

SCENARIOS & STRATEGIES

2050 Scenarios

Update – July 2022

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1. INTRODUCTION



Why scenarios?

Resilience for the long-term is critical across the water sector. Northumbrian Water and Essex & Suffolk Water has proven itself to be leading this agenda in many ways. To continue a journey to enhance resilience, help manage future uncertainty and shape long-term decisions across the business, Arup and KPMG were appointed to develop future scenarios. The scenarios articulated within this process incorporate a holistic range of factors impacting Northumbrian Water and Essex & Suffolk Water and are both highly relevant and uncertain. The result are scenarios which can support a wide range of future strategic planning activities, including the long-term business strategy and PR24 planning.

Planning often accounts for only one most probable future, defined by the limited information available. The information available today about the future is usually based on forecasting existing trends combined with some 'weak signals' that indicate how the future may evolve. The further into the future, the less data and evidence exists, and therefore future becomes more and more uncertain. At the same time planning becomes less tactical and more strategic.

Scenarios can be used at a more tactical or strategic level, but the timeframe signifies at what level of planning the scenarios will be most valuable.

Scenarios are plausible yet extreme situations that capture a range of factors that impact Northumbrian Water and Essex & Suffolk Water. They explore how multiple trends might evolve and interact over time across the northeast and east of England; providing a structured framework to help a user think about and manage future uncertainty.

Five scenarios have been selected as the most coherent (e.g., where different key factor projections are highly compatible) and diverse.

Ofwat Expectations

In its [final guidance on long-term delivery strategies](#), Ofwat has set out expectations regarding scenario testing. These are summarised in the table opposite, alongside how we have aligned our approach with these expectations.

The scenario methodology selected, Multi-factor Analysis, enables all of the expectations for scenario testing to be met. Details on the methodology are articulated in further detail in the [following section](#).

What Ofwat is asking for	How our approach aligns with Ofwat's expectations
<p>Use common reference scenarios: climate change, technology, demand, and abstraction reductions</p>	<p>We have used the highly impactful and uncertain drivers climate change, technology, demand, and environmental ambition as key factors driving change in the scenarios.</p>
<p>Consider a wide range of possible impacts of the high and low common reference scenarios.</p>	<p>The scenario narratives explore the impacts of the high and low common reference scenarios.</p>
<p>Can additionally present the results of combining two or more common reference scenarios, if they consider it helps to demonstrate that the strategy is appropriate given future uncertainties.</p>	<p>The methodology selected enables climate change, technology, demand, and environmental ambition to be considered together in each scenario reflecting the complex systemic nature of NWL's future operating context.</p>
<p>Use wider scenario planning, as deemed necessary, to test against any relevant factors not specified in the common reference scenarios, such as company-specific or localised factors.</p>	<p>The scenario methodology selected allows for multiple key factors to be considered including company-specific or localised factors, as well as climate change, technology, demand, and environmental ambition.</p>

2 . METHODOLOGY AND SCENARIO DEVELOPMENT

Our Approach To Scenario Planning

There are various robust methodologies to develop scenarios (three of the main methodologies are highlighted opposite, two of these are described in more detail in the [Government Foresight toolkit](#)). Each has its own merits, and the choice of the approach depends on their applicability to the operating context and their desired use.

We have selected the methodology Multi-Factor Analysis as it allows multiple key factors to be considered in a structured way. It is highly suitable to meet Ofwat's expectations as we can consider climate change, technology, demand, and environmental ambition as key factors driving change, as well local and company specific factors together in each scenario. The structured nature of the methodology creates clarity transparency to demonstrate Ofwat's expectations have been met. Another benefit of Multi-Factor Analysis is that systematic updates of the different methodological elements can be made in response to new evidence and analysis. This allows the scenarios to be refreshed and refined as additional insight is gathered.

Deductive and Inductive Analysis are less suitable to this context. Deductive analysis only explores two highly impactful and uncertain factors, which would preclude consideration of all of Ofwat's scenarios in tandem. Inductive analysis explores multiple drivers of change however the lack of structure can lead to key factors being less clear and transparent. This can also result in less effective discussion, collaboration and stakeholder engagement in both the process of scenario development and their use.

Multi-factor Analysis (also known as Morphological Analysis)

This is a sophisticated approach to scenario planning that allows exploration of multiple critical uncertainties to form an appropriate number of scenarios. A structured box shows a range of projections for each area of critical uncertainty, called key factors. Plausible, internally consistent combinations of projections are then identified for each key factor. These are reviewed to determine which set of key factors and projections point to a coherent future state or vision. Once identified, detailed narratives for each scenario are developed.

Two by Two Analysis

Deductive scenario planning uses a structured framework to explore two highly impactful, highly uncertain drivers. The two axes, often referred to as "critical uncertainties", form a two by two matrix with four quadrants. Each quadrant represents a contrasting but credible future scenario.

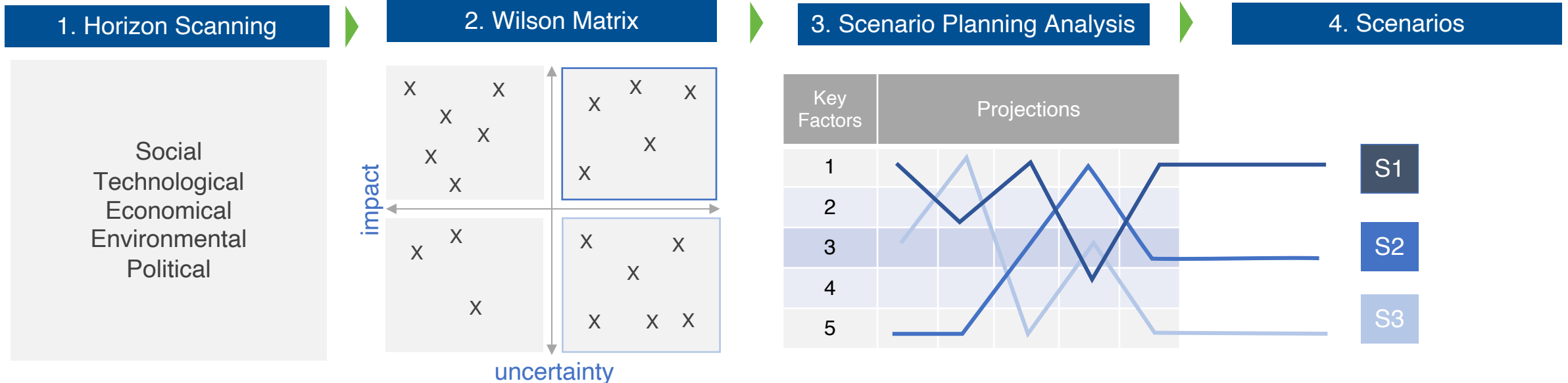
Inductive Analysis

Inductive scenario planning explores drivers of change in an unstructured way to formulate a series of narratives. This is typically performed collaboratively by an expert group, bringing together multiple perspectives to identify and build a compelling set of scenarios.

Scenario Development Overview

Scenarios are plausible narratives that describe the future of a given focal area or geography, in this case the water, wastewater and related services in the North East and Essex and Suffolk.

The scenario methodology used explores how multiple drivers of change might evolve and interact over time; providing a structured framework to help a user think about and manage future uncertainty. The methodology can be summarised in four steps.



Scenario Development Overview

1. Horizon Scanning

The first step is to identify key trends impacting the future operating context across each of the STEEP categories (see appendix 3 for more detail). This included:

- **Literature review:** 60+ documents have been reviewed to capture trends, developments, opportunities, benefits, risks, challenges and uncertainties. The document review included Northumbrian Water and Essex & Suffolk Water, Arup and other external reports.
- **Interviews:** Interviews were conducted with Northumbrian Water and Essex & Suffolk Water, Arup and KPMG experts. The results have been analysed to inform the trends workshop and input into the following scenario development.
- **Trend workshop:** A workshop was undertaken with key stakeholders within Northumbrian Water and Essex & Suffolk Water to identify the most impactful and uncertain trends on water, wastewater and related services in the North East and Essex and Suffolk - looking out to 2050.

2. Wilson Matrix

The second step is an assessment of impact and uncertainty, using the following definitions to form a Wilson Matrix.

- **Impact:** This is the potential impact that the trend might have on Northumbrian Water and Essex & Suffolk Water's business. This is based on a review impact on of future performance (including on PCs) – this could either be a major impact on a single PC or a widespread impact across multiple PCs.
- **Uncertainty:** This represents the level of uncertainty on whether the trend will mature and scale over time and the level of uncertainty of the types of impact or effect the trend will have. For example, whilst we know that climate change is happening, there is uncertainty as to the scale of the impact that it will have on Northumbrian Water and Essex & Suffolk Water.

3. Scenario Planning Analysis

The third step is to develop a scenario planning box showing a range of projections for each area of critical uncertainty, called key factors. Plausible, internally consistent combinations of projections are then identified for each key factor. These are reviewed to determine which set of key factors and projections point to a coherent future state or vision.

4. Scenarios

Once a coherent set of projections are identified, detailed narratives for each scenario are developed. In this case, we also developed the following components to support the narrative:

- **Metrics:** these metrics provide additional detail to quickly understand the future state being described.
- **Key factors:** list of key factors and associated projections out to 2050.
- **Event timeline:** the timeline brings together non-fictional events that have already occurred and support the narrative, as well as fictional events up to 2100.
- **Customer profiles:** personas that explore how life might change for customers in the future.

Customer Profiles

Acorn data provides a segmentation of the UK population based on the demographic, social and lifestyle attributes of residents. It segments households, postcodes and neighbourhoods into 6 categories, 18 groups and 62 types. Each attribute is indexed against the UK wide base to show under or over representation in served areas in the North East, Essex and Suffolk.

The overview of those living in Northumbrian Water served postcodes shows that lone parent households are more common and 37.7% of the profile live in households with an income of less than £20,000.

This analysis takes five key customer groups with highest volume that are considered to be core and opportunity groups for Northumbrian Water.

Steady Neighbourhoods

Index: 127

Core customers
3: Comfortable Communities

John lives with his wife and two children in their three bedroom terrace home in Gosforth, Newcastle. John has an average income, working in IT support and his wife works in sales. John is currently working from home but his company plans for him to return at least part time.

Modest Means

Index: 114

Core customers
4: Financially Stretched

Chloe lives in Ashington, a town now seeing economic decline, with a reduction in public services. Chloe works in administration at the local GP practice. She lives in a terrace house she inherited from her grandmother with a lodger.

Striving Families

Index: 111

Core customers
4: Financially Stretched

Asha and her partner live with their 3 year old in a rental property on a post war estates in Gateshead. Asha was furloughed from her job in hospitality during the Covid-19 pandemic before being made redundant. Her partner works is self employed as a delivery driver for a food delivery service.

Executive Wealth

Index: 111

Core customers
1: Affluent Achievers

Mary works in management for a major food retailer in Brentwood, Essex. Mary joined the company on their graduate scheme before the 2008 crash and has worked her way to a regional management position. She lives in a suburban detached home with her partner and two cats.

Mature Money

Index 89

Opportunity customers
1: Affluent Achievers

Richard and his wife moved to a detached house in Southwold after his adult children left home and he retired. Richard frequently travels abroad and is a prominent member of the local golf club.

Trends and key factors

We identified a long list of trends and from these identified key factors, these are set out to the right.

Some trends will be linear and grow incrementally over time. We also recognise that the world will experience some of these trends as “shock events”. For example, climate change will often not be felt as a gradual change over time, but rather as more extreme weather events, such as storms or floods.

Key factors are critical uncertainties, highly impactful and highly uncertain trends. The scenarios explore the uncertainty associated with these key factors.

The trends have been identified through a literature review of relevant information, as well as interviews with Northumbrian Water and Essex & Suffolk Water, KPMG and Arup experts. The trends include social, technological, environmental, economic and political/legal (STEEP) domains, and consider relevant trends at global, national and local levels. The trends have been organised by four themes, which were used to structure a workshop to select the most impactful.

Further details on these trends can be found in the [Appendix](#) and the trends report.

Customers, people and communities

- Affordability and vulnerability
- Future of work
- Population growth / demand
- Customer expectations
- Public/customer attitudes to sustainability

Environment and climate

- Climate change impacts including weather volatility
- UK carbon target
- Environmental legislation and ambition

Infrastructure and technology

- Green and blue infrastructure
- National infrastructure investment

Market and regulation

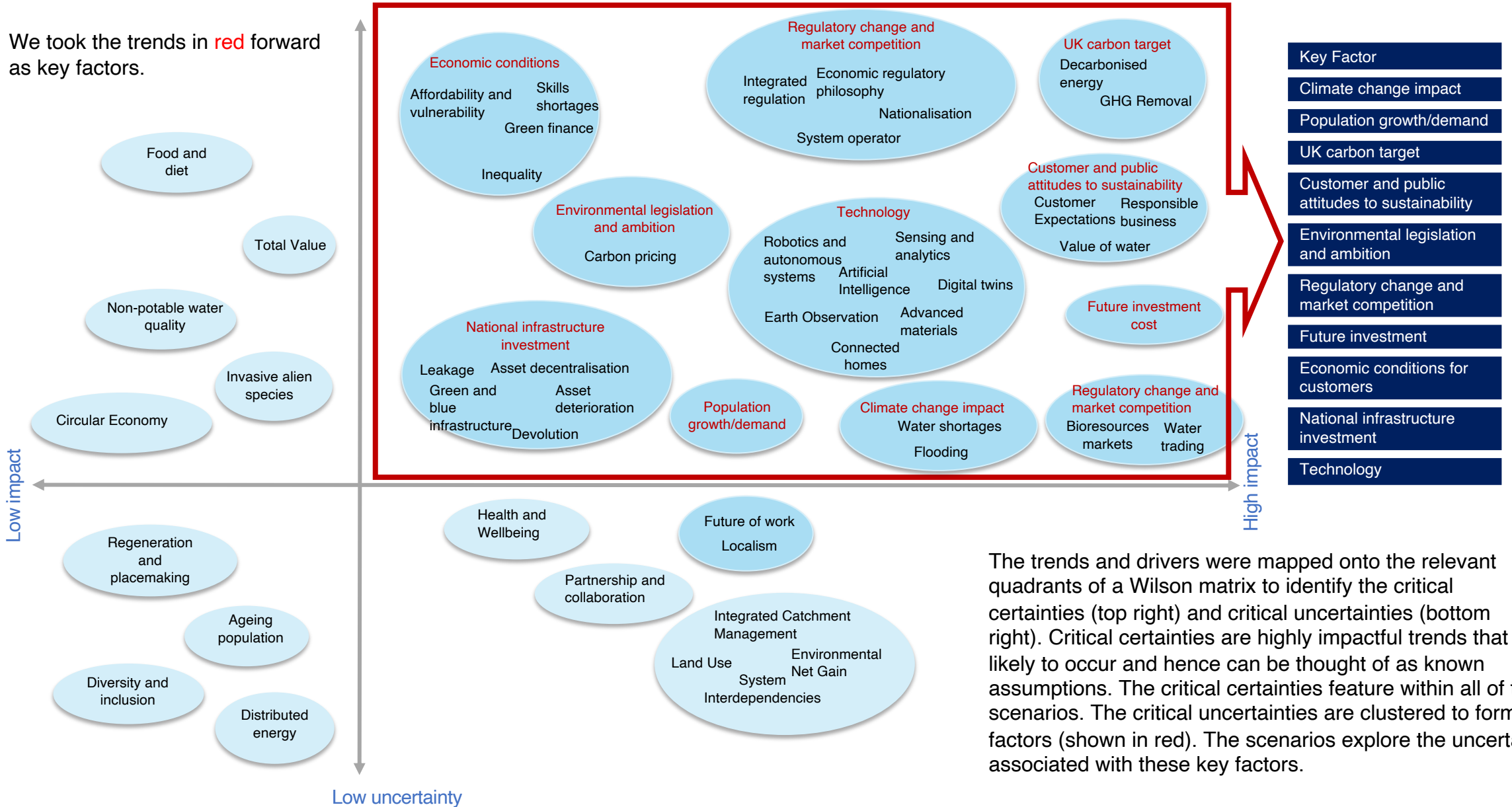
- Regulatory change and market competition
- Integrated regulation
- Economic cycles
- Future investment cost
- Devolution

Summary of trends and key factors.

Wilson Matrix

High uncertainty

We took the trends in red forward as key factors.



The trends and drivers were mapped onto the relevant quadrants of a Wilson matrix to identify the critical certainties (top right) and critical uncertainties (bottom right). Critical certainties are highly impactful trends that more likely to occur and hence can be thought of as known assumptions. The critical certainties feature within all of the scenarios. The critical uncertainties are clustered to form key factors (shown in red). The scenarios explore the uncertainty associated with these key factors.

Key Factor Definitions

Key Factor	Definition	Ofwat common scenario?
Climate change impact	The expected impacts of climate change, such as hotter drier summers and warmer wetter winters, on the water industry. This will also include an increasing frequency of one-off extreme weather events, such as storms or flood events.	Yes
Population growth/demand	The expected growth of the population served, coupled with other changes that affect demand, such as building regulations.	Yes
UK carbon target	The UK's target to achieve net zero carbon emissions by 2050 under the Climate Act (2008).	
Customer and public attitudes to sustainability	The change in customer and societal awareness to sustainability and climate change in relation to water and wastewater services	
Future of work	Rate of uptake of home working, flexible working and co-working.	
Environmental legislation and ambition	Changing environmental legislation, and its influence on driving investment needs in the water industry. This includes the EA's regulation on abstraction licensing	Yes (partial-abstraction only)
Regulatory change and market competition	How economic regulation changes with regards to market competition and customer-focus.	
Future investment	The change in the cost of debt and its impact on capital investment for the country as a whole as well as the availability of international investment and a fair return.	
Economic conditions for customers	The fluctuation of the economy between periods of expansion (growth) and contraction (recession) will result in more or less challenging circumstances for customers to pay for bills and other services.	
National infrastructure investment	Investment in maintaining an ageing asset base vs a shift towards solutions that actively improve the health of ecosystems and habitats.	
Technology	Speed of uptake and level of integration of new technologies such as automation in the water industry and digital representation of a real-world entity.	Yes

3. INTRODUCING THE SCENARIOS

The background features a gradient from dark blue on the left to light green on the right. A large, stylized white shape, resembling a wing or a leaf, is positioned in the lower right quadrant. This shape is composed of several parallel lines that create a sense of depth and movement. The overall aesthetic is clean and modern.

Guidelines for getting the most from scenario testing

Before looking at the scenarios, it is important to understand how best to use them going forward.

Background

The scenarios on the following slides are five out of many (if not infinite) different plausible futures that we may face looking towards 2050. There will be many other plausible combinations of the key factors that we have not developed into scenarios. The five scenarios have been chosen to cover what we believe to be important future states that Northumbrian Water and Essex & Suffolk Water should stress test long-term strategies against. This will help ensure plans are resilient and robust to enable the best possible outcomes for both customers and the business as we move towards 2050.

How to use the scenarios

With the help of the narratives and the timelines for each scenario, try to picture living in that environment, considering the attitudes, values and vulnerabilities of customers; the state of the economy and regulatory constraints; and the advancements and role of technology in the day-to-day lives of customers and the business.

Some questions to ask while reading the scenarios:

- What are the risks and opportunities that each scenario presents to Northumbrian Water and Essex & Suffolk Water?
- What level of investment will be needed to adapt to trends identified in each scenario?
- What impacts will each scenario have on the vulnerabilities and attitudes of customers?
- Where are there gaps that need addressing in the strategies currently in place to ensure Northumbrian Water and Essex & Suffolk Water can operate in these different futures?
- What needs to change at Northumbrian Water and Essex & Suffolk Water as we move into one or more of these uncertain futures?
- Where can Northumbrian Water and Essex & Suffolk Water add value to customers and wider society under these scenarios?
- What are the tipping points as we move towards any of these scenarios that will result in a need for a different strategy or investment?

Scenario 1

Customer and public attitudes to sustainability have become increasingly important

- The UK follows a **low climate change impact projections (RCP 2.6)** and sees limited changes in weather volatility. While population growth continues steadily, sustainability is becoming more important to customers and the wider public so so growth is slow with low demand.
- The UK is **ahead on carbon targets**, has strengthened environmental legislation and there is widespread use of green and blue infra and rapid uptake of technology across the UK and across the water sector **due to public pressures**.
- Working trends involve some WFH across the UK with urbanisation in progress. NWL will benefit from **stable economic conditions** in the NE and SE. From a regulatory perspective, water companies will have a stronger mandate, driven by public preferences. However, greater retail competition may limit the ability to leverage NWL brand with the local community/regulator (i.e. if customers switch away from NWL, the link between the company and the customer breaks).
- **Future investment costs remains broadly the same.**



RCP 2.6 pathway and minimised extreme weather



Constant future cost of investment



Increased importance of sustainability to customers



Constant economic conditions for customers



Rapid technology uptake and high levels of innovation

Scenario 2

Lack of effective climate action has negatively effected weather conditions in the NE

- There is 4 degree warming by 2100 and the UK sees **increased weather volatility** with more frequent and more extreme storms and droughts
- Businesses and legislators paid lip service to improving environmental legislation but this was later shown to be ‘greenwashing’ and has not mitigated the effects of climate change.
- There is greater regulatory intervention later in period after it becomes apparent that policy changes were not implemented and more sustainable operations were not progressed, including lower uptake of green and blue infrastructure, and less of a focus on asset health.
- Rapid population growth and **deteriorating economic conditions**. There is little change to the future of work, although urbanisation is continuing.
- The UK is behind on its carbon targets as people believed the UK was making changes, but this was not in fact seen.
- There is a reliance on conventional solutions with a **slow uptake of new technologies** seen across the UK and within the water sector.
- The **cost of future investment has gone up**, largely due to greater regulatory burden, while retail market competition hasn’t changed.



RCP 8.5 pathway and very extreme weather



Higher future cost of investment



Decreased importance of sustainability to customers



Challenging economic conditions for customers



Slow technology uptake and low levels of innovation

Scenario 3

Customers feel the effects of the rising cost of living and struggle to afford services

- There is a challenging economic conditions in the North East region between 2020-40, with a rising cost of living and widening gap in equality across the UK. The ‘levelling-up’ agenda has not had the desired impact in the North East and more customers struggle to pay their bills. Without a strong government focus on regional spending, Northumbrian Water has struggled to acquire funding for projects across their region.
- Across the UK, in the first part of this period, carbon targets are missed, as targeting cost of living and economic conditions is prioritised. In the later stages of this period (2040-2050) the UK catches up on its carbon commitments and public sentiment still favours more sustainable development.
- Greater strategic and operational state oversight are the most pressing changes for NWL. As economic conditions become more challenging the government responds by increasing micro management in the water sector in an attempt to curtail spending and lower costs.
- The government’s sustainability push leads to deployment of green blue infrastructure, albeit later in the period.
- Early focus on rapid technology deployment did not deliver all the expected benefits



RCP 4.5 pathway and extreme weather



Higher future cost of investment



Increased importance of sustainability to customers



Challenging economic conditions for customers



Rapid technology uptake and high levels of innovation

Scenario 4

The NE and SE regions are an attractive prospect for investment.

- The North and South East of England benefit from improved macroeconomic conditions, making it an attractive destination for foreign investment.
- Customers see the benefits of the influx of investment, with bills becoming more affordable while service improves.
- There are rapidly increasing levels of technology use due to the perceived economic benefits.
- The world is on a moderate climate change impact projection but the UK is behind on carbon targets due to the focus on economic growth.
- Companies are driven primarily by shareholder preferences, primarily on providing high rates of return.
- The future of work will involve some degree of working at home and urbanisation.
- There is a switch to more market competition, especially around retail.
- The government wanted to prioritise investment and so relaxed water sector regulation. This allowed the sector to have more control over long-term planning.
- There is less political and regulatory challenge for the water sector, which has driven investment to record levels.



RCP 4.5 pathway and extreme weather



Decreased future cost of investment



Decreased importance of sustainability to customers



Improved economic conditions for customers



Rapid technology uptake and high levels of innovation

Scenario 5

Technology and innovation to improve sustainability and asset health

- Market freedom drives innovation and there are rapidly increased levels of technology use due to the perceived economic benefits.
- The drive for innovation and technology put a renewed focus on green-blue infrastructure and other new technologies.
- Government funding/incentives resulted in widespread systems approach to infrastructure investment ahead of conventional solutions.
- Asset health has been a long term priority for water companies.
- The world is on a moderate climate change impact projection and the UK is ahead on carbon targets due to investment in climate change related technology and pressure from the public to act sustainably
- The future of work will involve some degree of working at home and urbanisation
- There is less political/regulatory challenge on Northumbrian Water and Essex & Suffolk Water rates of return, which could be advantageous to Northumbrian Water and Essex & Suffolk Water if it operates efficiently.
- Economic conditions are improved in the North East and Essex and Suffolk.
- The most pressing changes for Northumbrian Water and Essex & Suffolk Water involve a switch to more market competition, especially around retail. Greater retail competition may limit the ability to leverage Northumbrian Water and Essex & Suffolk Water brand with the local community/regulator.



RCP 4.5 pathway and extreme weather



Constant future cost of investment



Increased importance of sustainability to customers



Constant economic conditions for customers



Rapid technology uptake and high levels of innovation

Scenarios: at a glance

Metric	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
UKCP18 Pathway	RCP 2.6	RCP 8.5	RCP 4.5	RCP 4.5	RCP 4.5
Global Temp Rise (2100)	1.6° C	4.3° C	2.4° C	2.4° C	2.4° C
UK Net Zero Carbon	2048	Not met	Expected 2057	Expected 2052	2048
Water Sector Net Zero Carbon	2030 (scope 1 & 2), 2047 (scope 3)	Not met	2030 (scope 1 & 2), 2047 (scope 3)	2030 (scope 1 & 2), 2047 (scope 3)	2030 (scope 1 & 2), 2047 (scope 3)
Customer and public attitudes to sustainability	↑ Increased importance	↓ Decreased importance	↑ Increased importance	↓ Decreased importance	↑ Increased importance
Technology	↑ Rapid uptake	↓ Slow uptake	↑ Rapid uptake	↑ Rapid uptake	↑ Rapid uptake
Future investment cost	→ Constant	↑ Higher	↑ Increased	↓ Decreased	→ Constant
Economic conditions for customers	→ Constant	↓ Challenging	↓ Challenging	↑ Improved	→ Constant
Number Water Customers In 2050	→ 2,618,834	↑ 2,930,459	↑ 2,930,459	→ 2,618,834	→ 2,618,834
Number Sewerage Customers in 2050	→ 2,649,989	↑ 2,951,294	↑ 2,951,294	→ 2,649,989	→ 2,649,989

Customer Personas

In order to support our understanding of how the future might change, we have developed five customer personas. John, Chloe, Asha, Mary and Richard represent the spread of Northumbrian Water and Essex & Suffolk Water's customer base now across the North East, Essex and Suffolk.

The descriptions below set out how their lives might feel now. In each of the four scenarios, we explore how their lives could be different if they were the same age in 2050.



John (Middle aged, Newcastle)

John lives with his wife and two children in their three bedroom terrace home in Gosforth, Newcastle. John has an average income, working in IT support and his wife works in sales. John is currently working from home but his company plans for him to return at least part time.



Chloe (Young adult, Ashington)

Chloe lives in Ashington, a town now seeing economic decline, with a reduction in public services. Chloe works in administration at the local GP practice. She lives in a terraced house she inherited from her grandmother with a lodger.



Asha (Early 30s, Gateshead)

Asha and her partner live with their 3 year old in a rental property on a post war estates in Gateshead. Asha was furloughed from her job in hospitality during the Covid-19 pandemic before being made redundant. Her partner is self employed as a delivery driver for a food delivery service.



Mary (Mid 40s, Brentwood)

Mary works in management for a major food retailer in Brentwood, Essex. Mary joined the company on their graduate scheme before the 2008 crash and has worked her way to a regional management position. She lives in a suburban detached home with her partner and two cats.



Richard (Retired, Southwold)

Richard and his wife moved to a detached house in Southwold after their adult children left home and he retired. Richard frequently travels abroad where travel restrictions allow and is a prominent member of the local golf club.

4. SCENARIO 1

Customer and public attitudes to sustainability have become increasingly important.

The UK is on a climate change pathway with GHG emissions peaking before 2040. Extreme weather is minimised and global temperatures are expected to stay well below 2°C by the end of the century, despite a growing population. This is because on the whole, attitudes to sustainability have become increasingly important to citizens. Customers are placing a higher value on environmental protection because of successful global awareness raising campaigns to mitigate the impact on climate change. Subsequently, the UK managed to exceed carbon targets by following a green recovery route after the Covid-19 pandemic.

The government adopted stricter environmental legislation, such as tighter carbon budgets and higher biodiversity net gain targets through a revised environment bill following COP26. This encouraged widespread retrofit of infrastructure in place of new capital delivery and the widespread use of green and blue infrastructure.

Considerable climate finance investment was put into technology innovation which was rapidly taken up across the UK and across the water sector. The workplace continues to involve some working from home and adopts smarter, flexible ways for working to accommodate for the modern way of life across the country for organisations that are able to

efficiently operate that way. Urbanisation continues across the UK although it is constrained by regulation as the government encourages sustainability-focused decision making as the country develops.

Economic conditions are constant later in period because the UK has reached a stable point in the green transition and so steady growth is seen as businesses/people are adjusted to changes in legislation and behaviour. Earlier in the period there was an improvement in economic conditions due to the influx of investment and the creation of new jobs, but this has levelled off by 2050. From a regulatory perspective, water companies have a stronger mandate, driven by public preferences. However, greater retail competition is limiting the ability to leverage Northumbrian Water and Essex & Suffolk Water brand with the local community, as many customers are choosing their water company based on cost and environmental performance, rather than on geography.

Key Projections



RCP 2.6 pathway and minimised extreme weather events



Increased importance of sustainability to customers



Rapid technology uptake and high levels of innovation



No change in future cost of investment



Stable economic conditions for customers

Scenario 1

Customer and public attitudes to sustainability have become increasingly important.

Key Factor	Projection
Climate change impact	Climate pathway RCP 2.6 is realised. Climate change impacts and weather volatility is minimised.
Customer and public attitudes to sustainability	There is increased customer and societal awareness of sustainability and climate change in relation to water and wastewater services.
Technology	There is a rapid increase in technological innovation and the deployment of new technologies in the water industry.
Future investment cost	There is minimal change in the cost of debt impacting on capital investment for the UK. There is minimal change in the availability of international investment and a fair return.
Economic conditions for customers	There are stable economic conditions and water is affordable for customers.

Timeline



Scenario 1

Customer and public attitudes to sustainability are the primary driver in this future.



John (Newcastle)

John continues to work from home in IT three days a week. He was instrumental in setting up a community group to take up government grants for green development – which so far has resulted in swale installation at his children’s school as well as solar panels on the new community centre. John regularly contacts his water company to take more action on climate change and attends engagement forums to raise issues he feels strongly about. John swapped his car for an EV and has a home charging port set up.



Chloe (Ashington)

Chloe found a job working for one of the new battery storage companies that has been established in the North East, and she commutes to work 2 days a week on renewable energy fuelled public transport. Chloe initially found the new insulation and boiler requirements for her aging terrace house difficult to navigate but was able to contact a local start-up company to have the work completed. She has also installed a water butt to try and improve her water consumption.



Asha (Gateshead)

After Asha lost her job in the Covid pandemic, money was tight in her household. However, her partner was able to swap his job delivering parcels to work as an installer for battery storage. They recently moved from their post-war estate to a family friendly suburban area where they managed to buy their first home. The home is carbon neutral, as per new UK guidelines. Asha is very conscious of how much water her family consumes and tries to make small changes such as shorter shower times to improve this.



Richard (Southwold)

Richard still lives in his detached house but travels less frequently, due to the increased taxation placed on leisure travel. He has taken advantage of tax breaks; installing a ground source heat pump for his home, and trading his diesel SUV for a hybrid car. He has had his garden redesigned, including making it less water intensive in use.



Mary (Brentwood)

Mary helped pioneer sustainable initiatives at her employer – including phasing in the use of electric vehicles for their retail fleet. Mary lives in a large detached house in a suburban area, and along with other neighbours, Mary took advantage of a grant to install solar panels on her roof. Mary and her partner are making a concerted effort to ‘buy local’ when it comes to food and they are making concerted efforts to reduce water use, particularly in the garden.

5. SCENARIO 2

Lack of effective climate action has negatively effected weather conditions in the NE

Early in this period many policies were put in place aimed at mitigating the effects of climate change but these were found later to be ineffectual with 'greenwashing' widespread across businesses. Lack of meaningful action has resulted in a pathway heading toward 4 °C warming by the end of the century. The North East and Essex and Suffolk regions have seen significant changes in weather with increased rainfall as well as longer periods of drought in Essex and Suffolk.

Rapid growth is seen as at the start of this period as the government prioritised economic recovery from the Covid-19 pandemic. This continued despite the later period seeing challenging economic conditions, growth has not yet caught up but is anticipated to decline. There is high demand as customers do not prioritise water resource management. Public messaging implied that climate change was managed in the UK and little personal action was needed by customers. This messaging has led to almost no value being placed on the environment and sustainability with the population has slipped down the Maslow Hierarchy of needs.

Economic pressures are deemed to be of higher immediate importance to customers and government. The disposable income of customers has decreased substantially and paying for shelter and food are a priority. Environmental legislation decreased in an attempt to jumpstart the economy following Covid-19, meaning the UK has underperformed on its 2050 carbon targets.

The decrease in environmental legislation was accompanied by greater regulatory intervention, focussing on financial outputs and superficial 'green action' rather than true environmental outcomes. This impedes the response of water companies to climate change, including lower uptake of green and blue infrastructure and less focus on asset health. The industry is also mainly still focussed on producing conventional solutions with a slow uptake of new technologies seen across the UK and within the water sector because the cost of investment has gone up, largely due to greater regulatory burden. No change in market competition means that innovation hasn't been driven across the industry. There has also been little change to the workplace, with minimal flexibility of work despite continued urbanisation.

Key Projections



RCP 8.5 pathway and very extreme weather



Decreased importance of sustainability to customers



Slow technology uptake and low levels of innovation



Higher future cost of investment



Challenging economic conditions for customers

Scenario 2

Lack of effective climate action has negatively effected weather conditions in the NE

Key Factor	Projection
Climate change impact	Climate pathway RCP 8.5 is realised. Climate change impacts are severe including extreme weather volatility.
Customer and public attitudes to sustainability	There is decreased customer and societal awareness of sustainability and climate change in relation to water and wastewater services.
Technology	There is a low levels of technological innovation and deployment of new technologies in the water industry.
Future investment cost	There is a higher cost of debt impacting capital investment in the UK. There is reduced availability of international investment and poorer returns.
Economic conditions for customers	There are challenging economic conditions and issues of affordability for customers.

Timeline

- 
- 2022: Rejection of the new environment bill post-Covid-19 and no substantial decisions following COP26.
 - 2023: Budget announcement focuses on growing the economy, any sustainable finance grants dissolved
 - 2025: Water prices surge, and customers become more stressed about paying bills
 - 2030: UK water industry fails to meets Net Zero
 - 2040: Severe droughts occur every summer in the UK as climate change is exacerbated.
 - 2045: Major storm results in loss of service to 1,000,000 customers for over a week
 - 2050: UK fails to meet Net Zero
 - 2100: Sea level rise has put large areas of the SE region are underwater due and caused rapid coastal erosion in the north east

Scenario 2

Lack of effective climate action has negatively effected weather conditions in the NE



John (Newcastle)

While John's family previously had a comfortable safety net, the increase in cost of living and the loss of his wife's job, mean the family are feeling the pinch. John still worries about the environment, and feels saddened when he takes the family for a day out at Kielder Waterside park and sees how low the water levels are, and the lack of wildlife in local streams. However, compared to his economic woes, this does not feel like his main priority.



Asha (Gateshead)

Asha and her partner have felt the pinch as the climate crisis has accelerated. They have struggled to continue to pay their household bills and have had to get rid of their car as fuel prices rose too high. The family worries about the threat of water rationing in future as they will not be able to afford to supplement the provided supply with private tankering, as some wealthier residents are planning.



Mary (Brentwood)

Mary has mainly noticed the effects of the climate changing through water shortages in her area, which in a particularly hot spell one summer included a tanker supply for her suburb. In her role in food retail, Mary has seen the impact of rising temperatures on the availability and prices of goods, most notably fresh fruit and vegetables.



Chloe (Ashington)

Scarcity of resources as well as declining economic prosperity has exacerbated the issues in Chloe's ex-coal mining town. Unemployment has grown, although Chloe is still working in her local GP practice. Government and local authority cuts mean that she is worried about her future livelihood. Decreased environmental legislation has also caused issues with the old mines, with localised contamination of waterways and risk of tunnel collapse worrying local residents.



Richard (Southwold)

Richard has not felt the economic impacts of the climate crisis gathering, but his lifestyle has been affected. Rising water prices and water shortages have led to a permanent hosepipe ban for gardens and at the golf course. He has also moved his annual August trip to Spain to early April after soaring temperatures of 50 degrees led to hospitalisation due to heat stroke.

6. SCENARIO 3

Customers feel the effects of the rising cost of living and struggle to afford services

Following the Covid-19 pandemic, the UK pushed to 'build back better' and attempted to save the economy by prioritising non-'green' recovery. Over the following decade this led to higher costs of living, inflation and economic stagnation and the UK fell significantly behind on its commitments post COP26. In the North East region in particular, the inequality gap with the rest of the UK widened, leaving more customers struggling to pay their bills. For Northumbrian Water, in the initial years, it was more difficult to secure funding for large capital projects and non-traditional programmes.

On a global stage, the UK was left behind by other nations in the G8 group who prioritised climate change and benefited from the resulting 'green' jobs boom. Midway through the period, there was a shift in political focus as the UK was perceived both at home and abroad to be failing on climate change. The government implemented stronger climate change legislation. Northumbrian Water and Essex and Suffolk Water must now compete for funding against other Government priorities and the wider Government cost of borrowing (assumed to be lower than private finance). In the later stages of this period (2040-2050) the UK catches up to its agreed carbon commitments and public sentiment continues to favour more sustainable development, unlocking more funds for innovative green-blue projects.

Although population growth continues to increase rapidly, the UK continues on its current climate change impact projection of a 2 degree warming due to increased environmental legislation towards 2050.

Working patterns in the UK continued as a mix of at-home working and office use after the Covid-19 pandemic, with increased unemployment and rising costs of living for workers felt in the 2020s and 30s as the entire country went through a period of economic decline. The government's sustainability push leads to deployment of green blue infrastructure, albeit with delays, as the early focus was on rapid technology deployment alone, which did not deliver all the expected benefits earlier in the period.

Key Projections



RCP 4.5 pathway and extreme weather



Increased importance of sustainability to customers



Rapid technology uptake and high levels of innovation



Higher future cost of investment



Challenging economic conditions for customers

Scenario 3

Customers feel the effects of the rising cost of living and struggle to afford services

Key Factor	Projection
Climate change impact	Climate pathway RCP 4.5 is realised. While not the worst case pathway, climate change impacts are still significant, including extreme weather volatility.
Customer and public attitudes to sustainability	There is increased customer and societal awareness of sustainability and climate change in relation to water and wastewater services.
Technology	There is a rapid increase in technological innovation and the deployment of new technologies in the water industry.
Future investment cost	There is a higher cost of debt impacting capital investment in the UK. There is reduced availability of international investment and poorer returns.
Economic conditions for customers	There are challenging economic conditions and issues of affordability for customers.

Timeline

2021: COP26 in Glasgow overshadowed by the UK post Covid-19 budget which prioritises short-term economic recovery.

2022: UK fails to re-enter Trans-Pacific Trade Partnership and potential trade deal with USA is delayed to at least 2025

2025: Scotland votes 54-46 to 'Vote Leave' in a second Independence referendum but the results are not acknowledged by Westminster.

2035: UK misses commitment to reduce emissions by 78% compared to 1990.

2038: Youth unemployment reaches highest levels since 1983 and cost of living increases. Protests occur across all four nations.

2039: General election votes in party promising to rejuvenate economy and to improve living costs through a 'Green Pivot'.

2040: New stringent environmental legislation and regulation of water companies. The UK re-commits to international commitments for climate change.

2044: The UK has reduced its emissions as is on track to maintain 2 degrees warming. Net zero is expected in 2057.

2065: 1.5 million workers are employed in low carbon and



Scenario 3

Customers feel the effects of the rising cost of living and struggle to afford services



John (Newcastle)

John's family weather the increasing cost of living, although their plans for an annual holiday abroad get changed to a British staycation. This is in alignment with the government's 2040 taxation policy on overseas leisure travel, and so John and family started to see the benefits of holidaying at home more. John has always been worried about the environment and voted for the 'Green Pivot' in 2039. He feels a sense of pride that the UK prioritises its natural environment and is cautiously optimistic about his children's future.



Asha (Gateshead)

Asha is one of many young workers who was laid off in the 2030's due to challenging economic circumstances in the NE, and the family starts to rely on foodbanks to feed themselves. They are struggling to pay the bills and agree on a payment plan with NWL to pay several months of unpaid bills. After a tough few years, Asha and her partner are able to get a job that emerges out of the 'Green Pivot'. This allows them to start to build up their savings and start planning to buy their own house.



Mary (Brentwood)

Mary has not seen a huge change in her living standards as the regional inequality gap has not hit the south east so hard for earners. She is aware of rising bills but has not felt the need to change suppliers as she feels she is cushioned from any changes. She has noticed the challenge for food retail customers as bills rise, but this has not had a material impact on the business, given the essential nature of food.



Chloe (Ashington)

The challenging economy has exacerbated the issues in Chloe's ex-coal mining town. Unemployment has risen and although Chloe is still working in her local GP practice, government and local authority cuts mean that she is worried about what might happen to her livelihood. Chloe increasingly worries about the cost of her water bills as they now account for a significant portion of her household spending.



Richard (Southwold)

Richard feels the consequences of the rising inflation as the value of his pension drops and the government removes the 'triple lock*'. Richard and his wife decide to tighten their belts by downsizing to a modest terrace house and cut back on foreign travel. Richard is noticing his water bills rising and begins research into social tariffs available for pensioners.

* The triple lock is how the state pension is supposed to increase each year in line with the highest of the following: inflation, the average wage increase, or 2.5%

7. SCENARIO 4

Scenario 4

The North East and Essex and Suffolk regions are an attractive prospect for investment

Market freedom drives investment and innovation leading to an economic boom. The favourable economic conditions in the North East has seen more people delaying or having less children so they can maximise their access to the job market and take advantage of the local economic opportunities. There are rapidly increasing levels of technology use due to the perceived economic benefits. Companies are being empowered through high-level incentives to explore new ways of working, including digital initiatives and the further development of remote working.

Economic conditions in the North East and Essex and Suffolk have improved from 2020, with particular growth seen in the North East due to regional government spending, including as part of a 'levelling up' initiative for areas outside of London and the Essex and Suffolk. The influx of investment has created new jobs and opportunities, putting more money into the pockets of people in the North East and SE. This means that customers have more disposable income, and most pay their water bills in a timely manner. People have felt the immediate benefits of increased investment and a boom in the economy.

While most people accept the reality of climate change, they are unwilling to curtail their own behaviours further and the country is seen to be doing 'enough' with existing commitments and so environmental legislation has remained the same. Focus is on increasing investment above tackling climate change and while there is still some effort to prevent RCP8.5 (worst case scenario) the UK is on a middle RCP pathway and sees increased weather variability.

There is less political/regulatory challenge on Northumbrian Water and Essex and Suffolk Water rates of return, which could be advantageous to Northumbrian Water and Essex and Suffolk Water if it operates efficiently. Companies are driven primarily by shareholders, which has been compounded by an increase in market competition. The government wanted to prioritise investment and so relaxed water sector. Regulations. This has allowed the water sector to have more control over their long-term planning.

Consumers are able to choose their provider with the retail market initially seeing some movement after regulation changed in the early 2030's. However, due to the continued low value placed on water because the impacts of climate change aren't seen as severe, few customers view water

as a priority and so the retail market restabilised. The government's approach to environmental regulation is stable and inline with the commitments required in the Environment Bill.

Key Projections



RCP 4.5 pathway and extreme weather



Decreased importance of sustainability to customers



Rapid technology uptake and high levels of innovation



Decreased future cost of investment



Improved economic conditions for customers

Scenario 4

The North East and Essex and Suffolk regions are an attractive prospect for investment

Key Factor	Projection
Climate change impact	Climate pathway RCP 4.5 is realised. While not the worst case pathway, climate change impacts are still significant, including extreme weather volatility.
Customer and public attitudes to sustainability	There is decreased customer and societal awareness of sustainability and climate change in relation to water and wastewater services.
Technology	There is a rapid increase in technological innovation and the deployment of new technologies in the water industry.
Future Investment Cost	There is a decreased cost of debt impacting on capital investment for the UK. There is increased availability of international investment and a fair return.
Economic conditions for customers	There are improved economic conditions and water is affordable for customers.

Timeline

2022: The UK Environment Bill is passed without adding a duty onto water companies to show progressive reduction in the adverse impacts of discharges from storm overflows.

2039: The regulator changes the Price review process towards a 'light touch' approach allowing companies to focus on long term planning.

2039: The water sector is Net Zero.

2039: Newcastle is voted most liveable city in Europe due to low costs of living and economic opportunities.

2044: The UK and Australia are named as the countries furthest behind on their carbon commitments from the G9 countries.

2042: Regional monopolies for the water retail market are removed allowing consumers to choose their provider.

2065: The UK reaches the climate targets originally set for 2035 to reduce emissions by 78%.

2090: Global Net Zero. The UK has adapted its climate change targets but these are not as ambitious as other European states. The UK remains the only European country using coal power.

Scenario 4

The North East and Essex and Suffolk regions are an attractive prospect for investment



John (Newcastle)

John receives funding for his new business venture – this is backed by foreign investors who see the appeal of the North East. John hires five new staff who have all relocated from London, drawn by the relative low cost of living and employment options.



Chloe (Ashington)

Chloe is able to take advantage of the rise of the North East. The region becomes more appealing to younger workers who move from across the UK to be in the country's 'investment capital'. Chloe is able to sell her terrace house to one of these incomers and relocates to a flat in Newcastle city centre.



Asha (Gateshead)

Asha is employed by a business new to the region that was attracted by local investment conditions. Asha and her partner were considering having a second child but decide to put this off for a few years as they want to enjoy the economic boom in the area by remaining in full time employment. Asha takes advantage of the more open water market to shop around for the most cost effective water company – despite no longer needing to count every penny on household bills.



Richard (Southwold)

Richard sees the opportunity to invest in several new businesses – supplementing his pension nicely. While he does accept that climate change is an issue, he feels that the UK is already doing 'enough' with existing commitments and feels that doing more would be unfair. He is active in writing to his local MP against any further legislation which he feels constrains his personal freedoms.



Mary (Brentwood)

Mary uses increased government funding to push through an additional distribution centre for her company in Essex and plans to develop another three in the next two years.

7. SCENARIO 5

Technology and innovation to improve sustainability and asset health

Citizens wanted to see the UK as an innovation leader and so the government prioritised investment in new technologies and provided significant funding for their deployment at scale. The government promoted innovation and ‘doing thing differently’ to empower companies to trial new technologies and accelerate their Net Zero plans through incentives and greater competition. This helped drive the UK as a global leader in innovation and technology.

Government incentives resulted in a widespread systems approach to infrastructure investment ahead of conventional solutions. Asset health has also been a long-term priority for water companies, adopting technology to improve asset performance and better understand risks to service.

There is a renewed focus on green-blue infrastructure and other new technologies that support the increased desire for sustainability by the public. Advances in technology has made the public believe that there is a solution to climate change and so this has grown in importance as an issue for many people.

Earlier in the period there was an improvement in economic conditions due to the influx of investment and the creation of new jobs, but this has levelled off by 2050. UK economic conditions are stable later in period with the UK is seen as a global technology and innovation leader.

The cost of investment is constant later in period because the UK has reached a stable point in its drive to become a technology leader. Massive investment was seen in the early part of this period but at this point businesses and individuals have become accustomed to the new status quo and the cost of investment has stabilised.

Low demand has occurred as technology to manage demand and reduce consumption has become widespread. There is low growth across the UK but some increase locally as the NE becomes a technology hub for the UK.

Key Projections



RCP 4.5 pathway and extreme weather



Increased importance of sustainability to customers



Rapid technology uptake and high levels of innovation



Constant future cost of investment



Constant economic conditions for customers

Scenario 5

Technology and innovation to improve sustainability and asset health

Key Factor	Projection
Climate change impact	Climate pathway RCP 4.5 is realised. While not the worst case pathway, climate change impacts are still significant, including extreme weather volatility.
Customer and public attitudes to sustainability	There is increased customer and societal awareness of sustainability and climate change in relation to water and wastewater services.
Technology	There is a rapid increase in technological innovation and the deployment of new technologies in the water industry.
Future Investment Cost	There is minimal change in the cost of debt and its impact on capital investment for the UK. There is minimal change in the availability of international investment and a fair return.
Economic conditions for customers	There are stable economic conditions and water is affordable for customers.

Timeline

2025: The UK moves from 4th to 1st on Global Innovation Index rankings due to increased investment in technology and automation.

2039: Newcastle is voted most liveable city in Europe due to low costs of living and economic opportunities in the North East.

2044: The UK and Australia are named as the countries furthest behind on their carbon commitments from the G9 countries.

2042: Regional monopolies for the water retail market are removed allowing consumers to choose their provider.

2065: The UK reaches the climate targets originally set for 2035 to reduce emissions by 78%.

2090: Global Net Zero. The UK has adapted its climate change targets but these are not as ambitious as other European states. The UK remains the only country in Europe continuing to use coal power.

Scenario 5

Technology and innovation to improve sustainability and asset health



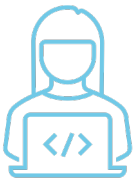
John (Newcastle)

John's background in IT means he is well placed to take advantage of the pro technology created by the government in the late 2020's. He sets up an start up in 2030 that revolutionises childcare for people working from home and sells the company for £7million in 2032. The family moves to a large rural property shortly after. The new house is filled with new technology to help the family save water although the new swimming pool John installs counterbalances this.



Asha (Gateshead)

Asha's work becomes ever more precarious as both she and her partner become more enmeshed in the growing 'gig' economy. Technology has taken over some roles in the manufacturing industry and the advent of driverless delivery vehicles puts her partner out of a job. Asha does take advantage of the more open water market to shop around for the most cost effective water company – every little helps on household bills.



Mary (Brentwood)

Mary is a huge advocate for the use of technology in her work and at home. She has managed to automate many roles across the supply chain as part of her role at a major food retailer. At home, Mary loves a new gadget and revels in displaying her 'connected' home to visitors – which includes remote control of heating and water, live monitoring of water and energy efficiency and a state of the art alarm system.



Chloe (Ashington)

Chloe is able to take advantage of the rise of the North East. The region becomes more appealing to younger workers who move from across the UK to be in the country's 'innovation capital'. Chloe is able to sell her terrace house to one of these incomers and relocates to a flat in Newcastle city centre. Chloe's new flat has smart water metering which Chloe notices significantly reduces her water bills.



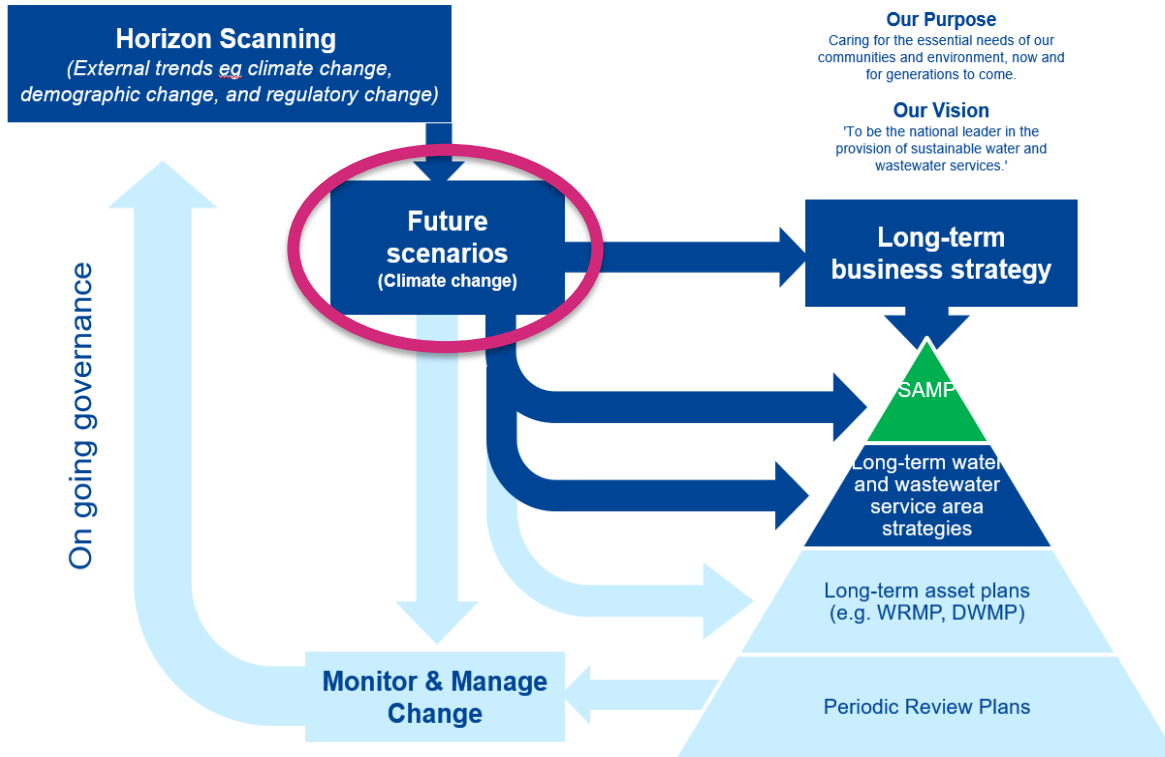
Richard (Southwold)

Richard initially values the government's investment in technology, after several judicious investments pay off well for him, allowing him to buy a house in the south of Spain to winter in. However, after witnessing untreated sewage discharge from a local brook repeatedly spilling onto the green of the 8th hole at his local golf club, Richard becomes a passionate campaigner to end the use of CSOs in the UK.

4. NEXT STEPS



Next steps and recommendations



These scenarios provide a fundamental input into Northumbrian Water and Essex & Suffolk Water's long-term business strategy development:

- In addition to using the Ofwat scenarios individually, we recommend that Northumbrian Water and Essex & Suffolk Water use the scenarios to stress test the business strategy and long-term water and wastewater strategies. They can also be used to identify trigger points; developing adaptive strategies.
- Future work can also consider the nature of each trend and the different types of threshold each may experience
- The scenarios align with long-term trends that inform other long-term planning processes in the business, such as DWMP and WRMP. The scenarios should be used to stress-test these plans over time.
- Further work could be done in developing an approach to using the scenarios to test shorter-term plans, such as PR24 plans.

Ongoing monitoring and review of key trends will be important in enabling an adaptive approach.

APPENDIX 1: SCENARIO PLANNING

Scenario 1

Key Factor	Projection		
Climate change impact	RCP 8.5	RCP 4.5	RCP 2.6
Population growth/demand	Rapid growth with high demand		Slow growth with low demand
UK carbon target	Ahead	On target	Behind
Customer and public attitudes to sustainability	Increased importance compared to today	Same importance compared to today	Decreased importance compared to today
Future of work	High working from home, small workforce, reverse urbanisation	Medium working from home and urbanisation	Incremental working from home and urbanisation
Environmental legislation/ambition	Increased (inc. EA enhanced scenario)	Stable (inc. EA BAU scenario)	Decreased compared to today
Regulatory change and market competition	Companies empowered through high level incentives, with greater competition	No change compared to today	Micro management
Future investment cost	Increased compared to today	Constant compared to today	Decreased compared to today
Economic conditions for customers	Challenging	Constant compared to today	Improving
National infrastructure investment	Integrated whole systems approach - investment focussed on existing national asset base and widespread green and blue infrastructure	Some integration, green and blue infrastructure, some new grey infrastructure investment	Siloed approach - new conventional solutions, no green and blue infrastructure
Technology	Rapid uptake with high levels of tech use	Slow uptake with low levels of tech use	

Scenario 2

Key Factor	Projection		
Climate change impact	RCP 8.5	RCP 4.5	RCP 2.6
Population growth/demand	Rapid growth with high demand		Slow growth with low demand
UK carbon target	Ahead	On target	Behind
Customer and public attitudes to sustainability	Increased importance compared to today	Same importance compared to today	Decreased importance compared to today
Future of work	High working from home, small workforce, reverse urbanisation	Medium working from home and urbanisation	Incremental working from home and urbanisation
Environmental legislation/ambition	Increased (inc. EA enhanced scenario)	Stable (inc. EA BAU scenario)	Decreased
Regulatory change and market competition	Companies empowered through high level incentives	No change compared to today	Micro management with stable levels of competition
Future investment cost	Increased compared to today	Constant compared to today	Decreased compared to today
Economic conditions for customers	Challenging	Constant compared to today	Improving
National infrastructure investment	Integrated whole systems approach - investment focussed on existing national asset base and widespread green and blue infrastructure	Some integration, green and blue infrastructure, some new grey infrastructure investment	Siloed approach - new conventional solutions, no green and blue infrastructure
Technology	Rapid uptake with high levels of tech use		Slow uptake with low levels of tech use

Scenario 3

Key Factor	Projection		
Climate change impact	RCP 8.5	RCP 4.5	RCP 2.6
Population growth/demand	Rapid growth with high demand		Slow growth with low demand
UK carbon target	Ahead	On target	Behind
Customer and public attitudes to sustainability	Increased importance compared to today	Same importance compared to today	Decreased importance compared to today
Future of work	High working from home, small workforce, reverse urbanisation	Medium working from home and urbanisation	Incremental working from home and urbanisation
Environmental legislation/ambition	Increased (inc. EA enhanced scenario)	Stable (inc. EA BAU scenario)	Decreased compared to today
Regulatory change and market competition	Companies empowered through high level incentives	No change compared to today	Micro management with stable levels of competition
Future investment cost	Increased compared to today	Constant compared to today	Decreased compared to today
Economic conditions for customers	Challenging	Constant compared to today	Improving
National infrastructure investment	Integrated whole systems approach - investment focussed on existing national asset base and widespread green and blue infrastructure	Some integration, green and blue infrastructure, some new grey infrastructure investment	Siloed approach - new conventional solutions, no green and blue infrastructure
Technology	Rapid uptake with high levels of tech use		Slow uptake with low levels of tech use

Scenario 4

Key Factor	Projection		
Climate change impact	RCP 8.5	RCP 4.5	RCP 2.6
Population growth/demand	Rapid growth with high demand		Slow growth with low demand
UK carbon target	Ahead	On target	Behind
Customer and public attitudes to sustainability	Increased importance compared to today	Same importance compared to today	Decreased importance compared to today
Future of work	High working from home, small workforce, reverse urbanisation	Medium working from home and urbanisation	Incremental working from home and urbanisation
Environmental legislation/ambition	Increased (inc. EA enhanced scenario)	Stable (inc. EA BAU scenario)	Decreased compared to today
Regulatory change and market competition	Companies empowered through high level incentives	No change compared to today	Micro management with stable levels of competition
Future investment cost	Increased compared to today	Constant compared to today	Down compared to today
Economic conditions	Challenging	Constant compared to today	Improving
National infrastructure investment	Integrated whole systems approach - investment focussed on existing national asset base and widespread green and blue infrastructure	Some integration, green and blue infrastructure, some new grey infrastructure investment	Siloed approach - new conventional solutions, no green and blue infrastructure
Technology	Rapid uptake with high levels of tech use		Slow uptake with low levels of tech use

Scenario 5

Key Factor	Projection		
Climate change impact	RCP 8.5	RCP 4.5	RCP 2.6
Population growth/demand	Rapid growth with high demand		Slow growth with low demand
UK carbon target	Ahead	On target	Behind
Customer and public attitudes to sustainability	Increased importance compared to today	Same importance compared to today	Decreased importance compared to today
Future of work	High working from home, small workforce, reverse urbanisation	Medium working from home and urbanisation	Incremental working from home and urbanisation
Environmental legislation/ambition	Increased (inc. EA enhanced scenario)	Stable (inc. EA BAU scenario)	Decreased
Regulatory change and market competition	Companies empowered through high level incentives	No change compared to today	Micro management with stable levels of competition
Future investment cost	Increased compared to today	Constant compared to today	Decreased compared to today
Economic conditions	Challenging	Constant compared to today	Improving
National infrastructure investment	Integrated whole systems approach - investment focussed on existing national asset base and widespread green and blue infrastructure	Some integration, green and blue infrastructure, some new grey infrastructure investment	Siloed approach - new conventional solutions, no green and blue infrastructure
Technology	Rapid uptake with high levels of tech use		Slow uptake with low levels of tech use

APPENDIX 2: FUTURE TRENDS SUMMARY

Full details of each trend can be found in the Trends Report

TRENDS - CUSTOMERS, PEOPLE AND COMMUNITIES

- Affordability & Vulnerability
 - Affordability and vulnerability is an increasing issue for customers.
- Localism
 - The strengthening of community power across urban, suburban and rural areas.
- Population distribution
 - Changing distribution between rural and urban areas
- Inequality
 - Income inequality in the UK is increasing, widening the gap between the richest and poorest.
- Food and Diet
 - Increased demand for food and changing diets.
- Regeneration and Placemaking
 - Placemaking capitalises on a local community's assets to create memorable public spaces that promote health, happiness, and wellbeing.
- Ageing Population
 - The population of the North East and East is ageing.
- Population Growth
 - Population served is expected to grow.
- Customer Expectations
 - Customers' expectations of the personalisation, convenience, speed and flexibility of the services is increasing.
- Sustainable Attitudes for customers and public
 - Awareness over the impact of climate change on water supply is increasing. This also includes changing attitudes to waste discharge into water bodies and a desire for increasing water quality.
- Value of Water
 - A culture shift on how we value water.
- Future of Work
 - Increasing uptake of home working, flexible working and co-working.
- Diversity and Inclusion
 - England is becoming more diverse.
- Health and Wellbeing
 - A broadening view of health and wellbeing, including mental health.
- Skills Shortages
 - Demand for digital and engineering skills increases

TRENDS - ENVIRONMENT AND CLIMATE

- Integrated Catchment Management
 - More holistic management of water and wastewater catchments.
- Land Use
 - The way in which we manage our land in the UK is changing.
- Distributed Energy
 - Decentralised energy closer to the consumer
- Earth Observation
 - Orbiting satellites that gather data on oceans, ice sheets, terrain, atmosphere and freshwater that is more readily available for private and public sectors
- Environmental Net Gain
 - Delivering environmental net gain, including biodiversity net gain.
- Invasive Alien Species
 - Water companies are on the frontline to manage invasive alien species.
- Non-Potable Water Quality
 - Water quality lowered for non-potable applications
- Circular Economy
 - Minimising waste, promoting resource efficiency and moving towards a circular economy.
- Climate Change Impacts
 - Hotter drier summers and warmer wetter winters are expected to have far-reaching impacts on the water industry.
- Flooding
 - Flood risk from all sources is projected to increase across the UK.
- Water Shortages
 - The country could face water shortages by 2050. Water shortages are anticipated to be more extreme in Essex and Suffolk.
- Net Zero Carbon
 - The UK's target to achieve net zero carbon emissions by 2050 and Northumbrian Water (scope 1 and 2) by 2027.
- Decarbonised Energy
 - To meet net zero carbon targets, energy will need to be decarbonised.
- Greenhouse Gas Removal
 - The large-scale removal of existing greenhouse gases from the atmosphere
- Environmental Legislation and Regulation
 - Changing environmental legislation will continue to drive significant investment needs in the water industry.

TRENDS – INFRASTRUCTURE AND TECHNOLOGY

- Asset Decentralisation
 - Decentralising water infrastructure to be more adaptable, flexible, resilient and reduce carbon footprint.
- Sensing and Analytics
 - Delivering smarter operations that can improve efficiency and predict issues
- Digital Twins
 - Digital representation of a real-world entity.
- Connected Homes
 - Customers able to manage devices, appliances and utility services from a single device in their home.
- Green and Blue Infrastructure
 - A shift towards solutions that actively improve the health of ecosystems and habitats
- Robotics and Autonomous Systems
 - Increasing automation and automation in the water industry.
- Artificial Intelligence
 - Adopting Artificial Intelligence (AI), machine-learning and new data analytics to bring better efficiency and resilience to the water utility value chain.
- Leakage
 - In England alone more than three billion litres of water are lost from leaking infrastructure every day. Ofwat's stated ambition is a 50% reduction in leakage from 2019 by 2050. Northumbrian Water have committed to a 15% reduction by 2025 in the North East, and 17.5% in Essex and Suffolk
- Asset Deterioration
 - Maintaining an ageing asset base
- System Interdependencies
 - Water infrastructure is increasingly integrated with other infrastructure systems.
- Advanced Materials
 - Developments in materials science and nanotechnology changing the nature of current materials and introducing new materials altogether.

TRENDS – MARKET AND REGULATION

- Water Trading
 - Selling surplus water to stressed areas of England.
- Economic regulatory philosophy
 - There are different approaches that regulators can take. The prevailing regulatory philosophy is one of ‘hands on’, ‘in the detail’, with extensive use of benchmarking, and clawback mechanisms to adjust for significant outperformance. Alternative philosophies (e.g. focusing on negotiated settlements) also exist, and could be put in place over an extended time horizon.
- Bioresources Markets
 - Markets for bioresources and waste such as biosolids for agricultural uses.
- Economic Cycles
 - The long-term economic outlook is extremely uncertain.
- Nationalisation
 - Public ownership of the water industry has attracted public support in recent years.
- System Operator
 - A role of an operator to mitigate risks around security of supply, losses and environmental impact of water trading
- Market Competition
 - A competitive, customer-oriented water market.
- Total Value
 - Valuing economic, social, financial and natural capital in decision making.
- Devolution
 - With a rise in directly elected metro mayors for cities and city regions in England, governance is becoming increasingly devolved.
- Green Finance
 - Transition to a green financial system and mobilising investment in clean and resilient growth.
- Partnership and Collaboration
 - New forms of partnerships and collaboration to tackle complex issues
- Responsible Business
 - Delivering social purpose and balancing the interests of all stakeholders.
- Cost of Capital
 - The cost of debt is at a historical low point. The cost of debt is likely to rise.
- Integrated Regulation
 - Integrating regulation to deliver resilient, timely, high-quality, environmentally beneficial and affordable water and wastewater services
- Carbon Pricing
 - Shifting the burden back to those who are responsible and can reduce it.