Portsmouth Water

Climate Change Adaption Report

2021

Contents

Foreword

Climate change effects the sufficiency of water available for supply, changing levels of demand, the quality of the water we abstract and the resilience of our assets. We recognise that understanding and adaptively planning for climate change is an important part of our long-term strategic approach to maintaining high levels of service. This document sets out our assessment of current and future climate change risks and our proposals to adapt and overcome them.

The risks identified in our first round Climate Change Adaptation report published in 2011 were not new to us. Many are controlled through business-as-usual activities, whilst the current company risk mechanisms and regulatory framework ensure a forward-looking approach to managing increasing levels of climate risk. As such, the approach taken in our 2011 plan was to build further adaptive capacity.

Our second-round report, publishing in 2015, reviewed our actions and how climate risks have been incorporated into investment decisions. It demonstrated positive progress towards increasing our resilience to climate factors. We also undertook a re-evaluation of our priority risks identified from our 2011 report. Whilst some risks were reduced as a result of our investment, given the long-term nature and uncertainty of climate change, few risks have significantly changed since 2011.

We now present our third report, which builds upon our first two submissions. We are reviewed our progress against our action plan, updated our climate change risks based on the latest Climate Change Risk Assessments (CCRA3), and included new risks that have emerged through our planning frameworks. We acknowledge that the importance in adapting to Climate Change is ever greater now and we will utilise this report as a building block in the development of future plans, such as our PR24 Business Plan, thus continuing to further integrate climate change into our decision-making processes.

This report also provides examples of the work we have recently completed to adapt to Climate Change. We are building the Havant Thicket winter storage reservoir to help secure long-term resilience for the South East and help reduce abstraction from chalk streams. Leakage has been reduced significantly in recent years and we have committed to a 50% reduction by 2050; whilst solar arrays have been installed and greener electricity purchased, as the first steps of a strategy to achieve net zero carbon emissions by 2030.

We are responsible for leading the strategic development of the Appointed Business and adapting to climate change is clearly recognised as probably the greatest global challenge in a generation. We are fully committed to doing all we can as business and within the UK water sector to mitigate the harmful and potentially devastating impacts of climate change on our communities and our natural environment.

C R TAYLOR Chief Executive Officer

Executive summary

This report to the Department for Environment, Food and Rural Affairs (Defra) has been prepared under the third round of the climate change adaptation reporting power created by the Climate Change Act 2008. It follows and builds on the first and second round reports submitted to Defra in 2010 and 2015. This report sets out:

- our assessment of current and future predicted effects of climate change on our operation and our customers.
- our proposals for adapting to climate change.

This report has been structured to highlight our risks, opportunities, and actions in four main areas to ensure we can continue to:

- provide safe and sufficient public water supply.
- be resilient to natural hazards.
- protect the environment and support biodiversity.
- manage interdependencies and cascading failures.

As a UK water company operating under the regulatory framework for England, we already manage our current climate-change related risks through operational procedures, risk management mechanisms, and regulatory commitments. We have long-term plans in place to manage our water resources and water supply systems; these have been developed taking into account the potential implications of climate change. As information on climate science and the projected effects of climate change evolve, we will ensure this is incorporated into our future plans.

In 2018, the UK water sector was challenged by cold weather, “the Beast from the East”, and the hottest June and July on record. During each of these extreme weather events we have maintained supplies to customers with no restrictions or reduced level of service. In its report, Ofwat said that we performed well during this difficult period and we believe this is because of the long-term investment we have made to improve our resilience to extreme climate weather events. The challenge now is to maintain this resilience in the face of potentially more frequent and more severe weather events under a changing climate.

As a member of Water Resources South East (WRSE), an alliance of six water companies, we are collaborating with our neighbouring water companies in developing strategic responses to maintaining the long-term security of water supplies in the South East of England. This collaboration is essential due to changing economic and environmental conditions, as well as climate change.

We are already providing bulk transfers to Southern Water, but plan to share further water with them via our new winter storage reservoir, Havant Thicket, for which we have just gained planning permission and which will be in operation by 2029. This will not only provide longer-term support to our neighbours but also provide us with additional long-term water security in the face of likely growth in the demand for water and the need to change some of our current abstractions to preserve environmental conditions. Both these pressures on water systems are likely to be exacerbated by climate change.

We are currently in the process of developing our next Water Resource Management Plan (WRMP), which goes further than earlier plans in considering the longer-term implications of climate change (up to the year 2100). In this process we are drawing on regional-scale analysis of water resources being carried out by WRSE. To explore the potential influences of climate change, the WRSE is considering 28 climate change scenarios to represent a range of possible futures. We will also be incorporating the findings from the forthcoming WRSE Regional Resilience Plan into our future planning.

This Regional Resilience Plan is being developed to provide a joined up, affordable, resilient, and sustainable approach to delivering sufficient water within the South East for many years to come. The draft will be available in early 2022.

Our Region

Portsmouth Water has been supplying water since 1857. We provide safe, high quality drinking water from springs, wells, boreholes, and surface water sources.

We have a proud record of maintaining high standards of customer service whilst having the lowest water supply charges in England and Wales.

Our supply area extends through South East Hampshire and West Sussex (Figure 1) from the River Meon in the West to the River Arun in the East, encompassing 868km^2. Most of the population live on the coastal plain in the urban areas of Fareham, Gosport, Havant, Waterlooville, Portsmouth, Chichester and Bognor Regis.

On an average day, we supply water to around 731,000 people, but in the summer this increases due to the many tourists who visit the coast, cities and the South Downs National Park.

We sit in the South East of England which is classified by the Environment Agency as 'seriously water-stressed' and is under increased pressure from climate change, population growth, and a need to protect our environment. Addressing these pressures can only be done effectively by collaboration. We are therefore planning to share water where we can and exploring how this can be achieved sustainably without impact on our supplies or to the environment.

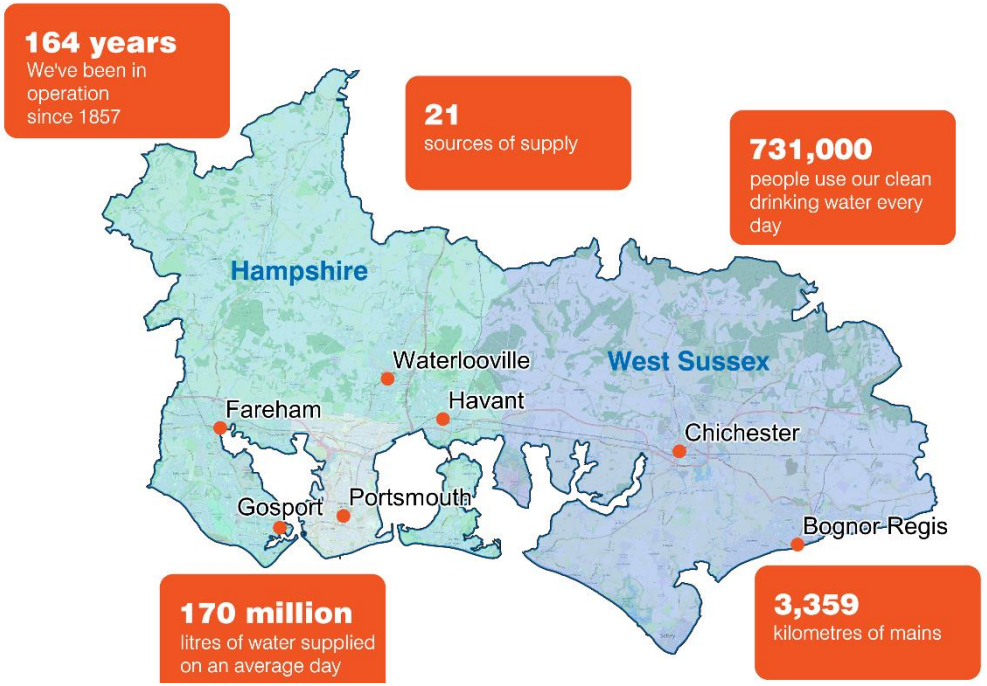


Figure 1 Key facts about our region

By 2045 we expect to supply a similar amount of water as today but to 102,000 more people. We'll be able to do this because we intend to reduce the amount of water lost to leaks, and help our customers to be more efficient with the water they use.

Our Customers and Stakeholders

We run our business as if our customers had a choice of their water provider, and continue to improve our services in a cost-effective manner, using the wider service industry and not just other water companies or utilities as a benchmark.

Our approach of putting customers at the heart of our business, together with effective stewardship of our water resources over many years have enabled us to deliver outcomes we are very proud of, including:

- **Strong performance during the extreme weather events in 2018.** Demonstrating the benefits of investing in and maintaining resilient water resources, infrastructure and distribution networks across our area of supply.

- Consistently a **top performer in customer service** based on independent reviews, and have the **lowest average customer bills** in sector by a significant margin.

We regularly engage with our **Customer Challenge Group**[1] who represent a wide range of customers and stakeholders. Their role is to ensure we accurately reflect our customers' view in our plans.

Through our customer engagement, we have established that our customers want a highly resilient service and for us to enhance the environment. We must therefore continue to review and invest to ensure we continue to maintain resilience to the possible impacts created by climate change and extreme weather. Enhancing the environment will also help us build deep resilience by helping increase biodiversity which is seen as a key pathway to limit global warming.

As an active member of WRSE we engage with a range of stakeholders in water resources, land use and environmental planning. These include the Environment Agency, Natural England, Defra, and abstractors such as the Horticultural Society and National Farmers Union. We engage on regional issues including the resilience of water resources to extreme weather events and climate change.

We also undertake stakeholder consultation on our plans. Most recently we undertook a program of extensive stakeholder consultation on our Draft Drought Plan which explains how we propose to plan for more severe future drought conditions.

Our aim is for this report to explain our commitment to adapting to climate change that satisfies the reporting requirements of Defra, in a format that will be easily understood by our customers and other stakeholders. The aim is to encourage them to engage with the work we are doing to adapt to climate change.

[1] Soon to be rebranded as our Customer Scrutiny Group.

Our Climate Change Risks

We have assessed the implications of climate change using the latest projections (UKCP18) and expect climate change, sea level rise, and an increase in the severity and frequency of severe weather events to bring future challenges. Most of the risks we anticipate having to face are not new, but with some events likely to increase in frequency and intensity, our exposure to climate risks could increase unless controlled through adaptation actions.

The assessment of each risk we face due to climate change is outlined in our full **Climate Change Risk Assessment.** This is an update of earlier climate change risk assessments, taking into account factors influencing levels of risk that have changed since the second-round climate change adaptation report. The risk assessment is included in Appendix A; and the risk assessment methodology is available here: Climate change adaptation risk methodology.

The latest independent advice report by the Committee for Climate Change identified the significant **key water sector risks** nationally. This advice will inform the UK Governments Climate Change Risk Assessment (CCRA3). In the following table we have mapped **our main risks** to these key water sector risks:

WHAT IS CCRA3?

The third and latest independent assessment of the risks and opportunities facing the UK from climate change. This informs the Governments Climate Change Risk Assessment (CCRA).

WHAT IS CLIMATE CHANGE ADAPTATION?

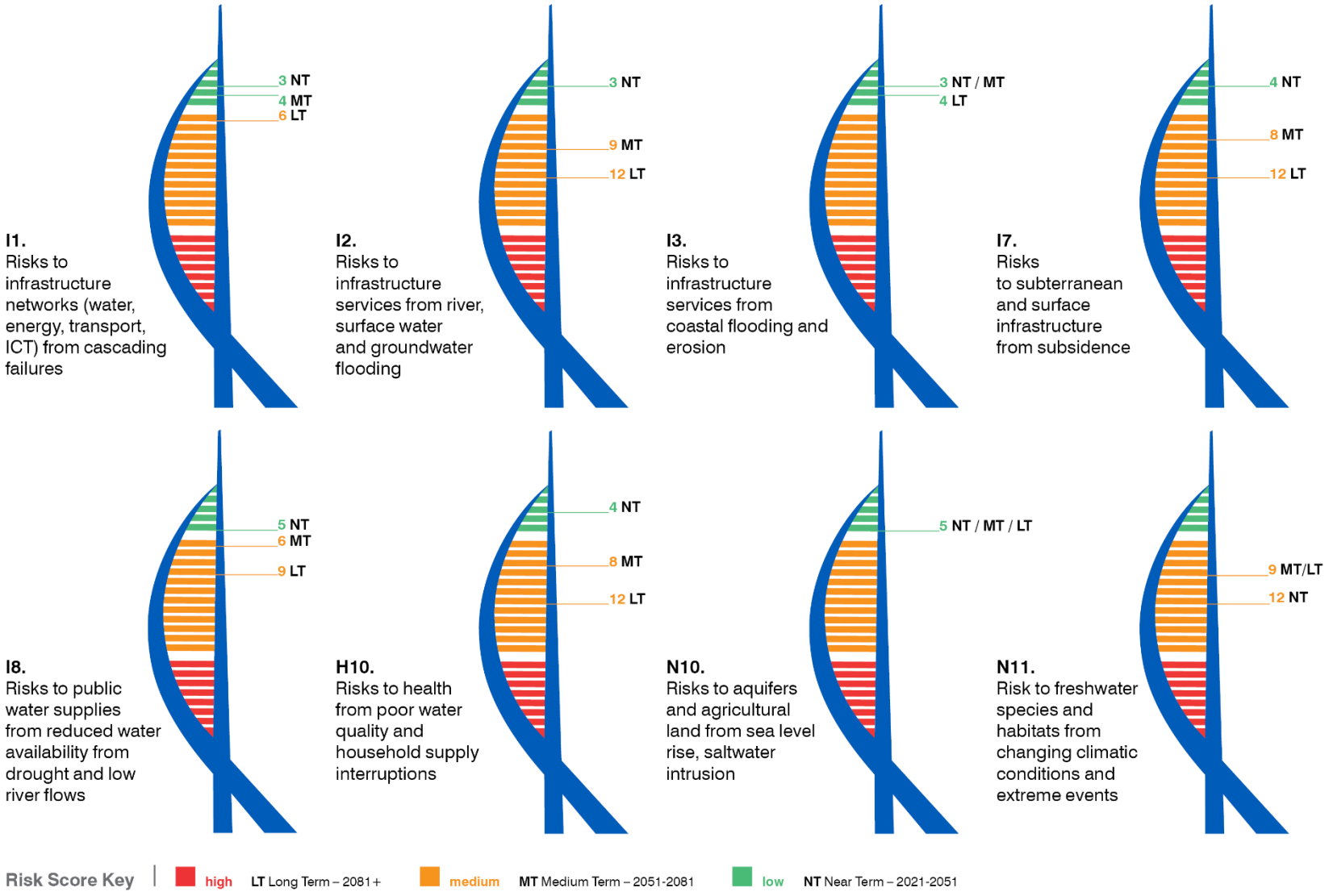
A process of adjustment to the actual or expected climate and its effects.

Key Risk Code	Key Risk Description	Our main individual risks (mapped)
I1	Risk to infrastructure networks (water, energy, transport, ICT) from cascading failures triggered by extreme weather events	• Increased interruptions to telecommunications and telemetry • Chemical supply chain disruption from regional heatwaves and floods • Road melt events impede treatment works access
I2	Risk to infrastructure services from river, surface-water and groundwater flooding	• Increased flooding of source and treatment works from rivers and groundwater • Increased flooding of pumping stations (raw and potable) and valves from rivers and groundwater • Increased regional flooding from rivers and groundwater impedes routine mains repair
I3	Risk to infrastructure services from coastal flooding and erosion, exacerbated by sea-level rise	• Water resources asset loss from coastal change • Abstraction asset loss or outage from coastal change
I7	Risk to subterranean and surface infrastructure from subsidence triggered by extreme weather events	• Accelerated asset deterioration of mains from more extreme wetting and drying cycles and earth movement
I8	Risk to public water supplies from reduced water availability from drought and low river flows	• Increased demand for water at peak from permanent population • Increased occurrence of drought • Increased summer abstraction by other (existing) catchment users
H10	Risk to health from poor water quality due to higher temperatures and household supply interruptions triggered by extreme weather events	• Lower river flows cause higher contaminant concentrations • Reduced cloud cover leads to increased biological growth in river • Increased demand from tourist population and/ or net inward migration of retirement population • Higher temperatures cause increased biological and bacterial growth in river
N10	Risk to aquifers and agricultural land from sea level rise and associated saltwater intrusion	• Rising salinity at River Itchen intake • Saline intrusion of borehole sources

		• Saline intrusion from lower groundwater / increased abstraction
N11	Risk to freshwater species and habitats from changing climatic conditions and extreme events, including higher water temperatures, flooding, water scarcity and phenological shifts.	• Flow reductions due to climate change necessitate abstraction reductions to protect the aquatic environment

Most of our main risks fit into the key climate risks, some more clearly than others. For example, increases in demand due to a greater population and impact to the efficiency of our pumps could manifest in a number of ways. We have however decided that the greatest risk of increased demand is that there would be the potential risk of supply interruptions i.e. these individual risks have been mapped to key risk H10. Individual risks linked with deterioration of pump efficiency have been mapped to I1.

The graphics below highlight the worst-case risk score for our main risks, mapped to the key water sector risks. See the Risk Score key for guidance on the risk scoring.



Our Adaptation Strategy

As a responsible water company we are already managing our climate change related risks through operational procedures, risk mechanisms and regulatory commitments. We have effective long-term plans in place which have been developed to take into account the risks and uncertainties that could arise from climate change. As information on climate change evolves we will ensure this is incorporated into our future plans. In developing these future plans we will take into account recently published guidance and international standards on adaptation presented in ISO 14090[2]and 14091[3].

Key plans include our:

Business Plan:

We prepare a Business Plan every 5 years. One of the key pillars of this is to outline how we plan to ensure the long-term resilience of our infrastructure and operations, taking account of a range of factors including the implications of climate change. We also outline our proposed Outcomes, Outcome Delivery Incentive (ODI)[4] targets and areas of investment. Ofwat scrutinise each Business Plan and would challenge us if they did not see improvement in our adaptation to climate change. Our latest Business Plan 2020-2025 is available on our website here: Business Plan 2020-2025

Water Resource Management and Drought Plan:

Our Water Resource Management Plan (WRMP) presents our long-term estimates of the demand for and supply of water, known as the supply-demand balance. It demonstrates the need for investment to maintain this, taking account of a range of factors that influence future levels of supply and demand, including the implications of climate change. Our current plan takes us up to 2045. Our Drought Plan sets out what actions we will take before, during and after a drought.

We have a statutory requirement to develop our WRMP and Drought Plan every 5 years. These are reviewed annually against the targets set in our Business Plan as part of our Annual Review. Revisions are then made to our WRMP and Drought Plan as appropriate. We engage with Ofwat, Defra and the Environment Agency to develop these plans and ensure revisions are suitable. Our latest WRMP and Draft Drought Plan are available on our website here: Water Resources Planning

[2] Adaptation to climate change — Principles, requirements and guidelines

[3] Adaptation to climate change — Guidelines on vulnerability, impacts and risk assessment

[4] Ofwat introduced the ODI framework. This allows us to propose performance commitments, which are supported by our customers. These are agreed with Ofwat and we have financial incentives and penalties to ensure these are met.

Drinking Water Safety Plans:

Ensuring the quality of our drinking water is crucial to the service we provide to our customers. We have a Drinking Water Safety Plan (DWSP) which provides a source to tap risk management approach that identifies and proactively manages risks to drinking water quality. This approach is central to the way in which we ensure a continuous supply of safe drinking water now and in the future.

Net Zero Route Map

Net Zero means achieving a balance between the carbon emitted into the atmosphere, and the carbon removed from it.[5]

We have developed a Net Zero Route Map to ensure we achieve net zero emissions by 2030. This commitment aligns with the challenge laid out in the Water UK – Net Zero 2030 Route Map. Our route map is available on our website: Net Zero Route Map

Emergency Plans

We have emergency plans to help us to manage the consequence of extreme events such as loss of power, flooding, and extreme weather. These include triggers and actions we should take to minimise risks to our operation and ability to supply our customers. These are audited annually by Defra.,

Membership of WRSE

As an active member of **WRSE** we are working to develop a long-term **Regional Resilience Plan**. This plan considers impacts based on latest climate change predictions (UKCP18) and will act as blueprint for water supply investment by us and our partner water companies across the South East to **secure the supply of water** for the public, industry whilst meeting the needs of the natural environment **up to 2100** in an affordable, resilient, and sustainable way. The outcomes from this Regional Resilience Plan will feed into our WRMP24 and Business Plan.

WHAT IS CLIMATE RESILIENCE?

Ability to cope with, and recover from, extreme weather, managing the impact on our customers and the environment. These extreme weather events could become more frequent and severe under a changing climate.

[5] As defined by the Energy Saving Trust.

Adaptation Reporting

The Climate Change Act (2008) provided the Secretary of State/ Defra with the power to ask us to provide information setting out our:

- assessment of current and future potential impacts of climate change on our organisation.
- proposals for adapting to the impacts of climate change.

We have already undertaken two previous rounds of reporting in 2011 and 2015, and this report provides information for the third round.

During the first round of adaptation reporting in 2011 we identified and prioritised our climate change risk by undertaking a Risk Assessment using the latest climate change information at that time (UKCP09). These risks then fed into the corresponding Climate Change Adaptation Action Plan to enable us to build further capacity for climate adaptation into our existing risk mechanisms. The work undertaken demonstrated that through our existing regulatory, legislative and company drivers, we had capacity to adapt to risk and uncertainty.

In alignment with Defra's guidance, we re-evaluated our Risk Assessment and Action Plan for the second-round report in 2015. This provided evidence of progress made towards becoming more resilient to climate change related risks.

In each of the previous rounds we focussed on building adaptive capacity within the following our four areas of strategic planning:

- Capital Planning
- Drinking Water Safety Planning
- Water Resources Management Planning and Drought Planning
- Resilience and Emergency Planning

This third-round report provides an update on the progress we have made since 2015 in adapting to climate change and focuses on our ability to continue to:

- provide safe and sufficient public water supply
- be resilient to natural hazards
- protect the environment and support biodiversity
- manage interdependencies and cascading failures

Public Water Supply

As a water supply company, our main focus is continuing to deliver clean, fresh drinking water.

Climate change has the potential to disrupt this, but by understanding the risk and opportunities and acting now, we can ensure this risk is minimised.

Our production, storage and distribution system is already highly resilient with 99.7% of customers fed directly from service reservoirs, which on average hold 2 days water storage; this is twice the industry standard. In addition, our strategic spine main, shown in Figure 2, provides a highly interconnected system between our 20 or so sources, allowing the transfer of water around the network and into any areas with an operational issue or shortage. This significantly reduces the likelihood of our customers experiencing an interruption to their supplies.

We will continue to review this to ensure climate change does not impact this position, and that our ability to supply water continues to stay highly resilient.

Risk and opportunity

Although the majority of the climate change risks we face could impact our ability to supply water for temporary periods, in this section we focus on the key risks and opportunities to ensure underlying sufficient supplies of good water quality can be maintained.

We have already experienced some reduction to the amount of water we can reliably supply due to climate change.

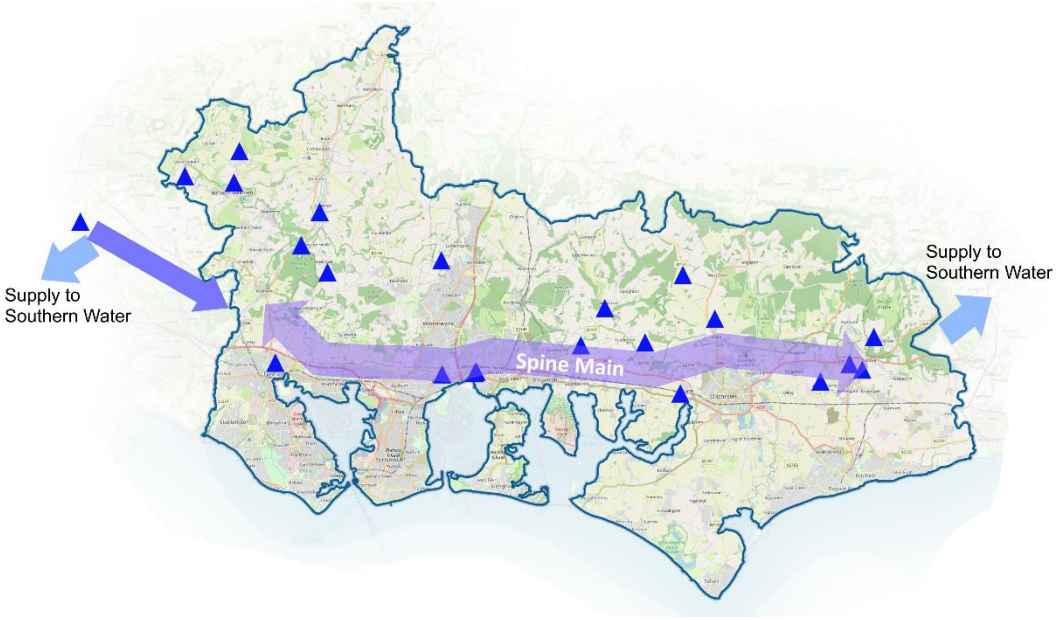


Figure 2 - Our sources and key/ main infrastructure

2020 saw both changes in where people worked due to the Covid pandemic and high summer temperatures (refer to Figure 3). The combination led to a significant increase in water use. We will continue to collect data and review to understand if a permanent change in water use has occurred due to customer behavioural changes and how this may impact our forecasts.

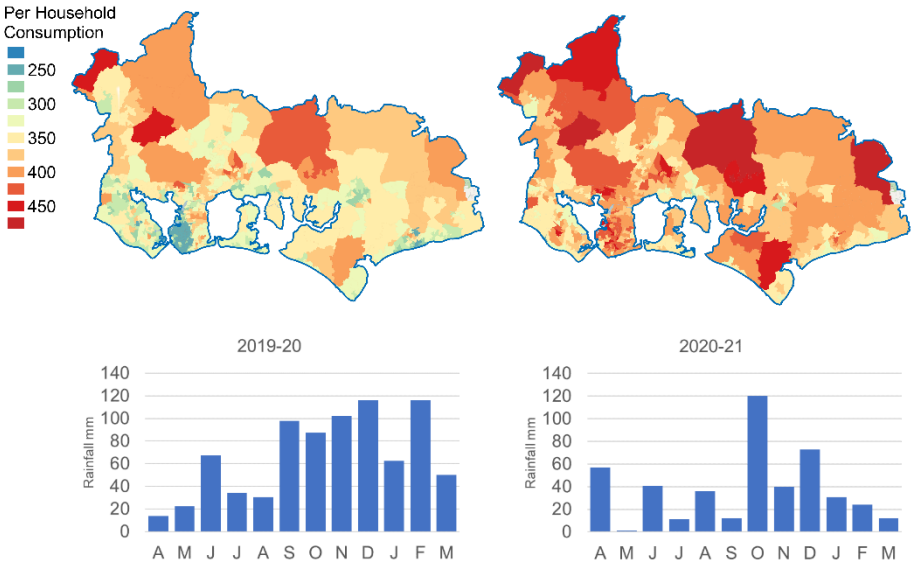


Figure 3 Comparison of Per Household Consumption and rainfall between 2019/20 and 2020/21

New Risks

We have undertaken extensive modelling of the possible impacts on future climate conditions on Deployable Output[6] and our intension is to keep the results from this under periodic review. The results, outlined in Figure 4, suggest that the projected mid-range reductions in Deployable Output are small. However, given the uncertainty in long-term climate projections there is a low probability of a significant reduction in Deployable Output by 2080. We are therefore developing our future approaches to be robust and adaptable utilising measures that are effective in a range of climate futures.

The largest uncertainty to which we are currently exposed relates to potential restrictions on abstraction from chalk aquifers and streams to ensure good ecological status can be achieved. These restrictions could potentially be exacerbated by a changing climate. At present the Environment Agency is considering further restriction on abstractions which is likely to reduce our water availability significantly. This could be compounded by a possible reduction in Deployable Output as we approach the 2080s, so in our WRMP24 we will consider potential alternative options to supplement our supply. These include waste-water reuse and desalination which we are investigating in collaboration with WRSE.

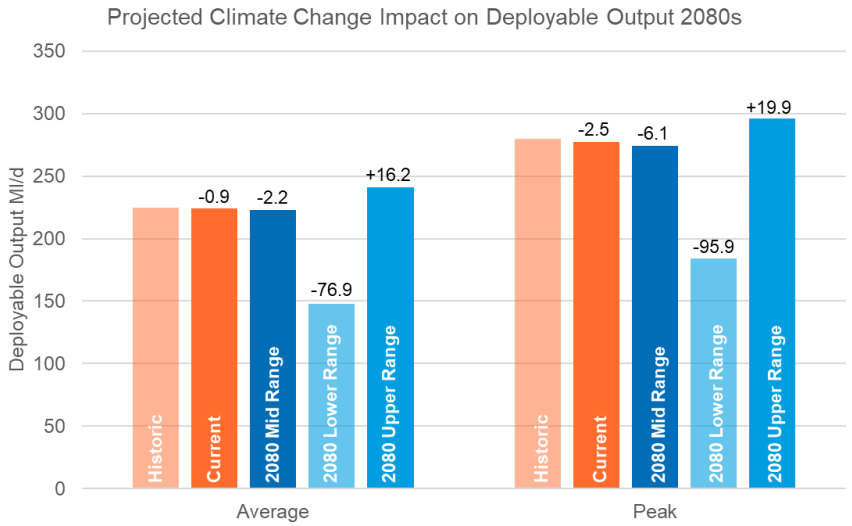


Figure 4 - Projected changes to Deployable Output by 2080s due to climate change

[6] Deployable Output is the amount of water that is available from a source during a defined scenario, e.g. a drought.

Our main risks, linked to the key water sector risks identified by the Climate Change Committee's independent advice which will feed into CCRA3, are outlined below:

Key Risk Code	Key Risk Description	Our mapped main individual risks	Risk score (2021-2051)	Risk score (2051-2081)	Risk score (2081+)
I8	Risk to public water supplies from reduced water availability from drought and low river flows	• Increased demand for water at peak from permanent population • Increased occurrence of drought • Increased summer abstraction by other (existing) catchment users	Low (5)	Medium (6)	Medium (9)
H10	Risk to health from poor water quality and household supply interruptions	• Lower river flows cause higher contaminant concentrations • Reduced cloud cover leads to increased biological growth in surface waters • Increased demand from tourist population and/ or net inward migration of retirement population • Higher temperatures cause increased biological and bacterial growth in surface waters	Low (4)	Medium (8)	Medium (12)
N10	Risk to aquifers and agricultural land from sea level rise, saltwater intrusion	• Rising salinity at River Itchen intake • Saline intrusion of borehole sources • Saline intrusion from lower groundwater / increased abstraction	Low (5)	Low (5)	Low (5)
N11	Risks to freshwater species and habitats from changing climatic conditions and extreme events	• Flow reductions due to climate change necessitate abstraction reductions to protect the aquatic environment	Medium (12)	Medium (9)	Medium (9)

Adaptation embedded in our business-as-usual operation (2015-2020)

We have embedded adaptation actions identified in our 2015 adaptation report into our recent business-as-usual operations through implementing the following plans.

Havant Thicket Reservoir

We obtained planning permission to create a **new winter storage reservoir** in Hampshire to secure reliable drinking water for the future. Further details are available in the supporting **Havant Thicket Case Study** which is provided at the end of this report**.**

Water Resource Management Plan

Our latest WRMP was published in 2019 (WRMP19) and details how we will **secure resilient water supplies to our customers for the next 25 years** (2020-2045).

Our methodology has been assessed as in line with best practice by the Environment Agency. HR Wallingford also helped us complete a climate change vulnerability assessment. This concluded that our water resource zone has a **'Low Vulnerability' to climate change** for the 2080's medium emissions scenario. Further details are available in Appendix A of our WRMP19.

Drought Plan

Our Drought Plan sets out the actions we would take during dry weather and droughts to make sure we can still supply water for our customers essential daily needs and protect the environment.

We have planned for four types of droughts, three are more extreme than ones we have experienced or planned for in the past.

Raw Water Resilience

We provided Southern Water with the **first stage of a West Hampshire bulk supply** in 2018. This was only possible because of our raw water resilience and long-term investment

We also started preparing proposals for a **further additional bulk supply to Southern Water** to support their short and long-term resilience. This proposal is integral to the regional water resource resilience solutions developed by the WRSE group. This will be facilitated by the construction of the Havant Thicket Reservoir.

Water Treatment Improvements

As part of our work we invested in Ultraviolet (UV) disinfection at two sites, and proactively worked with five local farmers to improve the quality of raw water in catchments where nitrate levels were identified to be high. We plan to continue scaling this approach up going forward and further details are available in this report.

These measures help improve our resilience to risks that could be worsened by climate change.

Temporary supply provisions

To respond to a temporary loss of supply, we deploy alternative water in the form of static tanks and bowsers. We have recently purchased 12 additional tanks to further increase our level of resilience.

Leakage improvements

We have spent £5.4m on leak improvements including detection and repairs between 2015 and 2020. One of the main investments is in detection technology to help us to improve our ability to identify when and where a leak occurs on our network and helps us to repair quickly, resulting in less water loss and interruptions to customers. As a result of our work, we exceeded our performance targets.

Reducing leakage helps us reduce our carbon emissions as we are not treating and pumping water we do not need to. It also helps build resilience within our supply network by ensuring more efficient use of water. This will become even more important in the long-term as resources become less plentiful due to the stresses placed on water availability due to climate change.

Figure 5 - one of our team out detecting leaks

Adaptation actions to be embedded in our business-as-usual operation (2020-2025)

We intend to embed the adaptation actions identified in this adaptation report into our business-as-usual operations, as we implement the following plans during the period 2020 to 2025.

Water Resource Management Plan

We have already started preparing our WRMP24. This will provide a **75 year plan** looking even further into the future from **2025 to 2100**.

We are working with the WRSE and following the specific climate change method statement which has been developed. This established that the **latest UKCP18 predictions** should be used to determine a Deployable Output impact for **28 climate change scenarios**. This will ensure we are taking a consistent, best practice approach and enable a sustainable Regional Resilience Plan to be developed.

Our WRMP24 will be informed by the WRSE Regional Resilience Plan and a draft will be published for consultation in 2022.

Drought Plan

In our next Drought Plan, we will increase our levels of resilience to more extreme droughts (classed as a **1 in 500 year event**) without the need to implement our Emergency Plan.

We also aim to use our network resource system model with updated stochastically generated inputs to revise our groundwater drought trigger levels for selected return periods. Further to this, we will look to carry out assessments on additional triggers based on rainfall and surface water and explore the use of areal rainfall data to develop new triggers that would be used alongside our updated groundwater triggers.

WRSE Regional Resilience Plan

Our supply area is an area of serious water stress and we plan and operate at a strategic level within the WRSE which recognises that the South East which is in a region that is under increasing pressure from population growth, climate change and the need to protect

fragile ecosystems. This provides risks, but also opportunities including work on the **WRSE Regional Resilience Plan** which aims to provide a joined up, affordable, resilient, and sustainable water supply that delivers for the public, industry and the natural environment for years to come.

The draft WRSE Regional Resilience Plan will be available for public consultation in early 2022.

Leakage

Managing leakage is an important adaptation action. As part of our Business Plan 2020-2025, we have an ambitious aim to reduce leakage by 15%. We are also committing to ambitious targets to further reduce leakage by 30% by 2040 and aspire to reach a 50% reduction by 2050. This will help reduce our carbon emissions and ensure available water is used efficiently, which will become more vital as climate change puts more pressure on available resources.

To reduce leakage by 2025 we are proposing to deploy fixed network monitoring across our distribution system to improve leak detection. However, as can be seen from Figure 6, leakage reductions are only predicted to play a part in our demand reduction.

Demand management, supported through metering and water efficiency, will play a larger role.

Metering

We are currently delivering the metering programme described in our current WRMP19. This includes encouraging customers to opt to change to a metered bill as well as introducing new meters to properties through our Change of Occupier initiative. Whilst the first years of this programme have been delayed by Covid restrictions, a recovery plan is in place and we are confident we can still achieve the meter penetration planned and shown in in Figure 7.

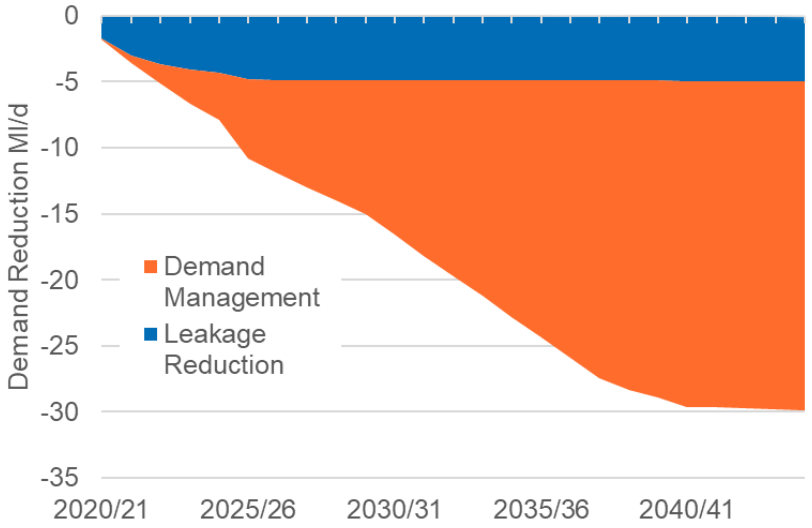


Figure 6 - demand and leakage reduction measures

Moving into our planning for WRMP24 we have worked up a number of water metering programmes for the planning model to consider when trying to balance anticipated demand against available supply. Most of these programmes describe a more ambitious metering programme that we currently have - including a universal smart metering programme.

The benefit of SMART meters is they will allow our customers to view their usage data in real time, and specifically address their biggest concern regarding opting for a meter which is that they will incur high charges. Whilst this trail is currently aimed at increasing meter up take, if successful it will be rolled out more widely, supporting our long-term vision of establishing a fully connected network.

Water Efficiency

We have a long-term aspiration of reducing customer water use (currently at approximately 150 litres per person per day) to 100 litres per person per day by 2050. By doing this, customers can help us adapt to the possibility of reduced water supplies in the future to ensure everyone can continue to access to the water they need.

To support this, we have launched our GetWaterFit programme which includes advice and support on using water wisely. This service is accessed by visiting www.getwaterfit.co.uk and includes:

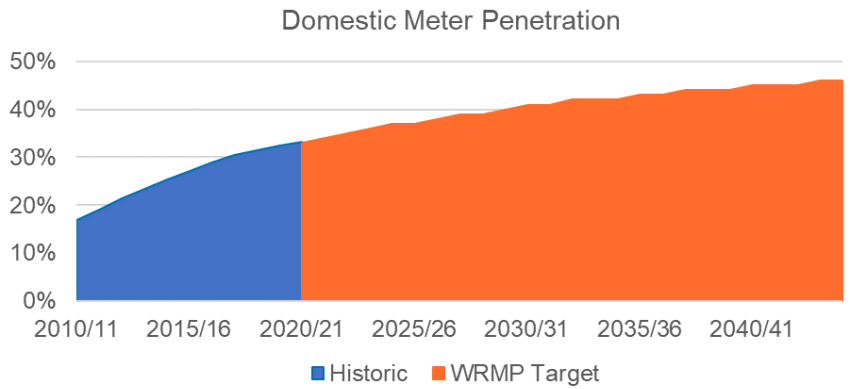
- free water-efficient devices
- free online session with a water-saving expert
- opportunities to raise money for local charities by completing simple water efficiency challenges.

Catchment Management

Customers agreed that it was more efficient to work with farmers to ensure raw water quality does not deteriorate, rather than invest in more complex treatment processes which are generally more energy intensive. This is another potentially significant adaptation action that also generates climate change mitigation benefits such as carbon capture and biodiversity gain.

We have therefore set a performance target (ODI) to engage with 50 farmers between 2020-2025 and help them commit to undertake a **Farm Management Plan**. These plans will be legally obligating and aim to ensure farmers and landowners do not use more nutrients than the crop or soil needs.

We will also be funding research into cover crops to identify the most effective crops for soaking up nitrates.



As part of our engagement, we will work with farmers more generally to enhance the biodiversity of the region and are working with Catchment Sensitive Farming and the Environment Agency as part of the Downs and Harbours Clean Water Partnership. Further details on grants we are making available are provided in the Improved environment, supporting Biodiversity Chapter of this report.

Details on how landowners can get involved are included on a dedicated website: www.cleanwaterpartnership.co.uk.

Downs & Harbours Clean Water Partnership

Resilience schemes

We plan to invest £2.793 million between 2020-2025 delivering four resilience schemes to help reduce the predicted demand deficit and significantly reduce the risk to customers from the loss of one or more treatment works at peak demand. These will help give us

greater resilience now and help us with our continued progress to adapt to climate change

Water Treatment Improvements

As well as our catchment management plan, we are also spending £5.8 million to further protect water quality. Again, these improvements help build resilience now and also help us with our continued progress to adapt to climate change.

Climate change adaptation actions

During previous rounds of climate change adaptation reporting, we developed a climate change Action Plan. Specific adaptation actions linked to ensuring continued supply and good water quality are outlined below, noting progress made since 2015, and outlining actions proposed for the next 5 years.

Action	Owner	Progress made (2015-2021)	Progress to be made (2021-2026)
1: Incorporate climate change risks into investment decision-making	Capital Planning	The company's asset management capability has significantly improved over the past 5 years, this includes improvements in the system for decision making. Our approach to resilience has also improved significantly and we have included some areas of climate change in this modelling. No dig has increased to 75%+ each year since 2015. Significantly reducing waste and new material requirements. Climate change was considered in development of WRMP19 which has fed into capital planning decisions.	We will integrate climate change effects further into the decision-making process. We will also continue to increase incorporating aspects of the wider environment into our decision making where appropriate.

Action	Owner	Progress made (2015-2021)	Progress to be made (2021-2026)
2: Build capacity within Asset Performance Modellers in understanding climate change impacts	Capital Planning	Progress not made due to organisation changes.	The Climate Change representative in the Regulation Team will: • Provide the asset performance modellers with new climate change data as required. • hold annual meetings with the capital planning team to review and discuss progress on this action and identify further needs.
3: Review the case for incorporating climate change impacts into Asset Deterioration Modelling	Capital Planning	We have completed a Resilience Study (Operational Model Report) which was used to help: • understand the interdependencies of the supply and distribution network • allow for outages/planned maintenance to occur with the assurances that demand will be unaffected • to model different aspects of the network and to establish key areas/network transfers that may be required • to simulate the time periods of shortages based on demand Four schemes were identified and included in our business plan for 2020-2025.	Our operational model will be reviewed and rerun for our next price review (PR24), including inclusion of wider environmental factors (climate change + others). Note that in line with Defra recommendations we are looking more at the environment and including other factors such as supply chain failures. Risks in these areas have been identified and experienced in many areas over the past few years due to Brexit and Covid.
4: Continue engagement with Regional Planners and decision makers and make use of up to date climate data	Capital Planning	We continue to maintain relationships with planners, decision makers and stakeholders. We are engaged with other water companies and stakeholders as part of WRSE.	We will continue to engage with WRSE and make use of the shared resources on climate change (including the climate change methodology which provides useful guidance on how to use UKCP18 projections).

Action	Owner	Progress made (2015-2021)	Progress to be made (2021-2026)
5: Incorporate the water quality findings of the climate change risk assessment into the Drinking Water Safety Plans	Drinking Water Safety Planning	The Drinking Water Safety Plans have been set up to include climate change risks.	The Drinking Water Safety Plan's will be populated with climate change risks by PR24. The Climate Change Representative in the Regulation Team will: • provide the Water Quality team with climate change data as required. • hold annual meetings with the Water Quality team to review and discuss progress on this action and identify further needs.
(Note Actions 6-8 are included in the Natural Hazard Chapter)			
9: Continue to research climate change drivers of water demand at average and at peak times of the year	Water Resource Management and Drought Planning	This was progressed as part of our WRMP19	This is continuing to be looked at for WRMP24 within the WRSE framework.

Action	Owner	Progress made (2015-2021)	Progress to be made (2021-2026)
10: Continued engagement with regional planners and decision makers on water demand issues.	Water Resource Management and Drought Planning	This is continually undertaken. We continue to engage with WRSE, the Environment Agency and several other key stakeholders. We followed the Environment Agency's forecasting guidance for our WRMP19. We have undertaken several club projects and have club projects. We have and are continuing to keep up to date with demand related research.	We are currently working on our WRMP24 and using the WRSE method statement for demand forecasts. As part of this, stochastic climatic datasets are used to produce demand under different drought severities. These are matched with the climate scenarios used in the supply forecasts, thus creating a consistent series of potential supply demand balances which will be used in the hydrological modelling of supplies. Our work with WRSE is helping us extend the time horizons for our water resources planning to 2100. We have forthcoming club projects with other WRSE companies.
11: Continued engagement with other stakeholders/ the Environment Agency on other catchment abstractors	Water Resource Management and Drought Planning	We have engaged with stakeholders including the Environment Agency and abstractors such as the Horticultural Society and National Farmers Union. This was most recently undertaken as part of the work on our Drought Plan which was updated in 2019 and 2021. We also engage with a multi sector stakeholder group as part of WRSE. This includes regular meetings.	We will continue to engage with stakeholders through our work with WRSE and increase engagement with other catchment users to decrease reliance on mains supply. This can potentially be aided through our catchment management programme.

Action	Owner	Progress made (2015-2021)	Progress to be made (2021-2026)
12: Research pressures on risk of breach of environmental flow requirements in water courses	Water Resource Management and Drought Planning	All our sources have been assessed relative to their environmental impact. We have only one source which the Environment Agency has identified in its Water Industry National Environment Programme (WINEP) process to need to be reviewed. As such, our planning has recognised the longer-term risk to this licence.	As part of our WRMP24 we are using the Environment Agency scenario testing, as part of WRSE methodology, to understand possible future impacts. We will also continue active engagement with the Environment Agency (and wider WRSE) to understand possible future flow restrictions linked to the fragile chalk streams.
13: Continued research of impacts of climate change and seasonal aquifer characteristics	Water Resource Management and Drought Planning	We used the most up to date guidance as part of our WRMP19.	We are continually reviewing new guidance and knowledge in preparation for WRMP24. Our work aligns with the WRSE methodologies. The East Hampshire Chalk Block groundwater model is currently being updated by the Environment Agency and we will review the outputs of this to explore if this can help us evaluate our future risk.
14: Review Level of Service in the next water resources management planning cycle	Water Resource Management and Drought Planning	This was undertaken as part of our WRMP19.	This will be undertaken as part of our WRMP24, and UKCP18 predictions are being used as part of this.
15: Assess impacts of climate change on our Drought Plan	Water Resource Management and Drought Planning	We followed the Environmental Agency guidance and methodologies for defining levels of service and calculating Deployable Output during development of our latest Drought Plan and WRMP19.	We are following the latest guidance through our work on our WRMP24 and revisions to our Drought Plan. This will include planning for a 1 in 500 year drought event.

Action	Owner	Progress made (2015-2021)	Progress to be made (2021-2026)
			Note, we are following WRSE's latest method statements for our WRMP24.
16 Quantify the likely risks of saline intrusion	Drinking Water Safety Planning	N/A (New Action)	We will evaluate the likely risk from saline intrusion reaching our abstraction points. We will consider sea level rise impacts on river intakes, spring headworks and aquifer contamination. We will also identify possible early warning monitoring points.

Monitoring

We already monitor our performance under several ODI measures.

We are committed to continue monitoring these measures to assess our performance into the future as circumstances change, including the climate. We plan to incorporate into adaptation actions insight gained through this monitoring and evaluation process.

Performance aim / Monitor	Measurement	2010/11 (performance)	2015/16 (performance)[1]	2020/21 (performance)	2024/25 (target)	2034/35 (target)
Risk of service restrictions in a 1 in 200 year drought	% of customers at risk	-	-	84	32	-
Supplied by a single system	No. of customers			0		
Unplanned outages	% loss of peak week production capacity	-	-	1.25	2.34	2.34
Water supply interruptions	mm:ss	05:13	03:30	02:49	05:00	-
Per capita consumption	l/p/d	161	143	150 [2]	140	129
Leakage	Ml/d	36	28.2	25.4	24.1	19.9
	% reduction from 2019/2020	-	-	-10.6	-15.2	-30
Mains Repairs	bursts per 1000km	100	66[3]	74	69	64
Domestic Meter Penetration	% of customers	17	27	33	-	-
Non-Domestic Meter Penetration	% of customers	90	90	88	-	-

Notes:

[1] AMP6 methodology

[2] 2020/21 performance impacted by COVID so 2019/2020 figures have been provided as more are representative of the trend.

(-) indicates there is no available data as either wasn't assessed in this way at the time of reporting or target not set.

[3] Note this was a particularly good year due to very benign weather conditions.

Natural Hazard Resilience

Natural hazards such as flooding and ground movement have the potential to have an impact our ability to operate our sites. To combat this, over the years we have invested in resilience measures which have helped us deal well with recent extreme events. We can supply all our customers from an alternative source, so even if one source were to be affected from a natural hazard event, we would still be able to get water to where it is needed when based on average daily demand.

The main risk mechanisms we use to plan and manage these are Resilience and Emergency Planning and Capital Planning.

Risks and opportunities

Our main risks, linked to the key water sector risks identified by the Climate Change Committee's independent advice which will feed into CCRA3, are outlined below:

CCRA3 Key Risk	Key Risk Description	Our mapped main individual risks	Risk score (2021-2051)	Risk score (2051-2081)	Risk score (2081+)
I2	Risk to infrastructure services from river, surface water and groundwater flooding	• Increased flooding to source and treatment works from rivers and groundwater • Increased flooding to pumping stations (raw and potable) and valves from rivers and groundwater • Increased regional flooding from rivers and groundwater impedes routine mains repair	Low (3)	Medium (9)	Medium (12)
I3	Risk to infrastructure services from coastal flooding and erosion	• Water resources asset loss from coastal change • Abstraction asset loss or outage from coastal change	Low (3)	Low (3)	Low (4)
I7	Risk to subterranean and surface infrastructure from subsidence	• Accelerated asset deterioration of mains from more extreme wetting and drying cycles and earth movement	Low (4)	Medium (8)	Medium (12)

Adaptation actions embedded in our business-as-usual operation (2015-2020)

We have embedded adaptation actions identified in our 2015 adaptation report into our recent business-as-usual operations through implementing the following programmes to improve asset and system resilience against flooding, the frequency and severity of which is sensitive to climate change.

Flood Resilience

In 2005, we commenced a programme of increasing resilience against flooding which successfully protected assets in the floods of 2012 and 2013. Further work has since been undertaken to withstand "extreme" flooding conditions and we have enhanced our Emergency Plan accordingly. We are now confident that supplies can be maintained in such extreme flooding conditions of a 0.1% annual exceedance probability event (1 in 1000 year return period).

Our work associated with extreme flooding has been dealt with in 2 ways:

- Emergency Planning:

Trigger levels, timings and an outline action plan have been developed and included in our Extreme Flooding Emergency Resilience Plan. This forms a basis for decision making and enables proper management of risks.

- Capital intervention:

Permanent flood defences were identified to be required at four our sites. Protection works were completed at Lavant, West Street, Aldingbourne between 2010 and 2015 and at Walderton between 2015 and 2020.

Network Resilience

In 2018, the water sector was challenged by "the Beast from the East" and the hottest June and July on record. During each of these we have maintained supplies to customers with no restrictions or reduced level of service. The average number of burst distribution mains rose from approximately 1 per day to a very low peak of 5, affecting a minimal number of customers.

In its report Ofwat said that we performed well during "the Beast from the East" and we believe this is because of our long-term investment in the network has improved resilience.

Since 1990 we have driven the annual burst rate down by 80% by renewing approximately 1% of the network per year. We have also undertaken deterioration modelling using empirical evidence and 15 years of network deterioration modelling, to better understand our company specific burst characteristics.

Planned adaptation actions to be embedded in our business-as-usual operation (2020-2025)

We will continue to ensure we are maintaining our resilient to natural hazards including extreme weather, flooding, and subsidence.

Climate change adaptative actions

During previous rounds of climate change adaptation reporting, we developed a climate change Action Plan. The actions linked to ensuring continued resilience to natural hazards are outlined below with progress made since 2015 and progress proposed for the next 5 years.

Action	Owner	Progress made in 2015-2021	Progress to be made 2021-2026
6: Review updated flood information as it becomes available (was 'review next round of Environment Agency Flood Maps as they become available')	Resilience and Emergency Planning	We have undertaken flood risk assessments for all our site using the Environment Agency flood maps and historic/ local knowledge. Based on this assessment it has been confirmed that flooding from groundwater and winterbournes are our biggest concern, note these are risks not yet covered by the flood maps. To ensure we can protect our sites we have developed an Extreme Flood Emergency Resilience Plan which sets out trigger levels and emergency measures to manage the consequence of rising groundwater and associated over topping for an extreme flooding emergency (1 in 1000) event.	We plan to ensure our operational sites continue to be resilient to a 0.1% annual exceedance probability (1 in 1000 year return period) flood event. To do this we will review: • any updated flood maps with account for climate change published by the Environment Agency in advance of our next Price Review (PR24). • our Extreme Flood Emergency Resilience Plan to ensure management measures suggested are still appropriate and identify alternative measures where appropriate. • the outputs from the East Hampshire Chalk Block groundwater model which is currently being updated by the Environment Agency. This will hopefully help us to explore future scenarios related to our groundwater flood risk.
7: Incorporate emergency weather event risks into investment decision making	Resilience and Emergency Planning	Linked to Action 1, 3 and 6.	We will investigate integrating climate change effects further into the decision-making process.

Improved environment, supporting Biodiversity

We rely on the environment to help provide the water needed to supply our customers. Management of the environmentally sensitive area we operate in is therefore a key element of our risk and resilience management. As such we are taking steps to improve the environment and supporting biodiversity.

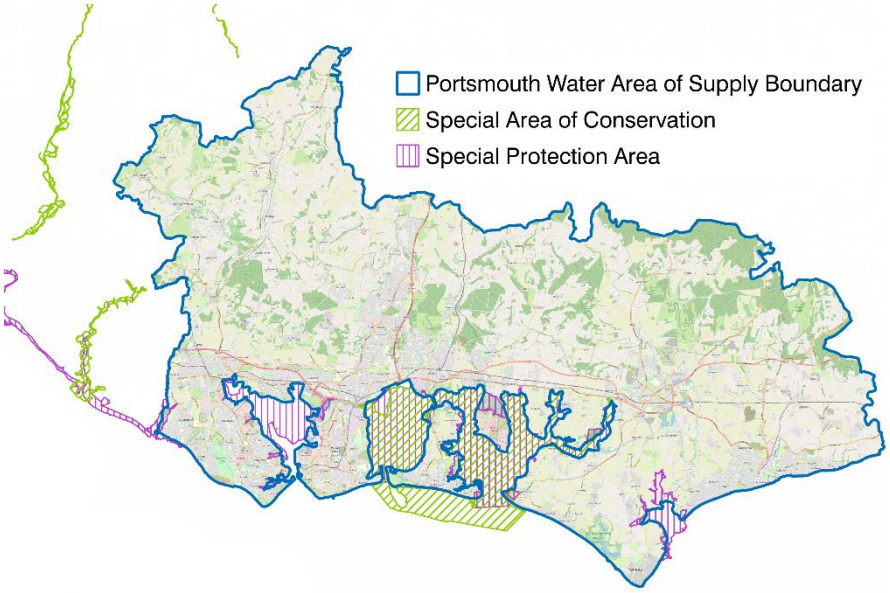


Figure 8 SACs and SPAs in our area of supply

Risks and opportunities

Improving biodiversity and land/water management have been identified by the CCRA3 findings as priority actions for the next two years to help limit global warming. There is therefore more urgency to ensure we are conserving, and where possible, improving the environment we operate within.

We operate in a special, but sensitive region. As shown in Figure 8 there are a number of special areas of Conservation (SACs) and Special Protection Areas (SPAs) within our supply area. Through are ongoing enhancement work we are aiming to helping to safeguard these.

We also have unique chalk stream habitats within our region which are becoming more fragile. As highlighted earlier in this report one of our biggest new risks is the likely reduction in our ability to abstract from these sources. However, this risk is also an opportunity for us to be more innovative and implement further efficiencies through leakage and demand management. We are also taking steps to strengthen our supply through development of the Havant Thicket Reservoir and will work to implement further improvement measures that come forward through the WRSE Regional Resilience Plan.

Adaptation actions embedded in our business-as-usual operation (2015-2020)

In the last 5 years we have taken the following actions to protect our national capital:

Biodiversity Action Plan

We identified and agreed a Biodiversity Action Plan programme with Natural England and the Customer Challenge Group.

Natural England confirmed that we achieved good status on each of our planned sites and as a result we achieved our ODI target.

Habitat Management Plans

We developed Habitat Management Plans for all operational sites.

Catchment Management

As highlighted in the last chapter, we have proactively worked with five local farmers to improve the quality of raw water in priority zones identified to be experiencing increased nitrate levels. We are scaling this approach up going forward and further details are available in this report. Figure 9 highlights the main rivers we are working with farmers to protect.

Itchen Valley Country Park SSSI

We own one Site of Special Scientific Interest (SSSI) at the Itchen Water Treatment Works, which we manage in conjunction with Itchen Valley Country Park through a Natural England High Level Stewardship agreement, to allow cattle grazing at the meadow to maintain the wet grassland habitat in favourable condition

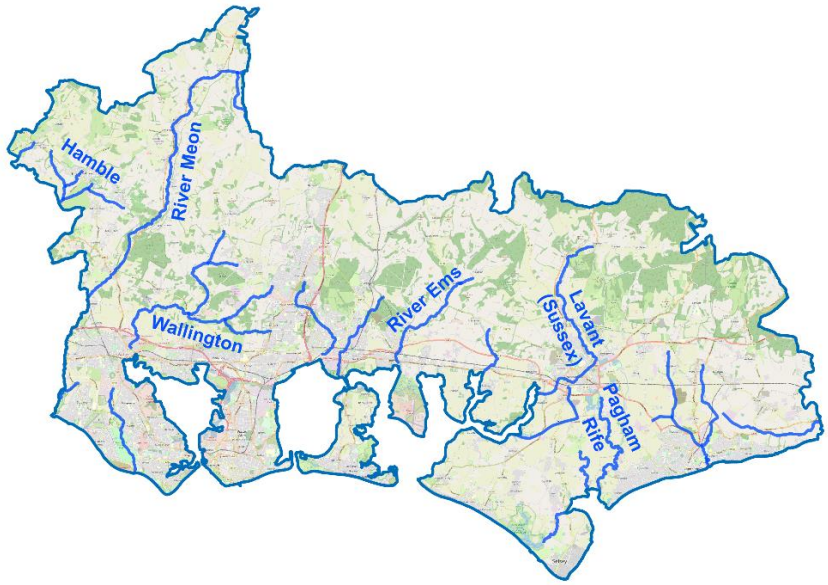


Figure 9 Key watercourses within the Downs and Harbours Clean Water Partnership

Sustainable Resource Use

We currently have the lowest volume of carbon per unit of water delivered within the industry. We plan to maintain this position and have also committed to be net zero by 2030. This means we will take steps to reduce our avoidable greenhouse gas emissions as much as possible and ensure emissions for our essential operations are balanced so they have less impact on the environment.

To help us achieve this we have assessed where our emissions come from and identified realistic options to decarbonise our operational activities. We have already started reducing our emissions and developed a Net Zero Route Map to support our journey. Further details are included in our '2030 Net Zero Route Map' and our Energy Case Study.

River restoration

We completed our obligations under the National Environment Programme. We undertook two river restoration projects on the Ems and the Hamble to improve the environment for fish and invertebrates. This has been achieved working with landowners and was signed off by the Environment Agency in 2017.

Westergate WTW

We constructed a new pond to cope with surface water run-off from the new Ultraviolet plant building (designed for a 1% annual exceedance probability), but also made provision to hold water all year round to provide an important new habitat for wildlife. The native pond species planted were chosen to naturally treat water, and were sourced from sites in Hampshire.

Havant Thicket

The Havant Thicket Reservoir project will undoubtably change the existing habitat, but through intervention we hope to improve this. So far we have:

- monitored the local area for >15 years to build up a detailed picture of the wildlife.
- relocated wildlife to safe and attractive habitats.
- installed 200 bat boxes and > 300 dormice boxes,
- improved > 200 hectares of woodland and wood pasture locally.
- planted 6,000 new trees.
- created new wildlife corridors along the site boundaries.
- worked with local groups to relocate trees.
- undertaken an initial natural capital accounting analysis which concluded that overall there would be substantial net gains due to the enhancement on recreation, health, well-being and water provision.

Eel Screens

We undertook a study in 2015/16 to assess the likelihood of eels being drawn into the works during abstraction. As a result of the findings we have invested £2.264 million on installing screens at the Itchen river intake to prevent eels being harmed. We consulted the Environment Agency on options and final specification. This was a statutory requirement and part of the Water Industry National Environment Programme (WINEP).

Adaptation actions to be embedded in our business-as-usual operation (2020-2025)

Our 2020-2025 Business Plan addresses the key targets set out in the Government's 25 year Environment Plan in relation to damaging abstractions, resilience in drought, leakage and increasing the amount of woodland.

Our customers have encouraged us to go further than the legal minimum and expressed a willingness to pay for additional benefits. One of our proposed performance Outcomes is therefore **an improved environment, supporting biodiversity**. We have worked closely with the Environment Agency and Natural England to develop six ODI targets to help ensure we deliver on this. These are expanded on in this and the monitoring section, and include Biodiversity, Catchment Management, Grant Scheme, WINEP, Carbon, and AIM. We will be held accountable for achieving these by Ofwat and our customers.

Biodiversity

We have agreed with Natural England a programme of work on our sites to maintain the good status we achieved between 2015-2020.

Catchment Management / Grant Scheme

Our 2020-2025 Catchment Management Programme will build on the innovative approach we delivered between 2015-2020 which aimed ensure farmers in priority zones do not have detrimental effect on the raw water we rely on to supply customers.

The scope of initiatives available to farmers and landowners has been increased to include a 'payments for ecosystem services scheme', a potential woodland creation scheme in partnership with the Forestry Commission and a focus on soil improvement interventions. These schemes also have the benefit of being biodiversity enhancing.

Our work with the Forestry Commission is a first for the industry. It will set a precedent concerning how the Forestry Commission will work with other UK water companies. It is being considered by DEFRA as a pilot for their new Environmental Land Management Scheme. We will also be funding research into cover crops to identify the most effective crops for soaking up nitrates.

Water Industry National Environment Programme (WINEP)

We have agreed a WINEP programme with the Environment Agency which includes:

- 11 schemes related to catchment management
- two schemes on the installation of eel screens on the River Itchen.
- one on bio-security related to how we minimise the potential to introduce invasive species on to our sites
- one on natural capital.
- three schemes on water resource abstraction (two on the Itchen and one at Soberton).

The programme is ambitious and requires us working with farmers on catchment management and with Southern Water on the River Itchen project.

AIM

Our abstraction incentive mechanism (AIM) has been established our abstraction from the River Hamble does not detrimentally impact the environment. We have agreed that if water levels fall below an agreed trigger level we will reduce abstraction. We continually monitor river levels to ensure we can do this.

Havant Thicket

As well as providing us with the chance to create an exciting new leisure facility for local communities, we want the reservoir to include a new wildlife conservation area. This will include new woodland, parkland and a wetland. A grant scheme will also support wildlife across Hampshire and West Sussex.

Wetlands are a vital habitat for wildlife, but they are coming under increasing pressure from pollution and droughts. We want to create a sustainable wetland along the northern shore of the reservoir to offer a new home for a wide range of water plants, wetland birds and other wildlife.

Climate Change adaptation actions

We do not have any specific climate change adaptation actions related specifically to improving the environment or supporting biodiversity as believe that our business-as-usual schemes are adequately monitored through our ODI reporting.

Monitoring

We already monitor our performance under several ODI measures.

We are committed to continue monitoring these measures to assess our performance into the future as circumstances change, including the climate. We plan to incorporate into adaptation actions insight gained through this monitoring and evaluation process.

Performance aim/ Monitor	Measurement	2010/11 (performance)	2015/16 (performance)[1]	2020/21 (performance)	2024/25 (target)	2034/35 (target)
Biodiversity	% of priority habitat land in good stewardship	-	20	30 [2]	90	90
WINEP	# of schemes	-	-	2	18	-
Grant Scheme	£000s	-	-	50	250	-
Catchment Management	# of farmers we have worked with to create Farm Management Plans	-	-	10	50	Contact with all non - priority farmers
AIM	Ml/d	-	-	0	18.8	18.8
Carbon	% reduction in GHG emissions	-	-	-25	-5	-
	% increase in use of renewable resource	-	>95	99		

Notes:

[1] AMP6 methodology

[2] 2020/21 performance impacted by COVID and in 2019/2020 we achieved 98%.

(-) indicates there is no available data as either wasn't assessed in this way at the time of reporting or target not set.

Interdependencies and Cascading Failures

As part of our process of building on earlier adaptation reports we continue to develop a greater understanding of the impact climate-change and extreme weather events could have on the performance of infrastructure and systems on which we depend to maintain our service but that are outside our control. The main interdependencies we have identified, in our assessment of climate risks relate to energy, transport, and information and communication technology (ICT).

We note that some of these infrastructure providers have also published reports on how they are adapting their services and infrastructure to be resilient to extreme weather events and account for climate change. We plan to review, periodically, findings by the National Infrastructure Commission on interdependencies and cascade risks and to use reports prepared under the climate change risk assessment programme to ensure that we are planning to develop appropriate levels of resilience within our water service systems.

Risk and opportunities

Interdependencies and cascading failures are a key risk and focus of the independent advice which will feed into the CCRA3. This has highlighted their significance within the water sector and reinforces the need for adaptation actions to be developed to address these cross-cutting risks and our exposure to them. Examples of such actions are given below.

Our main risks, mapped to the key water sector risks identified by the independent advice review which will feed into the CCRA3, are presented in the table below:

INTERDEPENDENCIES Are points of interaction. As we do not operate in isolation, we have interdependencies. These interdependencies have the potential to alter the nature and magnitude of our climate change risks.

CASCADING FAILURES These are impacts in one or more parts of an interconnected system that trigger impacts in others e.g. flooding causes a national power outage, which in turn causes impacts operation at a water treatment works.

Key Risk Code	Key Risk Description	Our mapped main individual risks	Risk score (2021-2051)	Risk score (2051-2081)	Risk score (2081+)
I1	Risk to infrastructure networks (water, energy, transport, ICT) from cascading failures	• Increased interruptions to telecommunication and telemetry • Road melt events impede treatment works access • Chemical supply chain disruption from regional heatwaves and floods • Storm damage to above ground assets (building and overhead cables)	Low (3)	Low (4)	Medium (6)

Adaptation actions embedded in our business-as-usual operation (2015-2020)

- Approximately 80% of our water treatment works and pumping stations have stand-by generation to provide an alternate electrical supply in the event of a power outage. The automation of standby generation was assessed in our recent Resilience Study.
- We have standalone water tanks that can be supplied should a cascading failure impact.
- Operational equipment at our works is not connected to our IT network and therefore there is limited threat should these be adversely affected. Note that to ensure we can still access our sites in an extreme weather event we have accessed flood risk to gain entry to each works.
-

Adaptation actions to be embedded in our business-as-usual operation (2020-2025)

- Through our planned resilience work, outlined previously in this report, no customers will be at risk of a service failure as a result of a loss of a treatment works.
- We are aiming to replace a significant proportion of grid electricity demand at our sites with locally generated renewable electricity, 12% by 2025 and 20% by 2030.
- Through our efforts to generate efficiencies through changes to operation and through demand management, we will reduce our reliance on energy.
- As part of our going effort to improve our resilience we plan to complete a maturity assessment on our corporate, financial, and operational systems, following the guidance within BS65000 -Guidance on Organisational Resilience. The intention is to establish how developed our approach is

within each area and identify any gaps and deficiencies. Following this we will identify an improvement plan for each area. This is expected to be an iterative process; as the understanding of our systems and their interdependencies develops, so will the understanding of the maturity of our approach develop.

Climate Change adaptation actions

During previous rounds of climate change adaptation reporting we developed an adaptation action linked to addressing risk from cascading failures; this was to incorporate heat wave and road melt events into Emergency Plans. Due to its low priority this has not yet been progressed but will be over the next 5 years. We also plan to incorporate two additional actions linked to our adaptation to cascading failures as outlined in the table below.

Action	Owner	Progress made in 2015-2021	Progress to be made 2021-2026
8: Incorporate heat wave and road melt events into Emergency Plans	Resilience and Emergency Planning	Not progressed	Emergency Plans will be updated to include UKCP18 data. The Climate Change representative in the Regulation Team will brief Emergency Planners on new climate change data in addition to annual update meetings to identify any arising climate related threats.
17: Investigate additional steps we can take to help build systemic resilience	Regulation Team /	NA (New Action)	We will review the new ISO 14090/14091 Adaptation to Climate Change guidelines reports given the importance of inter-connections between infrastructure systems. The aim is to identify if there are any additional steps we can take to assess our vulnerability, impacts and risk. Reference to ISO standards will ensure we are working to formalised standards of resilience. This is a beneficial action identified by the independent advice report for the CCRA3, which will help build systemic resilience across the whole infrastructure system if adopted by all.
18: Investigate how resilience to power outages can be strengthened.	Resilience and Emergency Planning	NA (New Action)	Test how a national power outage scenario would impact resilience.

Case Studies

New Water Source - Havant Thicket

We are creating a new winter storage reservoir to help secure long term reliable drinking water supplies for the South East. Climate change has factored greatly in this decision.

We have now been granted planning permission, and the reservoir will come into service in 2029.An impression of this is shown in Figure 10.

We are developing the reservoir in collaboration with Southern Water to ensure we effectively help address their urgent water needs[7].

The reservoir will help safeguard the River Itchen and River Test, two of Hampshire's rare chalk streams, by enabling less water to be abstracted from them. This is increasingly important as climate change is worsening the complex problems these streams are already facing.

The site will also create a new leisure facility and a wildlife conservation area. This will include new woodland, parkland and a wetland which are vital habitat for wildlife. This will help build climate resilience by increasing biodiversity; seen as a key pathway to limit global warming.

Based on an initial Natural Capital accounting analysis, there will be substantial overall net gains. This is due to the improvements on recreation, health, well-being and water provision.

We have already taken a proactive approach to minimise the possible impact on wildlife; monitoring the site for 15 years to understand it, relocating existing wildlife and trees, and planting new trees and habitat. We will continue to ensure wildlife is protected during construction and that the reservoir and surrounding area provide an enhanced habitat for all.

Further information can be found here: [The Reservoir | Portsmouth Water]

Figure 10 - Impression of the proposed new Havant Thicket

[7] See Southern Water accelerate gate one - RAPID for future information.

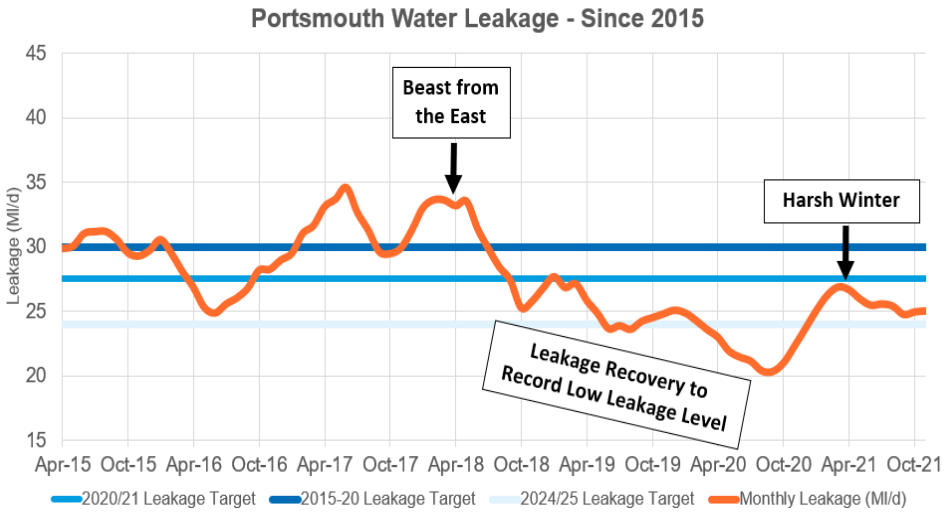
Leakage Reduction

Our leakage performance is industry leading.

We started 2015 at target level, but experienced a difficult 2016/17 with leakage gradually increasing.

We put in place a leakage recovery plan in June 2017, resulting in a reduction through the autumn. A harsh 2017/18 winter, including Beast from the East, lead to increases, but by continuing our leakage recovery plan we achieved record low leakage levels in 2019/20. The harsh winter of 2020/21 led to increases, but winter peak leakage was 18% lower than the previous harsh winter of 2017/18.

Figure 11 - one of our team installing a fixed noise logger below



Our leakage recovery plan has included:

- preparation of a dedicated action plan.
- implementation of a dedicated leakage team, and increased detection resource from 7 to 28 technicians.
- reduction of our repair backlog to less than 20 leaks.
- covering 40% of our network with permanent noise loggers, which detect leaks as they break out (see Figure 11).
- extensive pressure optimisation of 70% of our network through new advanced controllers.

Energy

Energy is core to providing our services. Without power we can't treat water or move it around the network.

How we source our energy has an impact on avoiding future climate change, but our energy systems must also be robust to future changes to energy reliability.

We have taken proactive steps to reduce emissions and these include:

- Regularly reviewing and implementing opportunities to improve our energy efficiency in pumps, processes and our general activities.
- Developing our Storage Production Optimisation in Real Time Tool (SPORT), aimed at optimising energy usage across our network.
- Installing six solar arrays across our site portfolio, together generating 2.5 million kilowatt hours of renewable electricity since installation in 2011, saving over 800 tonnes of CO2e emissions.
- Committing to purchasing over 90% of electricity backed by REGO certificates thereby ensuring that our grid-associated carbon emissions are kept to a minimum.
- Installing a vehicle telematics system which could save as much as 10% of vehicle fuel emissions

We have also established a pathway to help us achieve net zero carbon emissions by 2030. This is shown in Figure 12.

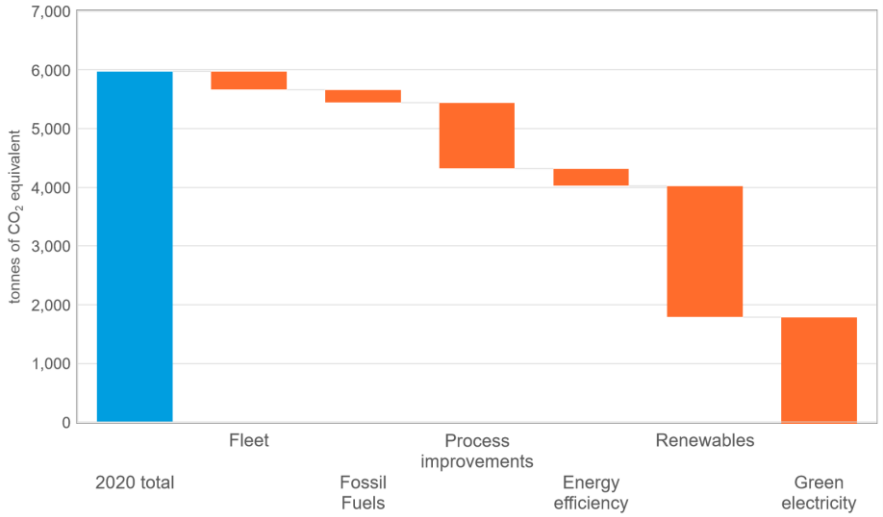


Figure 12 - Our proposed Net Zero pathway to 2030

Figure 13 Standby Power Generation Set

Our business-as-usual activities would see a significant reduction in greenhouse gas emissions as grid electricity production moves away from fossil fuels. Our pathway to net zero goes much further by including measures such as phasing out gas oil for backup generators and replacing with biodiesel, a sustainable fuel with a much-reduced carbon footprint.

We have configured more of our network to set to an open position in the event of power loss – this means the network keeps supplying customers even if for that period it becomes a bit less efficient. We have back up power generation at all our production sites and pumping stations – even with a long-term power outage we can maintain supplies. While we expect the power companies to develop responses to make their networks more resilient, we are looking at opportunities to make our systems more independent as well.

Figure 14 One of our new solar panel arrays

Flood Resilience

Flooding has the potential to impact the operation of our sites and our access to them.

To limit this, we commenced a programme of increasing flood resilience in 2005 which successfully protected assets in the floods of 2012 and 2013.

Further work has since been undertaken to withstand "extreme"[8] flooding conditions and we have enhanced our Emergency Plan accordingly. This now includes a specific Extreme Flooding Emergency Resilience Plan which forms the basis for decision making and enables proper management of risks.

We have also provided capital intervention in the form of permanent flood defences at four sites – see Figure 15 - flooding at a pumping station.

Figure 15 - flooding at a pumping station

[8] events with a 0.1% annual exceedance probability / 1 in 1000 year return period.

Figure 16 – flood protection of air vents at one of our sites

These interventions are designed with allowances for future rises in flood levels as a result of climate change. We plan to ensure our operational sites continue to be resilient to extreme flood events both now and in the future; giving consideration for the increased risks created by climate change. To do this we will review:

- any updated flood maps which account for climate change published by the Environment Agency in advance of our next Price Review (PR24).
- our Extreme Flood Emergency Resilience Plan to ensure management measures suggested are still appropriate and identify alternative measures where appropriate.
- the outputs from the East Hampshire Chalk Block groundwater model which is currently being updated by the Environment Agency. This will hopefully help us to explore future scenarios related to our groundwater flood risk.

New Headquarters

We are constructing a new headquarters to a BREEAM[9] 'Very Good' standard. An impression of this is shown in Figure 17.

In this new building there will be:

- no gas heating in the building,
- solar panels on the roof,
- connections for each car park space to offer electric charging,
- rainwater harvesting,
- and general water efficiency devices.

We have also worked with the Environment Agency to move the entire site out of Flood Zone 3[10] by creating flood compensation areas and building a bund alongside the stream through the site. We have also removed an existing culverted section of stream (known as de-culverting) which removes a restriction and therefore helps reduce flood risk upstream. These flood alleviation works have now been completed and signed off by the Environment Agency.

Figure 17 - Artist impression of our new headquarters

[9] BREEAM is a world leading sustainability assessment method

[10] Which have a high probability of flooding i.e. a 1 in 100 or greater annual probability of river flooding

Appendix A - Climate Change Risk Assessment

				First Round				Second Round						Third Round					
Risk management mechanism	Business function	Linked key CCRA3 risk	CCRA3 Risk Name	Risk score (near term)	Risk score (medium term)	Risk score (long term)		Risk score (near term)	Risk score (medium term)	Risk score (long term)	Risk description	Action	Validation	Activity 2015-2021 against action plan to mitigate risk	New Data that may change risk	Round 3 Amendment	Risk score (near term)	Risk score (medium term)	Risk score (long term)
WRMP	Water resources	I8	Risks to public water supplies from reduced water availability	5	20	25		3	6	9	Increased demand for water at peak from permanent population, driven by reduced rainfall and higher temperatures	Research risk through Water UK, UKWIR, Company population data, links with university projects. Incorporate risk in to future water resources management planning cycles as per regulatory guidelines and implement demand management and/or supply schemes as required.	Outturn data of distribution input, weather impacts, consumption monitors, etc. (June Return)	Our revised WRMP19 (and future WRMP24) has used the most up-to-date population forecasts, stochastic, and climatic projections to produce our demand forecast. Both supply and demand options have been developed and assessed for implementation, and will continue to be for WRMP24.	UKCP18 projections arrived too late for WRMP19 but is being considered in WRMP24	No change	3	6	9
WRMP	Water resources	H10	Risks to health from poor water quality and household supply interruptions	5	20	25		3	6	9	Increased demand from seasonal (tourist) population at peak	Continued engagement with regional planners. Review third party data. Incorporate risk in to future water resources management planning cycles as per regulatory guidelines and implement demand management and/or supply schemes as required.	Outturn data of distribution input, weather impacts, consumption monitors, etc. (June Return)	We have recalculated this using our latest demand forecast methodology used for revised WRMP19	WRMP19 forecasts	No change	3	6	9
WRMP and DP	Water resources	I8	Risks to public water supplies from reduced water availability	5	15	20		3	6	9	Increased occurrence of drought	Review Level of Service in next water resources management planning cycle. Assess impacts of climate change on Drought Plan.	None.	Review of Level of Service and drought resilience was re-assessed for WRMP19 and 2019 and 2021 drought plan revisions	UKCP18 projections arrived too late for WRMP19 but is being considered in WRMP24	No change	3	6	9
WRMP	Water resources	H10	Risks to health from water quality and household water supply (b) water quantity	3	9	15		2	6	9	Increased demand from net inward migration of retirement population	Continued engagement with regional planners. Review third party data. Incorporate risk in to future water resources management planning cycles as per regulatory guidelines and implement demand management and/or supply schemes as required	Outturn data of distribution input, weather impacts, consumption monitors, etc. (June Return)	We have recalculated this using our latest demand forecast methodology used for revised WRMP19	methodology accounts for net migration	Reduced uncertainty/risk due to inclusion in latest methodology	2	3	6
WRMP	Water resources	I8	Risks to public water supplies from reduced water availability	9	9	12		2	6	9	Increased risk of breach of environmental flow requirements in water courses, reducing reliability of sources for public water supply	Undertake AMP 5 investigations, continued engagement with Environment Agency.	Continued river flow gauging (Portsmouth Water and Environment Agency)	AMP5 and AMP6 investigations and engagement with the EA have continued.		No change	2	6	9
WRMP	Water resources	I8	Risks to public water supplies from reduced water availability	3	9	12		2	6	9	Increased summer abstraction by other (existing) catchment users due to reduced rainfall	Continued engagement with Environment Agency and regional planners. Make use of thrid party data. Share knowledge through WRSE and Water UK.	None.	We have engaged with stakeholders including the Environment Agency and other abstractors such as the Horticultural Society and National Farmers Union and will continue to do so to increase resilience to the water supply.	Increased engagement has improved understanding of current catchment pressures	Increased engagement and potential longer term work with other catchment users to decrease reliance on mains supply has reduced risk	2	6	6
WRMP	Water resources	I8	Risks to public water supplies from reduced water availability	3	9	12		2	6	9	Increase in agriculture leads to increase in abstraction by other catchment users	Continued engagement with Environment Agency and regional planners. Make use of thrid party data. Share knowledge through WRSE and Water UK.	None.	We have engaged with stakeholders including the Environment Agency and other abstractors such as the Horticultural Society and National Farmers Union and will continue to do so to increase resilience to the water supply.	Increased engagement has improved understanding of current catchment pressures	No change	2	6	9
WRMP	Water resources	N10	Risks to aquifers and agricultural land from sea level rise, saltwater intrusion	4	4	8		2	4	4	Saline intrusion of borehole sources	No action required at this stage. Review next round of sea level rise projections and aquifer modelling as they become available.	Continued conductivity monitoring will identify salinity.	Monitoring at productions sites continues		No change	2	4	4
WRMP	Water resources	N10	Risks to aquifers and agricultural land from sea level rise, saltwater intrusion	5	5	5		5	5	5	Rising salinity at River Itchen intake	No action required. Review next round of sea level rise projections and shoreline management policies as they become available.	Continued conductivity monitoring will identify salinity.	Monitoring at productions sites continues		No change	5	5	5
WRMP	Water resources	I8	Risks to public water supplies from reduced water availability	5	5	5		5	5	5	Reduced aquifer recharge during summer months causes reduced summer source yield	Continue to work with the Environment Agency and other stakeholders on aquifer modelling.	Continued groundwater level and source yield monitoring.	GW levels are monitored and reported daily, and within the annual review process		No change	5	5	5
WRMP	Water resources	H10	Risks to health from poor water quality and household supply interruptions	2	2	4		2	2	4	Population migration away from flood risk impacts regional supply-demand balance	Continued engagement with regional planners. Ongoing monitoring.	Outturn data of distribution input.	Population migration has been incorporated into the latest population projections which have been used in the regional planning process. DI is also assessed through the annual review process	methodology accounts for net migration	Reduced uncertainty/risk due to inclusion in latest methodology	2	2	2
WRMP	Water resources	I8	Risks to public water supplies from reduced water availability	2	4	4		2	4	4	Increased evapotranspiration reducing aquifer recharge	Continue to work with the Environment Agency and other stakeholders on aquifer modelling.	Continued groundwater level and source yield monitoring.	GW levels are monitored and reported daily, and within the annual review process		No change	2	4	4
WRMP	Water resources	I3	Risks to infrastructure services from coastal flooding and erosion	2	2	4		2	2	4	Water resources asset loss from coastal change	Continued engagement with regional planners. Ongoing monitoring.	Existing conductivity monitoring will identify salinity.	Review of regional coastal flood defence plans		No change	2	2	4
WRMP	Water resources	N10	Risks to aquifers and agricultural land from sea level rise, saltwater intrusion	4	4	4		4	4	4	Saline intrusion from lower groundwater / increased abstraction	No action required.	Review next round of sea level rise projections and shoreline management policies as they become available. Existing conductivity monitoring will identify salinity.	Conductivity monitoring undertaken at productions sites continues		No change	4	4	4
WRMP	Water resources	I8	Risks to public water supplies from reduced water availability	3	3	3		3	3	3	Reduced aquifer recharge during summer months leads to reduced source yield in October	Continue to work with the Environment Agency and other stakeholders on aquifer modelling.	Existing conductivity monitoring will identify salinity.	Review of Level of Service and drought resilience was re-assessed for WRMP19 and 2019 and 2021 drought plan revisions		No change	3	3	3
WRMP	Water resources	N10	Risks to aquifers and agricultural land from sea level rise, saltwater intrusion	2	2	2		2	2	2	Saline intrusion of Havant and Bedhampton Springs source	Ongoing monitoring.	Existing conductivity monitoring will identify salinity.	Conductivity monitoring undertaken at productions sites continues		No change	2	2	2
WRMP	Water resources	I3	Risks to infrastructure services from coastal flooding and erosion	2	2	2		2	2	2	Population migration away from coastal change impacting regional supply-demand balance	Continued engagement with regional planners. Ongoing monitoring.	Outturn data of distribution input.	Population migration has been incorporated into the latest population projections which have been used in the regional planning process. DI is also assessed through the annual review process	Revised methodology - population forecast now accounts for net migration	No change	2	2	2
WRMP	Water resources	N4	Risk to soils from changing climatic conditions, including seasonal aridity and wetness.	1	1	1		1	1	1	Increased soil compaction reduces aquifer recharge	Continue to work with the Environment Agency and other stakeholders on aquifer modelling.	Continued groundwater level and source yield monitoring.	GW levels are monitored and reported daily, and within the annual review process		No change	1	1	1
WRMP	Water resources	N11	Risks to freshwater species and habitats from changing climatic conditions and extreme events, including higher water temperatures, flooding, water scarcity and phenological shifts.								Future WINEP reductions exacerbate impacts of flow reductions due to climate change			New risk for round 3		New risk for round 3	12	9	9
Capital Planning	Potable transport	I7	Risks to subterranean and surface infrastructure from subsidence	4	12	16		3	6	9	Accelerated asset deterioration of cast iron water mains from more extreme wetting and drying cycles and earth movement	Near term risk is low. Review case in AMP 6 for incorporating climate change impacts in to asset deterioration modelling, and consider future climates when procuring replacement assets.	Continue to monitor asset performance data for capital maintenance planning.	Routine asset performance monitoring. Review of research to guide assessment of future trends		No change	3	6	9
Capital Planning	Potable transport	I7	Risks to subterranean and surface infrastructure from subsidence	4	8	12		4	8	12	Accelerated asset deterioration of ductile iron, fibre reinforced concrete, PVC and steel water mains from more extreme wetting and drying cycles and earth movement	Near term risk is low. Review case in AMP 6 for incorporating climate change impacts in to asset deterioration modelling, and consider future climates when procuring replacement assets.	Continue to monitor asset performance data for capital maintenance planning.	Routine asset performance monitoring. Review of research to guide assessment of future trends		No change	4	8	12

				First Round				Second Round							Third Round					
Risk management mechanism	**Business function**	**Linked key CCRA3 risk**	**CCRA3 Risk Name**	**Risk score (near term)**	**Risk score (medium term)**	**Risk score (long term)**		**Risk score (near term)**	**Risk score (medium term)**	**Risk score (long term)**	**Risk description**	**Action**	**Validation**	**Activity 2015-2021 against action plan to mitigate risk**	**New Data that may change risk**	**Round 3 Amendment**	**Risk score (near term)**	**Risk score (medium term)**	**Risk score (long term)**
Capital Planning	Abstraction	I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	2	2	4		2	2	4	Accelerated abstraction asset deterioration (from wetting and drying cycles)	Consider future climates when procuring new or replacement long term assets.	Continue to monitor asset performance data for capital maintenance planning.	Routine asset performance monitoring. Review of research to guide assessment of future trends		No change	2	2	4
Capital Planning	Abstraction	I3	Risks to infrastructure services from coastal flooding and erosion	2	2	4		2	2	4	Abstraction asset loss or outage from coastal change	No action required on existing assets. Consider risk when developing new assets. Review next round of coastal change projections and management policies. Continued engagement with regional planners.	Existing raw water quality monitoring will identify any salinity events.	Review of regional coastal flood defence plans		No change	2	2	4
Capital Planning	Raw transport	I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	2	2	4		2	2	4	Reduced raw water transportation pump (M&E) efficiency	No action required on existing assets. Consider future temperature exposure when procuring replacement assets.	Continue to monitor asset performance and energy data.	Routine asset performance monitoring. Review of research to guide assessment of future trends		No change	2	2	4
Capital Planning	Potable transport	I7	Risks to subterranean and surface infrastructure from subsidence	4	4	4		4	4	4	Accelerated asset deterioration of MDPPE and HPPE water mains (wetting and drying cycles; earth movement)	Consider future climates when developing new or replacement long term assets.	Continue to monitor asset performance data for capital maintenance planning.	Routine asset performance monitoring. Review of research to guide assessment of future trends		No change	4	4	4
Capital Planning	Raw transport	I8	Risks to public water supplies from reduced water availability	4	4	4		4	4	4	Raw water boosters asset loss from coastal change	Consider future climates when developing new or replacement long term assets. Review next round of coastal change projections and management policies. Continued engagement with regional planners.	Continue to monitor asset performance data.	Review of regional coastal flood defence plans		No change	4	4	4
Capital Planning	Treatment	I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	1	2	3		1	2	3	Reduced treatment pump (M&E) efficiency	No action required on existing assets. Consider future temperature exposure when procuring replacement assets.	Continue to monitor asset performance and energy data.	Routine asset performance monitoring. Review of research to guide assessment of future trends		No change	1	2	3
Capital Planning	Potable storage	I3	Risks to infrastructure services from coastal flooding and erosion	3	3	3		3	3	3	Asset loss or outage of service reservoirs from coastal change	Consider future climates when developing new or replacement long term assets.	Review next round of coastal change projections and management policies. Continued engagement with regional planners.	Review of regional coastal flood defence plans		No change	3	3	3
Capital Planning	Potable transport	I3	Risks to infrastructure services from coastal flooding and erosion	2	2	2		2	2	2	Population migration away from coastal change (network sizing)	Consider future climates when developing new or replacement long term assets.	Review next round of coastal change projections and management policies. Continued engagement with regional planners.	Continued engagement with regional planners.		No change	2	2	2
Capital Planning	Abstraction	I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	2	2	2		2	2	2	Reduced abstraction pump (M&E) efficiency	No action required on existing assets. Consider future temperature exposure when procuring replacement assets.	Continue to monitor asset performance and energy data.	Routine asset performance monitoring. Review of research to guide assessment of future trends		No change	2	2	2
Capital Planning	Abstraction	I8	Risks to public water supplies from reduced water availability	2	2	2		2	2	2	River Itchen intake too high due to low flows	No action required.	Continue to monitor intake yields.	Continued to monitor intake yields.		No change	2	2	2
Capital Planning	Raw transport	I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	2	2	2		2	2	2	Accelerated asset deterioration of raw water booster assets (wetting and drying cycles)	Consider future climates when developing new or replacement long term assets.	Continue to monitor asset performance data for capital maintenance planning.	Routine asset performance monitoring. Review of research to guide assessment of future trends		No change	2	2	2
Capital Planning	Treatment	I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	2	2	2		2	2	2	Accelerated deterioration of treatment assets (wetting and drying cycles)	Consider future climates when developing new or replacement long term assets.	Continue to monitor asset performance data for capital maintenance planning.	Routine asset performance monitoring. Review of research to guide assessment of future trends		No change	2	2	2
Capital Planning	Potable transport	I3	Risks to infrastructure services from coastal flooding and erosion	2	2	2		2	2	2	Potable water mains asset loss due to coastal change	Consider future climates when developing new or replacement long term assets.	Review next round of coastal change projections and management policies. Continued engagement with regional planners.	Review of regional coastal flood defence plans		No change	2	2	2
Capital Planning	Potable transport	H10	Risks to health from poor water quality and household supply interruptions	2	2	2		2	2	2	Increased seasonal (tourist) population (network sizing)	No action required.	Undertake network reinforcement as required.	Review of WRMP19 demand projections against network capacities		No change	2	2	2
Capital Planning	Raw transport	I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	1	1	1		1	1	1	Accelerated deterioration of raw water and potable storage assets (wetting and drying cycles)	Consider future climates when developing new or replacement long term assets.	Continue to monitor asset performance data for capital maintenance planning.	Routine asset performance monitoring. Review of research to guide assessment of future trends		No change	1	1	1
Capital Planning	Treatment	I3	Risks to infrastructure services from coastal flooding and erosion	1	1	1		1	1	1	Treatment asset loss or outage from coastal change	Consider future climates when developing new or replacement long term assets.	Review next round of coastal change projections and management policies. Continued engagement with regional planners.	Review of regional coastal flood defence plans		No change	1	1	1
Capital Planning	Potable storage, potable transport	I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	1	1	1		1	1	1	Reduced potable storage and potable transport pump (M&E) efficiency	No action required on existing assets. Consider future temperature exposure when procuring replacement assets.	Continue to monitor asset performance and energy data.	Routine asset performance monitoring. Review of research to guide assessment of future trends		No change	1	1	1
Capital Planning	Potable transport	I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	1	1	1		1	1	1	Accelerated deterioration of potable transport assets (wetting and drying cycles)	Consider future climates when developing new or replacement long term assets.	Continue to monitor asset performance data for capital maintenance planning.	Routine asset performance monitoring. Review of research to guide assessment of future trends		No change	1	1	1
Capital Planning	Potable transport	H10	Risks to health from poor water quality and household supply interruptions	1	1	1		1	1	1	Population migration away from flood risk (network sizing)	No action required.	Undertake network reinforcement as required.	None		No change	1	1	1
Resilience, Emergency Planning	Abstraction, treatment, raw and potable transport	I2	Risks to infrastructure services from river, surface water and groundwater flooding	3	9	12		3	9	12	Increased flooding to source and treatment works from rivers and groundwater	Review new flood maps as they become available. Risk already incorporated in to Emergency Plan. Consider future risk when procuring new or replacement assets.	Continued monitoring of asset performance and failure data.	Continued to review new flood maps if they became available. Continued considering future risk when procuring new or replacement assets.	None	No change	3	9	12
Resilience, Emergency Planning	Raw transport, potable transport	I2	Risks to infrastructure services from river, surface water and groundwater flooding	3	6	9		3	6	9	Increased flooding to pumping stations (raw and potable) and valves from rivers and groundwater	Review new flood maps as they become available. Risk already incorporated in to Emergency Plan. Consider future risk when procuring new or replacement assets.	Continued monitoring of asset performance and failure data.	Continued to review new flood maps if they became available. Continued considering future risk when procuring new or replacement assets.	None	No change	3	6	9
Resilience, Emergency Planning	Potable transport	I2	Risks to infrastructure services from river, surface water and groundwater flooding	3	6	9		3	6	9	Increased regional flooding from rivers and groundwater impedes routine mains repair	Review new flood maps as they become available. Risk already incorporated in to Emergency Plan.	Continued monitoring of asset performance and failure data.	Continued to review new flood maps if they became available.	None	No change	3	6	9
Resilience, Emergency Planning	Treatment	I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	2	4	6		2	4	6	Road melt events impede treatment works access	Incorporate in to Emergency Plan.	None.	None	None	No change	2	4	6
Resilience, Emergency Planning	Abstraction, raw transport, treatment, potable storage, potable transport	I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	3	3	6		3	3	6	Increased interruptions to telecommunications and telemetry	Ongoing monitoring.	Continued monitoring of asset performance and failure data.	Ongoing monitoring.	None	No change	3	3	6

				First Round				Second Round							Third Round					
Risk management mechanism	**Business function**	**Linked key CCRA3 risk**	**CCRA3 Risk Name**	**Risk score (near term)**	**Risk score (medium term)**	**Risk score (long term)**		**Risk score (near term)**	**Risk score (medium term)**	**Risk score (long term)**	**Risk description**	**Action**	**Validation**	**Activity 2015-2021 against action plan to mitigate risk**	**New Data that may change risk**	**Round 3 Amendment**	**Risk score (near term)**	**Risk score (medium term)**	**Risk score (long term)**
Resilience, Emergency Planning	Abstraction, treatment, raw and potable transport	I2	Risks to infrastructure services from river, surface water and groundwater flooding	2	2	4		2	2	4	Increased pluvial flooding to works and pumping stations	Review new flood maps as they become available. Risk already incorporated in to Emergency Plan. Consider future risk when procuring new or replacement assets.	Continued monitoring of asset performance and failure data.	Continued to review new flood maps if they became available. Continued considering future risk when procuring new or replacement assets.	None	No change	2	2	4
Resilience, Emergency Planning	Abstraction, raw transport, treatment, potable storage, potable transport	I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	2	2	4		2	2	4	Storm damage to above ground assets (buildings and overhead cables)	Risk already incorporated in to Emergency Plan. Consider future risk when procuring new or replacement assets.	Continued monitoring of asset performance and failure data.	Considered future risk when procuring new or replacement assets.	None	No change	2	2	4
Resilience, Emergency Planning	Potable transport	I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	2	2	4		2	2	4	Road melt events impede routine mains repair	Incorporate in to Emergency Plan.	None.	Incorporated in to Emergency Plan.	None	No change	2	2	4
Resilience, Emergency Planning	Potable transport	I2	Risks to infrastructure services from river, surface water and groundwater flooding	2	2	4		2	2	4	Increased regional pluvial flooding impedes routine mains repair	Review new flood maps as they become available. Risk already incorporated in to Emergency Plan. Consider future risk when procuring new or replacement assets.	Continued monitoring of asset performance and failure data.	Continued to review new flood maps if they became available. Continued considering future risk when procuring new or replacement assets.	None	No change	2	2	4
Resilience, Emergency Planning	Potable storage	I2	Risks to infrastructure services from river, surface water and groundwater flooding	3	3	3		3	3	3	Service reservoir monitoring equipment failure due to flooding	Review new flood maps as they become available. Risk already incorporated in to Emergency Plan. Consider future risk when procuring new or replacement assets.	Continued monitoring of asset performance and failure data.	Continued to review new flood maps if they became available. Continued considering future risk when procuring new or replacement assets.	None	No change	3	3	3
Resilience, Emergency Planning	Abstraction	I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	1	1	2		1	1	2	Road melt events impede abstraction works access	Incorporate in to Emergency Plan.	None.	None	None	No change	1	1	2
Resilience, Emergency Planning	Abstraction, raw transport, treatment, potable storage, potable transport	I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	1	1	2		1	1	2	Increased interruptions to electricity supply	Risk already incorporated in to Emergency Plan. Consider future risk when procuring new or replacement assets.	Continued monitoring of asset performance and failure data.	Considered risk when procuring new or replacement assets (e.g. Westergate WTW).	None	No change	1	1	2
Resilience, Emergency Planning	Raw transport	I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	1	1	2		1	1	2	Road melt events impede raw water boosters access	Incorporate in to Emergency Plan.	None.	None	None	No change	1	1	2
Resilience, Emergency Planning	Abstraction, raw transport, treatment, potable storage, potable transport	I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	1	1	2		1	1	2	Increased interruptions to electricity supply	Risk already incorporated in to Emergency Plan. Consider future risk when procuring new or replacement assets.	Continued monitoring of asset performance and failure data.	Considered risk when procuring new or replacement assets (e.g. Westergate WTW).	None	No change	1	1	2
DWSP	Raw water quality	H10	Risks to health from poor water quality and household supply interruptions	3	6	12		3	6	12	Lower river flows cause higher contaminant concentrations	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring.		No change	3	6	12
DWSP	Raw water quality	H10	Risks to health from poor water quality and household supply interruptions	4	8	10		4	8	10	Reduced cloud cover leads to increased biological growth in surface waters	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring.		No change	4	8	10
DWSP	Raw water quality	H10	Risks to health from poor water quality and household supply interruptions	4	6	8		4	6	8	Higher temperatures cause increased biological and bacterial growth in surface waters	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring.		No change	4	6	8
DWSP	Raw water quality	H10	Risks to health from poor water quality and household supply interruptions	4	6	6		4	6	6	Lower river flows cause warmer water and increased biological and bacterial growth in surface waters	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring.		No change	4	6	6
DWSP	Treatment	I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	2	4	6		2	4	6	Chemical supply chain disruption from regional heatwaves and floods	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring.		No change	2	4	6
DWSP	Potable transport	H10	Risks to health from poor water quality and household supply interruptions	3	3	6		2	2	4	Saline intrusion of potable water mains (metallic mains)	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring. Bursts repaired when required to prevent entry, and leak detection improved.		No change	2	2	4
DWSP	Raw transport (water quality)	H10	Risks to health from poor water quality and household supply interruptions	4	4	4		4	4	4	Saline intrusion of raw water mains (water quality risk)	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring.		No change	4	4	4
DWSP	Raw water quality	H10	Risks to health from poor water quality and household supply interruptions	2	4	4		4	8	8	Increased turbidity events from runoff (river and springs sources)	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring.		No change	4	8	8
DWSP	Potable transport and storage (water quality)	H10	Risks to health from poor water quality and household supply interruptions	2	2	4		2	2	4	Accelerated chlorine depletion in treated water (potable storage and transportation)	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring.		No change	2	2	4
DWSP	Potable transport (water quality)	H10	Risks to health from poor water quality and household supply interruptions	2	2	4		2	2	4	Regional flooding from groundwater and rivers causes infiltration of water mains; bacterial contamination risk	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring.		No change	2	2	4
DWSP	Treatment	H10	Risks to health from poor water quality and household supply interruptions	3	3	3		3	3	3	Increased bacterial growth in rapid gravity filters	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring.		No change	3	3	3

				First Round				Second Round						Third Round					
Risk management mechanism	**Business function**	**Linked key CCRA3 risk**	**CCRA3 Risk Name**	**Risk score (near term)**	**Risk score (medium term)**	**Risk score (long term)**		**Risk score (near term)**	**Risk score (medium term)**	**Risk score (long term)**	**Risk description**	**Action**	**Validation**	**Activity 2015-2021 against action plan to mitigate risk**	**New Data that may change risk**	**Round 3 Amendment**	**Risk score (near term)**	**Risk score (medium term)**	**Risk score (long term)**
DWSP	Potable storage (water quality)	H10	Risks to health from poor water quality and household supply interruptions	3	3	3		1	1	1	Saline intrusion of service reservoirs	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring.		No change	1	1	1
DWSP	Potable storage (water quality)	H10	Risks to health from poor water quality and household supply interruptions	3	3	3		3	3	3	Infiltration of service reservoirs from flooding	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring.		No change	3	3	3
DWSP	Raw storage (water quality)	H10	Risks to health from poor water quality and household supply interruptions	3	3	3		3	3	3	Increased flooding to raw water storage assets from rivers and groundwater; bacterial contamination, asset damage	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring.		No change	3	3	3
DWSP	Treatment	H10	Risks to health from poor water quality and household supply interruptions	1	1	2		1	1	2	Disturbance of flocculant blanket in treatment	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring.		No change	1	1	2
DWSP	Treatment	H10	Risks to health from poor water quality and household supply interruptions	2	2	2		2	2	2	Bacterial growth in rapid gravity filters	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring.		No change	2	2	2
DWSP	Treatment	H10	Risks to health from poor water quality and household supply interruptions	1	1	1		1	1	1	Algal growth in rapid gravity filters and clarifiers	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring.		No change	1	1	1
DWSP	Potable transport (water quality)	H10	Risks to health from poor water quality and household supply interruptions	1	1	1		1	1	1	Increased pluvial flooding leads to infiltration of potable water mains; bacterial contamination risk	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring.		No change	1	1	1
DWSP	Potable transport (water quality)	H10	Risks to health from poor water quality and household supply interruptions	3	3	3		3	3	3	Saline intrusion of potable water mains (non-metallic mains)	Incorporate risk into DWSP; operationally managed risk. Communicate climate and hydrology data.	Continued source-to-tap water quality monitoring.	Continued source-to-tap water quality monitoring.		No change	3	3	3