PR24

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RESILIENCE

APPENDIX A8
NES09

1. EXECUTIVE SUMMARY

For us, resilience is our ability to cope with and recover from disruption and anticipate trends and variability to maintain services for our customers and protect the natural environment now and in the future. While resilience has always been an important issue for us the nature and unpredictability of future threats is changing – along with the expectations of our customers and stakeholders in terms of the extent to which we're able to maintain services when risks and incidents do occur.

The threats to our service provision are also becoming ever more varied and complex. We are starting to see strong evidence of adverse climate trends with an increased prevalence of extreme weather events which have the potential to cause significant disruption to our operations. We also maintain a large and complex asset base, and we must replace and upgrade assets at a sustainable rate as they age and deteriorate over time. Meanwhile, we must remain increasingly vigilant to threats to our cyber-security, and in the current economic climate it remains more important than ever that we retain a strong and stable financial position. We must meet our legal requirements on all of these, including our obligations to maintain an efficient and economical water supply system and provide an effective drainage system.

For our 2020-25 business plan, our resilience framework helped us to understand the risks and so the investments we should make, including as enhancement expenditure. We have developed this resilience framework further for 2025-30, learning from Ofwat's feedback at PR19, our experiences using this in practice over the last few years, and an external review.

This linked our resilience framework more closely to our well-established risk management approach, as well as incorporating more systems thinking (such as from our zonal studies). This also brought together all of our long-term planning frameworks as well as forward looking assessments of our biggest risks to understand our priorities for 2025-30. This included our horizon scanning work and scenarios we look at in our **long-term strategy** (NES_LTDS).

Our structured and evidenced approach to risk helps us to understand where risks are, and we have evolved our approach to horizon scanning to understand how risks are likely to change over time (see Section 5 for details).

This assessment shows that our priorities for 2025-30 are:

- **Make sure that we have a programme of replacement assets sufficient to maintain asset health in the long-term.** In response to our ongoing work to assess the rate of deterioration/remaining life of our assets, it is important that we have a replacement programme which is costed and profiled for each investment period into the future, and fully funded in cost allowances at price reviews. We discuss this priority, and our approach to this for PR24, in Section 7.1 and in our **asset health enhancement case** (NES09).

- **Make sure that the resilience of our supply chain is protected**, and in particular making sure the supply chain is sufficient to respond to delivery challenges associated with our 2025-30 business plan. Our supply chain is critical to our success, and depends on clear, long-term relationships and investment plans. For 2025-30, we are

particularly concerned about the capacity of our supply chain to take on early, accelerated delivery – and the national and regional capacity available to deliver the 2025-30 programme. In response, we addressed this risk early and comprehensively (see **A6 – Deliverability**, NES07).

- **Review our approach in relation to identifying, mitigating, and managing long-term risks, especially in relation to climate change**. Our approach to planning for resilient water and wastewater services is described more fully in section 5.3, and our response to increasing climate risks more specifically in section 7.2.

- **Make sure that our financial resilience is sufficient to accommodate the overall scale of our 2025-30 business plan**. We have tested our financial resilience in the context of a large increase in investment and discuss this in **A5 – Risk and Return** (NES06).

- **Make sure that we maintain affordable bills and inclusive services especially in light of cost of living and investment pressures.** We discuss our approach to this fully in **A1 – Customer Affordability** (NES02).

- **Ensure that we maintain an effective approach to customer and stakeholder engagement especially in light of the scrutiny currently being applied to the water sector.** We discuss our approach to this in discussed fully in **A7 – Customer and Stakeholder Engagement** (NES08).

- **Build on our approach to continuing and emerging environmental expectations.** We have a strong track record as one of the leading companies on environmental performance and net zero, with high Environmental Performance Assessment (EPA) star ratings and an industry leading commitment to decarbonisation.

From these priorities, there are two key areas of enhancement investments for PR24 – **asset health** and **adapting to climate change**. We describe these enhancement cases in Section 7 and in our separate enhancement case documents (NES24, NES32, and NES35).

We discussed the need for these investments and when they should be done with customers, who supported the approach we include within our business plan. They asked us to develop these options, with a focus on investments where we are confident these need to be done now, and where they have an immediate impact on service. They preferred these options for resilience in our qualitative Affordability and Acceptability research, with our overall plan being preferred by customers in all of our acceptability research.

In addition to these investments, we also include a relatively small amount of enhancement expenditure in our plan to meet statutory requirements to meet **physical security standards** at newly designated SEMD sites, and to meet **enhanced cyber security standards** (**NES23**).

2. INTRODUCTION

This appendix explains how we have refreshed our resilience framework and combined this with our management of risks and our assessment of future trends to identify the priorities for PR24.

This is supported by our enhancement cases for resilience, which address three key priorities:

- Make sure that we have a programme of replacement assets sufficient to maintain **asset health** in the long-term.
- Adapting to **climate change**.
- Meeting new statutory requirements on **security** and **reservoir safety**.

2.1. BUSINESS PLAN NAVIGATION

This appendix does not directly support Ofwat's assessment of the Quality and Ambition Assessment, as set out in **the PR24 methodology.**

However, it is important to show how our resilience framework and assessment of the evidence supports our enhancement cases for resilience – and to explain how we discussed this with our customers. These investments are critical for us to meet our duties on resilience, and our customers support the approach and phasing we have put forward in our business plan and long-term delivery strategy (see our **line-of-sight document**, NES45).

This appendix also helps to support our assessment in **A2 – Data, Information and Assurance** (NES03) which tests against operational, financial and corporate resilience and how we have met our legal obligations. Finally, this appendix can support Ofwat to understand our approach when it is making sure it has met its duties on resilience - and **A2 – Data, Information and Assurance** (NES03) describes the work we have done that can support Ofwat in meeting its duties.

3. RESILIENCE: DEFINITION AND BACKGROUND

For us, resilience is our ability to cope with and recover from disruption and anticipate trends and variability to maintain services for our customers and protect the natural environment now and in the future.

While resilience has always been an important issue for us the nature and unpredictability of future threats is changing – along with the expectations of our customers and stakeholders in terms of the extent to which we're able to maintain services and protect the environment when risks and incidents do happen.

The threats to our service provision are also becoming ever more varied and complex. We are starting to see strong evidence of adverse climate trends with an increased prevalence of extreme weather events which have the potential to cause significant disruption to our operations. We also maintain a large and complex asset base, and we must replace and upgrade assets at a sustainable rate as they age and deteriorate over time. Meanwhile, we must remain increasingly vigilant to threats to our cyber-security, and in the current economic climate it remains crucial that we retain a strong and stable financial position.

As a result, it is more important than ever that our plans for the future are underpinned by a sound approach to maintaining resilience. The nature of these threats demand that we can't simply focus on one aspect of our resilience - it is vital that we take a holistic approach and focus on 'resilience in the round' including:

- Financial resilience: our ability to avoid, cope with, and recover from, disruption to our finances.
- Corporate resilience: the ability of our governance, accountability, and assurance processes to help avoid, cope with, and recover from, disruption; and to anticipate trends and variability to our business operations.
- Operational resilience: the ability of our infrastructure, and the skills of our workforce to run that infrastructure, to avoid, cope with and recover from, disruption in its performance.

The UK Government and our regulators have recognised the importance of resilience. The Water Act 2014 gave our regulator Ofwat an additional primary duty to further the long-term resilience of water and wastewater services across the sector (Water Industry Act 1991, Section 2). Subsequent Strategic Policy Statements (SPSs) issued to Ofwat from UK Government set a priority for Ofwat to challenge the water sector to plan, invest and operate to meet the needs of current and future customers in a way which offers best value for money in the long term – with the scope for resilience including water supply, wastewater, the full range of potential hazards, and threats and the resilience of ecosystems.

Strategic Policy Statement to Ofwat (extracts)

"We expect Ofwat to:

- Deliver a resilient water sector: 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, in a way which delivers value to customers, the environment and wider society over the long-term.

- Promote efficient investment, ensuring it is made in a way that secures long-term resilience and protects and enhances the environment, while delivering value for money for customers, society and the environment over the long-term.
- Challenge water companies to deliver greater flood resilience for their own infrastructure and services, and where appropriate provide wider benefits to their customers and the wider community.
- Challenge and encourage water companies to work in partnership with others to support and, where appropriate invest in flood resilience measures that secure wider benefits for them, their customers and the wider community.
- Promote good asset management and challenge companies to better understand the health of their assets and adopt a strategic and long-term approach. This approach should provide for resilient services taking account of growing pressures, including climate change and population growth, and the needs of a healthy environment, and provide value to customers and wider society in the longer-term."

The Water Act already requires water and wastewater companies like us to maintain an efficient and economical water supply system (Water Industry Act 1991, section 37) along with a general duty to provide an effective sewerage system (Water Industry Act 1991, section 94). We need to manage future threats to our resilience effectively to remain compliant with these two fundamental requirements. Alongside this, the Security and Emergency Direction (SEMD) places a requirement on companies to maintain effective emergency response and incident management plans to protect customers should certain key risks occur.

We must find the right balance of resilience and value for money. That is, we need to take a proportionate response to future risks which balances the need to protect services for customers against the cost of doing so – recognising that it will never be cost-beneficial to fully protect our services to customers against all possible current and future risks all the time – and customers are not willing to pay for the investment required to maintain this level of resilience. The National Infrastructure Commission recommends that the **standards for resilience should be clear, proportionate and realistic** – and should be set by the Government.

To help with this challenge, where appropriate in our planning processes, we use the '4Rs' approach (as commonly used in engineering, including in the water sector). This is a best practice means to identify the best and most cost-beneficial response to mitigating risks, where options considered can come under the heading of:

Resistance: Making sure that water and wastewater assets can resist the disruption associated with a risk should it occur, for example providing flood protection.

Reliability: Where our assets are designed to operate under a range of conditions – including for example severe weather, so to a large extent would be impervious to a particular threat. There is a strong synergy between the resistance and reliability of our assets and our overall 'Asset Health'.

Redundancy: Where the best response to a risk is to plan our water supply systems to duplicate for example treatment processes or water mains to ensure continuity of service in the event of a failure.

Response and recovery: In some instances, the most appropriate response to a risk is to make sure that we can respond to and recover from any disruption caused quickly and effectively, through having robust emergency response and incident management plans.

We elaborate further on this approach in the following sections of this document.

Longer term it is vital that approaches to resilience continue to evolve as risks, threats, customer and broader social-political expectations continue to change in the future. The **National Infrastructure Commission remains focused on this topic** and makes a number of recommendations for the future including:

- That Government should set out clear, proportionate, and realistic targets every five years for the resilience of energy, water, digital, road and rail services.
- Regulators should require a system of stress testing by 2024 to make sure these standards can credibly be met.
- Infrastructure operators should develop and maintain long-term strategies to continue to meet resilience standards in the future.

While the approach set out in the remainder of this document goes some way to responding to these longer-term recommendations, there is always more to do. We will continue to scrutinise developments and continually improve our approach both proactively and in line with any government and regulatory responses to these (and other) recommendations, to maintain resilient services for our customers in the future.

4. OUR RESILIENCE IN-THE-ROUND APPROACH AND IDENTIFYING KEY FUTURE RISKS

4.1. OUR APPROACH TO RISK MANAGEMENT

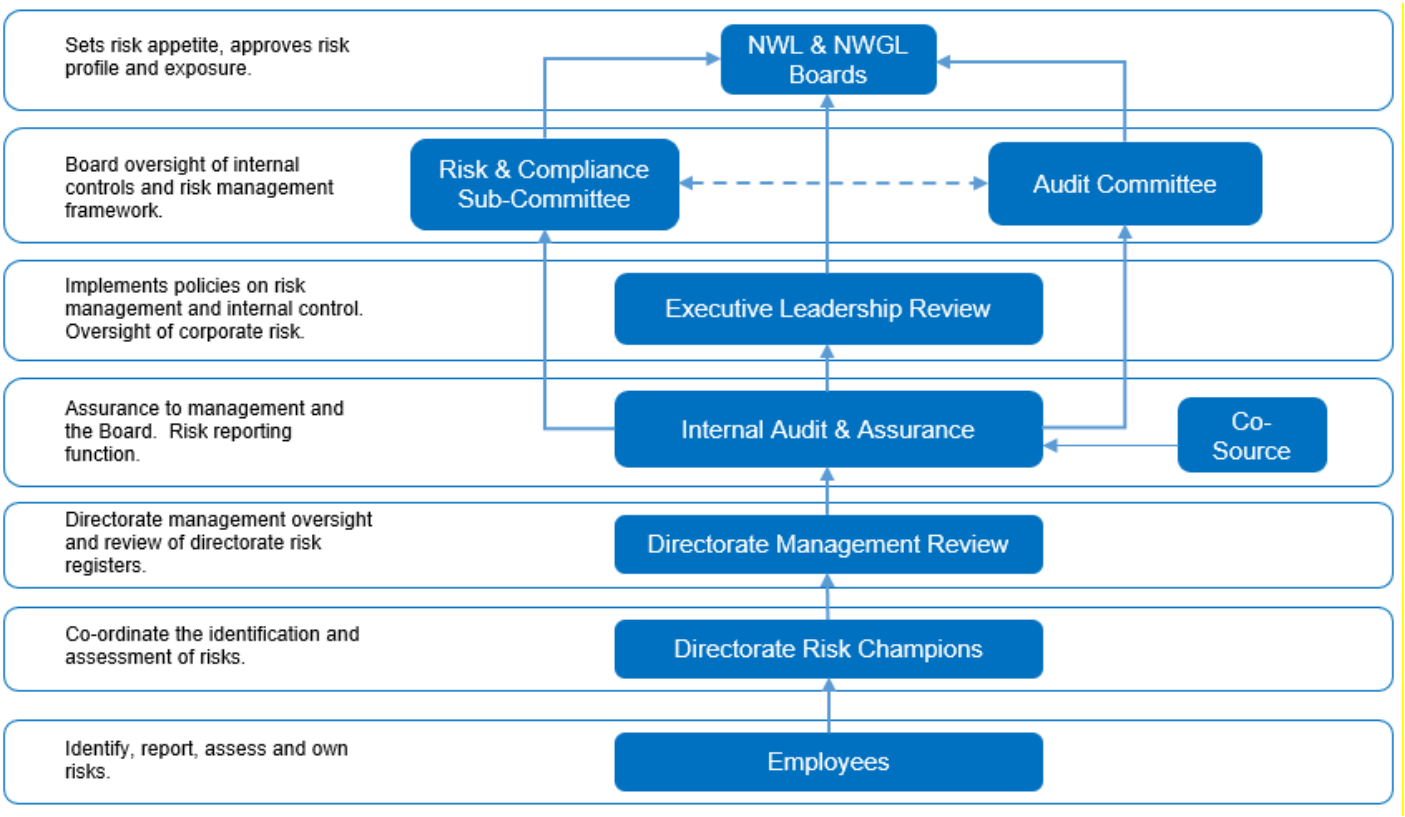
Managing risks means identifying, assessing, and controlling any issues, threats or events that might affect our ability to deliver services. Our approach to managing risks is a key foundation in our overall approach to resilience.

We have a robust and well-established approach to risk management. The diagram below sets out the fundamentals of our five-stage risk management process, which helps us to make sure that we can identify, assess, and report and escalate any risks to the appropriate level in the organisation. We can the mitigate or 'treat' risks where appropriate, and then continually review the risk and effectiveness of any mitigation.

FIGURE 1: 5 STAGE RISK MANAGEMENT PROCESS

This approach is embedded across all levels of Northumbrian Water, from individuals and teams who are responsible for the initial identification and assessment of risks and threats, to Board and Board sub-groups who are accountable for the overall operation of our risk management framework, setting the companies' overall tolerance to risk (or 'risk appetite') as well as monitoring the most significant or 'top rated' risks. This company wide approach is summarised in Figure 2 below:

FIGURE 2: ORGANISATION WIDE APPROACH TO RISK MANAGEMENT



Our approach makes sure that after risks are identified, we assess the likelihood of them occurring and the possible consequences if they do. This makes sure we can put mitigating actions in place where necessary, and finally that we regularly check any key mitigating actions which we are relying on to manage risks and audit them to make sure they are effective.

Our risk management approach is regularly audited by our parent company (CKI/CKHH) to provide an independent check on its effectiveness.

Our approach to risk management is an important foundation of our overall approach to resilience – but it is not sufficient by itself to maintain resilient services. To do this, we also need to understand how those risks and threats can disrupt the elements of our business which are critical to maintaining resilient services; and we need to understand how those risks and threats may change and evolve in the future. We also need to continually review our current performance for any evidence that risks and threats to resilience are already appearing, perhaps more quickly or in different ways than expected (and for example, our work on data and asset intelligence can help us to do this). And we need to understand how our organisation and networks fit into wider systems, in response to both growing national risks and constraints, and local threats and opportunities.

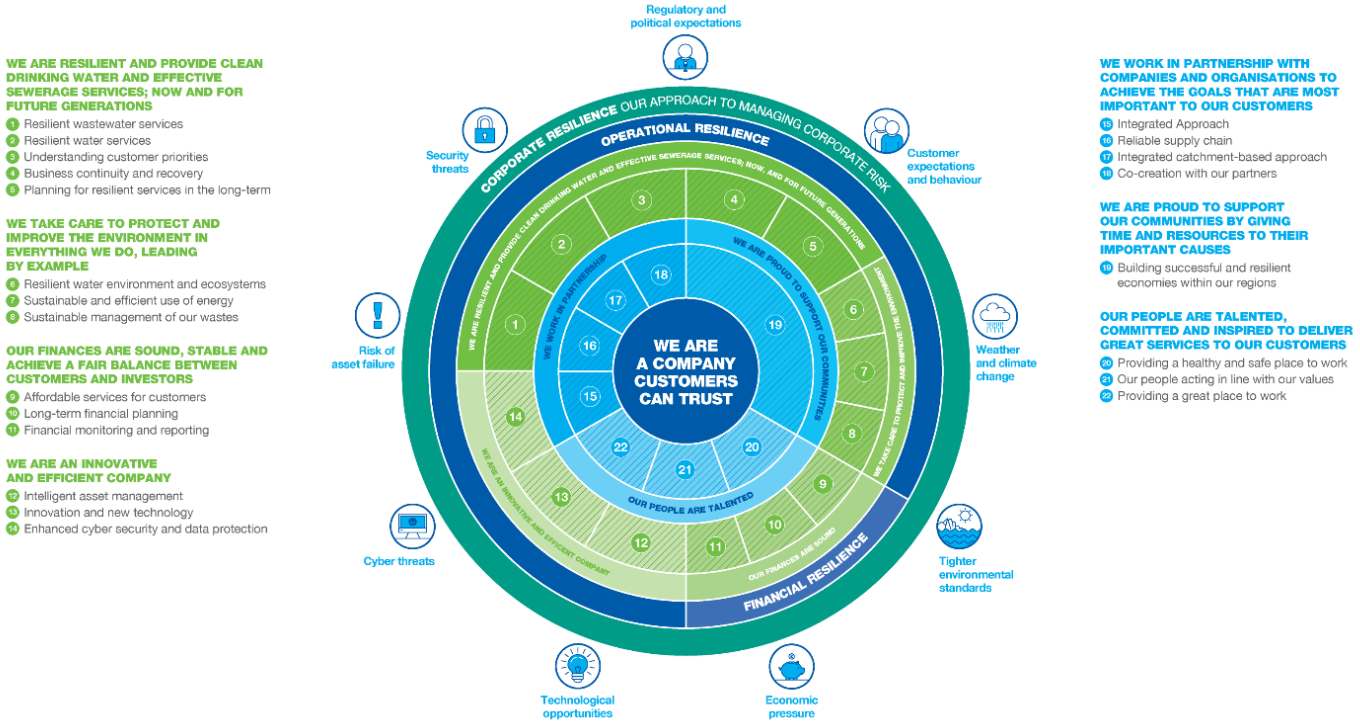
Most importantly of all, we need to continue to take action to make sure we continue to maintain resilient services for our customers and the environment, now and in the future.

4.2. OUR RESILIENCE FRAMEWORK AT PR19

In 2018, we created our resilience framework to establish an integrated approach to understanding risks and in particular their potential to disrupt key areas of our business required to maintain resilient services for customers, and in so doing help us to maintain corporate, financial, and operational resilience.

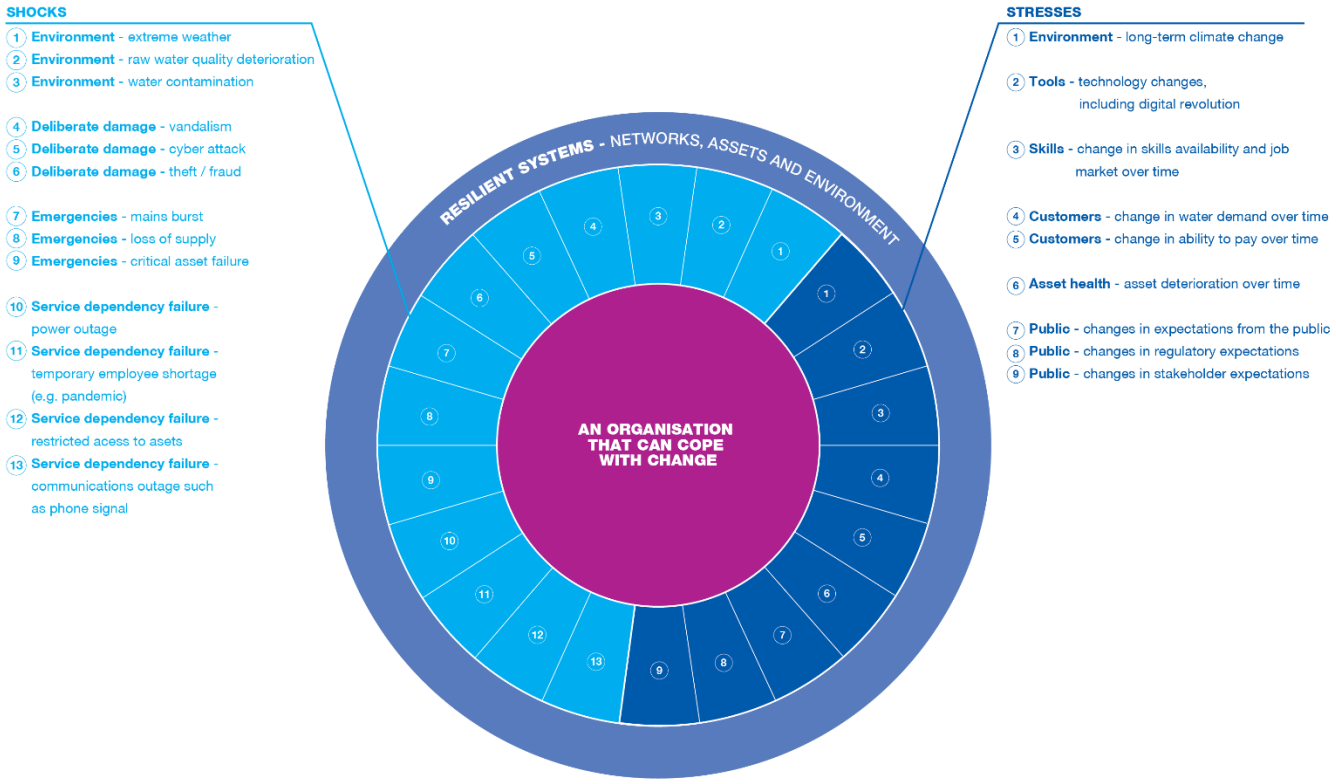
Our framework uses a 'systems thinking' approach which recognises the complexity of our water and wastewater systems and our links with external systems such as the local environment, our customers (in their role as both customer and citizen), communities and local economies, and other infrastructure sectors. This approach helps to inform better decision making by helping us to improve how we assess shocks and stresses, and how we measure our progress against actions to tackle these.

FIGURE 3: OUR RESILIENCE FRAMEWORK



In developing our resilience framework, we looked at the shocks (that is, immediate and sudden issues) and stresses (that is, slow building trends and changes) that could affect our ability to maintain resilient systems. We also looked at shocks and stresses on our ability to cope with change as an organisation.

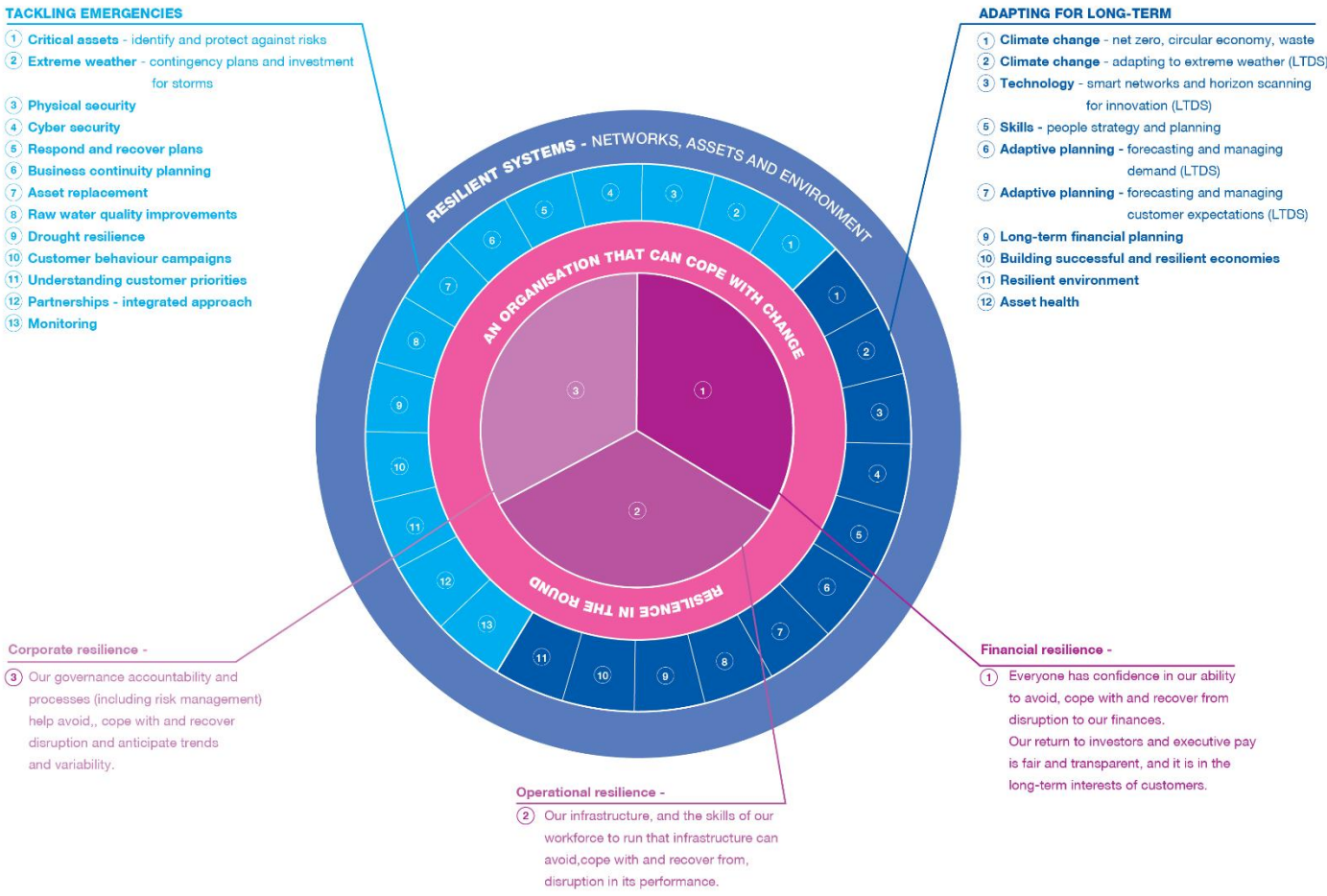
FIGURE 4: EXAMPLES OF SHOCKS AND STRESSES CONSIDERED IN OUR RESILIENCE FRAMEWORK



These shocks and stresses can place pressure on our ability to remain resilient. Under our resilience framework, we set out actions to monitor and tackle these shocks and stresses – for example, we have detailed business continuity plans in place where we might need to recover from a shock such as a water quality issue or interruption to supply. We monitor and report on these actions, as well as current and future risk levels, to our Board.

These shocks and stresses include issues that can affect the whole system – including where we depend on other services or local organisations, and changes in expectations and attitudes over time. The centre of the diagram shows threats to our organisation's ability to cope with change, including our people, partnerships, and supply chain.

FIGURE 5: EXAMPLE ACTIONS THAT SUPPORT RESILIENCE UNDER OUR RESILIENCE FRAMEWORK



We can address these shocks and stresses by both being prepared to tackle emergencies in the short-term, or by adapting for the long-term. Our resilience framework includes both.

4.3. ALIGNING OUR APPROACHES TO RISK, RESILIENCE AND PERFORMANCE MANAGEMENT

Between 2020 and 2023, we have embedded our resilience framework more and more within our 'business as usual' activity – in line with the feedback from Ofwat in section 5.1. We have aligned this with our already well-established approach to risk management. This has meant appointing departmental resilience champions, to oversee resilience risks along with progress on any associated actions. We rolled out training on identifying and understanding resilience risks to those champions and then to others across the organisation, to help improve understanding and knowledge of resilience across the organisation. Our Board Risk and Compliance Committee regularly discusses our key resilience risks including through specific 'deep dive' reviews.

We have also sought to extend our approach to understanding and responding to resilience risks to take advantage of the rich insights we already get from our ongoing approach to performance management. In some cases, we can see evidence of risks crystallising into issues and beginning to manifest in an impact on current performance – and our enhancement cases describe this evidence from performance over time where applicable.

Our long-term delivery strategy also looks at how risks may change and evolve in future. Section 4.5 describes how we have combined all these insights to identify and prioritise resilience actions.

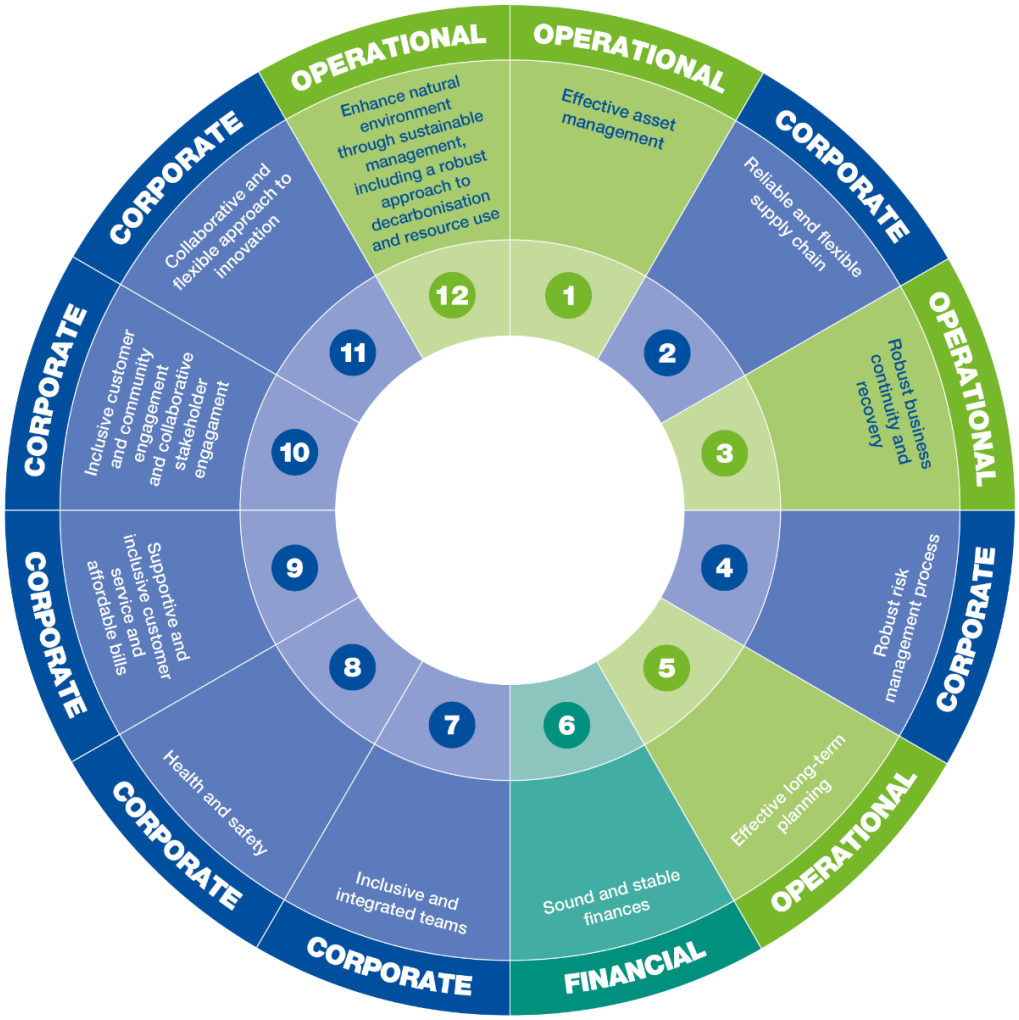
4.4. EVOLUTION OF OUR RESILIENCE FRAMEWORK

For 2025-30, we have looked again at our resilience framework and what can be improved. We asked an independent reviewer to speak to our resilience champions and others across the business to understand what was working, and what could be improved. We concluded that:

- A simplified framework could allow us to be more focused on the highest risks. A more complex framework can be more difficult to understand and manage and does not necessarily cover more risks.
- Our framework could be more closely linked to our risk management approach, including structuring our resilience elements alongside our top-rated risk areas.
- Our framework could look more at future long-term trends, including both threats and opportunities, and link more clearly to evidence about risks now and in the future.

We have revised our framework following our lessons learned and independent review – reducing this from 22 elements down to 12. Figure 6 shows our revised resilience framework.

FIGURE 6: OUR REVISED RESILIENCE FRAMEWORK



1. Understanding our assets and how they will perform under future challenges, and then targeting the right assets for maintenance and replacement at the right time, will support us in maintaining services to customers in future.
2. We rely on our supply chain to provide services now and in the future. We need to make sure that the right skills and capacity are available for the investment needed in 2025-30 and beyond.
3. We must be able to respond to incidents effectively, allowing us to continue providing services and recover quickly. This means maintaining an appropriate level of resistance to threats, as well as robust recovery plans.
4. We must be able to understand our risks clearly and communicate these effectively to the right level of governance. We must be able to mitigate these risks (where appropriate) and understand how effective this mitigation is in practice.
5. Effective long-term planning will help us to forecast and address risks to resilience in a timely way and make informed decisions about when and how to address these risks (for example, climate change).
6. We must make sure we are able to finance our functions effectively and efficiently, now and in the future, to avoid higher costs to customers.
7. We need effective teams to plan and run our services – a resilient organisation.
8. The safety of our employees and our communities is important to a resilient organisation and trust.
9. High standards for customer experience and affordable bills can help build and maintain trust from customers and our local communities.
10. Effective engagement and collaboration can help to support high quality decision making and deliver shared objectives in our areas – helping to maintain trust in the long term.
11. A leading approach to innovation can help to support reduced costs and improved service levels over the long term.
12. Our services depend on the natural environment, so understanding and enhancing our environment helps to make sure we can continue to deliver services in the future.

We explain our strengths and challenges against each of these areas in Section 4.5, as well as the links to our top-rated risks, long-term delivery strategy, and conclusions for PR24.

In some of these areas, we have identified either further opportunities for improvement - or areas of increasing risk. For these areas, we have carried out more work to improve our understanding of the risks to resilience in preparation for the 2025-30 period.

These are:

- **Long-term planning and systems thinking** (section 5.3). We have carried out some additional planning across some of our systems. In additional to the statutory WRMP, WINEP, and DWMP, we have also carried out zonal studies across our water networks and a review of risks to water quality at our treatment works (s4.5.6). This builds on the statutory planning frameworks to create a comprehensive view of risk across our systems.
- **Assessing our future asset health needs** (section 7.1).
- **Adapting to climate change** (section 7.2).

We have also improved against some of the other elements of resilience and will continue to do so. For example:

- Regarding Element 12 (environment) our **Emission Possible report** (2021) sets out our progress towards net zero emissions so far, and how we will hit our target by 2027. **Our Purpose** report (annually from 2021) summarises how we measure against human, environmental and social indicators (as well as physical and financial indicators) to support a long-term approach and leaving a positive legacy in the areas where we operate.
- Regarding Element 7 (our teams) our **workforce for now and tomorrow** (2020) describes our activities for developing skills in our communities that we will need in future. As part of our approach to PR24 deliverability, we will shift our focus for these skills and will invest into new skills needed to support growth in nature-based solutions and catchment management.
- Regarding Element 5 (Long term planning) we have improved our use of adaptive planning across the organisation, using these principles to plan for water resource management plans, drainage and wastewater management plans, and other areas. Our **long-term strategy** (NES_LTDS) shows how we have considered and managed uncertainty.
- Regarding Element 2 (supply chain) we have worked to build on existing partnerships and develop new ones across many of our delivery areas. For example, the Northumbrian Integrated Drainage Partnership and the North East Catchments Hub will both provide shared working and benefits for communities and the environment.
- Regarding Element 10 (engagement) our customer engagement programme helps us to monitor changing expectations from our customers, and our stakeholder management function helps us to understand changing stakeholder views.
- Regarding Element 11 (innovation) we have used more behaviour change and education campaigns to drive behaviours that support long-term resilience. For example, our **Bin the Wipe** campaign has been successful in reducing the number of sewer blockages, and has now been rolled out nationally.
- Regarding Element 9 (affordability and inclusivity) our **affordability strategy for PR19** included establishing the Water Poverty Unit to create a hub for national best practice – and we have continued to be closely involved with

and supporting work on national social tariffs. This helps to change the conversation to support affordability for our customers (and other customers across the UK) in future.

Case study: Maintaining financial resilience through prudent planning

The PR19 regulatory settlement presented significant financial challenges for 2020-25 that required agile planning and resilience. Major unanticipated cost increases in energy and interest negatively impacted the settlement's projections.

Our Board places strong emphasis on long-term financial health and we maintain a rolling 5-year plan, stress-tested against risks. This supports our investment grade credit rating. Despite pressures, we reduced gearing from 69.72% to 68.34% in 2022/23 and were one of a few companies to do so. The Board also implemented a new dividend policy linking payments to performance for customers and long-term financial resilience.

With 2025-30 capital investment at two to three times historic levels, we are focused on early-stage funding and smoothing cash flows. This includes £120m in transitional spending in 23/24 - 24/25 including c.£25m via Ofwat and Defra's 'accelerated investment' and c.£95m we are seeking through normal transitional funding.

Equity investment of c.£400m is also planned to support the significant 2025-30 programme. Through prudent planning and adapting to challenges, we aim to maintain resilience as we deliver essential water and wastewater services for our customers.

4.5. APPLYING OUR FRAMEWORK TO IDENTIFY KEY RESILIENCE RISKS FOR PR24

In the previous section we explain how we have evolved and strengthened our resilience approach for PR24. To assess the key resilience risks that we need to tackle in 2025-30, we have:

1. Carried out a comprehensive **review of our resilience framework**, to make sure that the elements give complete coverage of all aspects of operational, financial, and corporate resilience (see 4.4).
2. Assessed our current level of **risk exposure** for each element of our resilience framework, as determined under our well-established approach to risk management (see 4.1).

This provides a sound basis for us to understand the current level of risk exposure for each part of our organisation, and each element of our resilience framework.

We have a regular process in place to 'horizon scan', assess risks, and anticipate the future. Identifying factors that could impact on our long-term plans is important to help us understand what the future might be like, and how disruptive changes might affect us, our customers and local communities, and the environment around us. To do this, we:

3. Assessed how **the long-term trends** we identified in our **long-term strategy** (NES_LTDS) are likely to affect our risk exposure over time, with a particular focus on 'high impact, high uncertainty' future trends.

As part of this work, our **long-term strategy** (NES_LTDS) set out a 'Wilson Matrix' (see Figure 7). This sets out a long list of future trends and considers firstly how uncertain these were and then how material the impact they could have. We used this to identify some key areas of uncertainty and impact and establish a series of 'scenarios' for the future. We tested our long-term plans against these scenarios.

This allowed us to identify any high impact, high uncertainty trends which have the potential to significantly affect our risk exposure and resilience in the future.

Finally, we looked at the information we have from our current performance indicators and data, and we:

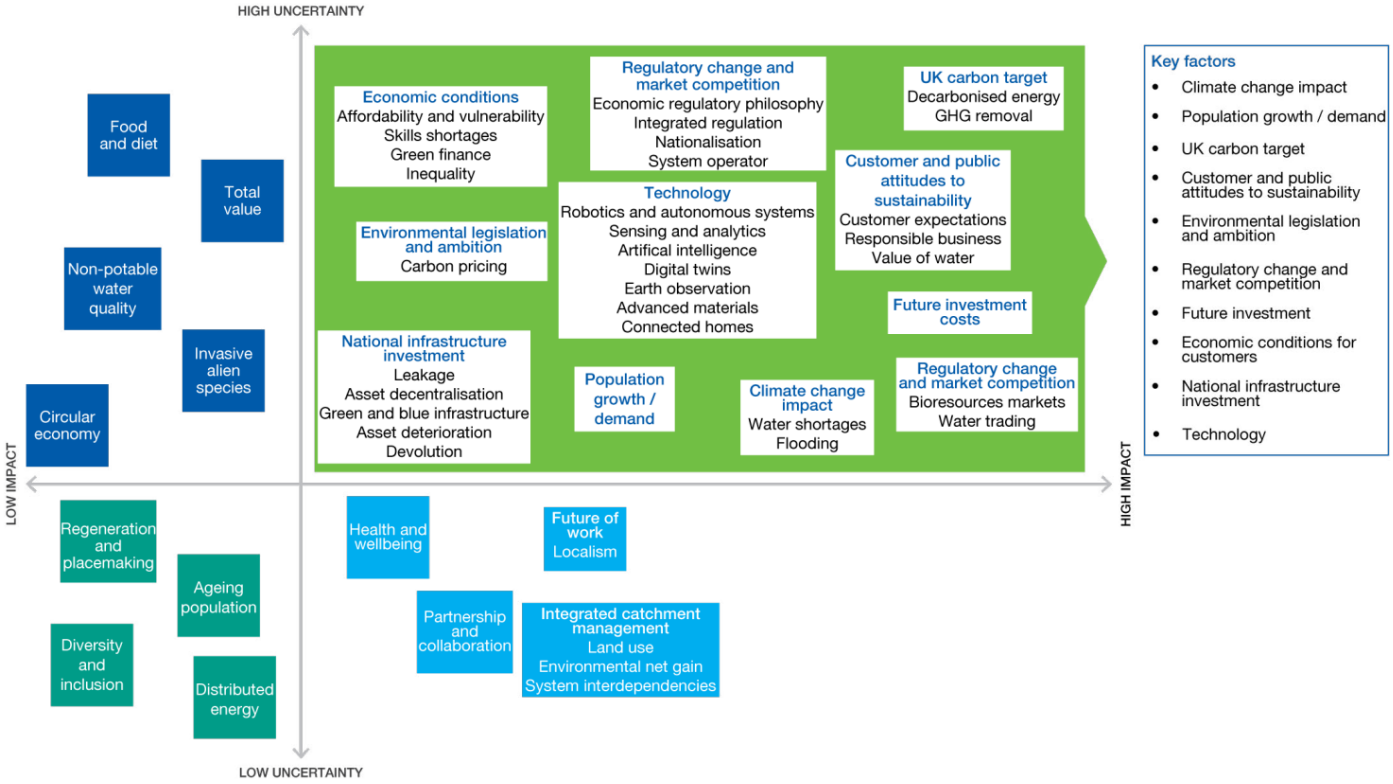
4. Assessed what our **current performance** indicators tell us about our strengths and the challenges we face in relation to each element of our resilience framework. In particular, we looked at the evidence of any current risks or future trends already manifesting themselves, and how this affects current performance metrics.

We have a robust approach to performance management. We regularly review performance at all levels of the organisation, and where performance is below our expectations, we establish plans to improve. Our Executive Leadership Team reviews performance every month, using a 'balanced scorecard' which is also issued to every Board meeting. Performance is also regularly reviewed at departmental leadership team meetings. We set targets each year to provide stretching objectives, and where performance is not meeting our expectations, or we have a particular need, we develop Executive Team 'portfolio projects' to deliver and track improvements – and we review progress every month.

Each year, our Executive Team carries out horizon scanning over two days to discuss emerging trends and threats. This informs the setting of service delivery targets and priority projects for the coming year.

This approach to performance management gives us a strong oversight of performance trends, and in particular gives us visibility of any areas where resilience risks are having an impact on performance.

FIGURE 7: KEY DRIVERS AND DISRUPTORS WITH SIGNIFICANT IMPACT ON OUR LONG-TERM PLANS



The table below shows each element of our resilience framework alongside:

- any relevant observations on current performance;
- a summary of the most relevant and highest rated risks from our corporate risk register (along with the likelihood and impact scores for each risk);
- any relevant high impact/high uncertainty long term trends from our LTS work; and
- summary columns including an assessment of ‘priority for intervention’ and headline actions required to maintain resilience.

We have identified ‘priorities for intervention’ where elements of our resilience framework correspond to high levels of current corporate risk; and where high impact/high uncertainty future trends could substantially exacerbate current risk in future; and particularly where we are starting to see evidence of those risks beginning to manifest in current performance commitments.

FIGURE 8: ALIGNING CURRENT PERFORMANCE, CORPORATE RISKS AND LONG-TERM PROJECTIONS TO INFORM RESILIENCE ACTIONS

NOW			SHORT-TERM RISK/PROGNOSIS				LONG-TERM RISK/PROGNOSIS	SUMMARY		ACTIONS
Resilience Framework Element	Corporate / Financial / Operational Resilience	Current Performance Relevant Indicators of Performance: Strengths and Challenges	Corporate Risk				Long term trends uncertainty / impact			
			Summary of Most significant/Highest Related Risks on Corporate Risk Register (MRS = managed risk score)	Highest Rated Managed Risk Score	Highest likelihood (1-5)	Highest impact (1-5)	Correlation to High Uncertainty/High Impact trends	Priority for Intervention?	Summary	INTERVENTIONS / ACTIONS FOR HIGH PRIORITY ITEMS
Effective asset management.	Operational	**STRENGTHS** - Generally strong performance against PR19 asset health metrics. - Consistently achieve collapses PC. - Achieving unplanned outage PC. - Generally achieve bursts PC albeit marginal fail in 2022/23. - IOSO55001 accreditation. **CHALLENGES** - STW discharge compliance PC slightly behind target. - Concerns (at industry level) that current asset replacement rates unsustainable, that capital maintenance allowance do not reflect bottom-up condition assessment of assets, and that some key asset classes (civils) reaching end of operational life.	No. 8: "The risk of an **asset or service failure due to the insufficiency of the capital plan to fund all maintenance priorities**. This will result in ODI penalties, reputational damage, poor customer service and customer dissatisfaction, a lack of ability to supply, and potential increased operational costs." **MRS 12 TOP RATED RISK** No 16: "The risk that we have inadequate asset information and data (age, health, criticality, Maximo attributes, unstructured construction data, etc.) because of a lack of previous investment to maintain data, inspect assets and keep data (structured and unstructured) up to date. This will result in poor asset health (leading to asset/service failures), the need to operate assets beyond their useful life, ODI penalties, and poor customer service." **MRS 10 TOP RATED RISK**	12 - AMBER	3	4	Y - Asset deterioration flagged as high impact high uncertainty long term trend.	High	Growing evidence base that current asset replacement rates are unsustainable, combined with current risk assessment and high impact/uncertainty future trends makes this a high priority for focus in our PR24 plan to protect resilience.	- Make sure PR24 plan proposes investment to address most immediate risks to Asset Health. Campaign for revised regulation approach from PR29 onwards to make sure capital maintenance allowances better reflect asset need: See A3-21 and A3-22.
Reliable and flexible supply chain.	Corporate	**STRENGTHS** - Supply chain bandwith and trends in key suppliers' financial viability (Dun & Bradstreet assessment) monitored on ongoing basis. - On track with commitment to invest >60p in pound with local supply chain. **CHALLENGES** - Some challenges with specific areas of supply chain - chemicals and energy prices. - Unprecedented step up in scale of investment needed in AMP8.	No. 4: "The risk of supply chain disruption because of employee shortages, Brexit, the Covid-19 pandemic and wider economic conditions (increased inflation/market pressures). This could result in delayed delivery of essential commodities such as chemicals which will impact on water treatment, increased prices and in some cases reduced product availability." **MRS 16 TOP RATED RISK** No. 14: "The risk of energy price volatility because of the unprecedented and far-reaching impacts supply resulting in increasing cost pressures elsewhere." **MRS 12 TOP RATED RISK**	16 - AMBER	4	4	Y - Skills shortages flagged as high impact/high uncertainty long term trend. Other high impact trends including asset deterioration, environmental regulation, population change and climate change are already driving significant step up in investment requirements and will continue to do so.	High	Current risk assessment combined with unprecedented set up in future capital maintenance requirements means high priority for action to ensure resilience of future supply chain.	- Address current specific risks by completing current Executive Team Portfolio Project on Energy and Chemicals Vision. - Make sure supply chain can support deliverability of PR24 plan (including maximising scopes for early starts in AMP7): See A6 – Deliverability.

Robust business continuity and recovery.	Operational	**STRENGTHS** - Strong compliance against SEMD 1998 assessment: Of 32 outcomes tested under SEMD we are assessed as 'Green - Meeting' against 27, and 'Amber - Just meeting' against 5. - Delivery of cyber resilience enhancement programme (on track). - General strong response to incidents and events, (although noting that climate related incidents are increasing in frequency and severity).	**No. 1:** "The risk that a key IS business system is inoperable because of a malicious attack or the failure of our cyber security. This could result in damage to key infrastructure assets, the inability to operate services, loss or corruption of asset/customer data, reputational damage, possible fines, and regulatory sanctions." **MRS 16 TOP RATED RISK** **No. 10:** "The risk of a General Data Protection Regulation (GDPR) breach because of cyber security failures, human error/misuse, malware, theft of a data carrying device, for example. This could result in fines/penalties, reputational damage, operational downtime, legal/enforcement action, loss of sensitive data, etc." **MRS 12 TOP RATED RISK** **No. 18:** "The risk that key operational technology (SCADA) is inoperable because of a malicious third-party attack. This could result in changes made to chemical dosing impacting our ability to supply potable water, associated public health impacts, possible fines and regulatory sanctions, reputational damage, etc." **MRS 10 TOP RATED RISK** **No. 20:** "Loss of communications network with consequence of hampered daily comms with sewer level monitors and communication with field workers." **MRS 9** **No. 7:** "The risk that trespassers access our sites because of a lack of security or proper abandonment of site resulting in injury, adverse environmental impacts water quality incidents, reputational damage, possible fines, and regulatory sanctions." **MRS 12 TOP RATED RISK** **No. 6:** "The risk that a strategic water asset (water treatment works, key distribution main or control point) fails because of a loss of power, unplanned/planned	16 - AMBER	4	4	Security and Business Continuity risks not flagged as high impact/high uncertainty. Climate change is relevant but addressed elsewhere in this assessment.	Low	Risks remain significant but current approach strong	Do need to address additional CPNI requirements ref: A3-09.

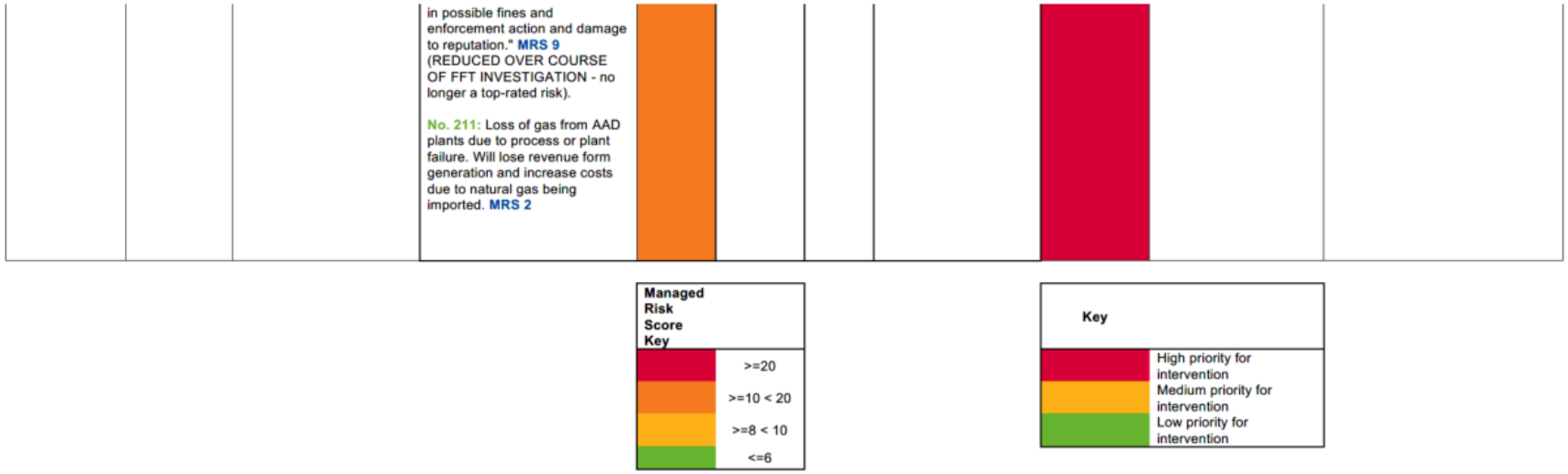
			interventions, burst, etc. This could result in a reduction in our ability to deliver treated water to the network and the loss of supply to customers." **MRS 12 TOP RATED RISK** No. 32: "Loss of non-mobile voice communications network. This relates to the loss of the Virgin/BT core communications Network, for example." No. 53: "Loss of power supply to a water treatment works resulting in sustained loss of supply at the customers' tap (pumped supply such as non-gravity WTWs)."							
Robust risk management process.	Corporate	**STRENGTHS:** - Robust approach to risk management with no RED rated risks remaining after mitigation. - All key mitigations audited for effectiveness and overall approach subject to five-year review by institute of internal auditors along with parent company (CKH) review. - Movement in top rated risks monitored and reconciled regularly and reported to ELT and Audit Committee. - All supports Board sign off of annual Risk and Compliance Statement. **CHALLENGES:** - While compliant currently, we are seeing future challenges (for example climate change and asset health) being escalated up to the annual Risk and Compliance statement. - Reconciliation of movement in top level risks. - Board sign-off of Risk and Compliance statement.	N/A - this is the risk register approach.	N/A			N/A - This element is about short-term risk management	Low	Current approach robust.	

Effective long-term planning.	Operational	**STRENGTHS** - Sign off of and delivery of WRMP19. - First iteration of DWMP delivered on time. - Flood risk and drought PCs ahead of target. - Sign off of and delivery of PR19 five-year business plan. - Delivery of water and wastewater resilience enhancement schemes largely on track for AMP7. - Board sign off of Section 172 statement - especially long-term planning section/long-term success. **CHALLENGES** - Are seeing some impacts of increasing climate risk, for example on interruptions performance. - Impact of Covid-19 pandemic on PCC performance. - AMP7 leakage reductions challenging, but on track for end of AMP, further reductions required in AMP8. - CRI performance needs to improve - transformation programme agreed with DWI but will take time to deliver. - Moratorium on new NHH supplies in the Suffolk region due to unprecedented growth.	No. 5: "The risk that we are unable to meet **demand during peak seasons** or are **unable to provide water to new developments** because of a lack of network capacity. This will result in a breach of our operating licence leading to regulatory sanctions, and damage to reputation." **MRS 12 TOP RATED RISK** No. 22: "Impact of climate change causing an increase to sewer **flooding and pollution** incidents / environmental discharges." **MRS 9** No. 6: "The risk that a strategic water asset (water treatment works, key distribution main or control point) fails because of a **loss of power**, unplanned/planned interventions, burst, for example. This could result in a reduction in our ability to deliver treated water to the network and the loss of supply to customers." **MRS 12 TOP RATED RISK** No. 2: "The risk that **non-potable water** is passed into the distribution network because of the contamination of a service reservoir or contact tank (for example, through ingress due to lack of inspection/maintenance). This will result in a breach of water quality, ODI penalties, possible enforcement action, reputation damage, reduced treated water storage and failure to supply." **MRS16 TOP RATED RISK**	16 - AMBER	4	4	Y - Climate change impact, population growth and leakage investment requirements all flagged as high impact/high uncertainty long-term trends.	High	The combination of top-rated risks, high impact/uncertainty future trends, and evidence of risk manifestation in some areas of current performance, indicate that this area is a high priority for ongoing focus in order to protect resilience.	**MAKE SURE PR24 ADEQUATELTY ADDRESSES RESILIENCE CHALLENGES INCLUDING:** - WRMP ensures sufficient water resources to meet demand including in face of climate change - and WRMP24 proposes significant investment to address this: See... including: - Robust leakage plan supported by enhancement investment case to ensure deliverability of future leakage targets: See A302 and A4. - Robust water efficiency plan supported by enhancement investment to ensure deliverability of future PCC targets: See A3-02. - Comprehensive supply side investments to address growth related supply demand shortfalls especially in Suffolk: See A3-01. - Complemented by Zonal studies to make sure our water treatment and supply systems sufficient to treat and distribute water. - Separate climate study has assessed the impact of climate change on our assets and operations, and informed proposed investment in relation to power and flood risk: See A3-10 and A3-11. - WINEP no deterioration driver includes impact assessment of climate change on RWQ and where appropriate adjusts sewage treatment standards in response: See A3-13-20. - Agreed water quality transformation programme supported by Hazrev initiative seeks to address water quality shortfalls. - DWMP seeks to maintain customer service levels into the future in the face of climate and growth pressures, etc: See A3-12.

Sound and stable finances.	Financial	**STRENGTHS** - Investment grade credit rating. - Board sign off of ring-fencing certificate / condition P. - Board sign off of viability statement. - Regulatory protections: - operating licence granted in-perpetuity. - revenue allowances set five years in advance and index linked. - low proportion of revenue exposed to competition or volume risks - adjustment mechanisms in relation to key risks outside company control (such as cost of new debt). - Robust approach to managing efficiency and high industry efficiency rankings. **CHALLENGES** - PR19 settlement in terms of allowed returns, cost allowances, and service targets has substantially eroded headroom on financial resilience. - This is compounded by the scale of future investment requirements, which place further significant pressure on financeability, and require AMP7 early starts. - Capital maintenance challenge as described under asset management.	**No. 8:** "The risk of an asset or service failure due to the insufficiency of the capital plan to fund all maintenance priorities. This will result in ODI penalties, reputational damage, poor customer service and customer dissatisfaction, a lack of ability to supply, and potential increased operational costs." **MRS 12 TOP RATED RISK** **No. 11:** "The risk that our BBB+/Baa1 credit rating is downgraded because of lower levels of revenue and the failure to deliver totex efficiencies committed in the MTP. This could result in additional costs of borrowing, the potential refinancing of existing EIB debt and pressure on the financial capacity to meet planned distribution profiles." **MRS 12 TOP RATED RISK** **No. 12:** "The risk of increasing discharge permit application and abstraction charges because of downward pressures on EA funding. This will result in increased operational costs and could also result in us having to fund any large capital refurbishment work on the Kielder Operating Agreement (KOA) as a lack of EA funding restricts it ability to do so." **MRS 12 TOP RATED RISK** **No. 13:** "The risk that we are prosecuted and penalised because a legal precedent is set for historic breaches of EIR resulting in financial and reputational penalties as well as suspension of work on CON29." **MRS 12 TOP RATED RISK** **No. 9:** "The risk of significant cost increases at Horsley WTW because of an adverse outcome to the current legal challenge. This will result in increased cost pressures which will impact on our ability to invest in base services." **MRS: 12 TOP RATED RISK**	12 - AMBER	3	4	Y - Economic cycles, including specifically cost of capital and affordability, flagged as high uncertainty/high impact future trend. Other high impact trends including asset deterioration, environmental regulation, population change, and climate change are already driving significant step up in investment requirements and will continue to do so.	High	The combination of top-rated risks combined with future investment pressures, and uncertainty on future allowed returns, combined with inadequacy of capital maintenance funding makes this area a high priority for action.	Action needed to make sure the financeability of our PR24 plan is critical in light of these pressures. See A5 – Risk and Return.

Inclusive and integrated teams.	Corporate	**STRENGTHS** - Very Strong GPTW score - 35th best workplace in UK, albeit improvement read on gender diversity and pay gap metrics.	No. xx: "Loss of employees due to pandemic virus, industrial action, for example. This would result in a significant impact on a number of business areas with people related, service/operational and financial consequences including the Company's ability to deliver services to customers (for example, water supply - quality or quantity) or operating call centres to take customer calls." **MRS 8. NOTE** this is more of a business continuity risk than an inclusive and integrated teams' risk.	8 - YELLOW	2	4	Y - Skills shortages highlighted as a high impact/uncertainty future trend.	Medium	Current performance strong but need to make sure future trends don't disrupt workforce.	- Not a priority for PR24 plan. - But important to complete Executive Team Portfolio Projects on Workforce Planning Strategy and Diversity and Inclusion.
Health and safety.	Corporate	**STRENGTHS** Robust approach with comprehensive suite of metrics tracked on live dashboard and reported monthly to H&S forum and ELT (copy available if needed).	No. 17: Risk of a reportable injury to employees etc because of company negligence resulting in a prosecution (financial and reputation damage). **MRS 10 TOP RATED RISK**	10 - AMBER	5	2	Health and Safety not flagged as a high impact/uncertainty future trend.	Low	Consequences if risks occur are high, but current approach is robust	
Supportive and inclusive customer service and affordable bills.	Corporate	**STRENGTHS** - Industry leading performance on C-Mex (currently leading). - Above average performance on D-MEX. - Achieving suite of three PSR PCs. **CHALLENGES** - Economic climate/inflation/cost of living crisis having a substantial impact on the number of customers in water poverty as tracked by our current AMP7 water poverty metric. - Step change in investment requirements from AMP8 placing further upwards pressure on affordability.	No. 42: "An increase in the number of domestic customers failing to pay their bills due to the inability to disconnect for non-payment resulting in increased debt recovery costs. An increase in the number of non-household customers failing to pay their bills resulting in an increasing cost of debt recovery as activity has to increase to maintain collection levels." **MRS 9**	9 - YELLOW	3	3	Y - Affordability and vulnerability flagged as a high impact/uncertainty future trend.	High	Current C-MEX performance very strong however affordability is a key current and future concern.	Our approach to vulnerability and inclusivity in general is set in in section... of our plan.
Inclusive customer and community engagement and collaborative stakeholder communication.	Corporate	**STRENGTHS** - Business plan test score for engagement (B at PR19). - Trust metrics - above average trust score in CCW water matters 2021/22. - NPS score. - Ethisphere trust status.	No. 105: "Our relationship with other stakeholders (M's, local and regional authorities, partner organisations) is weak/damaged resulting in a negative perception of the business and therefore lack of public support/advocacy for our operations." **MRS 6** No. 190: "Relationship with Water Forums is poor; they are not satisfied that we are: providing an excellent service performance to our customers;	6 - GREEN	3	2	Y - Customer expectations especially in relation to sustainability/environment flagged as a high impact/uncertainty future trend.	Medium	Effective engagement remains critical especially in light of public interest in environment and affordability pressures.	Our approach to effective engagement is set out in section... of our plan.

		CHALLENGES - The tone of current water sector media attention provides a challenging context for meaningful engagement.	clear transparent information; fair charges and the governance and assurance of the company is appropriate." **MRS 4**							
Collaborative and flexible approach to innovation.	Corporate	**STRENGTHS** - A leading approach to innovation centred around our annual and internationally recognised Innovation Festival. Innovation funding secured. - Strong performance with obtaining innovation funding. - Comprehensive suite of metrics tracked including for example: #ideas in innovation pipeline/success rate of pipeline ideas/potential value of the pipeline (refer to APR for more detail).					Y - Use of technology flagged as a high uncertainty/impact future trend.	Low	Use of technology will continue to be a key differentiator in the future however our current approach to innovation is strong.	
Enhance natural environment through sustainable management, including a robust approach to decarbonisation and resource use.	Operational	**STRENGTHS** Consistently strong environmental performance including: - Consistent high EPA assessment (three or four star). - Strong pollution performance. - On track with AMP7 WINEP delivery. - Beating PC on water environment improvements. - Ahead of PC on GHG emissions. - Leading on bioresources (100% against PC and industry leading efficiency). - Very strong comparative performance on leakage in ESW. - AMP7 vision for rivers and coasts includes strong target on storm overflow spill frequency. **CHALLENGES** - Further improvements needed to achieve leakage targets in both regions. - Impacts of Covid-19 pandemic on PCC. - High degree of media, public and political scrutiny on river water quality (RWQ).	No. 14: "The risk of energy price volatility because of the unprecedented and far-reaching impacts supply resulting in increasing cost pressures elsewhere. **MRS 12 TOP RATED RISK** No. 15: The risk that we are unable to effectively treat and manage sludge (bioresources) because of changes in legislation, regulation, or EA guidance. This will result in increased treatment costs and the loss of sludge to land routes. **MRS 12 TOP RATED RISK** No. 22: "Impact of climate change causing an increase to sewer flooding and pollution incidents/environmental discharges." No 23: "Sewer flooding failures caused by incapacity or blockages increase risk in pollution incidents, potential fines and loss of reputation." **MRS 9** No 4: "The risk of misreporting (under/over) sewage discharges because of incorrect or incomplete event duration monitoring (EDM) data resulting	16 - AMBER	3	4	Y - Environmental legislation and regulation along with sustainable attitudes and carbon pricing flagged as high impact/uncertainty future trends.	High	Strong current performance however future trends on environmental regulation combined with the high degree to which this is already manifesting in public, media, and political scrutiny, make this area a priority for intervention in our PR24 plans.	Our comprehensive plan for the environment is set out in our main business plan under 'addressing the environmental challenges'.


in possible fines and enforcement action and damage to reputation." MRS 9 (REDUCED OVER COURSE OF FFT INVESTIGATION - no longer a top-rated risk).
No. 211: Loss of gas from AAD plants due to process or plant failure. Will lose revenue form generation and increase costs due to natural gas being imported. MRS 2
Managed Risk Score Key
>=20
>=10 < 20
>=8 < 10
<=6
Key
High priority for intervention
Medium priority for intervention
Low priority for intervention

From this assessment, we have identified the following key priorities for PR24:

- **Make sure that we have a programme of replacement assets sufficient to maintain asset health in the long-term.** In response to our ongoing work to assess the rate of deterioration/remaining life of our assets, it is important that we have a replacement programme which is costed and profiled for each investment period into the future, and fully funded in cost allowances at price reviews. We discuss this priority, and our approach to this for PR24, in Section 7.1 and in our **asset health enhancement case** (NES35).

- **Make sure that the resilience of our supply chain is protected**, and in particular making sure the supply chain is sufficient to respond to delivery challenges associated with our 2025-30 business plan. Our supply chain is critical to our success, and depends on clear, long-term relationships and investment plans. For 2025-30, we are particularly concerned about the capacity of our supply chain to take on early, accelerated delivery – and the national and regional capacity available to deliver the 2025-30 programme. In response, we addressed this risk early and comprehensively (see **A6 – Deliverability**, NES07).

- **Review our approach in relation to identifying, mitigating, and managing long-term risks, especially in relation to climate change**. Our approach to planning for resilient water and wastewater services is described more fully in section 5.3, and our response to increasing climate risks more specifically in section 7.2 and in related enhancement cases NES24, NES32 and NES35.

- **Make sure that our financial resilience is sufficient to accommodate the overall scale of our 2025-30 business plan**. We have tested our financial resilience in the context of a large increase in investment and discuss this in **A5 – Risk and Return** (NES06). This includes an equity injection and reduced gearing.

- **Make sure that we maintain affordable bills and inclusive services especially in light of cost of living and investment pressures.** We discuss our approach to this fully in **A1 – Customer Affordability** (NES02).

- **Ensure that we maintain an effective approach to customer and stakeholder engagement especially in light of the scrutiny currently being applied to the water sector.** We discuss our approach to this in discussed fully in **A7 – Customer and Stakeholder Engagement** (NES08).

- **Build on our approach to continuing and emerging environmental expectations.** We have a strong track record as one of the leading companies on environmental performance and net zero, with high Environmental Performance Assessment (EPA) star ratings and an industry leading commitment to decarbonisation.

However, customer and stakeholder expectations are increasing – and the role we are expected to play is changing. Our statutory environmental programme (WINEP) is much larger than for previous business plans, and we expect this to continue in the future. Our long-term delivery strategy sets out our working assumption that environmental expenditure will be as high as at PR24 for the foreseeable future.

We set out our PR24 plan for the environment in our **business plan** (NES01). On its own, this is not sufficient – and we describe our approach to future issues such as tackling 'scope 3' (or 'embedded') emissions and a circular economy strategy in our **Environment Strategy** (NES75). This helps to make sure that we have a holistic approach to understanding and tackling increasing environmental expectations in future, including engaging in conversations about developing a future approach to outcome-based catchment management and regulation, with decisions made locally.

In addition to these resilience priorities, we have three specific legal requirements that we must address before 2030:

- We must respond to a government re-classification of protected Critical Protected National Infrastructure (CPNI) sites by further investing in security measures at some sites.
- We must meet a new target for resilience against moderate capability attacks ('enhanced cyber assessment framework'), as required by DWI in their letter of 23 June 2023 with treatment in the business plan tables confirmed by Ofwat on 5 July 2023.
- We must comply with a Ministerial Direction issued in 2021 which requires us to assess drawdown capacity at reservoirs and invest in some sites to meet new standards.

We discuss these specific legal requirements in section 7.3.

Finally, our resilience review has identified two actions that we will progress in the short term as part of business-as-usual activities. These are to:

- Address short term supply chain risks by completing our existing Executive Team portfolio project in relation to energy and chemicals.
- Address future trends in relation to skills shortages by carrying out another Executive Team portfolio project to review and refresh our workforce planning strategy (building on our People strategy).

5. BROADER RESILIENCE IMPROVEMENTS DELIVERED DURING 2020-25 / AMP7

5.1. LESSONS FROM PR19

At PR19, Ofwat rated our business plan as 'C' (or 'amber') on securing long-term resilience. The table below sets out Ofwat's observations about this assessment, along with how we have responded to its observations since PR19.

TABLE 1: SUMMARY OF OFWAT PR19 OBSERVATIONS AND OUR RESPONSE

Ofwat Observation at PR19	Our Response
Ofwat considered our plan fell short of high-quality, with insufficient and unconvincing evidence in some areas – particularly: unclear evidence of identification of priority risks through a clear risk management process; a lack of evidence of systems-based approach considering risks across internal and external systems; and insufficient evidence to demonstrate the impacts on our resilience.	Section 4 clearly sets out how we have aligned our risk management process with our approach to resilience, including a description of Zonal Studies setting out our systems-based approach.
Ofwat considered our approach to critical water assets to be robust, but this was not the case for wastewater. Ofwat noted that there was a high-quality level of customer engagement and strong embedding of the importance of the environment within the plan.	Our associated enhancement cases set out a robust risk approach in relation to key resilience risks. Section 6 sets summarises our approach to customer engagement on the topic of resilience, with further information in our **line of sight document** (NES45).
There were no aspirational resilience levels or future actions that will be required to improve maturity levels, and there was not sufficient customer support for the bill impacts from our wastewater resilience investments.	Section 4 clearly sets out our approach to identifying and prioritising future actions to maintain resilience. See above for customer engagement. Our **long-term strategy** (NS_LTDS) looks at our longer-term goals for resilience, and the investments we expect in the future.
Justification for developing further resilience needed to be linked to priority risk areas for wastewater (as had been done for water). A clearer prioritisation of risks across business services linked to a risk management approach would have made it easier to identify that the schemes proposed targeted the areas that presented the greatest risk to services.	Alignment with our risk management process as described above.

For PR24, we have reviewed our resilience framework and have provided much clearer evidence about our identification of priority risks (see section 54. This shows clearly how we have assessed our priority risks, and how this is reflected in our business plan. Our 2025-30 business plan tackles these priority risks.

We have also greatly improved our enhancement cases, and these look at options including across external systems and how a systems-based approach might support shared action to tackle these risks (particularly for climate change). This evidence includes the impacts on service levels we expect from these risks, and how we are mitigating this with our PR24 enhancement cases for climate change resilience and asset health. We also describe how we engaged with customers to develop these options, including phasing and testing support for these investments (our **line-of-sight document**, NES45, shows how we considered this evidence alongside statutory and regulatory expectations).

Our long-term strategy looks at our longer-term goals for resilience, and the investments we expect in the future. This is based on the analysis we describe in relation to these priority areas which discuss investments needed in the long-term too.

5.2. 2020-25 RESILIENCE INVESTMENTS

Our 2020-25 business plan also sets out a number of key investments that we committed to deliver over the 2020-25 period in order to strengthen the resilience, effectiveness, and efficiency of our water and wastewater services through several major investment schemes – which focus on a range of **redundancy, resistance** and **recovery** solutions to address resilience risks. These investments help to reduce our highest risks.

Despite a challenging start to the period due to the Covid-19 pandemic and associated lockdown restrictions, followed by global supply chain challenges, we remain on track with the majority of this investment – with overruns only expected on a small number of schemes.

The table below sets out a summary of these schemes, target and forecast completion dates, and a description of the resilience benefits that will be delivered for customers.

TABLE 2: AMP7 RESILIENCE INVESTMENT SCHEMES – WATER AND WASTEWATER

Scheme	Target date	Forecast completion date	Summary of activity	Description of resilience benefit for customers and NWL
Mosswood: We're installing new treatment capability at this water treatment works in County Durham to manage cryptospridium risk from raw water sources (such as rainwater and ground water). **RESISTANCE**	December 2022 (for DWI elements)	**December 2022 (for DWI elements) December 2023 for remainder**	The Drinking Water Inspectorate (DWI) elements of the scheme were delivered on time by December 2022. The remaining elements, including a power supply upgrade, are scheduled to complete by end 2023.	Protect customers against water quality risks associated with changes in raw water quality. Mitigates corporate risk no. 2: "The risk that non-potable water is passed into the distribution network because of the contamination of a service reservoir or contact tank (for example, through ingress due to lack of inspection/ maintenance). This will result in a breach of water quality, ODI penalties, possible enforcement action, reputation damage, reduced treated water storage and failure to supply."
Layer: We're installing new treatment processes to address raw water	March 2025	**January 2025**	We're in the final stages of negotiating costs and estimate we	As agreed with the Drinking Water Inspectorate. Read more here.

quality changes in Abberton Reservoir. **RESISTANCE**			will award the contract for this work by September 2023.	Mitigates corporate risk no. 2: "The risk that non-potable water is passed into the distribution network because of the contamination of a service reservoir or contact tank (for example, through ingress due to lack of inspection/ maintenance). This will result in a breach of water quality, ODI penalties, possible enforcement action, reputation damage, reduced treated water storage and failure to supply."
Springwell service reservoir: We're constructing a new water storage reservoir in Gateshead together with 1.5km of pipe to connect the reservoir to our network. **REDUNDANCY**	March 2025	**March 2025**	In January 2023 we awarded the contract for the work, and we forecast completion three months late in June 2025 with 5% (£2.4m) of investment forecast to be after the deadline. This is due to a reservoir size review extending procurement and planning timelines. The contractor is on site and construction is about to begin. There has been a series of successful customer events.	Protect 52,147 from a loss of supply event by providing additional storage sufficient to last 24 hours in the event of a supply failure. Read more here. Mitigates corporate risk no. 6: "The risk that a strategic water asset (water treatment works, key distribution main or control point) fails because of a loss of power, unplanned/planned interventions, burst, etc. This could result in a reduction in our ability to deliver treated water to the network and the loss of supply to customers."
Tees pipeline: We're upgrading the water supply network in the North East. **REDUNDANCY**	March 2025	**March 2025**	The contract was awarded in August 2022. Construction work has started on the shafts for the Tees Crossing and we forecast completion date for some elements of the work (those linked to our enhancement commitment) by March 25. Planning permission is granted. The schedule remains tight, and some elements cannot be accelerated by increasing workforce (for example, river crossings).	70,404 customers to benefit from a second source of supply should an issue arise with their primary source. Read more here. Mitigates corporate risk no. 6: "The risk that a strategic water asset (water treatment works, key distribution main or control point) fails because of a loss of power, unplanned/planned interventions, burst, and so on. This could result in a reduction in our ability to deliver treated water to the network and the loss of supply to customers."
Abberton pipeline: We're upgrading the raw water network in Essex (also known as Layer to Langford pipeline). **REDUNDANCY**	March 2025	**March 2025**	We're in the final stages of negotiating costs and estimate we will award contracts for the pipe procurement in September 2023.	370,000 customers to benefit from increased resilience of raw water supplies. Read more here. Mitigates corporate risk no. 5: "The risk that we are unable to meet demand during peak seasons or are unable to provide water to new developments because of a lack of network capacity. This will result in a breach of our operating licence leading to regulatory sanctions, and damage to reputation."
Barsham: We're installing a borehole water treatment plant and a new treated water service reservoir.	March 2025	**March 2025**	The contract was awarded in 2022. Construction is underway excavating for the main structures. We forecast completion by March 2025.	36,614 customers to benefit from increased resilience equivalent to 24 hours of storage.

REDUNDANCY				Mitigates corporate risk no. 6: "The risk that a strategic water asset (water treatment works, key distribution main or control point) fails because of a loss of power, unplanned/planned interventions, burst, and so on. This could result in a reduction in our ability to deliver treated water to the network and the loss of supply to customers."
Wastewater resilience Programme, to provide resilience protection at 141 sewage treatment works. **RESISTANCE AND RECOVERY**	March 2025	**March 2025**	On track with 70/141 sites upgraded and the remainder on schedule.	We are providing additional resilience protection at 141 sites primarily against flooding and power supply interruption risks. Mitigates corporate risk no 23: "Sewer flooding failures caused by incapacity or blockages increase risk in pollution incidents, potential fines and loss of reputation."
Howdon sewage treatment works upgrade. **REDUNDANCY**	March 2025	**TBC**	On track currently being in the late stages of contract negotiations, however this is a complex programme and as indicated in our most recent APR there is currently a risk of delay to the agreed schedule of 12 months.	Two key process units on the site will be duplicated to protect against failure and reduce the risk of any associated pollution. Mitigates corporate risk no 23: "Sewer flooding failures caused by incapacity or blockages increase risk in pollution incidents, potential fines and loss of reputation."

In relation to the small number of areas of water investment where we are behind schedule, we are fully engaged with Ofwat on an Action Plan to mitigate any associated risks and remain on track with this action plan. More detail can be found in our action plan.

In addition to these investments, we have significant improvements in relation to flooding, having very substantially reduced internal flooding incidents between 2019/20 and 2022/23 as described in the case study below.

Case study: Revolutionising sewer flood prevention: our progress

Over the past three years, we have spearheaded a transformative initiative that has driven significant reductions in sewer flooding, greatly benefiting customers.

Starting in 2020, we initiated a new strategy to combat flooding, resulting in significant positive outcomes. From April 2020 to March 2023, incidents of internal sewer flooding decreased by 65%, while external sewer flooding also experienced a notable reduction of 35%. The recurrence of internal flooding also dropped substantially by 78%.

Our success stems from the implementation of three pivotal changes. Primarily, we augmented our workforce to enhance our responsiveness to flooding incidents. Swiftly addressing flood sites not only elevates customer service

standards but also expedites the identification of underlying issues – be it a damaged pipe or encroaching tree roots – enabling efficient rectification and prevention of recurrence.

Secondly, our commitment led us to more than double the number of annual sewer surveys. These comprehensive assessments identify sewers requiring maintenance or cleansing to proactively mitigate issues, serving as a pre-emptive measure against impending flooding.

The third pivotal change introduces our ground-breaking 'Bin the Wipe' campaign. A staggering two-thirds of blockages in our sewer network are attributed to customers flushing items such as wet wipes down their toilets. By educating and encouraging responsible disposal practices, we have effectively reduced these preventable obstructions.

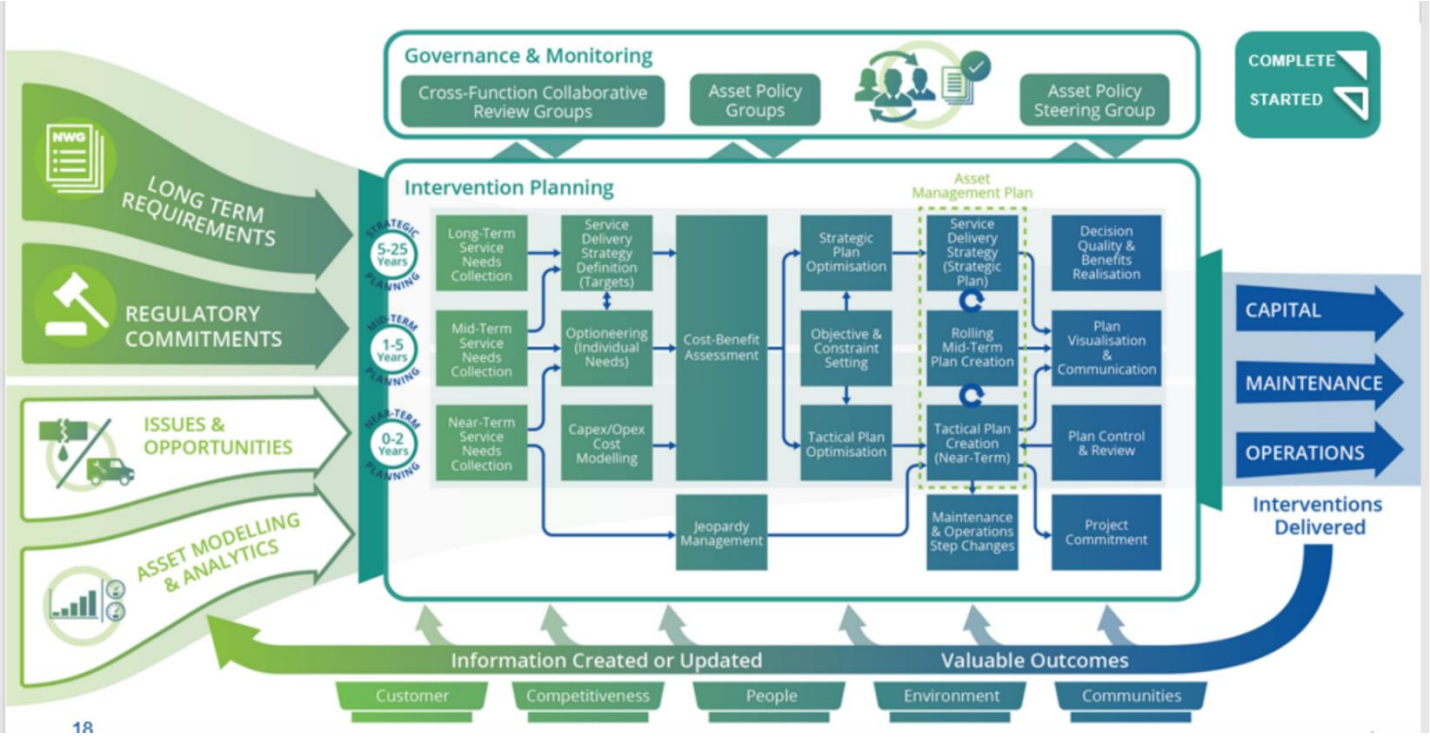
We continue to look for further improvements as we strive to push the boundaries of flood prevention. Over the last year, we actively engaged in research alongside CCW and Ofwat, resulting in the implementation of numerous recommendations to enhance support for customers affected by flooding. These measures encompass additional assistance during clean-up efforts, underscoring our commitment to comprehensive care.

5.3. LONG-TERM PLANNING AND SYSTEMS THINKING

Our 'service planning framework' is a comprehensive approach to short and long-term planning which helps us to make sure that our water and wastewater services remain resilient and capable of meeting future challenges. We describe this in Figure 8 below.

This framework takes into account a wide range of short-term and long-term information and needs. This includes: issues and opportunities identified by operators and through routine inspections; our long-term requirements identified under our risk management approach; trends we identify through our horizon scanning (see our **long-term strategy**, NES_LTDS) and our long-term planning in WRMP and DWMP (as well as regulatory commitments and new requirements); performance data; and data about the information on the condition, capability and criticality of our assets in meeting these challenges. Our asset modelling and analytics helps us to process this data to assess the key risks and impacts of interventions on our service to customers.

FIGURE 8: COMPREHENSIVE SERVICE PLANNING FRAMEWORK



We then optimise this for both a strategic plan, looking at five to 25 years ahead (and sometimes as much as 100 years), and our tactical plans for the near term (0-2 years) and medium term (1-5 years). This helps us to develop and commission short-term interventions that are needed immediately, while considering our longer-term strategic plan. In some cases, plans for resilience can mean enhancement expenditure if we need to manage increasing risks (or changing risk tolerance) from hazards which are beyond our control. A good example being our 25-year WRMP, which sets out a long-term plan and strategy which then dovetails with our five-year business plan where the first five years' worth of investment is planned in more detail for delivery.

We describe some of the key planning approaches and tools to maintain resilient services in table 3 below.

TABLE 3: PLANNING APPROACHES/FRAMEWORKS TO MAINTAIN RESILIENT SERVICES

Service	Planning approach	Purpose and relevance to resilience	Key Outputs for PR24	Business plan references
Water	Water Resource Management Plan (WRMP)	Makes sure that we have sufficient supplies of water to meet customer demand, even during severe droughts, and	Robust leakage plan to ensure deliverability of future leakage targets.	WRMP – published on our website and supported by our

		that we can extract that water without harming the environment.	Robust water efficiency plan including metering to deliver future PCC reduction targets. Supply side investments to address supply shortfalls in Essex and Suffolk, to meet new demand and allow abstraction reductions. Base plan for water treatment and networks.	supply (NES14) and demand (NES15 and NES36) enhancement cases. Zonal Studies: see case study below. There is no enhancement expenditure from these studies in 2025-30.
	Zonal Studies	A systems-based 'source to tap' approach to planning to make sure that raw water can be treated in sufficient quantity and reliably transferred to our customers via our supply networks – under a range of possible scenarios.		
	Water Quality Transformation and HazRev	Makes sure any risks to water quality are fully identified and mitigated, to ensure maximum compliance.	Base plan for water treatment and networks, alongside our HazRev programme. Enhancement case for climate change related process improvements supports mitigation of increasing hazards.	Our enhancement case for climate change process enhancements (NES24). Our performance commitments for CRI and water quality contacts (**A4 – outcomes**, NES05). Our lead replacement programme (NES20).
Wastewater	DWMP	A broader scope than the WRMP process. Ensures that each WW catchment is able to maintain resilience in the face of future challenges including growth whilst also delivering spill reduction, pollution and flooding improvements.	Range of interventions to maintain customer service levels into the future in the face of climate and growth pressures.	**Our DWMP** takes into account long-term growth. Our enhancement case for growth at wastewater treatment works (NES26).
	WINEP (Wastewater)	Makes sure that we deliver interventions that contribute to improvements in river and bathing water quality, enhancing biodiversity and reducing flooding.	WINEP Programme.	Our WINEP programme (NES27 to NES34, and others) takes into account future growth and

				includes investigations into future environmental and water supply resilience.
Water and Waste	Climate Impact Assessment	Ensures our WTWs, STWs and other assets remain resilience in the face of climate change including risks from severe storms and flooding.	Flooding and power resilience investments.	See section 7.2 and enhancement case NES32.
	Asset Modelling	Makes sure our asset base remains healthy and fit for purpose over the long term	Enhanced capital maintenance.	See section 7.1 and enhancement case NES35.

This table helps to show how we have integrated established and new long-term strategic planning frameworks (and other long-term assessments) into our business plan for 2025-30.

Case study: Zonal Studies to embed Systems Thinking

While our WRMP helps us to make sure that we have sufficient water supplies to meet future demand from customers, our use of 'zonal studies' complements this by making sure that we can keep our water treatment works fit for purpose in terms of performance and resilience – and that water can be transferred reliably across our supply network.

We review our supply areas at a system level, looking at the entire operational system from raw water catchment to each district metered area. We carried out hydraulic modelling and combined this data with information about customer contacts, asset failures, and water quality failures. We used this information to draw together annotated geospatial plots which show modelled and actual network performance – bringing together asset health and performance. We use this information alongside WRMP modelling to identify potential issues, resilience risks, and recommended interventions.

This approach helps to identify and progress priorities in each supply system, for example in AMP7 in our Tees supply area the priority is to improve the connectivity with our Central area. In Essex it is to strengthen the connectivity of our raw water network. For AMP8 in our Suffolk area the greatest priority is to address supply deficits and improve inter-connectivity of the treated water network to enable surplus water to be shared across zones.

Case study: Hazard Review at water treatment works

Our Hazard Review (HazRev) programme responds to the Drinking Water Inspectorate's ambition to accelerate capital maintenance spend to meet current and future expectations for water quality management and resilience. This review looks at both non-compliance with current regulations, and deviations from best practice recommendations – identifying

risks for interventions. Our Hazard Review assesses risks at specific water treatment works through a programme of independent expert site audits, risk identification and scoring.

We will submit our site reports to the DWI by 31 October 2023 and may be required to make subsequent investments by the DWI. We expect this to increase our capital maintenance in 2025-30 and beyond for water treatment works – not necessarily because there have been failures or infringements at these sites, but because this additional capital maintenance is needed to reduce residual risks in line with DWI expectations. This will reduce the risk of water quality failures for customers.

5.4. RESPONSE TO RESILIENCE INCIDENTS AND LESSONS LEARNED

Since 2020, we have seen several risks and threats to our services manifest themselves. We have responded well when incidents do occur – for example:

- **Ofwat's assessment** of our response to the 'Beast from the East' in 2018 said that we had 'planned for and managed the event effectively. Northumbrian Water performed well and largely met its customer's expectations'.
- In response to Storm Arwen, where 280,000 customers lost electricity supplies causing significant supply interruptions, we commissioned **an independent assessment** that concluded that our extreme event preparedness was effective and that we went above and beyond to attend to our customers in the aftermath of the storm.
- We **replied to Ofwat in response to the freeze-thaw event** in December 2022, explaining that we considered we had dealt with this challenging event well – and how we had addressed the points in Ofwat's 2018 feedback.
- We have performed well against the Security and Emergency Measures Directive (SEMD) – in our latest assessment, we achieved a strong performance of 'Green' against 27 out of 32 criteria, and 'Amber' (or just meeting) on the remainder.

Although we consider that we respond well to incidents, we always take the opportunity to review our response to incidents and identify any improvements that can be made for the future.

Case study: Weathering the storm: responding to extreme weather events

In early 2018, we faced unprecedented challenges from severe winter weather, known as the 'Beast from the East'. This caused a major spike in leakage as pipes froze and burst in the extreme cold and we had to drive leakage reductions further than normal in summer 2018 to compensate.

Our employees faced unprecedented temperatures, snow blizzards and relentless conditions dealing with frozen pipes, network disruptions, power-cuts to our sites and high levels of calls and contacts from concerned customers 24 hours a day. During extreme weather conditions, employees moved from eight to 12-hour shifts and doubled up on standby to

provide additional support when our customers needed it. They worked in partnership with local councils to help clear access to sites in our most rural locations and showed an amazing effort to make sure we supplied customers.

That summer then brought a prolonged heatwave, another condition that can cause pipe bursts, leaving us facing the double impact of winter and summer extremes.

However, our pre-incident planning for resilience paid off when the Beast hit. In its assessment, Ofwat recognised us as well prepared, implementing plans early without needing full emergency activation.

A key factor was our customer communications, which prevented panic and built confidence in our readiness. This demonstrated important lessons for the industry on public assurance.

Although we missed some performance commitments due to the extreme weather, our robust emergency plans allowed us to maintain reliable service despite severe challenges. Our effective response to the 'Beast' weather validated our focus on resilience and preparation.

Case study: 2022 – a close call and a harsh reminder of nature's thirst

The summer of 2022 saw Europe's worst drought in 500 years. The unprecedented conditions meant we entered into drought across the majority of the country and pushed some water companies to the brink of water scarcity, with three of them introducing temporary use bans (TUBS) sometimes called Hosepipe bans.

Our operating regions faced an extreme drought, characterised by prolonged dry spells, record high temperatures and increased water demand. There was additional pressure due to population growth and a serve agricultural drought. It was the driest July since 1935 and in Essex, only 71% of the average annual rainfall (406mm v 568mm) across the year as a whole. River flows were significantly below average across our region reflecting the dry summer and the Environment Agency moved the East Anglia region into formal drought status on 12 August. Average daily demand in ESW for 2022 was 466Ml/d although the highest peak daily demand was 613Ml/d on 19 July 2022 – a 32% increase. This was the same day when the UK broke a new world record for the hottest day on record – 40.3 degrees C in Lincolnshire. Records were set overnight too in Greater London which recorded the highest minimum temperature on record of 25.8°C.

Despite the severe challenges with careful management of our resources and working with our customers, we were able to avoid the need to implement restrictions on customer use of water.

Our approach was twin track to carefully manage both supply and help our customers to understand their impact to control demand. From early in the spring, we proactively engaged with our local communities and continued this through the winter period. Through an integrated campaign, which covered our social media channels, website, press releases, media interviews and paid for advertising, we engaged with our customers to help conserve water across the region. By helping our household and business customers to understand the position we were able to reduce demand

and develop the message through the summer months. By connecting to the local environment and coordinating our messages with other organisations like the Environment Agency, Conservation groups and farming organisations it we were able to help our customers understand the impact on our regions' rivers and reservoirs and help keep the water flowing to our homes all year round.

Alongside working with our customers, we took a proactive approach in our operations. We entered the summer with our lowest ever levels of leakage in the region with visible leaks being fixed inside and average of four days. Ahead of the summer we had ensured all our sources were operational and completed all maintenance actions. During the summer we operated dry weather supply schemes, our Langford Recycling Plant was operated which, at its peak, can provide an additional 20Ml/d of raw water for onward transfer to Hanningfield reservoir. We also used the Ely Ouse to Essex Transfer Scheme throughout the autumn and winter to support the refill of both Hanningfield and Abberton Reservoirs. Optimising our WTWs also helped to make sure all our water sources and WTWs were in supply.

Despite reservoirs reaching a record low of 45% in October our recovery over the winter with higher rainfall levels has been key. With proactive management and intervention, we have been able to refill our Abberton (over 90% full) and Hanningfield (98% full) reservoirs. Since its enlargement Abberton now holds over 40,000Ml of water, which based on how much water we plan to abstract from the reservoir each year means it now has sufficient water in it for two years.

Over the next few years, we are in the process of laying a new raw water pipeline from Abberton reservoir to our Langford WTWs. This will provide us with much greater resilience across our region in the future as it means we can more easily transfer water to the south and east of our region.

The severity of this summer and the record setting temperatures and low rainfall highlighted the importance of long-term adaptive planning and implementing proactive measures to meet demand across the region. We continue to build on the collaborative efforts, and sustainable water management practices to ensure the availability of clean water for communities, even in the face of changing climatic conditions.

6. COLLABORATING WITH STAKEHOLDERS AND CUSTOMERS

6.1. TACKLING DIFFICULT PROBLEMS TOGETHER

Like other infrastructure sectors, the water sector is still struggling with how to deal with the complexity of topics such as resilience. This has traditionally been tackled by simplification and focusing on small parts of the system in isolation – for example, a focus on building new water supplies rather than assessing how and when others could act to support drought resilience. Increasingly, though, we are better able to tackle these problems differently, with interdependent relationships and partnerships between organisations. Innovations such as monitoring, open data, and digital working allow us to use these relationships more effectively, sharing data and informing collective policies and frameworks to address these risks to whole systems.

Our work in some areas is clearly linked to national planning frameworks (through the Water Resource Management Plan and Drainage and Wastewater Management Plan). These set shared national standards and planning objectives, as well as providing networks and forums such as **Water Resources East** and **Water Resources North** to allow collective discussion and decision making about the best way to make sure that we have resilient systems for all stakeholders and citizens. This helps to drive a local, iterative approach that can take into account many perspectives – and so support good decision making across the whole system, not just for individual water companies and their customers.

The Government's **Plan for Water** includes interventions on behaviour change and new approaches for managing abstraction for farmers and other users, as well as new measures to reduce harmful chemicals and reduce water use from businesses and new developments. The Government has also set national standards for reducing leakage and water demand, as well as for resilience to risk. This provides a view on the measures that will be needed across many organisations to tackle the risks to resilience to drought and environmental resilience in the future.

This is only part of the picture for resilience, though. For some risks, national frameworks are unable to yet manage these risks collectively – or they don't exist at all.

For example, there are more limited national standards for resilience to flooding, and no requirement for single, costed, catchment-based plans – even though there are many organisations involved in tackling flooding (particularly local authorities, the Environment Agency, and drainage boards). The **National Infrastructure Commission** has recommended a more collective approach to tackling this, including joint plans and devolved local funding as well as national risk reduction targets. In the North East, our Northumbria Integrated Drainage Partnership provides the first steps towards an integrated regional plan by working together on some projects with shared objectives.

Our customers expect us to work in partnership with others to deliver wider benefits – and we agree. In discussion with the Water Forum, we have used partnerships more than ever before to develop our plans for 2025-30, and we will measure the financial and operational savings for customers that come from these. This will include seeking to change the conversation towards wider environmental plans for our catchments, and a sector wider (or UK wide) approach to climate change adaptation and asset health.

Case study: Learning from Storm Arwen: reviewing our response to ensure resilience against extreme weather events

Storm Arwen hit the North East of England over 26 and 27 November 2021 and was one of the most powerful and damaging winter storms in a decade.

The Met Office issued a red weather warning and while the storm was notable both for its extreme wind speeds and freezing temperatures, many sources point out that what made the storm particularly rare and destructive was the direction of the wind. Significant power disruptions were experienced across Northumberland and parts of County Durham because of the extreme wind speeds, and this interrupted supplies over several days.

There was widespread and sustained loss of power across the region and the situation was declared a civil emergency under The Civil Contingencies Act (2004). The loss of power had a significant consequential impact on provision of water to our customers, primarily because of loss of power to our assets and associated loss of communications.

We conducted a thorough and independent review into the effectiveness of our response to the storm, to make sure we can learn any lessons and improve our response to any future events.

Key strengths highlighted:

- Strong teamwork and effort by individuals ensured sustained, effective response.
- Support from supply chain contractors, especially local knowledge, was valuable.
- Remote working enabled more frequent, targeted communication for our incident management team.
- We exceeded our duty in providing alternate water for impacted customers, and farmers that were on private supplies.
- Good customer feedback on location-specific external communications.
- Close coordination between External Communications and Customer teams on messaging.

This review found that our response was robust, quickly mobilised and effectively organised. It also concluded that we went beyond our duty in organising alternative water supplies and made sure customers on our Priority Services Register received the support they required.

In the context of what was a very challenging and exceptional event to respond to, the review also identified a small number of areas where we could have been more robust - especially in relation to provision of back-up power - and had this been the case then we could have lessened the impact on customers.

We fully accepted responsibility for any further disruption caused where our response fell short and have addressed. Jacobs' review of our emergency manuals relevant to our preparedness and response to Storm Arwen confirmed that they are comprehensive in their content and intended use.

Soon after Arwen, we reviewed our stock of mobile generators. Many of the generators were replaced, not because they failed in Arwen, but because it became clearer what might be asked of them. New technology such as GPS positioning was included in the specification to better manage them and track them during incidents and for refuelling. Our enhancement case for power resilience will support us in increasing resilience to meet new expectations against this type of storm in future.

Better engagement with the main power supply network has also come about since Arwen. Power, water, and wastewater strategy managers are invited to a regular stakeholder forum held by Northern Power Networks. The level of information sharing continues to evolve from both sides, about both our vulnerable sites and their vulnerable networks.

The risks highlighted by national grid during last winter high demand period have also led to better resilience understanding and planning within the regional county councils.

Case study: Protecting critical infrastructure

Cyber security is an ever evolving and increasing risk, particularly for large critical national infrastructure companies where the threat comes from numerous sources including fraudsters but ever increasingly from hostile foreign states.

As such we have been investing in cyber security throughout 2020-25 and will continue to do so during 2025-30 as the threats and risks continue to evolve and become more advanced. Our security controls take numerous factors into consideration including current risk, government advice, new legislation as well as looking ahead at what the future risks may look like.

Our goal is to protect the confidentiality, integrity and availability of our assets and we do this by investing across the five core areas of: identify, protect, detect, respond, and recover. We have been investing in technology, processes, and people across all of these areas to make sure we have a holistic approach to ensure we're in the best possible position to manage our risk appropriately.

Our cyber security strategy is one of continuous improvement to keep up with the ever-evolving threat landscape and advancements in technology.

6.2. CUSTOMER ENGAGEMENT TO SUPPORT OUR FUTURE PLANS

We tested our approach to resilience for 2025-30 carefully with our customers.

Our line-of-sight document (NES45) describes a summary of our customer engagement on both climate change resilience and asset health. This goes on to describe the rationale for our decisions, including on the investment that should be done in the next five years, and in the long term. These are summarised below.

6.2.1. Climate change

Our customers have mixed views on **climate change**, with younger customers and customers in our Essex and Suffolk area being more supportive of investment in this area. These mixed views continued through the development of our business plan. In our qualitative affordability and acceptability testing, many felt this was important to avoid future issues and protect future generations. Others questioned if the investment was required, or if other investments would do enough to protect water supplies and quality anyway – and how much impact climate change would have in the UK. The majority of respondents in Essex and Suffolk, and around half of respondents in the North East, selected the 'medium' phasing option (used in our business plan).

Customers wanted to be sure that investment was really needed, and that we could be confident that the impact of climate change would mean increased risks to services. So, we set criteria for developing our plan by looking at where:

- There was a high likelihood that climate change would have an impact on our services in the short or medium term (under any future climate change scenario).
- This is likely to have an immediate impact on services – in our customer research, we identified supply interruptions from water treatment works and pollution incidents from sewage pumping stations as two of the key areas.

We asked our customers about higher investment in 2025-30, to tackle potential future risks – for example, addressing algae growth which can have impacts on water quality, filter performance, and sludge systems at water treatment works. We said that these were less certain, and that we did not think these effects would be seen in the next few years. Some customers did support these investments, but as there were mixed views, we have not included these in our plans for 2025-30.

In our qualitative affordability and acceptability research, our customers supported our 'medium' option (as included in our business plan). This includes investments in flooding and power resilience, as well as process enhancements for water treatment to address specific heat risks that are already happening now.

6.2.2. Asset health

Customers described asset health investment choices as a 'dilemma between a short-term fix and a long-term plan'. Some customers were cautious about spending money before it is necessary and noted that the future was uncertain. They prioritised affordability over asset health. The majority of customers thought we should do more, noting that this could prevent costs and problems escalating in future years. They also valued safe, clean spaces for workers and communities (enhancements and other service area summaries). In the North East, customers were more likely to favour bill reductions.

Customers asked for a 'hybrid, middle ground' option, that focuses on where we know exactly where work is necessary now, and where this has an immediate impact on service (and safe, clean spaces). This middle ground would be more affordable now, without taking too much risk on problems escalating in future years (enhancements and other service area summaries).

We developed our plan based on the criteria from customer engagement – that is, to focus on areas where we know exactly what work is necessary now, and where this has an immediate impact on service. This is more difficult for mains replacement, where we have less detailed information about the condition of these assets (as they cannot be readily visually inspected) and where it is more difficult to estimate the benefits of replacing a given main (or to have confidence that this targeting is effective). We prioritised civil assets such as service reservoirs and treatment works as these improvements were better value for customers.

Investments to replace concrete tanks at service reservoirs, water treatment works, and wastewater treatment works were viewed as a high priority for respondents across all regions as they relate to the main function of the company - to provide a safe water supply. Most customers included asset health in their 'ideal plan' (enhancements and other service area summaries).

In our affordability and acceptability research, customers supported our 'medium' investment in asset health – seeing this as keeping pace with the required level of work, while allowing a high level of investment in other areas. In Essex and Suffolk, customers often preferred a higher phasing option – which included increasing our mains replacement in this area.

As a result of our customer research, we looked at potential options for balancing affordability against an increased investment in asset health. We explored the costs of a smaller uplift in mains renewal, as well as challenging our costs and implicit allowances for our investments in treatment works and service reservoirs.

This challenge led to us removing our enhancement need for service reservoirs and so allowing us to include some mains replacement without changing the overall level of investment for asset health – and so remaining close to the level of investment that our customers supported in our qualitative research. Our customers had challenged us to go further to tackle potential future problems including for mains replacement, and so we included this in our investment plans for 2025-30.

We have chosen not to increase our mains replacement rate all the way to 1% per year. This is because although we have sufficient evidence to show that increased maintenance is necessary for the asset class as a whole we do not know what the right efficient and economic long-term replacement rate is and we don't consider that there is currently customer support for the increased level of investment that would be required to reach this level.

6.2.3. Longer-term plans

Our long-term delivery strategy sets out our plans for the longer term. We have set our long-term plan based on customer and stakeholder evidence as well as evidence of climate change, asset health needs, and the impacts these will have on our network (as outlined in this appendix).

Customers have asked us to look at increasing our confidence that investments are really needed now, and that climate change and asset health will mean an immediate impact on service levels. Section 6 describes how we will meet these expectations by preparing for the future, as well as our investments during 2025-30.

7. OUR PLANS FOR 2025-30 / AMP8

In Section 4.5 we identified key future resilience risks in relation to Asset Health and Climate Change Adaptation. Below we describe how we have explored these topics in more detail in order to inform our future plans.

7.1. ASSESSING OUR FUTURE ASSET HEALTH NEEDS

We deliver essential services to our customers through a highly complex and varied asset base, with many of our assets required to operate for a very long time. It is critical that those assets are healthy and can operate effectively. There is growing evidence of increasing risk in the asset base; we have been able to manage these risks through operational interventions to date but sooner or later this will need to be stabilised through additional investment. Addressing future challenges, such as climate change, and service improvement are also likely to require more material replacement of the existing asset base.

We looked at the age, condition, and criticality of assets to understand the right rate of replacement and repair to maintain healthy assets. Our analysis showed that there was reasonable evidence that – as a sector, and for Northumbrian Water – our current capital maintenance allowances mean that we are structurally under-investing in the maintenance of our asset base. This is also indicated by our 'implied' asset lives – for example, a replacement rate for water mains of 0.4% suggests that these assets will last for 250 years before replacement, and this is not likely to be the case.

In our **thought leadership document on long-term asset health**, we said that this would be a long-term challenge requiring a long-term solution. Addressing this will require:

- the development of common frameworks for assessing asset management maturity and asset criticality, and asset health;
- a new approach to assessing efficient cost allowances, probably for PR29; and
- strong protections for customers to make sure that they receive the full benefits of any additional investment and that water charges remain affordable for the long-term.

For PR24, we wanted to understand more about this long-term issue and start to address the highest risk areas. We looked at our different asset classes where there were likely to be risks including: mechanical, electrical and instrumentation (or MEICA) assets; below ground assets (pipes); and civil assets (mostly concrete structures). We carried out condition assessments for our civil assets and modelled this against criticality.

We then conducted a risk assessment against each asset class, which considered the sufficiency/stability of current investment levels, asset criticality, and the ability to defer any associated investment. This highlighted the priority asset classes for increased capital maintenance investment during AMP8, that is, those asset classes where current investment levels were deemed insufficient, where the assets were critical, and where our ability to defer any investment was limited.

In conclusion these priority areas are Civil Assets at Water and Wastewater Treatment Works, and Water Mains. This analysis and the case for additional investment in these asset classes is described in significantly more detail in our **asset health enhancement case** (NES35).

Our work on asset health is also helping to improve our maturity in this area for the longer term. Ofwat's **maturity assessment of asset management** (2021) showed that companies needed to improve in four areas for asset health:

- **Board engagement** on asset health and operational resilience. Our Board has taken an active role in setting our long-term direction, understanding and directing our analysis, and reviewing our enhancement cases for resilience at PR24. We have nominated an independent non-executive director to understand and review resilience in more detail, as well as discussing this with our Water Forum and responding to their challenge.
- **Links between short, medium, and long-term asset health trends.** Our strategic planning framework sets long-term objectives, and our condition assessments and asset intelligence work has allowed us to better understand the maintenance and replacement that will need to be done in the short-term and medium team to achieve these objectives.
- **Qualitative understanding of asset resilience risks from a wide range of future trends, such as climate change.** We have incorporated long-term trends and uncertainties into our resilience framework and aligned our approach to asset health with our long-term delivery strategy.
- **Improved asset information.** We have improved our asset intelligence and have used this to understand the investments that are needed now and in the future. We published the sector's first open data strategy and have committed to open data in this area to support cross-sector improvements.

Our own asset management maturity has improved since this assessment in 2021, and **our most recent assessment from 2023** (NES67) shows that we are now rated "competent" or "optimising" across most areas – with progress in maturity from a series of transformation programmes and activities. We will continue to improve towards a sector leading maturity on asset management.

7.2. ADAPTING TO CLIMATE CHANGE

Climate change is disrupting our climate and affecting weather patterns, causing serious challenges to the world's water supply. This increases the likelihood of climate hazards such as drought, flooding, extreme temperatures, and sea level risk in the UK.

As part of our climate change adaptation report in 2021, we assessed the key climate risks to understand how these would change by 2050 and 2090, to help us understand the impact for our communities in the North East and South East of England.

FIGURE 9: OUR INITIAL ASSESSMENT OF CLIMATE CHANGE RISKS

KEY CLIMATE RISK AND CLIMATE METRIC	RCP 4.5 - 2050S (ADAPT TO 2°C) HAZARD TREND	RCP 8.5 - 2090S (PREPARE FOR 4°C) HAZARD TREND
FLOODING		
Mean winter precipitation (% change) median projection	↑ 6%	↑ 21%
Local sea level rise (NE England)	0.07 to 0.23m	0.25 to 0.76m
Local sea level rise (SE England)	0.18 to 0.35m	0.46 to 0.97m
DROUGHT		
Mean summer precipitation change (% change) median projection (NE England)	↑ -10%	↑ -25%
Mean summer precipitation change (% change) median projection (SE England)	-15%	-37%
Hot spells	→ Minimal change	↑ 4 or more hot spells per year
EXTREME TEMPERATURES		
Daily maximum temperatures, 50 year return period (NE England)	→ Minimal change	↑ 32°C to 39°C
Daily maximum temperatures, 50 year return period (SE England)	→ Minimal change	↑ 37°C to 45°C

N.B. Hazard trend highlights which of our risks are most pressing, those with icon: ↑ indicates a high-priority area with the hazard increasing, the icon → indicates limited changes so are less pressing issues

Source: Northumbrian Water climate change adaptation report, 2021 – See that document for further source information

Our climate change adaption report, published in 2021, describes how our key climate risks are aligned with the independent assessment of UK Climate Risk (CCRA3), which carries out a comprehensive assessment of the risks and opportunities facing the UK from climate change.

We wanted to improve our understanding of the potential for future climate change to impact our infrastructure and operations – in particular, looking at the regional impacts and how risks might impact on our services now. We commissioned Mott Macdonald to carry out an independent study. This assessed the main climate hazards including long-term climate change and extreme weather events which impact the North East (water and wastewater services) and

South East (water only service) areas of operation and how their frequency and severity was likely to evolve in the future up to 2050. We commissioned this report as a preliminary risk assessment, to understand the risks that were most important in our areas and those which would not require further studies at the moment.

This work showed that:

- Droughts will intensify, particularly in the South East, where the increase in temperatures will be greater. However, annual rainfall is expected to decrease more in the North East. This will have an impact in reducing water available for our customers and the environment, but also in creating a soil moisture deficit (which could have an impact on flooding and underground assets).

- Heatwaves like the ones in summer 2018 will become more frequent and hotter, particularly in the South East.

- Floods will become significantly more extreme in the North East, associated with large scale storms. In the South East, summer convective rainfall will increase, potentially leading to localised flooding.

- Winter storms with associated high winds, which occurred during storms Desmond and Arwen will become more frequent and intense in the future.

- Sea level will continue to rise, in particular in the South East, and storm surges will be more frequent, although their intensity will probably remain the same.

- Freeze/thaw events and snow will decrease with global warming.

The report notes that weather events that have affected our Northumbrian Water systems during the recent past have led to significant extra costs so that we could respond, limit impacts during events, and carry out post-event repair and maintenance works to restore the performance of the system to pre-event levels.

The report identified the highest risks as:

- Two ‘very high’ risks in the North East (**flooding** and **wind**), with drought, deteriorating water quality, and soil moisture deficits as ‘high’ risk. All of these were forecast to increase over time.
- Three ‘very high’ risks in the South East (**drought**, **soil moisture deficit**, and **wind**), with heat and flooding as high risks.

Overall, the study concluded that climate change will result in a net increase in risk to our services, with hazard frequency/likelihood increasing in the majority of areas and only reducing in two areas – only one of which (cold and freeze/thaw) results in material consequences for our services.

In response to these highest risks our plan responds as follows:

- In relation to **Drought** our **Water Resources Management Plan (WRMP)** forecasts future population growth, demand, and water availability using our central assumptions about climate change – as well as looking at scenarios. Under any of the modelled scenarios, the investment included in our business plan would allow us to continue providing water (with adaptive pathways instead driven by short-term abstraction reductions). Reduced flow rates in rivers can also impact river water quality by increasing the concentration of phosphates and ammonia. One remedy for this is tighter consents for these parameters at STWs. This is addressed through the **WINEP** no deterioration driver and associated modelling.

- In relation to **Flooding** and **Wind** (which impacts our services primarily as power outages), our **enhancement case** (NES32) includes carefully targeted investment to improve the resilience of key assets to these increasing risks.

- In relation to **Heat**, increasing temperatures impact on the effectiveness of a number of our Water Treatment processes. We explore the highest priority areas along with investment proposals to mitigate this risk in our **process enhancements case** (NES24). During 2025-30 we will also assess the potential for higher temperatures to affect wastewater treatment processes.

- In relation to **Soil Moisture Deficits** we will carry out more work during 2025-30 to look at trends and potential impacts of this risk, especially on mains failures, and examine the extent to which any increased risk of failure might be offset by a reduction in winter pipe failures due to forecast reduced occurrences of freeze/thaw events. We do not include any enhancement expenditure in our business plan for this work, as this will be funded through base or through the innovation competition where appropriate. The sector will need to work together to do this, setting standards and sharing research to support a collective approach.

7.3. OUR PLANS – BASE AND ENHANCEMENT EXPENDITURE

Most of our investment to maintain and improve resilience during 2025-30 will come from our base expenditure. We describe our approach to base investment and enhancement investment in the sections below, with more detail about our enhancement investments for 2025-30 described in **A3 – Costs** (NES04) and in our enhancement cases.

Our enhancement cases are, in general, supporting a shift from ‘recovery’ to ‘resistance’ or ‘reliability’ (see the 4Rs of resilience described in Section 3). Recovery is often the least expensive option, and so is usually considered first when building resilience – but only if this is the most cost-beneficial option, and if customers and stakeholders are willing to tolerate temporary service failures.

Similarly, our asset health enhancement cases support a shift from ‘reactive’ to ‘proactive’ maintenance, reflecting the lower cost and increased benefits of proactive asset replacement (where this is relevant).

Both base and enhancement plans have been scoped carefully in order to balance the need for resilience improvement with the requirement to maintain affordability for customers.

7.3.1. Our plans – base expenditure overview

Our work on the resilience of our supply chain, financial resilience, affordable bills and inclusive services, and customer and stakeholder engagement do not need any enhancement expenditure – these will come from base expenditure. Similarly, we will continue to improve in the areas where we have not identified high priority risks (innovation, health and safety, business continuity, and inclusive and integrated teams).

Most of our programme for replacing sufficient assets to maintain asset health in the long-term will also be funded by base expenditure. However, we have demonstrated that in some areas these allowances – which are based on historic expenditure – are not sufficient to maintain asset health in the long-term. In those areas, we have put forward enhancement cases where it is cost-beneficial to carry out work now, and where customers support our approach to phasing.

Some of our programme for tackling climate change risks is also funded by base expenditure, but not where there are sharply increasing risks and new requirements for climate change adaptation.

We will fund most of our security requirements from base expenditure, except for where there are increases in requirements in 2025-30. This includes meeting existing requirements for physical security and meeting the existing target (CAF) for cyber security. Our enhancement expenditure includes only new sites designated for SEMD and meeting the new standard for enhanced cyber security.

7.3.2. Our enhancement expenditure for 2025-30

Some of our priorities for investment need enhancement expenditure. This relates to two of the priorities set out in previous sections:

- **Make sure that we have a programme of replacement assets sufficient to maintain asset health in the long-term.** In response to our ongoing work to assess the rate of deterioration/remaining life of our assets, it is important that we have a replacement programme which is costed and profiled for each investment period into the future, and fully funded in cost allowances at price reviews. We discuss this priority, and our approach to this for PR24, above and in our **asset health enhancement case** (NES35).

- **Review our approach in relation to identifying, mitigating, and managing long-term risks, especially in relation to climate change**. Our approach is described above and in enhancement cases **NES24** and **NES32**.

Our enhancement expenditure relates to these two priorities only – that is, maintaining **asset health** and adapting to **climate change**.

Our investments for 2025-30 for **asset health** are summarised below.

TABLE 4: KEY INVESTMENTS FOR ASSET HEALTH

Key investments	2025-30
Civil assets at water treatment works and water mains replacement (see our enhancement case, NES35)	£92m
Civil assets at wastewater treatment works (see our enhancement case, NES35)	£94m

Our investments for 2025-30 to **adapt for climate change** are summarised below.

TABLE 5: KEY INVESTMENTS FOR CLIMATE CHANGE ADAPTATION

Key investments	2025-30
Climate change resilience – Wastewater - Flooding and power (see our enhancement case, NES32)	£77m
Climate change resilience – Water – treatment process enhancements (see our enhancement case, NES24)	£81m
Climate change resilience – Water – flooding and power (see our enhancement case, NES32)	£12m

These are 'no regrets' investments with an immediate impact on reducing climate risk now.

In addition to these two priorities for investment, there are also some areas where we must meet **increasing national security and safety requirements** during 2025-30. These are:

- We must make sure that our security at treatment works and other sites meets national standards. The Security and Emergency Measures Direction 2022 (SEMD) sets new requirements for some of our sites. We have carried out security risk assessments at all of our sites which are designated as critical national infrastructure. We explain the new investment needed in 2025-30 to meet these new standards in our security enhancement case (NES23).
- We must meet a new target for resilience against moderate capability attacks ('enhanced cyber assessment framework'), as required by DWI in their letter of 23 June 2023 with treatment in the business plan tables confirmed by Ofwat on 5 July 2023. We explain the investment needed in 2025-30 to meet these new standards in our security enhancement case (NES23).
- We must maintain and operate our raw water reservoirs in line with the requirements of the Reservoir Safety Act. Changes in the guidance for assessment of reservoir drawdown capacity, issues by Defra in 2017, mean that we

need to invest in ten of our reservoirs during 2025-30 to meet these new standards. We explain this investment needed in 2025-30 in our **reservoir drawdown enhancement case** (NES22).

These requirements will be complete by 2030, and so no further investment is needed after 2030. However, these standards have increased over time and could increase further before we plan our investments again for 2030-35, or alternatively, other standards for resilience could be introduced or could increase. In our long-term strategy, we have assumed that investment will continue to be needed at this level in future. This could be to further improve security or reservoir drawdown capacity or could be for other unknown requirements. This assumption does not affect investments in 2025-30.

TABLE 6: KEY INVESTMENTS FOR SECURITY AND CYBER RESILIENCE

Key investments	2025-30
Security at water and wastewater treatment works and cyber security (**enhancement case** NES23)	£39m
Reservoir drawdown (**enhancement case** NES22)	£81m