieve these leakage targets, a high risk remains, which reflects the ambition of our performance commitment with the impact climate change and severe weather events have on leakage. We have devised a comprehensive five-year leakage strategy with detailed annual activity plans which are regularly reviewed by Wholesale Steering Group to ensure we reach our leakage targets, and new technology is reviewed to ensure it is delivering the anticipated results.

6. CLIMATE CHANGE RESILIENCE AND ENVIRONMENTAL HAZARDS

We are working with communities, regulators and key stakeholders to ensure that the built and natural environment can adapt to long term climate change including floods, storms, and droughts by utilising innovative methods and where possible natural processes. Alongside this we are driving better utilisation of energy and carbon accounting with targets on using and implementing renewable energy.

Under our key principle of climate change resilience and reducing environmental hazards, we address three risks: flooding and cascading impacts on infrastructure; loss of site access due to sea level rise, coastal erosion and/or flooding; and increased sinkhole occurrence. These risks have been associated with risks identified in CCRA2[25] in table 6-1.

Table 6-1: Our risks associated with climate change resilience and environmental hazards, and related CCRA2 risks

South East Water risk	Keys associated risk CCRA2 risk	Other related CCRA2 risks
Flooding and associated infrastructure failure	**In2:** Risks to infrastructure from river, surface, groundwater flooding	• **In5:** Risks to bridges and pipelines from high river flows/erosion • **PB5:** Risks to people, communities & buildings from flooding • **In1:** Risks of cascading infrastructure failures across interdependent networks
Loss of site access through sea level rise, coastal erosion and/or flooding	**In3:** Risks to infrastructure from coastal flooding & erosion	• **Bu4:** Risks to business from reduced access to capital • **Bu2:** Risks to business from loss of coastal locations & infrastructure • **PB6:** Risks to viability of coastal communities from sea level rise • **Ne12:** Risks to habitats & heritage in the coastal zone from sea level rise; loss of natural flood protection • **In12:** Risks to offshore infrastructure from storms and high waves • **In1:** Risks of cascading infrastructure failures across interdependent networks • **PB5:** Risks to people, communities & buildings from flooding
Increased sinkhole occurrence	**In8:** Subsidence risks to buried/surface infrastructure	• **In5:** Risks to bridges and pipelines from high river flows/erosion • **PB8:** Risks to culturally valued structures and historic environment

6.1. RISK LEVEL, PERFORMANCE METRICS AND COMMITMENTS

Our assessment of the level of risk and our associated performance metrics and commitments is shown in the table below.

Table 6-2: Risks identified under our 'climate change resilience and environmental hazards' key principle, their climate drivers, risk categories and types, the current and target risk scores and control rating scores using the matrix and methodology outlined in section 2.3, and performance metrics, measures and commitments made through WINEP, ODI, KPI or performance commitment (PC) set internally. *Target risk is defined as the risk once all adaptation measures have been implemented

Risk	Climate driver	Category/ type	Current risk	Target risk*	Control type	Control rating	Performance metrics and measures			
							Description	Current performance	2025 commitment	2040 ambition
Flooding and associated infrastructure failure	• More rain • Sea level rise • Intense rainfall • Storm surge	Physical acute	High 17	Low 6	Minimising and preventative	Effective 4	Protect company sites from risk of high/medium flooding (PC)	92 sites for 1-in-200 flood	92 sites for 1-in-1000 flood	
							Unplanned outage (%) of peak week production capacity (PC)	3.09	2.34	
Loss of site access through sea level rise, coastal erosion and/or flooding	• Sea level rise • Storm surge	Physical chronic	High 17[35]	Medium 8	Minimising and preventative	Adequate 3	Sea wall maintenance and beach replenishment	Not operated by South East Water		
							Holywell sediment budget annual change (m^3)	-3,943	Not operated by South East Water	
Increased sinkhole occurrence	• Less rain • More rain • Temperature rise • Intense rainfall	Physical acute	High 17	Medium 9	Monitoring	No/little control 1	None specified (research and plan development in progress)			

[35] While the risk of sea level rise is high to affected specific sites (in both likelihood and impact), this is only projected to impact two sites, which represents a very small proportion of our network. Thus, the impact is high for the relevant sites, but low for South East Water's overall water supply.

6.2. RISK OF FLOODING, ASSOCIATED INFRASTRUCTURE FAILURE AND LOSS OF SITE ACCESS

6.2.1. UNDERSTANDING THE RISK

Climate change is increasing the risk of flooding due to increased winter precipitation and the increased occurrence of high intensity rainfall events. A significant increase in the exposure of water treatment sites is also projected.

As part of a flood resilience assessment of our sites, we have identified 137 assets within Flood Zone 2; 61 of which are at risk during a reservoir breach. Under a 1-in-100 year event, 71 per cent of these assets become inaccessible and over 1,000 pipe bridge connections are at risk during a 1-in-100 year event. Our number of category A infrastructure sites (including water treatment works) at risk of frequent flooding (to a 1-in-75 year event) is 125-150 at present and projected to increase to between 150 and 175 in a 4°C 2080 scenario[6]. In our previous ARP we categorised "significant or permanent damage to assets or infrastructure" as a major risk and estimated potential damages of £1-5 million.

Flooding and the impacts on infrastructure can also result in cascading impacts and loss of site access. Loss of access increases site vulnerability, particularly from secondary failure where delivery of supplies, maintenance or repair is hindered and prevents the continuity of operations until flood water has drained and requires reliance on back-up generators. Water quality may also be negatively impacted. As highlighted in our Business Plan[7], 44 sites are inaccessible during a 1-in-100 year event increasing to 71 sites during a 1-in-1000 year event. High risk sites include Bray Gravels and Cow Wish as their main access routes are vulnerable to rapid inundation. Cascading failures were scored at the highest level of urgency in the government's CCRA2.

We allocate a high-risk rating of 17 to reservoir flooding and loss of site access due to flooding, and a medium-risk rating of 13 to vulnerable historic infrastructure. A low risk rating of six has been allocated to pipe bridges at risk of erosion of river banks. The target risk rating for all these risks is six.

6.2.2. ADDRESSING THE RISK – ACTIONS TAKEN

Investigation into the resilience of our water supply network to flood risk

In 2018 we investigated the resilience of our water supply network to flood risk[7], facilitating the prioritisation of 20 high-risk critical sites. Mitigation options to establish a 1-in-100 year flood event standard of protection (SoP) at each critical site were costed and extrapolated to an estimate of basic costs for an individual borehole, water treatment works or pumping station, and then applied to the wider South East Water network for a 1-in-100 SoP. The overall benefit cost ratio of 3.9 is substantial (summarised in table 6-3). Only six schemes (<0.7 per cent of all schemes) had benefit cost ratios of less than one.

Interdependencies

Phase two of our flood resilience study identified many cascading risks beyond flood depth and extent. During winter storms in 2013, we quantified and validated levels of infrastructure resilience and adaptive capacity provided under a 1-in-200-year flood event. Our study highlighted areas for improvement in power supply and through our 'build back better' scheme we improved facilities at several sites adding both alternative and reserve power supplies.

The Beast from the East extreme winter conditions in 2018 also highlighted dependencies on third parties for back up supplies of water and tankers.

Following this event we increased our resilience through the purchase of reserve tankers at multiple sites.

Table 6-3: Cost benefit analysis of flood resilience and flood mitigation solutions. Costs and benefits are given as net present value of the social value (2018)

Schemes	Cost (£ million)	Benefits (£ million)	Benefits-cost (£ million)	Benefits to cost ratio
Overall total	0.743	2.868	2.125	3.9
Single source of supply – total	0.146	0.598	0.451	4.1
Duplicated source of supply – total	0.597	2.270	1.674	3.8

Temporary site loss through flooding

As covered in our 2020 to 2025 Business Plan[7], we have introduced measures to ensure sites can be accessed during large scale flooding. Our cost-benefit analysis revealed that for the majority of sites it is more beneficial to respond reactively rather than to develop proactive resistance measures due to the uncertainty in climate projections. To reflect this finding we have stationed multiple 4 x 4 vehicles in strategic areas to respond to emergency call outs efficiently and ensure that access for maintenance during storm events or chemical deliveries is maintained. Resistance measures have been implemented at some sites, such as Cow Wish, where an additional chemical storage tank has been installed to allow site operations to continue when the site was inaccessible.

These measures and cost-benefit analyses follow £3.6 million investment on flood risk mitigation projects at our boreholes and treatment works within AMP5[36].

[36] Climate Change Adaptation Report (South East Water, 2015)

6.2.3. ADDRESSING THE RISK – PLANNED ACTIONS

Flood mitigation schemes at all critical sites

Our 2020 to 2025 Business Plan commitment determines that all critical sites must be able to withstand flooding from a 1-in-1,000-year event by 2040. As identified by the National Flood Resilience Review[37], there are 92 sites that need improvement, representing a 68 per cent increase in the number of schemes required compared to the 2015 to 2020 period. Flood prevention work at these sites will be completed during the 2020 to 2025 period. Additionally, as part of AMP7 we will design site specific solutions and increase modelling details to incorporate our drainage systems enhancing our overall resilience. The £1.3 million proposed expenditure on flood prevention at production sites will also reduce risk of supply interruptions to 866,000 customers.

A small number of sites are very costly or difficult to protect from flooding and where there are no cost-effective options we build additional redundancy into our system, so that customers can be supplied even if these sites flood.

Site specific planning

We have undertaken site-specific Temporary Defences Deployment and Logistics Planning to determine the most suitable defences to use at each site; how they would be deployed; and the responsibilities of various stakeholders including the local authorities. We will also work with other sectors and companies to ensure defences can be shared during an incident.

[37] https://www.gov.uk/government/publications/national-flood-resilience-review

6.3. COASTAL EROSION DUE TO SEA LEVEL RISE

6.3.1. UNDERSTANDING THE RISK

Sea level rise poses a great threat to permanent site loss, exposing our assets to both erosion and flooding with saline water. Rates of relative sea level rise in the south east of England are amongst the highest in the UK. Impacts of sea level rise will affect both coastal sites, such as Holywell and Eastbourne, and assets situated on estuaries such as the desalination plant options addressed in section 5.2. Coastal cliff erosion and scour of the sea wall defence at Holywell will render the site inaccessible before the site itself is lost if defences are not maintained. The risks and impacts of saline intrusion can be found in section 7.4.

We allocate a high-risk rating of 17 to our Holywell and Eastbourne sources and a medium risk rating of 10 to coastal erosion at Holywell. The target rating for these risks is six.

6.3.2. ADDRESSING THE RISK – ACTIONS TAKEN AND PLANNED

To manage the risk of coastal flooding and erosion, a Beach Management Plan (BMP) was developed by Canterbury City Council on behalf of Eastbourne Borough Council, Wealden District Council, Rother District Council, Hastings Borough Council and the Environment Agency. The Eastbourne frontages are currently protected against a 1-in-200 year overtopping event following completion of £30 million "hold-the-line" defences in 1990. As part of this scheme we constructed a 75m rock revetment at the base of the cliffs to protect the water source located at Holywell. Defences at Eastbourne are supplemented by an annual recharge of shingle[38], although SSSI restrictions prevent shingle replenishment at Holywell. The proposed current management measures include monitoring of the beach and cliffs and ad-hoc maintenance with material replenishment, recycled from overfull beaches.

We will also be looking at options to revise the site access road route to reduce the risk of loss of access should cliff erosion accelerate.

[38] Regional Beach Management Plan 2015: Eastbourne to Rye. Report – ENVIMSE100035/R-01 (Environment Agency, 2017)

6.4. RISK OF INCREASED SINKHOLE OCCURRENCE

6.4.1. UNDERSTANDING THE RISK

Sinkholes and subsidence currently present a high physical risk within our region owing to the unique chalk formation underlying superficial clay deposits within the UK[40]. During a three week period during spring 2014, more than 25 sinkholes opened up across southern Britain[41]. In our area, the formation of a sinkhole on the site of Aylesford Reservoir happened in September 2020[42].

Important note, we are still investigating the cause of the sinkholes at Aylesford Reservoir and therefore any references to sinkhole formation in this report are general references and not in relation to this particular site.

Subsidence sinkholes may occur by removal of soil through water flows and infiltration[43]; they can be unpredictable in both when and where they occur and pose ground stability problems. Dropout or suffusion sinkholes are the more common type of sinkhole that we experience, where soil either collapses instantly over a void, or soil with little cohesion progressively slumps, often driven by cycles of drought and heavy rain. Sinkholes forming in populated areas can lead to house evacuations; road closures and traffic; water stoppages; sewage spillage and other economic and social costs thus posing a threat to public safety and strategic water mains supply.

As a risk in our supply area due to the formation of the ground, we are reviewing the potential impact of climate change. For example increased flooding or more rain could contribute to the formation of sinkholes. In relation to sinkholes, we also report on leakage resulting from shrink swell subsidence in section 5.4.

We allocate a high risk rating of 17 to our risk of failure of strategic water mains; increased likelihood of sinkholes due to climate change and current known sinkhole locations. Our target is a low risk of six, and medium risks of seven and nine for these issues, respectively.

6.4.2. ADDRESSING THE RISK – ACTIONS TAKEN

Sinkholes research and probability modelling

In 2018 we commissioned the University of Kent to ascertain the causes and potential for sinkhole occurrence in our area, how this will be impacted by climate change, and to assess the risk that they pose to our key assets: sites, reservoirs, pumping stations and strategic mains. The output of this work is still under review.

Table 6-4 shows the most important factors to include within modelling, however, as highlighted by the University of Kent, sinkhole prediction is difficult, and beyond indicators such as major rainfall events and the introduction of drainage water to the ground, "the potential locations of new sinkholes are practically impossible to determine where a continuous soil cover overlies limestone".

We now understand that the local greensand Hythe formation deposits comprising layers with hard bands and soft weakly cemented layers of 'loose sands' or Hassocks can be easily eroded out by heavy rainfall and water flow events. Therefore, our assets in these areas need to be closely monitored and protected.

[40] Famously visible in the White Cliffs of Dover, part of the North Down chalk hill formation (English Nature et al. 1997)

[41] A Hole Lot of Trouble (The Geological Society) (geolsoc.org.uk)

[42] South East Water PPP – Case Study - Engineering excellence and agility brings sunken site back to life https://performance.southeastwater.co.uk/case-study/engineering-excellence-and-agility-bring-sunken-site-back-to-life/

[43] Predicting Sinkhole Susceptibility in Frederick Valley, Maryland Using Geographically Weighted Regression (Doctor, K.Z. et al., 2008)

6.4.3. ADDRESSING THE RISK – PLANNED ACTIONS

Aylesford Reservoir

Aylesford Reservoir, Kent, supplies water to residents across Kent, Medway and North East Sussex. It is located on unstable geology with many gull features, and increased infiltration washes the Sandgate Formation geology through fissures in the Hythe bedrock causing instabilities and sinkhole activity.

The sinkholes, which appeared in September 2020, affected one of the two reservoir cells resulting in the temporary loss of service. A wide range of specialist surveys were undertaken including CCTV, geophysical, laser scanning ground level monitoring and dynamic probing to understand what is happening under the surface.

During the winter of 2020/21 work on the complex repairs began and included filling the voids with foam concrete and resin.

Alongside this work an alternative reservoir storage scheme which re-purposed an existing above ground raw water tank was completed order to meet the 2021 summer demand.

We are evaluating longer term options, including the relocation of additional reservoir storage for treated water and will continue to monitor and investigate the risks from sinkholes and subsidence in future investment periods.

Table 6-4: Conditional factors important for sinkhole modelling

- Curvature
- Aspect
- Maximum bedrock permeability to water
- Distance to urban areas of 1990
- Slope
- Distance to nearest sinkhole
- Distance to B Roads
- Aquifer production
- Distance to chalk bedrock
- Fault density
- Distance to urban areas
- Soil texture
- Soil corrosivity
- Distance to rivers
- Distance to freshwater
- Distance to settlements (urban and suburban)
- Distance to faults
- Distance to anticline and syncline fold axes
- Water mains density
- Distance to A Roads
- Distance to all Roads
- Dominant soil grain size
- Elevation
- Minimum soil geological era
- Sinkhole density
- Burst mains density
- Soil swell potential

7. MORE SUSTAINABLE RESOURCE USE AND REDUCING WASTE

Using resources more sustainably and reducing waste is a key objective in our Environmental Resilience Policy. This will involve us reducing leakage, enhancing water and energy efficiency, and maximising the value and benefits we get from the natural assets we own and manage[30].

Table 7-1: Our risks associated with more sustainable resource use and reducing waste and related CCRA2 risks

South East Water risk	Keys associated risk CCRA2 risk	Other related CCRA2 risks
Low river flows limiting abstraction	**In09:** Risks to public water supplies from drought and low river flows	• **PB14:** Risk of household water supply interruptions • **In01:** Risks of cascading infrastructure failures across interdependent networks • **Bu03:** Risks to business operations from water scarcity • **Ne6:** Risks to agriculture & wildlife from water scarcity & flooding
Risk to sustainable resource use associated with customer usage/ behaviour	**PB14:** Risk of household water supply interruptions	• **Bu03:** Risks to business operations from water scarcity • **In9:** Risks to public water supplies from drought and low river flows • **Ne6:** Risks to agriculture & wildlife from water scarcity & flooding
Rising sea level and saline intrusion impact on abstractors	**Ne11:** Saltwater intrusion risks to aquifers, farmland & habitats	• **Pb06:** Risks to viability of coastal communities from sea level rise • **Ne12:** Risks to habitats & heritage in the coastal zone from sea level rise; loss of natural flood protection

7.1. RISK LEVEL, PERFORMANCE METRICS AND COMMITMENTS

Our assessment of the level of risk and our associated performance metrics and commitments is shown in the table below.

Table 7-2: Risks identified under our 'more sustainable resource use and reducing waste' key principle, their climate drivers, risk categories and types, the current and target risk scores and control rating scores using the matrix and methodology outlined in section 2.3, and performance metrics, measures and commitments made through WINEP, ODI, KPI or performance commitment (PC) set internally. *Target risk is defined as the risk once all adaptation measures have been implemented

Risk	Climate driver	Category/ type	Current risk	Target risk*	Control type	Control rating	Performance metrics			
							Description	Current performance	2025 commitment	2040 ambition
Risk of drought and low flow limiting abstraction	• Less rain • Temperature rise	Physical acute	High 17	Low 6	Monitoring, minimising	Effective 4	Breaches of licence parameters: • Annual abstraction licences • Daily abstraction licences	 2 50	 0 0	 0 0
							AIM sites targeted through WINEP: • Kingston • Charing • Itchel	 Good Good Good	 0 0 0	 0 0 0
							Abstraction environmental performance reporting to EA (%)	100	100	100
							Percentage of abstractors engaged with to improve catchment resilience (PC)	NA	20	40
Risks to sustainable resource use associated with behaviour	• Less rain • Temperature rise • Intense rainfall	Physical chronic	Medium 13	Low 6	Monitoring, minimising	Effective 4	Reduce per capita consumption, litres/head/ day (l/h/d) (PC)	165.9	138.8	115 (90 by 2080)
							Reduce demand during hot and dry weather	Promoted via communication action plan as part of the Dry Weather Plan		
							Household metering (%) (PC)	89.30		
Rising sea level and saline intrusion risk to abstraction	• Sea level rise • Storm surge	Physical chronic	Medium 13	Medium 7	Monitoring, minimising	Adequate 3	7 WINEP Investigations targeting chloride		✓	

7.2. RISK OF DROUGHT AND LOW RIVER FLOW LIMITING ABSTRACTION

7.2.1. UNDERSTANDING THE RISK

Climate change is projected to reduce river flows at critical times during the year, due to increases in year-round evapotranspiration and lower rainfall in summer periods. Additional concern surrounding vulnerable chalk streams in our area places our existing abstraction licences under increasing scrutiny and risk. Approximately 220 chalk streams exist worldwide, most of which lie in the southern half of England including some in our supply area. Chalk streams support a rich diversity of wildlife and unique species and require protecting. As such, our licences may need to be altered to maintain the balance between environmental needs and public water supply, requiring action to maintain our supply-demand balance.

We allocate a high risk rating of 17 to low river flows limiting abstraction with a target low risk of six.

7.2.2. ADDRESSING THE RISK – ACTIONS TAKEN & PLANNED ACTIONS

Our actions to address the risks of low flows limiting abstraction and abstraction impacts on the environment encompass a range of ongoing schemes that we will continue under our next resilience plan and business plan.

Restoring Sustainable Abstraction (RSA)

All of our abstractions are within licences that are actively regulated by the EA and we work hard to ensure that the abstractions are sustainable[31]. Restoring Sustainable Abstraction (RSA) is a process administered by the EA to determine whether an abstraction is environmentally sustainable. If abstractions are found to be unsustainable and causing environmental failures, then measures must be implemented to restore sustainable abstraction and improve the ecology in the area. Actions include, but are not limited to: shutting down the source; changing the abstraction licence; habitat improvements and land use changes.

We addressed sustainability at 12 sources with investigations, options appraisals, and/or adaptive management within our 2015 to 2020 Restoring Sustainable Abstraction (RSA) programme, which also formed part of our WINEP[30]. Our investigations have shown that the impact of low flows on abstractions and the environment are further compounded by other pressures, such as water quality, sediment inputs, invasive species, and SSSI maintenance, which we address in further detail within section 8.

Sustainability reduction to deployable output

If an abstraction is found to be unsustainable, we take action to establish what level of abstraction is sustainable at that site; this often results in the reduction of deployable output to meet the identified sustainable level. However, this action poses a risk to the security of our future water supply. Therefore, we use the EA's Abstraction Data Query Tool modelling[27] and we are working with Southern Water in Kent to build a new groundwater model, as detailed in our 2020 PPP report[31], for sustainably managing water company abstraction and informing future deployable outputs.

Bespoke Abstraction Incentive Mechanism (AIM)

Where our abstractions are unsustainable and pose an environmental threat, we will implement an Abstraction Incentive Mechanism (AIM) for reducing abstraction by switching to an intermediate, alternative supply when a long-term solution has not yet been developed or implemented. The main purpose of AIM is to reduce the environmental impact of abstraction at water-dependent, environmentally sensitive sites during periods of low flows.

This mechanism requires bespoke detailed triggers informed by in-depth investigations carried out via our RSA programme. Innovative development of trigger metrics established through linking local groundwater levels, abstraction and river levels / flows offers a better understanding of how our abstraction impacts the environment.

For the 2020 to 2025 period, three AIM sites were identified as a result of our RSA programme. Using macroinvertebrate monitoring and Lotic-Invertebrate Index for Flow Evaluation (LIFE) scores as a trigger for these sites has allowed us to reduce abstraction at critical drying periods and utilise other sources to protect vulnerable habitats, and ensure macro-invertebrate monitoring sites downstream are not flow stressed. In 2019/2020 AIM was triggered at both Kingston and Windmill Hill. As a result we used 44.93 million litres per day less at Windmill Hill and Kingston sites, which gave us a normalised AIM score of -0.27 million litres per day, resulting in us performing better than target.

Engaging with other abstractors

In an innovative and proactive step, we are working alongside other abstractors and stakeholders in two of our surface water catchments to reduce the overall volume of water abstracted. To support this movement, we are utilising our partnership and behaviour change toolbox approach, outlined in our Environmental Resilience Strategy[30]. Engagement with others forges a stronger catchment-based focus on wider water sustainability and resilience.

Lessons from previous low flow events

During 2010 and 2012 low rainfall impacted the chalk aquifer at Saddlescombe Water Treatment Works (WTW), with subsequent flooding at the site due to prolonged heavy rainfall. An adaptive management approach resulted in a 45 per cent decrease in the amount of groundwater abstracted at the WTW. This is in response to successfully reducing leakage (section 5.4) and reducing customer demand (section 7.3)[32]. As part of the approach, a dam was also created to maintain water flows in Poynings Stream making it more resilient to dry weather conditions.

7.3. RISKS TO SUSTAINABLE RESOURCE USE ASSOCIATED WITH BEHAVIOUR

7.3.1. UNDERSTANDING THE RISK

Our customers have the highest water use in the UK. The average household per capita consumption (PCC) 2020/21 was 165.9 litres per head per day (l/h/d) compared to a national average of 155.0 l/h/d. This is attributed largely due to the region being warmer and drier, in addition to being a region of high affluence driving high water consumption. Moreover, during extreme heatwaves, household consumption typically increases[45].

During 2020/21 our customers each used an average of 165.86 litres of water a day, representing a 15.9 per cent increase on 2019/20 annual performance. This increase is attributed to the impact of both Covid-19 and the exceptionally hot weather experienced during the spring/summer period[45]. This exemplifies the significant risks to sustainable resource use associated with behaviour, and increased consumption associated with shifts to working from home is unlikely to return to pre-Covid-19 scenarios or customer behaviours, requiring further consideration in demand forecasting.

[44] CCRA3 supporting evidence report - Power, K., Lang, A., Wood, J., Gubbels, F., McCullough, J., Carr, A., England, K., Guida, K. (2020) Understanding how behaviour can influence climate change risks, AECOM and Sniffer

[45] https://performance.southeastwater.co.uk/odi/per-capita-consumption/

Given that the south east of England is enduring significant population and economic growth within a designated area of serious water stress, consumer behaviour plays an important role in enabling us to deliver a reliable water supply. Subsequently, adaptive responses to this risk will also reduce the risks associated with supply-demand balance (see section 5.2) in addition to metering minimising risks associated with leakage (see section 5.4).

We allocate a medium risk rating of 13 to influencing water usage with a target low risk of six.

7.3.2. ADDRESSING THE RISK – ACTIONS TAKEN

The resilient customer initiative

We have introduced the resilient customer concept within our 2020 to 2025 Business Plan[7], which was unique within the water industry. The concept forms a key part of our strategy and responds to emerging themes within our customer engagement that demonstrated the desire for more control over their own water usage. Through our metering and behaviour programmes, we can ensure that customers have the tools to make them part of the solution by providing targeted information and strengthening the link between customer satisfaction and resilience[26]. Learnings from recent supply challenges, such as the freeze thaw and heatwave in 2018, have been used the develop our resilient customer concept further.

Metering, behavioural economics and behavioural science

As an area of water stress, a compulsory customer metering programme was rolled out in 2011 with the permission of the Secretary of State for Defra. Since 2011, metering has risen from 40 per cent of our homes to 90 per cent (805,000 properties) by the conclusion of the 10 year programme in March 2020[31, 46]. We also provide water efficiency advice and offer free water saving devices to all of those customers. Between 2011/12 and 2016/17, customer demand was reduced from 172 l/h/d to 151 l/h/d, representing a 12.2 per cent decrease in demand, despite the construction of 47,000 new homes in the same period. From a survey of 5,700 customers in 2015/16, 80 per cent stated that they have used less water since having the meter installed citing that this was a conscious decision to change their behaviour due to altruism, environmental and financial reasons, demonstrating the success of the scheme.

In addition, we have been developing a "My Water Use Report" through our partnership with Advizzo, an innovative behavioural economics company. The approach itself is based on 'nudge theory'. By producing individual meter reports, customers can compare their water usage to similar households within their neighbourhoods, motivating them to reduce their water use, hence reducing their bills. The scheme was piloted with 22,000 customers resulting in a two per cent reduction in demand over a relatively short space of time; it is hoped that in the long term this will translate to further demand reductions. We are now rolling this scheme out across all metered customers.

[46] Sustainable finance report (South East Water, 2019/20)

7.3.3. ADDRESSING THE RISK – PLANNED ACTIONS

We plan to develop and implement our innovative techniques between now and 2025 to complement our smart network and behavioural science approaches. Six-monthly audit reports to 800,000 metered households will help provide greater linkage between water usage and bills to our customers, and a Smart Network Trial for 200,000 customers will help us identify patterns in customer habits and usage through high resolution metering readings every 15 minutes. By engaging with customers, we will expect to save 151.6 million litres per day by 2080 by reducing consumption to 90 l/h/d[27].

7.4. RISK OF SALINE INTRUSION TO ABSTRACTIONS

7.4.1. UNDERSTANDING THE RISK

Rising sea levels threaten groundwater sources as a result of saline intrusion. Groundwater levels in the Chalk aquifers are too low to maintain the current hydrologic gradient, resulting in sea water intrusion of coastal aquifers forming a saline wedge, or penetration upstream of saline water during low flows in tidal reaches. The Chalk aquifers are highly important to our region as groundwater sources account for 73 per cent of our supply. Mitigating against the risk of saline intrusion is therefore imperative for the resilience of our systems.

We allocate a medium risk rating of 13 to our risk of saline intrusion with a target risk of seven at the lower end of the medium risk ratings.

7.4.2. ADDRESSING THE RISK – PLANNED ACTIONS

Reducing abstractions and increasing groundwater recharge

The movement of the saline wedge is affected by two factors, abstraction and groundwater recharge. We used WRMP19 to remove a number of increases to groundwater abstractions on the grounds of sustainability and long-term deterioration (see section 7.2). Land use management (section 8.3) and our PROWATER schemes (section 5.2) will also be implemented to increase the amount of recharge to aquifers and improve the quality and quantity of water in our coastal regions, such as the scheme at Friston Forest. These actions will facilitate higher groundwater levels within our aquifers, thus improving our groundwater catchment resilience, particularly under drought conditions, by maintaining a hydraulic gradient of freshwater discharging to the sea, reducing saline intrusion.

WINEP 2020 to 2025

High chloride concentrations are found in our coastal aquifer sources, suggesting sea water is the cause. Our statutory obligations under WINEP are focused on the current pressures affecting our Drinking Water Protected Areas. Chloride is a substance driving seven of our WINEP groundwater programmes, which are presently at the stage of catchment investigation[30]. We are also exploring the opportunity to reduce the impact of nitrates and salts (saline intrusion) reversing groundwater deterioration[30].

8. ENHANCING NATURE AND PROTECTING HERITAGE

Enhancing nature and protecting heritage in the decisions we make is a core principle of our Environmental Resilience Policy[30]. As part of this strategy we have made the following commitments:

- we will work to maintain healthy well-functioning ecosystems, manage the impacts from invasive non-native species and where possible enhance habitats to meet their full potential
- we will safeguard heritage features, protecting and conserving buildings, sites and objects of archaeological, architectural or historic interest where appropriate

Under this key principle we address three risks that threaten biodiversity and health of our ecosystems: climate impacts on SSSIs; reduced water quality through catchment management and farming practices; and risks from invasive non-native species (INNS). These risks have been associated with risks identified in CCRA2[25] in table 8-1.

Table 8-1: Our risks associated with enhancing nature and protecting heritage and related CCRA2 risks

South East Water risk	Keys associated risk CCRA2 risk	Other related CCRA2 risks
Risk of SSSI falling into unfavourable conditions	**Ne01:** Risks to species and habitats from changing climate space	• **Ne09:** Risks to agriculture, forestry, landscapes & wildlife from pests/pathogens/invasive species • **Ne06:** Risks to agriculture & wildlife from water scarcity & flooding • **Ne07:** Risks to freshwater species from high water temperatures • **Ne14:** Risks & opportunities from changes in landscape character
Risk to water quality through catchment management and farming practices	**Ne03:** Changes in suitability of land for agriculture & forests	• **PB13:** Risks to health from poor water quality • **PB14:** Risk of household water supply interruptions • **Ne4:** Risks to soils from increased seasonal aridity and wetness • **Ne06:** Risks to agriculture & wildlife from water scarcity & flooding • **Ne9:** Risks to agriculture, forestry, landscapes & wildlife from pests/pathogens/invasive species • **Ne14:** Risks & opportunities from changes in landscape character
Increase in INNS from climate change & flooding	**Ne09:** Risks to agriculture, forestry, landscapes & wildlife from pests/pathogens/invasive species	• **Ne01:** Risks to species and habitats from changing climate space • **Ne02:** Opportunities from new species colonisations • **Ne06:** Risks to agriculture & wildlife from water scarcity & flooding • **Ne07:** Risks to freshwater species from high water temperatures

8.1. RISK LEVEL, PERFORMANCE METRICS AND COMMITMENTS

Our assessment of the level of risk and our associated performance metrics and commitments is shown in the table below.

Table 8-2: Risks identified under our 'Enhancing nature and protecting heritage' key principle, their climate drivers, risk categories and types, the current and target risk scores and control rating scores using the matrix and methodology outlined in section 2.3, and performance metrics, measures and commitments made through WINEP, ODI, KPI or performance commitment (PC) set internally. *Target risk is defined as the risk once all adaptation measures have been implemented

Risk	Climate driver	Category/ type	Current risk	Target risk*	Control type	Control rating	Performance metrics and measures			
							Description	Current performance	2025 commitment	2040 ambition
Risk of SSSI falling into unfavourable conditions	• Less rain • More rain • Temperature rise • Intense rainfall • Extreme cold	Transitional	Medium 10	Low 6	Monitoring, minimising	Effective 4	SSSIs in favourable condition (PC)	54.8%	75%	–
							SSSIs in favourable/ recovering condition (PC)	98.3%	95%	100%
							No significant damage – no breaches of Assent or other permissions for development works on designated sites (KPI – Regulatory)	0	0	0
Risk to water quality through catchment management and farming practices	• Less rain • More rain • Temperature rise • Intense rainfall • Extreme cold	Transitional (Natural capital solutions) Physical chronic (pesticides, sediment)	Medium 13	Medium 7-10	Monitoring, minimising and preventative	Adequate 3	WINEP Completion	9	60	–
							Number of hectares of land enhanced to increase biodiversity (ODI)	1,172	1,460	1,822
							Number of hectares of land privately owned/ managed that has benefited from improved catchment management (ODI)	9,627	14,217	20,499
							Development projects that require planning permission to have a 10% biodiversity net gain (amended Defra Biodiversity metric)	–	✓	✓
Risk of increase in INNS from climate change & flooding	• Less rain • More rain • Temperature rise	Physical chronic	Medium 10	Low 6	Monitoring, minimising and preventative	Adequate 3	Completion of components of the derived Bewl to Darwell scheme. (ODI and WINEP)	–	✓	✓
							Putting in place control strategies for Japanese Knotweed, Crassula and Himalayan Balsam within company sites and within catchment areas. (KPI)	✓	✓	✓
							Compliance in accordance with the Protected Species Organisational Licence and European Protected Species Mitigation Licences – no breaches of licence. (KPI)	0	0	0
							Development of INNS Policy to include implementation of biosecurity facility provision and INNS training. (KPI)	–	✓	✓

8.2. RISK OF SSSI FALLING INTO UNFAVOURABLE CONDITIONS

8.2.1. UNDERSTANDING THE RISK

Over 44 per cent of our supply area is situated within a landscape designation in comparison to a 24 per cent national average (table 8-3). Operating in such a protected environment in the face of climate change presents a risk to the environmental conditions that enable rare and protected habitats and species to flourish within our region. Through legislation, we have a duty to further the conservation objectives of the Sites of Special Scientific Interest (SSSI) under our control. We do this through careful monitoring and proactive environmental management of all 33 of our SSSIs. This demands robust policies, procedures, and programmes of work in place to ensure SSSIs are recovering or in favourable conditions so that biodiversity can thrive. While the existence of so many nationally significant designations presents us with challenges, this also presents opportunities to contribute to a better environment in line with Defra's 25 Year Environment Plan[47], which addressed the principle of environmental net gain. Our WRMP19 considers the impact of current and future projects, and abstractions, whereas our Dry Weather Plan considers the impact of droughts on SSSIs so that our actions do not have unacceptable environmental impacts.

We allocate a medium-risk rating of 10 for risks to SSSIs due to the moderate impacts of this risk, and a target rating of six following adaptation. This reflects a reduced risk likelihood following effective controls.

Table 8-3: Landscape designations of our supply area

Landscape designations	
196	Sites of Special Scientific Interest (SSSI)
17	Special Areas of Conservation (SAC)
2	marine special areas of conservation
9	Special Protection Areas (SPA)
4	marine special protection areas
6	Ramsar sites (wetlands of international importance)
11	National Nature Reserves (NNR)
593	scheduled monuments
111	registered parks and gardens
1	world heritage site

8.2.2. ADDRESSING THE RISK – ACTIONS TAKEN

WINEP 2015 to 2020

As part of our 2015 to 2020 WINEP, we have addressed the risk to SSSIs and associated biodiversity by delivering ground-breaking trials to increase biodiversity and enhance the south east of England's natural habitats at a number of our sites (table 8-4).

"SOUTH EAST WATER HAD THE ONLY DEDICATED COMPREHENSIVE BIODIVERSITY ENHANCEMENT PROGRAMME IN THE PR14 WATER INDUSTRY NATIONAL ENVIRONMENT PROGRAMME AND HAS ACHIEVED FANTASTIC RESULTS IN ITS FIRST FIVE YEARS."

Dr Louise Bardsley, Senior Adviser at Natural England

[47] Defra's 25 Year Environment Plan (2018)

WINEP 2020 to 2025 One year performance

To enhance the natural environment and ensure any water we take does not have a negative impact on the environment we must deliver 60 improvement schemes between 2020 and 2025. Despite no requirements to complete any projects during 2020/21, nine projects were signed off by the Environment Agency and we expect to complete a further 34 projects in 2021/22, reaching our target of 43 schemes completed by the end of the year. During 2020/21, we undertook improvements on 1,172 hectares of land for protecting wildlife and enhancing biodiversity, meeting our target. We also exceeded our target for engaging and working with landowners of 2,843 hectares of land, at 2,858 hectares.

Protected species organisational licence (PSOL)

We have been awarded a PSOL by Natural England based on our exemplary performance and reputation with respect to protected species management and licences associated with our operational and capital investment work. The PSOL enables us to undertake specific regular activities with a reduced requirement for assessment from the regulator. In some circumstances we will still need to obtain normal or regional Protected Species Mitigation Licences. In all cases we will look to work with our contractors and regulators and ensure there are no breaches of any licence conditions[48].

Reviewing the impact of abstractions

In addition to improved biodiversity through land management in our SSSIs, we have a duty to ensure our operations have no unacceptable impact on the environment. Investigations into the sustainability of our Greywell abstraction through our 2010 to 2015 WINEP indicated that this abstraction was unsustainable as it was causing deterioration to the SSSI features of Greywell Fen. Within our WRMP14, we made a commitment to cease abstraction at Greywell in 2020 subject to being able to replace the water source and upgrade our distribution network. However, this represented a challenge as improvements could impact on environmentally sensitive wetland SSSI. We have consulted Natural England and the Environment Agency and have agreed to continue to abstract at Greywell until 2023 while we conduct detailed scientific studies to agree the best pipeline route to minimise the impact on this SSSI[27]. The risks associated with abstractions, restoring sustainable abstraction (RSA) and the abstraction incentive mechanism (AIM) are presented in further detail in section 7.2.

Table 8-4: Fact file for improving natural habitats

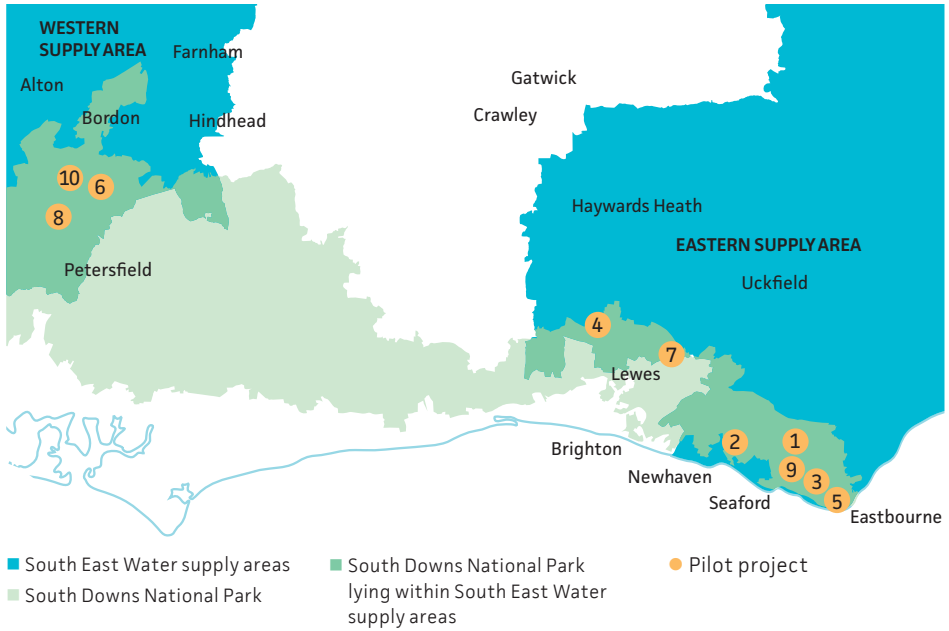
Extent of impact of 10 pilot studies for increasing biodiversity	
10	Biodiversity pilots implemented
384	Bat, botanical, butterfly, reptile and amphibian surveys undertaken
10.4	Hectares containing invasive non-native species (INNS) actively managed and controlled
970	Hectares lowland mixed deciduous woodland
246	Hectares of lowland calcareous grassland
148	Hectares of freshwater ponds, rivers and standing waters
13	Hectares of lowland heathland
735	Hectares of wet woodland

[48] South East Water draft 25 Year Environment Plan to be issued December 2021

Increasing biodiversity through improving natural habitats

We have completed 10 pilot studies through the WINEP[49], which focused on biodiversity enhancements on Priority Habitats and Species. This work has seen successful management of 1,166 hectares of our estate in AMP6 (figure 8-1, table 8-4), which we project to increase to 1,460 hectares in AMP7, representing 67 per cent of the total land we own.

Figure 8-1: Location of 10 WINEP pilot projects within the South Downs National Park



[49] Biodiversity Water Industry National Environment Programme Pilot Projects: Protecting our natural environment (South East Water)

8.2.3. ADDRESSING THE RISK – PLANNED ACTIONS

As part of our 2020 to 2025 Business Plan and core principle of protecting wildlife and increasing biodiversity, we aim to:

- move 33 of our SSSIs towards favourable condition
- provide greater wildlife protection and biodiversity enhancements on 15 of our operational sites in the South Downs National Park
- provide greater wildlife protection and biodiversity enhancements on 11 company-owned woodlands
- build more wildlife corridors and connected habitats, focusing on sites with potential to support priority species and habitats; supporting Defra's 25-year plan ambitions around creating bigger, better and more joined-up habitats
- extend our conservation work on 10 pilot projects to enhance wildlife and biodiversity on company-owned land

Innovation in Water Challenge: CatchmentLIFE

We have been awarded £197,000 as part of Ofwat's Innovation in Water Challenge fund to tackle shared challenges within the water sector in the face of climate change and population growth and drive innovative collaboration[50,51,52]. We are leading the development of CatchmentLIFE, a bespoke software which volunteers and experts can use, showing the impacts of habitat degradation on wildlife and ecological communities, together with: Bristol Water, Earthwatch Europe, Environment Agency, Loughborough University, Natural Resources Wales, SES Water, The River Restoration Centre (RRC), University of Huddersfield, and Wessex Water. The software will make scientific recording of habitats and wildlife easy for everyone, which will support scientific experts by providing much more data and information about the water habitats than can be collected alone. CatchmentLIFE has the potential to have a profound impact on the ecological status and improve water habitats nationally and identify collaborative options to resolve issues at the root-cause.

[50] Innovation in Water Challenge Winners (challenges.org)

[51] Innovation in Water Challenge decision document (Ofwat, 2021)

[52] Water collaboration set to improve habitats through citizen science (South East Water)

8.3. RISK TO WATER QUALITY THROUGH CATCHMENT MANAGEMENT AND FARMING PRACTICES

8.3.1. UNDERSTANDING THE RISK

Land use and farming practices such as extensive use of pesticides, fertilisers, soil erosion associated with tillage and grazing can have significant implications for biodiversity and water quality. Under climate change, increased rainfall intensity could result in an increased acute risk of higher turbidity and more pesticides and fertilisers running off into our rivers and reservoirs or leaching into groundwater. Moreover, changes in land use and crops grown (e.g. increased vineyards) due to warmer climate has the potential to affect raw water quality and can result in a less environmentally resilient abstraction source. Good catchment management practices have the potential to mitigate against high runoff of pesticides, fertilisers and soil erosion whilst enabling farmers to adapt their crops to changing climate, however this relies upon collaboration between stakeholders, our water efficiency options, and our ability to engage and influence customers.

We allocate a medium risk of 13 to risks due to farming practices and land use change with an adaptation target risk of seven to be achieved through enhanced catchment management.

8.3.2. ADDRESSING THE RISK – ACTIONS TAKEN

WINEP 2015 to 2020

As part of our drinking water safety plans and catchment management programmes, which also forms part of our WINEP, we monitor water quality trends and investigate deteriorating water quality. This award-winning catchment management programme has seen the completion of eight groundwater investigations of drinking water protected areas and our proactive approach enables us to understand the underlying causes of water quality deterioration and develop best practices for improving water quality.

We address deteriorating water quality trends by:

- managing and owning the catchment responsibly to ensure that water quality is maintained
- working with landowners to maintain water quality and improve it over time
- payments to landowners to seek improvements to water quality
- improvements to our water treatment processes

As a result of these actions we are seeing declining levels of nitrates within key parts of our supply area, and our WRMP19 has not made any reductions to deployable output due to deteriorating water quality trends. Nitrate investigations continue to form a crucial component of our current and future WINEPs.

Catchment Sensitive Farming and Stakeholder Engagement

Stakeholder engagement is vital for the successful implementation of our industry-leading and award-winning partnership with Catchment Sensitive Farming. Moreover, our customers indicated that catchment management was one of the most favoured resilience options within our WRMP19.[27] We have significantly developed our communications and engagement with stakeholders as we recognise they have a strong desire to increase their participation in water issues and activities. By working with the National Farmers Union and its members we can demonstrate which landholdings are having the least impact on a catchment and drive a social norming effect to help reduce the impacts of pollution on raw water quality. We intend to build on our current partnerships, and explore new alliances to ensure stakeholders are part of the resilience solution[7], which has already provided wide reaching benefits to date for us and our stakeholders, as shown in table 8-5.

Table 8-5: Case studies of implementing our approach to catchment sensitive farming

Anonymous pesticide amnesty	With the support of Catchment Sensitive Farming (CSF), in October-November 2018 we sponsored an anonymous pesticide amnesty which has enabled the safe removal of over a tonne of unused and out-of-date pesticides from farms in Kent. This facilitated safe disposal of pesticides from 23 farmers and land managers in the River Teise surface water catchment and Pembury and Hartlake groundwater catchments. By helping farmers to safely dispose of these chemicals once they are redundant, we're ensuring they won't ever find their way into watercourses which could affect drinking water quality, or cause damage to the environment.
Maize crop trials	Our monitoring identified maize as a high-risk crop in association with the pesticide metaldehyde and high levels of soil erosion due to bare soils over winter months. Working together with farmers and landowners, we trialled alternative methods of establishing maize, tillage techniques and cover crop seed mixes. This produced a mutually beneficial solution for both farmers and ourselves as reducing soils, fertiliser and pesticides washing from fields into rivers and groundwater resources prevents the expense of removing these substances at the water treatment works, and farmers and landowners benefit by losing less of these substances to waste. As part of this scheme, our Environmental team were awarded the prize for Water Resilience Initiative of the Year for its pioneering water and farming partnership called 'Together we know $h_2$ow' at the 2018 Water Industry Awards[31].
Cover crop trials at Woodgarston	Our investigations and source-receptor-pathway models found a significant link between nitrates used for crops and groundwater levels, as excess nitrate leached to the underlying aquifer. This places Woodgarston at risk of needing costly treatment processes. Cover crops are recognised as an effective way of reducing excess nutrients leaching into groundwater and can also complement crop rotations. Working collaboratively with CSF and Farming and Wildlife Advisory Group and Frontier Agriculture, we have funded and trialled two cover crop investigations in our Woodgarston catchment area. Our research showed that we can retain soil nitrogen by up to 70 per cent. We are now working with other farms in the area and have developed a catchment management programme.

8.3.3. ADDRESSING THE RISK – PLANNED ACTIONS

Catchment Sensitive Farming and Stakeholder Engagement

We will continue to use our industry-leading and award-winning partnership with Catchment Sensitive Farming to reduce the risk of catchment management impacts on water quality. We have set a target of 42 per cent engagement with landowners in priority at-risk areas (circa 14,217 hectares in our supply area). In addition to environmental benefits including water quality, biodiversity and economic benefits to farmers and stakeholders, the catchment management programme will also see an additional 3.3 million litres per day available as part of our WRMP19 for the period 2025 to 2045 without the need for the future renewal of our new nitrate removal plant at Woodgarston WTW when it reaches the end of its life around 2035. This is to be achieved through: using our partnership and behaviour change toolbox; by educating land owners about their septic tank discharges to groundwater; educating farmers about Nitrate Vulnerable Zone Regulations and best practice nutrient management incentivising use of alternative products; and by deterring fly tipping and land contamination.

WINEP 2020 to 2025

Our surface water and groundwater catchment projects are key to preventing raw water quality deterioration in the long-term; they are also more cost effective than an alternative 'end of pipe' solution in the shape of nitrate treatment plants, which would cost £174 million to build with an annual running cost of £6 million, together with Metaldehyde treatment plants which would cost £159 million. Using our WINEP 2020 to 2025 to implement the changes needed, we have 28 groundwater and eight surface water schemes to complete[53].

[53] https://environment.data.gov.uk/portalstg/sharing/rest/content/items/da6416e8b8c2410fb27155c6935d5e22/data

8.4. RISK OF INCREASED INNS

8.4.1. UNDERSTANDING THE RISK

South East England is particularly vulnerable to invasive non-native species (INNS) due to its proximity to mainland Europe with shipping activity from Europe into Kent and the Lower Thames acting as a pathway for INNS movement. Our own operations also carry the risk of inadvertently spreading INNS when transferring raw water between catchments and sharing of water supplies with our neighbouring water companies.

INNS present an additional pressure to our native biodiversity through predation, habitat modification, and eutrophication.

Impacts also extend to infrastructure damage, increased flood risk, health risks and impacts on commercial fisheries. Moreover, the presence of INNS can have adverse impacts on our treatment processes. Consequently, INNS presents serious environmental or socio-economic harm, thus forming a key part of our 2020 to 2025 WINEP.

Current INNS risks include Himalayan Balsam (Impatiens glandulifera) at Arlington Reservoir and New Zealand Pigmyweed (Crassula helmsii) at Ardingly Reservoir and previously Zebra Mussel (Dreissena polymorpha) within the Bewl-Darwell transfer scheme operated by Southern Water. In addition to managing or eradicating INNS, we have a wider responsibility to ensure no deterioration or biosecurity risk at a company scale so that we can proactively work collaboratively with other water companies in our region, and beyond, to share surpluses of water.

We have allocated a medium risk of 10 due to INNS with an adaptation target risk of six.

8.4.2. ADDRESSING THE RISK – ACTIONS TAKEN

WINEP 2015 to 2020

As part of WINEP 2015 to 2020 we investigated the biodiversity enhancement potential of our assets within the South Downs National Park, which involved controlling 10.9 hectares of land containing INNS. Our actions and performance as part of this programme are outlined in Appendices.

Collaboration with neighbouring water companies

Our collaboration with WRSE, of which we are a founding member, is a crucial mechanism to ensure that future risks from INNS are effectively managed. We work in collaboration with the region's five other water companies to identify opportunities to share resources that benefit customers and the environment through dedicated technical working groups and implementing outputs in our own water resources management plans.

Addressing the risk through transfer of raw water

As the majority of our pipelines transfer either treated water or raw water within one catchment, our pipelines present a low risk for INNS transfer, with the exception of our raw water transfer between Darwell and Hazards Green (Bewl-Darwell transfer scheme operated by Southern Water). In 2014 we identified the presence of an INNS concern species, Zebra Mussel. We completed an investigation in 2016 as part of our 2015 to 2020 WINEP, and concluded that there was a significant risk from the introduction of INNS through a raw water pipeline from the River Medway into the Pevensey Levels Special Area of Conservation (SAC), a sensitive wetland with European protection. Our investigation confirmed that the most pragmatic way to prevent current and future transfers of INNS was to cease raw water transfers across these catchments, with planned future actions under WRMP19 to effectively find the most cost effective and environmentally resilient solution that would 'replace' this raw water transfer. This process concluded that a treated water transfer from our water treatment works at Bewl was the best solution[6] which was given approval by the Environment Agency and this scheme is now included in our 2020 to 2025 WINEP (2025 completion deadline). To avoid the risk of the spread of INNS to the European protected site at Pevensey Levels, the existing bulk supply from Darwell Reservoir will cease from 2025 and we have agreed with Southern Water that, from 2026 onwards, Darwell will not be refilled via the Bewl-Darwell raw water transfer.

8.4.3. ADDRESSING THE RISK – PLANNED ACTIONS

WINEP 2020 to 2025

As outlined in our 2020 to 2025 Business Plan and our WRMP19, our 2020 to 2025 WINEP programme includes measures to identify: the risks posed by the spread of INNS and how pathways of spread can be mitigated to meet conservation objectives and to prevent deterioration in raw water quality. This includes two innovative investigations to identify potential methods of controlling INNS[30], training provisions, and modifications to the Bewl to Darwell to Hazards Green transfer by 2025. See Appendices for more details.

APPENDICES

PREVIOUS ARP RISKS

Table A1: Risks identified across each round of ARP reports and their relevant environmental resilience theme

Environmental resilience theme	Risk name	ARPs the risk has been reported in			Risk explanation
		ARP1	ARP2	ARP3	
Clean and plentiful water	Increasing demand in warmer weather	✓	✓	✓	Average annual temperatures in the south east of England are already around 1.5°C higher in the 21st century compared with the end of the 19th century[54]. Warmer weather due to climate change is likely to result in increased demand for water, in particular with respect to personal hygiene, washing, domestic garden watering and other external uses of water.
Clean and plentiful water	Reduced groundwater availability	✓	✓	✓	Reduced rainfall, particularly in consecutive seasons, reduces groundwater recharge. A corresponding increase in potential evapo-transpiration (PET) due to increasing temperatures reduces recharge potential further.
Clean and plentiful water	Reduced surface water availability	✓	✓	✓	Reduced rainfall with a corresponding increase in PET reduces reservoir refill capacity. Seasonal variability in rainfall is expected to increase between the winter and summer requiring increased storage capacity for the redistribution of water.
Clean and plentiful water	Risk of non-renewal of time limited licences or modification of existing licences	✓	✓	✓	Aquifers in the South East Water Operational area are over abstracted. Ongoing reform to abstraction licences to balance environmental needs with public water supply puts South East Water licences under scrutiny. There is uncertainty surrounding the future of current licence agreements placing further strain on South East Water supply.
Clean and plentiful water	Increased competition for shared water resources	✓	✓	×	The Water Resources South East (WRSE) Group, requires companies to work more closely in managing shared resources. All companies in WRSE are operating in an area of water stress which is being exacerbated by climate change. A more integrated strategy, as seen in recent years, will reduce this risk.
More sustainable resource use	Risks to sustainable resource use associated with behaviour	×	✓	✓	Water per capita consumption in the south east of England is already the highest in the UK due partly to warmer drier weather. Projected warming and drying trends are set to have the greatest impacts in the region and require behavioural changes to reduce demand.
Enhancing nature	SSSIs falling into unfavourable conditions	✓	✓	✓	Our abstractions, combined with periods of droughts could have a negative impact on the natural environment including land with designations.
Enhancing nature	Catchment management risk to water quality	✓	✓	✓	Fertiliser and pesticides leach into our groundwaters and runoff with soil into our reservoirs, with significant impacts on water quality. Increased rainfall intensities could increase this risk and result in environmental impacts such as turbidity, algal blooms and habitat deterioration, in addition to increased water treatment requirements for water supply.
Enhancing nature	Spread of invasive non-indigenous species	×	✓	✓	The movement of water between different basins may cause the spread of non-indigenous species, for example; zebra mussels. Such species can cause a wide range of problems, for example; the blocking of pipes.
Climate change resilience and environmental hazards	Risk of Flooding and Associated Infrastructure Failure	✓	✓	✓	Increased frequency of extreme rainfall events will heighten the risk of surface water and fluvial flooding of water company assets, particularly in areas within floodplains.
Climate change resilience and environmental hazards	Risk of Loss of Site Access due to Sea Level Rise, Coastal Erosion and Flooding	✓	✓	✓	Flooding of service trenches may inhibit the ability of South East Water to repair leaks. Flooding events may reduce the mobility of South East Water staff to access sites and detect and repair leaks in inundated areas. Sea level rise may expose South East Water assets to both erosion and flooding with saline water. Impacts will be greater at coastal sites, but those situated on estuaries will also be vulnerable.
Climate change resilience and environmental hazards		×	×	✓	Following recent events, the risks related to sink holes have a higher profile in the business, and research is underway on the links with climate.

[54] Based on Met Office HadUK data using annual average temperatures for 2001 to 2019 minus the average for 1884-1900.

ARP3 RISK WORKSHOPS

Table A2: Questions presented to different departments within South East Water to determine the risks faced across the business

- what current and future risks and opportunities have you identified that affect the objectives and operational capabilities of your organisation?
- on what climate evidence / data was the adaptation based on?
- to what extent are you (a) managing (b) going to manage the risk given current commitments and allowing for autonomous adaptation?
- can you provide detailed information on existing and planned adaptation measures?
- what additional action do you plan or need to take in the next five years to deal with these risks?
- what shortfalls in adaptation are you aware of, and what uncertainties do you recognise that may affect your ability to assess and mitigate risk?
- do you have a contingency plan in place for cascading failures? i.e. when there is a failure in other sectors
- are you considering the impact of multiple climate hazards: i.e. extreme precipitation and storms?

Future climate change: UKCP18 projections

The projections are intended to help decision-makers assess their risk of exposure to climate change. UKCP18 provides a range of products including probabilistic projects, Global Climate Models (GCMs) and Regional Climate Models (RCMs), where a range of emissions scenarios and model ensembles represent the uncertainty in climate change across a wide array of climate variables within. Here we present UK maps of RCMs for summer temperature change factors (figure A1); and precipitation change factors for summer (figure A2) and winter (figure A3) months.

Figure A4 demonstrates increased temperatures in all parts of the UK, however, all RCM ensembles indicate greater impacts in the south of England, and/or the south east of England, with 4-7°C of mean air temperature increase within the Thames and South East England river basins by 2061 to 2079 in summer months.

Summer months are also set to get drier across all parts of the UK in most RCM ensembles with greatest negative precipitation changes in the south of England (up to 70 per cent reduction by 2061 to 2078 in Thames and South East England river basins).

Conversely, winter precipitation (figure A3) is set to increase by up to 50 per cent, with high variability in the spatial distribution of impacts between RCMs.

We also present seasonal change factors and the intra-annual monthly trends across probabilistic, GCM and RCM UKCP19 products for mean temperature and precipitation for the Thames and South East England river basins (figure A4 and figure A5). Thus this figure also considers different representative concentration pathways (RCP2.6 to RCP8.5). While showing similar overall trends and overlap in projections between models, comparison of these products demonstrates the high uncertainty in projected precipitation and temperature changes that need to be considered within our modelling for our WRMP, dry weather plan, and other policies. We also present the Met Office UKCP infographic summary for the city of London (figure A6).

Figure A1: Regional climate model of summer (June, July, August) average mean air temperature anomaly (°C) 2061 to 2079 relative to 1981 to 2000 baseline under RCP 8.5 scenario

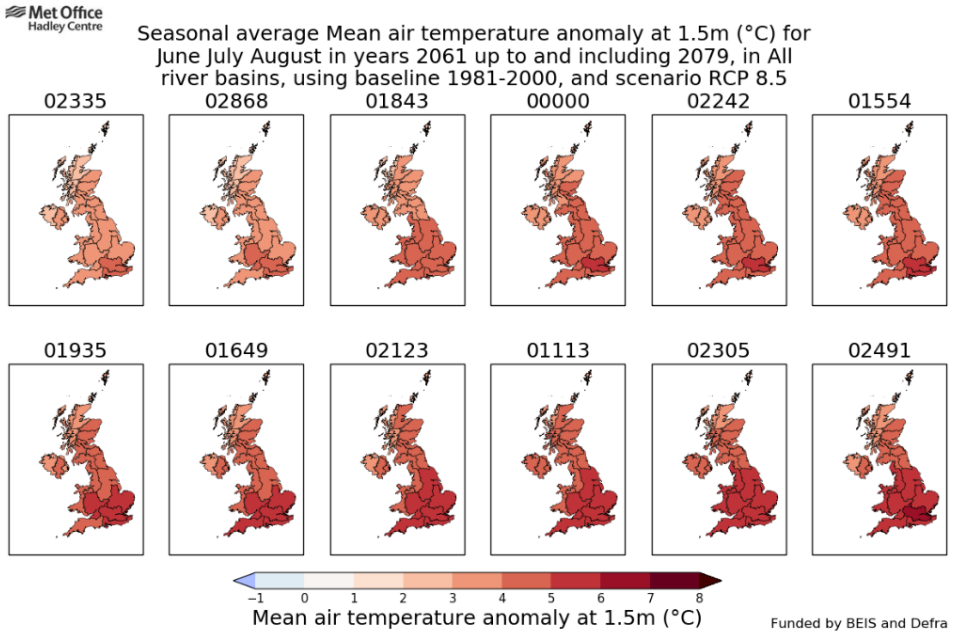


Figure A2: Regional climate model of summer (June, July, August) average mean precipitation anomaly (%) 2061 to 2079 relative to 1981 to 2000 baseline under RCP 8.5 scenario

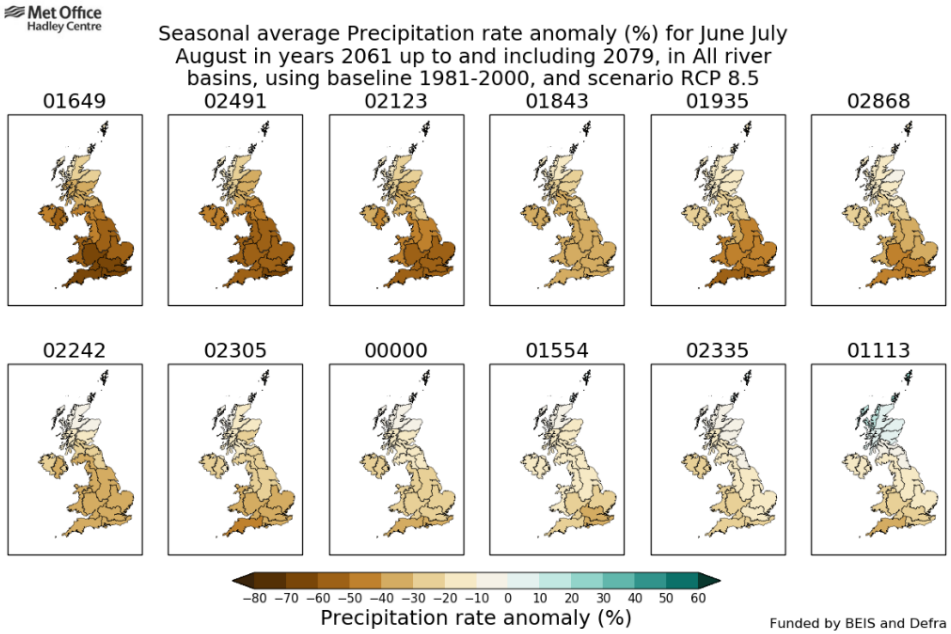


Figure A3: Regional climate model of winter (December, January, February) average mean precipitation anomaly (%) 2061 to 2079 relative to 1981 to 2000 baseline under RCP 8.5 scenario

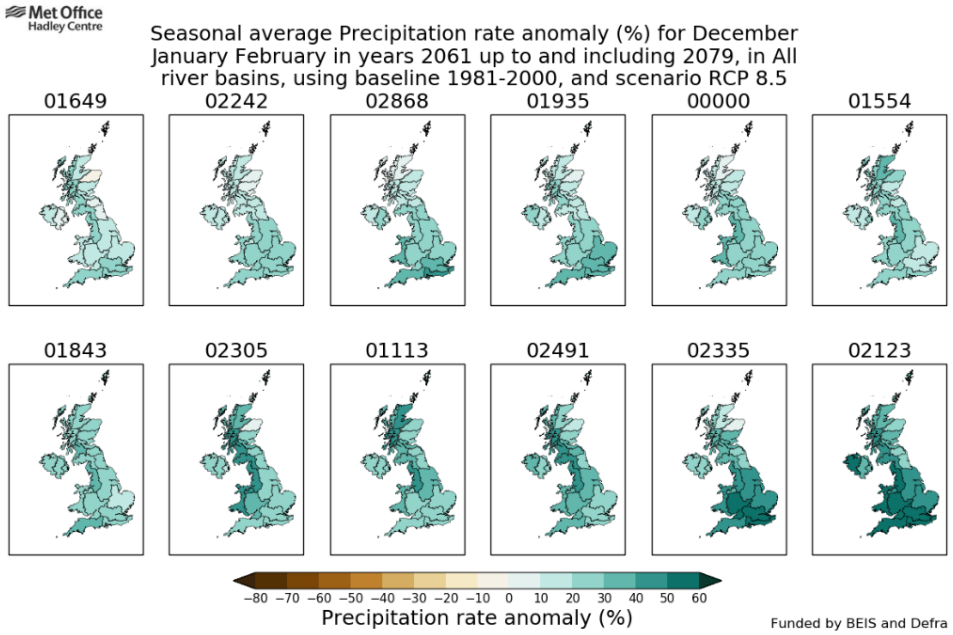


Figure A4: Seasonal temperature versus precipitation change factors 2060 to 2079 relative to 1981 to 2000 baseline under across multiple climate models and RCPs for the Thames

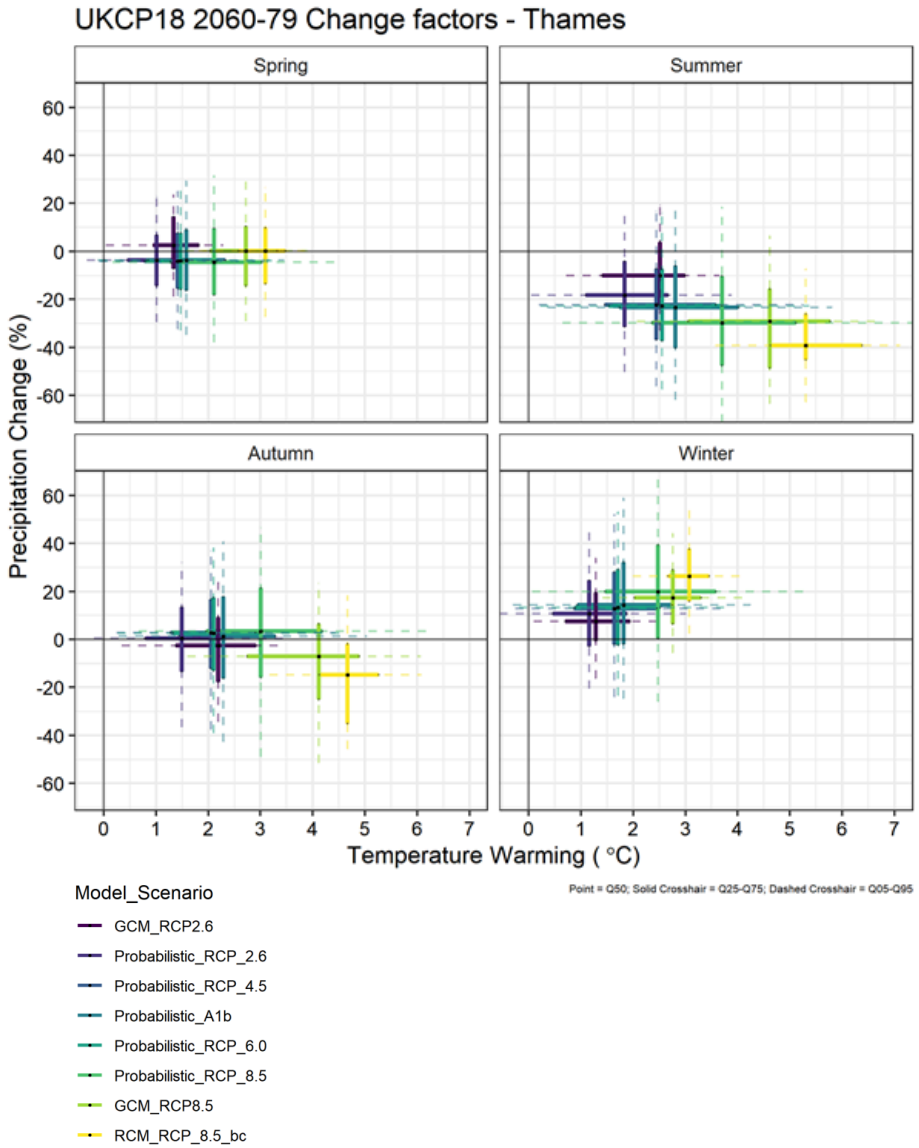


Figure A5: Seasonal temperature versus precipitation change factors 2060 to 2079 relative to 1981 to 2000 baseline under across multiple climate models and RCPs for the south east of England

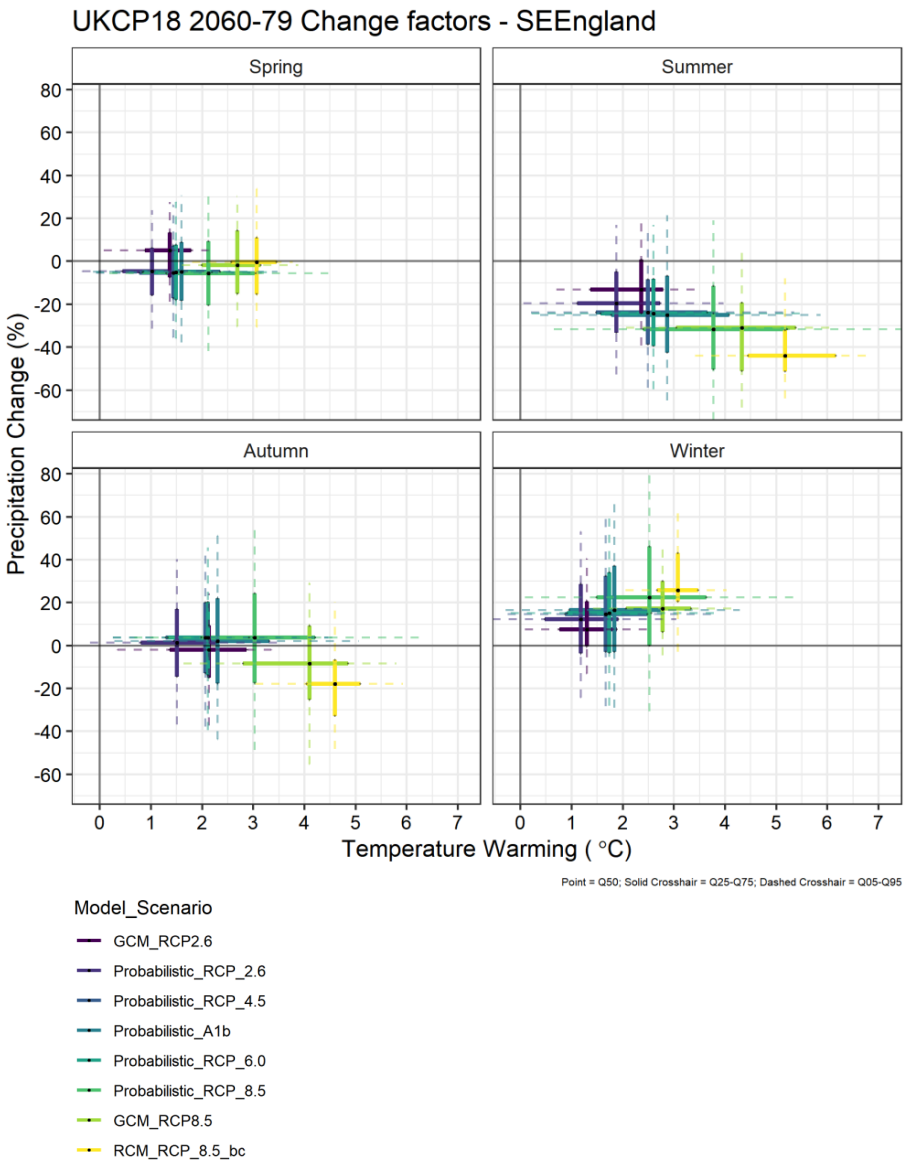
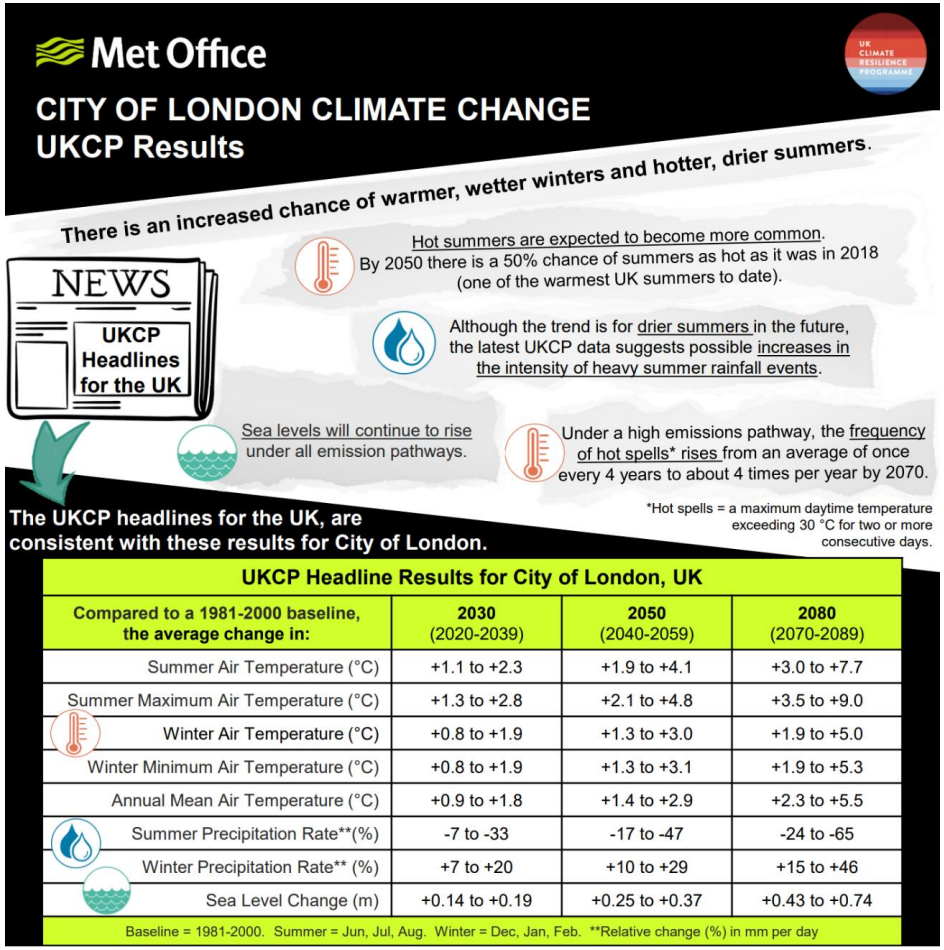


Figure A6: Headline results for UKCP18 climate projections for the city of London



UKCP Headline Results for City of London, UK

Compared to a 1981-2000 baseline, the average change in:	2030 (2020-2039)	2050 (2040-2059)	2080 (2070-2089)
Summer Air Temperature (°C)	+1.1 to +2.3	+1.9 to +4.1	+3.0 to +7.7
Summer Maximum Air Temperature (°C)	+1.3 to +2.8	+2.1 to +4.8	+3.5 to +9.0
Winter Air Temperature (°C)	+0.8 to +1.9	+1.3 to +3.0	+1.9 to +5.0
Winter Minimum Air Temperature (°C)	+0.8 to +1.9	+1.3 to +3.1	+1.9 to +5.3
Annual Mean Air Temperature (°C)	+0.9 to +1.8	+1.4 to +2.9	+2.3 to +5.5
Summer Precipitation Rate**(%)	-7 to -33	-17 to -47	-24 to -65
Winter Precipitation Rate** (%)	+7 to +20	+10 to +29	+15 to +46
Sea Level Change (m)	+0.14 to +0.19	+0.25 to +0.37	+0.43 to +0.74

Baseline = 1981-2000. Summer = Jun, Jul, Aug. Winter = Dec, Jan, Feb. **Relative change (%) in mm per day

UK CLIMATE CHANGE RISK ASSESSMENT 3 (CCRA3) EVIDENCE REPORTS

Flooding and sea level rise

Flooding presents the greatest risks to society and the most need for action in the next five years of all climate related risks identified in the UK Government's National Risk Register.

Flooding damages are likely to increase with Expected Annual Damages (EAD) from £2 billion to £4 billion by the 2080s (under a 4°C future). An estimated 1.8 million people live in areas with a 1.3 per cent or greater annual chance of river, surface water or coastal flooding. This is expected to rise to 2.6 million people by 2050 under a 2°C scenario and 3.3 million under a 4°C scenario. The number of properties with greater than 3.3 per cent annual probability of flooding is projected to increase from 240,000 people to 280,000 by 2060. These estimates assume population growth is low and current levels of adaptation are maintained. In the absence of adaptation strategies, EAD could increase £9 billion with a 4°C climate change and high population growth. EAD could reduce by 11 per cent under a 2°C scenario if 'Enhanced Whole System' (EWS) adaptation is pursued between now and mid-century. Note that EWS includes property level protection as well as local action. Beyond 2050, and under a 4°C rise, EAD will continue to rise under EWS.

Rates of relative sea level rise (SLR) in the southeast of England are amongst the highest in the UK owing to the isostatic rebound driving south east of England to sink and Scotland to rise. Table A3 shows relative sea level rise for areas within our supply area and an area in north east of England for comparison. There is a clear risk of increase in SLR in south east of England with a 4°C warming scenario potentially doubling the extent of SLR by 2100 compared to a 2°C warming scenario. Between Beachy Head and Selsey Bill a present day 200-year RP event would, with a 0.35m increase in sea level, be reduced to a 40-year RP event.

If the aspirations of Shoreline Management Plans in England are to be met, then the rate of coastal managed realignment needs to increase five-fold to compensate for the increasing costs associated with rising sea levels and increasing storm intensities. In a 4°C warming scenario by the 2080s the cost of coastal infrastructure maintenance could increase by 400 per cent as 200 km of English coastal flood defences (20 per cent of England's total coastal flood defences) become highly vulnerable to failure in storm conditions.

Table A3: Typical values of regional sea level rise (m) for two examples of coastline in south east of England and one example of north east of England for comparison

	Typical values of rSLR (m)			
	2°C		4°C	
Coastal area and region	**2050**	**2100**	**2050**	**2100**
South Foreland to Beachy Head (SE England)	0.13	0.38	0.24	0.76
Beachy Head to Selsey Bill (SE England)	0.14	0.38	0.25	0.76
Scottish Border to Tyne River (NE England)	0.09	0.27	0.20	0.65

Water availability

The UK is expected to be in a water deficit of between 800-3,000 million litres per day in the 2050s and by 1,400-5,900 million litres per day in the 2080s (based on comparing low population growth and a low emissions scenario with high population growth and high emissions). The south east of England is projected to be one of areas with the highest deficit owing to projections of lower rainfall and associated low river flows and groundwater levels. Furthermore, 33 per cent of clean and wastewater treatment sites are at risk of river and coastal flooding. Water distribution infrastructure is also reported to be highly susceptible as the clay soils of south-east England have pronounced shrink-swell susceptibility. Estimates suggest the current £300 million spent on burst pipes will rise dramatically, especially in the south-east.

Influence of behaviour on climate risks

During extreme heatwaves, household consumption typically increases, with average national increases on 20 per cent during the 2018 heatwave[55]. A review of how behaviour influences climate change risks found that planning for longer periods of peak water demand; water-efficient landscaping; implementing water saving practices; and climate-smart agriculture were the most impactful behaviours for adapting to drought risks.

Climate driven risks in the natural environment

The CCRA3 supporting evidence for climate driven risks in the natural environment[56] presents research on environmental impacts on freshwaters and farmlands based on exceedance of climatic thresholds. We present those relevant to our services as a water company within table A4. Temperature increases are set to be the second highest region in the UK after London, with exceedance of the 18°C threshold for 2.9 months and 3.9 months per year under 2 °C and 4 °C scenarios respectively in south east England compared to an average of 1.4 months and 2.5 months for the UK. This results in the greatest economic impact of algal blooms in the south east of England. Increased rainfall intensities are also set to increase the risk of soil erosion, with associated water quality impacts as fertilisers and pesticides enter our waterways, coupled with negative impacts for crop yields. While still representing a substantial risk within the south east of England, the projected number of days per year with daily rainfall events exceeding 30mm is comparatively low, at 0.4 and 0.5 days under 2 °C and 4 °C scenarios respectively compared to a UK average of 1.3 and 1.9 days per year. This represents no/negligible change for south east England compared to baseline conditions.

[55] CCRA3 supporting evidence report – Power, K., Lang, A., Wood, J., Gubbels, F., McCullough, J., Carr, A., England, K., Guida, K. (2020) Understanding how behaviour can influence climate change risks, AECOM and Sniffer

[56] CCRA3 supporting evidence report – Climate-driven-threshold-effects-in-the-natural-environment-UKCEH.pdf (ukclimaterisk.org)

Table A4: Thresholds and summary of impacts covered in national screening assessment[57], for baseline and under 2 °C and 4 °C scenarios (independent of time). Monetary figures refer to cost of annual impacts for the UK in 2018 prices unless otherwise stated

Habitat	CCRA risk	Climate hazard	Societal end point	Threshold	Impact	Current	2°C	4°C
Freshwaters	**Ne13**	Temperature	Algal blooms	17 °C (lake water)	Increased water treatment costs	£173 million (south east of England £34.2 million)	£295 million (south east of England £49.6 million)	£481 million (south east of England England £77.0 million)
Freshwaters	**Ne13**	Temperature	Fish habitat	18 °C (lake water)	Reduced dissolved oxygen, reduced biodiversity	0.9 months above threshold	1.4 months above threshold	2.5 months above threshold
Freshwaters	**Ne13**	Temperature	Biodiversity, zooplankton composition	14 °C (lake water)	Reduced biodiversity	3.2 months above threshold	3.7 months above threshold	4.9 months above threshold
Farmland	**Ne 5, Ne 7**	Rainfall	Soil erosion	30mm (daily rainfall)	Reduced soil fertility, crop yield, water quality and soil carbon	£2.6 million (south east of England £494,000)	£8.1 million (south east of England £494,000)	£6.5 million (south east of England £617,000)

Interacting climate risks in infrastructure and the built and natural environment

The CCRA3 supporting evidence for climate risks to the built environment[58] modelled the risks to buildings, the natural environment and the infrastructure sector under 2 °C and 4 °C warming scenarios for the 2050's and 2080's compared to a 2020 baseline. The report crucially highlights the functional, physical, geographic, policy and institutional, social and economic interdependencies that should be considered in risk assessments as climate change can forge new interdependencies, and magnify existing ones. They found the impacts of increase in summer temperatures and reduction in summer mean rainfall to have the most significant risk pathways for the natural environment through habitat degradation, further to saline intrusion and coastal environmental impacts.

[57] CCRA3 supporting evidence report – Climate-driven-threshold-effects-in-the-natural-environment-UKCEH.pdf (ukclimaterisk.org)

[58] Interacting-Risks_WSP.pdf (ukclimaterisk.org)

WINEP

Invasive Non-Native Species (INNS) Schemes

Table A5 highlights our actions over WINEP 2015 to 2020 that address the risk posed by INNS

Table A5: WINEP 2015 to 2020 actions and performance to address the risk of INNS[30]

2015 to 2020: Our actions so far to address the risk of INNS	2015 to 2020: Our performance so far to address the risk of introducing and transferring INNS
• Understand how INNS can be moved through our raw water transfers and storage reservoirs • Understand the risk posed by operating recreational venues • Understand future INNS threats when developing new water sources and infrastructure • Consider the ways that INNS can be spread through our operational activities	• We are an active partner of the national Check Clean Dry Campaign and are actively involved with this group, aiming to limit INNS spread, implement controls and prevent future INNS risk. • We are controlling INNS on our ten biodiversity pilot sites, including trialing various controls for Himalayan balsam (2015 to 2020 WINEP biodiversity program). • We have trained all of our grounds maintenance team to recognise and control Japanese knotweed which is successfully controlling this invasive plant on our company sites. • Our engineering and infrastructure development schemes are screened prior to commencement for the presence of INNS within or adjacent to the work site. If INNS are identified, appropriate measures are put in place to ensure risks posed by INNS are effectively controlled, eradicated or managed to prevent spread during the construction phase.

Table A6 highlights our proposed schemes over WINEP 2020 to 2025 that will continue to address INNS.

Table A6. WINEP 2020 to 2025 schemes, completion dates and scope information issued by the Environment Agency to water companies on 27/03/2020 as part of the PR19 Water Industry National Environment Programme (WINEP[30])[59].

Scheme Name	Completion Date	Scope
Bewl-Darwell Transfer Darwell Reservoir – Prevent deterioration	31/03/2025	Implement preferred option from AMP6 – New treated water transfer to remove threat of INNS to Pevensey Levels SAC. Construction of an extension to our water treatment works at Bewl and the creation of infrastructure to move treated water to the Pevensey Levels Area.
Biosecurity facility provision and training – water company scale – Prevent deterioration	31/03/2025	Review provision at all Water Company owned land and sites and provide biosecurity facilities where missing, especially sites with recreational use. Provide training in the identification and management of INNS. We will develop an INNS awareness and training course for all staff and contractors and will establish a programme to raise awareness of INNS issues with our stakeholders.
Innovation project for Himalayan Balsam (Impatiens glandulifera) at Arlington Reservoir (Investigation)	31/03/2022	The investigation will combine desk and field surveys to provide an up-to-date assessment of the current status of Himalayan balsam and identify potential innovative methods available (including, if feasible, biological control options under research and development nationally) to control Himalayan balsam. Subject to study findings, potential control methods will be trialled. This will form part of an options appraisal to establish the cost/benefit for the delivery of identified control methods in future WINEP programmes.
Innovation project for New Zealand Pigmyweed (Crassula helmsii) at Ardingly Reservoir (Investigation)	31/03/2022	The investigation will combine desk and field surveys to provide an up-to-date assessment of the current status of New Zealand Pigmyweed and identify potential innovative methods available (including, if feasible, biological control options under research and development nationally) to control New Zealand Pigmyweed. Subject to study findings, potential control methods will be trialled. This will form part of an options appraisal to establish the cost/benefit for the delivery of identified control methods in future WINEP programmes.
Investigation for biosecurity of INNS pathways – Water company scale	31/03/2022	Risk assessment and options appraisal for all company assets, including reservoirs, any raw water transfers, draw-down/scour valves and assets, incorporating options appraisal, mitigation measures assessment and delivery of operational changes/small cost interventions as pilot projects/further investigation.
Produce a company-wide invasive non-native species plan – water company scale – Prevent deterioration	31/03/2025	Leading on from risk assessment and options appraisal work (7SE200007) produce a company-wide invasive non-native species plan (to include managing pathways of risk and site/species specific actions to prevent deterioration and achieve conservation/WFD objectives where relevant). Pathway of spread includes recreation.

[59] https://environment.data.gov.uk/portalstg/sharing/rest/content/items/da6416e8b8c2410fb27155c6935d5e22/data

WRMP SUPPLY/DEMAND OPTIONS

Table A7 presents the WRMP19 preferred options for achieving resilience to a one in 200 year drought.

Table A7: Preferred options within the WRMP for achieving 1-in-200 year drought resilience[27]

	(Ml/d) Summer peak / one in 200 drought			
Option Type	**By 2025**	**By 2030**	**By 2045**	**By 2080**
Leakage reductions	12.6	17.9	36.5	42.7
Water efficiency	14.0	24.2	56.1	151.6
Groundwater	18.2	18.2	21.5	21.5
Surface water	0.0	0.0	35.7	35.7
Water treatment	0.0	8.0	8.0	8.0
Effluent re-use	0.0	0.0	0.0	0.0
Desalination	0.0	0.0	0.0	0.0
Regional transfers	0.0	-2.0	7.0	7.0
Totals	**44.8**	**66.3**	**164.8**	**266.5**

DEFRA CCRA2 RISKS AND RELEVANCE TO SOUTH EAST WATER

Table A8. The 56 individual risks and opportunities identified in the UK Climate Change Risk Assessment 2017 Evidence Report[25]

More action needed	Research priority	Sustain current action	Watching brief
Ne1: Risks to species and habitats from changing climate space	**Ne3:** Changes in suitability of land for agriculture & forests	**Ne9:** Risks to agriculture, forestry, landscapes & wildlife from pests/pathogens/invasive species	**Ne14:** Risks & opportunities from changes in landscape character
Ne2: Opportunities from new species colonisations	**Ne7:** Risks to freshwater species from high water temperatures	**Ne10:** Extreme weather/wild-re risks to farming, forestry, wildlife & heritage	**In7:** Low/high river flow risks to hydroelectric generation
Ne4: Risks to soils from increased seasonal aridity and wetness	**Ne13:** Ocean acidification & higher water temperature risks for marine species, fisheries and marine heritage	**Ne11:** Saltwater intrusion risks to aquifers, farmland & habitats	**In8:** Subsidence risks to buried/surface infrastructure
Ne5: Risks to natural carbon stores & carbon sequestration	**In5:** Risks to bridges and pipelines from high river flows/erosion	**In13:** Extreme heat risks to rail, road, ICT and energy infrastructure	**In10:** Risks to electricity generation from drought and low flows
Ne6: Risks to agriculture & wildlife from water scarcity & flooding	**In11:** Risks to energy, transport & ICT from high winds & lightning	**In14:** Benefits for infrastructure from reduced extreme cold events	**PB3:** Opportunities for increased outdoor activity in warmer weather
Ne8: Risks of land management practices exacerbating flood risk	**In12:** Risks to offshore infrastructure from storms and high waves	**PB13:** Risks to health from poor water quality	**PB12:** Risks of food-borne disease cases and outbreaks
Ne12: Risks to habitats & heritage in the coastal zone from sea level rise; loss of natural flood protection	**PB2:** Risks to passengers from high temperatures on public transport	**PB14:** Risk of household water supply interruptions	**Bu4:** Risks to business from reduced access to capital
In1: Risks of cascading infrastructure failures across interdependent networks	**PB6:** Risks to viability of coastal communities from sea level rise	**Bu3:** Risks to business operations from water scarcity	**Bu7:** Business risks /opportunities from changing demand for goods & services
In2: Risks to infrastructure from river, surface/groundwater flooding	**PB7:** Risks to building fabric from moisture, wind, and driving rain	**Bu6:** Risks to business from disruption to supply chains	**It7:** Opportunities from changes in international trade routes
In3: Risks to infrastructure from coastal flooding & erosion	**PB8:** Risks to culturally valued structures and historic environment		
In4: Risks of sewer flooding due to heavy rainfall	**PB10:** Risks to health from changes in air quality		
In6: Risks to transport networks from embankment failure	**PB11:** Risks to health from vector-borne pathogens		
In9: Risks to public water supplies from drought and low river flows	**Bu2:** Risks to business from loss of coastal locations & infrastructure		
PB1: Risks to public health and wellbeing from high temperatures	**Bu5:** Employee productivity impacts in heatwaves and from severe weather infrastructure disruption		
PB4: Potential benefits to health & wellbeing from reduced cold	**It2:** Imported food safety risks		
PB5: Risks to people, communities & buildings from flooding	**It3:** Long-term changes in global food production		
PB9: Risks to health and social care delivery from extreme weather	**It5:** Risks to the UK from international violent conflict		
Bu1: Risks to business sites from flooding	**It6:** Risks to international law and governance		
It1: Weather-related shocks to global food production and trade			
It4: Risks from climate-related international human displacement			

Key

Natural Environment and natural assets **(Ne)**
Infrastructure **(In)**
People and the built environment **(PB)**
Business and Industry **(Bu)**
International dimensions **(It)**

DEFRA CCRA2 RISKS AND RELEVANCE TO SOUTH EAST WATER

Table A9. Summary of Defra's CCRA2 risks, their relevance to South East Water and where further information can be located within this report.

CCRA 2017 Risk	CCRA 2017 urgency category	Directly relevant to South East Water?	Risk Likelihood	Risk Magnitude	Risk Understanding	Controls	Actions	Metrics/ reporting	Report reference
In1: Risks of cascading failures from interdependent infrastructure networks	More action needed	Yes – flooding and associated infrastructure failure	Unlikely	Catastrophic	High	Reactive. Alternative and reserve supplies	Back up water and chemical supplies and tankers Bottled water supplies 4 x 4 vehicles in strategic locations	Flood resilience report Resilience strategy	Section 6.2
In2: Risks to infrastructure services from river, surface water and groundwater flooding	More action needed	Yes – flooding and associated infrastructure failure	Unlikely	Catastrophic	High	Flooding plan	New infrastructure for 1-in-1000 standard of protection	Number of sites at risk of flooding Flood resilience report	Section 6.2
In3: Risks to infrastructure services from coastal flooding and erosion	More action needed	Yes – loss of site access through sea level rise and flooding	Unlikely	Catastrophic	High	Flooding plan	New infrastructure for 1-in-1000 standard of protection	Number of sites at risk of flooding Flood resilience report.	Section 6.3
In4: Risks of sewer and surface water flooding due to heavy rainfall	More action needed	Yes – flooding and associated infrastructure failure	Unlikely	Catastrophic	High	Flooding plan	New infrastructure for 1-in-1000 standard of protection	Number of sites at risk of flooding Flood resilience report.	Section 6.2
In9: Risks to public water supplies from drought and low river flows	More action needed	Yes – low flows limiting abstraction	Unlikely	Catastrophic	High	Restoring Sustainable Abstractions Demand management	Abstraction Incentive Mechanisms Land use increasing groundwater recharge Liaising with/incentivising other abstractors	WINEP AIM breaches % of abstractors engaged; ODIs Resilience strategy WRMP Dry Weather Plan	Section 7.2
	More action needed	Yes – risks to supply-demand balance	Unlikely	Catastrophic	High	Leakage reduction Demand management	New reservoir and source development Sustainable abstractions Climate change modelling	ODIs WRMP, supply-demand balance Dry Weather Plan Leakage levels	Section 5.2
In5: Risks to bridges and pipelines from high river flows and bank erosion	Research priority	Yes – flooding and associated infrastructure failure	Unlikely	Catastrophic	High	Flooding plan	New infrastructure for 1-in-1000 standard of protection	Number of sites at risk of flooding Flood resilience report	Section 6.2

RISKS continued

Table A9. Summary of Defra's CCRA2 risks, their relevance to South East Water and where further information can be located within this report.

CCRA 2017 Risk	CCRA 2017 urgency category	Directly relevant to South East Water?	Risk Likelihood	Risk Magnitude	Risk Understanding	Controls	Actions	Metrics/ reporting	Report reference
In8: Risks to subterranean and surface infrastructure from subsidence	Watching brief	Yes – increased sinkhole occurrence	Unlikely	Catastrophic	High	Adaptive engineering for if assets go offline	Research by University of Kent to develop future plans	Research by University of Kent	Section 6.4
	Watching brief	Yes – increased leakage through ground movement and winter freeze-thaw	Unlikely	Moderate	Medium	Metering Smart network	Pipe repairs New infrastructure Smart networks	Leakage levels Water mains bursts targets Mains repairs per 1000km of network	Section 5.4
In14: Potential benefits to water, transport, digital and energy infrastructure from reduced frequency of extreme cold events	Sustain current action	Yes – increased leakage through ground movement and winter freeze-thaw	Unlikely	Moderate	Medium	Metering Smart network	Pipe repairs New infrastructure Smart networks	Leakage levels Water mains bursts targets Mains repairs per 1000km of network	Section 5.4
Ne01: Risks to species and habitats from changing climate space	More action needed	Yes – SSSIs falling into unfavourable conditions	Unlikely	Moderate	Medium	Biodiversity pilots	Restoration Abstraction reviews Catchment sensitive farming	WINEP Biodiversity surveys	Section 8.2
Ne03: Changes in suitability of land for agriculture & forests	Research priority	Yes – risk to water quality through catchment management	Unlikely	Major	Medium	Water quality monitoring	Catchment sensitive farming WINEP investigations	WINEP completion ODI managed land targets Defra Biodiversity metric	Section 8.3
Ne09: Risks to agriculture, forestry, landscapes & wildlife from pests/ pathogens/ invasive species	Sustain current action	Yes – increased risk of INNS	Unlikely	Moderate	Medium	WINEP investigations Checking all transfers	New transfer scheme WINEP investigations INNS training	WINEP and ODI completion Compliance with Protected Species Organisational Licence and European Protected Species Mitigation Licences	Section 8.4

RISKS continued

Table A9. Summary of Defra's CCRA2 risks, their relevance to South East Water and where further information can be located within this report.

CCRA 2017 Risk	CCRA 2017 urgency category	Directly relevant to South East Water?	Risk Likelihood	Risk Magnitude	Risk Understanding	Controls	Actions	Metrics/ reporting	Report reference
Ne11: Saltwater intrusion risks to aquifers, farmland & habitats	Sustain current action	Yes – sea level rise and saline intrusion impact on abstractors	Unlikely	Moderate	Medium	Groundwater monitoring and LIFE monitoring triggers	AIM WINEP Investigations PROWATER promoting groundwater replenishment	Dry Weather Plan WINEP	Section 7.4
PB14: Risk of household water supply interruption	Sustain current action	Yes – sustainable resource used associated with behaviour	Unlikely	Moderate	Medium	Metering and Smart Network	Metering and Smart Network Incentives Education Collaborating with stakeholders	WRMP Business Plan Household consumption Non-household consumption	Section 7.3
PB13: Risks to health from poor water quality	Sustain current action	Yes – impacts on water quality	Unlikely	Catastrophic	High	WINEP groundwater and surface water investigations	Catchment sensitive farming Restoring sustainable abstractions New water treatment works	WINEP ODIs DWI reporting WRMP Business Plan	Section 5.3

CONSULTATION RESPONSES

Between 13 October 2021 and 10 November 2021 we publicly consulted on our draft Climate Change Adaptation Report which set out the 12 key risks we foresee as a business, mitigation we've already undertaken and further work we plan to do in the future to reduce these risks further.

We received nine responses from a range of organisations and we thank all those who responded for taking the time to review the documents and submit feedback.

The following pages contain details of the responses received and our feedback.

We will be responding to those stakeholders who submitted views in further detail over the coming months.

CONSULTATION FEEDBACK Summary of feedback on draft report received from Stakeholders and South East Water's response

Organisation

South East Water staff member

Q: Do you wish to be updated on this consultation?

No

Q: Do you agree with our assessment of climate change risks?

No

Comment

As I understand it, the South East is going to have hotter drier summers and warmer wetter winters. Although risks of not enough rainfall and too much are in the document (sometimes cheek by jowl), I do not feel the paradox is clearly explained or the overall result examined.

Q: Have we identified the correct climate change risks or are there any missing that you feel we should consider?

No

Comment

This question is poorly phrased when you only have a yes/no option: No, you haven't correctly identified the risk but yes, there are things missing. Yes, you've correctly identified the risks and no, nothing is missing. Essentially, the climate change risk is periods of not enough water and periods of too much. Everything else is a result of one or other of these. These seem to have been taken as separate entities. The proof of the pudding will be them all working together.

Q: Are we focussing on the right risk areas?

Yes

CONSULTATION FEEDBACK Summary of feedback on draft report received from Stakeholders and South East Water's response continued

Organisation

South East Water staff member continued

Q: Do you support our prioritised approach and direction of travel?

Yes

Comment

Not sure on this one as I'm not clear on the priorities: the reports say what's been done and what's next. I do not see a differentiation in amongst these.

Q: Is your business/organisation working on your climate change adaption approaches?

N/A

Q: Would you be interested in collaborating with us on these areas?

Yes

Comment

Yes we would be interested in collaborating with you.

Q: What areas are you working on and would you be interested in collaborating with us on these areas?

N/A

Comment

I think the water companies should be working with the government and developers to ensure that all new buildings can efficiently re-cycle grey water where water safe to drink is not required. Also, we should be looking to do the same with existing properties. Is domestic/office hydro-electric power pie in the sky or a possibility? I just throw that in as a wild idea, you never know...

South East Water response

We will continue to work with Government and developers to look at future water saving initiatives and are keen to see innovation in this area.

CONSULTATION FEEDBACK Summary of feedback on draft report received from Stakeholders and South East Water's response continued

Organisation

Medway Valley Countryside Partnership

Q: Do you wish to be updated on this consultation?

Yes

Q: Do you agree with our assessment of climate change risks?

Yes

Comment

I would say a qualified yes as climate change risks and their mitigation is a nuanced and complex topic.

Q: Have we identified the correct climate change risks or are there any missing that you feel we should consider?

Yes/No

Comment

Seasonal changes in rainfall pattern may change meaning rain at the 'wrong' time of the year as happened in summer 2021. If rain is scarce in spring, as it was in Spring 2020 this can have very detrimental affects on wildlife. If it is too abundant in summer such as 2021 it can cause flooding issues and run off is lost to recharge aquifers. To mitigate, help store and improve water quality more natural flood management schemes and wetland creations are required. There is no mention of coastal squeeze and the detrimental impact hard engineered solutions can have on the natural migration of inter-tidal habitats, arguably the UKs last remaining truly natural habitat left.

Q: Are we focussing on the right risk areas?

Yes

Comment

Most, but more schemes needed. Countering INNS needs higher priority. Natural bio-engineers such as beavers should be introduced more widely.

CONSULTATION FEEDBACK Summary of feedback on draft report received from Stakeholders and South East Water's response continued

Organisation

Medway Valley Countryside Partnership continued

Q: Do you support our prioritised approach and direction of travel?

Yes

Comment

Most, but more schemes needed. Countering INNS needs higher priority. Natural bio-engineers such as beavers should be introduced more widely.

Q: Is your business/organisation working on your climate change adaption approaches?

Yes

Comment

We could do more with targeted funding as a delivery partner for South East Water.

Q: Would you be interested in collaborating with us on these areas?

Yes

Comment

Yes we would be interested in collaborating with you.

Q: What areas are you working on and would you be interested in collaborating with us on these areas?

N/A

Comment

INNS in the Medway catchment. NFM schemes. Blackwater project in Medway catchment. Countering plastic pollution in Medway catchment. We raise public and landowners awareness plus take practical action on all of the above but that is not enough. The existing legislation and the polluter pays principle is not being enforced strongly enough in our opinion. Continuity of funding to maintain moment and keep our expertise is a constant challenge.

South East Water response

As a company, we do prioritise INNS. We agree with the comments and we would welcome further dialogue – particularly via our catchment management team and our INNS Lead.

CONSULTATION FEEDBACK Summary of feedback on draft report received from Stakeholders and South East Water's response continued

Organisation

Ash-cum-Ridley Parish Council

Q: Do you wish to be updated on this consultation?

Yes

Q: Do you agree with our assessment of climate change risks?

Yes

Comment

You will almost certainly need to update your assessment after the COP26 meeting. I suspect that little will be agreed and that your assessment will have to acknowledge a deteriorating situation.

Q: Have we identified the correct climate change risks or are there any missing that you feel we should consider?

Yes

Q: Are we focussing on the right risk areas?

No

Comment

You need to work with National Government to balance development needs against water availability. We can't simply ban further development in the South East, but we could introduce a development levy in areas of low water availability. This would do two things. It would encourage developers to think twice about where they develop and it would help to fund a national water grid to even out the availability of water.

CONSULTATION FEEDBACK Summary of feedback on draft report received from Stakeholders and South East Water's response continued

Organisation

Ash-cum-Ridley Parish Council continued

Q: Do you support our prioritised approach and direction of travel?

Yes

Comment

You have already demonstrated the truism, using water meters, that the only way to modify people's behaviour is through their wallets. That 18% reduction in demand dwarfs most of your other initiatives and therefore mandates that you do more in this area, following the example of the electricity industry. Examples include smart meters, variable pricing at times of high demand, variable pricing based on end use (eg lowest price for drinking water, highest price for garden watering, etc).

Q: Is your business/organisation working on your climate change adaption approaches?

No

Comment

As a Parish Council we have no budget or powers to act. We can, however, disseminate information and report on leak.

Q: Would you be interested in collaborating with us on these areas?

No

Comment

No, we are not interested in collaborating at this time.

Q: What areas are you working on and would you be interested in collaborating with us on these areas?

N/A

Comment

The first step would be a timely analysis of the results of this survey. You can also be pro-active in involving local government if there are particular initiatives where they can be of help.

South East Water response

We are addressing the comments raised in the survey and will continue to address local government in our Environmental Scrutiny Group regular meetings.

CONSULTATION FEEDBACK Summary of feedback on draft report received from Stakeholders and South East Water's response continued

Organisation

South East Water staff member

Q: Do you wish to be updated on this consultation?

N/A

Q: Do you agree with our assessment of climate change risks?

N/A

Q: Have we identified the correct climate change risks or are there any missing that you feel we should consider?

N/A

Q: Are we focussing on the right risk areas?

N/A

Comment

The plan rightly has focus on the impact to raw water quality. However I think it is likely to also be an impact on the treated water quality within the water supply network. I'm not sure about how much research has been undertaken on such in the industry, but I feel increases in temperatures seen so far and expected will have an impact. The main areas I think it could be likely is biofilm growth and specification of dominant biofilms (if biofilm societies become too linear in types it'll likely create greater negative impacts); greater Fe oxidation (partly due to the impact from biofilm) occurs in warmer temps. Also potential impact from changes in water turnover (some good impact from higher demand meaning less water stagnation). It might require different management of booster chlorination to manage T+O experience; management of SR levels needs to be improved; as well as understanding of SR characteristics to better prepare for SRs that stream and increasing "dead-spots". I do know that University of Sheffield lead the way on impacts to water quality within the water mains, and have done a lot of research on discoloration and biofilm growth.

CONSULTATION FEEDBACK Summary of feedback on draft report received from Stakeholders and South East Water's response continued

Organisation

South East Water staff member continued

Q: Do you support our prioritised approach and direction of travel?

N/A

Q: Is your business/organisation working on your climate change adaption approaches?

N/A

Q: Would you be interested in collaborating with us on these areas?

N/A

Q: What areas are you working on and would you be interested in collaborating with us on these areas?

N/A

South East Water response

Thank you for the comments regarding in-pipe issues with treated water as the climate effects change. This is something we can look at in the future – beyond this report for Defra.

CONSULTATION FEEDBACK Summary of feedback on draft report received from Stakeholders and South East Water's response continued

Organisation

Hadlow Down Parish Council

Q: Do you wish to be updated on this consultation?

Yes

Q: Do you agree with our assessment of climate change risks?

Yes

Q: Have we identified the correct climate change risks or are there any missing that you feel we should consider?

Yes

Q: Are we focussing on the right risk areas?

No

CONSULTATION FEEDBACK Summary of feedback on draft report received from Stakeholders and South East Water's response continued

Organisation

Hadlow Down Parish Council continued

Q: Do you support our prioritised approach and direction of travel?

No

Comment

More money and resources should be allocated to reducing leaks. Our own observation indicated that leak repair is in fact low priority, with some repairs of major leaks in the parish taking months rather than days. An overall target of 15% reduction per year seems unambitious.

Q: Is your business/organisation working on your climate change adaption approaches?

Yes

Comment

These are kept under review.

Q: Would you be interested in collaborating with us on these areas?

No

Comment

No, not at this time.

Q: What areas are you working on and would you be interested in collaborating with us on these areas?

N/A

South East Water response

Thank you for your feedback.

CONSULTATION FEEDBACK Summary of feedback on draft report received from Stakeholders and South East Water's response continued

Organisation
CCW

Q: Do you wish to be updated on this consultation?

Yes

Q: Do you agree with our assessment of climate change risks?

Yes

Comment

The company has identified and assessed twelve climate related risks, that they see affecting South East Water. The assessments clearly set out the companies understanding of each risk, the actions they have already taken, and the planned future actions to address the risk. This suggests that the company is improving its understanding of risk, and how they can mitigate it further.

It is good to see that the company has used information from the CCRA2 and UKCP18 to help shape their approach to risks.

It would be good to understand how South East Water plans to engage with customers on climate change. We would like the Climate Adaptation Report to show consumers how they can play their part, for example by changing their behaviour to reduce their water use and/or to reduce instances of sewer flooding.

Q: Have we identified the correct climate change risks or are there any missing that you feel we should consider?

Yes

Comment

Covered in our response to Question 1.

Q: Are we focussing on the right risk areas?

Yes

Comment

It is positive to see that the company have conducted workshops with their own employees to ensure they are covering all risks, and scoring them appropriately. It is helpful to see how the company has used a matrix to score the level of risk. However, it is not clear how they have established the 'acceptable' level of risk, nor consulted consumers in this process.

CONSULTATION FEEDBACK Summary of feedback on draft report received from Stakeholders and South East Water's response continued

Organisation
CCW continued

Q: Do you support our prioritised approach and direction of travel?

Yes

Q: Is your business/organisation working on your climate change adaption approaches?

Yes

Comment

We have encouraged all water companies in England to produce a CCAR, so are pleased to be able to respond to South East Water's consultation at this stage. We will also be analysing all companies' reports from a consumer perspective once they are available, and plan to publish these findings. We would like to have seen the consultation placed at the front of the website to increase its visibility, and given that climate change is a hot topic at present, to show customers that the company is taking action on adaptation.

One thing we would encourage South East Water to do is create a consumer friendly document that sits alongside the main report. We want to ensure that this is engaging to consumers, easy to read and understood by a wide audience. This document can help consumers see that they can play a part in helping to mitigate these risks, for example by reducing their water use and using drains responsibly. It would be good to use this consumer-facing report as a vehicle to help consumers understand how climate change may affect the safe, reliable and affordable service they receive, and a call to action for them to help you in your adaptation journey.

Q: Would you be interested in collaborating with us on these areas?

Yes

Comment

Yes we would be interested in collaborating with you.

Q: What areas are you working on and would you be interested in collaborating with us on these areas?

Yes

Comment

As above, our priority is that consumers are reassured the company is taking adequate steps to adapt to the challenges of climate change. Also, that as part of this process, the consumer perspective is taken into consideration when drafting these reports. If you would like to discuss in more detail how we can help to make the report more consumer focussed, then please let us know.

South East Water response

The main technical report is specifically for Defra in reponse to particluar questions. We also produced a much shorter customer-facing, non-technical summary document which was also published alongside the Defra-facing document for consultation. We are aiming to include climate change adaptation updates within our annual Performance, People and Planet report which is available on the company website. We would welcome the opportunity to discuss with CCW how we could make the summary report more customer focused.

CONSULTATION FEEDBACK Summary of feedback on draft report received from Stakeholders and South East Water's response continued

Organisation

Horsmonden Parish Council

Q: Do you wish to be updated on this consultation?

Yes

Q: Do you agree with our assessment of climate change risks?

Yes

Comment

In Meeting the Supply Demand Balance there is percentage figures for other aspects but not for Burst Pipes which is given as a reduction of more than 500 yr on yr which is not comparable. 500 of what???

Q: Have we identified the correct climate change risks or are there any missing that you feel we should consider?

Yes

Comment

A possible risk is the number of private boreholes which landowners appear to be digging. What is the risk here and at what point does it impact on the amount of water available?

Q: Are we focussing on the right risk areas?

Yes

CONSULTATION FEEDBACK Summary of feedback on draft report received from Stakeholders and South East Water's response continued

Organisation

Horsmonden Parish Council continued

Q: Do you support our prioritised approach and direction of travel?

Yes

Q: Is your business/organisation working on your climate change adaption approaches?

Yes

Comment

As a parish council we have encouraged developers to invest in low energy systems, low water usage, increased green spaces and sustainable building products and methods but we are a consultee and it is the borough planners who make the final decision.

Q: Would you be interested in collaborating with us on these areas?

No

Comment

No, we are not interested in collaborating at this time.

Q: What areas are you working on and would you be interested in collaborating with us on these areas?

No

Comment

Only because we are a consultee on the majority of decisions and not the final decision maker.

No only We would be willing to publicise in our local magazine any water saving ideas and ways our community could help.

South East Water response

Communications is looking to submit a water saving article into a future magazine.

CONSULTATION FEEDBACK Summary of feedback on draft report received from Stakeholders and South East Water's response continued

Organisation
Environment Agency

Q: Do you wish to be updated on this consultation?

–

Q: Do you agree with our assessment of climate change risks?

–

Q: Have we identified the correct climate change risks or are there any missing that you feel we should consider?

–

Comment

The general consensus regarding the climate change report is that it is comprehensive and sets out key risks and issues posed by climate change for South East Water. The highlights document is also very well presented, setting out the challenges and allowing the reader to understand how the company is going to reach its climate goals. In light of COP26 would it be useful in the introduction for the document to reference the carbon reduction talks related to water usage, the commitments and emerging actions form the conference that may impact on water company activity.

Q: Are we focussing on the right risk areas?

–

Comment

One theme generally missing is around the implications of other abstractors also being impacted by climate change. Potential consequences for South East Water.

- Increased abstraction of shared sources, higher likelihood of licence restrictions coming into force/ being in place longer
- Emergency requests for water supply support to the non-PWS sector (e.g. livestock watering etc.) during drought (exacerbating high customer demands)
- Increased resource pressure on neighbouring companies meaning imports could be less available/ exports requested more often. The other thing potentially for South East Water to consider would be customer desensitisation – As customers are urged to save water more, often due to more frequent droughts, the efficacy of such messaging could decline

CONSULTATION FEEDBACK Summary of feedback on draft report received from Stakeholders and South East Water's response continued

Organisation

Environment Agency continued

Q: Do you support our prioritised approach and direction of travel?

–

Q: Is your business/organisation working on your climate change adaption approaches?

–

Q: Would you be interested in collaborating with us on these areas?

–

Q: What areas are you working on and would you be interested in collaborating with us on these areas?

–

South East Water response

We are undertaking work in the Little Stour and Cuckmere catchments specifically relating to the other abstractor issues. Understanding this wider use of water is important for future water resource planning, especially as with climate change this could lead to a less resilient environment.

CONSULTATION FEEDBACK Summary of feedback on draft report received from Stakeholders and South East Water's response continued

Organisation

Cuckfield Parish Council

Q: Do you wish to be updated on this consultation?

–

Q: Do you agree with our assessment of climate change risks?

–

Q: Have we identified the correct climate change risks or are there any missing that you feel we should consider?

–

Q: Are we focussing on the right risk areas?

–

Comment

Overall the plan looks comprehensive and certainly ambitious so really hope you are able to achieve all the targets that you have set out in your plan.

CONSULTATION FEEDBACK Summary of feedback on draft report received from Stakeholders and South East Water's response continued

Organisation

Cuckfield Parish Council continued

Q: Do you support our prioritised approach and direction of travel?

–

Q: Is your business/organisation working on your climate change adaption approaches?

–

Q: Would you be interested in collaborating with us on these areas?

–

Q: What areas are you working on and would you be interested in collaborating with us on these areas?

–

Comment

My queries just concerned whether you had set up any partnerships with the Wildlife Trusts in terms of managing your SSSI's and linking these up with other reserves or areas in similar floodplains and also whether you had any links or partnerships with the waste water companies too as I would presume working alongside these would also be of benefit particularly with respect to our rivers and their water quality.

South East Water response

We have 10 year active management plans for all company SSSIs and work in partnership to deliver biodiversity work on the ground. We have biodiversity specialists within our Environment Team, who deliver on this work and across all the work we do as a company to deliver biodiversity net gain where possible.