

SRN48 Operational Resilience Technical Annex

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**Southern
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Executive Summary

We remain committed to ensuring a safe and secure water supply for our customers and protecting the environment. We know that securing resilient water and wastewater services is key to addressing the growing pressures and long-term challenges our sector faces.

As part of our PR24 planning we have identified 6 challenges that we must address to improve our operational resilience. They include:

- Population growth and demand pressures
- Climate Change
- Drought
- Ageing assets
- Cyber security
- Transition to net zero

We understand our key challenges and how they impact us, and we know we need to act. We have taken several steps in ensuring we are delivering resilience benefits.

We have made great progress since our 2019 resilience action plan and have implemented Ofwat's recommendations on Initial Assessment Plan. The actions we have delivered have supported us in making considerable strides in a number of key areas to enhance our resilience, including:

- Embedding our integrated risk and resilience framework;
- Integrating our lessons learnt process to ensure we continue to learn and improve from our past failures;
- Developing clearly defined governance structures and;
- Embedding improved ways of working – focusing on horizon scanning and emergency planning to address current gaps in our capability and improve how we anticipate and respond to incidents.

Since delivering our 2019 resilience action plan we have been on a journey to improving our operational resilience and ensuring that resilience is embedded at the heart of our strategy. We recognise our performance challenges and acknowledge that we have not always gotten things right. However, we have identified and understood our key resilience challenges and have adopted a practical approach to solving them. Our AMP 7 activities were focused on delivering cost – effective and quick win solution to address our most pressing issues impacting our customers and the environment first. In AMP 8, we are focusing on enhancing our operational resilience to respond to our future challenges through programmes designed to bolster the resistance of our assets, introduce redundancy options, and enhance the reliability of our services.

In AMP 7 we made investments in several priority areas to improve our performance however the increasing effects of external pressures such as climate change have caused us to fall short of some of our performance targets. We are working hard to improve our performance and have introduced our Turnaround plan to deliver short sharp improvements by 2025.

As part of our journey, we have also understood the impacts of six of our most pressing resilience challenges: **Population growth and demand pressures, climate change, drought, ageing assets, cyber security and transition to net zero** and have adopted a practical approach to addressing them. Our approach focuses on identifying and delivering cost effective, quick win solutions to address the most

pressing issues impacting our customers and the environment first. We implemented programmes focused on improved anticipation, response, and recovery first as our review of past failures found that in most cases, had we gotten this right, we could have avoided or significantly reduced the impact.

In AMP 8 our focus is on adopting a more proactive approach to resilience through enhancing our resilience to our future challenges. Our approach aligns with Ofwat's view of resilience summarised within **Ofwat's 2022 Operational resilience discussion paper**. We are delivering on programmes which are providing us with improved asset health monitoring and transparency and supporting us in adapting and preparing for our future challenges. We have gone through a robust process to identify our long-term risks to operational resilience. Through our process, we identified 11 shocks and stresses which could impact our operations in the future and have completed our resilience assessment process to understand where investment need is required to mitigate or significantly reduce the impacts. The investments we are proposing in AMP 8 have gone through a comprehensive decision-making process to ensure that they deliver best value interventions that support us in meeting our targets, delivering our regulatory requirements, and securing resilient outcomes for our customers and the environment.

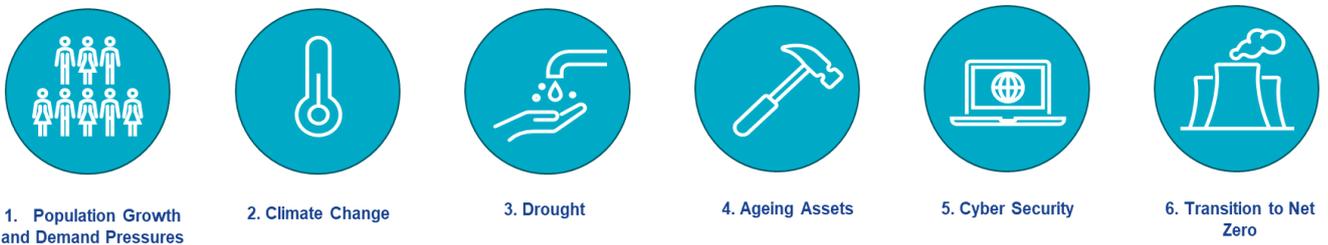
1. Our Progress Since PR19

At PR19, it was clear that we needed to make improvements in how we approached operational resilience based on Ofwat’s initial assessment of our plan. Since then, we have been working hard to deliver better outcomes for our customers and the environment through prioritising operational resilience. We took a best practice approach with our PR19 resilience action plan to support us in delivering tactical resilience wins and implemented Ofwat’s recommendations on the initial assessment of our plan. We are still on our resilience journey and are continuing to build on our performance learning lessons from past events, however we have made considerable strides in a number of areas including:

- Embedding our integrated risk and resilience framework at the heart of our operations
- Defining our practical approach to operational resilience
- Integrating our lessons learnt process within our operational resilience approach to ensure we continue to learn and improve from past failures
- Defining clear governance structures to support our decision-making process and;
- Embedding improved ways of working – focusing on horizon scanning and emergency planning to address gaps in our capability and improve how we anticipate and respond to incidents.

The improvements we have made will continue to support us in delivering our stretching targets and addressing our 6 key operational resilience challenges summarised in **Figure 1.** below. Further detail on our resilience challenges can be found in the *Resilience in the round* technical annex.

Figure 1: Our operational resilience challenges



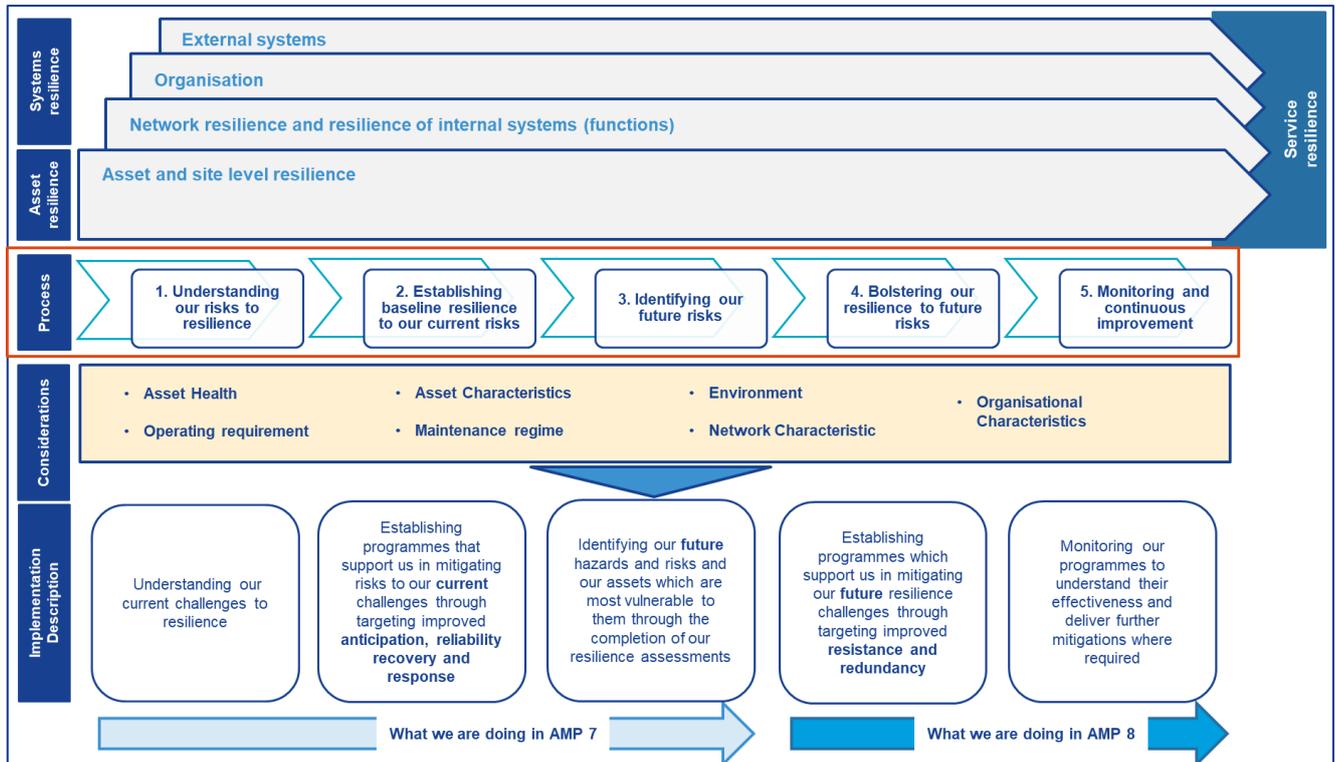
We understand our resilience challenges and how they impact our operations and have adopted a practical approach to addressing them. Our approach underpins everything we do to define a clear process to tackling our challenges and has helped shape our decision-making in AMP 7. We plan to continue to build on it in AMP 8 to support us in securing resilient outcomes for our customers today and for future generations.

2. Our Approach to Operational Resilience

We have adopted a practical approach to solving our existing and potential future operational resilience challenges. Our approach is focused on delivering cost effective and quick win solutions to address the most pressing issues impacting our customers and the environment first. Some of these solutions include improving our anticipation capability to avoid incidents and ensure we are better prepared and bolstering our recovery and response capability for improved resilience to disruptions.

Our practical approach draws from the integrated resilience framework to define a cost – effective strategy to addressing our challenges whilst maximising the beneficial impact for our customers and wider environment. Our approach provides a roadmap to ensure we are compounding the benefits we are already delivering from our ‘quick win’ solutions whilst considering the impact of future pressures on our operations to identify sustainable solutions. We are maturing on our journey using our approach in **Figure 2**.

Figure 2: Our approach to operational resilience



A key enabler of our approach is ensuring we deliver **systems resilience** - recognising the interconnectedness of various stages involved in wastewater treatment and water supply processes and how it can impact our operations. It is supporting us in understanding our challenges holistically for more effective decision making and interventions.

As part of our systems resilience approach, we are collaborating with other organisations to strengthen our ability to withstand challenges and deliver better outcomes. We are doing this by:

- ¹Partnering with other sectors including environmental organisations, government agencies and the farming sectors to deliver our **Catchment First programme**. The programme is helping us to improve the quality and quantity of water in our catchments. As part of this, we are actively engaging with farmers to ensure pesticide and herbicide concentrations in rivers are maintained at a level which does not overwhelm treatment processes and to reduce catchment sources of nitrates.²
- Collaborating with our distribution network operation (DNO) to identify solutions which support business continuity in the face of disruption.
- Collaborating with all our neighbouring water companies to deliver a resilient water future for the Southeast through the **WRSE Water Resources Regional Plan**.
- Working collaboratively with 75 organisations across our region to deliver our drainage and wastewater management plan (**DWMP**). With their input, we identified 14 planning objectives, building on the six common objectives used across the industry.

Our systems thinking approach is supporting us in addressing our resilience risks holistically and efficiently. We plan to continue this approach in AMP 8, working more collaboratively with the industry to address our most pressing challenges.

Our approach to operational resilience is underpinned by the **5 – step process** illustrated in **figure 2**. It addresses the key considerations for operational resilience within Ofwat’s operational resilience discussion paper to deliver the breadth and depth of information required to inform our investment prioritisation and decision making. Our 5 – step process is summarised further below.

2.1. Understanding our risks to resilience

Our challenges are already having an impact on our operations and the service we deliver today. Whilst we continue to reduce the number of pollutions we experience each year, we remained above our targets for 2022-23 largely due to increased frequency of extreme weather events, in particular more intense periods of rainfall. We know from our performance outcomes, feedback from our customers and engagement with our regulators that there are several operational areas we need to improve on including **pollution incidents, leakage, internal sewer flooding and sewer collapses**. We have adopted a bow-tie analysis approach to support us in understanding the end-to-end impact of our challenges on our performance areas so that we can manage the resulting risks through the delivery of effective mitigation strategies.

2.2. Establishing baseline resilience to our current risks

We completed a bow tie analysis for each of our key performance impacts to link the root cause and resulting impacts. Using the outputs from our analysis, we were able to identify and prioritise high impact quick win solutions. Our findings showed that it would be more impactful to initially prioritise implementing **anticipation, response, and recovery** solutions as in many cases, improved anticipation, and prompt response and recovery could have avoided or significantly reduced the impact³. Prioritising addressing these

¹ [About Catchment First \(southernwater.co.uk\)](https://www.southernwater.co.uk)

² Southern water draft WRMP 24

³ Southern Water: Resilience action plan

elements first also enables us to identify and address capability gaps across the business, to ensure that baseline processes, knowledge and cultures are established and continuously developed.

The programmes established to date are at various stages of maturity and are part of our ongoing commitment to improve our current performance. Through the programmes, we have built structured processes which have improved horizon – scanning and utilised lessons learned from previous incidents to drive better response and recovery. Our programmes are summarised in **figure 3** below and we have mapped them to the challenges they are responding to, demonstrating how they are impacting our current performance. We have also indicated the area of focus for resilience across the Anticipation and the 4R's of resilience.

Figure 3: Maturity of our key AMP 7 resilience programmes and how they are impacting our current performance

| Our challenges | What we are doing in AMP 7 | | | | | | | | | | What are the expected AMP 7 performance outcomes | | | | | | |
|------------------------------|----------------------------------|-------------------------------------|---|----------------------------|--|---|--|--|---|--------------------------|--|---------|----------|-------------------|------------------|----------------|---------------|
| | Sewer Level Monitoring programme | Unplanned outage recovery programme | Control centre transformation programme | Proactive analytics centre | Drought measures development programme | PIRP - Platinum Health Checks top 250 MPS | Asset Health Monitoring and Maintenance strategy | Incident Management and response programme | Asset Management Transformation Programme | Smart Metering programme | Pollutions | Leakage | Flooding | People Capability | Unplanned Outage | Sewer collapse | Mains repairs |
| Drought | | ● | | | ● | | ● | | ● | | | | | | | | |
| Climate change | ● | | ● | ● | | ● | ● | | ● | ● | | | | | | | |
| Population Growth and demand | | ● | ● | | ● | | | | | ● | | | | | | | |
| Transition to Net zero | | | | | | | ● | | | | | | | | | | |
| Rapid changes in technology | | | | | | | | | | | | | | | | | |
| Cyber security | | | | | | | | | | | | | | | | | |
| Ageing Assets | | | | | | | ● | ● | | | | | | | | | |
| Capability | | | | | | | | | | | | | | | | | |
| Alignment to 4R's + A | | | | | | | | | | | | | | | | | |
| Anticipation | ✓ | | ✓ | ✓ | ✓ | | | | | ✓ | | | | | | | |
| Reliability | ✓ | | | | | ✓ | ✓ | | | ✓ | | | | | | | |
| Resistance | | | | | | | | | | | | | | | | | |
| Redundancy | | | | | | | | | | | | | | | | | |
| Response and recovery | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | ✓ | | | | | | | |

| | No/ low benefit realised in AMP 7 | Table 1.6 Maturity Key | |
|--|-----------------------------------|------------------------|---------------------------------------|
| | | ● | Programme fully integrated within BAU |
| | Benefit realised in AMP 7 | ● | Programme fully rolled out |
| | | ● | Programme partially rolled out |
| | High benefit realised in AMP 7 | ● | Programme designed |

3.3. Programmes targeting improved anticipation, response and recovery

3.3.1. Sewer Level Monitoring Programme

Our sewer level monitoring programme is part of our wider Pollution Incident Reduction Programme (PIRP) and supports our ambitions for zero pollutions by 2040. It is also a key part of our flood reduction plan. Sewer blockages are the primary root cause for flooding and a major contributor to pollution incidents. Across the water industry it was estimated that blockages from wet wipes alone cost UK companies £100m a year to deal with⁴. Our sewer level monitoring programme is designed to help us improve on our performance by leveraging smart technology to digitise our sewer network and drive down our pollution and flooding incidents.

Our sewer level monitoring programme targets increased network visibility using industry leading monitors and artificial intelligence to support us in improving our anticipation of risks and deliver preventative measures. To date we have installed over 24,000 monitors across our region⁵. We carried out an extensive review of our sites to identify our locations for installations considering pollution and flooding data and reviewing proximity to watercourses to ensure we targeted our most critical sites. The sensors monitor the depth and flow of water in our waste network and indicate where potential issues could arise.

Our investment in sewer level monitoring provides coverage of our network and enables much better resolution in the network in real time. It has also enabled us to detect issues on our network which may have gone undetected or picked up too late by our previous monitors. In the financial year ended 2023, our monitoring programme supported with preventing 3 CAT 3 pollutions, 11 internal floods, and 110 external floods⁶.

3.3.2. Proactive Analytics Centre

Our proactive analytics centre has been established as part of our strategic drive to bring down pollution incidents. Our 2021-22 pollution performance evidenced the impact of the increasing tendency for periods of intense rainfall on our operations as our incidents remained well above our Ofwat targets. Our bow tie analysis of pollution events identified that for most incidents, the root cause was not fully understood or treated before reactive interventions were triggered and therefore issues were not comprehensively identified or addressed. Our findings also showed that we did not have a consistent approach for utilising existing data to generate proactive interventions. To address this, we stood up our proactive analytics centre in February 2022. The programme has been designed to address capability gaps which existed in its predecessor analytics team and support us in effectively analysing and triaging real time signals and sensors for a more efficient response⁷. The team utilise machine learning and big data including historic and current sewer level data, and hyperlocal rainfall data to support improved anticipation of risks to our services. The programme delivers improved monitoring and analytics on our wastewater pumping stations and our rising mains:

⁴ Southern Water – Innovative sewer technology to tackle blockages

⁵ Southern Water Monitoring Equipment and machine learning

⁶ SLM Benefit Tracker July 2023 – [REDACTED]

⁷ PIRP Y3 Business Case Control centre and Proactive analytics centre

Proactive analytics centre - wastewater pumping stations (WPS)

In 2022, 32% of our pollution incidents were due to failures at our wastewater pumping stations. Our proactive analytics team used information including wet well trend data to identify possible disruptions before they occur. Various other data sources are also used to create exception reports and identify at risk areas where proactive action can be taken to prevent pollutions and floods, reduce WPS energy costs and prevent reactive interventions.

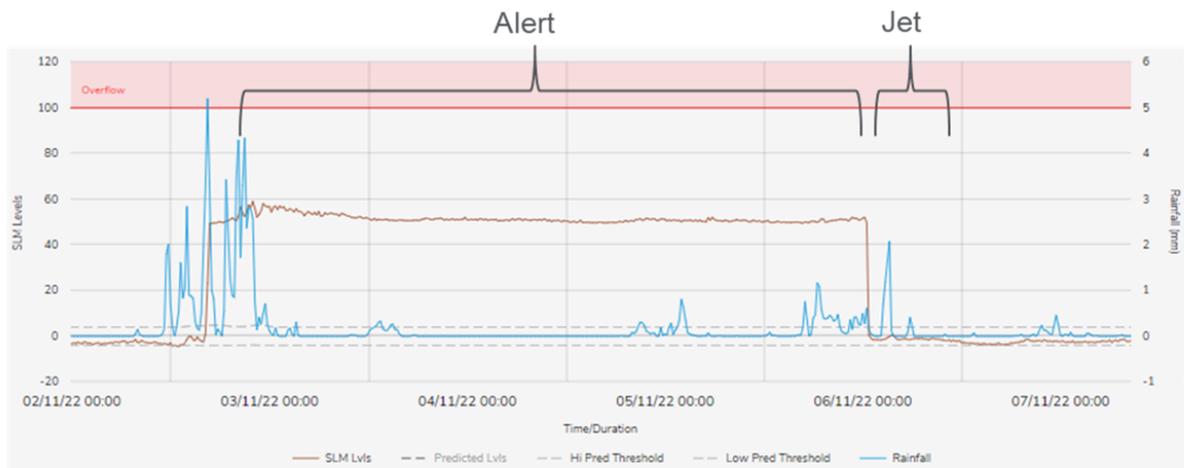
Proactive analytics centre – Rising main anomaly detection

Analysis from our pollution bow ties also showed that our rising mains also demonstrate a lack of resilience in wet weather and improvements to our WPS performance has resulted in increased risk to our fragile rising mains. To address this, our proactive analytics team make use of existing data to detect issues with our rising mains before they occur or escalate. Early detection of transient pressure in rising mains allows identification of at-risk areas where appropriate action can be taken to prevent pollutions, floods and sewer bursts.

Our proactive analytics centre has replaced our previous analytics team to significantly enhance our anticipation capability, deliver proactive intervention where required and improve our response and recovery to disruptions on the network. We are continuously improving and enhancing the capability of the team, through our lessons learned process and we will continue to build on the developments we have made in AMP 8.

Proactive Response Example: Woolley Road Vinters Park Parkwood

An alert was raised on the 4th November on our sensor on Woolley Road Vinters Park Parkwood due to blockage on the sewer. Our proactive analytics team reviewed the exception data and raised a high priority same day work order to investigate. Once the root cause of the alert had been identified, a jetting crew was dispatched to deliver proactive maintenance and prevent disruption on the network.



3.3.3. Incident management and response programme

As part of our lessons learnt process, we have completed deep dive reviews on our past failures to understand root causes linked to the 4R's of resilience plus anticipation. Our review found that in most cases, enhancing our anticipation, response and recovery could have avoided or significantly reduced the impact of disruptions in most cases. Our plan to address these gaps resulted in the development of our incident management and response programme.

This incident management and response programme was designed to allow us to identify emerging risks earlier so that we can respond quicker to minimise the impact of operational incidents. The programme implemented improvements in:

- **People** – introducing defined incident management and continuous improvement and training roles
- **Processes** – embedding new continuous improvement processes to learn from our operational incidents and improve our responses to similar incidents when they occur in the future.
- **Systems** – implementing new incident escalation matrices to enhance our decision-making processes.

The improvements we have made are supporting us in improving our anticipation capabilities, through embedding improved ways of working, focusing on horizon scanning and emergency planning. A key outcome of the programme was a complete reorganisation of our control centre through our control centre transformation programme.

Our control centre transformation programme was initiated in 2019 commencing with a review of our operations centre and our incident management review process to identify gaps or opportunities for efficiencies. As a result, we implemented an organisational redesign, which has resulted in increased monitoring activities and headcount in key roles within our operational teams to support faster response times. Our control centre is monitored 24/7, with an on-shift Operational Control Manager retaining holistic oversight and responsibility over both water and wastewater operations. The improvements we have made are supporting us in delivering improvements in our response times and implementing preventative measures to minimise disruptions.

3.4. Programmes targeting improved reliability

3.4.1. Asset health monitoring and maintenance strategy

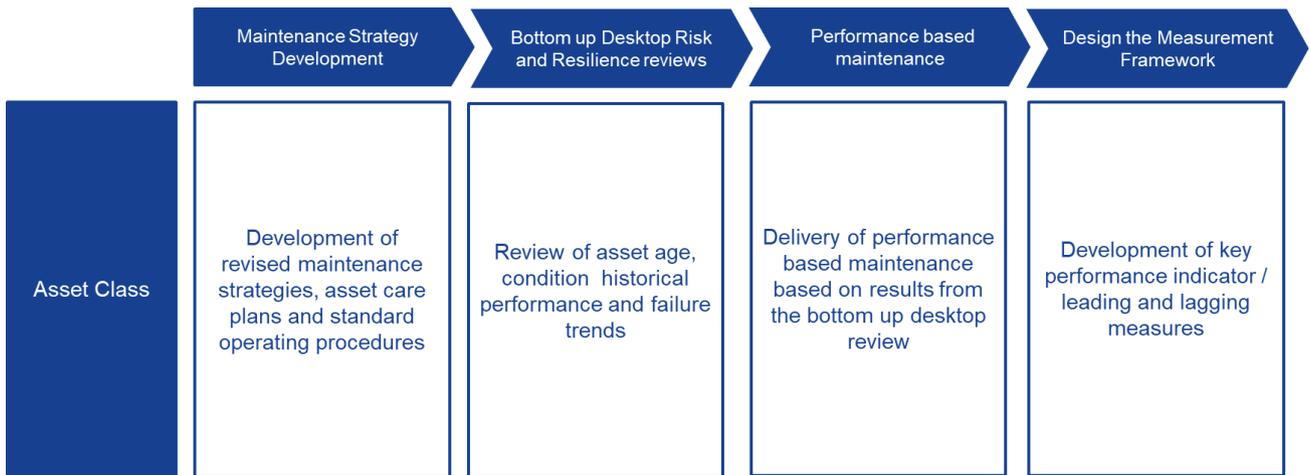
Tackling asset health is one of our most significant opportunities to improve our operational resilience. We know that our assets are ageing with many coming to the end of their useful lives. We also recognise that our Victorian era infrastructure were not designed to withstand the current challenges we are experiencing or the increasing pressures we will face in the future. Coupled with the fact that we have relatively low maintenance maturity, and limited customer willingness to pay for asset renewals, we face a significant challenge to ensure our assets are operating at optimal capacity and that we are delivering our obligations and our customers growing expectations. We are working hard to address these challenges and deliver a more reliable asset base and our asset health monitoring and maintenance strategy programme has been critical to delivering this.

Our asset health monitoring programme is designed to drive continuous improvement in the overall reliability of our asset base. Through the programme we are undertaking comprehensive assessments of our assets including age, performance and failure trends and overlaying this information with other data including criticality and location. We are collecting, monitoring and analysing our asset health information and using it

to support more informed decision making, to ensure that our assets are delivering at their optimal output level⁸.

As part of this, we have introduced a new asset health and reliability framework, designed to support the programme and ensure a clearly defined methodology and approach to our programme. Our framework summarises a four-step approach to delivery. To date our approach has been rolled out across our inlet screens and our wastewater pumping stations.

Figure 4: Our asset health and reliability methodology



We are completing bottom – up risk and resilience reviews to understand the condition of our assets. The output from our assessment facilitates our understanding of where performance - based maintenance is required and supports us in developing key performance indicators to enable us to proactively identify future disruptions.

We have initiated our comprehensive assessment of our assets to understand their current condition and level of performance. We successfully piloted the programme on inlet screens and have started to roll it out across our asset base starting with wastewater pumping stations. As part of our process, we are capturing key asset data to support us in managing our assets, and feed into our maintenance strategy and asset lifecycle strategy. Through our top-down risk and resilience reviews, we are collecting information on our assets including asset condition, historical issues, asset age, and overlaying it with data on failure trends and reactive maintenance. This information is fed into our unified risk model, which enables us to prioritise sites where intervention is required based on criticality, to deliver performance - based maintenance. Asset information is also used to develop key performance indicators for our assets to support in proactively identifying future disruptions. Through this programme we are on a journey to developing a comprehensive list of leading and lagging measures across which will be systemised and used to provide a richer picture of our asset condition for improved performance outcomes. Our leading and lagging measures are used to predict the future performance of our assets by using either forward looking metrics, or past performance to guide predictions.

⁸ Southern Water- Maintenance Steering Group (ToR)

We are reviewing our current maintenance strategies against our asset data and information to understand current gaps and develop a revised maintenance strategy for our assets within the context of capability requirements, frequency of execution and efficiency optimisations.

In the past, our maintenance strategies have had low maturity largely due to our wider data challenge. As a result, we are reviewing our maintenance strategies for each of our equipment classes against that data we are collating on our assets, to understand maintenance coverage gaps and introduce revised strategies where required. Our strategies are also positioned within the context of core capabilities required to effectively execute the strategy to ensure that all maintenance is delivered in line with requirements. Our maintenance steering group are required to review and sign off any revisions to our maintenance strategy to ensure appropriate challenge and decision making.

Our asset health monitoring and maintenance strategy programme is in its early stages of delivery. To date, we have developed revised maintenance strategies across our entire asset base. A key component to the successful delivery of the programme is around our data and how we harvest and analyse it. We recognise the data challenges we face, which is consistent with the challenges faced across our sector. Our enterprise asset management system comprises of several legacy systems and databases which are not well integrated or connected making data siloed and difficult to extract meaningful insights. Our challenge around data impacts every part of our business and impacts our ability to deliver our asset management strategies. **To address this, we launched our operational asset management programme - our largest transformation programme to date** designed to transform how we manage and maintain both our above ground and below ground assets through the implementation of Maximo. The Maximo solution will support us in delivering our Enterprise Asset Management, displacing legacy applications to transform how we manage our assets. The programme will deliver more reliable and meaningful asset information linking data sources to provide actionable insights which will feed into our wider strategy. Our operational asset management programme is further detailed below.

3.4.2. Pollution Incident Reduction Plan – Platinum health checks programme

Our Pollution Incident Reduction Plan (PIRP) is our ongoing operational programme focussed on reducing pollution incidents. We published our first PIRP in August 2020 and are now in the fourth year of delivery. To date, our overall number of pollutions have continued to decrease, and we delivered a 7.5% reduction in pollutions in 2021-22 against the previous year⁹. One of our key workstreams on the programme is supporting us in delivering resilience improvements for our wastewater pumping stations.

Pollutions associated with wastewater pumping stations (WPS) have continued to remain an industry outlier with poor resilience demonstrated in this asset class during periods of heavy rainfall. Our platinum health check workstream prioritises the top 280 WPS sites to eliminate asset failures due to Electrical Mechanical and ICA failures¹⁰. These wastewater pumping stations were selected based on sites with repeat pollutions in the last three years and were prioritised by their impact on the environment.

⁹ SWS Environment+ Pollution Incident Reduction Plan 2022

¹⁰ Effectiveness of Previous Interventions - [pirp-july-2023.pdf \(southernwater.co.uk\)](#)

In delivering the programme, we utilised our asset health and reliability framework, to complete our site surveys, testing the sites against performance metrics including permit compliance and alarm data and asset redundancy to develop our understanding. In AMP 7 we invested £5.4m for the workstream and have begun delivering maintenance repairs at 52 of our sites. As a result of this, we are forecasting a delivery of £2.4m in benefits realised through the reduction of c.30 Cat 3 pollution incidents per year. Once completed we will implement new operational maintenance strategies and outline plans for future maintenance.

The programmes summarised are some of our key solutions delivering capability improvements supporting better anticipation response and recovery and securing asset reliability. To ensure these programmes are sustained, we have simultaneously embarked on a journey to improve our asset management capability and secure ISO55k. Our transformation roadmap outlines our strategic plan to implementing key activities targeted at improving our asset data, processes and organisational capabilities to effectively embed our proactive risk approach and maximise our asset value.

3.4.3. Asset Management Transformation programme

Our asset management transformation programme is supporting us in optimising our asset value and organisational capabilities to ensure we deliver our strategic objectives. We know our challenges are growing and intensifying and recognise that we need to re-evaluate our approach to managing our assets to improve the reliability of our data and drive effective investment decisions that support both our short term and longer-term priorities.

The transformation of our asset management capability is central to delivering a successful turnaround plan. We have started making significant investments in our Operational Asset Management (OAM) systems to improve our maintenance and operations, increasing our understanding of our asset performance and risks. **We now need to invest further to uplift our asset management capability, invest in our people, data, and digitise our processes.** Our transformation programme will support us in delivering in 6 key areas:



Developing our asset management capability

We will improve, retain and attract the right talent and capabilities across all facets of the asset lifecycle. We have developed our capability and skills mapping framework mapping key decisions, systems and processes to understand where capability gaps exist. The outputs from the capability map will be used to inform colleague development plans to guide required skills and trainings. It will also allow us to identify careers pathways, support recruitment strategies and AMP 8 deliverables.



Developing our systems thinking

We will improve our capability to plan, monitor and visualise our performance, and risks through a system– thinking lens, and collaborate better with other organisations to become more connected within our planning processes. We have already started delivering this in developing our WRMP 24, working closely with the WRSE to develop a regional plan and have identified potential options for resource sharing. We developed our DWMP in collaboration with 75 organisations across our region and we also introduced our Catchment First programme during AMP 7, which is our commitment to put the wellbeing of the environment at the centre of our decisions. The programme moves away from utilising traditional engineering solutions to adopt a more collaborative approach, working with partners to deliver sustainable outcomes. We plan to continue this this collaborative approach, to improve our understanding of our risks, value and performance at a system level.



Improving our long – term planning capability

We will develop our long-term planning capability to ensure we are testing the trade-offs in decision making and run scenarios to understand their impacts. We are already doing this regionally with other water companies with the WRSE to consider a range of potential futures relating to abstraction licence changes, growth and climate change and understand how it impacts our plan. We have also recently published our wastewater DWMP, which provides an assessment of our future needs over a 25-year horizon. We plan to follow this approach across the rest of our long-term plans using the lessons learnt to improve outcomes.



We are investing in our asset health

We are improving our understanding of asset health and the impacts of solutions delivered within the AMP. Our asset health monitoring programme is integral to this, supporting us in transforming the way we deliver asset maintenance, moving away from a fix-on-fail regime to delivering proactive maintenance. The programme will also support in delivering several of the elements of Ofwat's integrated monitoring framework including the development of leading and lagging measures.



Digitisation of the asset lifecycle

We want to digitise the asset lifecycle to improve our understanding of risk and performance at every stage of our process. This will enable us act faster with better insight. We are currently utilising different PIONEER modules to support our asset lifecycle process, however our operational asset management programme will further enhance our capability and support full digitisation of our processes.



Investing in data and Insight

We want to improve our data maturity with focus on linking our data points to generate the needed insights in areas we know will add the most value. Our operational asset management programme will be key to this, using Maximo to manage the entire asset lifecycle from design to disposal for our above and below ground assets. Our data will be more connected and generate improved insights

A key element in our asset management transformation programme is the improvement of our systems which will be delivered by our operational asset management programme (OAM).

We are improving our operational asset management systems redesigning how we plan, schedule, maintain and operate our assets. Our OAM programme is designed to transform how we manage all our above and below ground assets. It defines the end-to-end process by which we invest, operate, maintain, repair and replace our network assets in order to service our customers. The programme is key to achieving our strategic goals, enabling us to simplify our processes and update our legacy systems so that we have more efficient tools when servicing our customers¹¹.

¹¹ SW – Operational Asset Management (OAM) Overview_May2023

Figure 5: Benefits of our operational asset management programme



Our OAM programme is on track to be delivered by the end of 2025 and will consist of the implementation of two new systems: **IBM Maximo** and **ESRI ArcGIS**.

Maximo will replace our Ellipse system, transforming how we manage and maintain our assets

IBM Maximo will be our new work management system designed to introduce best in class processes and ways of working. Maximo will replace Ellipse in managing the entire asset lifecycle from design to operational life to disposal for our above and below ground assets. The Maximo roll out will occur across two releases with the

roll out for above ground assets on the Isle of Wight planned for October 2023 and release dates planned for the rest of the region following this. Below ground roll out of the programme will be completed by March 2025. Its implementation will provide structured asset register for our assets in one place, enable our work orders to be created, planned, scheduled and executed within the system, and enhance our logistics capability with storerooms and inventory set up in the system enabling us to manage stock reservation, issues, orders and returns.

ArcGIS will replace our two existing GIS applications (Map guide and Ops Eye View) and provide improved geospatial capability

The transition to using ARCGIS is well into delivery and implementation phase with the two key enterprise systems in Corporate GIS and Enterprise Asset Management (EAM) being implemented based on the detailed design phase which has been completed¹².

Corporate GIS Phase One was successfully rolled out in Q1 2023 and is based on the adoption of the ArcGIS Utility Network model. The new GIS package (provided by ESRI) will have been delivered for all

¹² SRN 2019_00008 Information Management Annual Report 2023 v1 (003)

areas by 2025. The new system will enable increased accuracy and other advanced geospatial data analytical capability. The technology delivery of EAM Phase One remains on track with initial delivery underway in Q1 2023. Integration of the two systems is planned in Q2 2023 onwards. Following the phase one deliveries, both systems will be subsequently integrated during phase two to deliver an integrated asset management solution, providing the underlying asset management data for both the above and below ground assets. In parallel, activities concerning the business change needs and business data migration are being implemented to drive the transition, roll-out and go-live strategy across our business.

The programmes we have implemented to date are designed to provide resilience to our **current** operational disruptions and **improve our ability to anticipate and respond** to them, whilst ensuring **our assets perform reliably**. They represent the earlier part of our roadmap to delivering robust operational resilience and focusing on minimising the impacts we currently experience. We are collecting data on our assets to deliver more effective maintenance regimes, improving our organisational capabilities for better anticipation and response to disruptions. This positions us well to align with Ofwat's integrated monitoring proposals.

2.5. Identifying our future risks

The initial stages of our operational resilience approach addresses our current risks to resilience however we know the intensity and frequency of the impacts resulting from our challenges will continue to increase. We have taken a proactive approach to understanding our **future** risks by completing climate and resilience assessments. Our assessments have supported us in identifying our sites most vulnerable to future shocks and stresses to understand where intervention is required to mitigate the impact. Further detail on our climate and resilience assessments can be found in **section 3.0 Climate and operational resilience assessments**.

2.6. Bolstering our resilience to future risks

We are proposing 5 resilience enhancement cases for AMP 8 to address our sites identified by our climate and resilience assessments as most critically impacted by future shocks and stresses. The enhancement cases address our risks through strengthening our assets to deliver **resistance** to shocks and stresses and delivering network **redundancy** to mitigate the impacts of our threats. Further detail on our enhancement cases and forecasted benefits they will deliver can be found in **section 4.0 AMP 8 action plans**.

2.7. Monitoring and continuous improvement

We will continue to monitor the effectiveness of our programmes in delivering resilience and better outcomes for our customers and wider environment. We have integrated our lessons learnt process within our approach to ensure we continue to improve our processes and enhance our resilience.

Our approach to operational resilience reflects our journey to date and how we plan to continue to refine and improve going forward. We are taking steps to ensure that we continue to manage our current and long-term risks whilst embedding and maturing our journey. As part of this, we have implemented several of the recommendation from Ofwat's 2021 **Asset Management Maturity Assessment (AMMA)** recommendations, including:

- Developing a competency assessment framework to support in identifying areas where we need to formalise learning and development pathways for asset management.
- Collaborating with industry partners to understand our risks and drive efficient interventions and;
- Developing natural and social capital tool to quantify the natural and social environmental value that solutions provide so that it can be used as part of the decision-making process.

Since the AMMA we have delivered on organisational changes to mature our asset management capability and support us in securing resilient outcomes. The changes we have made have been key to addressing our current challenges and helping us prepare for our future risks. We have continued to build on this by delivering more targeted assessments of our operational resilience. Section 3.0 provides further detail on how we have used these assessments to drive the identification of our investment need for our 5 AMP 8 resilience enhancement cases.

3. Climate and Operational Resilience Assessments

We are moving towards a more **proactive** approach to resilience to enable us to better anticipate and prepare for future risks. We have leveraged our integrated risk and resilience process to understand the effects of our challenges and how it could impact our operations to develop AMP 8 solutions for prioritisation. **Our climate and operational resilience assessments** have provided a structured process for understanding where intervention is required. The assessments have helped us to understand the impact of **shocks and stresses** on our assets, the extent to which our current mitigations reduce the impact and the residual risks that need to be addressed.

Figure 6: Our integrated risk and resilience process



3.1. Identification

An outcome of delivering our resilience action plan was the development of a comprehensive list of **shocks and stresses** that could impact our operations. Through a series of workshops, we engaged core functions to support in compiling the shocks and stresses which could impact our operations and validated our findings through external review and expertise. In developing the list, the team considered several factors including;

- Shocks/stresses already impacting our operations,
- Impact of climate change and nature and;
- Characteristics of our current asset base (*location, age, and wider socio-economic indicators highlighting a growing propensity of issues*)

Through this process, we identified **11 shocks/stresses**, all of which are aligned to our operational resilience challenges in **table 1** below. We have established a risk and resilience team, who monitor these shocks and stresses and ensure they progress through the subsequent stages of **analysis** and **evaluation** and feed into our investment planning process to develop **treatment and mitigation solutions**. The team are also responsible for ensuring the tools and methodologies are available in the business for monitoring and reviewing these resilience risks.

Table 1 Relevant shocks and stresses that could impact our future operations

| | Shocks and stresses | Related Challenges | Water / Wastewater |
|----|---|--------------------|----------------------|
| 1 | Flood risk from rivers, surface water and the sea (tidal) | Climate change | Water and Wastewater |
| 2 | Coastal erosion | | |
| 3 | Subsidence | | |
| 4 | Power Interruptions/ Power Outage | | |
| 5 | Heat Stress | | |
| 6 | Saline intrusion | | |
| 7 | Cyber Security | Cyber Security | Water |
| 8 | Malicious Damage | Population Growth | |
| 9 | Critical Asset Failure | Ageing Assets | |
| 10 | Loss of raw water | | |
| 11 | Contamination | | |

3.2. Analysis and evaluation

The 11 shocks and stresses summarised within our identification phase are our long list of future threats to resilience. Our **analysis and evaluation** phase is a four-stage process to identify sites which require resilience intervention.

Phase 1: We used GIS mapping and FME software to identify our sites at risk to our 11 shocks and stresses

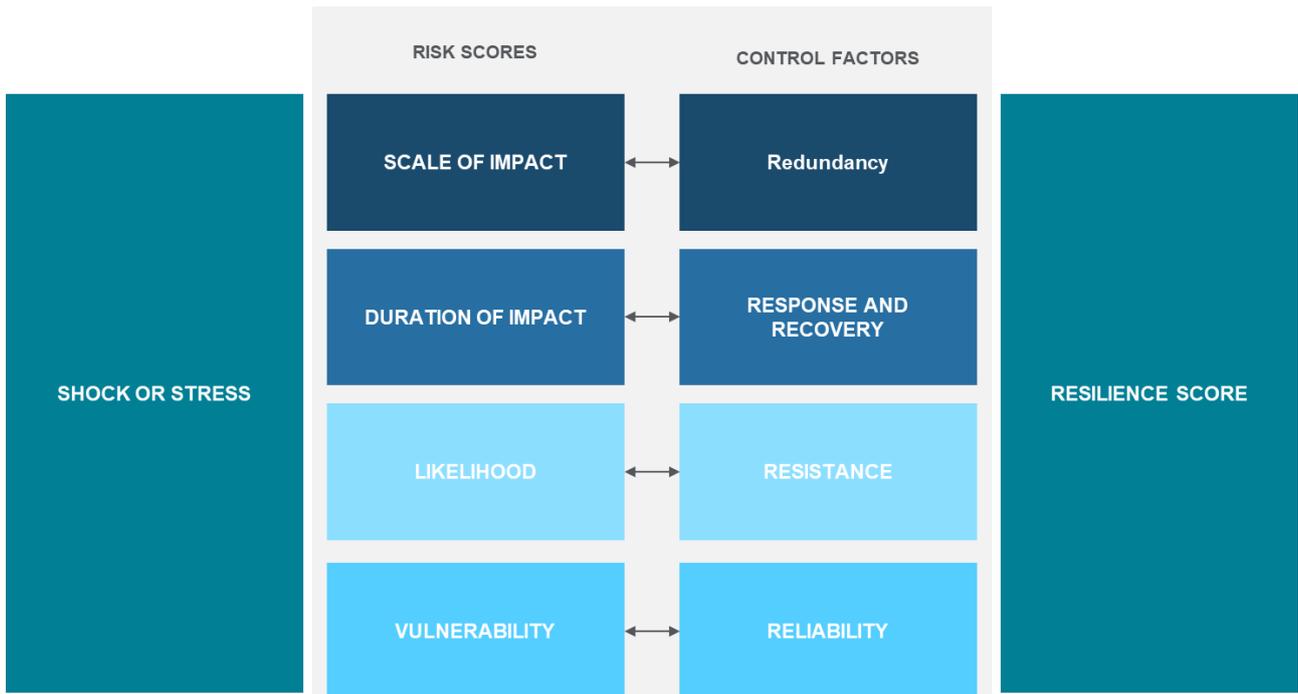
In 2022 we engaged ██████████ to carry out a high – level assessment on 18000 of our operational assets using the latest UK Climate Projections ('UKCP18'). Geographical Information Systems (GIS) and Feature Manipulation Engine (FME) software was used to overlay our assets and identify those at highest risk of susceptibility to the hazards. The mapping output identified a total of 1756 assets (about 10%) that could become vulnerable to the shocks and stresses based on their location¹³.

¹³ Climate Change Risk Assessment for PR24 Investment Planning – Phase 1: Technical Methods and Initial Results

Phase 2: We carried out our resilience assessment against our 1756 assets using our resilience modelling tool to understand their ability to withstand the shocks and stresses

The sites identified as 'at risk to the threat' were taken through our resilience assessment process to identify those critical for prioritisation. Our impact focused resilience assessment methodology frames resilience in within a vulnerability (susceptibility to the threat and its impact) and capabilities (control factors which support the mitigation of risk) context to quantify resilience and understand where interventions are required¹⁴.

Figure 7: Our resilience assessment methodology



Our resilience assessment tool enables us to update our resilience assessments directly using live data. The tool is linked to several data sources and databases including our condition monitoring systems, which provide live information on our sites including impact on service.

¹⁴ Southern Water Resilience Assessment Procedure

A resilience score was calculated for each of our sites based on the following data:

1. **Scale of impact** – Establishes the impact of the shock or stress on our sites. For our water sites, this is the number of households being served by the site, and for our wastewater sites this could be the environmental consequence of the shock or stress.
2. **Duration of impact** – Determines the length of time for which the sites would be unavailable should the shock or stress occur.
3. **Likelihood of impact** – Assesses the chance of the shock or stress occurring taking into consideration site history, geographical and other data.
4. **Vulnerability to impact** – Assesses the inherent vulnerability to the shock / stress impact based on design, operational or conditional factors.

Based on the outlined criteria, a risk score for each of our sites is generated and subsequently compared against the score for control factors, (resilience through **resistance, reliability, redundancy, response, and recovery***) to derive a resilience score. The results of the assessment are quantitatively scored and totalled to provide a vulnerability and capability scores. Negative scores occur when the site vulnerability score exceeds the site control score indicating that the control measures will not adequately prevent the customer or environmental impacts. These sites were therefore prioritised for further assessment.

**In this methodology, we consider our “Anticipation” capabilities as a part of our Response and Recovery capabilities.*

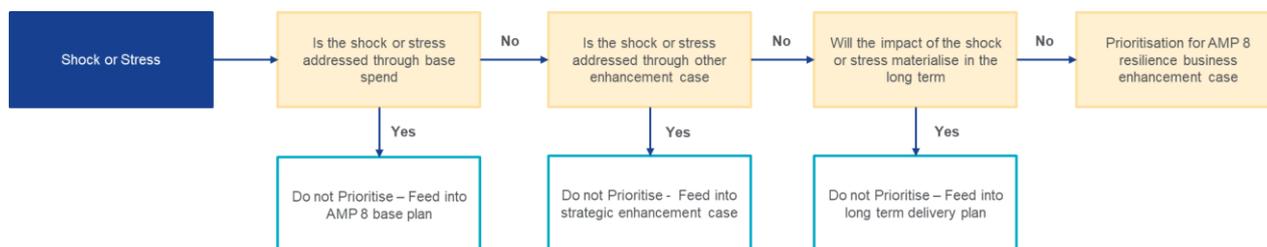
Phase 3: We obtained frontline operational information on the historic exposure to the shock or stress

We calibrated our modelling outputs with the experience of frontline operation and subject matter experts through a series of workshops to understand the historical site exposure to the shocks and stress, and whether it had an impact on our services. Sites meeting **both** criteria were progressed on to our final assessment stage. Where there was no history of a shock or stress event, we applied the resilience risk data and subject matter expertise when deciding whether to progress to the final assessment stage.

Phase 4: Our AMP 8 resilience enhancement decision tree was used to identify our list of sites to be prioritised for AMP 8 investment

Our final assessment phase focused on the sites which progressed through phases 1-3 and were further assessed using our ‘AMP 8 resilience enhancement case decision tree’. The prioritisation process has been designed to shortlist shocks and stresses and associated sites for AMP 8 resilience enhancement case by providing clear decision criteria that need to be met.

Figure 8: Decision tree to prioritise AMP 8 shocks and stresses for business enhancement case



Our analysis and evaluation phase identified 53 sites that require investment needs to be prioritised in AMP 8 for resilience enhancement. These sites have been taken through our option development and prioritisation process where we have identified the best value solutions to mitigate impact. The 53 sites have been developed into five business cases for resilience enhancement as shown in **table 2**. Further detail on our optioneering process can be found within the relevant AMP 8 resilience enhancement case.

Table 2 Number of sites requiring investment in AMP8 and the associated shock/stress¹⁵.

| Case No. | Relevant Shock/Stress | Number of Water Sites requiring investment | Number of Wastewater Sites requiring investment |
|--------------|--|--|---|
| 1. | Asset Heat | 2 | 22 |
| 2. | Flooding | 0 | 6 |
| 3. | Infiltration | 0 | 1 |
| 4. | Power | 9 | 21 |
| 5. | Coastal erosion (Including subsidence) | 0 | 3 |
| Total | | 11 | 53 |

Five of the eleven shocks and stresses (*contamination, critical asset failure, cyber security, malicious damage and raw water loss*) were not prioritised for additional investment through AMP 8 resilience enhancement spend as their impacts are being addressed through other spend areas in our core plan:

Cyber security, Contamination and Raw Water Loss impacts are being addressed by other enhancement business cases as part of our submission to the Drinking Water Inspectorate (DWI).

In AMP 8 we are submitting two enhancement cases which summarise our investment to address cyber security, contamination, and raw water loss: **Cyber security NIS** and **Water Quality Enhancement**.

The cyber security resilience assessment reviews the risk of any malicious or accidental cyber events that disrupts the operation and use of any systems, physical infrastructure, software, information and data that is essential to the reliable operation of our sites. We assessed our assets including Water Supply Works (WSW) and Booster stations for resilience to the threat of cyber security incidents. Our *Cyber security*

¹⁵ Operational Resilience – Weekly update 11042023

[SRN34 NIS Enhancement business case](#) summarises our investment into addressing the associated risks. Further detail can be found within the business case.

Our water quality enhancement business case is our investment supported by the DWI to achieve the necessary water quality performance in AMP 8 through several areas including counteracting raw water deterioration through nitrate interventions and disinfection improvements.

In recent AMPs, the quality of our raw water has continued to deteriorate due to increasing nitrate concentrations due to historic overuse of nitrate by farmers. We also experience raw water deterioration due to the presence of protozoa and viruses such as E.Coli, Clostridia and Somatic coliphages that contaminate our raw water. In AMP 8 we plan to invest £116.2m into our Nitrate intervention and disinfection future resilience programmes to address the risk of contamination and raw water loss at our most impacted and critical sites. Through these programmes, we are delivering a range of solutions including installing NRP, UV and chloring contact provisions. Further detail on these programmes can be found within our [SRN30 Raw Water Deterioration enhancement business case](#).

Critical asset failure is being addressed by our four - site strategy and our asset health and maintenance programme

As part of our four – site strategic review we have completed a detailed internal review of the condition and performance of our four largest water supply works ([REDACTED]) which supplies over 900,000 customers. In AMP 8 we are proposing c£400m of enhancement spend to deliver several major process interventions which will enhance the supply resilience across the four sites. Further detail on the four – site strategy programme can be found within [SRN25 Supply Resilience Enhancement Programme Enhancement business case](#). Our asset health and monitoring programme is also supporting us in addressing our critical asset failures. We are prioritising our most critical assets to deliver performance – based maintenance interventions and improve the reliability of asset performance and developing a robust maintenance strategy which will ensure the asset will perform as designed for the remainder of its useful life.

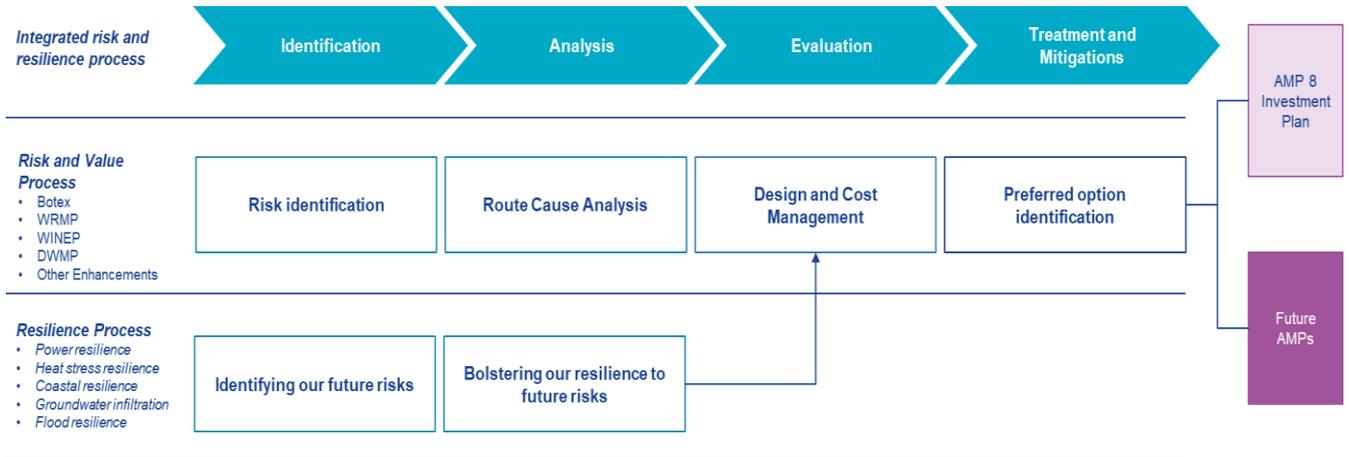
We are addressing **malicious damage** shock as part of our security and emergency measures direction (SEMD) submission

We are completing significant perimeter security upgrades at some of our key sites including four major surface water treatment works which supply water to over 60% of our customers. The security upgrades will improve our resistance to malicious damage, by strengthening our deter, delay and detect capabilities. Further detail on our approach can be found within our SEMD submission.

As part of our long term and adaptation planning, we are continuing to assess these resilience risks and we have indicated where necessary areas we may need to carry out additional investigation in AMP8 to determine any potential resilience investment in AMP9 or beyond – an example is Tidal Flooding. In addition, we have identified trigger points and decision points in the future for the relevant resilience risks – these are described in detail in our Long-Term Delivery Strategy (LTDS).

We transitioned our sites and assets where resilience enhancement needs were identified into our wider **Risk and Value** process for solution development and alignment with the rest of our investment planning process. Our risk and value (R&V) process supports our asset lifecycle process and comprises of a series of check points and decision gateways to drive a collaborative and multidisciplinary approach to address our risks and deliver best value for our customers. It is designed to support an integrated team approach in which our operations, risk, engineering and asset strategy and planning teams work together through a series of R&V checkpoints to deliver the most effective solutions to address our risks:

Figure 9: Our AMP 8 investment plan development process



Our AMP 8 interventions addressing our resilience challenges are further detailed in section 3.0 AMP 8 and longer – term interventions.

Since our Resilience Action Plan submission in 2019, we have developed and implemented an improved approach to identifying resilience risks within an integrated risk and resilience framework that is both aligned to our enterprise risk framework allowing our Executive team and Board visibility to support decision making and also ensures that the risks are considered as a key part of our asset investment planning process. We will continue to improve this process and evolve it to align with the ambitions described in the Operational Resilience Discussion paper published in April 2022.

4. Our AMP 8 Action Plans

The investments we are proposing in AMP 8 have gone through a comprehensive decision-making process to ensure that they deliver best value interventions. We are delivering a number of programmes which target resilience directly through our business enhancement case and indirectly through base and enhancement expenditure.

Our AMP 8 investment plan builds on our previous investments to continue addressing our key current challenge areas and their future impact. The resilience investments identified are part of our practical approach to operational resilience and will **bolster our resilience to our future risks**.

Our targets are stretching, and our plan is ambitious as we recognise, we have more to do to deliver the service expected of us. We have worked hard to ensure that our planned investments are cost efficient, but we recognise that there is limited scope for us to deliver all our investments due to cost constraints and bill impact. As such, we have prioritised the key investments designed to effectively address our growing challenges and deliver improved performance outcomes¹⁶.

In AMP 8 our planned investments will deliver resilience through three main strands:

1. **Our base plan** - which summarises our key maintenance programmes to ensure our assets are reliable
2. **Our operational resilience enhancement business cases (SRN49-53)** - which address resilience from a strategic context to mitigate our most critical challenges
3. **Our other resilience intervention programmes** - which indirectly deliver resilience benefits through several mechanisms including improved anticipation resulting from digitising our assets.

Our base plan targets improvements in the health, performance and reliability of our asset to deliver baseline asset resilience. Whilst these activities are essential, we recognise that capital maintenance only addresses a small part of the challenge we face.

Enhancing interventions are required to enable us to better prepare and respond to the shocks and stresses our developing challenges present. Our resilience enhancement cases summarise our planned interventions targeted at responding to these challenges.

More information on the specific operational resilience programmes including AMP 8 investment, how it is being funded, and benefits delivered is provided in the Investment Cards contained in the **Appendix**. The programmes provide real examples of some of the operational resilience benefits our base spend will deliver.

¹⁶ [SRN30 Raw Water Deterioration](#)

Figure 10: Our AMP 8 programmes delivering resilience benefits

| Our Challenges | Our AMP 8 interventions that will improve our Operational Resilience | | | | | | | | | | | AMP 7 continuing programmes | | | | | | What are the expected AMP 8 performance outcomes (Cumulative impact of Inflight + AMP 8) | | | | | | | | | |
|----------------------------|--|---|---|----------------------------|------------------------|---------------------|--------------------------|--------------------------------|--------------------------------|--------------------------|---|-------------------------------|----------------------------|--|--|--|--|--|------------|---------|----------|-------------------|------------------|----------------|---------------|--|--|
| | Base Plan | | Operational Resilience Enhancement Programmes | | | | | Other Resilience Interventions | | | | | | | | | | | | | | | | | | | |
| | Mains Renewals Programme | Planned Sewers and Rising Mains Programme | Power Resilience | Coastal Erosion Resilience | Heat Stress Resilience | Flooding Resilience | Groundwater Infiltration | Storm Overflow Taskforce | Water Resources Supply Options | Smart Metering Programme | Supply Resilience Enhancement Programme | Control Centre Transformation | Proactive Analytics Centre | Drought Measures Development Programme | PIRP: Platinum Health Checks Top 250 WPS | Asset Health Monitoring And Maintenance Strategy | Incident Management And Response Programme | Asset Management Transformation Programme | Pollutions | Leakage | Flooding | People Capability | Unplanned Outage | Sewer Collapse | Mains Repairs | | |
| Drought | ◆ | | | | | | | ◆ | ◆ | | | | ● | | | ● | ● | | | | | | | | | | |
| Climate Change | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ● | ● | ● | ● | ● | ● | ● | | ■ | | ■ | | ■ | | ■ | | |
| Population & Demand Growth | | ◆ | | | | | | ◆ | ◆ | ◆ | ● | | | ● | ● | | | | ■ | | | | ■ | ■ | | | |
| Transition to Net Zero | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cyber Security | | | | | | | | | | | | | | | | ● | ● | | | | | | | | | | |
| Ageing Assets | ◆ | ◆ | | | | | | | | ◆ | | | | ● | ● | | ● | | ■ | ■ | | | ■ | ■ | ■ | | |
| Capability | | | | | | | | | | | | | | | | | | | | | ■ | | | | | | |
| Alignment to 4R's + A | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Anticipation | | | | | | | | | | | ✓ | ✓ | ✓ | | | | ✓ | | | | | | | | | | |
| Reliability | ✓ | | ✓ | | | | ✓ | | | ✓ | | | | ✓ | ✓ | | ✓ | | | | | | | | | | |
| Resistance | | | | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | |
| Redundancy | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | |
| Response & Recovery | | | | | | | | | | | ✓ | ✓ | | | | | ✓ | ✓ | | | | | | | | | |

Key

| AMP 8 Programmes | | AMP 7 Programme Maturity | | Expected levels of benefit | |
|------------------|--|--------------------------|---------------------------------------|----------------------------|-----------------------------------|
| ◆ | Relationship between our AMP 8 Programme and our Key Operational Resilience Challenges | ● | Programme fully integrated within BAU | ■ | No/ low benefit realised in AMP 8 |
| | | ● | Programme fully rolled out | ■ | Benefit realised in AMP 8 |
| | | ● | Programme partially rolled out | ■ | High benefit realised in AMP 8 |
| | | ● | Programme designed | | |

Figure 10 illustrates the work we're planning to deliver during AMP 8 and how they impact the 7 key challenges we face and the 4 Rs + A. It also shows the schemes we delivered in AMP 7 that we anticipate will continue to realise benefits in AMP 8 and enhance our operational resilience.

5.1.1. AMP 8 Resilience Interventions - Base Plan

Our base plan improves resilience by addressing our asset health and condition. We are replacing our ageing assets and investing in capital maintenance programmes to deliver performance improvements that will secure our baseline resilience.

Our base plan delivers improvements in our baseline resilience by targeting asset health and performance and addressing our ageing asset challenge. Our plan is designed to support us in achieving our performance targets including pollution, flooding and leakage by delivering several capital maintenance programmes:

- **Mains Renewals Programme** – Intervention to renew and repair our water mains as part of our drive to manage leakage and prevent interruptions to supply of our water distribution network
- **Planned Sewers and Rising Mains Programme** – Intervention to prevent sewer collapses on our network to prevent pollutions

5.1.2. AMP 8 Resilience Interventions - Operational resilience enhancement business cases

Our AMP 8 resilience enhancement cases are directly targeting our climate shocks and stresses to deliver enhanced resilience at our most critical and significantly impacted sites.

Our resilience enhancement cases deliver solutions which mitigate our key vulnerabilities to the impacts of climate change, providing enhanced resilience through redundancy on the network and resistance in our assets. Specifically in AMP 8 we will deliver the following enhancement programmes:

- **Coastal Erosion Resilience** – Investing at 3 sites to protect them from the increasing levels of risk posed by coastal erosion impacts due to rising sea levels
- **Power Resilience** – Enhancing 30 key water and wastewater sites to be more resilient to the impacts of power supply Interruptions through increasing levels of redundancy and resistance in our power infrastructure
- **Groundwater Infiltration Resilience** – Building resistance into our sewerage network through delivering sewer watertightness measures to reduce the amount of water that infiltrates our sewers
- **Flooding Resilience** – Investing in flood defence measures to protect 6 key wastewater sites to reduce the exposure to flooding events caused by increasingly frequent and severe rainfall
- **Heat Stress Resilience** – Enhancing 24 water and wastewater sites to ensure they are suitably ventilated and cooled to safely operate under heat stressed conditions, that are becoming more frequent due to climate change.

5.1.3. AMP 8 Resilience Interventions - Other Resilience Interventions

In addition to the programmes mentioned above, we will be delivering a number of other programmes that will increase our operational resilience to the challenges we face. For AMP 8, these include:

- **Supply Resilience Enhancement Programme** - Investment in Four of our major WSW ([REDACTED]) that require significant upgrades and improvements to deliver against an ambitious DWI improvement programme.
- **Storm Overflow Taskforce** – Delivering projects across Kent, Hampshire and the Isle of Wight to identify, target, design and deploy sustainable solutions to prevent storm overflow discharges resulting in harm to the environment¹⁷

The Investment Cards in the Appendix to this Technical Annex provides more information on the programme details and investment type for each of the AMP 8 interventions described above.

5.1.4. Benefits delivered by our AMP 8 action plan

The programmes we are delivering in AMP 8 are designed to ensure we are prepared for our challenges, by delivering resilience benefits across the 4R's + A. By investing in them we are proactively and efficiently addressing key areas we know will deliver the most beneficial investments across our operations. The benefits we are delivering in AMP 8 are supporting us in delivering against our Turnaround plan and our longer – term priorities.

Figure 11: Key benefits delivered by our AMP 8 programmes



5.1.5. Our plan supports our long – term priorities

Resilience is a key element of our long-term ambitions identified in our strategic priorities to 2050¹. Three of our priorities are directly impacted by resilience:

- Ensuring a reliable supply of high-quality water for the future
- Protecting and improving the environment

¹⁷ SWS- Pathfinder Projects introduction

■ Understanding and supporting our customers and communities

Our Long-term Delivery Strategy (LTDS) develops the ambition into a forward-looking adaptive plan that sets clear goals from 2025 to 2050. These goals are reflected in the long-term performance commitments as part of the strategy. Resilience is a key part of the LTDS and the strategic frameworks, WRMP, DWMP, FRMP and RBMP ensuring that we can deliver for our customers.

We remain committed to ensuring a safe and secure water supply for our customers and to protecting the environment. Our AMP 8 plan outlines significant investments in several priority areas to transform the way we operate, through strengthening our assets, investing in our people to embed the right culture for business outcomes and building our capability to better anticipate threats. We have already made significant changes which this plan will continue to build on to deliver our commitments to our customers and stakeholders and the environment.

Appendices

Appendix 1 Our Success Stories

On our journey to becoming operationally resilient we have had some great wins which have enabled us to respond to threats swiftly and reduce the impact of disruptions on our services and wider environment:

Case Study 1: Our Pollution Incident Reduction Plan

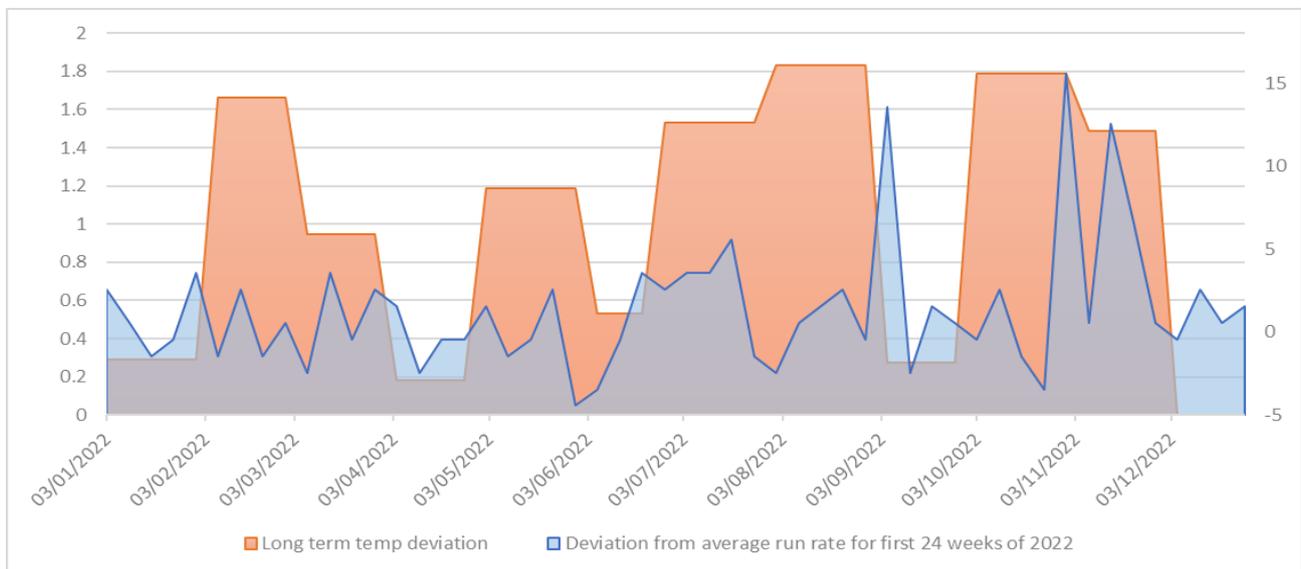
¹⁸Our Pollution Incident Reduction Plan (PIRP) is our ongoing operational programme that is focussed on reducing pollution incidents. We published our first PIRP in August 2020 and throughout its evolution, our overall number of pollutions have continued to decrease.

In January 2023 we completed our deep dive into the impact of weather conditions (Summer: Heat Wave and Low flow, Autumn and winter storms) on our asset base and how it affected the number of pollution incidents that occurred in 2022. We also reviewed historical data to identify common trends.

Our Findings

¹⁹The heat wave in July and August resulted in a sustained higher rate of weekly pollution incidents. It also resulted in our highest proportion of unchallengeable category 3 incidents in the against the previous 3 years. During this period there was an increased environmental impact of releases due to strong crude and reduced dilution to low watercourse levels. The reduced flow through the network also resulted in an increase in foul sewer pollutions caused by blockages.

Figure 12: 2022 Impacts: Summer Heat Wave and Low Flow Conditions



¹⁸ SWS Environment+ Pollution Incident Reduction Plan 2022

¹⁹ SWS 2022_23 Pollutions and the Weather_

2022 Weather impacts: Autumn and Winter Storms

There was a strong correlation between the pollution performance weekly variance in the latter months of the year (weeks 36, 44, 46 and 47) and the weekly rainfall volumes during those periods. We also observed strong correlation between deviation from the first 6 monthly average number of pollution incidents, and periods of heavy rainfall during the Autumn and Winter Storms. The increased rainfall in November (245mm vs LTA of 96mm) resulted in a spike in the number of Cat 3 pollution events, and increase in non-compliant spill events.

Figure 13: 2022 Weather impacts – Autumn and Winter Storms

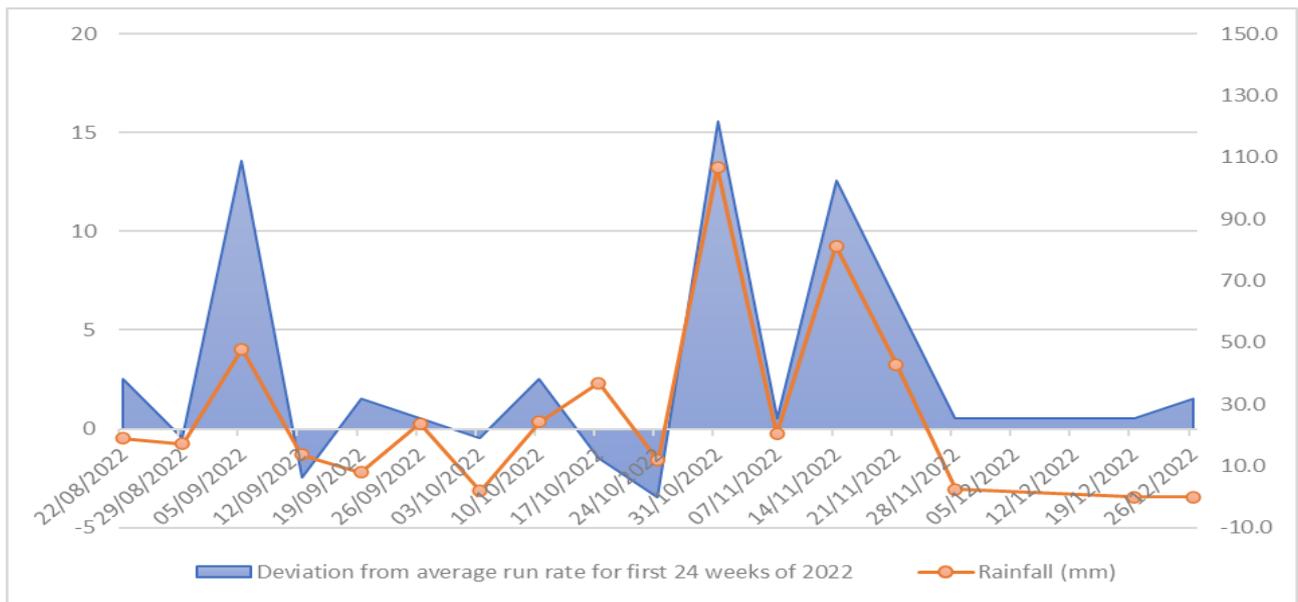
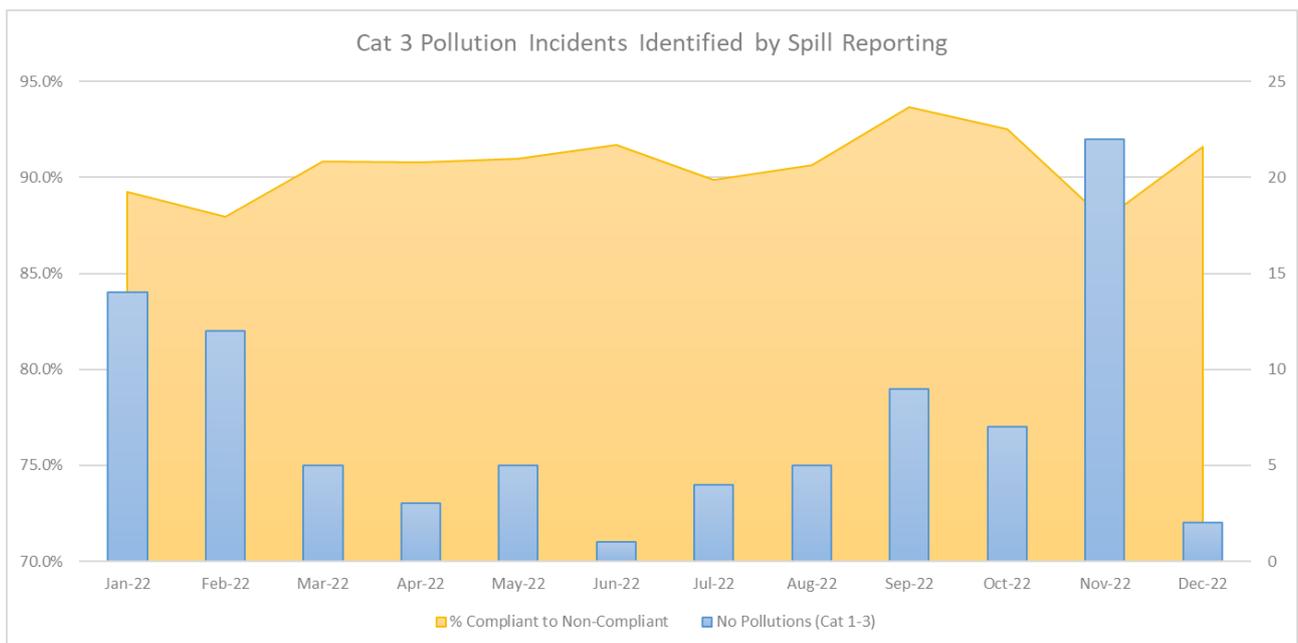


Figure 14: 2022 Spill reporting pollution performance



Interventions

Within our PIRP we have developed several intervention activities to support us in meeting our pollution targets. We found that addressing our top 3 causes of asset failures that contribute to pollution events (Electrical, Mechanical & ICA failures, Burst Rising Mains and Blockages) would result in us addressing 79% of our failures, providing additional resilience to extreme weather events.

Addressing Electrical, Mechanical and ICA failures

Our platinum health check workstream focuses on the prioritised top 280 WPS sites to eliminate asset failures due to Electrical Mechanical and ICA failures²⁰. These wastewater pumping stations were selected based on sites with a repeat pollution in the last three years and prioritised by their impact on the environment. Our platinum health check process outlines a 3-stage approach:

Stage 1: Completion of an intrusive inspection and health check

During stage 1, we tested the sites for overall performance against key metrics including permit compliance, black start, asset redundancy, control resilience and alarm data. We also completed ICA, electrical and mechanical component health checks, repairing or replacing low-cost components which required minimal time to resolve. Using our understanding of the site, we developed a report on findings highlighting further remedial work required to ensure that the site is robust and resilient.

Stage 2 Remedial work and re-commissioning of site

The findings from the report developed in stage 1 were used to implement new HWB and control system upgrades for the site, and repair / replace components which could not be completed as part of the stage 1 process. Once completed, the sites were recommissioned to full resilience. The team documented operating instructions to provide site handover information to the operations team.

Stage 3: Development of a new operational plan for future maintenance

We developed an asset maintenance plan to provide recommendations to maintain performance including well cleaning and back-up system maintenance schedule tasks (MST).

Our platinum health checks programme has already delivered great benefits and at the end of 2022, we reported 63 less pollution incidents as a direct result of the programme.

²⁰ Effectiveness of Previous Interventions - [pirp-july-2023.pdf \(southernwater.co.uk\)](#)

²¹Addressing Bursts in Rising Mains

Bursts in rising mains accounts for approximately 15% of our failures that result in pollutions. Between January 2021 to January 2022, 148 reported spills were attributed to rising mains on or networks, and of those, 30 were registered as Category 3 spills or above, costing the business approximately £3.1m. We developed our rising main calming project to:

1. Identify rising mains with significant or frequent spills and pollutions reported
2. Perform a root cause analysis to identify, mitigate and resolve the cause of the spills and prevent future issues, through scheduled maintenance or asset refurbishment
3. Establish a maintenance programme and develop a culture of best practice to minimise spills and pollutions.

Through this plan, we have investigated the top 150 repeating rising main failures and developed a database of sites detailing asset condition and known site susceptibility to spills and pollutions. We have also began implementing our remedial work. Network calming has been enabled at several of our sites, through the installation of Variable Speed Drives (VSDs) and Proportional Integral Derivative (PID) loops as well as air valves replacement. This enables consistent pumping at lower pressures and reduce the build-up of corrosive gases enabling smart, calm and robust rising mains.

Our rising main calming project targets improved resilience through a reduction in bursts and pollutions year on year. The data we are collecting on our assets health and condition will enable us to identify high risk spill sites /frequent spill sites and target them for tailored remediation, reducing the need for reactive interventions in response to spills.

Addressing Blockages

The build-up of silt, FOG and other debris in the sewer network results in sub-optimal asset performance in the field due to reduced or halted flows. This increases the likelihood of failure of assets both on the gravity network and the pumping stations. Blockages contribute to 15% of our failures that result in pollution incidents.

Organised, proactive cleaning of our assets can prevent failures by removing the material that can create the blockages and stop pollutions from occurring. Whilst there are already regular activities that provide some of this service, we implemented our enhanced wet well cleaning programme to ensure we are proactively addressing blockage risks. Data analysis of assets in the field determined that through our enhanced cleaning programme we will avoid 157 cat 1-3 pollutions: 147 from network cleaning and 10 from wet well cleaning. We will also reduce 24 cat 4 events through our wet well cleaning programme.²²

²¹ PIRP Y3 Business Case Paper – Rising Mains Calming

²² PIRP YR3 Business Case – Network Cleaning Programme V0.3

Case Study 2: Our response to Storm Eunice

In February 2022, the UK was struck by three major storms in quick succession causing widespread damage across the country. Storm Dudley, Storm Eunice and Storm Franklin caused several days of heavy rainfall, that impacted the UK. Storm Eunice in particular set a new record for the fastest wind gust recorded in England with 122 miles per hour (196 km/h) at The Needles, Isle of Wight. The storm also caused c£360 million worth of damage in the UK, with a total estimated 1.4million homes without power. Across our region, there were still over 70,000 homes without power two days after Storm Eunice first hit.

In preparation for the storms, we stood up our gold and red incident response structures to support with water and wastewater supply. The gold and red structures were in place for 11 days to manage the impact of the storms. Our teams were stood up to minimise the impact of the storms on the environment by ensuring zero pollutions while ensuring a continuous water supply for our customers.

We delayed our non-critical planned works and reallocated our people to best respond to the impacts of the storm.

We reviewed our non-critical planned works including sludge movements and delayed them to enable us to reallocate our people and resources to respond to our most critical activities. Our reactive workforce were on 24/7 standby to ensure we were ready to respond to incidents efficiently and maintain our critical services for our customers. We also dispatched 30,000 bottles of water to our vulnerable customers as a precautionary measure.

We deployed 120 wastewater tankers across our region to effectively manage the increase in volume of wastewater to mitigate the risk of disruption to our services.

We deployed over 100 waste vehicles including tankers and pipe lorries across the region to support our operations. Our tankers allowed us to safely and effectively collect and transport excess water from critical areas and areas prone to flooding to relieve the strain on our systems and minimising the risk of overflow. We also deployed 10 clean water tankers to minimise disruption to water supply to our customers. Our tankers were strategically positioned to support areas we anticipated supply interruptions would be impacted to ensure critical water services were maintained during this period and played a critical role in ensuring business continuity over the period providing updates on access issues to aid route planning and effectively allocate resources for necessary clearing requirements.

We kept our generators running in preparation for the storm impacts and deployed 89 mobile generators across our region.

In preparation for the storms, we ensured our generators were available and ready for deployment mobilising 387 fixed generators and 89 mobile generators to manage our wastewater and supply sites. We engaged dedicated teams to deliver 24/7 monitoring and maintenance of our generator fuelling requirements and as a result completed over 100 fuel runs for P&I and over 50 other supply chain fuel requirements. Our teams were also mobilised to relocate generators in priority order to minimise potential impacts at sites as power was restored. A total of 35 generators were used to restore temporary power while awaiting mains power to be restored.

Through enhanced planning activities, we were able to prepare for the disruption to ensure our services remained resilient to the impact of the storms. As a result, we managed to keep water supplies to the vast majority for our customers, with less than 400 customers out of our 2.6million community (0.01%) out of water.

Case Study 3: Supply resilience enhancement programme (Four site strategic review)

In November 2022, we initiated our four-site strategic review of our four largest works: [REDACTED]. The four works supply over 1.6 million people daily equivalent to approximately 62% of Southern Waters consumers²³.

Over the past 10 years, we have been served a number of notices from the DWI across the four sites. As a result, we identified an opportunity to address these risks holistically from a systems thinking lens to deliver additional benefits by addressing the DWI requirements and risks in the round. We developed our four-site strategic reviews, designed to cover a robust review of risks at the sites and develop strategic plans for mitigating them. Each of the four sites were initially assessed for asset and site level resilience, and subsequently assessed for network / system resilience²⁴.

Site level reviews

Our site level reviews were completed to understand and identify site-specific risks at each location. Each site was reviewed for water quality risks to understand treatment requirements and assessed for the performance of current onsite processes designed to mitigate the risks. We also completed site reliability reviews to understand the condition of our assets, and redundancy assessments to identify single points of failure and determine alternative processes in the event of a disruption or failure. Our site level assessments were used to inform our system resilience assessments to understand where interventions were required.

System resilience review

Our system resilience reviews outlined our holistic review of our systems to identify interdependencies, bottlenecks and vulnerabilities not immediately evident on completing our site resilience reviews. This entailed reviewing the outcomes of our zonal risk assessments and assessing our options for interzonal transfers in addition to reviewing our strategic solutions summarised within WRMP19/ 24.

Our ambition across AMP 8 and 9 is to upgrade each of the four sites to enable a step change in service delivery through reconfiguration of existing processes. The output from the strategic reviews has been developed into a delivery programme and we have identified other actions (outside of our notices) that will further reduce the risks on the sites. In AMP 7, we invested £100m across the four sites to maintain the level of service required to provide short term stabilisation and resilience at each site. We have implemented measures including increased monitoring of source water and site automation to enable shutdowns to prevent unwholesome water from entering supply. In AMP 8, we are seeking additional investment through our **Supply Resilience Enhancement Programme** (*Special Cost Claim*) to support us in addressing key challenges around increased water demand, emerging water quality challenges, and the impact of climate change on our water operations.

²³ [4 site plan report v1.1.docx \(sharepoint.com\)](#)

²⁴ Southern Water: 4 Site Plan Report v1.1

We have already started to implement measures which provide short term stabilisation for some of the sites including increased monitoring of source water combined with automation to enable site shutdowns which prevent unwholesome water from entering supply, and in AMP 8 we plan to build on this to deliver the long-term resilience of our largest sites through enhanced site reliability, inter-zone redundancy. Further detail on the programme can be found within our [SRN25 Supply Resilience Enhancement Programme Enhancement business case](#).

Appendix 2 – AMP 8 Resilience Intervention Investment Cards

Information on each AMP 8 Resilience Intervention can be found in the following Investment Cards.

These cards provide:

- Information on the investment type
- Alignment to the 4Rs + A
- Background information to the programme
- Description of the solution
- Overview of expected benefits

This Appendix is structured in the following order:

Our Base Plan Resilience Interventions ([SRN19 Botex Technical Annex](#))

- Mains Renewal Programme
- Planned Sewer and Rising Mains Programme

Our Operational Resilience Enhancement Business Case Interventions

- Coastal Erosion Resilience Enhancements ([SRN53 Resilience – Coastal Enhancement Business Case](#))
- Power Resilience Enhancements ([SRN49 Resilience – Power Enhancement Business Case](#))
- Groundwater Infiltration Resilience Enhancements ([SRN50 Resilience – Infiltration Enhancement Business Case](#))
- Flooding Resilience Enhancements ([SRN52 Resilience – Flooding Enhancement Business Case](#))
- Heat Stress Resilience Enhancements ([SRN51 Resilience – Heat Enhancement Business Case](#))

Our Other Resilience Interventions

- Supply Resilience Enhancement Programme ([SRN25 Supply Resilience Enhancement Programme Enhancement Business Case](#))
- Storm Overflow Taskforce ([SRN40 WINEP – Storm Overflows Enhancement Business Case](#))
- Supply and Demand Management
 - Water Resource Supply Options ([SRN26 Water Resources – Supply Enhancement Business Case](#) and [SRN27 Water Resources – Demand Enhancement Business Case](#))
 - Smart Metering Programmes ([SRN28 Smart Metering Enhancement Business Case](#))

Our Base Plan Resilience Interventions – Investment Cards

| AMP 8 Action Plan: Operational Resilience Interventions – Mains Renewals Programme | | | | | | | |
|--|-------|---|-------------|------------|------------|---------------------|--------------|
| Investment Type | Botex | Alignment to 4Rs + A | Reliability | Resistance | Redundancy | Response & Recovery | Anticipation |
| | | | R | | | | |
| Background <ul style="list-style-type: none"> Our AMP7 success in finding and fixing existing leaks has provided us the platform to adopt a more proactive approach to addressing leakage, based on renewing key parts of the network to mitigate the number of bursts and associated leakage. As a result, in AMP 8 we plan to invest in a larger proportion of mains renewals and mains repairs than in AMP7. A robust network with stable asset condition will provide several benefits and requires less reactive mains repairs and disruption on our network. | | Solution Description <ul style="list-style-type: none"> Our response for AMP8 is to deliver targeted mains replacement of the entire section as opposed to localised repairs. Our approach will require targeted mains replacement whilst minimising traffic disruption arising from mains replacement activity. | | | | | |
| Benefits Overview <ul style="list-style-type: none"> We estimate that the mains renewals programme will result in benefits related to a reduction in leakage and water quality issues. | | | | | | | |
| More information on this programme is provided in SRN19 Botex Technical Annex ²⁵ | | | | | | | |

²⁵ [SRN19 Botex Technical Annex](#)

AMP 8 Action Plan: Operational Resilience Interventions – Planned Sewer and Rising Mains Programme

| Investment Type | Botex | Alignment to 4Rs + A | Reliability | Resistance | Redundancy | Response & Recovery | Anticipation |
|---|-------|---|-------------|------------|------------|---------------------|--------------|
| | | | R | | | | |
| <p>Background</p> <ul style="list-style-type: none"> The number of rising mains bursts and sewer collapses has been trending up in recent years. In 2022, they were the root cause of 11% of pollution incidents– up from 7% in 2021. We propose a marked change in the amount of planned sewer and rising main renewal that takes place. Our data shows that our highest rising main burst history is on cast-iron and PVC pipes which are also the pipe materials associated with our longest installed assets. We plan a targeted replacement programme of these assets prioritised by risk | | <p>Solution Description</p> <ul style="list-style-type: none"> Our plan for AMP8 is threefold: <ul style="list-style-type: none"> Increase planned rising main refurbishment to address the highest risk mains, with a reduction in reactive costs. Our plans deliver 40 km of rising main replacement. Continue to invest in additional monitoring and modelling, calming the pressure changes which can lead to burst mains. Additional surveys and refurbishment for critical sewers only, with 25km of sewer rehabilitation. We will continue to address non-critical sewers with low failure consequence on a reactive basis. Our rising main replacement programme will include our highest risk rising mains assets In AMP 8, our sewer rehabilitation activity will prioritise investment at our Critical A & B sewers and Non-Critical sewers in poor condition. | | | | | |
| <p>Benefits Overview</p> <ul style="list-style-type: none"> During AMP 8, we expect this programme to reduce: <ul style="list-style-type: none"> Environmental and customer impacts from sewer collapses and pollution incidents Reduced costs through reduction in need for large scale tinkering or long-distance over-pumping mitigation services. | | | | | | | |

More information on this programme is provided in [SRN19 Botex Technical Annex](#)²⁶

²⁶ [SRN19 Botex Technical Annex](#)

Our Operational Resilience Enhancement Business Case Interventions

AMP 8 Action Plan: Operational Resilience Interventions – Coastal Erosion Resilience Enhancements

| Investment Type | Enhancement | Alignment to 4Rs + A | Reliability | Resistance | Redundancy | Response & Recovery | Anticipation |
|---|-------------|--|-------------|------------|------------|---------------------|--------------|
| | | | | | | | R |
| Background <ul style="list-style-type: none"> Sea levels have continued to rise due to climate change and between 1990 and 2018, it rose by 3.6mm per year on average, compared to 1.43mm per year between 1911 and 2018. We are working with the EA and collaborating with other organisations locally to ensure that our sites are protected but also to ensure that the social and environmental benefits delivered by existing protection measures are not lost but enhanced. We want to act before the impacts of coastal erosion significantly impact our assets and we are doing this collaboratively. | | Solution Description <ul style="list-style-type: none"> Working with the Environmental Agency's (EA) National Flood and Coastal Erosion Risk Management (FCERM) team, we have identified three sites that require investment in AMP8 In AMP 8, we have identified £17.3m of investment needs for the three sites Portobello, Eastbourne, and Ventnor where coastal erosion is exacerbating a subsidence risk. We are proposing to deliver a variety of activities at these sites, which includes but is not limited to: <ul style="list-style-type: none"> Stabilisation work Reinforcing our network Improving coastal defences | | | | | |
| Benefits Overview <ul style="list-style-type: none"> Delivering this coastal erosion resilience programme will help protect our assets from the risks posed by rising sea levels and coastal erosion. | | | | | | | |

More information on this programme can be found in [SRN53 Resilience - Coastal Enhancement Business Case](#)²⁷

²⁷[SRN53 Resilience - Coastal Enhancement Business Case](#)

AMP 8 Action Plan: Operational Resilience Interventions – Power Resilience Enhancements

| Investment Type | Enhancement | Alignment to 4Rs + A | Reliability | Resistance | Redundancy | Response & Recovery | Anticipation | |
|---|-------------|--|-------------|------------|------------|---------------------|--------------|--|
| | | | R | R | R | | | |
| Background <ul style="list-style-type: none"> Power supply interruptions are a significant threat that impacts our operations Climate change is causing more frequent and severe extreme weather events that can lead to interruptions to our power supply through damage to Distribution Network Operator power infrastructure and our own Power Infrastructure We need to invest in our own assets to increase their resistance and build in redundancy to mitigate the impact of power supply interruptions. | | Solution Description <ul style="list-style-type: none"> During AMP 8 we will invest in the delivery of two types of enhancement solutions: <ul style="list-style-type: none"> Enhancement of SWS Power Infrastructure at 10 wastewater sites in the River Stour Catchment and Eastbourne WTW to make them more resistant to power supply interruptions; and Installation of fixed standby diesel generators to provide additional redundancy to power supply interruptions at 9 key water and 11 key wastewater sites | | | | | | |
| Benefits Overview <ul style="list-style-type: none"> We expect this programme to deliver the following indirect benefits in AMP 8: <ul style="list-style-type: none"> Reduced pollution incidents; and Reduced number of customer supply interruptions. | | | | | | | | |

More information on this programme can be found in [SRN49 – Resilience - Power Enhancement Business Case](#)²⁸

²⁸[SRN49 – Resilience - Power Enhancement Business Case](#)

AMP 8 Action Plan: Operational Resilience Interventions – Groundwater Infiltration Resilience Enhancements

| Investment Type | Enhancement | Alignment to 4Rs + A | Reliability | Resistance | Redundancy | Response & Recovery | Anticipation |
|-----------------|-------------|----------------------|-------------|------------|------------|---------------------|--------------|
| | | | | R | | | |

Background

- As we continue to experience increased intensity and frequency of rainfall, our sewerage networks will remain at great risk of becoming inundated due to groundwater infiltration.
- During periods of heavy rainfall, excess groundwater enters our sewerage system, occupying a large proportion of its capacity leading to internal/external floods and pollution events.
- This is a particular challenge in our region as we have the second highest foul only collection systems and the highest number of infiltration reduction plans which have a provision for directly over-pumping to receiving bodies.

Solution Description

- During AMP8 we will deliver 222km of enhanced sewers in nine collection systems with the greatest impacted catchments. 30,000 homes will benefit from this investment.
- Our infiltration enhancement case is a multi-AMP investment focused on enhancing our sewers so that that they are in a good structural state and are resilient to groundwater infiltration.

Benefits Overview

- We expect this programme to deliver the following benefits in AMP 8:
 - Reduction of 3 Infiltration reduction plans due to 117km of watertight measures be installed at:
 - Lavant, Pan Parish and St Marybourne
 - A further 105 km of watertight measures to be deployed at the following six systems:
 - Lower Nailbourne, Goodworth Claitford, Sidlesham, Barnham, Winchelsea Beach, Upper Nailbourne

More information on this programme can be found in [SRN50 Resilience - Infiltration Enhancement Business Case](#)²⁹

²⁹[SRN50 Resilience - Infiltration Enhancement Business Case](#)

AMP 8 Action Plan: Operational Resilience Interventions– Flooding Resilience Enhancements

| Investment Type | Enhancement | Alignment to 4Rs + A | Reliability | Resistance | Redundancy | Response & Recovery | Anticipation | |
|---|-------------|---|-------------|------------|------------|---------------------|--------------|--|
| | | | | R | | | | |
| Background <ul style="list-style-type: none"> We have an increased risk exposure to flood events in our region as a result of the climate challenge. Our sites are becoming increasingly flooded both in frequency and magnitude, impacting our asset health and reliability and service delivery. Our flood defences and nature-based flood management processes are no longer effective under the new climate impacts we are experiencing and are therefore unable to protect our assets from flooding. | | Solution Description <ul style="list-style-type: none"> We have identified a need for investment at 6 of our sites which are increasingly being impacted by floods and require investment to enhance their resilience to flooding. Our programme will deliver solutions which target resistance to flooding including installing temporary flood protection measures, building perimeter defences, and investing in catchment wide schemes which store and divert water with a preference for nature - based solutions | | | | | | |
| Benefits Overview <ul style="list-style-type: none"> We expect this investment to reduce the operational impact caused by flooding events at our sites and reduce the number of pollution incidents. | | | | | | | | |

More information on our Flooding Resilience Enhancement Programme can be found in [SRN52 Resilience - Flooding Enhancement Business Case](#)³⁰

³⁰[SRN52 Resilience - Flooding Enhancement Business Case](#)

AMP 8 Action Plan: Operational Resilience Interventions – Heat Stress Resilience Enhancements

| Investment Type | Enhancement | Alignment to 4Rs + A | Reliability | Resistance | Redundancy | Response & Recovery | Anticipation | |
|--|-------------|---|-------------|------------|------------|---------------------|--------------|--|
| | | | | R | | | | |
| Background <ul style="list-style-type: none"> Global mean temperature rise has significant impacts for our operations and service delivery. We know that IPCC data projects an increase in mean temperatures by 2030, however our assets are already impacted by heat stress under our current climate conditions. Heat stress results in increased water quality issues at the point of discharge into our rivers/ sea outfalls and also compromise the original design thresholds of key process equipment and electrical / electronic components. | | Solution Description <ul style="list-style-type: none"> We have identified a need for investment in AMP 8 to address the impact of heat stress across 2 of our water and 22 wastewater sites. Our programme ensures that existing high heat producing equipment are suitably ventilated and cooled to minimise the operational impact of future high heat stress conditions. | | | | | | |
| Benefits Overview <ul style="list-style-type: none"> We expect this programme to deliver the following benefits in AMP 8: prevention of pollution incidents, supply interruptions and unplanned outages resulting from sustained increased temperatures impacting the operation of our assets | | | | | | | | |

More information on our Heat Stress Resilience Enhancement Programme can be found in [SRN51 Resilience - Heat Enhancement Business Case](#)³¹

³¹[SRN51 Resilience - Heat Enhancement Business Case](#)

Our Other Resilience Interventions

AMP 8 Action Plan: Operational Resilience Interventions – Supply Resilience Enhancement Programme

| Investment Type | Enhancement | Alignment to 4Rs + A | Reliability | Resistance | Redundancy | Response & Recovery | Anticipation |
|--|-------------|----------------------|--|------------|------------|---------------------|--------------|
| | | | R | R | R | | A |
| Background <ul style="list-style-type: none"> Four of our major WSW () require significant upgrades and improvements to deliver against an ambitious DWI improvement programme. These WSW supply 900,000 properties and over 1m customers, and do not currently perform in line with ours, our regulators', nor our customers' expectations. These WSW are required to at least 2050, if not beyond. These WSW are facing deteriorating raw water quality, and do not have modern treatment processes fully integrated with conventional processes. These WSW will have new sources of water to mitigate against impacts of licence reductions. | | | Solution Description <ul style="list-style-type: none"> We have relaunched holistic strategies for the four WSW to ensure that they are fit for purpose and are resilient to future changes These strategies span multiple AMPs, including AMP8. The investment covers everything from renewing our aging control systems, to installing additional treatment processes to cover changing raw water requirements and improving our handling of waste. This is a single programme of strategic investment at each WSW. | | | | |
| Benefits Overview <ul style="list-style-type: none"> We expect this programme to deliver the following benefits: <ul style="list-style-type: none"> Improved treatment process resilience under a wide ranging of operating conditions Enhanced treatment of more variable raw water qualities being experienced at the sites Avoidance of Compliance Risk Index (CRI) failures at our WSW and in the wider zones that they supply Reducing the levels of unplanned outage, particularly at and Water Supply Interruptions – there will be reduced interruptions to customers and businesses as we will prepare the sites for use of more sustainable sources of water in the future, protecting our critical rivers and chalk streams Customer Contacts about Water Quality – improving taste, odour and appearance of water within the zones fed by these WSW Drought Resilience – securing long-term supply of WSW under normal and drought conditions. | | | | | | | |

More information on our Supply Resilience Enhancement Programme can be found in [SRN25 Supply Resilience Enhancement Programme Enhancement Business Case](#)³²

AMP 8 Action Plan: Operational Resilience Interventions – Storm Overflow Taskforce

| Investment Type | Enhancement | Alignment to 4Rs + A | Reliability | Resistance | Redundancy | Response & Recovery | Anticipation |
|---|-------------|--|-------------|------------|------------|---------------------|--------------|
| | | | | | | | R |
| <p>Background</p> <ul style="list-style-type: none"> Our Storm Overflow Task force was set up in 2021 in response to the increasing pressure on our sewerage system from the effects of climate change and greater urbanisation. In 2020 and 2021, there were approximately 20,000 spills from the 980 storm overflows across our operating region in the South-East of England. Our aim is to make significant reductions in the number of discharges from storm overflows as quickly as possible. We used artificial intelligence techniques including fuzzy logic to analyse 2 years of spill data from our storm overflows to determine the root cause of spills: <ul style="list-style-type: none"> 65% are caused by rainwater 25% are caused by groundwater infiltration 10% are caused by other issues including blockages and operational issues. | | <p>Solution Description</p> <ul style="list-style-type: none"> We will be investing in 179 storm overflows starting in AMP8 We will continue to tackle the two root causes of discharges from storm overflows: <ul style="list-style-type: none"> Rainwater: We are proposing to focus on managing rainwater at source through a mix of catchment and nature-based solutions. We will focus on green, and phase grey solutions to maximise opportunities for wider benefits for our customers and the environment. <ul style="list-style-type: none"> This includes green surface water separation as a solution to manage rainwater and return it to the environment as close to where it falls as possible as per Defra’s core principles Groundwater: We will reduce groundwater infiltration through lining our sewers and private sewers, and construct wetlands at our storm overflows to treat the discharges before the water is released back to the environment. | | | | | |

Benefits Overview

- We expect the programme to reduce the number of spills per overflow from an average of 17.04 to 15.5.

More information on our Storm Overflow Taskforce Investment can be found in [SRN40 WINEP – Storm Overflows Enhancement Business Case](#)³³

³² [SRN25 Supply Resilience Enhancement Programme Enhancement Business Case](#)

³³ [SRN40 WINEP – Storm Overflows Enhancement Business Case](#)

