

UUW40

Operational resilience and asset health - our approach

October 2023

Chapter 7 supplementary document

This document demonstrates that we understand our assets and systems and have a balanced approach to deliver our asset management plans.

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1. Resilience and asset health

1.1 Key messages

We pursue an adaptive, efficient approach to resilience. We continue to pursue an adaptive approach to securing long-term resilience; we account for uncertainty in our long-term approach by providing adaptive systems tolerant to change, while protecting customers and the environment from unacceptable service loss. We target an efficient and low regrets approach in the shorter term, and keep options open for the longer term. This approach is informed by regional stakeholder insight and reflects stakeholder priorities, contributing to building the North West's resilience.

We routinely apply a systems approach to securing resilience in the round. We look beyond our own assets to take account of cascade failure risks and interdependent services in our decision making.

Mature risk and resilience governance provides alignment and integration between decisions across the business. The alignment of our risk management processes from field to board ensures that decisions at all levels of our business help us to meet our strategic ambitions. The transparency of business objectives through our integrated governance and risk management framework helps us to deliver within the board-approved strategic risk appetite, enabling effective risk management across our business.

We understand our assets and systems and have a balanced approach to deliver our asset management plans. This approach is supported and third-party assured, as evidenced by our ISO certification, Asset Management Maturity Assessment (AMMA) and other external assessments. Meanwhile, we seek to nurture and demonstrate thought leadership in asset health and systems resilience helps us to optimise our understanding of how healthy assets enable resilient systems.

We have made good progress, and continue to deliver, on our PR19 resilience action plan. We are enhancing our services, securing performance improvements, and maintaining and increasing our resilience to a broad range of current and future shocks and stresses.

Our AMP8 plan delivers substantial investment in improving resilience, through targeting both base and enhancement expenditure to reduce the risk of service failures. Delivering our plan will enable us to continue to maintain sound financial and corporate resilience.

Our plan for resilience directly faces into the affordability challenge and competing priorities for enhanced environmental performance while acknowledging the inter-generational fairness needed when investing in our asset base.

We have tested our plans and processes and commissioned external independent benchmarking to ensure that our approach to asset management, including resilience and asset health, follows best practice and is embedded into our business as usual approach and long-term delivery strategies. We regularly assure and benchmark both our asset management approach and our current plans, coupled with targeted assurance on identified elements of our asset management capability, such as our operational maintenance programme.

This document should be read in conjunction with our business plan assurance document in supplementary document *UUW76 - Confidence and assurance of the submission*, it provides additional information specific to our approach to assurance of our operational resilience capability.

1.2 Structure

1.2.1 This document is structured as follows:

- **Section 2** provides an overview of our approach to resilience and asset health and improvements we have delivered since PR19.
- **Section 3** provides an update on our resilience action plan.

- **Section 4** describes our risk management system.
- **Section 5** details our current key operational risks and the approach we take to mitigate and control these.
- **Section 6** outlines our long-term challenges and how they are considered in our long-term plans.
- An overview of our future plans, broken down by price control, are set out in **Section 7**
- **Section 8** outlines our AMP8 plans and future strategy for Water Network Plus
- **Section 9** outlines our AMP8 plans and future strategy for Wastewater Network Plus
- Our AMP8 plans and future strategy for bioresources is outlined in **Section 10**
- Details of our cross-cutting issues and plans are outlined in **Section 11**
- **Section 12** describes our ‘business as usual’ three-line assurance processes.
- **Section 13** provides a summary of our recent third-line assurance activities on resilience and asset health.

1.3 Overview

- 1.3.1 We have a robust corporate structure, vision and values to support the delivery of our resilience strategy. Our corporate approach secures our financial resilience, which underpins our ability to deliver our investment plans and to absorb shocks. We are operationally resilient to a wide range of shocks and stresses that ensure the continued provision of water and wastewater services to customers and businesses in the North West.
- 1.3.2 This document demonstrates how we continue to pursue an adaptive approach to securing long-term resilience; accounting for uncertainty in our long-term planning by providing adaptive systems that are tolerant to change, while protecting customers and the environment from unacceptable service loss. We look beyond our own assets to take account of cascade failure risks and interdependent services in our decision making, targeting an efficient and low regrets approach in the shorter term and keeping options open for the longer term. This approach is informed by regional stakeholder insight and reflects stakeholder priorities, contributing to building the region’s resilience.
- 1.3.3 Our mature risk and resilience governance provides clear alignment and integration between decisions across the business. The alignment of our risk management processes from field to board ensures that decisions at all levels of our business help us to meet our strategic ambitions and deliver within the board-approved strategic risk appetite, enabling effective risk management across our business. Our plan for resilience directly faces into the climate and affordability challenges, balancing the competing priorities for enhanced service and environmental performance, while acknowledging the inter-generational fairness needed when investing in our existing asset base.
- 1.3.4 Our industry leading understanding of our assets, as assessed by the Asset Management Maturity Assessment (AMMA) and certified through the ISO55001 standard, will continue to educate our approach to managing our asset base to deliver an appropriate blend of asset rehabilitation, renewal and operational interventions to target cost effective resilience now and into the future. We provide examples of how we are enhancing and developing our understanding of our assets and systems, see Section 2.8 for further information.
- 1.3.5 We recognise that delivering resilient services is not just about physical assets. It is also about the wider interactions and impacts of financial and corporate factors, as well as, for example, considerations of the environment, stakeholders, our people and culture including physical and cyber security.
- 1.3.6 In this document we describe how we deliver our risk and resilience framework, to embed resilience through our operations and what our current principle risks are. We demonstrate that we have a

comprehensive approach to understanding, preparing for, and mitigating against these risks and issues that may threaten our ability to secure operational resilience.

- 1.3.1 Operational resilience is one component of ‘resilience in the round’ and of securing systems resilience to ensure highly reliable customer services. While operational resilience is critical, it is just one part of being ‘resilient in the round’. In this document, we will also explain how we have evolved our thinking from PR19 to further strengthen our systems-based appraisal and management of risk. We have been building on our existing strengths but demonstrating how we need to do things differently in future, including activities around developing our corporate culture, training our people, improving data and analysis and deeper collaboration with partners and stakeholders. In this document, we outline our resilience action plan in more detail.
- 1.3.2 The purpose of this supplementary document is to demonstrate that our plan delivers appropriate asset stewardship with increased resilience and adaptability, providing best value to customers now and in the future. We summarise how our investment plans from both base and enhancement expenditure are focused on the principal risks and hazards to which we are exposed and that we have sought to address. It demonstrates how our plans have developed and evolved over time as risk profiles change, new threats and opportunities emerge and regulations change. We continue to enhance our asset information and decision-making processes, targeting cost beneficial investment to secure resilience and service improvements.
- 1.3.3 We describe how our business plan will deliver service resilience, taking a systems approach and building upon previous investment, while facing into future challenges. We plan that, over the short, medium and long term, we will continue to deliver service and environmental enhancements that customers can afford.
- 1.3.4 We have tested our plans and processes and commissioned external independent benchmarking to ensure that our approach to asset management, including resilience and asset health, complies with best practice and is embedded into our business as usual approach and long-term delivery strategies. We regularly assure and benchmark both our asset management approach and our current plans, coupled with targeted assurance on identified elements of our asset management capability, such as our operational maintenance programme.

1.4 Improvements since PR19

- 1.4.1 Our previous plan in PR19 provided a solid foundation from which we have been able to build greater resilience into our services, focusing on addressing identified weaknesses and further developing our systems-based resilience approach, identifying areas of growth.
- 1.4.2 We have progressed investment and targeted improvement strategies to strengthen our previously identified areas of improvement, not just from a physical perspective, but in developing our asset data and intelligence, decision support making tools, training and operating procedures. This has contributed to us becoming more resilient in the round.
- 1.4.3 We have continued to mature our systems-based approach in line with our commitments at PR19; this is underpinned by our business capability model, which includes key operational systems based approach capabilities, such as production planning and customer experience.
- 1.4.4 We have recognised the importance of people resilience and a full Organisation Capability Review has been completed in AMP7 to put in place a People Plan to support and enable the delivery of our ambitions into AMP8 and beyond.
- 1.4.5 We conducted a gap analysis on corporate risk data to enable alignment with key operational risks. The output from this assessment was embedded throughout our organisation in our Risk and Asset Planning (RAP) framework. We also routinely assess the national risk register against our corporate risk register to as part of our horizon scanning process.

- 1.4.6 We recognise that our strategy should continuously adapt and not remain static, to have the ability to respond to threats, trends, and emerging risks. We have matured our approach to be able to anticipate, react, and recover from shocks and stresses.

2. Our approach

2.1 Overview

- 2.1.1 Our approach to securing resilience and maintaining asset health is risk based and data driven. We recognise that operational resilience must be secured 'in the round' underpinned by corporate and financial resilience.
- 2.1.2 We have a robust and data driven approach to risk assessment that incorporates both top-down and bottom-up aspects of risk assessment. This enables us to review the exposure to a broad range of risks in a robust and consistent manner that is repeatable and auditable. More on our approach can be found in Section 4.2 below and in our supplementary document *UUW43 - Corporate approach to resilience*. This is also reported on annually in our Annual Report¹; see the Risks and Opportunities Section of our 2023 Annual Report starting on page 63.
- 2.1.3 Our service delivery is underpinned by our asset base. We have proactively invested to better understand the health of our asset base since privatisation. This understanding of asset health helps us to make informed decisions about the most appropriate blend of strategies to deliver improving service performance, while maintaining and enhancing our operational resilience. This approach leads to an informed adoption of investment in differing degrees of reliability, resistance, redundancy and response and recovery.
- 2.1.4 Our approach follows guidance from the National Infrastructure Commission (NIC) in its paper 'Anticipate, React, Recover²', and is aligned to both the cabinet offices paper 'Keeping the Country running³' and Ofwat's PR19 publication 'Resilience in the Round⁴'.

2.2 Anticipate

- 2.2.1 We plan for, and anticipate, the impacts of a broad range of potential threats and hazards that could impact upon our ability to provide resilient water and wastewater services. Identifying, risk assessing and monitoring the likelihood of such events and how they may impact on our services. This includes both acute shocks such as extreme weather, legislation changes and long-term chronic issues such as climate and demographic changes.
- 2.2.2 We have a mature approach to understanding our current and future risk, resilience and asset health. This supports us in balancing conflicting needs to deliver service at a cost current and future customers can afford.
- 2.2.3 We routinely model all aspects of our asset base, predicting their current risk and future deterioration. We predict their repair, refurbishment and replacement under various credible investment and service performance scenarios. This modelling is carried out at asset level, including approximately five million sewer lengths, one million water mains and half a million non-infrastructure assets.

¹ unitedutilities.com/corporate/investors/results-and-presentations/annual-reports/

² nic.org.uk/app/uploads/Anticipate-React-Recover-28-May-2020.pdf.

³ gov.uk/government/publications/keeping-the-country-running-natural-hazards-and-infrastructure.

⁴ ofwat.gov.uk/publication/resilience-in-the-round/.

2.3 Adaptive

- 2.3.1 We take a risk-based approach to the control and mitigation of risks and hazards that are appropriate to the likely impact, modifying our acceptance of risk and applying controls for each area, relative to four risk appetite descriptors, agreed for each service at UUW board level:
- **Averse:** A strong opposition to accept risk within business strategy or operational activity;
 - **Prudent:** A reluctance to accept risk within business strategy or operational activity, with careful acceptance within tight boundaries;
 - **Moderate:** Willingness to accept risk with regard to business strategy or operational activity provided this is within reasonable limits; and
 - **Accepting:** Willingness to accept risk with regard to business strategy or operational activity.
- 2.3.2 We invest in appropriate levels of resilience to secure 'best value' resilience in response to the level of threat. We modify our approach based on changes to the threat level or on changing risk appetite and build upon the gains of previous investment across all aspects of resilience.
- 2.3.3 We plan for multiple future scenarios and develop alternative pathways to manage the uncertainty of timing and the impact of longer-term factors such as climate change. We routinely horizon scan for change drivers and identify likely future decision points. Our approach helps us to make decisions today that are no or low regrets in the face of future uncertainty.

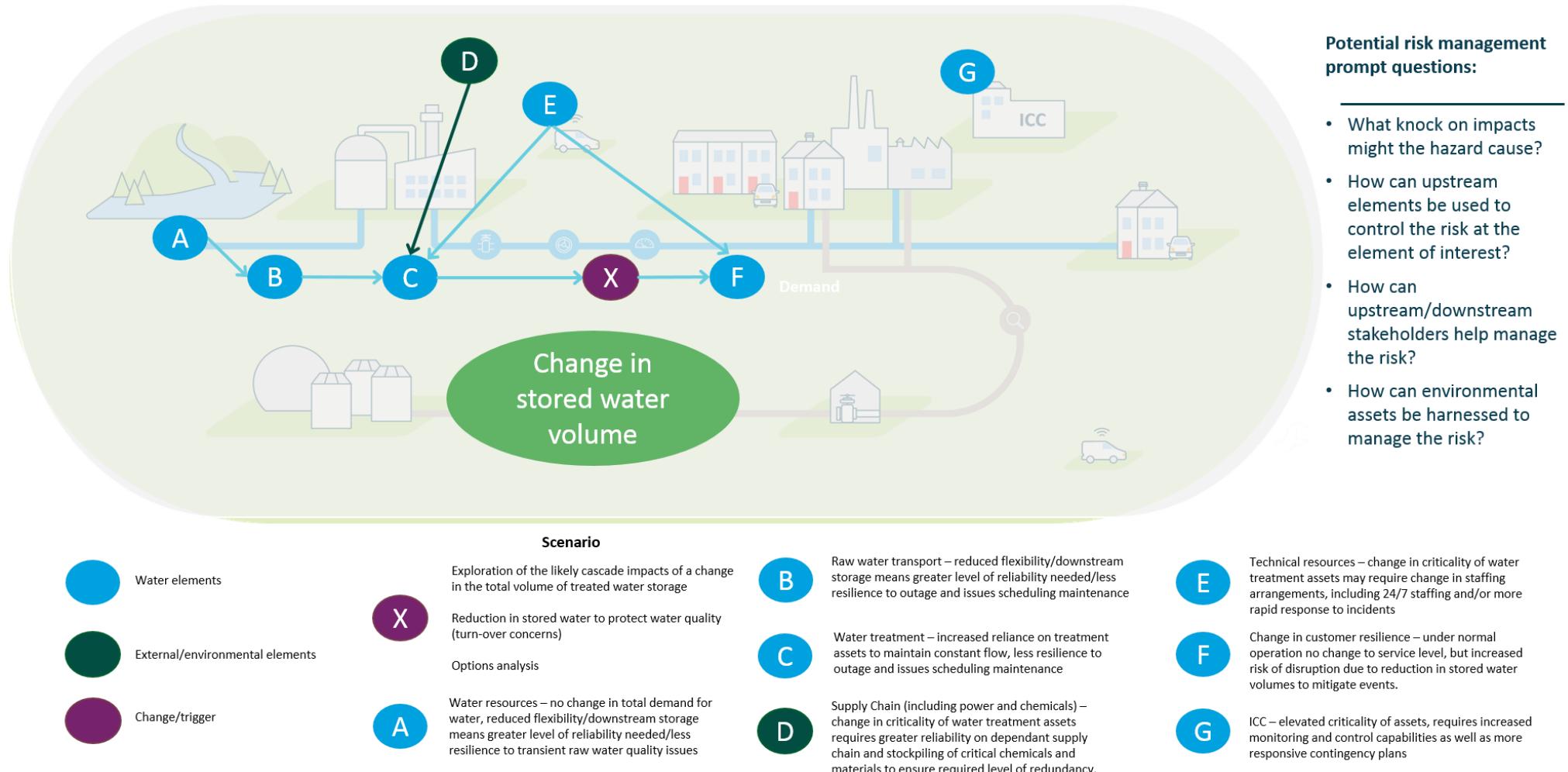
2.4 Systems-based resilience

- 2.4.1 Our systems-based assessments help us to understand the interactions between, and within, our assets and systems and those of other stakeholders, so that we can better manage shared or interdependent risks. This helps us to consider near, medium and long-term horizons when we think about the factors that could influence how we work. Taking a systems view is a fundamental enabler for our delivery of resilient services and in turn, better outcomes for customers.
- 2.4.2 Aligned with achieving our ambition to be recognised as the leading water company in systems-based resilience our vision for delivering resilient services to customers means we:
- Maintain a systems approach across our operations and investment activities. We routinely step back and consider elements of our systems, how they are affected by other internal and external systems and the impact we have on all those systems.
 - Continuously improve connectivity between our systems and assets. We assess what scale we need to consider when reviewing issues, to reflect how scale influences our decision making and how to engage different disciplines to achieve vertical and horizontal line of sight.
 - Collaborate in all our activities, with customers and with stakeholders (internal and external) who have an interest in and/or influence on our systems and assets.
- 2.4.3 We recognise that we operate a number of systems, from water treatment and distribution to wastewater treatment and subsequent bioresource recycling to land, and that there are many interactions, both internal and external, that can influence how they function. These systems exist at a variety of scales, and this variety and complexity is one of the factors that makes a systems-based approach challenging. A system is a set of elements that are interconnected and work together to serve a common function or purpose. All of the following examples can be considered from a systems perspective:
- A physical asset: such as a pump within a site such as a water treatment plant belonging to a catchment and a region forming part of a production line: such as the flow of water from source to tap and then beyond to sea;

- Industry, the weather, the environment and communities or customers (specifically their behaviour);
 - The variety of management procedures and processes we use to deliver our services; and,
 - The mechanisms used to deliver programmes of work, particularly when adaptive programmes are developed, which consider decision points in the face of future uncertainties.
- 2.4.4 We have worked to establish our integrated approach to resilience and we have a number of delivered and ongoing initiatives and recent case studies that demonstrate our developing systems approach. Key examples are our Dynamic Network Management (DNM) programme that provides early visibility across our wastewater network of issues and incidents and our West Cumbria supply programme that has delivered an integrated water supply system across West Cumbria with centralised optimisation and control of much of the asset base. We are building on these foundations, testing their success as we embed a systems approach throughout our organisation.
- 2.4.5 In *Chapter 7* of the business plan we describe our approach to systems resilience mapping and how to fully appreciate the risks that are posed to our services. We have mapped our whole system, and the network of systems on which we rely and how they interact with each other.
- 2.4.6 We are now building on this initial systems mapping work to focus on key system independencies and to identify risks to be addressed in AMP8. We are developing outputs from our systems mapping work to create a systems interrogation tool, which United Utilities Water can use to improve risk management to identify the most appropriate and efficient investment needs.
- 2.4.7 The tool will allow us to act on complex information in the systems maps when assessing and mitigating risks. It will allow us to be presented with elements upstream and downstream of an element of interest. Alongside this, questions will be prompted to ensure risk identification and mitigation considers system interdependencies and a broad range of mitigation measures.
- 2.4.8 In identifying our critical interdependent and dependant systems we can identify and quantify the risks that are posed to us, and the cascade implications both upstream and downstream. Taking a wider systems view enables us to identify potential co-delivery and partnership opportunities, understanding who is the most appropriate body or service provider to secure resilience as efficiently as possible. For example, working with the local Distribution Network Operators (DNOs) to understand the current supply side power resilience and any planned enhancements. This reduces the risk of duplicative investment by UUW. For more detail, see Section 6.2 of supplementary document *UUW67 - power resilience enhancement case*.
- 2.4.9 Table 1 shows how the complex system maps we developed have been simplified to provide useful tools for our colleagues. The maps can be used to identify the most significant up and downstream impacts of an issue and to ensure that they are appropriately considered throughout the risk management process. The linkages between the elements of the system are each weighted, dependent upon their potential to react strongly with disruption to the associated elements. This process will be used more broadly in the remainder of AMP7 and into AMP8 as we further develop our systems approach within the business. The system can be navigated, and key elements reviewed and analysed, to ensure that the wider context of risks can be better assessed.

Figure 1: Example systems resilience decision support tool

Worked example – considering the effects of a change in treated water storage on the United Utilities system to support decision making



2.5 Multi-layered

- 2.5.1 We have developed a multi-layered approach to securing resilience, reducing single points of failure at an organisational, system, and asset level. Our approach is aligned to an evolved version of the Cabinet Offices 4Rs model we call the 5Rs, extended to include a 'Review' stage. In adopting a multi-layer approach we are able to prioritise investment on the areas/layers that secure the most cost beneficial return on investment, avoid issues on diminishing returns associated with single focus investment strategies and ensures that resilience is delivered 'in the round', providing greater service security to a broader range of shocks and stresses when compared to traditional asset level investment.
- 2.5.2 The '5R' concept discusses how resilience is best delivered through:
- **Reliability** – investing in the health of our assets;
 - **Redundancy** – maintaining efficient headroom/capacity in our systems to be able to absorb shocks;
 - **Resistance** – securing our assets against security threats;
 - **Response and recovery** – ensuring that we have the response capability to react to events when they do occur; and
 - **Review** – how we analyse and learn from past events and incidents to further enhance our resilience.
- 2.5.3 Our approach has been to deliver cost beneficial levels of each of the '5Rs' focusing not only on individual aspects but a broad spectrum to ensure that we are capable of maintaining services in the face of acute shocks and chronic stresses. At different points in time, we have focused on the 'R' that provides the most value or where we have identified the biggest 'gap'. This strategy provides more resilience than if one area is focused on. For example, it is not cost beneficial to invest in providing a very reliable system if there was no capacity to respond and recover in the event of an incident, or if insufficient resistance to credible threats had not been implemented to prevent malicious service interruption. Our investment plans have, therefore, varied, targeting asset cohorts or prioritising intervention types that are the most cost beneficial, with periods of more or less intensive replacement activity.

2.6 Our 5R approach

- 2.6.1 In this section we explain in more detail what our 5R approach is, how we implement it, and how it is securing service resilience.
- 2.6.2 We understand that as good asset stewards we have to make choices to invest in our assets for the benefit of customers, the environment and wider society. How we choose to invest is determined by the value that is delivered from the intervention option along with the cost of delivery.
- 2.6.3 We make choices between each of the 'R's to balance the level of risk to services.

Reliability

- 2.6.4 Reliability seeks to ensure that our assets are designed to continue to operate under a range of conditions and that they are maintained at an appropriate level of health to continue operating and delivering service.
- 2.6.5 We measure the reliability of an asset with a broad range of operational measures. These are summarised in an innovative metric we call Base Asset Health (BAH). BAH is an assessment of the relative consumed life of an asset. This metric provides an overview of an underlying level of health for an individual asset or across a cohort of assets. Further information on our approach can be found in our

paper “Asset health in the water sector: Proposal for a framework” submitted to the Ofwat Future Ideas Lab in 2021⁵.

- 2.6.6 In general use, exposure to natural hazards, pressure and load all contribute to the deterioration of asset health and a potential reductions in reliability. In addition, other factors such as technological obsolescence and operation beyond design capacity also affects the asset health. Ageing and poorly performing assets therefore present a cross-business risk with uncertainty both to efficiency and resilience and the associated service capability.
- 2.6.7 A deterioration in the health of our assets can contribute to either the likelihood or severity of risks occurring. Many of these risks have a predicted reduction in risk exposure during AMP7 and beyond, due to a range of management activities. However, even for these risks, the contribution of the asset health to the risk may be increasing.
- 2.6.8 We invest from base, enhancement and reinvestment of outperformance in the replacement and refurbishment of our assets to secure continued reliability. We recognise that replacing assets can be costly, and poorly directed replacement can have limited value and resilience benefit, where investment in an alternative ‘R’ could have delivered more benefit at a reduced whole life cost.
- 2.6.9 In order to make sure that our investments are efficient and represent the best value option, we have invested in improving our understanding of our asset base. Capturing information and developing tools and processes to enable us to make data-led robust decisions about our base asset health. In doing so, we can make no or low regret investment decisions in the replacement of assets to secure continued reliability.
- 2.6.10 The positive outcome of our efforts in improving asset data and systems are reflected in the 2020 AMMA carried out by Ofwat as a cross industry benchmarking, particularly our industry leading approach to data and information management.

Redundancy

- 2.6.11 The redundancy element is concerned with the design and capacity of the network or system. The availability of backup installations or spare capacity enables operations to be switched or diverted to alternative parts of the network in the event of disruptions to ensure continuity of services.
- 2.6.12 The provision of efficient levels of redundancy in some of our systems and networks, for example twin - process streams, duty/standby arrangements at pumping stations and duplicate infrastructure, allows us to absorb acute shocks such as unplanned treatment works outages or heavy rainfall events. We recognise that this is not the case for our entire operation, and that while some redundancy may be available this may be at a reduced level of service until business as usual operations are fully recovered.
- 2.6.13 We recognise that providing system redundancy can be inefficient, incurring operational and maintenance costs for a capacity or service that can be seldom used. Therefore, we aim to maintain an efficient level of redundancy in the systems that we operate. In developing our asset information strategy and associated systems, we target improving the understanding of our assets, their relative health and their criticality to the system in which they operate. This strategy helps us to make informed asset investment decisions to secure appropriate redundancy for service delivery, where this represents the best value option.
- 2.6.14 Examples of efficient redundancy in our system include our operational target to maintain 10 per cent of regional demand for water in strategic regional storage reservoirs and through optimised system operation such as our Dynamic Network Management approach that uses predictive technology to maximise the availability of capacity in the sewerage system and reduce the impact of shocks from extreme weather events.

⁵ ofwat.gov.uk/wp-content/uploads/2021/04/United-Utilities-Asset-Health-Framework-Future-Ideas-Lab.pdf

- 2.6.15 Resilience can be created within existing systems by increasing headroom. Reducing losses is a key strategy to increase headroom across our systems. This headroom could significantly increase system resilience to meet forecast growth and development in the North West without the need to build new infrastructure. Key examples include the reduction in water lost as leakage and removing surface water from sewers, especially from combined sewer systems.

Resistance

- 2.6.16 The resistance element of resilience is focused on providing protection. The objective is to prevent damage or disruption by providing the strength or protection to resist the hazard or its primary impact.
- 2.6.17 Resistance includes both physical security to assets but also the ever increasing risk from cyber threats. Cyber-based risks could increase with growing deployment of sensors, a move to cloud computing and increased digitalisation of business processes.
- 2.6.18 In improving our understanding of asset information and criticality to the services we provide we have been able to determine the appropriate levels of physical resilience required at our water sites to meet national security requirements.
- 2.6.19 In understanding the criticality of asset loss to a service we can develop appropriate and efficient investment strategies. For example at our most critical sites securing against a physical attack, while maintaining service provision and allowing the auto-shut down of lesser criticality sites or those that have alternative supply arrangements once an attack is confirmed.
- 2.6.20 We invest in securing against cyber-attack, ensuring compliance with security standards. Protecting our own assets and systems but also conducting vulnerability screening of our supply chains systems and data handling.

Response and recovery

- 2.6.21 The response and recovery element aims to enable a fast and effective response to, and recovery from, disruptive events. The effectiveness of this element is determined by the thoroughness of efforts to plan, prepare and exercise in advance of events.
- 2.6.22 Our Integrated Control Centre (ICC) is fundamental to how we respond and recover in the event of an incident. These teams provide an informed view of how the water, wastewater and bioresources business streams are performing, in real time. Incidents are able to be responded to in a timely and coordinated way, and using an approach that prioritises our resources and minimises the impact to customers and the environment.
- 2.6.23 Our ICC is set up to deliver the following activities, in order to bring together teams and directorates:
- 24/7 company duty management – responsible for horizon scanning and leading the response to breaking incidents. They seek to ensure relatively minor events don't escalate into incidents.
 - Remote monitoring and control – several teams with discrete responsibilities covering monitoring of proactive alerts and reactive alarms and co-ordinating the operational response. In addition, a dedicated 24/7 water network team interrogate pressure, flow and telemetry data to quickly identify root cause and deploy resources and equipment and provide technical advice to minimise disruption to customers.
 - Customer service enquiries – providing proactive and reactive communications to customers.
 - Work management – the direction and monitoring of our field-based teams for reactive and planned work to repair and maintain our networks and facilities.
 - Support teams – including operational technology, emergency planning, business continuity and data management teams.
 - Deployment of Alternative Supply Vehicles (ASVs) – we are able to mobilise our fleet of ASVs to keep customers supplied during a repair and ensure regular communications with customers.

- 2.6.24 We work hard to deliver a high quality response and recovery approach. We work with other water companies through Water UK and Defra and we are constantly sharing good practice and experience.

Response - ICC Incident Capability

- 2.6.25 We are set up to cope with, and respond to, incidents utilising our mature and well-structured incident response plan and capability.
- 2.6.26 We have enhanced our situational awareness to put us on the front foot with regard to being able to impact assesses and respond appropriately to emerging issues, often preventing escalation of incident significance. For example, we take into account long-range Met Office forecast data into our production planning process to identify freeze thaw events but also peak demand events to enable us to prepare for such instances (for example filling up treated water storage assets and accelerating/postponing production outages). We described some of these activities and how the company prepared for the 2022 freeze-thaw incident in the report we published after the event⁶.
- 2.6.27 Embedment of subject matter experts within the Integrated Control Centre (ICC) is allowing more targeted and informed responses to events and incidents, especially from a water network failure risk. Technical support has always been available 24/7 in our ICC and in 2022 we introduced an additional support rota, bolstering the previously available technical support out of core business hours. This provides additional managerial and technical support in our ICC to mitigate the majority of the impacts from smaller events. In the first year of implementation we recorded our second best level of performance since the measure was introduced.
- 2.6.28 We recognise that we are still susceptible to major incidents, and are reviewing our resilience capabilities against the most critical failures. This includes reviewing and preparing contingency plans for our most impactful assets and systems.
- 2.6.29 Continued improvements to our situational awareness and monitoring and control capabilities enables us to identify and react to events as they occur. Supporting incident triage and accelerating response times and therefore reducing the impact to customers' service levels.

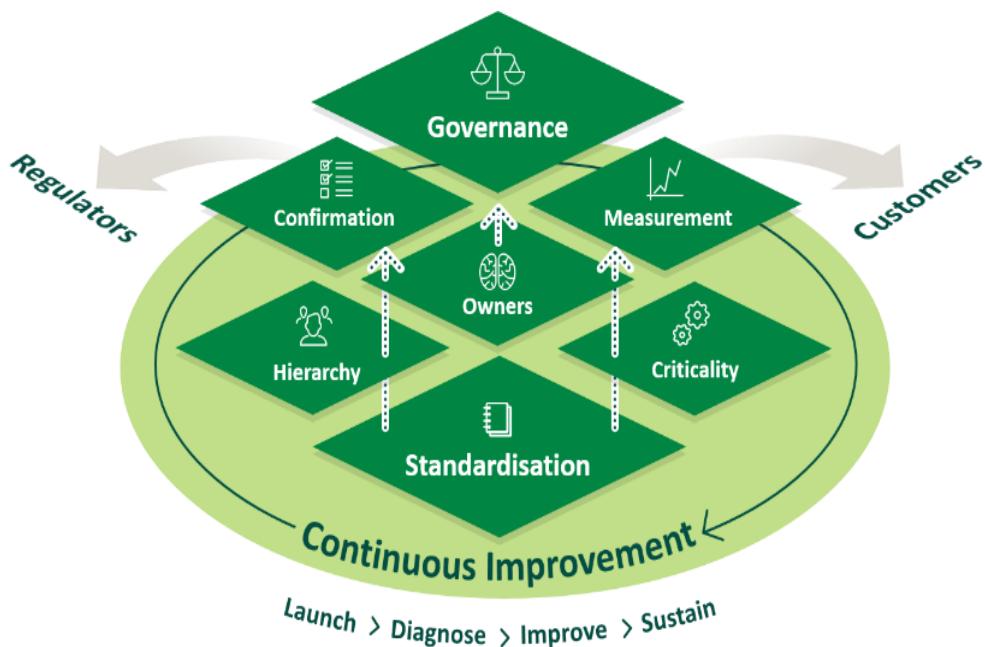
Review

- 2.6.30 This is the fifth 'R' of resilience, which was added by UUW to the Cabinet Office approach. It covers how we analyse and learn from past events and incidents to further enhance our resilience. Our strategy is not static and has evolved over time and in response to improved intelligence, threats, trends, and emerging risks as we mature our approach to be able to anticipate, react, and recover from shocks and stresses. This includes embedding and sharing the lessons from past events experienced by UUW and elsewhere, including experience internationally and from other sectors.
- 2.6.31 An early example of this approach was our broad sharing of lessons learnt after the 2015 water quality incident at our Franklaw water treatment works. Since then we have routinely shared our best practice findings and sought to gain learnings from others. For example, in 2023 we held a pollution summit with representatives from across the industry to help share learnings and ideas about how to reduce environmental pollution and avoid pollution incidents. Our maintenance excellence programme has benefited greatly from benchmarking across other asset intensive industries, learning and sharing best practice as we work to improve asset and system reliability.
- 2.6.32 After incidents, we have a robust and effective lessons learnt process that is underpinned by a Plan, Do, Check, Act process. Reviewing incidents allows us to assess our response to, and recovery from, these events. We can learn important lessons, which will help to inform the solution to future issues, as well as putting measures in place to prevent reoccurrence of the same problem. It also allows us to share best practice across business areas.

⁶ [unitedutilities.com/contentassets/706b59b346d64fa7bcd56e94177b6946/freeze-thaw-2022-uu-response---final-28-feb-2023.pdf](https://www.unitedutilities.com/contentassets/706b59b346d64fa7bcd56e94177b6946/freeze-thaw-2022-uu-response---final-28-feb-2023.pdf)

- 2.6.33 Our lessons learnt processes are not just applicable to incidents and events that we or others have responded to, but are also fundamentally linked to the Asset Lifecycle Management (ALM) processes.
- 2.6.34 Our Process Excellence Team works to improve the processes behind understanding how to best embed lessons, how to determine true root cause and problem solving.
- 2.6.35 Process Excellence is the focus on processes to make them more efficient and effective to deliver customer demands better, faster and cheaper, an illustration of our approach can be seen in Figure 2 below. Our approach is made up of two key components: Continuous Improvement (CI) and Business Process Management (BPM). BPM provides the key information relating to the current state of the process, while CI provides the tools and methodology to improve the process. Process Excellence is a key enabling element of the systems-based approach and capability model.
- 2.6.36 Specifically, we ensure that we are exercising our contingency plans, before they are called upon, to ensure that they remain fit for purpose. We do this both at a company level but also at a multi-agency level with our Local Resilience Forum partners and in national exercises. Exercising of contingency plans is vital to assure ourselves of their effectiveness and to insure staff remain familiar with them.

Figure 2: Our Continuous Improvement framework



- 2.6.37 Our Process Excellence team has developed a full suite of material to build upon these high-level principles, giving colleagues across United Utilities Water the specific detail of how we must create and manage our business processes based on our framework, in order to collectively achieve process excellence.
- 2.6.38 Delivering process excellence means:
- Possessing skills to understand which processes drive key business activities;
 - Ownership of our processes, and whether they function effectively;
 - Process performance assessed by data analysis and measurement; and,
 - Continuous Improvement techniques available to everyone in United Utilities Water to deliver efficient, sustainable and resilient business process improvement.

2.7 Sustainable asset management

What does asset management mean to an organisation like ours?

- 2.7.1 We are custodians of extensive and critical infrastructure. The asset base we own and operate is a testament to the pioneering innovation that made the North West what it is today, from major

aqueducts providing the backbone of our water system bringing water from North Wales and the Lake District into the urban centres of Merseyside and Greater Manchester, through to state of the art bio-resource processing centres providing nutrient and power recovery to agriculture and industry. The engineering challenges that have been overcome in building our water and wastewater infrastructure is interwoven with the social fabric of the North West, even reflecting the very identity of the region through the major reservoirs of Haweswater and Thirlmere and countless other regional landmarks.

- 2.7.2 We are committed to managing our assets efficiently and effectively via the internationally recognised Asset Management discipline, as demonstrated by our certification to the ISO55001 standard. This enables our organisation to balance various stakeholder and organisational needs to deploy our resources in the places that provides the best value.
- 2.7.3 We work to understand what is important to our stakeholders and balance these wants and needs with the availability of resources and our goals as an organisation, to come up with plans that satisfy the immediate needs, while considering the demands and challenges of the future. Through effective asset management, we can make sure that our assets are supporting our aims to protect and grow social and environmental value at every stage of the asset lifecycle.

Our asset management framework

- 2.7.4 Our Asset Management Policy⁷ commits us to operate, maintain and invest in our assets to deliver our core water, wastewater and customer services, reliably and to the highest quality now and for the future, while also:
- Protecting and enhancing the environment;
 - Supporting communities to be stronger;
 - Caring for customers through trusted relationships;
 - Creating a great place to work for all our employees;
 - Delivering a sustainable return to investors; and,
 - Innovating in partnership with suppliers.
- 2.7.5 Our value-based asset management decisions balance short, medium and long-term needs as we build resilience and reduce inherent risks across our asset base against challenges from climate change, demographic change and other major drivers. This policy is aligned and consistent with our other business policies.
- 2.7.6 One of the most important elements of asset management is giving everyone involved a frame of reference that helps them to understand how what they do fits in to the wider picture. Having a stable framework that represents the Asset Management System is key to this as it develops awareness of how we all work together to achieve our objectives and deliver for our stakeholders.
- 2.7.7 In AMP7 we have undertaken a range of benchmarking activities to understand our strengths and development areas; internal self-assessments using the Institute of Asset Management's (IAM) maturity assessment tool; external assessments undertaken by Asset Management Consultants; and participating in the Asset Management Maturity Assessment (AMMA) commissioned by Ofwat.
- 2.7.8 Insight from these activities has informed our improvement plans. Since taking part in AMMA, we have consolidated our Asset Management Capability, by achieving the International Standard for Asset Management (ISO55000:2014)⁸. This was awarded by external independent auditors following a detailed examination of our Management Systems in 2022 after our first assessment audit. The successful surveillance audit in summer 2023 helps to demonstrate the depth of commitment to asset management across the organisation. This ISO standard provides independent assurance of our

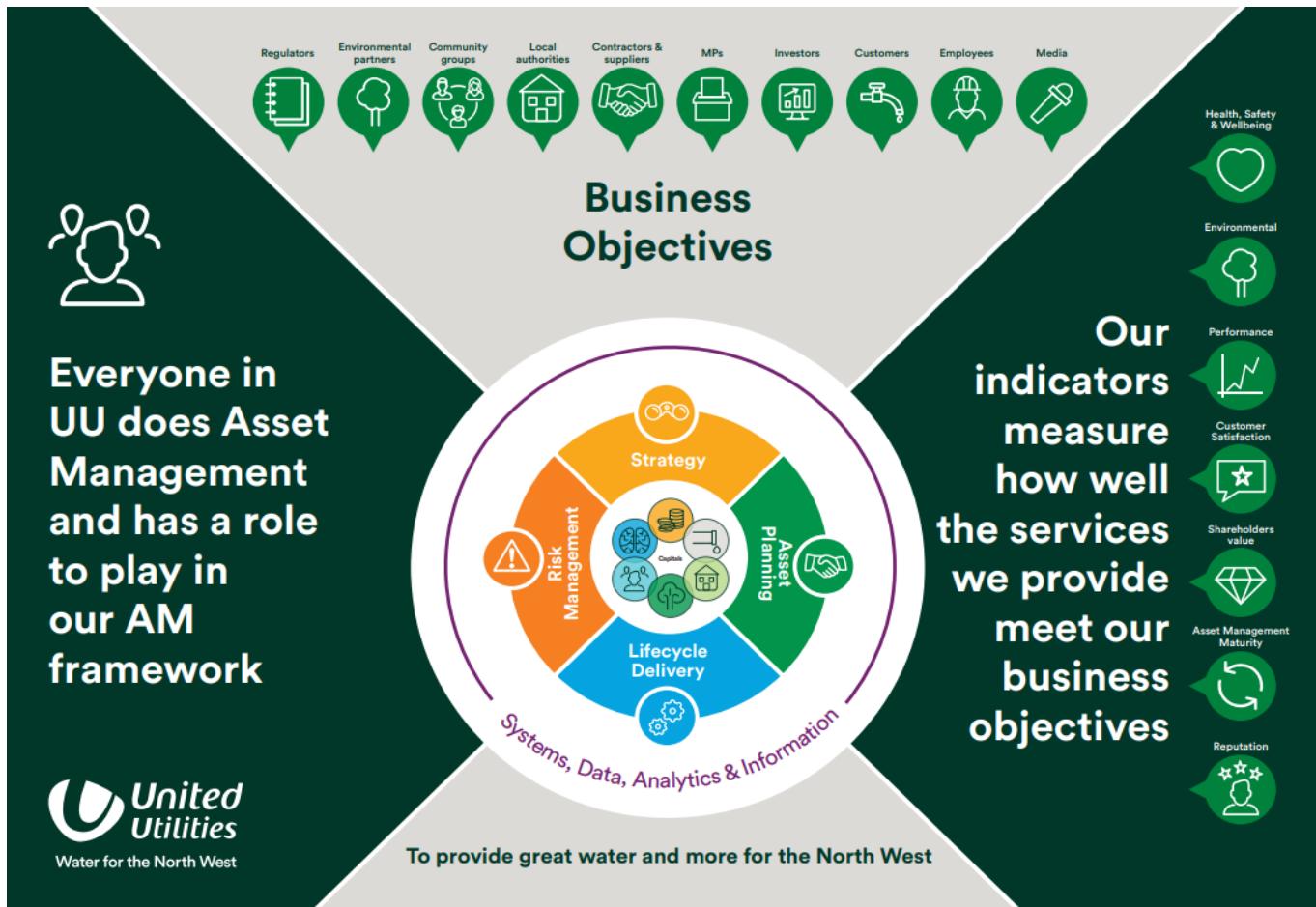
⁷ [unitedutilities.com/globalassets/z_corporate-site/responsibility-pdfs/asset-management-policy_july-2023.pdf](https://www.unitedutilities.com/globalassets/z_corporate-site/responsibility-pdfs/asset-management-policy_july-2023.pdf)

⁸ iso.org/standard/55088.html

competence in asset management and provides us and our stakeholders with confidence that we have an established and effective Asset Management System.

- 2.7.9 Our asset management framework is set out in Figure 3, below.

Figure 3: Our asset management framework



Our future strategy

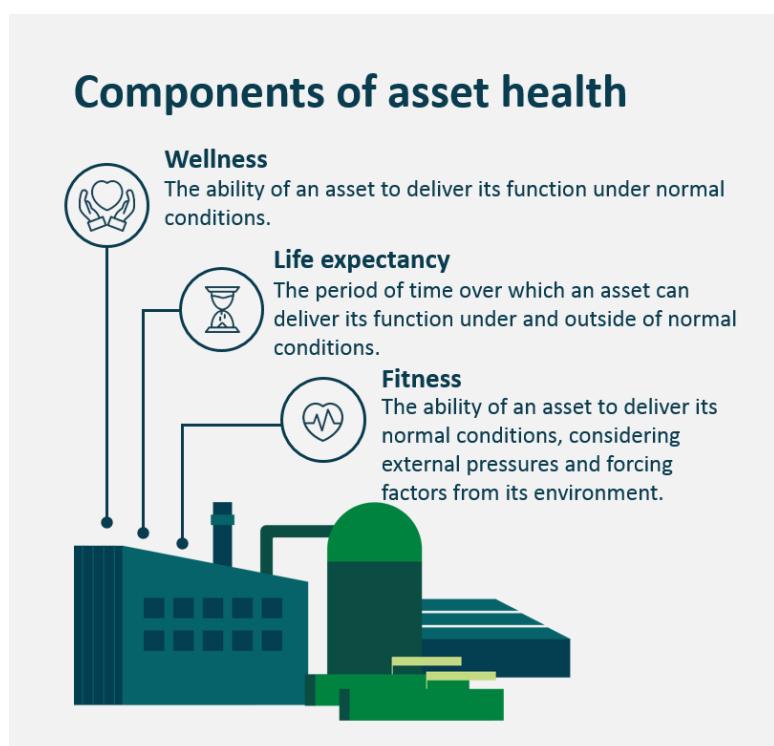
- 2.7.10 While we are confident we have got the right foundations in place, we are ambitious to do more. So, we have set ourselves a target of achieving 'Asset Management Excellence' by the end of AMP8.
- 2.7.11 We have developed a strategic asset management plan which sets out this vision and also the milestone activities that can help us to progress towards this aim. These are centred around our Asset Lifecycle Management Capabilities which will enable us to further integrate our activities both internally and with our supply chains and stakeholders. Ultimately by thinking about the whole asset lifecycle we will embed a systems approach into our activities, which will maximise the value we get from our resources and minimise waste.
- 2.7.12 The key strategic themes that we will deliver through this work include:
- More transparent alignment between our organisational objectives and the work we do on our assets;
 - Clearer ways of articulating environmental and social benefit;
 - Decision-making processes that incentivise even more innovative solutions and collaborative delivery mechanisms that result in multiple mutual benefits;
 - Design processes that harness the latest technologies and deliver solutions that offer best value over the whole life of the asset;

- More efficient asset creation activities that minimise impacts on the environment and local communities;
 - More seamless transition of new assets into operational management;
 - Better exploitation of our data to optimise the management of our assets at all stages of their lifecycle;
 - A permanent shift in the deployment of our maintenance activities from reactive recovery to proactive maintenance, meaning that maintenance is safer, quicker and less disruptive;
 - Using data to support our decisions and activities with greater levels of insight; and,
 - Doing the right thing with assets at the end of their life, making sure that we do not leave legacy risks, and that we reuse, re-purpose or recycle components and materials where we can.
- 2.7.13 As we continually develop these capabilities, we are looking to learn from best practice in other organisations and sectors. For example, our award winning Maintenance Excellence programme has been developed taking inspiration from organisations in the USA. Through establishing collaborative knowledge sharing relationships with others in the UK water industry and beyond⁹, we have also helped to develop forums where organisations can share best practice.

2.8 Asset health – understanding our assets

- 2.8.1 In order to make appropriate decisions around investing and maintaining our asset base it is essential that we understand our assets, starting from a high-quality inventory, through useful performance data and structural condition assessments. To deliver continuous improvement to systems resilience it is critical that it is underpinned by sustained asset health.
- 2.8.2 Through the targeted collection of appropriate data we gain a good understanding of our assets to support both the operational needs of the business and the longer-term asset management needs.
- 2.8.3 We use three primary concepts to consider measurement of asset health; these are outlined in our well-received submission to Ofwat's Future Ideas Lab¹⁰. See Figure 4 for how we define the components of asset health.
- 2.8.4 Operational health indicators help us to understand how likely an asset is to be unwell. We use these indicators to help assess the effect of our operations and our operational maintenance in keeping our assets fit and well.

Figure 4: Components of asset health



⁹ These include UKWIR Future Asset Planning, Asset Health Forums, knowledge sharing with Northumbria Water, Welsh Water, Scottish Water, and National Nuclear Laboratories.

¹⁰ ofwat.gov.uk/wp-content/uploads/2021/04/United-Utilities-Asset-Health-Framework-Future-Ideas-Lab.pdf

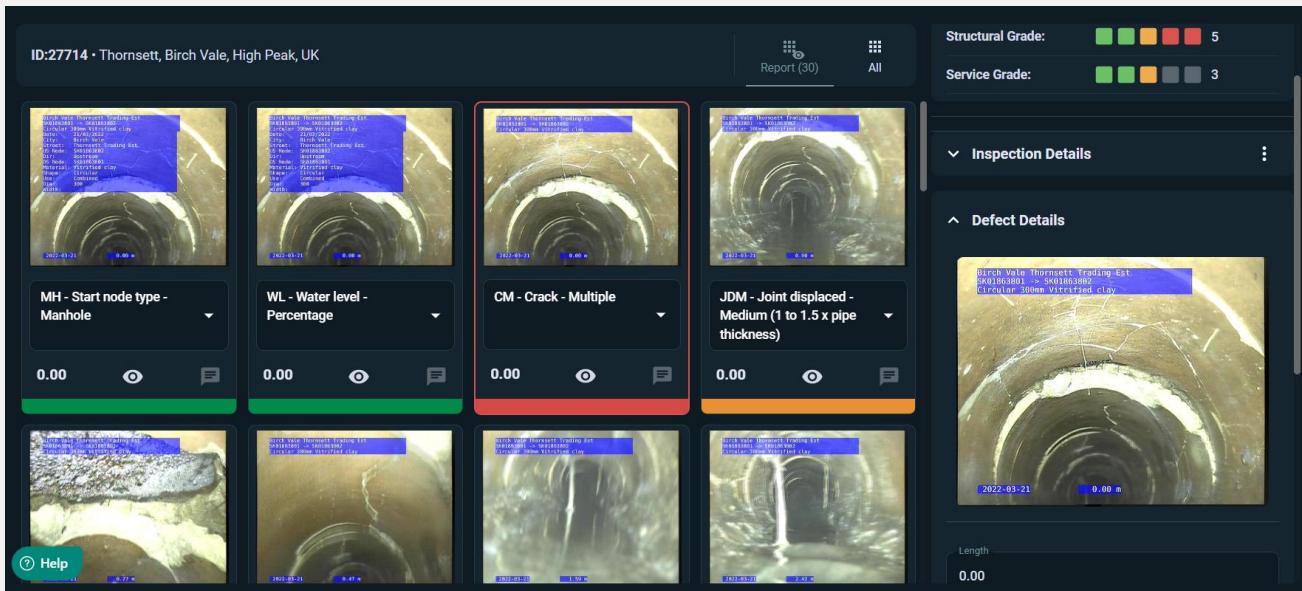
- 2.8.5 Capital maintenance health indicators help us to understand the life expectancy of the asset, or the expected time until a significant intervention may be required. We call this measurement framework Base Asset Health (BAH) and we have developed this approach to enable us to assess the BAH for individual assets or roll these up at any level up to whole company level. This approach gives us the ability to understand and communicate the health of our asset base across the business.
- 2.8.6 For long-term planning, it is the life expectancy measures that are most critical. This is why we have developed our Base Asset Health (BAH) metric to help understand and communicate the impact of different investment plans upon the underlying health of our assets.
- 2.8.7 Our improving operational performance trends demonstrate this. This means we have more confidence about when and where investment in renewals is the most effective and efficient way at improving reliability.
- 2.8.8 Healthy assets are essential to delivering high-quality water and wastewater services to customers as well as for meeting our statutory obligations to the environment. They enable us to sustain and enhance our performance and to be resilient to external shocks and stresses. Emerging challenges, such as climate change, as well as potential new contaminant risks and demographic change, place additional demands on our asset base so we must embrace innovation to protect water quality and the environment for the long term. Our commitment to sustainability means we must balance short, medium and long-term needs to safeguard the future and to balance costs fairly between generations.
- 2.8.9 The increasing focus on asset health within our business has been driven to a large extent by the growing awareness of the health of our asset base and how this relates to future performance. The key metrics produced on asset health have ensured that investment continues to be directed to the parts of the asset base most in need.
- 2.8.10 The following four case studies demonstrate how we have been supplementing long standing business-as-usual operational data capture with innovative and targeted technologies to broaden our understanding of asset health across the asset base. We provide four examples of either difficult or critical to assess asset cohorts and how we have been improving our understanding through the application of technology:
- (i) Artificial Intelligence for sewer condition assessment – applying machine learning to operational data;
 - (ii) Civil and structural condition capture – data capture to support analysis of long life above ground assets;
 - (iii) Chemical tanks condition assessment – understanding the chemical storage tank lifecycle; and
 - (iv) Water mains – modelling deterioration in support of leakage detection.

Artificial intelligence for sewer condition assessment helps us improve our sewer deterioration models for assessing future investment needs

We have led an industry team working as part of the Ofwat ideas lab to develop Artificial Intelligence systems to quickly and simply classify sewer defects from operational camera surveys. This built upon our work alongside a start-up company call Vapar within our annual 'Innovation Lab' process.

Traditionally, understanding sewer condition required dedicated cameras and specially trained staff to watch and interpret the videos; all at significant cost. In addition to these condition surveys, we also use cameras to survey the condition of sewers before and after maintenance work, we call these 'fast pass' surveys. Fast pass surveys have usually generated 'single use' operational data, but there is additional information that could be mined from these videos. We now have access to trained expert AI systems that automatically 'watch' and code defects from these video files, an example is provided in Figure 5.

We have piloted using this software in our planned cleaning programme and are now extending the use further within our reactive operational teams. These teams can now upload fast pass surveys as part of their day job.

Figure 5: A CCTV survey in Vapar showing specific sewer defects and the overall condition

The surveys are uploaded into the cloud where they are reviewed and coded by the Vapar software. The software identifies specific defects from the survey and stores them as photographs, it encodes the defects, produces standard reports and also holds the original video file.

The rapid provision of good quality information allows improved decision making operationally, but also provides a growing library of condition data across our sewer network. Part of the scope of the pilot was also to determine the appropriate standard for capturing CCTV survey data. We found that some cameras didn't perform well enough and that some teams were going too fast to use the captured video; these findings have fed into our standard operating procedures. As we capture more data, we will use this to further improve our sewer deterioration models for assessing future investment needs, both at a strategic and operational level.

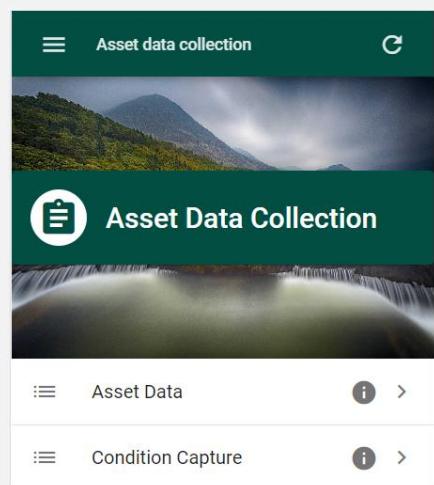
Civil and structural condition capture helps us to evaluate real world asset lives

The routine collection and storage of asset condition data relating to civil structures has often been limited to a few classes of particularly critical assets, such as impounding reservoirs, service reservoirs or chemical storage tanks. Civil structures are generally large, long-life structures, without immediate performance impacts at the first signs of deterioration. Consequently, routine operational maintenance regimes are focused on maintaining reliability and efficiency of mechanical, electrical, instrumentation and control assets, with less focus upon the civil or structural assets. Typically, civil survey data remains in unstructured, technical reports, making routine modelling and risk assessment challenging.

In order to address the above shortfalls in civil data capture, we have developed a simple Android app for condition data capture (Figure 6).

The app utilises some of the everyday capabilities that are now routine on a smart-phone, such as QR code scanning and GPS geolocation. Our colleagues can scan one of the QR asset tags deployed across 500,000 above ground assets; this displays the available details of the scanned asset and enables a simple survey to be completed.

The survey consists of a structured assessment of key components of the asset, allowing the capture of photographs, comments, an overall condition grade and detailed aspects of each component. The app is available across the business, enabling surveys to be undertaken by any authorised

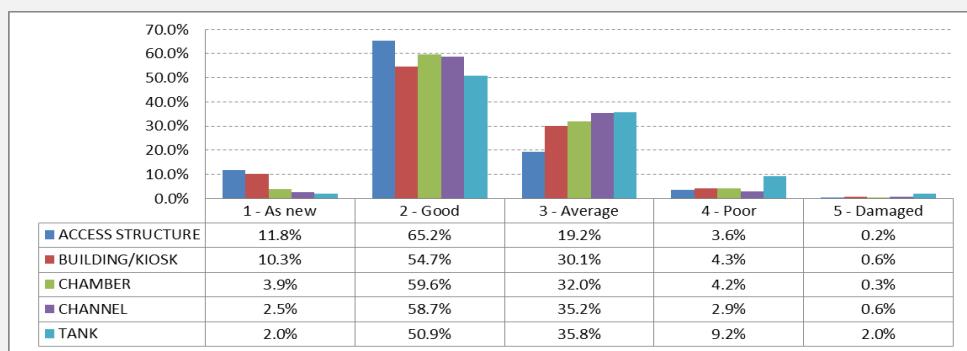
Figure 6: Screenshot of the asset data collection application

colleague, following some simple training, either as part of a proactive survey programme or on an ad hoc basis. The app is simple to use and provides a more intuitive and consistent approach to data capture than traditional methods. The captured data is then transferred to a central repository, allowing access across the business.

In a recent data collection project, we picked five classes of common, civil assets on small to medium-sized water, wastewater and bioresource treatment sites where our existing data and models indicated that the civils assets would be approaching 'end of life' condition states. A total of 65 wastewater treatment works, two bioresources treatment works and ten water treatment works were surveyed. The high-level results are shown in Figure 7 below.

The data has been used to modify our expected lives for key structural assets and will be an important source for further asset health prediction, as well as routine operational risk capture. This helps us to better plan for future replacement by managing cost shocks of early write off and providing indication of future investment needs.

Figure 7: Condition distribution across key civil and structural assets at treatment works



Chemical tank condition assessment – supporting asset management predictive modelling need.

UUW operates over 2,000 chemical storage tanks. These support a wide range of processes across water, wastewater and bioresource treatment, dominated by disinfection, coagulation, pH correction and corrosion inhibition. A sample of 271 chemical tank surveys from between 2018 and 2020 were collated to further enhance our approach to tank condition surveying and to identify common risk factors for consideration in future design and replacement.

The following predictive risk factors were identified that affect tank condition:

Location – external tanks are significantly more likely to have higher rated defects; and

Age – tanks older than 15 years are significantly more likely to have higher rated defects.

The defects observed through close visual inspections were classified into five categories:

Structural degradation of the shells – these defects are likely to require either tank refurbishment or tank replacement. Typical examples are cracking, holing, thinning of the tank shell, lining or coating.

Structural degradation of the ancillaries – these defects are likely to require ancillary refurbishment or replacement, typically bolt, gasket, pipework replacement or corrosion treatment or bund resurfacing.

Structural degradation of access structures – these defects were associated with ladders and access ways dedicated to supporting operation and maintenance of the tanks.

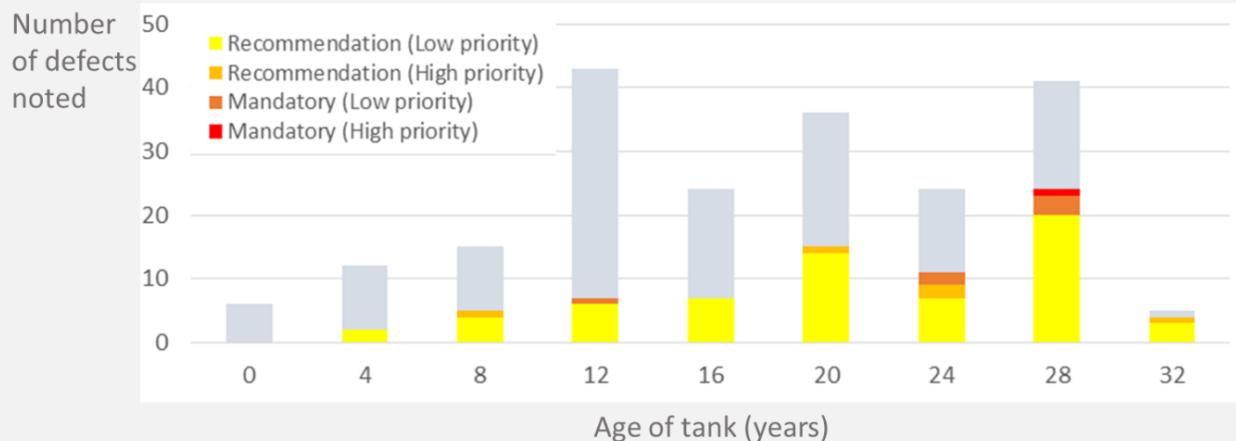
Bund degradation – these defects affect either the dedicated or integrated bund.

Operational and maintenance defects – these defects are likely to require changes to either operation or maintenance of the tanks. Typical examples are cleaning of debris from bund or tank roofs, checking sump pump operation, cleaning of spillages.

Figure 8 below shows the increase in defect identification rate and severity with tank age. This data has been used in conjunction with tank replacement data to revise the expected tank asset life for depreciation charge

assessments. The detailed understanding of defect categorisation and associated risk factors has fed into our future tank surveying approach to enable us to collect a single data set designed to support the operational inspection requirements as well as the asset management predictive modelling needs.

Figure 8: Chemical tank deterioration with age



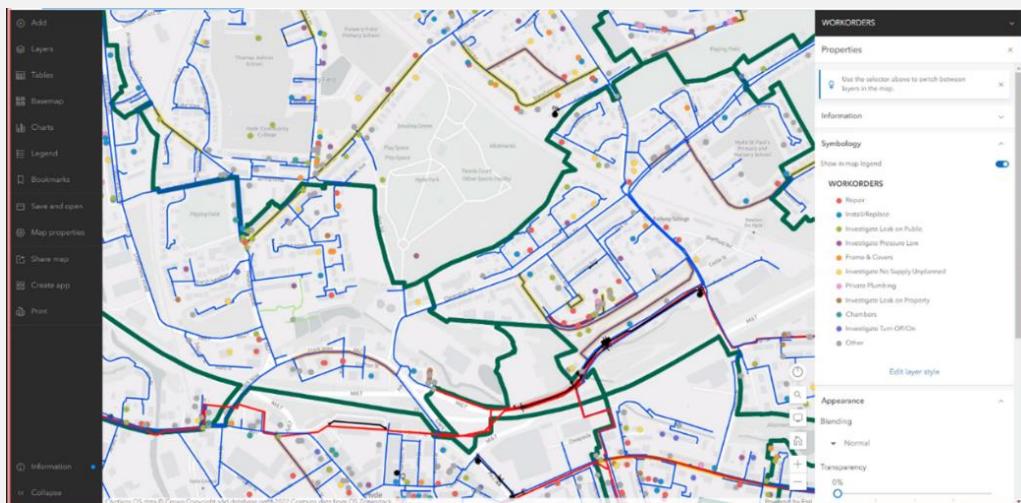
Water mains – modelling deterioration in support of leakage detection

Modelling deterioration of water mains has been a central part of asset health capability since the privatisation of the water industry. The key risk factors affecting current and future performance are reasonably well understood and are typically considered to be age, material, diameter, soil/geology, operating pressure and failure history.

How these are accounted for, the specific weighting applied to each factor and the level of granularity of the modelling all vary from company to company. We have consistently maintained models that apply to individual pipes and are deployed within an overall investment framework that considers the costs of different proactive interventions as well as the costs of reactive strategies coupled with the expected service impacts of failure. This framework enables us to test most credible investment scenarios for the water network.

During AMP7 we have been working to deliver additional value from these models by deploying them into active leakage detection in the operational business. This has required the development of enhanced leakage models that can be rapidly applied in areas identified by operational analysts for leakage detection. We have developed detailed, interactive, pipe level maps that can be accessed via either an Android app or via a web page. An example of an Interactive leakage detection risk map can be seen in Figure 9.

Figure 9: Interactive leakage detection risk map



The maps provide simple colour coded pipes with their predicted failure risk as well as their predicted leakage risk. We currently have developed base maps for use in 'normal' situations and plan to further develop the maps to be used in more extreme situations subject to leakage breakouts, such as freeze thaw events and long

summer droughts. We have identified clear patterns of failure associated with these seasonal events, such as a substantial increase in cold failures particularly in cast iron pipes.

Our failure, leakage, interruption and customer contact modelling has formed a central part of our selected options within our 2024 Water Resources Management Plan¹¹ as well as our PR24 business plan.

Understanding asset health – conclusions

- 2.8.11 The continued investment we are making into better understanding of our assets and the systems that they operate within is giving us a much clearer understanding of the risks that we are managing when operating our business. Our approach helps us to understand the right time to modify our plans for asset replacement in a targeted and effective way. We are confident that our mature approach to asset health and more broadly operational resilience will enable us to continue to deliver improving service levels at an appropriate level of resilience.

2.9 Enabling resilience

- 2.9.1 Our resilience is underpinned by enabling strategies: the people, processes, and tools to deliver resilience are a fundamental consideration when assessing resilience in the round.

People

- 2.9.2 The health, safety and wellbeing of our people is of paramount importance. We rely on the skills and capabilities of our people to deliver a resilient service. We want everyone who works on our sites or on our behalf to go home safe and well and therefore we implement a proactive process of identifying and rectifying unsafe practises and reducing exposure to risks. These are identified and managed through our centralised risk identification and management process.
- 2.9.3 Our colleague accident frequency rate for 2022/23 was 0.072 accidents per 100,000 hours worked. This was lower than the previous year and amounted to nine accidents reported. We have focused risk-based plans in place to maintain progress towards our 2025 target of a 10 per cent year-on-year improvement in performance.
- 2.9.4 In recognition of our commitment to health and safety, we were awarded the Royal Society for the Prevention of Accidents (RoSPA) gold standard medal for the 11th consecutive year. In support of colleagues' wellbeing we have again retained the Workplace Wellbeing Charter accreditation.
- 2.9.5 Process safety is a disciplined framework for managing the integrity of operating systems and processes that handle hazardous substances. It relies on good design principles, engineering and operating and maintenance practices. We had instigated a review of process safety at UUW prior to the Avonmouth tragedy – and this was subsequently accelerated to ensure that our processes and safe systems of work adequately protect our people.
- 2.9.6 The resilience of our workforce becomes increasingly important as the world becomes more digital. We need to ensure we have the right people, with the right skills and capabilities, in order to carry out their roles effectively and manage in the modern world.
- 2.9.7 During the last year, we have delivered over 20,000 days of training, ensuring our colleagues have the right skills, knowledge and behaviours to safely and effectively undertake their roles. A major delivery this year was the water quality awareness training completed by 4,500 colleagues as part of our wider Water Quality First programme.
- 2.9.8 We recognise that, in order to attract and retain people with these skills, we need to ensure we have a culture that supports diversity and inclusivity. In 2022, we again ranked in the top one per cent of over 850 companies across Europe in the Financial Times' Statista Survey for Diversity and Inclusion Leadership, and were the leading utility company in the Top 50 Inclusive UK Employers Index. We have

¹¹ [unitedutilities.com/corporate/about-us/our-future-plans/water-resources/developing-our-water-resources-management-plan/](https://www.unitedutilities.com/corporate/about-us/our-future-plans/water-resources/developing-our-water-resources-management-plan/)

been included in the Bloomberg Gender Equality Index 2022, showing our commitment to more equal and inclusive workplaces. We strive to be the employer of choice in the North West through improving our brand, to attract the right quality candidates and retain them and these awards confirm that we are making progress in this area.

- 2.9.9 Every five years, and triggered when necessary, each department within United Utilities Water completes an Occupation Capability Review (OCR) to determine the required workforce, skills, capability, and structure to deliver the core functions of the department, this includes a forward look into the requirements of the future strategy. The outputs of these reviews are used to form an action plan to ensure mitigations are put in place to address any risk identified and close the gaps. This becomes more important in the operational world as we move into advanced digitalisation of services and systems, we need to ensure that we maintain the current capabilities to operate and maintain existing asset bases, while upskilling on the latest technology.
- 2.9.10 Rather than going to the market to fill any capability gaps identified through the OCR, in the first instance we look to build skills resilience internally through training and development, including digital skills. We have graduate and apprentice schemes, and ambassadors that work with schools and education institutions to encourage the younger generation to pursue science, technology, engineering and mathematics (STEM) careers. We want to inspire and attract people into STEM careers and have many outreach activities to reach people from the widest talent pools. We've committed to supporting the '10,000 Black Interns' programme over the next five years.
- 2.9.11 Prior to the COVID-19 pandemic, the majority of United Utilities Water's employees would routinely travel to work on a daily basis to one of the group's offices or sites. During the pandemic, we recognised the need to evolve our ways of working to adapt to the future. The board was fully involved in the development of the group's next ways of working, including the pilot project prior to rolling out the hybrid way of working for roles which fulfilled specific criteria within the organisation. Post-pandemic we have recognised the need and benefits from the new way of working and have retained our 'hybrid' way of working where appropriate. Benefits include, improvements in engagement and wellbeing, improvements in operational performance, reduction in employee sickness absence, reduced travel costs and greenhouse gas emissions. Increased hybrid working provides many opportunities including the ability to attract employees from a wider and potentially more diverse talent pool.

Digital

- 2.9.12 New technology and innovations create opportunities for improvements in service and efficiency, and keeping at the forefront on innovation is vital to delivering a sustainable service through a changing climate. Adopting new technology can introduce risks, however, through cyber security and changes to our ways of working.
- 2.9.13 We have evolved our approach during AMP7, responding to the significant increase in cyber threats, most notably following the start of the war in Ukraine. We will continue to ensure we are taking all reasonable steps to maintain our digital resilience.
- 2.9.14 In 2025, Openreach plans to switch off the Public Switched Telephone Network (PSTN). This 'switch off' will also impact ADSL and IDSN connections that rely on the copper network. We have recognised the need for United Utilities Water to replace our business critical telemetry connections before the existing methods become obsolete. To mitigate this risk we are making good progress replacing our PSTN connections with digital alternatives such as 4G mobile technologies. This has given us an extra layer of resilience, allowed remote monitoring and fault fixing, OPEX savings and also enabled broader situational awareness. We are targeting the completion of this project prior to the 2025 'switch off' to ensure we maintain a resilient service.
- 2.9.15 In addition to the technological updates described above, we have also launched our Digital Skills Academy, a new learning portal for employees to access digital learning content to upskill them for their roles now and in the future.

2.9.16 We have comprehensive IT Disaster Recovery (ITDR) arrangements across critical systems with resilience built into the underlying infrastructure where necessary. This was demonstrated during the Covid-19 pandemic, where we effectively and efficiently moved large numbers of colleagues from office working to remote working over-night. These disaster recovery arrangements differ from Business Continuity planning for loss of systems. Business Continuity planning for loss of systems details how services will be maintained during a system loss, whereas Disaster Recovery arrangements detail how, and in what order, systems will be brought back online following a loss. These two aspects of our resilience are interlinked and complimentary to each other. More detail on the business continuity aspects of response to and recovery from a cyber-attack are detailed below.

Business continuity and contingency plans

- 2.9.17 We use the term business continuity to cover planning for loss of office accommodation, centralised business services (in particular control room and customer service centre activities) and loss of people, for example through flu pandemic or inability to get to work due to extreme weather or fuel supplies disruption.
- 2.9.18 Our effective management of Business Continuity (BC) means we are able to better plan for, and respond to, incidents that could cause business disruption. Our aim, in all circumstances, is to keep our business operating at an acceptable level that safeguards the health of our employees, as well as the interests of customers and other key stakeholders, ultimately protecting our operation and reputation.
- 2.9.19 Our Business Continuity approach is aligned to ISO22301 and our comprehensive business continuity plans will consider BCI 'Good Practice Guidance' using templates provided by the Business Continuity Adviser through our ClearView Business Continuity Management system. ClearView provides a validated, high availability and resilient system that is accessible 24/7.
- 2.9.20 Central Government's planning assumptions for a range of risks are set out in the National Security Risk Assessment (NSRA). These assumptions provide information on the common consequences of the emergency scenarios set out in the NSRA. Where relevant, these scenarios will form the basis of our Business Continuity planning and the development of specific, strategic plans, for example pandemic, fuel supply disruption, loss of national telephony.
- 2.9.21 To ensure they are up to date, we review our Business Continuity plans regularly, or at the point of any considerable changes in the business or within specific departments. We provide appropriate information, instruction, training and supervision to those involved in embedding our Business Continuity Framework, so that we have a workforce that is skilled and competent in Business Continuity Management.
- 2.9.22 The Incident Control Centre (ICC) Response Manager will assist individual departments in the management of business continuity incidents and any necessary escalation of incident management structures. Business continuity incident management teams are resourced and run by the affected business areas, supported by the ICC, and follow company good practice incident management process.
- 2.9.23 The BC aspects of response to and recovery from a cyber-attack are managed through the Security Steering Group. The Cyber Security Incident Response Plan (CSIRP) details the roles and responsibilities and actions that would be undertaken in response to a cyber-attack. Across the business, departments are required to develop BC Responses for a four week outage, to the following three scenarios:
- Loss of United Utilities Group IT network;
 - Loss of internet; and,
 - Loss of telecoms.
- 2.9.24 We ask potential suppliers for details of their business continuity arrangements. Where the key user of the service determines it not to be relevant to assess business continuity provision, this is documented in the procurement strategy. In the tender assessment process for key contracts, tenderer business

continuity arrangements are assessed against criteria aligned to Business Continuity Institute (BCI) Good Practice Guidelines. Business continuity is covered as part of our annual supplier health check.

- 2.9.25 A risk-based approach to plan validation (through the delivery of exercises) is taken. The frequency and depth of exercising is determined by the criticality of the business function, and is programmed in annually. The mode of delivery for exercising is varied to encompass modular, desktop and live-play formats. Exercising is coordinated and supported by the Emergency Planning Team who keep a record of tests undertaken and lessons and risks identified.
- 2.9.26 We share good practice with industry colleagues and partner agencies as defined by the Civil Contingencies Act in accordance with company information management policies. We will also consider emerging good practice from other organisations and how that may benefit our own Business Continuity processes.
- 2.9.27 We monitor and review our capabilities including regular audits of the effectiveness of the Business Continuity Management system and improvement programme. We also encourage colleagues to:
- Speak openly but responsibly about threats and opportunities related to events that will/could impact business operations and associated recovery plans.
 - Share good Business Continuity practices with others to assist us all in meeting the required standards.

Maintenance excellence

- 2.9.28 Maintenance excellence is our approach to keeping our assets and equipment as safe, cost-effective and reliable as possible. An efficient maintenance strategy is vital for providing the high-quality services customers depend on. For our colleagues, it is key that we reduce labour-intensive, last-minute and dangerous work as much as possible.
- 2.9.29 To achieve maintenance excellence, we aim to eliminate asset failure and avoid expensive repairs or short-term fixes. We are doing this by scheduling routine maintenance work, prioritising our most critical assets and investing in innovative technology. We have dedicated teams working in new ways to prevent asset failure across the business. In recognition of our approach and progress we have made, UUW was awarded the Best Leadership for Reliability Uptime Award in 2022 at the International Maintenance Conference. The judges said: "UUW, from the United Kingdom, was selected as an Uptime Award winner in the Best Leadership for Reliability Program category, as a way of recognising this organisation's intense effort to manage its assets from a reliability culture."
- 2.9.30 Our success has been measured throughout the programme, benchmarking our planned and tested end-to-end process against industry best practice maintenance models. Key successes and lessons learnt are being used to shape the rollout of maintenance excellence across UUW.
- 2.9.31 Our Maintenance Excellence programme is fully aligned to our process excellence approach. Process excellence is a key enabling element of the systems resilience initiative and capability model.

Supply chain

- 2.9.32 We spend approximately £1.3 billion annually with over 1,700 suppliers, from major corporations to sole traders. It is critical that we ensure our supply chain is resilient.
- 2.9.33 Supply chain risk is considered as part of the Corporate Risk Management Framework, which follows an enterprise-wide approach to risk and is aligned to ISO31000:2018. Our approach covers key aspects of supply chain management that could impact the achievement of our business objectives, associated performance target and obligations as a water and wastewater company. These include:
- Security of supply;
 - Supplier viability;
 - Price volatility;

- Procurement compliance;
 - Delivery Partner failure; and,
 - Dispute with supplier.
- 2.9.34 In looking to manage the uncertainty that exists within a supply chain and mitigate the risk of any issues arising, we adopt a Category Management approach to our supply chain segmenting spend and management into discrete, related categories of goods, works and services. Our procurement strategies are designed to link into our Category Management approach and consider all available options for risk mitigation and avoidance, including ensuring flexibility of our supply chain by identifying alternative sources.
- 2.9.35 All procurement process and contract requirements will have a strategy document prepared, which is taken through the Commercial Approvals Board (CAB). The strategy is presented to the Commercial Director and Head of Regulatory Procurement for review, comment and sign-off prior to any procurement process being undertaken or contract being entered into.
- 2.9.36 We have recently introduced a supplier engagement strategy, we call our United Supply Chain (USC) approach to engage and on-board our suppliers. This monitoring framework provides a standard that suppliers must meet across a broad range of topics, including business resilience, security, and risk.

United Supply Chain approach – working collaboratively with our supply chain to improve resilience

In AMP7 we introduced our supplier engagement strategy United Supply Chain approach (USC), this approach is fundamental to achieving our business objectives, setting out our expectations for each AMP cycle and beyond. USC is about being better together by working collaboratively and building assurance within our supply chain. We believe this will then mitigate risk, build resilience, improve compliance and ultimately deliver better value within a high-quality supply chain.

USC engages with suppliers to measure and monitor performance to reduce risk and increase value across our supply chain. By engaging with our suppliers we are able to mitigate up and coming supply chain risks together, utilising USC as an escalation and reporting vehicle both with suppliers and within our own business.

The result of this has been the embedment of closer and improved relationships between us and our suppliers, linking strategies, operational excellence and standards through supplier forums and engagement. This allows us to continue to improve our risk management and resilience by working collaboratively with our supply chain to increase transparency and visibility of issues. Understanding minimum requirements in key policy areas and sharing ideas will enable us to collectively develop and implement effective risk mitigation strategies.

Project delivery

- 2.9.37 We complete a risk management process for all projects within our capital programme. This follows an approach that allows project risks to be understood and proactively managed, optimising project success by minimising threats and maximising opportunities.
- 2.9.38 A project risk is an uncertain event or set of circumstances that could have positive (opportunity) or negative (threat) impacts on the achievement of project objectives such as cost, timescale and reputational.
- 2.9.39 The risk process adopted for projects with the Capital Programme is aligned to the Association for Project Management (APM's) Project Risk Analysis and Management (PRAM) guide. Risks may be identified through structured risk workshops, risk review meetings, project meetings, Contractor Early Warnings, checking of lessons learnt from previous projects or through a review of risk registers of similar projects.
- 2.9.40 Risks are recorded in the corporate system, RADAR, which in turn creates the Project Risk Register. This provides a template to identify and record threats and opportunities, along with the risk assessment and all response measures, in a standard and consistent way. Our RADAR system has enabled the central

collection of risk information and facilitated the development of a body of lessons learnt that we use in a continuous improvement process to inform future risk mitigation.

- 2.9.41 Precise descriptions of each risk are important in order to properly understand the nature of the risk, to undertake effective response planning and allow subsequent analysis. For each risk, we record the:
- **Cause** – the event (source) that gives rise to the risk;
 - **Effect** – the deviation from the expected condition; what may or may not happen as a result; and
 - **Consequence** – the impact on project objectives.
- 2.9.42 Risk categories are used to help structure risk identification, analysis and reporting. Risks are categorised based on their Cause. There are 14 Threat Categories and 4 for Project Opportunities, see Table 1 below.

Table 1: Project delivery risk categories

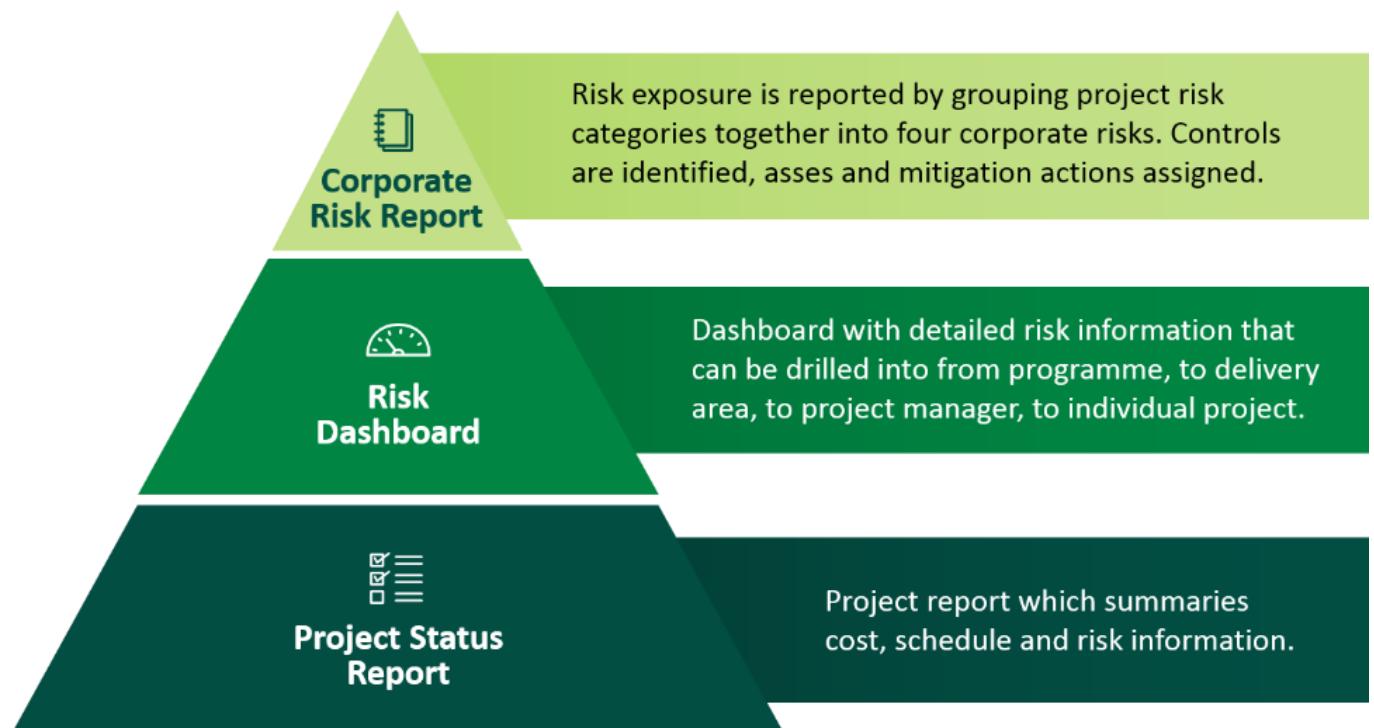
Threats	Opportunities
Regulatory and legislative	Project specific opportunities
Planning, control and consents	Risk and Value
Customer, public and other stakeholders	Collaborative Planning
Requirements, scope, design and estimation management	Design for Manufacture
Commercial, Procurement and contracts	
Supply chain and contractor performance	
Land Acquisition and access	
Infrastructure and supporting services	
Ground conditions	
Environmental and weather	
Tech Performance	
Operational Interface	
Project and programme management	
Health and Safety	

- 2.9.43 To increase the understanding of each individual risk event they are assessed in terms of their impact on cost, schedule and reputation, and the likelihood of occurrence.
- 2.9.44 The requirement for a three point estimate for both cost and schedule ensures that the range of any potential impact is considered. An industry standard PERT¹² calculation is then completed to generate a P50 value which is used to generate an impact score.
- 2.9.45 Reputation is assessed and an impact score assigned using a set of qualitative criteria that considers the potential number of customers affected, the risk to public health, regulatory, health and safety, environmental failure and political/media impact.
- 2.9.46 Likelihood is assessed in terms of probability and frequency of occurrence over a given time period. The likelihood percentage of a risk occurring is assessed against a defined scale, generating an impact score.

¹² The program (or project) evaluation and review technique, commonly abbreviated PERT, is a statistical tool, used in project management, which was designed to analyze and represent the tasks involved in completing a given project. It was first developed by the United States Navy in the 1950s.

- 2.9.47 Once an individual impact score has been calculated for each Reputation, Schedule and Cost, an overall Risk Score can be generated. The Risk Score indicates priority of risk which helps determine responses and escalation.
- 2.9.48 A standard set of risk reports are produced on a monthly basis from Tableau, the corporate reporting system (see Capital Programme risk is also reported half yearly to the executive board)
- 2.9.49 Each project, regardless of value, is quality assessed by the Risk Manager prior to the project being submitted for management approval. Frequency of additional assurance reviews undertaken is determined by project value. An assurance checklist is used for each review to assess the quality of the risk register and to provide specific feedback to the Project Manager regarding areas for development.

Figure 10: Standard reports for project delivery risks



3. Improving resilience – our AMP7 action plan

3.1 Overview

- 3.1.1 We recognise that delivering resilient services is not just about physical assets. It is also about the wider interactions and impacts of financial and corporate factors, as well as, for example, considerations of the environment, stakeholders, our people and culture.
- 3.1.2 At PR19, we recognised that while our existing approach to resilience has been assessed as sector-leading, there was more we could and needed to do to develop a more systems-based approach. Over the last AMP we have been building on our existing strengths but demonstrating how we need to do things differently in future, including activities around training our people, developing our corporate culture, improving data and analysis and more collaboration.
- 3.1.3 Taking a systems-based approach to resilience helps to enhance our understanding of the interactions between and within our systems and those of other stakeholders so that we can better understand and manage shared and/or interdependent risks. It also helps us to think over a range of timeframes to ensure we consider near, medium and long-term horizons when we think about the factors that could influence how we work. Taking a systems view is therefore a fundamental enabler for our delivery of resilient services, and in turn, better outcomes for customers.
- 3.1.4 Aligned with achieving this ambition, our vision for a systems-based approach to delivering resilient services to customers means:
- Instilling a systems culture in everything we do; routinely step back and consider elements of our systems, how they are affected by other internal and external systems and the impact we have on all those systems;
 - Achieving connectivity between our systems by developing understanding and guidance, so we know at what scale we are operating, how other scales influence our decision making, and how different disciplines should be engaged; and,
 - Collaborating in all our activities, with customers and stakeholders (internal and external) who have an interest in or have an influence on our systems.

3.2 Our AMP7 resilience action plan

- 3.2.1 During AMP7, we developed our action plan to further develop our systems-based approach to resilience, building on our ongoing systems initiatives, particularly our capability model, asset management, risk-based planning and integrated catchment approaches.
- 3.2.2 Through delivering this plan, we have developed our business capabilities into an integrated resilience framework to underpin our operations and future plans with a clear line of sight between risks to resilience, planned mitigations, package of outcomes and our corporate governance framework.
- 3.2.3 To develop our action plan we have:
- Considered Ofwat's challenge at PR19, and tested what we were already doing to address it. This helped us to establish our current baseline position;
 - Completed a review of our current initiatives, considered how we reported these in our business plan and captured our existing actions that contribute to delivery of a systems-based resilience framework;
 - Reviewed our current and planned initiatives looking across and beyond the industry (with the support of third-party resilience experts) to identify best practice in systems-based resilience; and,
 - Identified proposed actions supported by an assurance process and a procedure for measuring our progress.

- 3.2.4 Recognising that taking a systems approach is about broadening our understanding of risks and interdependencies and increasing the breadth of our influence, we have sought to identify actions which ensure we focus on resilience at a broad range of scales.
- 3.2.5 Our action plan builds on:
- Our business capability model, which includes the key operational capabilities, such as production planning and customer experience, but also corporate and financial capabilities. Our capability model helps us to create end-to-end processes that are effective and integrated, with digital solutions and technology that support decision making by creating and communicating a systems view of our assets;
 - Our asset management strategy and its associated risk-based planning tools and processes, which encourage systematic analysis of risk and robust consideration of a wide range of resilience options for managing asset health, service and our outcomes. For example, our Risk and Asset Planning (RAP) process was used for our PR19 expenditure planning to ensure that options included the 5R's of resilience (resistance, reliability, redundancy, response and recovery and review); and,
 - Our approaches and tools for delivering a systems approach at a catchment scale, incorporating the natural environment and ecosystem services through natural capital valuation. Through our systems-led integrated catchment management approach, we identify and address the needs of the catchment as a whole, based on collaboration and understanding of wider stakeholder needs. To support this view, we have developed integrated models, pursued new funding mechanisms, and worked with our regulators to create an innovative and value-adding framework for delivering multiple, mutual benefits in the catchments in which we operate. This reflects the importance we place on ensuring the resilience of the wider systems in which we operate. We recognise that we need to ensure the catchments as a whole are resilient, not just the assets we own.

3.3 Delivery of our action plan

- 3.3.1 Whilst our approach to resilience prior to AMP7 was robust, we recognise there is still more we could and need to do to develop a more systems-based approach. We have built on our existing strengths and have developed our approach to do things differently in future. This has included activities around training our people, developing our corporate culture, improving data and analysis and increased collaboration.
- 3.3.2 In AMP7, our priority has been to ensure there is a strong link between our various systems-based processes and asset management initiatives, supported by targeted improvements where required, to embed methodologies and ensure we maintain an integrated resilience framework. This approach to delivery of our action plan has had the following outcomes and benefits:
- **Instilling a systems culture:** Wherby our teams regularly step back to consider how their actions affect and are being affected by other activities within and beyond our business. Taking a systems-based approach helps to enhance our understanding of the interactions between and within our systems and those of other stakeholders so that we can better understand and manage shared and/or interdependent risks. It also helps us to think over a range of timeframes to ensure we consider near, medium and long-term horizons when we think about the factors that could influence how we work;
 - **Enhancing our understanding of system interdependencies:** Whilst we can and do define the systems we use to deliver our services and the external systems we interface with, we have worked to understand the links and interdependencies between them at appropriate scales; from national to local, strategic to operational. Empowered with this knowledge, we have continued to develop processes to maintain a vertical line of sight within systems and horizontal line of sight between systems;

- **Linking different risks and opportunities:** We have a comprehensive approach to risk management, but have historically tended to place most focus on specific risks and issues that could cause problems to the services we deliver. We have strengthened our procedures to ensure we consider interdependencies between risks, the potential long-term challenges we might face, and the potential for cascade failures in a consistent way;
- **Building systems-based approach skills:** Our Capability Audit helps us to plan for and deliver the skills our teams need to meet our outcomes for each AMP. . Enhancing this for the long-term has resulted in us being able to better forecast future changes in our industry, and to understand how our organisation needs to evolve to address the associated challenges and opportunities; and,
- **Continuing to engage and collaborate widely.** We work extensively with external stakeholders on key issues, particularly through our integrated catchment approach, which we have developed further to embed this broad collaboration in everything we do. We have also learnt from our Water Resources Management Plan (WRMP) process and the approach we have developed to deliver our Drainage and Wastewater Management Plan (DWMP). Our WRMP has evolved to incorporate regional planning and consideration of other water abstractors in the catchment, which has required close working with numerous stakeholders inside and outside of the region. We have provided further support to our internal departments so that they engage with each other at the right times to deliver integrated schemes efficiently and effectively. Greater collaboration between our finance, human resources and operational teams has also helped to reinforce our resilience.

3.3.3 We have split the initiatives which underpin our resilience action plan into four categories, people, process, tools and technology, and data and information. The activities which embed these initiatives are outlined below, along with the associated outcomes delivered from the list above.

People actions

Activities

A full Organisation Capability Review has been completed to ensure a robust People Plan is in place to support AMP7 delivery and to support planning into AMP8 and beyond. This included reviewing our internal capabilities, future requirements and capabilities and conducting external horizon scanning. We developed comprehensive action plans for delivery, including appropriate resourcing and trading plans, focus on engagement, resilience planning and interventions. We undertake regular capability audits to ensure our plans remain appropriate and support planning into the next AMP, particularly focusing on the capabilities, skills and resources required to support our evolving systems-based approach to service and resilience.

Training on a systems-based approach has been developed and delivered to all appropriate staff working throughout Asset Lifecycle Management processes to help to enhance our systems resilience, through improved asset management capability. Our Asset Lifecycle Management training went live in July 2022 and the scope has been extended to system thinking and other United Utilities Water drivers including resilience.

We have developed and delivered e-learning training on natural capital to all appropriate staff.

We have developed and delivered improved guidance on risk and resilience to all appropriate staff to raise awareness of the need to consider wider system threats and the importance of understanding the effectiveness of controls across multiple risks.

Outcomes

- Building systems-based approach skills.
- Instilling a systems culture.
- Linking different risks and opportunities.

Process actions

Activities

We have developed guidance for incorporating horizon scanning to better account for long-term risks and opportunities within policy and strategy. Our guidance has been developed from experience of our integrated catchment and DWMP approaches; this ensures consideration of system interdependencies at appropriate check points.

We have embedded an enhanced resilience assessment into DWMP, including wider system threats and constraints such as the headroom in local power supplies to ensure plans are deliverable and robust.

We have reviewed the linkage between our Risk Breakdown Structure and the corporate risk process to ensure risks continue to have a clear line of sight to business objectives.

We have developed and aligned maturity scale for all components of Asset Lifecycle Management. This included updating the asset management decision making process to acknowledge improved systems understanding when developing programmes of work.

We have reviewed our water trading opportunities, including testing in regional and company models. This ensures resilience is considered in regional and company plans and in the selection of solutions.

Outcomes

- Enhancing our understanding of system based interdependencies.
- Linking different risks and opportunities.

Tools and technology actions

Activities

Our strategic risk and intervention modelling environment, PIONEER, has been enhanced in AMP7; to better consider the impact of climate change on future risks to the wastewater network, to deploy asset specific performance data across a broader range of our equipment and to model the failures and activity across the water network at a much finer level of granularity than possible in support of previous business plans.

We also have continued to develop our myRisk suite of applications to support our evolving business processes for capturing, escalating and managing operational risks across the business. As an in-house development, this suite of applications is tailored exactly to meet our business needs to deliver an efficient and effective approach to operational risk management across all elements of our wholesale business.

As part of our evolving capability to plan, respond and recover from disruption we have deployed the Clearview product, this has significantly improved our business continuity planning capability. Clearview is used to identify risks and capture business critical contingency and essential system recovery plans, it provides a stage to hold key information such as emergency procedures as well as providing a platform for the active management of business continuity events/incidents. Further details are available in section 2.9.17.

We have developed and deployed, as part of our WRMP process, a systems analysis tool that enables a broad envelope of credible drought events to be rapidly assessed to produce a richer view of our drought resilience than by relying solely upon historic weather records and climate change forecasts. This gives us a better view than ever of the drought risk we carry and helps us to ensure that our plans are robust and resilient. This integrates directly into the broader suite of tools that we maintain for understanding and managing our drought risk.

In preparing for, and completing, our Drainage and Wastewater Management Plan (DWMP) we have piloted and developed new assessment methodologies and tools to ensure that the solutions identified deliver efficient and robust resilience investment plans for AMP7/8 delivery.

DWMP solution and programme optimisation tools have enabled us to account for the wider value that the investment will deliver, including for resilience. Aiding our testing of scenarios and alternative benefit valuations/priorities in developing our proposed DWMP investment plan.

Outcomes

- Linking different risks and opportunities.
- Enhancing our understanding of system interdependencies.
- Linking different risks and opportunities.

Data and information actions

Activities

We will continue to develop and deliver resilience centred action plans to insure that there remains a focus on delivering, sustaining and improving resilience in the round in the short, medium and long term.

We have conducted a gap analysis on corporate risk data to enable alignment with operational risk capture at an appropriate range of systems scales. This has been embedded into the Asset Lifecycle Management training and the Corporate Risk Team have re-worked the reputational impact assessment tool to include a multi-capital assessment of value that is aligned to our decision support framework.

We demonstrate strong connectivity between our different plans including River Basin Management Plans and Flood Risk Management Plans, this allows us to better identify links, and, improve signposting, to wider opportunities to deliver benefits and promote collaboration.

In order to improve data sharing between risk management authorities, a new data sharing agreement has been produced to allow data to be shared securely. This will help to identify multiple sources of flooding and present the opportunity to progress projects in partnership to create more resilient solutions. We will continue to develop and deliver resilience centred action plans to ensure that there remains a focus on delivering, sustaining and improving resilience in the round in the short, medium and long term.

Outcomes

- Continuing to engage and collaborate widely.
- Enhancing our understanding of system interdependencies.
- Instilling a systems culture.
- Linking different risks and opportunities.

4. Risk management

4.1 Overview

4.1.1 Our risk and resilience framework is multifaceted, focusing on uncertainty, and the effect on objectives and the application of control to support long-term resilience. The framework is applied continuously throughout the year by the entire business with reporting coinciding with the full and half-year reporting cycles. The framework is made up of six component parts:

- **Mandate and commitment** – the initial component of our risk management framework is the mandate and commitment by the group board, based on the requirements to achieve objectives and protect customer and stakeholder interest and investment;
- **Approach** – our approach focuses on enterprise-wide risks identified and assessed against the company's long-term objective delivery, covering all internal and external factors. The approach encourages integrated activity and value creation for all stakeholders and the multi-layered effects (knock on and cascading consequences) over short and long-terms time horizons;
- **Governance and reporting** – our comprehensive governance and reporting covers how risks are reported and mitigation plans governed, delivering vertical alignment of assessment and reporting from field to group board;
- **Process and systems** – our process detail how risks and resilience issues are identified, captured, categorised and quantified consistently across the business; aligned to best practice ISO31000:2018. The consideration of new and emerging circumstances associated with causal factors, including threat and opportunities, consequences, including impacts to objectives and stakeholders and control effectiveness is a fundamental aspect of the process. For risk treatment, adopting four types of control and mitigations to ensure full reliance across the enterprise; corporate, financial and operational structures. These are directive, preventative, detective and responsive, which incorporate the 5R model that provides multiple barriers to prevent or limit shocks and stresses manifesting, and to minimise the impact if they do;
- **Procedure, guidance, tools, and training** – we ensure that appropriate training, guidance, and capability is provided to ensure a consistent approach to risk assessment; and,
- **Risk profile** – this is the principal output of the framework. Risks are categorised based on the value chain of the company, through principal risk areas, both primary and supportive, where value can be gained, preserved or lost. They are ranked and reported bi-annually to the group board.

4.2 Corporate risk framework

- 4.2.1 The initial component of our risk management framework is the mandate and commitment by the group board, based on the requirements to achieve objectives and protect customer and stakeholder interest and investment. Directorates are responsible for identifying, assessing and treating risks with a mandatory biannual Business Unit Risk Assessment (BURA) review in line with the half-year and full-year reporting cycles in November and April. Our governance and reporting structure is illustrated in Figure 11, which shows the responsibility for the development, coordination and governance of risk management across the group.
- 4.2.2 To read in more about our approach to securing corporate resilience, see supplementary document *UUW43 - Corporate approach to resilience*.

Figure 11: Audit and risk governance structure

- 4.2.3 The business risk management database (RADAR) is a bespoke SharePoint based system that facilitates the recording, monitoring and reporting of strategic, tactical and operational risks, including their controls and actions. A key component of the framework is the procedure, guidance, tools and training documents/packages that are in place for use or reference on our corporate intranet site to drive a consistent approach.
- 4.2.4 The business risk profile is event-based and made up of strategic and tactical level risks only. It is enterprise-wide, covering all types of risk from across the entire organisation, and multi-dimensional illustrating the nature and extent of risk facing the company relative to risk exposure and correlation and interdependency.

4.3 Operational asset risk management

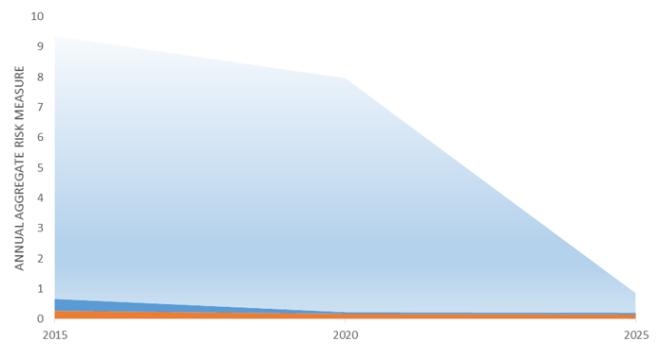
- 4.3.1 Consistent with our business risk management framework, Risk and Asset Planning (RAP) is our process to identify operational asset risks and issues, identify and monitor strategic performance requirements, and prioritise these for investment or operational management. It aligns with the International Standard for Asset Management (ISO55001) embodying the principles of the Asset Management System¹³.
- 4.3.2 RAP provides the framework within which we undertake options appraisal. Through this we identify, capture, quantify, validate, assess, prioritise and cost our risks in a systematic way. At each stage we review and filter out those risks for which there is insufficient evidence or materiality to warrant further resources. We have a tiered escalation process to review risks captured in the field.
- 4.3.3 The Tier Process consists of three levels of escalation, enabling operational risks to be identified and raised through the business in a documented and auditable manner. Risks are identified through monitoring of site data, risk review meetings and by reviewing performance reports as detailed in the Tier guidelines document. Assessment of risks and their impact is carried out by field teams using site data, performance reports and local investigations.
- 4.3.4 Our myRisk tool provides a common approach to the capture and assessment of operational risks across a wide range of financial and non-financial drivers. The system is an integral part of our RAP process,

¹³ Asset Management: An Anatomy. Institute of Asset Management, 2015.

allowing risks to be identified and managed locally or escalated to the appropriate level. It is built around our value framework, and is aligned to our delivery model to ensure consistency of approach.

- 4.3.5 In order to embed the principles of systems resilience into business decision making, we have further developed our decision support tools to enable colleagues to ensure they have taken account both upstream and downstream interdependencies, and also to guide them in the development of investment strategies. These tools can be used for example to assess if an upstream nature-based solution could help to mitigate the risk being considered.
- 4.3.6 Every investment decision needs to be made with clear purpose, from a position of knowledge on expected outcomes and a quantification of the expected benefit. We have made significant steps forward in Asset Management capability during AMP7, and recognise the need to continually improve.
- 4.3.7 Our approach to securing corporate resilience, supported by the risk and resilience framework, has led to significant improvements in risk reduction across many aspects of the company. The best example of this is our progress in reducing the societal risk from our fleet of impounding reservoirs, the largest in the English and Welsh water sector.
- 4.3.8 We report and escalate the risk to society from our impounding reservoirs using our established governance processes, as dictated by our corporate approach to resilience. This provides the direction, support and governance to ensure that an appropriate risk appetite has been agreed by the UUW board, the right strategy has been developed and risk reduction delivered.
- 4.3.9 During AMP6 we targeted a reduction in dam failure risk through our proactive Portfolio Risk Assessment (PRA) processes. We targeted flood-risk failure modes during AMP6 and targeted erosion dam failure modes during AMP7, our plan for AMP8 is to continue to reduce risk in line with HSE guidance. Recent demographic changes have increased the underlying consequences associated with dam failures in some locations leading to an increase in the number of dams requiring risk reduction interventions. More information can be found in supplementary document *UU_CAC_01 cost adjustment claims submission*.

Figure 12: Impounding reservoir risk reduction profile – example of how our corporate risk process has worked



IR societal risk reduction profile (2015–2025)

- 4.3.10 Figure 12 shows how the change in focus to reducing societal risks in AMP7 has delivered a major reduction of the level of risk associated with our fleet of reservoirs. As we learn more about the modes and mechanisms of dam failures and how best to prevent them we are able to continue to efficiently manage these critical assets safely and securely through targeted investment and monitoring.

4.4 Horizon scanning

- 4.4.1 Horizon scanning helps us to analyse whether we are adequately prepared for potential opportunities and threats, it is about exploring what the future might look like to understand uncertainties better. This helps ensure that services are resilient to different future environments and enables us to respond to longer-term risks more effectively. We systematically investigate evidence about future trends as part of this process.
- 4.4.2 When our resilience provisions were audited by ARUP post our PR19 submission, they observed that we have a significant opportunity to enhance our horizon scanning. Since the last AMP we have been working to embed our horizon scanning approach across the organisation. This includes the establishment of a dedicated role within our long term planning team and the creation of our new and emerging risk group which reports into our Group Audit and Risk Board (GARB), see Figure 12.

- 4.4.3 Horizon scanning is fundamentally linked to the demand analysis aspect of Asset Lifecycle Management and is useful not just to identify demand analysis in terms of operations and the service we provide, but also the people, skills and our capabilities.
- 4.4.4 Through horizon scanning we use the latest and best information, such as the national risk register, to inform our plans. Through horizon scanning we:
- Identify external risks that are outside of management control that could influence the political and financial environments in which we operate;
 - Understand the risks and opportunities from cascade failure of dependant and interdependent services such as other infrastructure providers and the supply chain;
 - Coordinate work between departments and input from experts outside the company, through creating communities of interest around specific topics;
 - Improve cross departmental horizon scanning work by using a wide range of expertise to obtain new insights and challenge current thinking;
 - Develop networks to gather and share information and to gain new insights; and,
 - Bring emerging issues to a senior-level audience, as well as commissioning work on areas of interest.
- 4.4.5 We are ensuring consistency of approach, systemisation, and documentation of core planning assumptions. To evidence that we understand our position in the service chain, are alert to new and emerging risks, and have a process for capturing them, and acting upon them. We elaborate on our adaptive planning needs and performance aspirations in the face of a different future more in UUW12 Long term delivery strategy.

5. Risk assessment

5.1 Introduction

- 5.1.1 Understanding and responding to the most material issues affecting our business is key to delivering our purpose. Addressing these issues over the short, medium and long term is an integral part of our strategic themes and risk management.
- 5.1.2 Successful management of risks and uncertainties enables us to deliver on our purpose to provide great water and more for the North West, and be more resilient across our corporate, financial and operational structures.
- 5.1.3 By recognising the causes and consequences of risks through the identification, analysis and evaluation of the individual and compounded risk, and the capacity and capability of the company to manage these, we are able to be proactive, prepared and prioritised.
- 5.1.4 Our myRisk tool, which is used to record and evaluate risks as well as capture controls and risk mitigation, currently holds over 22,000 risks that have been identified across all of our business operations. These risks are triaged and escalated to the relevant responsible parties or committees depending on the level of risk and current risk controls.
- 5.1.5 The most significant risks identified are recorded on our company-wide risk, issue and opportunity database and reporting tool (RADAR). This database holds over 100 principle risks sub-grouped into risk categories as per Table 2 below.
- 5.1.6 Risk management is not just about adverse events happening, however, but also about realising opportunities. Looking ahead and considering the longer term is therefore fundamental. We combine this future view with an ongoing review of our processes and practices to ensure their effectiveness in an ever changing business environment.

5.2 Changes in United Utilities group-wide principle risks since PR19 Final Determination

- 5.2.1 The business risk profile is based on the value chain of the company, with the ten principal risk categories representing inherent risk areas, where value can be gained, preserved or lost relative to the performance, future prospects or reputation of the company.
- 5.2.2 Table 2 shows the risk category movement post PR19 final determination and now. With the majority remaining relatively stable.
- 5.2.3 The risks listed below in Table 3 represent the principal risks to the group. They influence our policy decisions and investment strategies, including our approach to corporate, financial, and operational resilience.

Table 2: Principle risk categories and relative risk

Risk category	Relative change since PR19 FD
Water service	Stable
Wastewater service	Increased
Retail and commercial	Stable
Supply chain and programme delivery	Increased
Resource	Stable
Finance	Stable
Health, safety and environmental	Increased
Security	Stable
Conduct and compliance	Stable
Political and regulatory	Increased

5.3 Changes in UUW wholesale operational risks since PR19

- 5.3.1 Since the PR19 submission we have continued to follow our horizon scanning and risk assessment processes, reviewing the risks to the business every six months, or following a trigger event, as part of our well established BURA processes.
- 5.3.2 Fundamentally the same risks that we have previously identified and reported on as part of our expansive operational risk disclosure for our PR19 Submission¹⁴ remain.
- 5.3.3 All of our risks, controls, and mitigation measures are under constant monitoring, and reported on to group board at least twice annually. We assess for any changes to the likelihood of the risk occurring or the level of consequence that we could expect. This includes a review of the effectiveness of the mitigation and controls in place. We disclose the current status of the most significant risks in our annual report.
- 5.3.4 New risks and opportunities are also identified through this process, see section 5.7 below for more details on our approach and a summary of the identified new and emerging risks that have been identified.
- 5.3.5 In Table 3 we show how the top 5 operational risks, as disclosed in our FY23 annual report, have changed overtime, with previously lower ranking risks now being reported in the top 5 operational risks. This demonstrates how risks evolve overtime and how changes in legislation and climate have altered our risk position.

¹⁴ Chapter 4: Supplementary document Operational resilience: Our detailed risk assessments and resilience plans - document reference: S4005

Table 3: Principle Wholesale operation risks

Risk	Risk description	What has changed?	Risk rank PR19	Risk rank PR24
Failure of the Haweswater Aqueduct	There is a potential for failure of Haweswater Aqueduct (HA), due to asset deterioration, asset failure and/or ingress into the aqueduct, leading to water quality and/or supply interruptions.	We have successfully replaced a key section of tunnel, identified as in poor asset health, with 4 new pipes in 2020. We are managing the remaining risk through our Haweswater Aqueduct Resilience Programme (HARP).	1st	1st
Failure of wastewater network (CSO's and sewer flooding)	There is a potential for a failure of the wastewater network to occur due to inadequate hydraulic capacity relative to population growth, climate change or operational issues, such as equipment failure leading to sewer flooding.	In completing our first round of Drainage and Wastewater Management Planning (DWMP) we have identified and quantified the additional volumes of surface water likely to enter our wastewater systems as a result of 'urban creep' (increased surface impermeability), population growth, and climate change. The Environment Act 25 year plan requires us to significantly improve spills performance (the activation of CSOs) by 2035	3rd	2nd
Water sufficiency event	There is a potential for a water sufficiency event due to an extended period of hot, dry weather, increased demand, prolonged capital delivery outages, reduced system capacity, raw water quality issues leading to the implementation of water use restrictions, including Temporary Use Bans (TUBs), non-essential use bans, emergency drought measures and drought orders.	Drier weather, seen in recent years, has driven this risk higher on our agenda. In 2018, there was unusually dry weather in summer months, leading to a dry weather incidents and announcement of a potential Temporary Use Ban (TUB). In the event, no TUB was actually needed to be implemented. In 2020, we saw the sunniest spring on record and in 2021, and the dry weather in late August and September resulted in a regional reservoir storage at the beginning of October being significantly below the average for that time of year.	Risk identified but not previously in top 10	3rd

Risk	Risk description	What has changed?	Risk rank PR19	Risk rank PR24
Recycling biosolids to agriculture	<p>This risk represents a multitude of factors, including market demand, which impact, not only the in-year access to land bank, but the total land bank available for recycling, and the resilience of the supply chain of sewage sludge to agricultural land. This is the predominant disposal route for over 95 per cent of biosolids, excluding raw sludge cake.</p>	<p>This risk has been upgraded to the top ten operational risks since PR19. In AMP7 we have seen multiple shocks to the biosolids market, culminating in the Environment Agency (EA) issuing three Regulatory Position Statements (RPS) (which are formal documents that enable activity normally considered outside the law to be undertaken) to manage disruptions in the sludge supply chain to agriculture.</p> <p>Moreover, there are a series of regulatory changes such as changing interpretation of the Farming Rules for Water, proposed implementation of the EA sludge strategy and withdrawal of the Sludge use in Agriculture Regulations, and government ambitions for nutrient neutrality that are restricting market demand for our product.</p> <p>The impacts of these changing regulations are uncertain but we have led collaborative industry and regulator modelling, which has demonstrated that the industry faces a potential shortfall of outlet for up to two-thirds of biosolids. While there is uncertainty over the timing and scale of the change there is a significant risk of landbank shortfall in AMP8.</p>	Risk identified but not previously in top 10	4th
Failure to treat sludge	<p>Bioresources treatment capacity and availability in light of changing demographics, increasing standards of wastewater treatment driving sludge growth, and evolving regulatory expectations. We forecast sludge growth of over 10 per cent in the next ten years, and without investment or market delivery, a shortfall in sludge treatment capacity of 36,000TDS/year by the end of AMP8.</p>	<p>This risk has moved up on our agenda since PR19 due to the increase in forecasted sludge growth over the next ten years. In addition, a change in the EA's interpretation of regulations, results is the Industrial Emissions Directive (IED) now applying to sewage sludge as of August 2022. This requires United Utilities Water to review assets against best available technique at 11 sites, and surveys are underway to assess the degree of investment required. This has prompted the accelerated rationalisation of sites. Over the course of AMP7 we anticipate that we will have prematurely shut five anaerobic digestion sites, almost a third of this type of site.</p> <p>We are exploring the use of markets to provide new build capacity or long-term trades.</p>	Risk identified but not previously in top 10	5th

5.4 High impact/low likelihood risks

- 5.4.1 Alongside the top ten operational risks, there are also risks that are assessed to be high impact but the occurrence is very unlikely; the most significant wholesale operational risks are outlined below with the current mitigations and controls.
- 5.4.2 In Table 4, below, we summarise how the top operational high impact, low likelihood risks that we disclose in the annual report have changed since PR19.

Table 4: Summary of high impact/low likelihood risks.

Risk	Risk description and mitigations	Top 3 at PR19 FD	Top 3 at PR24
Uncontrolled release of water from statutory open reservoirs	<p>There is a potential for uncontrolled release of a significant volume of water from statutory open reservoirs due to flood damage, overtopping, earthquake or internal erosion leading to catastrophic impacts downstream including, loss of life, property, infrastructure and environmental damage.</p> <p>Each statutory embankment reservoir is inspected every 48 hours by Catchment Controllers, every six months by UUW Supervising Engineers and every ten years by independent Panel Engineers. In addition, UUW proactively assesses the probability of failure of each dam using detailed engineering models comparing these against the HSE thresholds. The performance of the investment programme is measured via an Ofwat agreed ODI measure. Should a dam-related emergency occur each asset has a specific contingency plan in place.</p>	✓	✓
Disease pandemic	<p>There is a potential for a disease pandemic/epidemic in the UK due to lack of immunity to a virus or bacteria leading to serious illness in a large proportion of the population and knock on consequences to UUW work force (including contractors), both directly and indirectly, the wider supply chain and macro economy.</p> <p>Control measures aim to minimise the potential impact to our service delivery and our staff's health and welfare. A well-established incident management procedure is in place, which proactively initiates as the risk emerges, as opposed to when it fully materialises. The incident management process is supported in this case by a Pandemic Response Plan, which sets out a structured approach including determination of the pandemic profile, predicting the impact to United Utilities Water's employees and operations, liaising with contractors and suppliers regarding service delivery and developing a multi-channel internal and external communication strategy.</p>	✗	✓
Criminality leading to loss of assets	<p>There is a potential a significant physical asset is compromised due to criminal activity leading to loss of supply, contamination, pollution, regulatory penalties, prosecutions, social consequences (including potential loss of life), reputational damage and the costs associated with emergency response and the asset repair or replacement costs.</p>	✓	✓

5.5 Wider business risks

- 5.5.1 As well as direct water company risks associated with our services and assets that are within management control there are also wider risks that threaten our ability to provide resilience water and waste water services. These risks are listed below.

Security of the supply chain

- 5.5.2 There is a potential for a significant supply chain event due to political, social, economic or environmental factors leading to the supply of critical goods/services to be interrupted, shortages of resource or product and the failure to meet operational, programme or regulatory requirements

Supplier viability

- 5.5.3 There is a potential for existing suppliers to be unsuitable or unable to fulfil contractual obligations due to financial, managerial, ethical or sustainable instability, leading to non-viable supply chains and an inability to deliver of goods and services.

Carbon commitments and liabilities (Climate change mitigation commitments)

- 5.5.4 There is a potential for failure to make sufficient reductions in our net annual Greenhouse Gas (GHG) emissions due to operational and strategic decisions, growth pressures, insufficient progress in technology and markets, uncertainty in regulatory and funding frameworks, delays to implement emissions reductions schemes, and monitoring and methodology changes leading to reputational damage, restriction to investment funds from the market and regulator and direct costs in either taxation or to buy carbon credits to offset excess GHG emissions.

Cyber risk

- 5.5.5 There is a potential that data and technology assets are significantly compromised due to malicious or accidental activity leading to a major impact to key business processes, business services, regulatory compliance, financial, and operational performance.

Interdependency

- 5.5.6 As we mature our approach to resilience we are increasingly seeing value in looking wider beyond our immediate control. Understanding the risks from dependant and interdependent service providers and the risks of associated cascade failure.
- 5.5.7 We recognise that there are many interdependencies associated with delivering our resilience activities and the actions of others are likely to impact on our ability to manage our risks. We have outlined our main interdependencies below and how we are using them as opportunities to enable resilience.

Energy

- 5.5.8 During FY23 we generated 205GWh, equivalent to almost a quarter of the electricity we consumed, however, as a relatively energy intensive business we will remain reliant on a continuous energy supply.
- 5.5.9 We are diversifying our portfolio of supplies by investing in generation of more renewable energy e.g. wind, solar and maximising CHP outputs. This will reduce our reliance on the grid in order to build resilience to power outages. Our energy management plans aim to reduce power consumption by site-specific initiatives, and ensure that critical assets have energy resilience measures in place, such as dual supplies and back-up generation or storage.
- 5.5.10 This risk is becoming of increasing concern as the UK energy generation grid continues to decarbonise and the percentage of intermittent renewable power generation increases.

Telecoms

- 5.5.11 We rely on advances in technology, connected networks, and reliable communications to continue to deliver resilient services. Increased severe weather events, space weather and higher temperatures can put pressure on telecommunication assets and result in service disruptions.
- 5.5.12 With an increasing uptake of smart systems to improve our situational awareness, we are ensuring that the solutions we develop are sustainable, working with suppliers to ensure new technology and IT systems, which support our business are resilient.

Transport

- 5.5.13 While we advance our systems approach and enhance our centralised operational monitoring and control capabilities to drive efficiencies, many of our services require reliable logistics and supply.
- 5.5.14 Despite the variety of consequences that could come from this risk, there are many controls available to us. The possibility of having multiple access points to sites and assets greatly reduces the risk of not being able to access sites. This can range from alternate access points on the opposite side of the site, or additional manual entrances and exits.

Co-site infrastructure

- 5.5.15 There is often a close proximity of multi-infrastructure conduits to our network, which may run in parallel to roads and railways, pipes and cables, and various other infrastructure. This increases the sensitivity to cascade failure in the event of severe weather, due to flooding or land slips.
- 5.5.16 We work closely across infrastructure sectors to ensure that all of our street works consider co-sited infrastructure, and take steps to ensure that our work causes minimal disruption to any services provided in proximity to the work being carried out. We recognise the need to further mature proactive partnership in response to the increasing risk to this from climate change. We are actively engaged in the National Underground Asset Register as we look to share data across other sectors.

5.6 Risks requiring multi-agency collaboration

Flooding

- 5.6.1 The nature of being a water and wastewater company means that flooding and the effects of flooding are an ever present risk. We rely on upland reservoirs and rivers for the majority of our water supplies, assets in close proximity to these water bodies are at risk of flooding unless the risk is properly controlled or mitigated. Similarly, our wastewater collection and treatment sites run largely under gravity and need access to point of discharge into water bodies, this places them at the bottom of hills and in close proximity to water.
- 5.6.2 The unique topography and weather patterns of parts of the North West also contribute to this issue. Greater Manchester for example sits within a topographical bowl creating challenges for flooding from rivers, sewers and surface water. The flooding risk is exacerbated by high rainfall, the county receives an average of 1047mm rain every year 40 per cent more than the UK average. Compounded by Greater Manchester's rivers being impacted by agriculture, industry, runoff from roads as well as sewage, with 37 per cent of the North West's combined sewer overflows situated in Greater Manchester.
- 5.6.3 Our assets are at risk of flooding from multiple causes. Pluvial flooding from extreme rainfall events, fluvial flooding from rivers, and coastal flooding from storms. Each of these pathways presents a viable risk today, but will increase with the effects of climate change, and be exacerbated by urban development and population growth. Refer to Section 6.2 of this document for more detail on our approach to climate change.
- 5.6.4 We recognise that this requires a multi-agency approach to solving this issue and UUW has a part to play as the drainage provider, but this also need to include the Environment Agency and land drainage authorities. This is why we have joined forces to develop an Integrated Water Management Plan for

Greater Manchester with the Greater Manchester Combined Authority (GMCA) and the Environment Agency, piloting this collaborative approach to the way we plan for and manage all elements of the water cycle in Greater Manchester¹⁵.

- 5.6.5 To help mitigate the risk we have a significant focus on removing surface water from the sewerage system in AMP8, this includes working with Local Authorities to promote the installation of Sustainable Urban Drainage Systems (SuDS), including as part of highway developments.
- 5.6.6 We were very active in supporting the work of the NIC in their review of surface water flooding risk¹⁶, providing evidence and expertise in their review of the risks and development of recommendations to Government.
- 5.6.7 We have conducted a flooding risk assessments for all of our at risk assets, this includes powered sites that are likely to be damaged in the event of a flood occurrence. This includes an allowance for the likely effects of a range of future climate change scenarios on the Environment Agencies flood extent maps. The outputs of which are included within our long term delivery strategy submission for proposed investment targeted at the most significant risks in AMP9 onwards. We anticipate the need to review and reassess the flooding risk to sites post the release of the National Flood Risk Assessment (NaFRA 2) in 2024 by the Environment Agency, which we understand to be a significant step forward in modelling flood risk capabilities including the specific impacts of climate change, topography and existing flood defences.
- 5.6.8 We will continue to build our relationships with interdependent service providers, including the Distribution Network Operators (DNOs) in our region to understand the level of protection from flooding that key electricity transmission assets have, enabling us to identify vulnerabilities and seek out common benefits. We have a direct relationship with the DNO's in our region and via the Greater Manchester Strategic Infrastructure Board¹⁷ which also includes other energy infrastructure providers and telecoms sectors.

Power resilience

- 5.6.9 The collection, transportation, treatment, and onward distribution of water, and treatment of wastewater, is fundamentally energy intensive. A reliable supply of power is paramount to ensuring consistency of treatment processes and telemetry to maintain the wholesomeness of the water produced. Our integrated supply system of treatment and storage assets provide a great deal of system redundancy, providing capacity to manage incidences of power interruption without impact to quality standards or customer acceptability.
- 5.6.10 We take on board the insight gained from our stakeholders and use this to inform our plan; an example on power resilience is outlined below.
 - The British Energy Security Strategy reinforces government strategy to increasingly move to renewable sources, increasing the future risk of intermittent power resilience associated with renewable sources. Although the strategy includes the development of new nuclear power generation capacity this is not anticipated to be online soon or be of sufficient capacity to provide resilience during periods of lower renewable generation.
 - Energy resilience has also become a priority for other regulators and the UK Government.
 - The Drinking Water Inspectorate (DWI) have signalled that power resilience is a major driver for PR24. They have also recognised the link between carbon and resilience and have indicated that resilience should be prioritised.

¹⁵ greatermanchester-ca.gov.uk/what-we-do/planning-and-housing/integrated-water-management-plan/

¹⁶ nic.org.uk/studies-reports/reducing-the-risks-of-surface-water-flooding/

¹⁷ greatermanchester-ca.gov.uk/what-we-do/planning-and-housing/strategic-infrastructure/greater-manchester-strategic-infrastructure-board-gmsib-terms-of-reference/

- The Department for Business, Energy and Industrial Strategy (BEIS), supported by the Department for Environment, Food and Rural Affairs (Defra) and Water UK, are developing contingency plans to deal with possible nationwide power losses. This is aimed at reviewing the impact that a national power outage could have on a providers' ability to maintain services.
 - Defra's priority statement to Ofwat is to deliver a resilient water sector, and Ofwat should challenge the water industry to plan, invest in, and operate its water and wastewater services to secure the needs of current and future customers.
 - These influences, and our own internal assessment, has led to the submission of a power resilience enhancement case to provide United Utilities Water with a new level of improved resilience at our most critical sites to protect services, customers and the environment. More detail can be found in supplementary document *UUW67 - Power resilience enhancement claim*.
- 5.6.11 Irrespective of our integrated supply system, we also ensure consistency of power supply by maintaining power resilience plans for critical sites. These can include mitigation measures such as:
- Provision of onsite generation capacity and fuel stores;
 - Provision of Uninterruptible Power Supply (UPS) systems to buffer voltage fluctuations that can result in equipment shutdown;
 - Site remote SCADA access and restart capabilities;
 - Emergency plant (including mobile generators);
 - Bunkered fuel storage;
 - Supply chain contracts, with suitable service level agreements, to provide rapid deployment of additional generator capacity and fuel;
 - Developing site-specific (for key sites) and general power contingency plans, including identification of deployment requirements (size, coupler standards, necessary area to set up generator); and,
 - Registering key sites with the distribution network operators Electricity Supply Emergency Code (ESEC) list for protection during major incidents and during potential rota cuts, and, should it be necessary, reducing site production to secure water quality in the event of reduced power availability.
- 5.6.12 Our historic focus in delivering resilient services for customers has been to deliver appropriate levels of reliability, redundancy, resistance, and response and recovery capabilities in our own asset base, managing the risks for which we are best placed to manage.
- 5.6.13 However, through adopting a systems-based approach, it is becoming increasingly evident that the water sector needs to secure enhanced levels of power resilience as drivers for change, such as climate change and reduced reliability of services provided by others, increases the potential future risk of power disruption affecting water services.
- 5.6.14 There are several key drivers that mean it is now more necessary than ever for us to secure resilient power supplies. Resilience cannot be secured within and by one organisation's systems and due regard needs to be given to the interdependence of systems and practices of national operators, (e.g. National Grid and the Distribution Network Operators) but also the effects of national policy.
- 5.6.15 The National Energy Security Strategy recognises the increased dependency and risk associated with reliance on external power supplies to meet the UK's demand. At a national level this means that the risk of a significant regional or national power disruption event is more likely than in recent years. Additionally, increasingly stormy weather, such as wind (e.g. Storm Arwen) and flooding (e.g. Storms Desmond and Eva) are placing additional risks on our assets and the assets of dependant service providers, which may be beyond their original design capacity. The resulting flooding and damage to power systems are a particular threat to continuous wholesome water service provision.

- 5.6.16 Increasing dependency and interaction between different systems provides resilience, but it also comes with risk. Power systems, communication systems, and water systems are all intrinsically linked. A significant failure in one infrastructure system, for example power, can have knock on effect on water regardless of our alternative power capabilities if the communications network required to run our telemetry is not resilient to power outages. This is also demonstrated in the withdrawal of copper phone lines and move to power dependant fibre networks and mobile communications. There is also currently no common resilience standards across infrastructure providers such that organisations can plan and prepare for interruptions of interdependent systems efficiently by addressing the risks for which they are best placed to manage.
- 5.6.17 Increasing deployment of renewable energy generation (locally to site and as national power assets) is helping UUW to meet its GHG emissions targets. However, we recognise that renewable power generation, at a site level, is insufficient and unsuitable to meet the demands of a large treatment facility and at a national level can be at risk of sub-optimal generation conditions requiring alternative supplies.

Our plan to secure power resilience

- 5.6.18 Recognising the risks posed by these changing drivers we are developing plans for further resilience of power availability at critical sites to supply side losses. The focus of which is improving our systems-based risk assessment and identifying best value investment opportunities to secure additional resilience where this is deemed to be required.
- 5.6.19 Our developing methodology includes:
- Analysis of smart meter data to understand the likelihood of supply side interruptions;
 - Working with the regional distribution network operators to understand their approach to resilience, sharing risk information and developing co-ordinated response plans to outages;
 - Taking account of site criticality – ensuring that we account for current levels of resilience afforded by the redundancy in the system and invest appropriately;
 - An enhancement case designed to provide alternative power provision solutions to meet the individual power requirements of identified sites that we deem to be at risk of power interruption. More details of the enhancement case can be found in supplementary document *UUW67 - power resilience enhancement claim*; and,
 - Developing long-term delivery strategies that are adaptive to changing circumstances and risks, such as climate change, so that we are prepared for the additional risks that could manifest in the long term. For example, increased flood risk to third-party substations that supply our assets if climate change goes unmitigated and continues to influence further extremes in weather patterns. Another example is the increased de-carbonisation of electricity generation resulting in a greater dependency on wind and solar which can be less reliable than the current gas power plants.

5.7 New and emerging risks

- 5.7.1 Following a horizon scanning activity undertaken by the business, a watching brief is held over risks and issues that are worthy of note due to their new, emerging or reputational status, and typically have too high levels of uncertainty or complexity to quantify.

Cash collection

- 5.7.2 There is a risk that we are unable to maintain acceptable levels of household customer cash collection due to external factors outside of business control such as laws on disconnection for non-payment, social deprivation in the North West, Welfare Reform and changes in the economic climate (including cost-of-living crisis), leading to loss of revenue, increased bad debt provision and a high retail cost to serve.

Credit rating

5.7.3 There is a potential for ratings agencies to lower credit ratings below any UUG board-approved target due to a deterioration in financial and/or operational performance (compared with the latest business plan) and/or external factors (such as inflation) leading to more expensive funding and potential reputational risk.

Conflict in Ukraine

5.7.4 The conflict in Ukraine has led to a number of risks emerging (growing, developing or becoming more prominent) from a security or economic perspective:

- Cyber – the likelihood of a cyber risk has been increased to reflect the rising tensions between Russia and the West;
- Security of the supply chain – this risk reflects the knock on impact of inflationary pressure on manufacturing output with some production facilities reducing operation. It also reflects sanctions imposed against Russia and Belarus and the restriction or prevention of access to certain goods; and,
- Cash collection – inflationary pressure is having a significant impact on the cost of living, affecting customer' ability to pay bills.

Plastics

5.7.5 Attention on single-use plastic and micro plastic (plastics less than 5mm) pollution is ongoing, with the water cycle identified as one of the routes to their presence in the environment. We have been actively involved in industry research lead by UKWIR which is continuing to explore analytical methods for the enumeration of microplastics in different water environments (drinking water, treated wastewater and biosolids) as well keeping abreast of potential changes to the regulatory landscape across water, wastewater and bioresources to understand risk and to inform our adaptive plans.

Perfluoroualkyl and polyfluoroalkyl substances (PFAS)

5.7.6 There is a growing focus on PFAS chemicals. PFAS are manufactured chemicals used in everyday products. Known as 'forever chemicals', they are persistent, bio accumulate and there is concern that they may be toxic at very low concentrations. We have developed in-house lab capability to analyse all of our drinking water sources and are compliant with the requirements of the Information Letter issued by the Drinking Water Inspectorate. We are also involved in industry research through UKWIR's Chemical Investigation Programme which will help inform and improve understanding of any potential risk associated with wastewater and biosolids, and will actively monitor for changes in public perception or legislation as the body of knowledge on these substances increases at an exponential rate which may require us to adapt our plans.

6. Long-term challenges

6.1 Introduction

6.1.1 As a business we are analysing and managing today's risks, as well as preparing for future uncertainty, striving to be resilient to future risks. Our key long-term challenges are summarised below, with the approach we are taking to be prepared for and adapt to these changes.

6.2 Climate change

6.2.1 Weather has a fundamental impact on our services and how we deliver them. Climate change will always be of strategic and operational importance. We are already seeing the effects of climate change on the region's weather, with increasing summer temperatures, wetter winters, and more extreme rainfall events. Without action, these trends will continue and there will be an increasing impact on the services we provide, and on the customers and communities that we serve.

6.2.2 In the North West we are already observing:

- Temperatures that are +1°C warmer than the pre-industrial period, which based on the current trajectories is anticipated to continue to warm to between +3°C and +6°C above pre-industrial levels by the year 2100; and,
- Twice the likelihood of a hot summer, with further seasonal changes in the North West projected to be greater than the average for England and Wales, with much wetter winters and, under some scenarios, much hotter and drier summers, as detailed in Figure 13. A 1 in 100-year rainfall event in the period 1981–2000 is projected to become a 1 in 50-year event in the period 2061–2080.

6.2.3 We recognise that the climate has already changed and we are planning for unavoidable future changes. Adapting to a changing climate represents one of the most significant challenges to future services and operations. In responding to this, we see substantial opportunity to deliver lasting value for customers and the North West.

6.2.4 Climate change is destabilising the ecosystems on which we rely to provide resilient and affordable services to customers. We and others are taking action, and need to do more over time, to effectively adapt to increasing climate impacts on the essential services we provide. Recognising this challenge, we are committed to mitigating our contribution to further climate change and adapting iteratively to the changes we experience. We have evolved our understanding of climate risk by incorporating the latest climate science into our risk assessment processes and embedding it within our long-term planning.

6.2.5 We have tested our plans against a range of climate change projections, using the latest best available information from the Met Offices UKCP18 climate change projections. These projections are categorised by their Representative Concentration Pathways or RCPs. Each RCP is associated with a predicted level of future greenhouse gases relative to pre-industrial levels. The relative concentrations will have different levels of consequences on average global temperatures, through a mechanism called radiative

Figure 13: Changes in seasonal rainfall from a 1981-2000 baseline



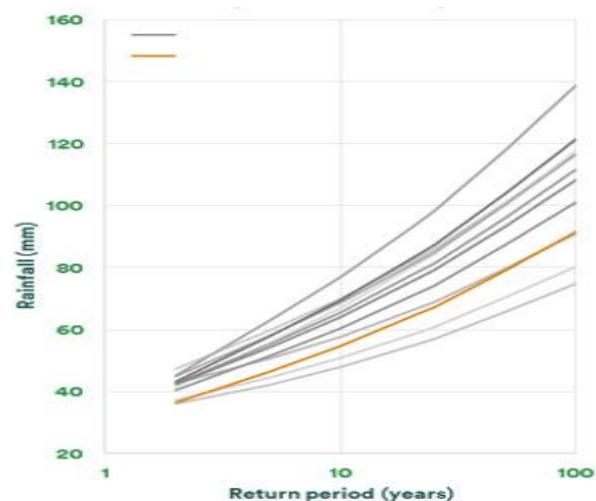
Source: UUW analysis of UK Climate Change Projections

forcing. In developing our long term adaptive plans we have considered a range of climate change scenarios, where applicable. These include;

- benign (RCP2.6) or a 1.6°C increase in average global temperatures by 2081-2100;
- central (RCP 6.0) or a 2.8°C increase in average global temperatures by 2081-2100; and,
- extreme (RCP8.5) or a 4.3°C increase in average global temperatures by 2081-2100.

- 6.2.6 We have further developed our understanding of how climate change is likely to test the resilience of our services through our company-wide assessment of climate-related risks, updated cyclically with latest evidence. This explores the risks from both the acute impacts of more frequent and severe weather events, and more chronic stresses over time from trends for drier and warmer conditions and sea level rise. We are taking steps to adapt to climate change and continue to provide a resilient service. At the heart of our response is systems resilience, further details of which can be found in section 2.4, improvements we have been making to our approach through our AMP7 resilience action plan can be found in section 3.2.
- 6.2.7 Climate change presents a systemic and often compounding risk throughout our operations and services, to which all water companies are susceptible. It affects the reliability and quality of our raw water supply, and influences customers' use patterns, for example with increasing demand for water during warm periods. Rainfall patterns are changing, leading to increased flood risk, see Figure 14.
- 6.2.8 Susceptibility to the effects of climate change, with respect to drought risk and raw water quality, are most immediate where water companies, such as United Utilities, have a high dependency on surface waters for public supplies. Surface waters are more exposed to the effects of evapotranspiration with additional impacts from increased warming and sunlight driving biological activity, which can be associated with an increased risk of adverse taste and odour causing compounds as a consequence of algal growth.
- 6.2.9 Increased rainfall volumes, and frequency/return periods of such events, increases the frequency and impacts of flash storms, potentially causing high surface run off and flooding. The chart below in Figure 14 shows the possible likely range of rainfall volumes and return periods.

Figure 14: Extreme daily rainfall return periods

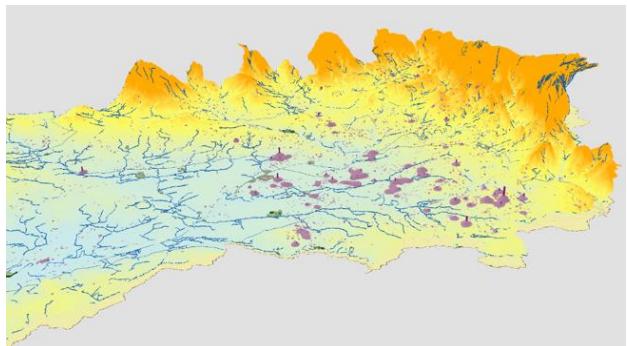


Observed 24-hour heavy rainfall event return periods (1981–2000 period) in amber. Grey lines show possible return periods accounting for climate change using factors from UKCP18 (2061–2080 period).

- 6.2.10 Relatively high rainfall and a hilly topography in the North of England means that water resource systems are dominated by surface water sources including large numbers of impounding reservoirs. In our region, in a typical year, 94 per cent of the water we supply comes from river or reservoir sources, and only six per cent comes from groundwater. This contrasts with the South and East of the country where extensive groundwater supplies typically make up a higher proportion of water resource systems (e.g. 65 per cent, on average, of Affinity Water's supply). This means that we have a more direct dependency on seasonal rainfall patterns and susceptibility to 'in-year' dry weather periods, which we expect to become more frequent and more extreme under all future climate change projections. This is in contrast to companies that have a greater proportion of groundwater sources, where the hydrological processes tend to delay the 'in-year' acute shocks to subsequent years. With the impacts materialising as a result of concurrent dry periods.

- 6.2.11 Rainfall, and the projected increases in both intensity and volume as a result of climate change, will pose a significant threat to our wastewater operations. Under all climate change projections we can expect to need to drain and potentially treat more surface water, increasing the risk of sewer flooding and storm overflow spills if the effects are not mitigated through our investment plans. This risk is exacerbated by the fact that we have the greatest percentage of combined sewers in England and Wales (54 per cent compared and industry average of 33 per cent).
- 6.2.12 Where the rain falls is as important as the total volume, urban rainfall calculations (October 2022)¹⁸ demonstrates that, when normalised per 10,000 sewer connections, the urban rainfall in the North West is 40 per cent higher than the industry average. Assuming that a greater proportion of rain falling in an urban area is likely to enter the sewer system, climate change is likely to pose a disproportionate threat to our sewerage system.
- 6.2.13 The topography of the North West also plays an important part when considering the need for rainfall management and the effects of climate change. Unique local topographies interact with surface water runoff to increase system surcharging and flood risk. This is especially true of Manchester, which is situated at the base of the Pennines and therefore receives significant inflows of rainwater from the upland areas. Manchester itself however is relatively low lying, with low levels of relief forming a 'bowl' shape, see Figure 15 for details. The effect is that the area becomes inundated with rainwater from the uplands that is then slow to drain through the lowland, prolonging surcharging of the system and flooding risk. This will become more impactful under all future climate change projections. To help mitigate this risk we have developed our rainwater management strategy, submitted as part of our Advanced WINEP submission, Our Advanced WINEP proposal is a Rainwater Management Programme which will unlock earlier, innovative investment and partnerships on rainwater management and storm overflows.
- 6.2.14 More information on the climate of the North West is provided in Chapter 2 – Water and more for the North West and the Long-Term Delivery Strategies (LTDS) *UUW12 Long term delivery strategy* and our plan for net zero can be found in *UUW06 Delivering social and environmental value* and supplementary document *UUW37 - Net zero 2050 plan*.

Figure 15: A 3D topographic representation of the Manchester drainage area



Climate change adaptation and mitigation

- 6.2.15 We recognise how we contribute to rising greenhouse gas concentrations, and we take significant steps to minimise this through the development of our climate change mitigation strategy.
- 6.2.16 We already have a strong track record of sustainability reporting and disclosure, having reported our GHG emissions for nearly 20 years. We have set and achieved multiple emissions reduction targets and in July 2021 we had four targets approved by the Science-Based Target Initiative. Our approved science-based targets are to:
- reduce absolute Scope 1 and scope 2 GHG emissions by 42 per cent by 2030 from a 2020 base year;
 - increase annual sourcing of renewable electricity from 95 per cent in 2020 to 100 per cent by 2023;
 - have 66 per cent of suppliers (by emissions, within Scope 3 capital goods) having science-based targets by 2025; and,

¹⁸ Ofwat (2022) *Urban rainfall calculations* <https://www.ofwat.gov.uk/publication/urban-rainfall-calculations/>

- reduce absolute Scope 3 GHG emissions covering all other Scope 3 categories by 25 per cent by 2030 from a 2020 base year.
- 6.2.17 We are already making good progress on delivering these targets and our footprint pledges. From October 2021 all the electricity we purchase will be Renewable Energy Guarantees of Origin (REGO) backed green electricity. We are progressing our journey to a 100 per cent green fleet by purchasing electric vehicles to replace smaller vans and cars, and by completing trials of biogas powered heavy goods vehicles. We have established two tree nurseries and identified hundreds of potential sites for new and 'replanted' woodlands to support our pledge to create 550 hectares of new woodland by 2030. We are confidently progressing on our pledge to restore 1,000 hectares of peatland by 2030 with our ongoing partnership programmes to secure water quality and to 'slow the flow'.
- 6.2.18 We are exposed to risks associated with the necessary transition to a low carbon economy. Changing policies, regulation and legislation to address mitigation and adaptation requirements can increase operating costs and call for agility and adaptability in the way we operate.
- 6.2.19 We recognise the need for further environmental improvements to support our resilience and the need to be actively collaborative and innovative in our approach to embed sustainable long-term improvements. Our new values framework enables us to assess the latest best value approach, considering social affordability, carbon impact, and environmental need using our systems-based approach and place-based adaptive planning approaches.
- 6.2.20 As a relatively energy-intensive business, we are susceptible to risks arising in the way energy is managed, including those resulting from decarbonisation activities and exposure to additional taxation. The cost of energy is expected to rise, and more accountability to be put on businesses for the greenhouse gas emissions they produce. We are taking actions to ensure we are resilient to changes in energy prices.
- 6.2.21 Our energy strategy is focused on using less, generating more and intelligently using our assets to get best value, while maintaining security of supply. In 2020/21, we generated 205GWh of renewable energy, equivalent to almost a quarter of the electricity we consumed.
- 6.2.22 We generate renewable energy from the sun, wind, and water, and extract bioresources from wastewater that we break down into biomethane (which is used to generate renewable energy) and biosolids (which are treated to provide a high-quality fertiliser for farmers). Since the cost of energy continues to rise, investment in renewables provides us with financial resilience and also contributes to our efforts to reduce our climate change impact by reducing our carbon footprint.
- 6.2.23 In 2017, we were awarded the Institute of Chemical Engineering Global Energy Award for our work on renewable energy at our Davyhulme Biomethane plant, just one year after completing one of Europe's largest floating solar array at our Godley reservoir in Hyde, producing three megawatts of clean energy.
- 6.2.24 We have switched to buying only green energy, and we are continuing to address our roles and responsibility in this space.

Adaptation requirements

- 6.2.25 Climate-related risks are managed through our embedded risk management framework and across our governance and reporting processes. Our approach helps to ensure the identification, assessment and management of climate change risks, to reduce impact and likelihood, while maximising opportunities.
- 6.2.26 Our mitigation metrics are aligned to limiting global temperature rises to 1.5°C. Adaptation metrics account for the risks and uncertainties associated with this, the global climate goal, and with higher temperature rises (including 2°C and 4°C), as well as how the many potential variations in climate change impact the delivery of service improvements. Targets are set with risk and uncertainty included.
- 6.2.27 While the most significant climate-related risks are physical risks, transition risks are also managed through our risk management framework.

Climate change risks

- 6.2.28 Climate change poses two broad risks that we anticipate will increasingly impact our water supplies:
- ### The quality of the water
- 6.2.29 Increased risk of taste and odour issues – associated with more frequent periods of extended warm, sunny, and calm conditions leading to more ideal conditions for algal growth in reservoirs and the development of associated bi-products affecting the quality of the raw water. Changing temperatures will also affect chlorine demand within the network and dosing regimens may need to be reassessed as a consequence; and,
- 6.2.30 Increased risk of raw water quality issues (especially colour and turbidity), associated with increased winter rainfall events resulting in land slips, increased surface erosion and run-off and also increased frequency and severity of summer moorland fires resulting in increased colour during post event rainfall and less stable catchment land due to loss of vegetation, also resulting in higher erosion and sediment loads into reservoirs.

The sufficiency of water

- 6.2.31 Poor pressure/loss of supply – as a result of disruption to water supply systems from increased frequency and intensity of storms resulting in loss of power, flooding (risks to pipe bridges and pipes near river banks etc.), landslips, and ground movement; and,
- 6.2.32 Increased frequency of implementing actions from our Drought Plan, as a result of increased periods of prolonged dry weather, and increased summer demands.
- 6.2.33 We have considered how these risks will impact the water and waste water services that we provide.

Wastewater networks

- 6.2.34 Heavier rainfall events lead to additional flows in our networks, and therefore an increased risk of the drainage system becoming overwhelmed. This increases the likelihood of storm overflows and also blockages.
- 6.2.35 Increased rainfall (storm) events can result in severe sewer flooding. The majority of sewers in the North West carry surface water as well as sewage. This means that when there are intense storm events, or incidents of prolonged severe weather, the sewers may become completely full of water creating a risk of sewage flooding out onto the ground or even inside homes and businesses.

Wastewater treatment

- 6.2.36 If an area experiences particularly heavy rainfall, as we have seen more often in recent years, our wastewater treatment works may have insufficient capacity to treat the higher flow volumes. Increased rainfall and extreme weather events resulting in flooding of assets and preventing access to assets, and increased likelihood of erosion events.
- 6.2.37 Strong (less dilute) sewage and first flush incidents cause challenges for treatment and reduced river flows could mean more treatment required to protect the rivers; with a subsequent need to update permits, driving increased treatment requirements.

Bioresources

- 6.2.38 Increased rainfall results in higher likelihood of flooding of assets included water logged fields so in turn reducing land availability. This can lead to an increased risk of unstable stockpiles and reduced sludge quality from prolonged use of stockpiles.
- 6.2.39 Reduced reliability of biosolids recycling route and changing demand for biosolids can lead to increased use of alternative, higher cost and less sustainable outlets for biosolids management.

Securing wholesome supplies

- 6.2.40 Seeking to understand the risks that climate change poses to our ability to produce wholesome water, and when we can expect these risks to be beyond the capacity of our current operations, allows us to take appropriate intervention decisions at the right time, mitigating the risks before they impact on the service to customers.
- 6.2.41 We have identified that the principal risks to water quality, from a perspective of climate change, are associated with deterioration of source waters. Either as a direct result of more frequent and longer lasting conditions for undesirable biological activity in water bodies (for example leading to higher levels of algae and cyanobacteria) or from physical risks associated with landslips during extreme rainfall episodes, and the damaging effects of moorland fires.
- 6.2.42 There is a twin track approach to mitigating these effects:
- Investing in the catchment to help improve its resilience to these events (i.e. addressing the issue at source); and,
 - Investing in treatment capabilities to be able to manage the effects of increased turbidity or the removal of taste and odour causing compounds.
- 6.2.43 The preferred option is always to address the risk at source, recognising that catchment land management represents the first stage of water treatment and such interventions are likely to have wider benefits for resilience and biodiversity.
- 6.2.44 We monitor the quality trends in the incoming raw water to our water treatment works. This enables us to forecast if and when raw water quality is likely to exceed the design standards of each individual works. In monitoring the raw water quality we can design adaptive pathways, implementing catchment interventions to reduce and stabilise the rate of raw water deterioration and avoid or delay investment in enhanced treatment process until we can confirm that it is the most appropriate course of action. Examples of this adaptive approach include our work at Rivington Water Treatment Works to secure compliance with taste and odour standards, after detecting deteriorating raw water quality we initially deployed catchment management solutions, followed by enhanced temporary treatment capabilities before finally determining that a permanent upgrade to the works was required to secure ongoing compliance. This adaptive pathway, delivered over a 12-year period, means an optimal solution has been developed to secure long-term water quality resilience at Rivington Water Treatment Works, all at best value to customers.
- 6.2.45 As a significant land owner, we have a responsibility and opportunity to use our land to secure future resilience. We monitor the condition of our catchment land and the effects on water quality, developing investment schemes such as Sustainable Catchment Management Programme (SCaMP) and our Green Recovery investments to improve the resilience of our owned and non-owned catchment through nature-based solutions.
- 6.2.46 During AMP7 we have expanded our long-running SCaMP programme into a broader Catchment systems thinking. This prioritises natural solutions to create more value for the environment working in partnership wherever possible to enable multiple benefits from a targeted approach. Not only does this begin to reverse long-term trends in deteriorating water quality, it provides many other benefits including:
- Protecting and improving water quality and quantity;
 - Reducing the rate of increase in raw water colour which will reduce future treatment costs;
 - Protecting and enhancing the natural environment;
 - Improving biodiversity and exceeding national targets for designated sites (SSSIs);
 - Increasing the resilience of upland habitats to the impacts of climate change; and,
 - Storing significant volumes of carbon as upland peat moors.

- 6.2.47 We will continue to build and evolve Catchment systems thinking to capture new and emerging risks to secure future resilience for flooding and water resources. This approach not only addresses current performance issues, but it is also provides a longer-term framework to support the management of arising issues.
- 6.2.48 Catchment systems is about working together to deliver the best solution for the overall system; employing our place-based planning methods to inform and target investment right across the catchment, rather than asset centric solutions. This takes many forms, such as employing nature-based solutions to reduce surface water and improve/reduce the impacts of deteriorating water quality, but also existing asset optimisation; new assets, and nature-based treatment solutions for final 'polishing'.

Securing sufficient supplies

- 6.2.49 Our Drought Plan approach aims to manage water supplies so there is enough water available of an appropriate wholesome standard for customers across the North West during a 1 in 200-year likelihood drought condition. We finalised our Drought Plan in August 2022¹⁹, and this considers the impacts of climate change as a key influence on future raw water supply. Our drought plan also recognises the customer acceptability issues of using different source waters and blends. This includes the impacts of changing water supplies and variations in the output of Water Treatment Works.
- 6.2.50 We have stress-tested our Drought Plan under many different future scenarios to ensure that we are resilient up to a 1 in 200-year drought event, securing resilience over the coming years. We have invested in our supply-side drought options to have them readily available, minimising the time it takes to bring them online during dry weather conditions and ensuring water quality is at the heart of our decision making in preparing for and during drought period. We are investing in further supply side options and reducing demand through leakage and promoting water efficiency.
- 6.2.51 Our Water Resources Management Plan²⁰ (WRMP) uses the Environment Agency Water Resources Planning Guideline on Climate Change provides guidance on incorporating UKCP18 in to the WRMP24 plans. We have adopted our advanced modelling approaches to assess the impacts of the new projections. The three factors that influence the supply-demand balance are:
- Water availability, which water quality has a significant impact on;
 - Demand from customers, which when significantly higher than usual can cause risks to water quality; and,
 - The amount of uncertainty associated with our assessments, known as headroom, for which changes in raw water quality is a major factor.
- 6.2.52 All of these factors are exacerbated by climate change. With hotter and drier summers more common under a changing climate, the amount and the quality of water available to abstract for water supply deteriorates.
- 6.2.53 Hotter, drier climate change scenarios may trigger earlier investment needs and will influence future requirements for both strategic regional and national water transfers, likely affecting the timing, frequency of transfer, duration, and volume. Under a warming climate and growing population, overall water demand is anticipated to increase, even when accounting for potential improvements to water efficiency and leakage reduction. This increase in demand can lead to water quality issues, however, with our water quality first culture we seek to ensure that the implementation of drought sources or increased abstraction of reservoirs does not compromise the quality of the water supplied.
- 6.2.54 We operate a conjunctive supply system, where abstraction from groundwater sources is balanced against surface water (lake and river) abstractions. During dry weather this may mean that due to limited water resource availability, some customers may receive an increased blend of groundwater in

¹⁹ There is further information on our Drought Plan on our website: unitedutilities.com/corporate/about-us/our-future-plans/water-resources/drought-plan/.

²⁰ unitedutilities.com/globalassets/z_corporate-site/about-us-pdfs/wrmp-2019---2045/final-water-resources-management-plan-2019.pdf

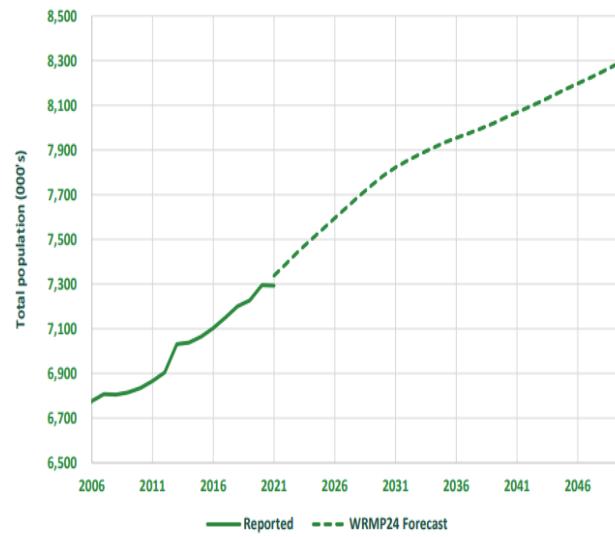
their supply. Customers can often have a negative response to source changes where a greater proportion of hard ground water is in their supply compared to softer upland water, which can lead to customer contacts relating to taste, smell and appearance. We therefore assess the impact on water hardness, prior to increasing abstraction from boreholes across the region. Where we identify a notable change in hardness, we proactively communicate this to customers, before adjusting the blend of water that they receive. We are reviewing customer acceptability of water in further detail, to be able to plan the blend of water sources such that it is acceptable to customers, during both normal and drought conditions.

- 6.2.55 In WRMP19, we based our water resources planning on the objective to be resilient to a 1 in 200-year drought. A significant step change occurred in WRMP24, where we are now planning for resilience to more extreme droughts, with a return period of 1 in 500-years by 2039.
- 6.2.56 In developing and delivering our long-term strategic plans, we are adopting an adaptive pathway approach, planning for likely future scenarios and identifying lowest regret investment needs while also understanding worst case future scenarios for our planning to provide long-term resilience. This approach allows us to remain agile as the climate changes and as science provides us with understanding and certainty, while acting on changing customer and stakeholder expectations and potential changes in legislation. As we develop our long-term plans, we will take into account the cost of mitigating and adapting to the effects of climate change. We will plan to invest in a timely and efficient manner recognising the need to consider what is affordable for customers today as well as tomorrow, and how this impacts the communities of the North West in a fair and equitable way. Therefore, we want to plan for plausible futures using adaptive planning so our service is resilient before the risk has materialised and that we invest at the best times recognising uncertainties. Further detail on this can be found in *UUW12 - Long term delivery strategy*.

6.3 Demographics

- 6.3.1 The changing customer base that we serve is a key causal factor impacting everything that we do. It is, therefore, critical for us to understand demographics change within our supply area, to allow us to deliver resilient services now and in the future.
- 6.3.2 Based on Local Development Plans (LDPs) and Office for National Statistics (ONS) population forecasts, we forecast our supply area population to grow by approximately 860,000 by 2045, as illustrated in Figure 16. The increase in population means a direct increase in the demand for water and wastewater services across our region.
- 6.3.3 We forecast the additional demand for water resulting from the increase in population to be more than offset by the delivery of our WRMP plan, with the annual average demand forecast set to reduce from 1738Mld in 2025/26 to 1424Mld by 2049/50 inclusive of the forecast demand growth, largely as a result of our ambitious leakage reduction programme and per capita consumption reductions. More details can be found in our WRMP technical document – Demand for water²¹.

Figure 16: Long-term trend in United Utilities total population, with housing-plan led forecast from 2021



²¹ unitedutilities.com/globalassets/z_corporate-site/about-us-pdfs/wrmp24-drafts/revised-draft-wrmp24-technical-report---demand-for-water.pdf

- 6.3.4 Reducing household occupancy rates increases demand for water as lower occupancy households tend to use more water per capita, linked to an ageing UK population and lower birth rates. In the North West we forecast that occupancy will reduce from 2.3 per property in 2021 to 2.15 by 2050²¹.
- 6.3.5 During the COVID-19 pandemic we observed a change in the location of demand for water services, as people stayed at home and non-household (workplace) consumption reduced. Hybrid and remote working practises could sustain some of this demand migration to domestic properties. Before the pandemic there was already evidence that city populations are no longer expected to be growing significantly faster than the rest of the country as previously projected. This potentially focuses increased demand for services away from city areas to more rural settings, which will add to pressure on services. System resilience is comparatively lower in rural areas as a result of topography and historical demand for services as the existing infrastructure tends to be less well connected to neighbouring systems (steep valleys) and sized for a historically lower population.
- 6.3.6 As well as a greater population, the make-up of that population will alter the demands placed on United Utilities:
- Different segments of the population have varying expectations and needs for water services. For example monitoring of unmeasured household consumption shows that, on average, cultural background can increase household demand by as much as one third;
 - Increasing demand for water services in the region due to increased domestic and international tourism. This can often be localised in more rural areas of lower historic resilience and tend to only have single supply routes, for example the Lake District.
- 6.3.7 More information on the population of the North West is provided in *UUW12 Long term delivery strategy*.

Increase in total population

- 6.3.8 An increasing population means a direct increase in demand for services, for water this could be an additional demand for 120 mega litres of water per day by 2045, on top of the current average daily demand of 1800 mega litres per day. The impact of additional demand for water associated with population growth is anticipated to reduce throughout the planning horizon (2025–2050). This is the result of increased penetration of water efficiency measures with time, such as improved housing water efficiency standards in new builds and increased meter penetration.
- 6.3.9 Increased demand for water will place more stress on the North West's water resources, at a time when there is a strong regulatory direction to reduce water abstraction to protect water ecosystems.
- 6.3.10 With greater water demand there will be an equivalent uplift in demand for sewerage services with an increase in total load and volumes needing to be treated, again at a time when environmental standards for discharge quality are tightening.
- 6.3.11 The additional demand for housing to support the projected population growth will also result in an increased area of land and property requiring surface water drainage.
- 6.3.12 Therefore, it is imperative that we grow the focus on the efficient use of water and sewers, taking a systems-based approach to understand the interdependencies on these services, to minimise the pressure on limited resources, the costs of service provision, the environment and our assets.

Change in occupancy rate

- 6.3.13 Household occupancy has a direct relationship with household demand for water, lower occupancy households on average tend to consume more water per person compared to higher occupancy rates.
- 6.3.14 The forecast trend in occupancy for our supply region indicates a move to reducing occupancy rates. In the North West we forecast that occupancy will reduce from 2.3 per property in 2021 to 2.15 by 2050²¹. This is linked to a changing age profile in the UK. The UK's age structure is shifting towards older ages because of declining fertility rates and people living longer, the North West is mirroring this profile.
- 6.3.15 As people age they tend to live in lower occupancy housing and also tend to have different consumption patterns, with greater time spent at home and increased water use outside of the home.

Additional impacts of change in age profile

- 6.3.16 As the population of the North West increases to age, it is likely that there will be a shift in the wider economic status with an increased number of pensioners and people otherwise not seeking work.
- 6.3.17 This could manifest in a reduced workforce pool in the North West, increased pensioners on fixed incomes could threaten ability to pay bills, and a higher dependency ratio on those in employment.
- 6.3.18 Additionally, a general increase in life expectancy could contribute to increased pressures on any company defined pension benefit members.

Segmental use of water

- 6.3.19 Different segments of the population have different expectations and needs for water services. Water use can vary between different cultural backgrounds, those that are disabled or have healthcare needs, pensioners, and families. While we do account for ethnicity in terms of seasonal demand for water, especially during Ramadan, We are currently working to fully understand the full picture on how ethnicity determines water use characteristics of certain populations, or how growth in these populations may or may not apply a disproportionate impact to water services. As previously stated above, cultural background can increase household demand by as much as one third.
- 6.3.20 In the short term, there is operational benefit in understanding where these population centres are so as to avoid planned work at sensitive times, such as during festivals where water has a religious significance.

Change in demand geography

- 6.3.21 Overall levels of poverty, defined in terms of disposable household income, have remained relatively stable in the North West over the last five years. Resolution Foundation analysis conducted in spring 2022 forecasts that, due to inflation, the poorest quarter of households are set to see their incomes fall by 6 per cent. This will see a further 1.3 million people across the UK to fall into absolute poverty next year.
- 6.3.22 Considering that some of the poorest communities are in our supply area and the current outlook for inflation is bleak, it can be anticipated that the number of people, and the level of poverty experienced, is likely to increase in the North West. The impact being on household ability to afford their water bill, potentially impacting on the number of households applying for financial support and increasing the level of bad debt.

Mitigation

- 6.3.23 In order to mitigate these risks we use the latest best information and regulator guidance in order to forecast population growth and the effects on demand for services. This demand analysis is fed into our strategic planning frameworks to ensure that we can meet our regulatory and business expectations now and in the future.
- 6.3.24 We use a scenario approach to stress test the various permutations of population growth, accounting for both LDPs and multiple ONS projections that account for different levels of migration. This will form a key part of the development of our Long-term Delivery Strategy in the development of Our Future Plan for PR24 and beyond.
- 6.3.25 Key activities to meet the future demand from demographic change are focused on reducing the current demand for services and creating further headroom (i.e. redundancy) in our existing systems so as to accommodate the effects of change. Specifically these include:
- 50 per cent leakage reduction to reduce demand on the ecosystem and make available additional capacity for service growth;
 - Targeting average PCC to 110 litres per person per day to reduce the existing demand for services and reduce the impact of future additional demand;
 - Promoting the deployment of SuDS in new developments and retrofitting to remove surface water from the sewerage system; and,
 - Delivering our Catchment systems thinking Strategy (CaST) to further reduce volumes and load at source, creating capacity in the system to accommodate new demand.

7. Our future plans

7.1 Overview

Our vision and core purpose is to provide great water for a stronger, greener and healthier North West.

- 7.1.1 Providing resilient water and wastewater services to customers across the North West is fundamental to ensuring that United Utilities Water (UUW) can deliver on its core purpose, now and in the future.
- 7.1.2 To support the delivery of our targets and ambitions we have set stretching future performance targets that go beyond the traditional regulatory planning horizons. In setting long-term targets, we can ensure that short-term investment decisions are made within the context of our long-term strategic ambitions, future forecasts and future uncertainties.
- 7.1.3 Our AMP8 plan aims to manage the principal risks that have been identified by the company. Details of the risk assessment process can be found in Section 4. This is aligned to our approach to corporate resilience and is supported by our risk and resilience framework – details of which can be found in *Chapter 7- Resilience and asset health* and supplementary document *UUW43 - Corporate approach to resilience*.
- 7.1.4 Our AMP8 plan delivers substantial investment in improving resilience through targeting both base and enhancement expenditure to reduce the risk of service failures.
- 7.1.5 In this section we summarise how our ambitious AMP8 plans to secure enduring resilience and stable asset health are contributing to the delivery of our resilience targets and ambitions and our purpose and strategic objectives. We describe how investment of £2,765 million of base expenditure, combined with a £4,455 million investment to enhance services will deliver improved resilience.
- 7.1.6 Figure 17 summaries our total investment plans for resilience and asset health, split between base expenditure and enhancement, and the performance levels that we expect to achieve against the AMP8 common asset health measures.

Figure 17: Our AMP8 plan in numbers

<p>Securing an 82% reduction in unplanned outages at water treatment works by 2030</p>	<p>Maintaining stable performance in water mains repairs on our already frontier performance. As measured by repairs per 1000km of main</p>	<p>Delivering a 5% improvement in sewer collapses. As measured by sewer collapses per 1000km of sewer</p>																							
<p>£2,765 million – base expenditure</p>		<p>£4,455 million – enhancement expenditure</p>																							
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- 7.1.7 In addition to the common asset health performance commitment performance, Figure 18 summarises some of the key projects and resilience programmes that we intend to deliver, or start in the case of phased programmes, in AMP8. Delivering on our purpose to provide great water for a stronger, greener and healthier North West across the entire range of business operations.

Figure 18: Key AMP8 resilience projects

Haweswater Aqueduct Resilience Project Replacing 62km of the aqueduct to secure continued water service resilience to a population of 2.5 million	Security Delivering enhanced physical and cyber security to our assets	Bioresources Securing 60 days contingency storage to improve resilience in biosolids recycling	Rainwater management Delivering enhanced investment of £531 million to remove rainwater from our sewerage system – including £60 million of partnership funding
	Environment Restoration of 4764 hectares of peatland to improve water quality.	Water Resources Increasing water resources by 22 million litres per day by 2030	
	Power resilience Investing in back-up power resilience at some of our most important sites	Coastal Erosion Protecting 14 assets and systems from the risk of coastal and river erosion	

8. Water future plans

8.1 Overview

8.1.1 A summary of our plan for Water Network Plus, encompassing both water supply and treatment and water network ambitions, is included in Figure 19. This represents a selection of our entire AMP8 and long-term plan, as discussed previously in *Chapter 5 - Delivering great service*, focusing on the aspects of our plan that will secure resilience and asset health.

Figure 19: Our future plan for Water

Water	Improving resilience of our catchments - increasing quality and flow	1 in 500-years Improving drought risk resilience by 2039, accounting for climate change.	50% Halving our leakage performance by 2050 (2017/18 baseline)	 Investment to ensure that our assets continue to be 100% compliant with drinking water standards	Asset health Delivering a 82% reduction in unplanned outages at water treatment works Maintaining stable (frontier) performance in water mains repairs
	131 Mld Reducing sustainable water abstraction by 131 Ml/d by 2050	 Reducing the demand for water to 110 l/p/d by 2050	Delivering a 13% reduction in water supply interruptions by 2030		
	Delivering a minimum of 25 Ml/d of water transfer capability by 2030	 Halving the risk of a hosepipe ban by 2031		Upgrading five works to be able to remove taste and odour causing compounds in AMP8	
					Increasing investment to meet new, more stringent resilience standards for our reservoirs

8.1.2 We split out our plans for water supply and treatment and water network for both AMP8 and the long-term, to expand on these aspects of our plan.

8.1.3 The principal risks and hazards addressed by this investment plans are:

- Failure to treat water;
- Water sufficiency;
- Failure of the distribution system (leakage); and,
- Failure of the Haweswater Aqueduct.

8.2 Water supply and treatment long-term strategy

8.2.1 We plan for our future water supply system to supply the region and play a part in wider national resilience through a sustainable, integrated range of diverse water sources and concerted action to reduce leakage and demand. The water resource and treatment systems of the future aim for a reliable integrated service, compliant with drinking water standards, adaptive to changing demands, safe, and resilient to both chronic and acute system shocks. Working with partners and communities, we will continue our investment in catchment land, both owned and non-owned, to secure reliable high-quality inflows to our surface water system, while providing flood protection to communities downstream.

8.2.2 Our revised draft Water Resource Management Plan 2024 (rdWRMP) sets out our strategy to achieve a long-term, best value and sustainable plan for water supplies in the North West. It plans for an adequate supply to meet demand over the 25 years from 2025 to 2050 and beyond, delivering enhanced levels of drought risk resilience. Our strategy benefits customers in the North West, as well as supporting national water resource needs, and the ecosystem we operate in. More on how our rdWRMP delivers environmental benefits can be found in *Chapter 6 - Delivering social and environmental value*.

- 8.2.3 The resilience and health of catchments in the North West is critical to the delivery of water services. Not only do they provide raw water collection and storage services, they also provide the first stage of water treatment and slow the flow to reduce flooding risks downstream. We believe land management is a crucial part of the water supply cycle and that management is important for the protection of water quality. We will, therefore, continue to own and manage a significant land holding to continue protecting water quality and enable us to react appropriately to the emergence of new threats; for example, the increasing prevalence of problematic organic compounds.
- 8.2.4 We will maintain the health of our fleet of impounding reservoirs, the largest in the UK water sector, complying with the revised statutory requirements following the Balmforth review (2020) following the Todbrook incident. This is to ensure that they continue to provide a reliable supply of water, now and in the future, even in the face of a changing climate and population growth. As responsible asset stewards, we will ensure that the level of societal risk posed by our reservoir assets remains within a tolerable range²², accounting for changes to risk factors, such as populations, over time.
- 8.2.5 In addition to ensuring adequate supplies of raw water, it is also essential that we provide sufficient treatment capabilities to deliver a reliable supply of wholesome water. Our long-term plan for drinking water quality sets out our vision to provide industry-leading water quality that is compliant with current and future drinking water quality standards, targeting a sustainable and reliable supply of safe clean drinking water for future generations.
- 8.2.6 We continue to follow our risk identification and hazard review (HazRev) process for identifying hazards to control, minimise and lessen the impact of system failures during project design, construction and subsequent operation. The HazRev process was initially developed for use in water treatment assets following our Franklaw incident in 2015. Having realised the value in assessing risks at both an asset, facility and system level, we have expanded the process to cover catchment assets (CatchRev) and network assets (NetRev). We are currently the only large water company in the UK to apply this approach to all of our assets.
- 8.2.7 Through our long-term investment strategies, we plan to:
- Utilise catchment interventions to preserve water quality and availability at source while enhancing natural capital value. This includes the delivery WINEP enhancement schemes to improve catchment land;
 - Maintain the health of our fleet of impounding reservoir assets to meet new, more stringent measures;
 - Identify and develop new water resources in support of increased water resilience for the North West and national needs for the future potential transfers of water outside to other regions;
 - Create additional supply capacity at both resource and treatment level by reducing leakage by 50 per cent by 2050 from a 2017/2018 baseline and through promoting water efficiency;
 - Continue investment in maintaining the asset health of our water collection and treatment assets. This includes our plans to be industry leaders in maintenance, leading to fewer asset failures and, in turn, better performance across water quality compliance and customer contacts; and,
 - Continue to monitor and analyse raw water quality trends, and the effects of external factors such as climate change and drinking water regulation on current treatment performance and capabilities. So to develop interventions for our works to deliver on our ambitions for water quality compliance now and over the long term.
- 8.2.8 For further information, see Table 5 in the appendix section for a link to our long-term water quality plan and rdWRMP24.

²² As defined by our Portfolio Risk Assessment (PRA) definitions of societal risk.

- 8.2.9 For more information about our Environmental Strategy, and how it contributes to securing resilience, see *Chapter 6 - Delivering social and environmental value*.
- 8.2.10 Our strategy and AMP8 plan aims to improve service resilience; further information is provided in supplementary documents *UUW56 wastewater network plus price control* and *UUW57 water network plus price control*.

8.3 Water supply and treatment AMP8 plan

- 8.3.1 During AMP8, we will continue to work to improve the resilience of our catchments and water treatment works to ensure that we maintain and improve our supply headroom. We will adaptively plan for potential future water trading requirements, so we can play part in supporting national water supply needs, seeking interventions that also benefit the North West. We will invest in the health of both our catchment and treatment assets to ensure that outages are minimised, while addressing risks to our existing production capacity.
- 8.3.2 Our key investment strategies for AMP8 aim to:
- Reduce further unplanned outages through highly targeted investment programmes into critical assets such as chemical storage, control infrastructure and filters. Delivering improvements in resilience, in line with our 5R approach, improving works resilience and reliability;
 - Increase production capacity by 22 million litres per day by 2030, in line with our water resources management plan requirements. This will involve the development of new sources as well as restoring and/or maintaining production capacity at existing assets;
 - Invest in improving the resilience of our catchments, restoring 500 hectares of peatland to improving raw water quality treatability, and catchment susceptibility to storm damage, as well as increasing quantity and flow patterns of inflows to some of our impounding reservoirs. We will do this by making more use of partnership schemes to deliver a wide range of benefits from natural flood management to catchment stabilisation for water quality and availability;
 - Further harden our sites against malicious attack as nationally we face increasing cyber security and ongoing physical security risks. We will protect our assets to the latest protective security standards guidance which was revised in March 2022. We also plan to improve remote monitoring of our production processes to improve security and efficiency of process operation; more details on the scope of this programme of investment can be found in supplementary document *UUW61 NIS and SEMD enhancement case*;
 - Deliver a 13 per cent reduction in leakage by 2020 – aligned to our 2050 ambition to halve the level of leakage;
 - Deliver a reduction of 25 Ml/d in per capita consumption – aligned to our 2050 ambition to reduce water use per person per day to 110 litres; and,
 - Support national planning by developing options that would allow us to transfer large volumes of water outside our region.

8.4 Water network long-term strategy

- 8.4.1 Our water distribution systems of the future aims to deliver a highly reliable integrated service, with improved asset health and reduced losses, water quality compliance will be maintained throughout the network to customer's taps, increased digitalisation in partnership with enhanced response and recovery capabilities targets a highly reliable supply system with quick restoration times in the event of a failure. Additional headroom as a result of reduced losses and per capita consumption facilitates growth in the North West that remains resilient to both chronic and acute system shocks.
- 8.4.2 Aligned to our 5R strategy for securing resilience in the round, our strategy for securing resilience within the water network has evolved over time and in response to need. Network infrastructure represents

some of the longest lived assets in the company portfolio, and it is the asset base that is most directly connected to customers. Therefore, it is imperative that we continue to develop long-term investment strategies for these assets.

- 8.4.3 Building on our recent investment in response and recovery capability in AMP6 and AMP7, and investment programmes targeted at service reservoirs, our future strategy will refocus on proactive investment in water mains to further improve the asset health of our water network.
- 8.4.4 We plan to continue digital enablement of our network to provide industry-leading situational awareness to support service improvements, and critically enhancing our ability to react to events and incidents, as well as gathering asset and performance information to help target asset rehabilitation and replacement.
- 8.4.5 We are planning to create the necessary additional capacity in the distribution system to allow for forecast growth in population, economic growth in the North West, while accounting for external factors such as climate change. Targeting a positive supply demand balance with a prudent level of headroom to be able to absorb and recover from incidents on the network.
- 8.4.6 We will continue to develop long-term investment plans to maintain the asset health of key strategic water distribution assets such as our major aqueduct systems.
- 8.4.7 Long-term investment strategies aim to:
 - Target an ambitious 50 per cent reduction in leakage by 2050 and reducing the demand for water by 110 p/l/d per capita consumption by 2050 to provide much of the necessary additional capacity in our system to manage forecast growth and the forecast impacts of climate change, while maintaining sufficient redundancy in the system to be resilient to acute shock and stresses from drought and asset outages; and,
 - Invest in maintaining the asset health of our water distribution assets, both at the strategic large diameter trunk mains, and at the smaller distribution mains level, which will add resilience in our water supply network, for example, through the Haweswater Aqueduct Resilience Project (HARP) and Vyrnwy Aqueduct Modernisation Programme (VAMP).

8.5 Water network AMP8 plan

- 8.5.1 During AMP8, we will continue to work to improve the resilience of our water network assets by ensuring that they have the required reliability, resistance, redundancy, and response and recovery capabilities to deliver our service ambitions.
- 8.5.2 We continue to invest in the health of our network assets, including mains, to ensure that the risk of supply interruptions are minimised, while ensuring that, should they occur, we have the necessary situational awareness and response capability to be able to reduce the effects on customers.
- 8.5.3 Investment strategies for AMP8 aim to:
 - Further enhance our systems approach to ensure that we consistently provide top quality water to customers, reducing their service interruptions by a third. We will work with our stakeholders and partners to reduce third-party impacts across our network, while ensuring that future development does not cause any detriment to our ability to deliver our services;
 - Maintain our response and recovery capabilities, maintaining a significant fleet of alternative supply vehicles in the UK sector, while continuing to develop and test our contingency plans for system outages;
 - Target a 13 per cent reduction in leakage by 2030, through better situational awareness with a faster response, coupled with proactive replacement. This will help to secure water sufficiency;
 - Improve water mains resilience through targeted, proactive investment exactly where it is most needed, helped by cutting-edge risk modelling; and,

- Deliver water efficiency campaigns to reduce water usage, reducing overall demand on raw water storage and production capacity, increasing headroom to be able to absorb and recover from acute shocks to the system.

8.6 Water network 5Rs

8.6.1 Our future investment strategy aims to secure and enhance continued service resilience in line with the principles of our 5R model, as outline earlier in this document.

Reliability:

- We are investing in the health of our assets through highly targeted investment programmes, helped by cross-cutting risk modelling. We are investing in our critical assets such as chemical storage, control infrastructure and core processes. This includes filters to help us to prolong the cost-effective life of these assets.
- We are investing in the resilience of the Haweswater Aqueduct, a key and long-life asset. A capital project to replace the tunnel sections is already underway and the remaining sections of tunnel will be improved as part of Haweswater Aqueduct Resilience Programme (HARP) by 2029;
- We are continuing to leverage our maintenance excellence programme to further manage the transition from reactive to planned operational maintenance. As an example, this includes investing in pre-prepared service packs for critical assets to ensure that all required resources are routinely available helping to improve efficiency;
- We are making targeted investments at key treatment sites where the assets are now service life expired in order to improve overall process reliability. In addition, we are making treatment upgrades to improve drinking water quality whilst also restoring deficits in production throughput to meet sufficiency requirements; and,
- We are developing new supply options to support a future water transfer from our area. These include new bore holes and river abstractions. This investment will also help us to improve levels of services for drought permits and temporary use bans (TUBs).

Redundancy:

- We are maintaining headroom in our system by focusing reducing leakage and consumption;
- We are maintaining headroom in our systems to improve their ability to absorb shocks and stresses by increasing our production capacity in line with our revised draft Water Resources Management Plan (rdWRMP) 2024;
- We are maintaining headroom by reducing our leakage through better situational awareness, coupled with a targeted programme of proactive mains replacement, which helps to secure water sufficiency and reduce our impact on the natural environment. This is supported by water and wastewater efficiency campaigns to reduce water usage. This programme will focus on the worst performing half of our network comprising legacy materials such as cast iron, PVC or asbestos cement mains; and,
- We are continuing to provide secure water resources, and are planning to meet the new Government requirement of being resilient to a 1-in-500-year droughts by 2039. Our plans account for the long-term demand patterns that include climate change and population growth. We are facilitating the improved resilience of other companies, and our own, by developing adaptive water trading ambitions.

Resistance:

- We will improve the remote monitoring of our production processes as, nationally, we face increasing cybersecurity risks from malicious players, making us more resilient to external threats to our assets, systems and processes. We are investing to improve the resilience of our catchments,

making more use of partnership schemes to deliver a wide range of benefits from natural flood management to catchment stabilisation for water quality and availability with associated biodiversity benefits.

Response and recovery:

- Our plan includes for significant investment in meters, control valves, and other monitoring and control equipment across the water network. This investment will enable us to further improve our targeting of faults and failures within the network allowing faster response to minimise their impacts; and,
- To help us respond to incidents, we have a comprehensive set of business continuity and contingency plans, with a dedicated Integrated Control Centre (ICC) that coordinates incident responses. We can deploy our fleet of alternative supply vehicles (ASVs) that can inject treated water directly into supply while we perform repairs, which ensures disruption to customers' supply is minimised.

Review:

- We analyse and learn from past events and incidents to further enhance our resilience. We complete post-incident reviews (PIRs) following an incident to highlight key learnings and gap analysis. We regularly initiate internal exercises across the business to stress test our plans and further develop where appropriate. We take part in Local Resilience Forums (LRFs) that relate to a number of external risks, and complete activities including risk assessment processes, multi-agency training, multi-agency exercises, plan development and joint incident response.

9. Wastewater future plans

9.1 Overview

9.1.1 A summary of our plan for Wastewater Network Plus, encompassing both wastewater supply and treatment and wastewater network ambitions, is included below in Figure 20. This represents a selection from our AMP8 and long-term plans, as discussed in *Chapter 5 - Delivering great service*, focusing on the aspects of our plans that will secure resilience and asset health.

Figure 20: Our future plan for Wastewater

Wastewater	 Delivering <10 spills from CSOs per year (on average) by 2050 Reducing overflow spills at 437 CSOs in AMP8	 Continue delivering frontier pollution performance	Rainwater management Investing £531m including £60m partnership funding to remove surface water	 Delivering a 32% reduction in internal sewer flooding by 2030	Asset health Delivering a 5% improvement* in asset health by 2030 *measured by sewer collapses/1000km
	 Delivering increased treatment capacity to meet supply demand needs	100% Delivering 100% discharge compliance	 Securing compliance of wastewater reservoirs to reservoir act 1975 requirements		

9.1.2 We have split out our plans for wastewater network and wastewater treatment for both AMP8 and the long term to expand on these aspects of our plan.

9.1.3 The principal risks and hazards addressed by this investment plans are:

- Failure of wastewater network; and,
- Failure to treat wastewater (in terms of quality, flow and spills performance).

9.2 Wastewater network long-term strategy

9.2.1 The wastewater system of the future demands transformation to limit the impact of rainfall and adapt to a changing climate – we envision a highly integrated system with high reliability, reduced surface water connections and reduced need for storm overflow spills, which are physically and digitally integrated into the operation of wastewater treatment systems. We plan to continue and expand our partnership work with the wider community, local authorities and developers to remove surface water from the wastewater system at source, developing multi-agency catchment integrated systems, working toward common goals and ambitions. Delivering maximum value through systems that are co-funded where appropriate and more resilient to chronic and acute shocks.

9.2.2 The system of the future should capture and release rainwater safely and securely back into the environment in a way that best protects customers from the impacts of flooding and reduces environmental harm from storm overflow spills, while also meeting new performance targets.

9.2.3 Our current drainage and wastewater assets are under increasing stress. We plan to evolve our drainage systems so that they are more sustainably integrated with the natural environment. Today climate change, population growth and an ageing infrastructure all have negative consequences on asset health and performance. We have taken a comprehensive approach to our first DWMP, recognising the importance of long-term planning to adapt to climate change and meet the demands of population growth. In addition to the baseline risk and asset vulnerability assessment, we have run a

comprehensive suite of resilience assessments across the whole of the North West, to develop a robust understanding of wider catchment resilience issues that are not directly linked to systems characteristics.

- 9.2.4 The results from these assessments were incorporated into the options development stage of the DWMP. A combination of approaches were taken, from incorporating the assessments into generic high-level solutions, to bespoke optioneering, depending on the scale of risk. This work will be used to inform the best solution for the particular issue across the region. This includes the development of investment needs and the exploration of innovative delivery models such as partnership delivery and environmental markets. More details can be found in *Chapter 6 - Delivering social and environmental value*.
- 9.2.5 Further information and a link to our DWMP can be found in Table 7 of the Appendix Section.
- 9.2.6 We plan to improve and maintain the health of our wastewater network asset base. In the context of the sewer network, accounting for hydraulic capacity, good asset health directly results in reduced storm overflow spills. In our future ideas lab submission on storm overflow incentivisation²³, we demonstrate how operational issues at wastewater network assets account for an average of 29 per cent of storm overflow spills in the English and Welsh water sector – this is as high as 61 per cent for individual companies. At UUW, operational issues accounted for 12 per cent of storm overflow spills in the latest event duration monitor data; the remaining 88 per cent being the result of hydraulic capacity issues. This demonstrates good asset health practises and better-than-industry average performance, although we accept that more must be done to make our existing network more resilient to asset failure or unavailability, as well as the enhancements required to reduce demand and increase capacity. Our future strategy is aimed at both reducing the occurrence of operational issues and providing additional hydraulic capacity through both surface water removal and asset investment. We plan to deliver these benefits through our targeted asset health and Dynamic Network Management (DNM) strategies and our rainwater management investment strategy.
- 9.2.7 Long-term investment strategies aim to:
- Ensure there is sufficient capacity within our sewerage network to meet the demand requirements of today and the future, reducing overflow spill frequency and flooding risk;
 - Reduce the risk posed from the natural environment such as fluvial and/or coastal flooding and erosion of sewers, wastewater treatment works and major pumping stations, where there is a high risk of damage and service disruption, accounting for future climate change effects;
 - Reduce the risk of service disruption from third-party services such as power and telecoms, working with partners to ensure risks to disruption are addressed by the most appropriate organisation; and,
 - Make enhancement improvements to 437 storm overflows to promote resilience in the system, especially in periods of prolonged rainfall, and provide additional capacity in the system to meet new performance requirements.

9.3 Wastewater network AMP8 plan

- 9.3.1 We plan to continue to digitally enable our wastewater network to be one of the most proactively managed in the water industry, delivering first-class service at the lowest whole life cost. For sewer flooding, we will continue our progress towards maximising control through active expansion of our DNM capabilities, customer awareness campaigns and an enhanced policing of third-party impacts, while promoting large-scale investment in rainwater management and property-level mitigation to improve resilience to severe weather.

²³[unitedutilities.com/globalassets/z_corporate-site/about-us-pdfs/looking-to-the-future/uuw-future-ideas-lab-submission---storm-overflow-incentives-for-pr24.pdf](https://www.unitedutilities.com/globalassets/z_corporate-site/about-us-pdfs/looking-to-the-future/uuw-future-ideas-lab-submission---storm-overflow-incentives-for-pr24.pdf)

9.3.2 Investment strategies for AMP8 aim to:

- Improve asset resilience through proactive replacement of end-of-life or suboptimal sewer materials, such as pitch fibre and glass reinforced plastic (GRP), improving the overall asset health of the sewer system to deliver sustainable performance benefits. We will deliver an enhanced programme of high consequence sewer condition inspections, coupled with our leading artificial intelligence driven CCTV sewer condition capture approach, helping to identify and resolve the most critical defects before they impact customers or the environment;
- Significantly increase the amount of nature-based (blue/green) infrastructure investment across our region. This will target reduced overflow spills and stress on our treatment works. We will utilise a range of delivery options from traditional engineering to catchment capture approaches such as natural flood management and sustainable drainage systems. This includes a significant acceleration of deliverables into AMP7;
- Investing £531 million plus £60 million partnership funding to remove rainwater from our sewerage system, maximising current sewer capacity. Separating surface water from our foul network, and encouraging customers to do the same, will help to cope with future demands from growth and climate change and help to reduce the risk of sewer flooding;
- Increase our focus on third-party impacts to our network with improved detection of trade effluent breaches, reduced highway drain connections, tackle misconnections and an expansion of our highly successful ‘what not to flush’ campaign, further discouraging sewer misuse;
- We will deliver integrated supply-demand strategy with additional monitoring on large property developments, piloting of zonal infrastructure charging and targeting at least half of new homes to include rainwater harvesting and sustainable drainage systems;
- We will improve river locking detection and prevention coupled with outfall flap valve installation, mitigating backflow into our networks. Optimised and proactive use of offline storage via our DNM sensor network to make best use of the capacity of our network, anticipating peaks and troughs in demand to further reduce flooding and pollution. Continuation of our targeted property level flood mitigation programme aims to mitigate the worst service failures from foul flooding; and,
- We will investigate and protect 14 water and wastewater assets against river and coastal erosion.

9.4 Wastewater treatment long-term plan

9.4.1 The wastewater treatment system of the future should act as guardian to the environment – we envision an integrated system of innovative physical and biological treatment and nature-based solutions working in partnership to deliver high water quality standards, causing ‘no harm’ to the water environment. It will be highly reliable with a reduced need for overflow spills, dynamically integrated into the wastewater network. We will monitor, analyse and predict system performance in real-time to optimise systems and adapt quickly to changing circumstances, delivering efficiently, and safe guarding services and the environment.

9.4.2 Our services will be delivered with a net zero impact on the carbon balance while fully harnessing the potential of new technology to recycle nutrients and recover energy throughout the process.

9.4.3 Long-term investment strategies aim to:

- Plan for sufficient treatment capabilities to recycle waste water safely back to the environment while meeting quality standards;
- Proactively monitor performance, regulations and standards, investigating potential future investment needs and meeting statutory drivers as outlined in the WINEP and future WINEPs;

- Monitor river water quality and the effects on it from significant overflows and wastewater treatment discharges, investing to prevent harm, evaluate and inform future investments and reduce the frequency of overflow spills;
- Invest significantly in innovation through our DNM approach, further enhancing our pollution performance on all metrics by use of remote monitoring and control technologies; and,
- Continue to use a catchment systems thinking to manage our catchments in a holistic way to reduce flow and nutrient loads, promoting resilience in the system.

9.5 Wastewater treatment AMP8 plan

9.5.1 Our wastewater treatment programme sees major enhancement investment across many of our sites to deliver our regulatory requirements under the WINEP. We intend to take the opportunity through our investments in AMP8 to improve our overall resilience and improve asset health, delivering integrated systems-based solutions that will be fit for the future where clear cost efficiencies are identified. We will work to develop a much richer understanding of greenhouse gas (GHG) emissions while enhancing our natural environment and protecting it from the impacts of demographic and climate change.

9.5.2 Investment strategies for AMP8 aim to:

- Continue our programme to deliver better rivers for the North West into AMP8 as we work to deliver our pledges for flow and spill compliance, deliver WINEPs and improve our pollution performance. We will make improvements to data and asset performance information from new flow measurement at wastewater treatment works to improve transparency and accuracy around permit compliance, and to support asset investment decisions from an asset health perspective;
- Invest in targeted asset health investment at critical components of our treatment facilities. Aligned to our 5R model, we will provide a multi-layered approach to resilience by investment in the asset health (reliability) of assets and in the contingency plans for treatment works outages (response and recovery); and,
- Continue to use a catchment systems thinking to manage our catchments in a holistic way to reduce flow and nutrient loads, and promoting added resilience in the system.

9.6 Wastewater network plus 5Rs

9.6.1 Our future investment strategy aims to maintain and enhance continued service resilience in line with the principles of our 5R model.

Reliability:

- We are investing and improving the resilience of our assets through proactive replacement of end-of-life sewer and rising mains materials, such as pitch fibre, PVC and asbestos cement. We have planned for an enhanced programme of high consequence sewer condition inspection, coupled with our leading artificial intelligence driven CCTV sewer condition capture approach, helping to identify and resolve the most critical defects before they impact customers or the environment;
- We are optimising and proactively using offline storage via our DNM sensor network to make best use of the capacity of our network anticipating peaks and troughs in demand to further reduce flooding and pollution, and maximising the operational capacity of those assets. Continuation of our targeted property level flood mitigation programme to mitigate the worst service failures from foul flooding; and,
- We are investing in our systems, with a focus on removing surface water from the system, ideally at source, to reduce the impact of increasingly frequent rainfall events.

Redundancy:

- We are creating and maintaining headroom in our system by delivering an integrated supply and demand strategy, including additional monitor installation on large property developments, piloting of zonal infrastructure charging and targeting at least half of new homes to include rainwater harvesting and sustainable drainage (SuDs) solutions. We are also piloting widespread integrated rainwater management, preventing overloading of the network and treatment sites, utilising catchment capture approaches such as natural flood management and SuDS where appropriate. We will be separating surface water from our foul network and encouraging customers to do the same, while reusing surface water for our operational activities such as network flushing;
- Through our DWMP, we have completed a risk assessment to understand current and future risks to understand the challenges that arise from uncertainties such as population growth and climate change. The aim of this was to understand where we are likely to see a deficit in achieving our long-term planning objectives if no action is taken, and to develop our adaptive plans to best manage the risks over the planning horizon of 25 years. The creation of new assets and behavioural changes to enable surface water removal from the system will also provide more capacity in the system. Our WRMP and DWMP are intrinsically linked; water consumption reductions will give some headroom in the system in the form of wastewater reductions.

Resistance:

- To increase our resilience to external threats, we have intensified our focus on third-party impacts to our network with improved detection of trade effluent breaches, reduced highway drain connections and an expansion of our highly successful 'what not to flush' campaign, further discouraging sewer misuse. In addition, we are improving river locking detection and prevention coupled with outfall flap valve installation, mitigating backflow into our networks and improving our network's resistance to fluvial flooding; and,
- Our targeted power resilience programme will deliver improved resistance to power failures at some of our most critical sites where the current supply and support arrangements present significant risks.

Response and recovery:

- To help us respond to incidents, we have a comprehensive set of business continuity and contingency plans. We also have a dedicated Integrated Control Centre (ICC) that coordinate the incident response in a timely manner, using an approach that prioritises our resources and minimises the impact to customers and the environment; and,
- Our programme to deliver better rivers for the North West will continue into AMP8; as we work to deliver our pledges for flow and spill reductions, we will deploy additional sensors to better understand the current performance of our emergency overflows, helping to inform future investment or permitting needs.

Review

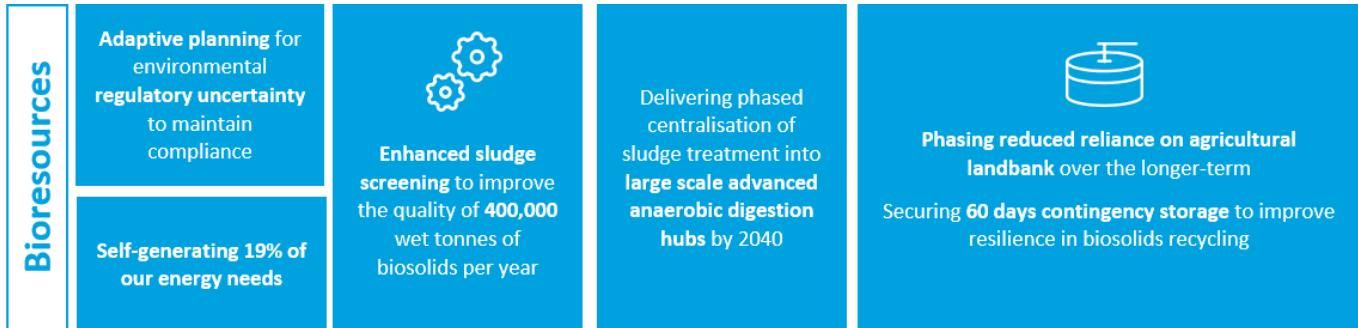
- We analyse and learn from past events and incidents to further enhance our resilience. We complete post-incident reviews (PIRs) following an incident to highlight key learnings and gap analysis. We regularly initiate internal exercises across the business to stress test our plans and further develop where appropriate. We take part in Local Resilience Forums (LRFs) that relate to a number of external risks, and complete activities including risk assessment processes, multi-agency training, multi-agency exercises, plan development and joint incident response.

10. Bioresources future plans

10.1 Overview

- 10.1.1 A summary of our plan for Bioresources is included in Figure 21. This represents a selection of our entire AMP8 and long-term plan, as discussed in *UUW58 - Bioresources business plan*, focusing on the aspects of our plan that will secure resilience and asset health.

Figure 21: Our future plan for Bioresources



- 10.1.2 We have split out our plans for Bioresources for both AMP8 and the long-term, to expand on these aspects of our plan.
- 10.1.3 The principal risks and hazards addressed by this investment plans are:
- Recycling of biosolids to agriculture;
 - Failure to treat sludge; and,
 - Mersey Valley sludge pipeline failure.

10.2 Bioresources long-term strategy

- 10.2.1 The bioresources business model will be transformed over the next 25 years. We anticipate that biosolids recycling to agriculture will reduce over time to match the growing environmental ambitions of customers and regulators. Innovation will be at the heart of our transformation to deliver new technologies that ensure that we embrace and realise the benefits of a more circular economy, generating higher value products that reduce our impact on the environment and deliver significant benefits to society.
- 10.2.2 The sludge treatment centres of the future will become bio-refineries; we envision fewer, large-scale treatment centres that will generate efficiencies and sufficient economies of scale to recover and capture value at every stage of an integrated wastewater and bioresources production line. We will work in partnership with the wider community, and industrial and academic partners to develop new products for new markets. We will embrace markets for delivery and seek co-treatment opportunities where they add value for customers.
- 10.2.3 Successful management of our bioresources business could enable progress beyond net zero in this area to create carbon negative works, capturing and utilising carbon in innovative forms and products. Maximising resource productivity will support ambitions for a zero-waste economy and improve the sustainability of our activities, while adding wider value to society. For more details, see *Chapter 6 - Delivering social and environmental value*.
- 10.2.4 While we know that the future will not be ‘business as usual’, there is significant uncertainty of the scale and timing of future change. Our approach is to balance the risks to the agricultural outlet against the risk of over investing or prematurely investing in the alternatives that provide greater certainty for the future, but with a greater financial and environmental cost. Given the uncertainty over the future availability of landbank, potential needs for alternative outlets and the increasing environmental

protection requirements through sludge treatment coming under waste regulation, we have developed an adaptive plan that enables us to navigate through the uncertainty and make significant investment decisions at the appropriate points in time.

- 10.2.5 In our supplementary document *UUW66 - Bioresources enhancement claims*, we set out our proposal for £10,418 million of investment to fund preparatory work in AMP8 for uncertain and long-term options for alternative biosolids disposal outlets. This will allow planning, detailed design and permitting of advanced works for implementation of sludge drying and thermal treatment technologies. These advanced works will accelerate the implementation of alternative outlets by up to three years and inform PR29 planning. Unless we act now and start to plan for alternative, uncertain and long-term options, we face a risk of being unable to provide a resilient sludge management service, and ultimately risk having no outlet for sludge disposal in future AMPs. However, we will only seek to move to alternative outlets if we reach a trigger in our adaptive plan.

10.3 Bioresources AMP 8 plan

- 10.3.1 Delivery of our AMP8 bioresources business plan will ensure that we continue to maximise the value created through recovery and reuse of sewage sludge. Our AMP8 plan will deliver no regrets actions, where we have certainty over the need and outcomes, and interventions are beneficial across all potential pathways for biosolids disposal. Our plan to deliver no or low regrets actions in AMP8 targets better environmental outcomes but with low risk of inefficient investment.
- 10.3.2 Biosolids recycling to agriculture is entirely dependent on access to third-party landbank and acceptance of our products by farmers and land managers. The reliance on agricultural land as an outlet makes this area of the business vulnerable to changing market sentiment. An increasing number of factors that are outside of company control threaten the availability of landbank for biosolids recycling. We led collaborative industry and Environment Agency national landbank modelling, which has demonstrated that there is a significant risk of landbank shortfall for up to two-thirds of biosolids nationally.
- 10.3.3 There is a clear need to provide a greater level of sludge outlet resilience than planned at PR19. At PR19, the loss of the sludge recycling outlet to land was considered a long-term possibility, but this is now considered a near-term possibility, and a medium-term probability.
- 10.3.4 Through our WINEP actions, we plan to increase the resilience of our sludge to land operations, prioritising no and low regrets investment to meet immediate resilience needs, supported by planned maintenance, to secure our ability to recycle sludge to agriculture.
- 10.3.5 We are anticipating a significant increase in demand for our bioresources services to wastewater, and we forecast sludge growth of over 10 per cent over the next ten years. The need for capacity is compounded by increasing regulatory standards for sludge treatment, which is leading to the accelerated rationalisation of sites. The accelerated rationalisation of sites enables us to avoid wasteful investment in meeting IED standards at sites that would ultimately have been closed in the medium term as we implement our long-term delivery strategy. We have identified the need to increase our regional treatment capacity to ensure sufficient resilience in our service provision and, in AMP8, we are seeking a market solution to deliver 45,000 tonnes of new advanced anaerobic digestion capacity.
- 10.3.6 Investment strategies for AMP8 aim to:
- Increase the resilience of our sludge to land operations, through our WINEP actions, by providing 60 days' covered strategic storage to provide resilience against closed periods in the agricultural calendar. We will also double our production of enhanced quality biosolids cake a year at a higher percentage of dry solids, enabling access to greater and more diverse areas of landbank, increasing the flexibility and resilience of our operations;
 - Deploy fine screening of all our sludges (a first for the industry), going beyond current standard practices, seeking to minimise the increasing threat and challenge of micro plastics and other non-degradable material in biosolids recycled to land. Improving product quality will support market

acceptance of higher quality products, improving resilience in biosolids recycling to agriculture and reducing risks to the environment;

- Take a leadership role in development of the bioresources market and seek a market solution, where it delivers best value, to provide increased sludge treatment capacity to meet rising demand;
 - Invest to meet increasing regulatory expectations including compliance with Appropriate Measures for the Biological Treatment of Waste, Industrial Emissions Directive and the Environment Agency Sludge Strategy;
 - Deliver bioresources preparatory works for alternative outlets; we set out our enhancement proposal for £10,418 of investment to fund preparatory work in AMP8 to improve planning for uncertain and long-term options for alternative biosolids disposal outlets. For further detail see our supplementary document *UUW66 Bioresources preparatory works for alternative outlets*; and,
 - Collaborate and work in partnership with others to determine the optimal biosolids management approach for the future. Through innovation in areas of high uncertainty, we will seek to deliver new technologies to provide alternative treatment and disposal options to reduce the long-term risk of restricted agricultural outlets.
- 10.3.7 Moving to an alternative disposal outlet is not considered as part of our core pathway in AMP8 as these actions may be considered as abortive investment in the longer term, as there remains uncertainty over both timescales for change and the preferred alternative outlet for sludge disposal. These pathways will only be followed under more adverse landbank scenarios, and the additional activities may be described as 'higher regret', relative to investments included in our core pathway. We have, therefore, deferred significant investment to implement actions to move away from biosolids recycling to agriculture. Should the seismic change to markets or legislation manifest during AMP8, we would require additional investment over and above the proposed programme to start moving to alternative pathways.

10.4 Bioresources 5Rs

- 10.4.1 Our future investment strategy aims to secure and enhance continued service resilience in line with the principles of our 5R model.

Reliability:

- We are investing in our assets through a phased centralisation of sludge treatment into large-scale anaerobic digestion hubs and a phased reduction on agricultural landbank;
- Our enhanced sludge screening will improve the quality of 400,000 wet tonnes of biosolids per year; and,
- We are planning to provide 60 days' covered strategic storage to provide resilience against closed periods in the agricultural calendar.

Redundancy:

- Through investing in our assets, as described in the activities within 'reliability', we are maintaining efficient headroom and capacity in our systems to be able to better absorb shocks and stresses; and
- We will take a leadership role in development of the bioresources market and seek a market solution, where it delivers best value, to provide increased sludge treatment capacity to meet rising demand.

Resistance:

- We have taken a balanced view of the agricultural outlet risk by proposing enhancement investment to improve the resilience of the supply chain to agriculture in order to maintain the agricultural outlet for biosolids recycling. This approach includes the necessity of a Notified item as a means of managing the uncertainty over additional future investment requirements, beyond our low regrets plan. We believe this is the right approach to best protect the interests of customers.

Response and recovery

- To help us respond to incidents, we have a comprehensive set of business continuity and contingency plans. We have a dedicated Integrated Control Centre (ICC) that coordinate the incident response in a timely manner, using an approach that prioritises our resources and minimises the impact to customers and the environment.

Review:

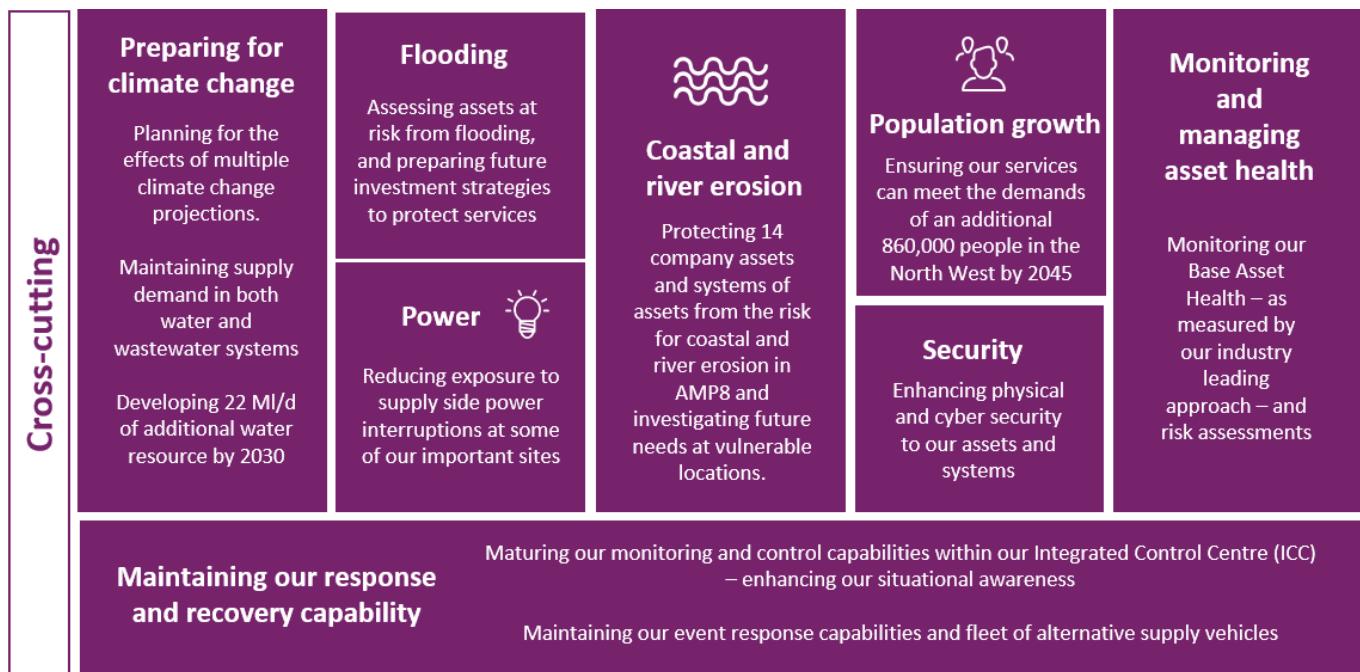
- We analyse and learn from past events and incidents to further enhance our resilience. We complete post-incident reviews (PIRs) following an incident to highlight key learnings and gap analysis. We regularly initiate internal exercises across the business to stress test our plans and further develop where appropriate. We take part in Local Resilience Forums (LRFs) that relate to a number of external risks and complete activities including risk assessment processes, multi-agency training, multi-agency exercises, plan development and joint incident response.

11. Cross-cutting plans

11.1 Overview

- 11.1.1 Across all three price controls, there are a number of plans that are cross-cutting – as seen in Figure 22. In this section, we give further information on these issues and our plans for investment to address them.

Figure 22: Cross-cutting plans



11.2 Security

- 11.2.1 In response to the security and resilience threats facing UK national resources, the UK Government has introduced legislation to ensure providers of essential services adhere to a common standard for security, resilience and emergency planning.
- 11.2.2 All Water Companies – under Section 208 of the Water Industry Act 1991 – are required to and, in the interests of national security and mitigating the effects of a civil emergency, adhere to the general and specific directions of the Secretary of State. Under Section 208 paragraph 3, it defines that a Water Undertaker is to prepare/revise plans, to have regard to any relevant Guidance/Requirements, best practices and any risks, short or long term.
- 11.2.3 This legislation aims to ensure that UK water companies can maintain essential services to their customers at all times by providing cyber and physical security protection to their assets, and by maintaining appropriate emergency response plans operated by trained staff.
- 11.2.4 For more information, refer to supplementary document *UUW61 - NIS and SEMD enhancement case*.

11.3 NIS-D

- 11.3.1 The Water Industry is regulated by Department for Environment, Food and Rural Affairs (Defra) via the Drinking Water Inspectorate (DWI). The DWI are the Competent Authority (CA) and UUW are an Operator of Essential Services (OES). The DWI has set an industry standard, which is the target maturity level for both cyber and physical resilience of the network and information systems associated with our essential function (production and transport of water). The DWI act as the competent authority to the water industry for both Network and Information Systems (NIS) and security.

- 11.3.2 The NIS enhancement programme is intended to address deficient areas identified by the DWI audit process. These deficiencies present a risk to our NIS systems and potential for non-compliance with the NIS legislation. The NIS enhancement programme will improve our capabilities, resilience and cyber maturity of the systems in our NIS scope supporting our essential function.
- 11.3.3 The legislation and regulatory process that identified this requirement are the NIS Regulations 2018. The process that identified the requirements is the National Cyber Security Centre (NCSC) Cyber Assessment Framework, which must be completed annually by UUW and submitted to the DWI NIS Principle Inspector. Completing the Cyber Assessment Framework identifies deficiencies against Control Outcomes (CO) that we must address or provide a risk mitigating explanation.
- 11.3.4 For more information, refer to supplementary document *UUW61 - NIS and SEMD enhancement case*.

11.4 Power Resilience

- 11.4.1 The reliability of UUW's services is a top priority for customers, now and in the future, as customers expect a continuous supply of high quality water and wastewater services. To do this effectively, we have a dependency on a reliable energy supply and are exposed to the interdependent cascade impacts of its failure. Disruptions to energy supplies can have a significant impact on customers' services and the environment. Energy resilience is a key issue facing the UK water industry and power vulnerability in UUW poses a significant risk. In order to maintain the services that customers, stakeholders and the environment require of us – for now and in the future – we must be resilient to energy interruptions, able to cope with, and recover from, disruption and anticipate trends and variability.
- 11.4.2 We have previously explored this risk in Risks requiring multi-agency collaboration, section 5.6.9 above, as part of the risks requiring a multi-agency response.⁴⁷
- 11.4.3 For more information, see *UUW67 - Power resilience enhancement case*.

11.5 Flooding risk of our assets

- 11.5.1 Through the Drainage and Wastewater Management Plan (DWMP) 2024, we have run a comprehensive suite of assessments across the whole of the North West to develop a robust understanding of water catchment resilient issues. The focus for this DWMP has been to assess our most significant risks, including fluvial and/or coastal flooding of wastewater treatment works and major pumping stations.
- 11.5.2 The ability for sewer networks and wastewater treatment works to operate effectively, without harm to the environment or customers, can be affected due to flooding from surface waters, rivers and the coast. This is a significant risk as we have a large proportion of our assets within close proximity to watercourses and coasts as we rely on gravity, where possible, to allow us to safely return treated flows back to be discharged into the natural environment.
- 11.5.3 To understand the risk to wastewater treatment and wastewater network assets, we have assessed their flood risk exposure. The approach considers all assets, not just those deemed to be a critical asset as the risk to flooding, is a widespread risk given the close proximity of assets to watercourses and coasts. The approach uses the Environment Agency flood maps for surface water and river and coastal flooding at 1-in-30, 1-in-100 and 1-in-1,000-year return periods. Their flood maps were used in the analysis and were accurate at the time this assessment was conducted.
- 11.5.4 As part of the DWMP methodology, we have carried out a high-level assessment to identify potential high-risk assets and high-level costs to provide mitigation. This investigation aims to act as a signpost to indicate where we may want to invest to provide resilience to ensure that we are able to operate effectively in a fluvial or coastal flooding event.

- 11.5.5 The Environment Agency Costing Tool Database²⁴ was used to provide an estimated cost to provide earth banking of sufficient height to project from forecast flood depths. All wastewater treatment works, last in line wastewater pumping stations, and high criticality pumping stations were included in the assessment.
- 11.5.6 For more information, see our Drainage and Wastewater Management Plan (DWMP) 2023²⁵.

11.6 Flooding – sewers

- 11.6.1 More rainfall lands in the North West than in any other area of the country. We need to protect and enhance our network by investing £531 million inclusive of £60 million of partnership funding to remove surface water from the sewer system to mitigate exposure to climate change, development and urban creep evidenced in the DWMP.

Table 5: Rainwater management investment programmes

Programme area	Description	Gross value inclusive of UU and partnership funding (£m)
Accelerated WINEP	Early delivery of AMP8 CSO schemes into AMP7	58
Advanced WINEP	Novel/Innovative approaches to rainwater management	247
AMP8 WINEP	Core AMP8 WINEP programme	84
DWMP enhancement	System enhancement investment identified in via DWMP	142

- 11.6.2 Wastewater networks react differently to weather patterns seasonally, and the consequences of shorter, sharper events often result in different consequences to prolonged lower magnitude events. As climate change will mean increased frequency and intensity of these events, managing this input of rainwater through attenuation and disconnection is seen as the most sustainable approach to starting our long-term adaptive plans, reducing the likelihood for carbon intensive conventional solutions for future generations.

- 11.6.3 For more information, see our Drainage and Wastewater Management Plan (DWMP) 2023²⁵.

²⁴ gov.uk/flood-and-coastal-erosion-risk-management-research-reports/long-term-costing-tool-for-flood-and-coastal-risk-management

²⁵ [Drainage and Wastewater Management Plan, 2023](#)

12. Business as usual three-line assurance processes

12.1 Our assurance process

- 12.1.1 We have a well-established ‘three-line assurance’ framework throughout the business:
- **First line of assurance** – business operations: day-to-day operational control and processes. Management establishes an appropriate risk and control environment, is accountable for effective risk management and control activity and provides management assurance;
 - **Second line of assurance** – oversight activities: independent of control operators. Second line functions provide policy, direction and frameworks as well monitoring of the first line activities to assure compliance; and,
 - **Third line of assurance** – independent audit and assurance providers. Our internal audit team and specialist external auditors review the effectiveness of risk and control activities as well as providing assurance in respect of company disclosures. In the case of regulatory reporting our internal audit team become second line with external statutory auditors becoming the third line.
- 12.1.2 Each year we publish a detailed description of our approach to assurance²⁶.

12.2 First-line assurance – business operations

- 12.2.1 Our first-line assurance for resilience and asset health is central to maintaining the capability of our asset base. Our Risk and Asset Planning (RAP) processes are focused on managing asset and system risk, this process is common across our operational business, embedded through three levels of tier meetings where risks are identified, managed and escalated according to business need. This process ensures that right across our business there is a clear, structured way to proactively flag existing and potential risks and where appropriate, initiate and deliver operational or capital investment.
- 12.2.2 The RAP processes are managed by a dedicated team within the Asset Management directorate, helping to ensure consistency of application of the approach. This is delivered through regular cross business functional home meetings as well as knowledge sharing and significant, active engagement with the Institute of Asset Management (IAM). We have three layers of asset management training to continually improve our cross business competence, from a one hour online training overview to a multi-day classroom based course. To date, over 250 people across UUW have attended the classroom training and over 190 people have achieved the IAM Asset Management Certificate, including the majority of our asset management community.
- 12.2.3 Our business operations have structured performance meetings that include for assessment of asset health on a monthly cycle. These meetings are held at local management, regional management and business management levels each month. We have evolved our asset health framework to support these performance meetings to enable operational teams to have access to key asset health performance data to support their operational decisions. These utilise the “fitness, wellness and life expectancy” approach to understanding asset health with summary metrics helping to communicate “wellness” associated with operational maintenance through to life expectancy assessments for individual processes and classes of assets.
- 12.2.4 These processes are refined and enhanced through a continuous improvement process guided by the asset management directorate, engaging with subject matter experts from across the company to ensure that we are both following and improving our processes and tools.

²⁶ unitedutilities.com/corporate/aboutus/performance/assuring-our-performance-2020-25

- 12.2.5 We have adopted a structured risk assessment approach to underpin the governance and assurance processes supporting this plan. The risk assessment supports us in determining the appropriate level of governance and assurance that is applied to the elements of our delivery plan.

12.3 Second-line assurance – oversight activities

- 12.3.1 Our second line assurance approach is well embedded across our business and covers UUW Board level activities through to assurance teams across the business. Core elements of our second line assurance for operational resilience include;
- Site standards audit – a dedicated team responsible for a continuous programme of site standards audits, including health and safety and asset risks and deficiencies.
 - Corporate audit – providing both internal and external resource, targeting audits across a pre-identified range of business capabilities identified through known or anticipated risks to build an annual audit programme. In addition to reviewing the effectiveness of these areas and reporting on aspects of the group's compliance with them, corporate audit also makes recommendation for improvement.
 - Risk and resilience board – a bi-monthly senior director level steering group responsible for ensuring appropriate identification and focus on current, new and emerging resilience risks to the operational business.
 - Asset management system review – an annual director led review of the effectiveness of the asset management system, including tools, processes, systems and people.
 - Group audit and risk board – a six-monthly executive level steering group responsible for monitoring the group risk portfolio and the associated audit programme
- 12.3.2 For further details on our second line assurance activities, refer to supplementary document *UUW43 - Corporate approach to resilience*.

12.4 Third-line of assurance – independent audit and assurance

- 12.4.1 In addition to these internal activities that provide second line assurance we routinely commission assessments of various elements of our asset management capability, from overall assessments to deeper dives into specific focal areas such as asset health. These audits and assurance projects are critical to providing an ongoing, outwards facing view of our current and planned capability development. We use these to ensure that our plans for continuous improvement are sufficiently stretching to support the efficient delivery of our business objectives.

13. Recent third-party audit and assurance

13.1 Overview

- 13.1.1 We regularly engage in benchmarking and assurance processes as part of our drive for continuous improvement in Asset Management. The following is a summary of the findings from recent assurance activities, including;
- ISO 55001 certification
 - Ofwat's Asset Management Maturity Assessment (AMMA)
 - Operational asset resilience – an audit by Jacobs
 - Asset health – an independent review by Jacobs
- 13.1.2 We demonstrate the key findings, how we have improved our approach and how this has influenced our improvement plans for AMP8 and beyond.

13.2 ISO 55001 certification

- 13.2.1 In 2022, we engaged independent auditors to assess our Asset Management capabilities against the International Standard for Asset Management (ISO 55001²⁷).
- 13.2.2 We have been actively working to develop these capabilities since 2015 and following internal self-assessments and the results of the Asset Management Maturity Assessment by Ofwat in 2021, we sought certification against the International Standard.
- 13.2.3 The assessment itself comprised nine full days of audit, in which the external auditor interviewed 74 people from across eight directorates, and visited 11 locations across our operational sites and head office.
- 13.2.4 As a result, on our first attempt, we successfully achieved the Certificate for ISO55001, receiving only one 'minor non-conformity' around the management of our peripheral assets.
- 13.2.5 This was a significant achievement, recognising the efforts of all our teams. We recognise that this is only a milestone on the journey towards our goal of asset management excellence, however ISO 55001 certification is a solid platform on which to develop greater levels of capability through continuous improvement.
- 13.2.6 In order to maintain our certification we plan to engage our external audit partner to undertake an annual surveillance audit, as well as completing a full re-certification every three years.
- 13.2.7 As required by this plan, in July 2023 we successfully completed our first surveillance audit, comprising four full days of audit. This was conducted by the same external auditor who led our certification audit and was supported by over 25 people from across the organisation, visiting four operational sites and our head office. The external auditor's report has confirmed that we continue to meet the requirements of the standard and has identified some opportunities for improvement that we will work to deliver before the next surveillance audit in September 2024.

13.3 Asset management maturity assessment

- 13.3.1 During 2021, Ofwat worked with companies to co-create an asset management maturity assessment (AMMA). The assessment was intended to help both Ofwat and the companies to better understand how mature the processes, teams, technologies, and cultures are within companies for monitoring and managing asset health and operational resilience. The AMMA developed has built on previous asset management frameworks, enhancing them to focus on the specific needs of the water industry. This

²⁷ iso.org/standard/55089.html

cross-sector picture of asset management maturity complements Ofwat's broader activity to promote operational resilience.

- 13.3.2 The results of the assessment²⁸ were released in November 2021 and included an overview of the industry, as well as detailed breakdowns of the assessment by water company, including highlighting good practice and recommendations for maturity improvement by assessed area.

- 13.3.3 A number of UUW activities were highlighted as areas of best practice, including asset health assessment, operational risk management and competency management:

*"United Utilities Water uses **strategic deterioration models** to give a longer-term view of the expected residual service life of an asset to the next major intervention, using **Base Asset Health indicators** in addition to performance commitment/outcome delivery incentive performance."*

*"United Utilities Water showed that they understood asset health trends over time using overall asset health measures of **Base Asset Health**."*

*"United Utilities Water's '**myRisk**' tool captures, assesses and escalates operational risks. It provides a common approach for capture and assessment of risks across a range of financial and non-financial drivers. The tool is integrated with the company's Risk and Asset Planning (RAP) process, allowing risks to be identified and managed locally or escalated to the appropriate level."*

*"United Utilities Water undertook **development of strategic scenarios** to use across planning activities including ranges in expected external drivers such as demographic change, climate change, digital technology change, customer service expectations and regulatory change."*

*"United Utilities Water demonstrated **competency frameworks tailored around specific roles and teams**, including a **centrally managed competency framework** for operational roles needing up-to-date qualifications to comply with statutory and mandatory requirements."*

- 13.3.4 There were also a number of broad recommendations that Ofwat provided for consideration by the whole sector that are summarised below.

Overarching recommendation

We expect all companies to reflect on the AMMA's findings and identify appropriate steps to improve their asset management capabilities. Where we have outlined common areas for improvement in this report we expect companies to work together to improve asset management maturity across the sector.

Recommendation #1

Companies should improve their approaches to **risk management** by ensuring boards have clear oversight and understanding of current and future asset health risks and of the plans to mitigate these.

Recommendation #2

Companies should improve their approaches to **long-term planning**, ensuring alignment between short, medium and long-term objectives in their strategies and plans.

Recommendation #3

Companies should systematically identify and consider **uncertainty** in all areas of asset management, from strategic asset planning to data quality management.

Recommendation #4

Companies should develop a strategic approach to **data and information management** that takes into account the ability to share data.

²⁸ https://www.ofwat.gov.uk/wp-content/uploads/2021/10/AMMA_Insights_And_Reccomendations_Report.pdf

Recommendation #5

Companies should make sure that **employee competencies and skills** are appropriately considered to plan and manage their assets efficiently now and in the future.

Recommendation #6

Companies should systematically consider wider aspects of **social and environmental value in decision-making** and monitor whether delivered interventions provide the benefits expected in their planning.

13.3.5 We have reviewed these six recommendations, along with company specific feedback and have incorporated the recommendations into our Asset Lifecycle Management (ALM) improvement programme, specifically we have;

- Continued to present regular data and reports to all levels of the business, including the UUW Board summarising current and future predicted asset health and other resilience risks.
- Reviewed our planning approaches to ensure that a common value framework is central to all, helping to ensure that short, medium and long term plans remain aligned.
- Started to better record and account for uncertainty across our planning processes through our statistical modelling tools and specifically within our adaptive planning frameworks.
- Continued to enhance our leading approach to data and information management by, for example, our approach to deploying a single, common data structure between our above ground and buried assets.
- Further developed our colleagues' competency frameworks to ensure that the skills associated with asset management are recognised with specific training needs such as the IAM certificate of competence in asset management.
- Ensured comprehensive coverage of social and environmental value within our value framework.

13.3.6 Through our ALM programme we have continued to mature and build upon our solid asset management foundations; delivering against our action plan over the course of AMP7. We have made significant improvements in our understanding and knowledge of our asset base, with progress on the relationships between asset performance and condition and the service provided, as recognised by our successful ISO 55001 certification in 2022.

13.4 Operational asset resilience

- 13.4.1 Our operational asset resilience capability was audited by Jacobs in January 2020 and again in April 2023. The review in 2020 commended our approach, however, opportunities to improve were identified.
- 13.4.2 The main opportunity identified by the audit was to focus on developing and defining the scope of UUW's resilience capability and delivering this scope through establishing a greater level of formality within the existing governance groups. These recommendations were included in our resilience action plan and were subsequently delivered through that programme.
- 13.4.3 This improvement was reflected in our most recent operational asset resilience audit, which recognised the improvements that had been implemented and recognised our strong overall position on operational asset resilience, particularly highlighting our strength in the area of asset information.

"Our review found that United Utilities Water is in a strong position with regards to its approach to operational asset resilience, as well as the maturity of the different elements contributing to its approach. When assessed against good practice, United Utilities Water was found to be performing well. Asset information regarding asset health are areas where United Utilities Water is particularly strong and is implementing a number of activities that will support Ofwat's objective of a transition to a more integrated monitoring framework for operational resilience."

13.5 Jacobs' independent review

- 13.5.1 Alongside our corporate audit activities detailed above in early 2022, we engaged Jacobs to complete a methodological review of UUW's approach to asset health. The review was undertaken through a series of 13 interviews with UUW staff from across the organisation and at different levels within the business and included an assessment of supporting evidence provided in advance of, and as a result of, the discussions. The review was delivered against six high-level asset health topics that were cross referenced to Ofwat's AMMA.
 - UUW's understanding of asset health and criticality;
 - Understanding the views of stakeholders (internal and external);
 - Measuring and monitoring asset health and criticality;
 - The use of asset health in investment planning and decision making;
 - Asset health reporting and assurance; and,
 - Innovation and asset health.
- 13.5.2 The approach was not intended to reproduce the AMMA assessment, but the UUW AMMA response was reviewed, cross-referenced, and Jacobs considered whether the interviews broadly corroborated the information provided. The assessment was broken down into six focus areas:
 - UUW's understanding of asset health and criticality;
 - Understanding the views of stakeholders (internal and external);
 - Measuring and monitoring asset health and criticality;
 - The use of asset health in investment planning and decision making;
 - Asset health reporting and assurance; and,
 - Innovation and asset health.
- 13.5.3 Following the work by Jacobs, an assessment of maturity was provided against industry good practice based on a four point scale from "lagging" to "optimising". Lagging would correspond to being significantly behind the sector and optimising considered to be ahead or at the forefront of maturity in the sector. This scoring and assessment is subjective and based on the experience of Jacobs and understanding from across the UK water sector.
- 13.5.4 Table 6 below details the assessment scores for each of the six focus areas.

Table 6: Results of Jacob's health assessment

ASSET HEALTH CAPABILITY AREA	LAGGING	DEVELOPING	PERFORMING	OPTIMISING
UUW's understanding of asset health and criticality				✓
Understanding the views of stakeholders (internal and external)			✓	
Measuring and monitoring asset health and criticality			✓	
The use of asset health in investment planning and decision making			✓	
Asset health reporting and assurance			✓	
Innovation and asset health			✓	

3.5.5 The Jacobs report also noted that:

"United Utilities Water is recognised as a thought leader on asset health in the water sector."

"United Utilities Water has both sustained and improved certain facets of its approach to asset health..."

13.5.5 Jacobs' recommendations focused on communication and engagement to help further develop internal stakeholder knowledge and understanding, as well as maintaining momentum on asset health thought leadership through continued demonstration of progress. We incorporated these actions into our resilience and asset lifecycle management action plans and have continued to drive for cross industry improvements in resilience and asset health through our engagements with the operational resilience working group, as well as our active involvement in the UKWIR big question on asset management and through a number of direct company-to-company engagements. We look forward to continuing to work together with Ofwat and the wider industry in further developing our asset management capability through AMP8 and beyond.

Appendix A

A.1 Long-term planning frameworks

Table 7: Long-term planning framework

Framework	Guidance source	How does this support resilience?	Where to find additional information
Long-term delivery strategy	Ofwat	<p>Provides a long-term performance framework to support business planning.</p> <p>Provides a mechanism to prepare for future uncertainty and detail adaptive pathways and investment plans should uncertainties manifest.</p> <p>Helps to identify when the most efficient point of investment, identifying low regrets options is.</p>	<i>UUW12 Long term delivery strategy</i>
Regional water resource planning	Environment Agency	<p>Provides a consistent framework across regional water companies to assess future supply demand balances under a range of future scenarios. Helps to identify sources of additional supply/opportunities to support regional resilience through water trading.</p>	waterresourceswest.co.uk/publications
Water resources management planning	Environment Agency	<p>Assesses the future reliability of a supply demand surplus, identifies demand and supply side options that can be implemented to secure a surplus.</p> <p>Prepares for a range of future uncertainties including climate change, environmental restrictions and demographics.</p>	unitedutilities.com/corporate/about-us/our-future-plans/water-resources/developing-our-water-resources-management-plan/
Long-term water quality planning	Drinking Water Inspectorate	<p>Identifies risks and investment requirements to secure continued compliance with water quality regulations.</p> <p>Accounts for a range of emerging risks such as micro plastics and PFAS.</p> <p>Ensures that we have sufficient treatment capability to match forecast demand at the right quality.</p>	Supplementary document <i>UUW57 - Water Network Plus Price Control</i>
Drainage and wastewater management planning	Environment Agency	<p>Assesses the future reliability of a supply demand surplus. Identifies demand and supply side options required to meet both recycled water quality standards and forecast volumes.</p> <p>Accounts for a range of future uncertainties including climate change, environmental restrictions and demographics.</p>	unitedutilities.com/corporate/about-us/our-future-plans/Our-long-term-plans/dwmp-publication-may-2023/
Water industry natural environment programme	Environment Agency	<p>Provides a methodology to identify requirements to protect the environment.</p> <p>Promotes development of blue/green infrastructure investment and nature-based solutions to manage flood risk and remove surface water from the sewerage system, addressing some of the impacts of climate change.</p>	Supplementary document <i>UUW57 - Water Network Plus Price Control</i> <i>UUW56 – Wastewater Network Plus Price Control</i> <i>Chapter 6 Delivering Social and Environmental value</i> <i>Chapter 8 Delivering at efficient cost</i>
Bioresources – Regional Planning	Industry best practise	<p>Provides a framework to maintain a resilient service and meet changing regulation needs.</p> <p>Adaptive pathways account for climate change, increased sludge volumes, legislative restrictions and uncertainty.</p>	Section 7 of <i>UUW12 Long term delivery strategy</i>

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