FINAL REGIONAL PLAN

June 2025

WReN
Water Resources North

Contents

1. What is a regional water resources plan?

Regional planning has been promoted by water companies and regulators to bring about greater coordination of water resources planning, not only for public water supply, but also for other sectors that abstract water. Regional planning allows the exploration of strategic regional and inter-regional solutions (in particular transfer options between regions) at a national scale to meet the challenges and water resources needs of the future.

In building our regional plan, we have considered the aims and objectives of the Water Resources National Framework (WRNF) as well as other policies and plans relevant to England. Our aim is to put forward a plan that supports the needs of our customers, the environment and, where tangible needs have been defined, other sectors. Our plan identifies opportunities to support the recovery of waterbodies, in line with River Basin Management Plan (RBMP) and Catchment Plan (CP) actions. We also aspire to achieve leakage and per capita consumption (PCC) targets, and have proactively sought to explore the potential of water transfers whilst ensuring drought resilience and the environment are protected in our own region.

1.1. Background to regional planning

The Environment Agency led the development of a Water Resources National Framework (WRNF)[1]. This was developed together with Ofwat, the Drinking Water Inspectorate and Defra, and approximately 40 representatives from the water industry, other water users and environmental NGOs. The WRNF was published in March 2020, and outlines what regional plans must deliver[2].

In summary, the WRNF states that a regional group must:

- Take account of the national framework and set out its potential contribution to the national need
- Be reflected in WRMPs
- Forecast supply and demand over at least 25 years and set out solutions to any deficits
- Be a single strategic plan with a preferred adaptive solution
- Take a multi-sector approach
- Look beyond regional boundaries and use technical approaches compatible with other regions
- Include enhanced environmental improvements and demand management
- Take a catchment-based approach
- Consider wider resilience benefits, including reducing flood risk, when developing options
- Be open to market mechanisms
- Take into account growth ambition
- Comply with SEA and HRA legislation

Appendix 1 shows how WReN is meeting these requirements.

Each regional group has been tasked with pulling together a regional plan. These regional plans, which include strategic and regional solutions, have been reflected into the more detailed set of water company Water Resources Management Plans (WRMPs) for the next round of company business plans (at Price Review 24, PR24). Individual company plans have taken account of the strategic picture from the regional plans.

Regional plans must also uphold aims which support the Government's 25-year environment plan[3], which pledged that 'we would be the first generation to leave the environment in a better condition than we found it'.
Of particular relevance to water resources are the following objectives set out under the 25-year environment plan:

- Reducing the damaging abstraction of water from rivers and groundwater
- Reaching or exceeding objectives for rivers, lakes, coastal and ground waters that are specially protected, whether for biodiversity

[1] Meeting our future water needs: a national framework for water resources, Environment Agency (March 2020)
[2] It is worth noting that since publication of the WRNF, practical experience in delivering against the framework has highlighted the need for further clarity on meeting some of the objectives (e.g. planning for sectors other than public water supply). A regulator led review will inform future planning rounds.
[3] A Green Future: Our 25 Year Plan to Improve the Environment, HM Government (January 2018)

or drinking water as set out in River Basin Management Plans

- Supporting Ofwat's ambitions on leakage, minimising the amount of water lost through leakage year on year, with water companies expected to reduce leakage by at least an average of 15% from 2020 to 2025."

We have used the WRNF expectations, the objectives of the 25-year environment plan and those from other regulators and stakeholders, to help shape our approach to our regional plan. We have also strived to incorporate, where appropriate, guidance and policies that have been published more recently.

1.2. Purpose of this document

This Final Regional Plan builds on the Draft Regional Plan for consultation document published in November 2022, and takes account of feedback from this consultation, along with that upon the draft Water Resources Management Plan 2024 (WRMP24) submissions. It also incorporates further work to reconcile and align inter-regional transfer options with the plans of other regional groups, and a full revision of the underpinning planning data and appraisals in line with water company final WRMP24 submissions.

The document follows a nationally agreed overarching structure and provides additional context on the current and forecast future resource position, which has been updated for water company final WRMP24 submissions. The document is complemented by supporting appendices and explains the key drivers of change in the supply-demand position, particularly where driven by new policy and methodological considerations.

Beyond staking out a baseline position (**Section 4**), this document summarises our approach to developing an adaptive, best-value plan at region level (**Section 5**), in the context of the decision-making[4] approaches and supporting metrics. It also summarises the salient choice or decision areas for our plan (**Section 6**), the resulting indicative solutions to meet deficits, and the outcomes of scenario and stress tests (**Section 7**).

In addition, it explains how we have represented environmental destination and accounted for non-public water supply needs as well as customer and stakeholder priorities as we have built our future plans.

1.3. Other guidance and interfacing planning processes

The regional planning process exists in a complex landscape of other plans, legislation and guidance, which we have considered, where appropriate, as part of regional plan development.

Water Resources Management Plans (WRMPs) and Water Resources Planning Guidelines (WRPG)[5]

The Environment Agency and Natural Resources Wales publish the Water Resources Planning Guidelines (WRPG) to provide water companies with guidance on how they can ensure that their WRMPs comply with statutory requirements and government policies. Although the regional planning process is currently a non-statutory one, we have ensured that our regional plan follows the principles outlined within the WRPG as far as is relevant to a high-level strategic plan (noting that the regional plan is necessarily less detailed than company WRMPs).

Water Industry Price Review process (PR24)

Water companies in England and Wales are regulated in five-year periods known as Asset Management Periods (AMPs), and each AMP is informed by a Price Review (PR) process. The most recent Price Review is PR24, and water companies submitted their business plan proposals for PR24 to regulators in late 2023. The Final Determination for PR24 was delivered by the regulators in December 2024. This has set water companies' performance and investment targets, as well as customer bills, for the AMP8 period, between 2025 and 2030.

UK Net Zero commitment

The UK has a legally binding target to reach net zero emissions by 2050, and in October 2021 the Government published its Net Zero Strategy[6]. This set out policies and proposals for decarbonising all sectors of the UK economy by 2050. In support of this, the water industry has also proposed an ambitious plan to achieve net zero operational

[4] This term is used interchangeably with 'options appraisal' in industry methodologies published by the organisation UKWIR.

[5] Water resources planning guideline - GOV.UK (www.gov.uk), UK Government, 2021

[6] https://www.gov.uk/government/publications/net-zero-strategy

emissions by an earlier date of 2030[7]. WReN companies are playing their role within this alongside the water companies of other regions. The new Government has also subsequently set a target to achieve a clean power grid (at least 95% clean power), representative of around 20% of UK primary energy demand, by 2030.

The following aspects are considered to have particular relevance to water resources planning:

- The importance of decarbonising the UK's electricity system and in particular the role that hydrogen may be able to play in this. Water demand in the energy sector including hydrogen and carbon capture is a major theme when considering sectors beyond public water supply although there remains considerable uncertainty in relation to the timing and geographical location of this demand (see **Section 4.6**).
- An emphasis on sustainable use of resources – including water – and the role of the circular economy.
- The importance of energy efficiency, including standards and regulation for energy efficient homes. Whilst the Net Zero Strategy is specifically focussed on energy, we would reflect that standards and regulation also have a role to play in delivering water efficiency and, indeed, efficient use of (hot) water can play an important part in reducing overall household energy use.

River Basin Management Plans (RBMPs)

River Basin Management Plans (RBMPs) look at the challenges that our water environment faces and provide a framework for protecting and enhancing the water environment. Clearly, this includes considering how abstractions from all sectors impact on the water environment, and RBMPs also provide a framework for the protection of sensitive habitats in England and Wales[8]. Since the publication of our emerging regional plan, the Environment Agency has also completed consultation upon the draft RBMPs[9]. Our regional plan considers how we can support delivery of actions in the RBMPs that are relevant to our region – the Humber and Northumbria River Basin Districts – in particular where the RBMPs include actions related to water abstraction.

Abstraction licensing strategies (CAMS)

The Environment Agency regulates the abstraction of water from the environment via a permitting system, and through existing licences and granting of new licences. This is done through a process called the catchment abstraction management strategy (CAMS) process and via abstraction licensing strategies. Licensing strategies are published on a catchment basis[10]. These strategies have been taken into account when considering the amount of water that may be available in a particular catchment both now and into the future.

[7] Water UK, Net Zero 2030 Routemap - Water UK – Net Zero 2030 Routemap
[8] Due to be published in Final form in December 2022.
[9] https://consult.environment-agency.gov.uk/environment-and-business/draft-river-basin-management-plans/
[10] https://www.gov.uk/government/collections/water-abstraction-licensing-strategies-cams-process

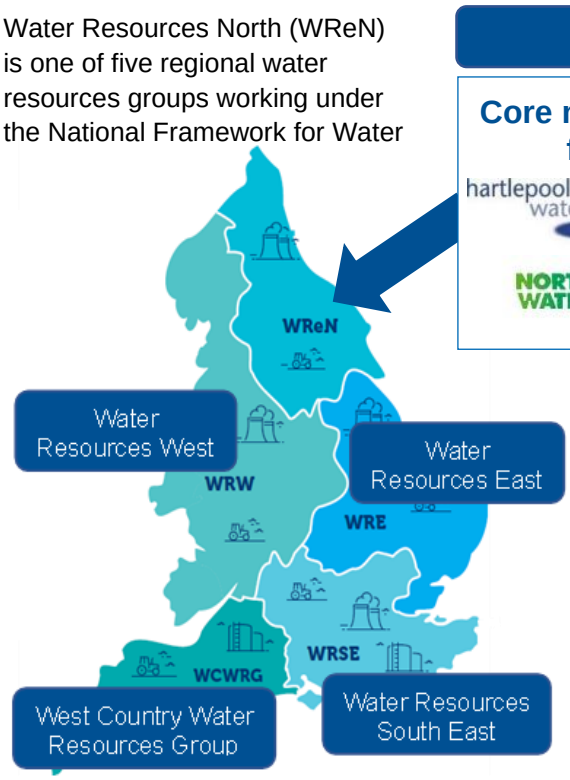
2. Who we are - Region at a glance

Our region is highly diverse, including significant population centres in Yorkshire, Teesside, Wearside and Tyneside, as well as widespread rural communities and significant expanses of environmentally important landscapes. Our major rivers include the Rivers Ouse, Tees, Wear and Tyne. The Ouse, with its tributaries, drains the vast majority of Yorkshire into the Humber. The natural and varied geography of our region influences the climate, with rainfall ranging from in excess of 1000mm per annum in the Pennine hills to some of the driest places in the country on the east coast. We have been working with regulators, stakeholders, customers and other regions to develop our regional plan, and help secure resilient supplies for the nation as a whole.

2.1. Introduction to WReN

Figure 2-1 Regional Water Resources Planning Groups

Water Resources North (WReN) is one of five regional water resources groups working under the National Framework for Water



Area of 23,481 km²

Major rivers include the Rivers Ouse, Tees, Wear and Tyne

5 water resource zones

Grid (YW), Kielder (NWL), East (YW), Berwick (NWL) and Hartlepool (HW)

8 million people

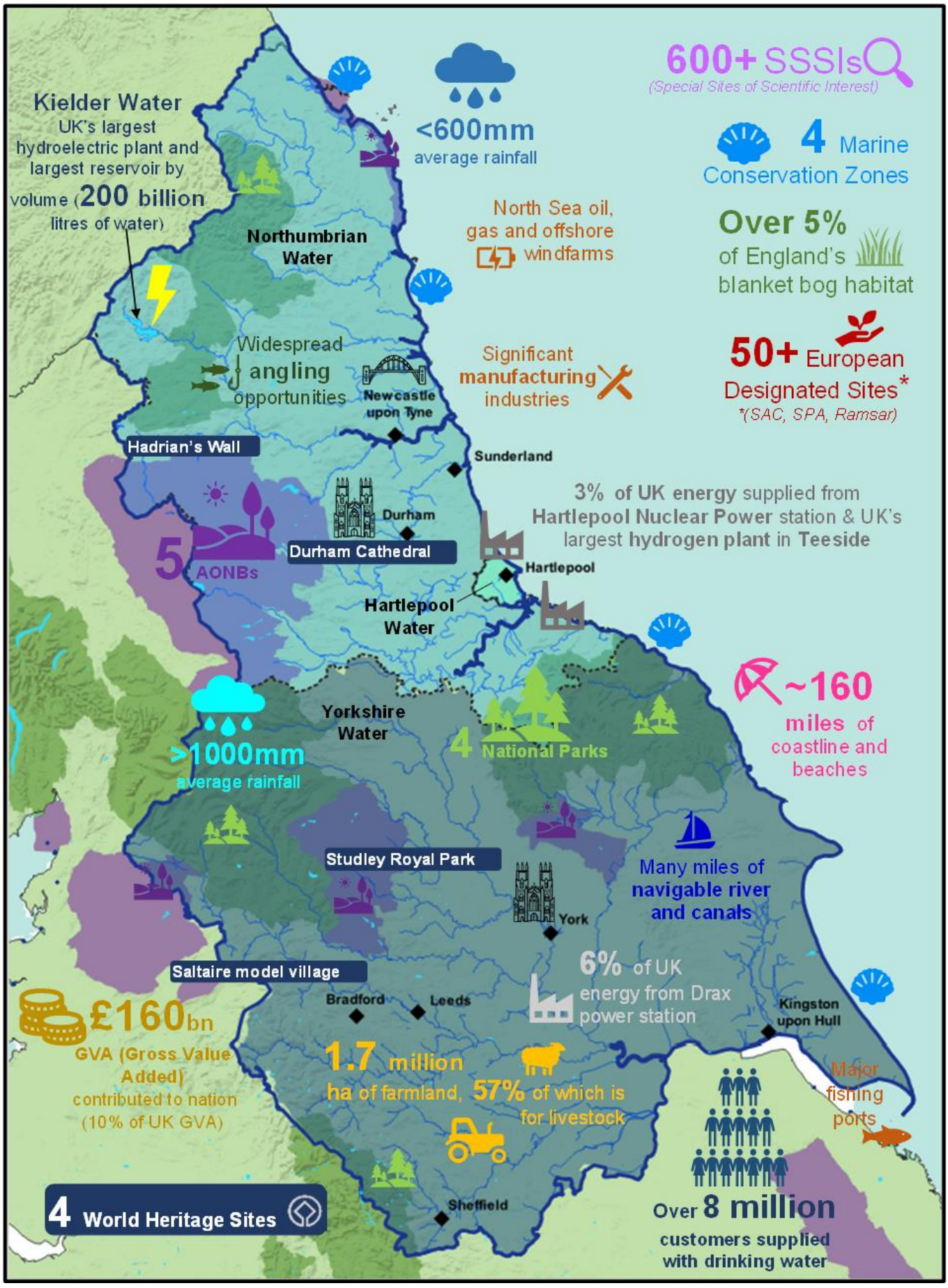
98% population served by just Grid and Kielder

Working with stakeholders to help facilitate sustainable growth across Yorkshire, the Humber and the North East whilst also protecting and enhancing our valuable natural

Our aim is that the region has a sustainable, long-term plan for water resources that protects our region's resilience (public water supply, environment, and multi-sectoral water supply) in the face of challenges such as climate change and population growth and changing demands for water use as our industrial and agricultural sectors evolve. We are working with other regions to help secure resilient water supplies for the country as a whole.

Although our core members and funders are Yorkshire Water (YW), Northumbrian Water (NWL) and Hartlepool Water (HW), other stakeholders who have an interest in water resources in our region are working with us and are actively involved in the regional planning process. This includes sectors other than public water supply who make beneficial use of the water in our environment, such as agriculture, energy, navigation and wider industry. The importance of water to our region's environment, ecology and biodiversity will also play a key role in shaping our future plans. **Figure 2-2** presents a picture of the key characteristic of our region.

Figure 2-2 Characteristics of the WReN region



2.2. Catchments and zones in the WReN region

Our region is highly diverse and home to over 8 million water company customers across 23,500 km^2, from the Peak District south of Sheffield up to the border with Scotland. The five water resource zones (WRZs) in the WReN region are shown in **Figure 2-3** along with the main Water Framework Directive (WFD) surface water management catchments in the region. The Northumbrian Industrial WRZ from previous WRMPs is now included as part of Kielder WRZ.

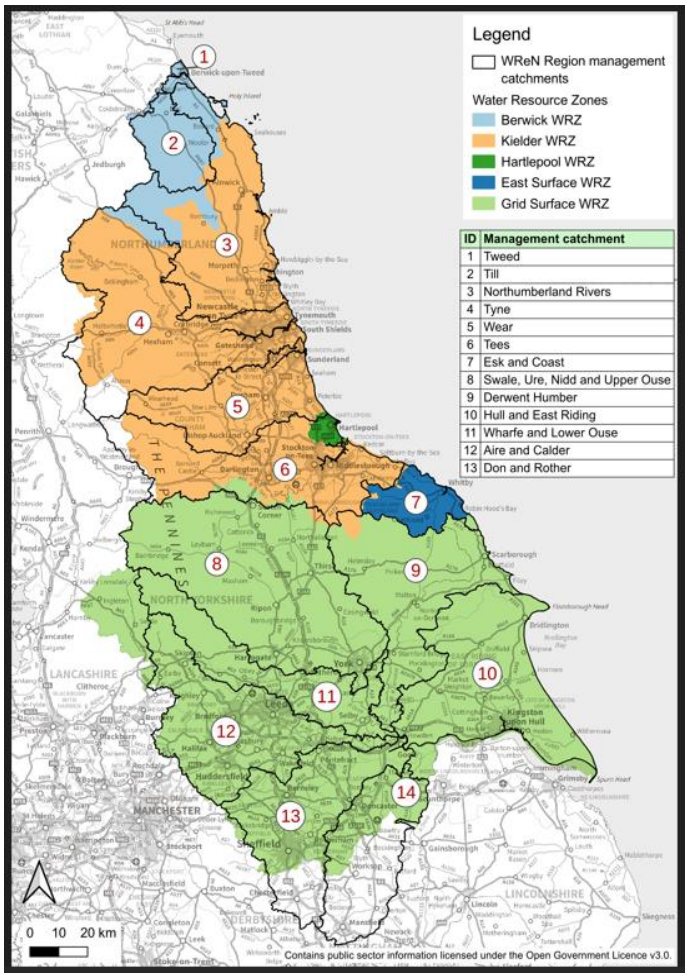


Figure 2-3 Mapping of water resource zones and WFD management catchments in the WReN region

These catchments experience a number of combined pressures. The degree and significance of these pressures varies between catchments but includes issues such as future lack of water availability, WFD concerns (notably modifications and water quality), growth in abstraction demand and risk of abstraction reductions. Flooding is also a major issue in many of these catchments.

2.3. WReN planning objectives

Options identified as feasible for meeting our future water resources needs were taken through an options appraisal process using a multi-criteria approach to produce a best value plan (**Section 5.5).** The decision-making methodology for the options appraisal expands on the traditional Economics of Balancing Supply and Demand (EBSD) approach for WRMPs to include other criteria in addition to cost and this required the development of bespoke WReN objectives and metrics. A best value plan was then created which may not be optimum for each individual objective but is the most optimal plan when all objectives are considered collectively.

The objectives were initially identified using the Water Resources National Framework and Environment Agency Water Resource Planning Guidelines (EAWRPG). The WReN objectives and metrics were further refined in consultation with stakeholders, regulators and customer focus groups. Customer views, for example, were sought through focus group discussion from both household and non-household customers. Feedback from the participants provided information on level of support for different objectives, customer ranking of metrics and the type of options they would prefer to see included in a best value plan. The research also helped assess the aspects of the process customers understood, and where further clarity on objective and metric definitions was needed.

The strongest level of support was for:

- ‘creating a plan that is affordable and sustainable over the long term’
- ‘contributing to the Government’s ambition in the 25-year environmental plan’
- ‘meeting the future PWS’ (now amended in response to specific customer and stakeholder feedback see below)

The detailed outputs of the customer engagement are presented in Appendix 7 and further summarised in **Section 3.3.** The customer engagement report presented in Appendix 7 is further supplemented by customer research conducted by Yorkshire Water in August 2024 prior to the publication of its final WRMP- further details on this can be found in Yorkshire Water’s WRMP. WReN used the customer feedback along with other stakeholder feedback on balance to support in the decision-making process and we have made updates in response to feedback through the process (see Appendix 4 for further

details of the changes made to objectives and associated metrics).
A high-level summary of the ten WReN objectives is provided in **Figure 2-4** below with a more detailed description provided in Appendix 4.

Figure 2-4 A high-level summary of the ten WReN objectives

1. Meet the future PWS and non-PWS needs in our region.

2. Meet demand management policy requirements to reduce leakage and per capita consumption as defined in the Water Resources National Framework

3. Meet and maintain a PWS drought resilience level of service of 1 in 500-year for level 4 restrictions

4. Identify WReN's potential to contribute to national resilience

5. Produce a plan that supports the views of regional stakeholders and water companies' customers and is not detrimental to social wellbeing

6. Contribute to the Government's ambition in the 25 Year Environment Plan to '*leave the environment in a better state than we found it*'

7. Incorporate Strategic Environmental Assessment outputs and other relevant environmental legislation in decision making

8. Achieve the WReN environmental destination and River Basin Management Plan (RBMP) objectives (sustainability reductions) taking a catchment wide approach

9. Achieve multiple benefits including non-drought resilience

10. Create a plan that is affordable and sustainable over the long term

3. Where we are today

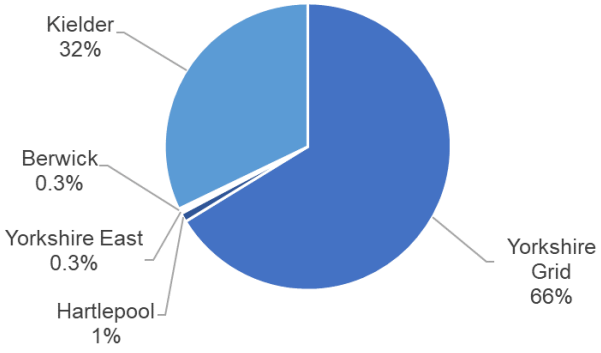
This section provides information on the water resources position for our region leading into the regional planning process, as well as what our customers and broader stakeholders have told us about their initial priorities. For public water supply, it summarises what we said in the last round of company plans (WRMP19) and, at a high level, our progress in delivering those plans. It also identifies what we know about the current water needs in other sectors and the status of our natural environment for our region.

3.1. Water resources leading into the regional planning process

Public Water Supply

The current consumptive water need for public water supply (PWS) in the WReN region is over 2,000,000 litres per day. This is supplied by our five potable Water Resource Zones (WRZs). The two largest of these are Yorkshire Grid and Kielder and these supply water to approximately 98% of the region's 8 million population.

Figure 3-1- Percentage (%) population supplied by each of the five potable WRZs in the WReN region



Yorkshire Grid and Kielder water resource zones are well connected within their respective zones but the region is currently less well connected between zones.

Northumbrian Water currently operates a non-potable Industrial WRZ in Teesside, which supplies water to industrial water users in that area. For WRMP24, Northumbrian Water has merged this WRZ with its Kielder WRZ and so the data presented in this submission reflects this merger.

In WRMP19, with the exception of the Yorkshire Grid, the supply-demand balance for WReN's water resource zones showed a surplus in the baseline dry year annual average scenario over the full 25-year planning period, without the need for interventions. The Yorkshire Grid zone forecast showed a risk of the zone falling into deficit, starting from 6 Ml/d in the mid-2030s and increasing to 34 Ml/d by 2045. This deficit was primarily caused by the risk that climate change will significantly reduce future available water resources. However, through its WRMP19, Yorkshire Water committed to closing the Yorkshire Grid zone deficit through an enhanced leakage detection and repair programme alongside investment in some existing borehole supplies by 2025. The borehole investment has been delayed into AMP8 and forms part of Yorkshire's WEMP24 plan. These investments are intended to improve resilience and help ensure the risk of longer-term deficit in this zone, as identified in WRMP19, is mitigated.

WRMP19 25-year planning period commitments across the region as a whole

Leakage
12% reduction in AMP7 period of 2020 to 2025

PCC
(per capita consumption)
reduction in customers' water use to 125 litres per person per day

Although WRMP19 did not show deficits in all WRZs, all three water companies committed to reducing leakage throughout the 25-year planning period[11]. Reductions in leakage were seen over the AMP7 period and further reductions are targeted over AMP8 (see **Section 4** and **Section 5**).

[11] Regional value for reduction in customers' water use calculated based on a weighted average reflecting the size of each WRZ

For per capita consumption (PCC) in 2020/21, the Covid-19 pandemic led to an increase in the amount of water used by customers through the reporting year for all water companies. A significant increase in demand was seen due to:

- more people remaining at home in the day either because of working from home or having been furloughed,
- using more water because of increased handwashing,
- having more time to garden and therefore doing more watering,
- using more paddling pools and hot tubs at home.

Nationally, across the industry, the impact of this has been estimated as an increase in PCC of between 3 and 15%, with peak demand increasing by 20 to 40%[12]. Non-household demand was 15 to 40% lower than normal due to many businesses being closed for a significant proportion of the year. However, this reduction was not sufficient to counterbalance the rise in domestic use and across the industry total demand was between 2 and 5% higher.

In WRMP19, all water resources zones were considered to have good underpinning resilience as they showed a surplus against a 1 in 200-year drought event after implementation of preferred plan actions.

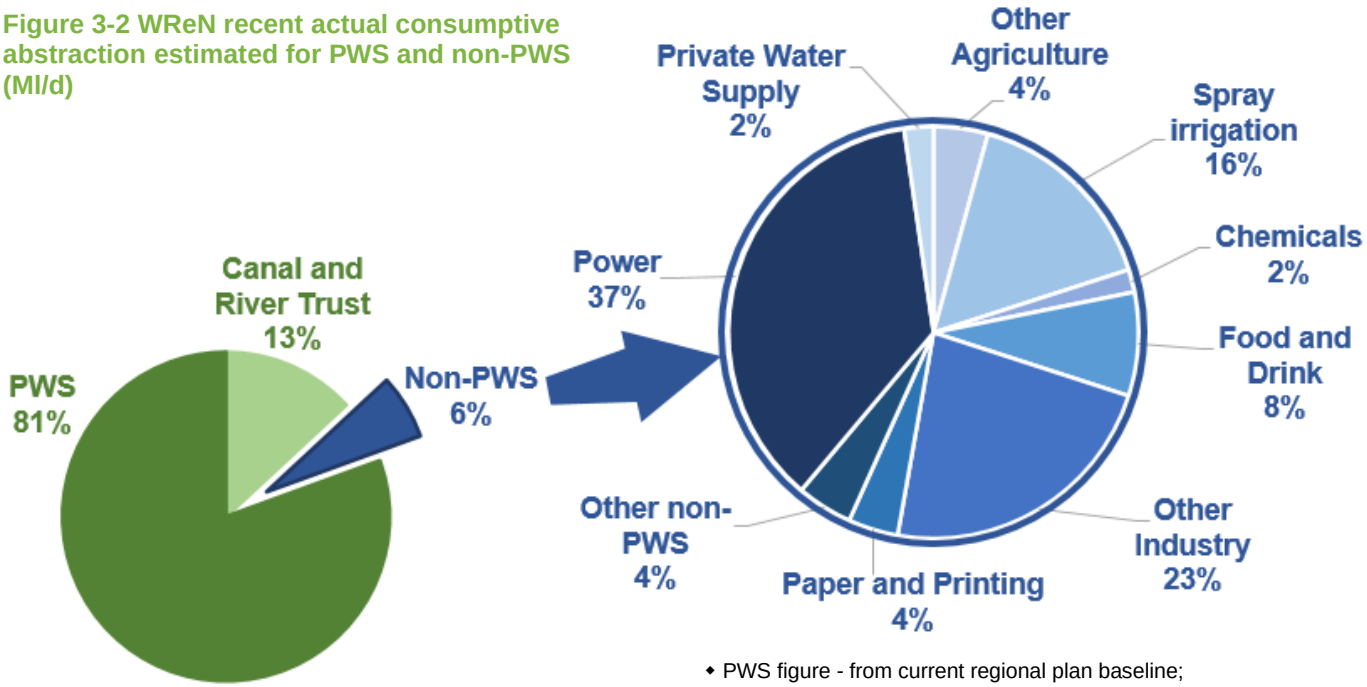
For the WReN Regional Plan and WRMP24, all WRZs have been re-assessed against a 1 in 500-year drought using the latest planning methods. The results of this along with our updated demand and supply forecasts are presented in **Section 4** of this report.

Other sectors

The water abstracted and used in WReN is dominated by that taken for public water supply as presented in **Figure 3-2**. This shows that the consumptive demand for non-public water supply sectors in the WReN region amounts to approximately 6% of total water abstracted for consumptive use. This includes abstraction data provided by the Canal and River Trust (CRT) for navigation abstractions which are assumed to be consumptive.

However, as a part of the regional planning process, it is necessary to consider the current and future demands from other sectors as well as PWS. Unlike PWS, there is no holistic plan for water use in other sectors, and therefore it is not currently possible to report progress against targets in the same way as it is for water companies' WRMPs.

Figure 3-2 WReN recent actual consumptive abstraction estimated for PWS and non-PWS (Ml/d)



- PWS figure - from current regional plan baseline;
- Canal and River Trust figure - from analysis of abstraction data provided by Canal and Rivers Trust (assumed all consumptive);
- All other non-PWS figures - from 'Understanding Future Water Demand Outside of the Water Industry', Defra (2020)

[12] Northumbrian Water Group (NWG), 2021, Impact of Covid 19 on NW Demand, page 7

3.2. Status of the natural environment

The Government's 25 Year Environment Plan commits to improving at least 75% of WFD waterbodies to as close to their natural state as soon as practicable. The proportion of surface waterbodies currently in the WReN region achieving Good or High ecological status/potential[13] is 20%[14], compared to the national average[15] of 16%. The proportion of groundwater bodies achieving Good quantitative status is 83%, relative to the national average of 73%.

Out of the 80% of waterbodies not achieving good ecological status or potential, 8% is due to abstraction and flow, although this does not account for longer-term flow pressures which the Environmental Destination component of the regional plans seeks to address.

The Environment Agency published the next round of River Basin Management Plans (RBMPs) in October 2022 and the flood risk management plans in December 2022 following draft consultation between October 2021 and April 2022. The Environment Agency is also in the process of updating Catchment Abstraction Management Strategies (CAMS), and water company AMP7 Water Resources WINEP investigation schemes are complete. Collectively, alongside additional work in support of Environmental Destination (see Appendix 6), this will inform the measures within future RBMPs including water resources measures (see also **Section 1** considerations for longer-term investigation).

3.3. Customer priorities

Our regional plan draws on customer priorities, identified via:

- WRMP24 customer engagement undertaken at water company level in 2022 & 2024
- WReN customer engagement from 2021 (see **Appendix 7**)
- Previous PR19 customer research

This allowed us to compare and contrast customer preferences across the region.

A summary of customer views across several key areas of interest is presented in **Table 3-1**. Overall, the views across the three research pieces do not vary significantly. We used customers' views to inform the strategic choices we made and the options we chose as part of our plan.

Table 3-1 High level customer views for key topics

Topic	High-level customer views
Affordability	Affordability is a top concern with customers, particularly in the context of the recent cost of living crisis.
Supply/drought resilience	Provision of safe and continuous supply, is a top priority, particularly in the face of climate change.
Leakage	Reducing leakage is a top priority with customers, this view remaining a constant across the research (2019-2022).
Environmental improvement	Customers support environmental improvements. There is willingness to pay a small increase in bills for investment against targets as long water companies are transparent about this (affordability will be a key consideration in the pace of delivering improvements).
Demand reduction	A mid-range concern with customers; water saving devices, voluntary metering and behavioural changes are preferred.
Levels of service	Improvements to levels of service were typically seen as a low priority. Customers think restrictions could help them realise the value of water and instil long-term behavioural change. It is also seen as least-costly.

[13] Based on data from the main River Basin Districts in the region; the Northumbrian River Basin and Humber River Basin.

[14] River Basin Management Plans – 2019 update

[15] England and Wales only (excluding Western Wales)

Topic	High-level customer views
Option preferences	Slight preference shown for groundwater abstractions (due to perceived lesser environmental impact) and water transfers (due to improvements in resilience within the region). Overall, achieving a reliable supply of water is more important regardless of the combination of options chosen to achieve this. It is clear that customers are more interested in the 'outcome' or impact of the specific option regardless of type.
Water trading	Customers are open to the idea of water trading providing that: a) no adverse effects on supply within our region b) recipient companies don't use it as an 'easy option' which could lead to greater inefficiencies (proxy for leakage).

3.4. Stakeholder priorities

WReN recognises the importance of engaging with those who have an interest in water resources in the region for the creation of a truly regional plan. We have engaged with stakeholders throughout the regional planning process, including on the emerging plan which was published for consultation in January 2022 and the draft Regional Plan which was published for a 14-week consultation period from 18 November 2022 to 24 February 2023. During these consultations, we received detailed responses from a range of stakeholders including regulators and statutory bodies; water retailers; energy sector; industry consultants and suppliers; and landowner associations such as National Farmers Union and Country Land and Business Association.

Following the consultation on the draft Regional Plan, we published our Statement of Response on Friday 8 September 2023. This advised how we would take account of each response in our final Water Resources North Regional Plan.

An overview of the key themes from feedback received on the draft Regional Plan is provided in **Table 3-2** along with actions we have taken whilst shaping our plan. Further details on our Statement of Response can be found in **Appendix 8.**

Stakeholder Advisory Group

The WRNF emphasised the importance of involving stakeholders from non-PWS sectors in order to better understand the future water needs of other sectors as well as key environmental groups to inform and contribute to the development of WReN's environmental ambition.

WReN's Stakeholder Advisory Group (SAG), formerly called the Stakeholder Steering Group, consists of water company leads, regional EA representatives and primary stakeholders from the energy, agriculture and environment sectors. The group meets regularly and has been important in steering the development of our regional plan.

Sector specific engagement

Outside of the Stakeholder Advisory Group, WReN has undertaken separate discussions with other sectors such as energy, agriculture, environment and navigation.

The absence of coherent, overarching plans for non-public water supply sectors, together with other constraints such as competition law, makes it extremely difficult for many of these sectors to accurately plan for their future water needs at a sectoral level. We have therefore been working with non-public water supply stakeholders to better understand how well the national framework data represents reality and seek to ensure we are accounting for their future water needs as accurately as possible. A summary of the discussions held, including the challenges each sector is facing and potential next steps for how we can work collaboratively moving forwards is provided in **Section 5.6**. **Appendix 8** provides a more detailed overview of our stakeholder engagement activities throughout the regional planning process.

Table 3-2 Overview of draft plan feedback and action taken

Feedback and action
Alignment with other water resource plans Regulators in particular emphasised the need for ongoing alignment between company WRMPs in the WReN area and the Regional Plan, including to reflect the latest updates to guidance, policy and to reflect lessons learnt from the 2022 drought. Building on the inter-regional reconciliation process, the need to ensure consistent plans with neighbouring regions was also emphasised, particularly around the cessation of the Derwent Valley transfer from Severn Trent, Kielder and associated SRO schemes. A specific discrepancy between the company plans on the timing of internal regional transfers from Northumbrian Water and Yorkshire Water was also raised. ***ACTION:*** ***WReN has continued to engage with other regional groups and water companies to ensure alignment of plan options, data, and narrative including a further inter-regional reconciliation 3 exercise (See Section 5.4). The final WReN Plan draws on the underpinning work at water company level in line with latest guidance and policy and reflects the updated position and timelines on transfers within WReN and SROs.***
Costs and affordability There was support to our approach for phasing investment in the plan to mitigate the impact on customer bills, however, there was a general request (relevant to all companies and regions) to ensure that affordability did not impinge on delivering environmental solutions in a timely manner. The WReN plan has emphasised the need for environmental investigations to identify appropriate, best-value solutions. ***ACTION:*** ***WReN has updated the final plan with the latest profiling of investment in line with water companies' WRMPs. Revisions to proposed investigations and scope definition for environmental improvements have been made including timeline and trigger points. The timing of expected resolution of environmental destination needs in the River Derwent SAC has been revised to an earlier 2040 date (from 2050 previously) with 2027 now the decision point for this investment.***
Decision making & best value planning Whilst extensive scenario and plan testing has been completed, several responses have indicated the need for the impact and decision-making of scenarios to be further drawn out in the WReN Regional Plan (beyond that included in the water companies). Further sensitivity testing and/or justification on the timing of achieving policy targets (e.g. drought resilience) and/or on the profile of delivery (e.g. for leakage and demand management) has also been raised by regulators. There is evident concern at the inherent uncertainty of non-household demand needs from the energy sector, and the potential impacts of this on the plan. ***ACTION:*** ***WReN has updated the plan in line with final WRMPs, inter-regional reconciliation 3, further plan scenario testing and sensitivity testing. Narrative has been updated and expanded to provide further explanation on plan scenarios and their impacts, the plan pathway representation and justification on timing and profiling of delivery (See sections 5.5 & 6). Further work will done on the impact of decision-making and scenarios for the non-public water supply sector as we progress into the second round of regional planning (See Section 0). Further explanation has also been provided on the uncertainties on energy sector demand, and how change would be managed/accommodated to ensure supply-demand needs are met within the best-value plan (See Sections 5.6 and 7.5).***
Demand management Generally, it was requested for WReN to include further information in its Regional Plan to demonstrate in more detail that all aspects of demand management will be delivered and that water companies should be more ambitious with respect to leakage reductions. There was acknowledgement of engagement to date but also that more collaboration was needed, particularly with wider stakeholders including non-PWS, to influence and support consumers in reducing demand to help meet targets.

Feedback and action

ACTION:

WReN has updated the plan to reflect:

- ***changes in preferred leakage strategy and programme to manage and reduce leakage (in line with final WRMPs) (See Section 7.1)***
- ***further justification of the demand reduction profile and targets including detail on how we intend to deliver all aspects of demand reduction through working together with retailers, household / non-household customers, NAVs and other stakeholders (See Section 6.1)***
- ***changes in the adaptive monitoring plan including in relation to demand performance (See Section 7.3)***

Drought resilience

Broadly, the approach outlined in the draft plan to operate to a 1 in 200-year level of service for emergency drought orders (Level 4 restrictions) in the Yorkshire Grid prior to moving to a 1 in 500-year resilience level has been supported. However, feedback has indicated a need to undertake further sensitivity testing on the timing of moving to the improved service level (around the 2039 policy target date), to affirm the best-value plan.

ACTION:

WReN has updated the plan to reflect changes and provide supporting narrative in relation to best-value plan and sensitivity testing approach and findings (i.e. Yorkshire Grid timing of moving to drought resilience levels with the aim of achieving 1 in 100 by 2025/26, 1 in 200 by 2027/28, and 1 in 500 by 2039/40). Scenario testing was carried by optimising to achieve the 1 in 500-year level of service by 2035, 2040, and 2045, further details can be found in Section 6.2.

Environment

Broadly, the need for environmental improvement was supported. A key concern particularly for regulators, was the timeline for Environmental Destination in relation to abstractions from the Yorkshire River Derwent and whether abstraction reductions could be delivered at a greater pace to deliver environmental benefits as soon as practicable.
Another area of concern particularly for other / non-PWS sectors, was associated with future licence capping and licence reductions such as when, how and the underpinning data informing decision-making. Uncertainty around future water availability could compromise investments required for other drivers (such as decarbonisation) and could be detrimental to production and plant operation to present a security of supply risk (e.g. food and energy). A number of comments were also made on specific environmental areas (such as biodiversity net gain and historic environment) and for particular options.

ACTION:

The Regional Plan has been updated to align with revisions at water company level in relation to:

- ***environmental destination (noting that the profile and pace of the proposed environmental destination has been reviewed at WRMP level and the associated Decision point and Trigger date have been brought forward to 2027 and 2040 respectively) (See Section 6.4)***
- ***actions that we have or will undertake to support other / non-PWS sectors in creating visibility of their needs and challenges (such as those associated with abstraction reduction) and to work collaboratively with regulators and other stakeholders on the steps required to address any barriers (See Sections 5.6 and 7.5)***
- ***detail of option assessment is provided in the WReN Strategic Environmental Assessment (SEA) Environmental Report which is available as supporting documentation with the Regional Plan.***

Non-public water supply

A key message from the feedback is that non-PWS sectors should be brought further into the regional planning process and that there are several barriers to this including funding and data requirements. Of particular concern is understanding needs, growth and the competing future demand for the same water sources in a joined-up way and facilitating the identification and development of joint solutions. The power sector for example, has significant future water demands associated with growth forecasts and decarbonisation ambitions (with low carbon power projects which require availability of water). Going forwards, we will reconfirm non-water company sector leads and will look for them to lead workstreams (e.g. demand forecasts) to feed into the future iterations of the WReN Regional Plan.

Feedback and action

ACTION:

WReN has included further detail on the actions that we have and will undertake to incorporate non-PWS into future regional planning cycles (See Sections 7.5 and Section 8).

Options detail

Feedback in this area related to the amount of information available on some of the schemes which made it difficult to provide detailed comments on some of the proposals or assessments. At **the draft plan** stage, the options included in the plan **were** largely at an early stage of development**.**

ACTION:

Certain site specific information is not available in the published documents due to the sensitive nature and due to security issues. However, information that can be published has been updated to reflect the latest option detail and assessment information that can be published along with clearer sign-posting to this document (See Appendix 5 for further details).

Options sufficiency

The main feedback in this area was that the options put forward in the plan were not as wide-ranging as expected to provide more flexibility to manage uncertainties through the adaptive planning process and with the loss of import from Severn Trent Water to Yorkshire Water. Stakeholders commented that they would have liked to have seen more nature-based, third party, non-PWS, catchment and reservoir solutions**.**

ACTION:

WReN has provided further explanation on its options selection process for feasible supply options for meeting deficits in the Grid zone including nature-based solutions (See Sections 5.5 , 7.4 and Appendix 5). Nature-based solutions that that are not specifically selected within the WReN regional plan are included in the PR24 WINEP plans for Yorkshire Water and Northumbrian Water and further work will be completed. Any new options identified through the WINEP process will be considered fully in the second round of regional planning and next round of water resource management planning.

Regional transfers / SROs

The responses in this area generally emphasised the need for common narrative to be maintained in the Final Regional Plan with other regions and companies on cross-boundary options positions, and the need to continue work on potential exports from WReN even though they may not be included in the current plans of other regions. WRW welcomed the work undertaken with WReN to date and stated their desire for ongoing collaboration in this area (including on options currently discounted). There was specific questioning regarding the absence of any exports to the Water Resources East (WRE) area, a question which interfaces with options sufficiency above.

Concern was also noted on the reservoir expansion element of the South Yorkshires Sources SRO given its location in the Peak District National Park. Although this was included in Severn Trent Water's draft WRMP, it was potentially a candidate option to facilitate maintaining the existing Derwent Valley transfer to Yorkshire Water and so interfaced with the WReN plan; this option has now been removed from the Severn Trent Water / WRW preferred plan.

ACTION:

WReN has revised the plan to reflect the latest position statement on SROs and consistent with that agreed with other regions, water companies and Reconciliation 3 including Derwent Valley transfer (which now ceases under all scenarios in 2035) and Kielder water resource zone exports. Specific detail has been added to provide further explanation of the WRE exports explored previously, and the future risks/opportunities/dependencies associated with them (See Section 6.3)

We have made commitment to ongoing work with all adjacent regions and companies on options beyond this planning round (See Section 5.4)

Feedback and action

Stakeholder engagement

Generally, comments were supportive of the work WReN has undertaken to bring about meaningful engagement with a range of stakeholders including the non-PWS sectors and that this should continue moving forward, particularly with key sectors (such as agriculture and energy) and at a local level. One stakeholder felt that the plan may be 'hard to digest' and would benefit from a change in some of the data presented to make it more digestible.

ACTION:

WReN has provided further detail on how we will engage further with stakeholders (See Sections 5.6 and 7.5, Section 8 also details work we plan to do going forward)

We have published a new Non-Technical Summary document to increase the ease of understanding the main report in a more condensed format

Supply-demand forecasting

A number of comments raised flagged the need for more detail on the supply-demand scenarios included in the plan, within the main Regional Plan report, including the scenarios tested around the 'central' supply-demand balance. There was concern that a more precautionary approach was needed to climate change**,** however, our interpretation of this response was that greater detail was needed on the extensive testing of climate and drought risk in the plan process (beyond that held in appendices and/or company WRMP24s). A need to reflect the latest guideline updates was reiterated by regulators (these occurred following submission of the draft Regional Plan). Non-household forecasting uncertainties due to the energy sector were a key area of concern, as described under the decision-making section earlier.

ACTION:

WReN has updated the Regional Plan to:

- ***Sections 4.4 and 4.5 detail the scenarios that have been tested in relation to demand and demand growth accounted for within the plan***
- ***included specific call-out to provide emphasis upon the climate change and drought testing process and impacts, and the resilience of the plan to different climate change scenarios (including high emissions) (See Sections 4.4, 4.6 and 6.2)***
- ***reflected the changes in supply-demand balance from revised draft WRMP24s, including summary of any changes in assumptions and reflecting latest guidance from regulators (See Section 4.4)***
- ***Included a position statement on the non-household demand uncertainty, how this is handled in the plan, and work ongoing to reduce this in future with the energy sector (See Sections 4.5, 5.6. and 7.5)***

4. What the future looks like

This section sets out our future regional environmental, public and non-public water supply needs for our Final regional plan. It reflects a full refresh of our public water supply and demand forecasts in line with the Final Water Resources Management Plans, which includes significant potential abstraction reductions required to achieve our environmental destination. This section also sets out what we currently know about future demand in other sectors, the impacts of work with other regions around inter-regional transfers, and various other considerations that will continue to evolve as we move towards future planning rounds.

4.1. Sustainable abstractions and wider environmental work

Sustainable abstraction is essential to support healthy ecology and the natural resilience of our rivers, wetlands and aquifers. Abstraction reductions have a major influence upon our future water resources position, and significant work has been undertaken to understand future requirements.

WINEP work in AMP7

The Water Industry National Environment Plan (WINEP) collates the actions that water companies are required to deliver as part of their environmental obligations. Water resources focussed WINEP drivers have an ongoing, cyclical role in determining the extent and pace of changes to abstraction and the resulting impact on WRMP supply forecasts.

It is important to note that water companies in our region have already done much work to improve the water environment. For example, water companies:

- Changed the timing and volumes of releases of water from several reservoirs to reflect a more natural flow, with higher winter flows and lower summer flows, as well as ‘spate’ releases to ensure river conditions which allow migratory fish to move up and downstream at keys times of their annual life cycles. Further changes on other reservoirs are also planned.
- Installed screens on high risk river abstraction intakes to ensure eels do not become entrapped.
- Built fish passes or easements on structures (e.g. weirs) which prevent fish from moving naturally up and down rivers.

  Water companies are also addressing the impacts that reservoirs have on the natural ‘form’ of rivers, for example, by adding gravel to rivers which are depleted of natural sediment by the presence of a dam wall.

Moreover, Northumbrian Water continues to work closely with land managers and farmers to improve the quality of water at their abstractions. In AMP7 the focus of the work was on:

- Reducing pesticides, nitrates and cryptosporidium in raw water, as well as addressing the problem of colour in water from degraded peatland. To achieve this, Northumbrian Water engages with farmers and offers them grants to enable change in farm infrastructure and farming practices.
- Supporting the Pennine Peat Life Programme to regenerate degraded peatlands which supply the upland reservoirs in the Tees catchment.
- Supporting partner organisations to deliver projects which take a holistic approach to improving river habitat, increasing biodiversity, and addressing the impacts of climate change, focusing on the South Tyne catchment.
- Reducing the risk of spreading of invasive non-native species (INNS).

As well as continuing to invest in activity to deliver improved water quality across upland, lowland and groundwater catchments, Yorkshire Water undertook the following investigations in AMP7:

- Nitrates investigations and other raw water initiatives to improve source water quality (e.g., optimising the location and timing of abstraction from upland catchments with high dissolved organic carbon)
- Investigations to confirm sustainability of public water abstraction from chalk environments
- Investigations to consider long-term requirements beyond immediate WFD drivers for licences with modelled long-term deficits

Licence capping and sustainability reductions

Regional plans must demonstrate that they account for the impact of Environment Agency’s policy on capping of time-limited abstraction licences to prevent deterioration of waterbodies. The

Environment Agency has confirmed that where an abstraction licence change is necessary to prevent deterioration in England, groundwater licences will either be capped at a recent actual average utilisation or at the maximum peak abstraction, depending on the risk that deterioration will occur. This capping will occur on licence renewal, for affected time limited licences or licences with a time limited variation, and by 31 March 2030 or 2035 for the affected permanent groundwater licences.

In preparing their final WRMP24 supply forecasts, water companies have considered whether:

- any of their abstraction licences are unsustainable at the full annual licensed quantity; and
- if not, whether they need to implement any sustainability reductions to reduce the annual licensed quantities to a sustainable level of abstraction.

Northumbrian Water have specifically looked at:

- the need to implement any sustainability reductions on groundwater licences during AMP8, arising from AMP7 Water Industry National Environment Programme (WINEP) investigations and options appraisals;
- whether there are any un-used abstraction licences that pose a risk of deterioration under the Water Framework Directive and if these can be surrendered;
- whether any groundwater licences will need to be capped to Max Peak or Recent Actual Average on renewal or by March 2030, to reduce the risk of waterbody deterioration under the Water Framework Directive.

Northumbrian Water has agreed sustainable levels of abstraction for each of its sources in the Berwick & Fowberry WRZ with the Environment Agency and these have been used in their baseline groundwater DO assessments. Moreover, in liaison with the Environment Agency, Northumbrian Water has agreed to surrender two unused groundwater licences (Routing Burn, Seal Burn, Black Burn and Halton Lee Gate). As these two licences are not currently in use, they are excluded from Northumbrian Water's baseline WRMP24 DO or supply demand balance.

Northumbrian Water have several groundwater abstraction licences with time limited variations which are due for renewal during AMP8. The Environment Agency has confirmed that none of these licences are considered to pose a risk of deterioration and so do not expect them to be subject to capping on renewal. One such groundwater licence in the Fowberry area has a time limited condition which increases the annual average abstraction rate from 2.7 Ml/d to 3.2 Ml/d. Whilst Northumbrian Water anticipate that the renewal will be granted, they have taken the precautionary approach of assuming the lower abstraction volume of 2.7 Ml/d in WRMP24 deployable output assessments. No environmental destination sustainability reductions are required on any of Northumbrian Water's licences for WRMP24.

Yorkshire Water has completed its AMP7 WINEP investigations. Where investigations have identified the need for licence changes, we are in the process of agreeing the magnitude and pace of these with the EA. Where decisions have not yet been formally reached, or where new investigations are being undertaken in AMP8, our plan makes allowance for the uncertainty in the outcomes of these investigations through the Environmental Destination scenarios.

Hartlepool Water has completed AMP7 investigations into the sustainability of its abstractions from the Skerne aquifer. The investigations concluded that no licence reductions are required on the basis that the waterbodies are compliant with WFD screening thresholds. More broadly, Hartlepool Water has committed to capping its permanent groundwater licences to recent actual average levels by 2030.

4.2. Environmental destination

The Environment Agency's WRNF policy document (the 'National Framework') identifies that, nationally, a step change is required to improve the water environment and address unsustainable abstractions from it, in order to improve resilience to drought, climate change and increase environmental protection, by 2050. This is a longer-term strategy and is aimed at going above and beyond the current legal obligations that water companies must fulfil.

Through our environmental destination we will ensure that sustainable water supplies and long-term environmental resilience go hand in hand. Within this and future iterations of the plan we will take an evidence-based approach to understanding the long-term needs of the environment and the most appropriate solutions to achieve a shared ambition. Working with others, we will protect and enhance catchments, in particular those which support our most rare and valuable species and habitats.

Environmental destination scenarios

The National Framework sets out a range of environmental destination scenarios that Regional Water Resource Groups and their constituent water companies need to build into their final WRMP24s to deliver the step change in resilience and environmental protection required. These scenarios are described in the table below, and appropriate low/high scenarios included in our adaptive planning framework described later in this document.

Table 4-1. Environmental destination scenarios

Name	L/M/H	Description
Ofwat core	Low 1	Based on current known legal requirements for abstraction reductions up to 2050 only. The scenario should represent the lowest plausible abstraction reductions that meet currently known legal requirements in force at that point in time, in alignment with low Ofwat common reference scenario.
Business as Usual (BAU)	Low 2	National Environmental Destination BAU scenario used as starting point, locally validated to remove waterbodies with significant uncertainty whether reductions are required.
Business as Usual "Plus" (BAU+)	Medium	Expands on BAU through the inclusion of Common Standards Monitoring Guidance (CSMG) flow targets for European protected areas. This should take account of any local flow target for European sites where one has been agreed (with the EA/NE). Where one has not been agreed the default would be to use the default CSMG flow target. **This is the minimum scenario for inclusion within SDB baseline forecasts for regional planning groups.**
Enhanced	High	High scenario aligned with the national WRNF Enhanced scenario.
Enhanced (locally agreed)	High	High scenario (as above) incorporating any local agreements with regulators (*noting that no local agreements have been made through Water Resources North and this scenario has not been considered*)

We have worked with the Environment Agency, to identify a longer-term environmental destination for our region, to deliver longer term sustainability and environmental resilience. The licence and abstraction reductions proposed under environmental destination are to achieve and maintain sustainable abstraction to 2050 (and beyond), taking into account climate change impacts and future demand.

Northumbrian Water

Northumbrian Water adopted the Business as Usual Plus (BAU+) Environmental Destination scenario in calculating their DO for WRMP24 preferred plan. This already includes the sustainability reductions arising from completed WINEP investigations, which are already included within their baseline WRMP24 supply forecast.

Under the BAU+ scenario, and the alternative scenarios, there are no further abstraction or licence reductions applicable to Northumbrian Water's abstraction licences and hence, no environmental destination reductions in deployable output are needed in their area.

Yorkshire Water

Yorkshire Water has assessed a range of environmental destination scenarios to inform the preferred plan position and the alternative pathways (see **Section 7.3**). The abstraction reductions under the BAU+ scenarios have been taken into account in calculating the final plan DO. The table below summarises the timing and extent of the impacts of deployable output through the planning period in relation to Environmental Destination for Yorkshire Water.

Short-term licence changes to meet Water Framework Directive Objectives

As there are no confirmed legal requirements for abstraction reductions at any of Yorkshire Water's

sources, no changes are assumed under the baseline scenario. Yorkshire Water assumed a 6 Ml/d impact on DO from some groundwater sources under the BAU scenario, based on licence capping to recent actual usage with peak use (within existing licensed volumes) permitted for short term operational use. Under the BAU+ scenario, Yorkshire Water assumed the DO impact from these groundwater sources would increase to 11Ml/d[16]. This is due to the additional impact of climate change on natural flows. Under the Enhanced scenario, a more significant climate change impact is assumed, resulting in a loss of 17 Ml/d in deployable output.

Long-term licence changes to meet Environmental Destination

As the estimated abstraction reductions in the WRNF are not currently known legal requirements and are subject to uncertainty over whether the reductions are required, Yorkshire Water have assumed zero long-term reductions in the Baseline and BAU scenarios respectively.

Under the BAU+ scenario Yorkshire Water has assumed 104 Ml/d reduction in deployable output from the River Derwent abstraction at York linked to achievement of Common Standards Monitoring Guidance (CSMG) targets for the River Derwent, effective from 2040, in line with regulator expectations.

The Enhanced scenario represents the 'worst' case loss of DO from the lower Derwent under the same environmental driver as BAU+. The licences under consideration will be investigated in depth as part of an AMP8 Environmental Destination WINEP scheme and the outputs reflected in future iterations of Yorkshire Water's WRMP.

Table 4-2. Yorkshire Water Environmental Destination Scenarios DO impact

Scenario	Total DO impact (Ml/d)	Year licence change effective from
Baseline	0	-
BAU	-6	2035 for groundwater
BAU+	-115	2035 for groundwater 2040 for rivers
Enhanced	-180	

[16] Selected licences at the groundwater sources are subject to ongoing AMP7 WINEP investigations which will conclude in 2024.

4.3. Impacts of abstraction reductions on non PWS sectors

To achieve the environmental destination ambitions, similar action to reduce abstractions is also required from non-PWS abstractors. Therefore, the Environment Agency is working with these non-PWS licence holders to ensure they also deliver their proportion of change. However, the mechanisms and timing of changes will be different from those that apply to water companies. WReN is working closely with the Environment Agency to support these sectors to make practical planning assumptions about how licence reductions to prevent deterioration may be represented in supply forecasts for non-PWS abstractions.

The national model provided estimates for the reductions in abstraction required from other sectors in the WReN region, under BAU and Enhanced scenarios. This shows potential reductions of ~8Ml/d (BAU) and 10 Ml/d (Enhanced) for the agricultural sector and 4 Ml/d (BAU) and 16 Ml/d (Enhanced) for the industrial sector. These reductions are constrained to particular catchments and more information is available in our catchment dashboards[17].

4.4. Public water supply forecasts

A supply-demand balance compares the forecast water available for use with the forecast demand for each year of the planning period. If this balance shows a deficit between the available supply and the demand for water, we need to identify solutions to close the gap. This section relates to forecasting of the position for public water supply systems only (including where other sectors directly utilise these supplies).

The position presented in this section reflects the *baseline supply-demand position* before any options to deliver further leakage reductions or reductions in per capita consumption (PCC) have been applied (described in **Sections 6** and **7**). They also reflect the position without the benefit of drought measures such as temporary use bans (TUBs). Our forecasts reflect significant reductions in abstraction linked to the ambition for greater protection of environmental needs. They take account of the latest population and property forecasts, and latest approaches/data for assessing drought resilience and climate change.

[17] Catchment dashboards are available upon request

Following consultation on both our January 2022 Emerging Plan and the subsequent draft Regional Plan in November 2022, we have completed a refresh of public water supply and demand forecasts. The forecasts align with the latest and best available forecasts in the water company final WRMP24 publications alongside this Final Regional Plan. Further details of the modelling and key data assumptions can be found in **Appendix 2** and **3**, and the individual water companies' final WRMP24s.

Changes to the baseline forecasts

We have produced a forecast of available supplies over the next 60 years which takes into consideration the factors that influence the supply-demand balance position. Our WReN final plan presents a material supply-demand **deficit** from the start of the planning period for the Yorkshire Grid zone- due to changes to the way the baseline is calculated compared to previous WRMPs[18]. Although in surplus at the start of the planning horizon, the Kielder zone also enters deficit early in the planning horizon. However, it is important to note that the baseline presented in this section excludes the benefit of drought measures and demand measures. This represents a change from how the baseline may have been presented in earlier plan stages (i.e. emerging Regional Plan) or WRMPs, in line with the latest tables guidance.

Beyond these factors, compared to forecasts in previous planning rounds, the underlying baseline deficit is mostly driven by:

- updated DO methodologies to assess resilience to a 1 in 500-year drought at a system level
- new methodologies and data for assessing climate change impact on supply (impacting the supply demand balance from the start of the planning horizon)
- demand changes as a result of Covid-19 (which have persisted beyond the epidemic itself)

Deficits increase over time, largely due to further climate change impacts, abstraction reductions to meet environmental drivers, demand growth, and changes to existing water imports into our region. These pressures are further described below.

Assessment of 1 in 500-year drought resilience

To better inform our understanding of drought resilience, we have used new, more sophisticated methods for our public water supply forecasts for this round of planning compared to WRMP19. We have done this to assess our position against the WRNF expectation that water companies would achieve resilience to a 1 in 500-year drought, without recourse to Level 4 drought restrictions (i.e., standpipes, rota cuts or in the case of some areas of the region, pressure reductions) required by 2039.

Specifically, we have applied long-periods of 'stochastic hydrological' data (plausible synthetic scenarios based on historical hydrological patterns) to water company water resources models, to better assess supply availability under severe and extreme drought events. This is particularly important for the Kielder and Yorkshire areas, given the potential for water exports or inter-regional transfers to be considered. This change in input data from stochastic to historic data, has decreased our DO estimates.

Climate change impacts

The potential impacts of climate change on water resources for public water supply have been considered in water resources planning since 1999. In the 2019 WRMPs, water companies used UK Climate Projections 2009 (UKCP09) data. For the development of our regional plan and the WRMP24s, we have updated our assessment of the potential impacts using the latest UK Climate Projections 2018 (UKCP18) projections.

Like other regions, the focus of our regional plan has concentrated on applying the Regional Climate Models (RCMs) data, which is spatially coherent and allows for consistent assessment across regional modelling. We have assessed climate change impacts on our supply-demand balance under a medium emissions scenario for our central estimate position. Further details on how this has been carried out is included in **Appendix 2 & 3**.

Water resources modelling results using the new data showed that the expected impact of climate change is significantly greater than was shown by the UKCP09 data used at WRMP19. It is most severe in the Yorkshire Grid and Kielder zones. In terms of scaling the impact of climate change over

[18] This is in line with the definition of the fWRMP24 baseline in supply-demand tables. This is different from the baseline presented in the emerging regional plans. This distinction is important when comparing between previous plan versions.

time, climate change impacts have been scaled back to 1990, so some climate change influence is included on our forecasts even at the start of the planning period.

Major influences on baseline demand

The effect of the Covid-19 pandemic has materially impacted consumption and we have observed permanent behaviour changes following the normalisation of hybrid or remote working. There still remains considerable uncertainty as to how long (if at all) it will take for the non-household sector to return to pre-Covid levels. Based on recent research, including an industry project with Artesia[19], we have applied a 'new normal' impact of Covid-19 on demand to household and non-household consumption for all demand scenarios.

Baseline impacts summary

The combined effects of the new stochastic data and the requirement to be resilient to a 1 in 500-year drought, and the updated climate change projections result in a step-change reduction in our future supply forecasts. This is exacerbated by increased demand, with higher consumption observed since the Covid-19 epidemic. This results in an underlying deficit for WReN from the start of the planning period (prior to inclusion of any drought measures and demand/leakage reduction interventions).

Key drivers of increasing deficits over time

The availability of future water supply is influenced by a range of factors. Whilst there are common challenges to water supply across all regions, the influence of the factors varies by geography and each region faces their own unique challenges. The key challenges/upward pressures and their proportional impact to future water supply (to 2050) in the WReN region, under baseline conditions, are discussed below. These are primarily focused in the Yorkshire Grid zone, with Kielder zone seeing minor impacts. Berwick, Hartlepool and Yorkshire East zones remain in surplus throughout the planning period. Consideration has also been given to forecasts beyond 2050 to 2085, however, the forecasts become much more uncertain.

Environmental needs

Greater allowance for environmental needs causes the largest pressure on available supply, with a loss of 115 Ml/d of water availability in the Yorkshire Grid zones over the 2025-50 planning period. This is primarily a result of adopting the "Business As Usual Plus" (BAU+) Environmental Destination scenario, which is discussed in detail in **Section4.2**.

[19] Collaborative Study - The impact of COVID-19 on water consumption during February to October 2020 – Final report, (2021), Artesia Consulting – available upon request.

Climate change

Application of climate change over the planning period results in a further loss of 55.86 Ml/d of water availability (combined across Kielder and Yorkshire Grid) after the initial baseline impacts. However, climate change is a major area of uncertainty on available supplies and is a key component of our target headroom uncertainty allowance. We have also included it in our stress testing to aid development of the best value plan (**Section 5.5**).

Demand growth

Demand is predicted to increase by 58.52 Ml/d over the 2025-50 planning period (combined across Kielder and Yorkshire Grid). In alignment with WRMP24 Guidance, population and property forecasts have been designed to reflect Local Authority planned growth. For WReN this is the Housing Plan scenario. Further details on how this has been assessed is included in **Appendix 2**.

Whilst not technically 'demand', inset appointees (also known as new appointments and variations, or NAVs) are also expected to increase within the Yorkshire Water and Northumbrian Water supply areas. EA guidance requires contractual volumes to be accounted for as exports from our system. These developments further impact the supply-demand balance of the system.

Changes to existing water transfers (imports)

As part of developing our plan, we have considered transfers of water between companies and regions to meet our own needs, and also to support the water resources challenges of other regions (i.e. the export of water from our region). These aspects are described later in **Sections 5.3** and **6.3** respectively.

However, as part of the 'inter-regional reconciliation' process to align transfer options between regional plans (the third round of which completed in Spring 2023), changes to an existing import and transfer of water into our region was identified that impacts the baseline supply-demand position. A material impact on supplies in the Yorkshire area is currently forecast through cessation of an existing transfer of water from the Water Resources West (WRW) area.

The existing contract for the transfer of water from the Derwent Valley reservoirs in the Severn Trent Water (STW) area (WRW) to Yorkshire Water (WReN) is confirmed for termination in 2035 due to the impacts of abstraction licence capping (to prevent environmental deterioration) in the WRW/STW area. In the update to its draft WRMP24, STW has confirmed that cessation of the existing transfer will be included in its preferred plan for WRMP24 and would also occur under *all* plan pathways and scenarios.

In YW's final WRMP24 this represents a loss to the Yorkshire Grid of circa 46 Ml/d (DYAA scenario), which has been carried through into WReN's supply forecast. It should be noted that loss of the transfer will cause specific sub-zonal deficits for Yorkshire Water requiring specific options to offset the loss of the transfer. These options differ from those required to address more widespread deficits in the Yorkshire Grid zone (e.g. driven by climate change or environmental destination). In short, losing the transfer breaks the existing integrity of the resource zone.

Previous rounds of reconciliation

We have been in regular dialogue with WRW about the future availability of this transfer throughout the development of both our regional plans. A potential future alternative option previously explored was to increase the capacity of the Derwent Valley reservoirs in the STW area, and this informed the scope of the new RAPID South Yorkshire Sources SRO[20] scheme. The SRO project explored a range of different reservoir enlargement options, which, if delivered, would have protected Yorkshire Water's import whilst also addressing supply-demand deficits within the WRW region.

At the emerging plan stage, following the first round of inter-regional reconciliation, this led us to including two pathways in the WReN plan to account for the potential to retain the existing transfer (along with its cessation). Our emerging plans previously assumed the SRO would be able to support both WRW and WReN needs within the BVP[21], allowing the existing

[20] Technically, despite the name, as well as exploring different option variants for reservoir enlargement, the SRO project includes backfill options for Yorkshire Water for cessation of the transfer.

[21] Whether this option would have constituted part of the best-value in future, if viable, would have required further exploration supported by the SRO work. It is possible that applying options in the WReN area to offset the loss of the transfer would still have constituted the best-value plan by comparison, but this question is no longer relevant.

transfer to continue (note the loss of the existing transfer was included in a pathway in the WReN emerging plan). However, the reviews during the second round of reconciliation in spring 2022 to inform the draft plan, determined that the SRO project was still at a very early stage of development and should not be included in the preferred pathway for the draft plans. This was largely due to questions over feasibility, and significant uncertainties on the size and scale of benefit.

For the SRO scheme to be included in the preferred plans it would have needed to be sized to accommodate a significant number of uncertain needs, including the impacts on STW of licence capping in the 2030s as well as the long-term environmental destination scenarios by the 2050s, plus Yorkshire Water's long-term needs. STW's environmental destination need (aligned to BAU+) was larger in the draft plan compared to the emerging plan – this increased the risk of the SRO project not finding a feasible reservoir option to meet all the needs.

Regulator and stakeholder concerns over the potential environmental and heritage impacts of the South Yorkshire Sources SRO meant that the solution would not progress any further as an SRO. Instead, the SRO was rescoped to focus on the development of alternative supply-side solutions in South Yorkshire.

Supply-demand balance summary

We have used the final WRMP24 projections of future supply and demand to calculate a supply-demand balance for all water resource zones in the region. The key data components of the supply-demand balance position along with the underpinning assumptions are provided in **Appendix 2**. A summary of the supply-demand balance position is shown below. **Table 4-3** shows our supply-demand position[22] prior to the inclusion of further demand management and leakage reductions beyond the AMP7 2020-2025 period, or the benefit of drought measures.

The baseline supply-demand balance demonstrates that water resource pressures do not affect all WRZs in the WReN region to the same degree. Berwick, Hartlepool and Yorkshire East zones remain in surplus throughout the planning period. Initially, at the start of the planning period, the Kielder zone has a surplus but turns to deficit in the following year, which subsequently continues to increase over time. Major underlying deficits are shown in the Yorkshire Grid zone, which increase significantly through the planning horizon (over two-fold the deficit in 2050 compared to 2025).

Table 4-3 Baseline supply-demand balance: Position prior to further demand management, leakage reductions and drought measures

	Summary of forecast surplus (+) and deficits (-) – Ml/d		
Zone	**2029/30**	**2039/40**	**2049/50**
Berwick	+0.75	+0.73	+0.73
Hartlepool	+8.50	+2.09	+2.11
Kielder[23]	-28.90	-36.03	-44.80
Yorkshire East	+4.69	+4.64	+4.49
Yorkshire Grid	-136.42	-199.50	-312.18

Baseline supply-demand scenarios

It is important to recognise that all forecasts have inherent uncertainty around them. If the future turns out differently to our forecasts, this could change our supply-demand balance position and whether we have a supply surplus or deficit in each resource zone.
This is in part accounted for in our target headroom allowance assessment (which provides a buffer for uncertainty), but major long-term uncertainty areas have been considered as part of our adaptive planning and scenario framework.

To assess the sensitivity of our supply-demand balance position to these uncertainties, a number of supply-demand scenarios have been considered. Stress testing has been undertaken for the final supply-demand balance against the Ofwat Common Reference Scenarios (CRS)[24] for low and high:

[22] This data is for the core 25-year planning period to 2050 that drives planning needs in our plan. We have also forecasted out to a 60-year planning period, albeit at higher level, which is used rather for the purpose of scenario analysis on our plan (Section 8.2).
[23] It should be noted that the Northumbrian Water Industrial zone has been presented as part of the Kielder zone as these two zones have been merged for this round of planning. This represents a change in zonal reporting from WRMP19. It should also be noted, however, that the merger of these two zones does not result in a straightforward addition of the DOs, and surpluses/deficits, because of the way that potable demands were previously accounted for within the Industrial zone.
[24] PR24 and beyond: Final guidance on long-term delivery strategies (April 2022)

- Climate Change
- Demand
- Technology
- Abstraction reductions (environment)

The CRS set out a set of plausible bounds or extremes for key uncertainty areas for testing. They allow us to understand the sensitivities of our supply-demand position and how this may impact future investment needs and required solutions. The use of key scenarios in our plan decision-making process is described further in **Section 5.5**.

For those zones already in surplus, scenario testing did not highlight a material risk of deficit requiring intervention within the plan. In the case of Kielder, scenario testing demonstrated that plan investment choices were not sensitive to changes in the supply-demand balance (**Section 7**). However, in the case of Yorkshire Grid, testing on the supply-demand balance baseline showed that:

- The zone is particularly impacted by climate change and abstraction reduction (environment) uncertainties. Albeit still in deficit, the low demand scenario represents an improvement in the SDB position (noting the high scenario shows no change).

- Barring the low demand scenario (with a #90 Ml/d deficit), a sizeable deficit is still observed throughout the planning horizon for the residual 'low' scenarios, with over 200 Ml/d deficit by 2050.

- Under 'high' scenarios there is a tangible additional risk of materially larger deficits, with deficits of at least around 350 Ml/d under the high environmental destination and climate change scenarios.

- When looking to the longer-term, by 2084/85 deficits range between 180-500 Ml/d across all scenarios, which is also relevant to exploring our long-term investment needs.

Therefore, the Ofwat CRS are particularly important to help inform the resulting planned investment and solutions, so that they can suitably meet the needs of the future if the forecast position changes as part of the best-value adaptive plan. For this reason, our future choices and best value plan is largely focussed on the Yorkshire Grid and closely aligned with Yorkshire Water's WRMP24. It should also be noted that Yorkshire Water has created bespoke scenarios to address risks not captured by the CRS, more specifically, a hydrogen scenario, whereby an estimated non-household demand increase of 15 Ml/d is realised by 2027/28 for hydrogen production. The impacts of this are presented further in **Section 7**.

4.5. Non-public water supply forecasts

In addition to public water supply, the WRNF expects regional groups to explore water demand outside of the water industry and consider the needs of other sectors. WReN has worked with representatives across the main sectors in the region, including agriculture, power and navigation to develop an updated demand forecast for non-public water supply. A summary of baseline and future predicted abstraction for the WReN region is provided in **Table 4-4**, categorised by primary and secondary sectors.

Data used in forecasts

At this stage, the demands presented for non-public water supply sectors largely remain those contained in the WRNF. There are various uncertainties around thesis data, particularly around the future projections for water demand including the long-term impact of behavioural changes following the Covid-19 pandemic. Nevertheless, engagement with other sectors to date has largely validated the growth factors attributed to each sector as it is recognised that this is the best information available at present. An exception to this is the power sector, where updated projections have been provided through the sectors Joint Environment Programme (JEP)[25]. Additional abstraction data has also been provided by the Canal and Rivers Trust which has been used to update the baseline demand for the non-public water supply. However, no growth forecasts are currently available to update the future demand for navigational abstraction. Previously, these abstractions were exempt from licensing and so they are not reflected in the WRNF data.

[25] Scenarios for the projection to 2050 of Water Use by Power Producers – updated using FES21, A Moores, Joint Environmental Programme, Report ref. ENV/695/2021

Consumptive only water use

The updated demand forecast suggests the WReN region will require an additional 249 Ml/d of water to support other sectors. This increase is largely driven by demand from the power sector which is forecast to increase to 296 Ml/d by 2050, from a baseline of 60 Ml/d. This figure has been obtained from the work undertaken by the JEP as previously stated. The data presented in the WRNF did not account for net zero commitments, which is likely to result in higher freshwater demands in some locations. As suggested in the JEP report, there is considerable uncertainty in the potential water requirements for the power sector at a regional level largely due to the uncertainty in how the UK will approach decarbonisation. Whilst it is possible to consider forecasts for the UK as a whole, it becomes harder to predict future need at a more granular scale (i.e. regional, sub-regional, catchment) as it is not presently known where, within the UK, much of the future demand may occur. This is discussed further in **Section 5.6** and **Appendix 8**.

There may be capacity within existing licenced volumes to accommodate the forecasted demand. However, as discussed in **Section 4.1** the Environment Agency are undertaking a review of existing licences, which may be capped at recent actual volumes to prevent WFD status deterioration. As a result, new sustainable water sources may be required in the future to meet this deficit.

The future water requirements of non-public water supply sectors are approximately 31% of the overall demand for the region (including public water supply) by 2050. However, many of the abstractions contributing to the additional 250 Ml/d required for non-PWS abstractions are constrained to specific locations. Therefore, it is important to consider water needs of our non-PWS sectors at a more localised scale, however, this presents various challenges such as data availability and limited funding for non-PWS activity

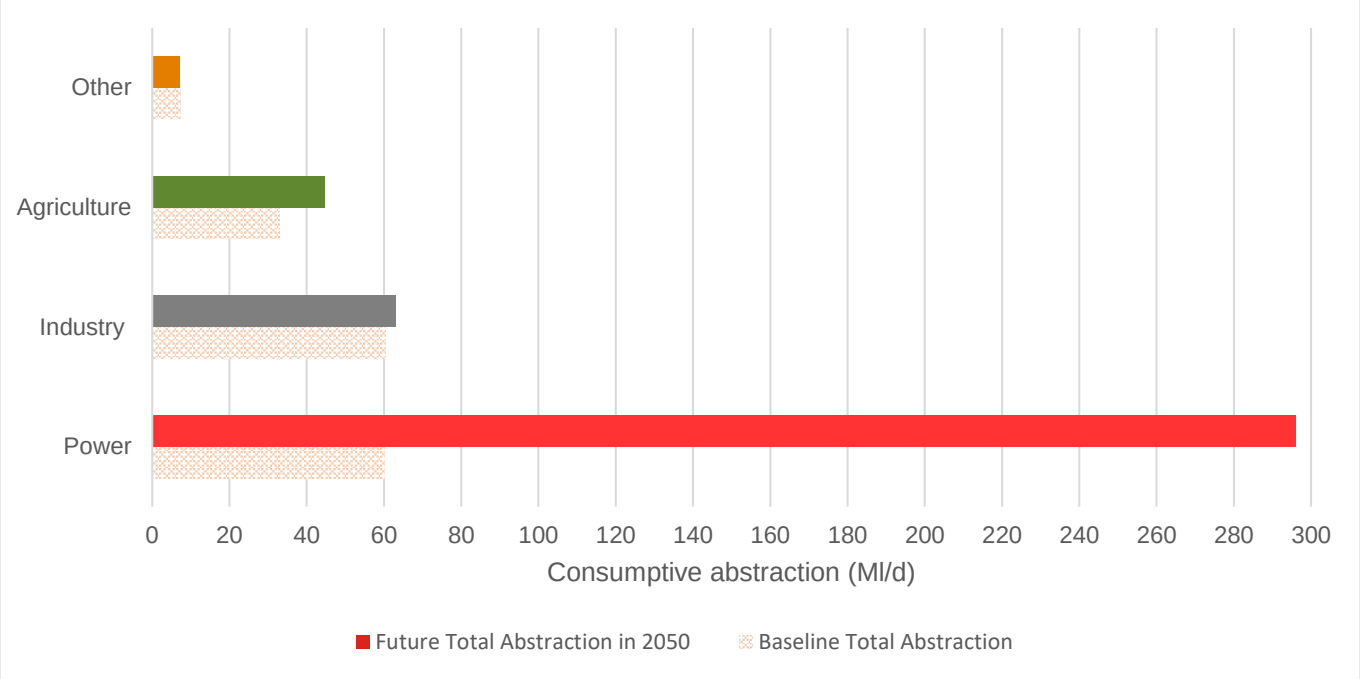
Figure 4-1 presents forecasted consumptive growth in 2050 compared with baseline values for main non-PWS sectors

Non-consumptive water use

These forecasts are based on consumptive only abstraction and the numbers associated with other sector abstractions are considerably larger when inclusive of non-consumptive data, with the power sector surpassing PWS abstraction more than three-fold. This is largely attributed to the hydropower and non-evaporative cooling energy processes which return a large proportion of the water initially abstracted to the environment directly and locally, with little or no treatment. Whilst the emphasis of the WReN Regional Plan is on consumptive abstraction, it is also important to consider the non-consumptive freshwater requirements of other sectors.

Our approach for non-PWS sectors' supply forecasts is detailed in **Section 5.6**.

Figure 4-1 Forecasted consumptive growth in 2050 (solid) compared with baseline values (hatched) for main non-PWS sectors[26]



[26] Unless specified otherwise, figures are 2010 - 2015 from 'Understanding Future Water Demand Outside of the Water Industry', Defra (2020)

Table 4-4 Baseline and future predicted consumptive abstraction in the WReN region, by primary and secondary sector[27][28].

Primary Sector	Secondary Sector	Baseline Total Abstraction actual consumptive (Ml/d)	Future Total Abstraction in 2050, consumptive (Ml/d)
Agriculture	General	6.7	6.7
	Horticulture	0.2	0.3
	Other Agriculture	0.1	0.1
	Spray	24.2	34.8
Total Agriculture		**31.2**	**41.9**
Aquaculture		0.09	0.09
Industry	Chemicals	2.9	3.6
	Food and Drink	13.1	16.3
	Industry General	0.6	0.5
	Metals	2.5	2.3
	Minerals	16.7	15.7
	Other Industry	17.7	17.0
	Paper and Printing	6.5	7.3
Total Industry		**60**	**62.7**
Other	**Total Other**	**7.2**	**7.2**
Power	Evaporative Cooling	41.9	*JEP projections do not break forecasts down to secondary sector level*
	Hydropower	0.00	
	Non-evaporative Cooling	0.00	
	Process Water	11.8	
	Production (general)	6.4	
Total Power		**60.1**	**296[29]**
Private Water Supply		3.8	3.6
Non-PWS Sub-total		**162**	**412**
Navigation (Canal and River Trust)[30]		340	340
Non-PWS Total (including navigation)		**502**	**751**
Public Water Supply[31]		***2084***	***1710***

[27] Unless specified otherwise, figures are 2010 - 2015 from 'Understanding Future Water Demand Outside of the Water Industry', Defra (2020)
[28] Figures may not add due to rounding or due to clipping of WRNF data to WRZs contained within the WReN region only.
[29] Figure from JEP (2021) Scenarios for the projection to 2050 of Water Use by Power Producers – updated using FES21, A Moores, Joint Environmental Programme, Report ref. ENV/695/2021
[30] Figure from analysis of abstraction data provided by Canal and River Trust, assumed all consumptive. No growth forecasted by CRT therefore assumed growth factor of 1
[31] Figures from draft Regional Planning tables

4.6. Evolving considerations for supply availability

Alternative reservoir management strategies

We have been undertaking work to explore alternative approaches to reservoir compensation flow management that could increase ecological, water resources, and flood resilience in the region in the long-term. We are proposing to continue this work into the 2025-2030 AMP8 period as part of our future WINEP work. This offers the potential for multiple benefits to be achieved through adoption of alternative reservoir flow management regimes.

Growing demand in non-PWS sectors

The Teesside and Humber industrial clusters are key potential locations of increasing demand in our region. A number of new non-household water demands have been identified in the north east of our region including hydrogen production on Teesside. NWL has met with Teesside businesses who forecast increases in raw water (+190 M/d) and potable water (+30 Ml/d) demand, which have subsequently been accounted for in the WReN baseline supply-demand forecasts. NWL is also in the process of setting up a director led group to provide the focus and engagement needed given the significant increase in non-household demand growth in the Teesside locale. We have continued to work closely with NWL, the Environment Agency and both existing and new non-household businesses and this is reflected in this regional plan position.

The North Humber bank has been identified as a cluster for future hydrogen production. As stated in **Section 4.4**, Yorkshire Water have handled the uncertainty in water demand for hydrogen production in their plan through testing a specific “hydrogen scenario”, whereby an additional 15 Ml/d is required by 2027/28. Through the Annual Review process and in concert with WReN, Yorkshire Water are committed to tracking and monitoring non-household demand growth, particularly energy sector growth (hydrogen) to reduce uncertainty.

As discussed in previous sections, WReN has set up sector specific sub-groups for priority sectors (energy, agriculture and navigation) to support development of our next regional plan. These will help support us identify, as far as practical, the future needs of other sectors so that the risk of water being a constraint to future sectoral growth is minimised.

Critical period and peak demand

As an overall region, dry year average considerations are the dominant driver of the resource position and need. Month to month seasonality of demand is inherently included in the water resources modelling assessment of DO. Operational experiences during recent hot, dry periods (notably 2018, 2020, and 2022) have tested public water supply system, but did not lead to any security of supply risks. More information on the most recent 2022 drought event is given in the next section.

Yorkshire Water includes a critical period scenario in its WRMP24 for the Yorkshire Grid. The scenario represents a four-week summer demand increase, such as that experienced in 2018. This scenario also shows a deficit that is considered when selecting the solution programme. This is primarily a local area concern, rather than one that materially affects the WReN strategic regional plan. However, it is important when considering water transfer needs to ensure that the lost capacity from a transfer does not impinge on local peak demand considerations. If in the future another region selects a transfer from our region, the availability during a critical period scenario would need to be considered. Similarly, options to address the cessation of the STW transfer in 2035 need to accommodate critical period and peak demands.

4.7. Implications of the 2022 drought

2022 was the hottest summer on record for England and the driest since 1995. Most of England was in drought, with the Yorkshire area particularly affected for WReN.

The dry weather conditions triggered the need for level 1 to 3 drought actions (drought communications, a temporary use ban (TUBs) and drought permits/order applications) in the Yorkshire Water supply area. Several drought permits and orders were granted by the EA/Defra, however only a few drought permits needed to be implemented.

These actions helped reduce the impact of the 2022 drought. An analysis of demand data shows that the implementation of TUBs reduced demand by around 42 Ml/d during the hot weather period. A potential benefit of 1,000Ml was estimated from the implementation of drought permits for the period October 2022-March 2023. This benefit was not fully realised due to recovery of reservoir stocks.

As a result of the 2022 drought, Yorkshire Water is reviewing the timing of its drought permit applications to avoid the delay of benefits in future droughts. However, no new drought permits have been identified based on the 2022 drought. Reservoir stocks and DO control lines were not affected greatly by the inclusion of the 2022 drought, so there was no substantive change to their supply forecast as a result. The groundwater source reliable outputs were also unchanged as a result of the 2022 drought. Analysis of DYAA and critical period demand showed that the addition of 2022 data did not significantly change dry year uplifts. However, an 8% uplift to the annual average leakage targets has been added to represent summer leakage breakouts. Outage allowances have been remodelled to include events recorded during the 2022 drought.

The lessons learned from the 2022 drought will be incorporated into future company Drought Plan revisions.

5. Our Approach

We have undertaken a problem characterisation to assess the risks associated with water resources in our region, alongside consultation with our stakeholders including regulators and other regional groups to develop planning process methodologies that are aligned with policy, guidance and where appropriate, consistent across companies and other regions.

A 'twin track' approach was taken to identify both demand reduction options and supply options. Working with regulators, other sectors and water companies, we reviewed existing and new options available to us and identified a feasible options list for further development.

We developed planning objectives and measurable criteria (metrics) in consultation with stakeholders, regulators, and our customers, to support our decision making for the development of a best value plan through an iterative process including reconciliation with other regions. Multi-criteria analysis supported by environmental appraisal was used in our decision-making process to support us in finding the plan which meets both inter- and intra-regional needs and as well as providing the best value to society and customers.

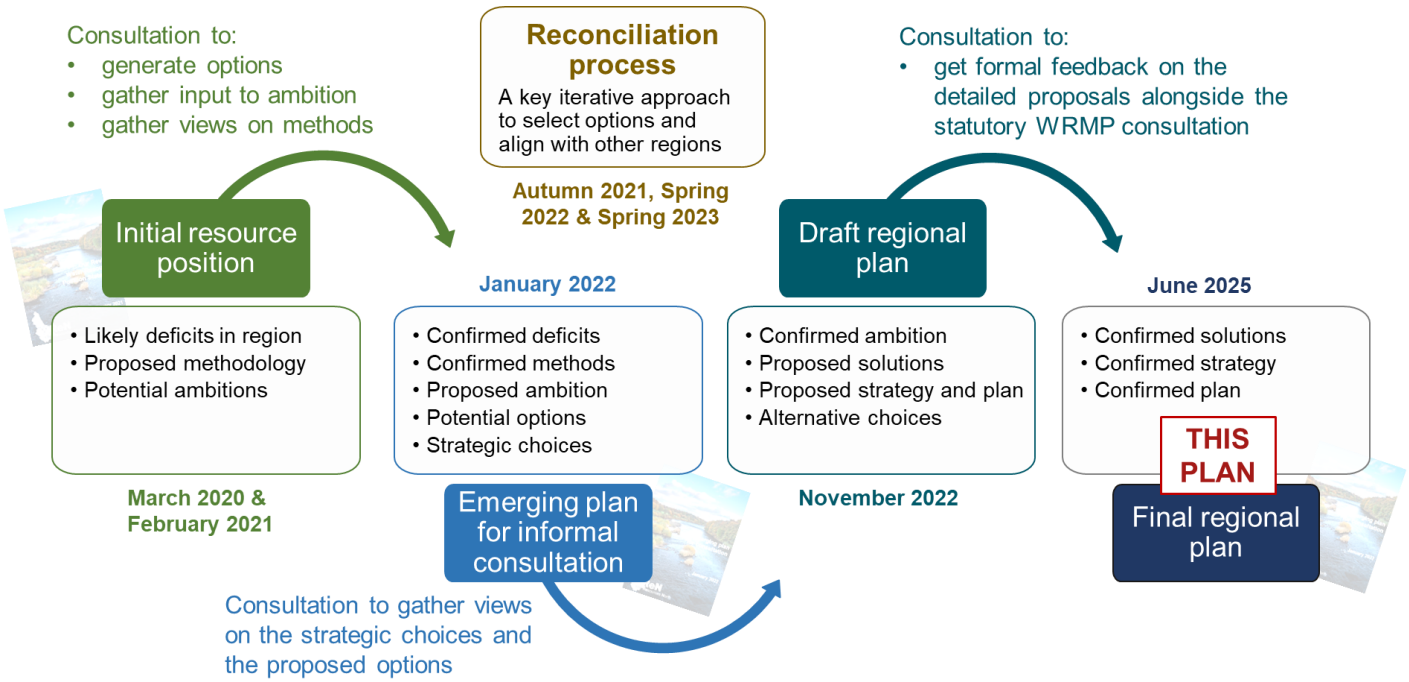
An adaptive planning approach has been taken which provides alternative pathways which can be taken according to the outcome of key future uncertainties. This allows us the flexibility to divert to an alternative future if required.

5.1. Overall plan timeline and approach

The WReN regional plan has been developed through a collaborative approach with both in-region and out-of-region regulators, other sectors, and wider stakeholders. The overall timeline and approach for development and delivery / publication of the Final Regional Plan in June 2025 is provided in **Figure 5-1**. The regional reconciliation processes undertaken in autumn 2021 (iteration 1), spring 2022 (iteration 2) and spring 2023 (iteration 3) allowed for aniterative approach which has been key to enable alignment with other regions, confirm strategic choices, and select options that meet the national need across regions. This process is further detailed in **Section 5.4**

The WReN regional plan has been delivered through a number of workstream groups, which were formed from, and led by, water resources planning experts from within the three water companies. In developing the plan, these workstream groups have followed

Figure 5-1 Stages of regional plan development



methods that are consistent with the Environment Agency's Water Resources Planning Guidelines and other industry water resources guidance, such as that published by UKWIR. These experts are involved in both regional and water company level (WRMP) planning which has facilitated alignment, where appropriate, across the three water companies and with the regional plan throughout the process.

The timeline in **Figure 5-1** shows how the regional plan has developed from our initial resource position in March 2022, which set out our potential needs, methodologies and ambitions, through reconciliation to publication of our emerging plan in January 2022, the draft regional plan in November 2022 and this Final Regional Plan. The initial resource position helped us to understand our needs and potential ambitions at the beginning of the process. Further iterations of gathering of data, consultation feedback and reconciliation helped to shape the subsequent emerging plan and revisions. Each stage of the process has been been developed by using the most up to date requirements and data available at the time of preparation. The final round of consultation and feedback process on our draft regional plan alongside consultation on the water companies draft WRMP24s informed the production of this Final Regional Plan.

Data presented in this report has been subjected to internal checks and peer reviews as well as being informed by and incorporating individual company data sets which have undergone both internal and external formal assurance processes. These checks have been carried out proportionately to the level of risk, maturity of data, and materiality of changes since WRMP19. The content of this plan was presented to a board of water company directors who have been kept informed throughout the planning process.

5.2. Environmental Destination

Our approach to Environmental Destination is described in detail in **Appendix 6**. As described in **Section 4.2**, the National Framework's 'Environmental Destination' scenarios illustrate potential changes in abstraction that may be required to ensure the water environment is sufficiently protected in the long-term. In developing our plan, we have reviewed the national scenarios and explored the potential impacts on the environment and water supply.

The EA has been clear that the modelled scenarios are not intended to be confirmed final figures for any catchment. Instead, they are intended to start a broader conversation with stakeholders and regulators to understand what changes to abstraction may be required in the long term. Consequently, the national model outputs provide a basis for:

- initial engagement with stakeholders and regulators to validate the national figures with local knowledge
- beginning (or continuing) dialogue with catchment partners to explore long-term ambitions
- selection and prioritisation of catchments requiring further investigation
- selection of scenarios to test within the regional plan.

Following publication of emerging regional plans, to promote consistency between each region's interpretation of the National Environmental Destination scenarios, Ofwat, working with the Regional Co-ordination Group and the EA, developed a set of common references scenarios that the regional groups should consider (see **Section 4.2**). These scenarios form the basis for the Environmental Destination elements of our adaptive plan pathways.

WReN's short, medium, and long-term priorities in support of Environmental Destination are set out in **Appendix 6**. Our approach is consistent with that set out in the final guidance[32] and the joint Environment Agency, Natural England and Defra letter to regional groups[33] (plus further communication from the Environment Agency[34]) on expectations around long term Environmental Destination.

5.3. Regional supply-demand options under consideration

We identified and developed a range of PWS options for appraisal within the regional plan where a deficit, or where a material risk of deficit exists. A 'twin track' approach was taken to close the deficit which looks at ways of both reducing demand through demand

[32] Long-term water resources environmental destination - Guidance for regional groups and water companies. October 2020 v1

[33] Defra, Natural England, Environment Agency – letter issued to regional groups, 12th August 2021.

[34] Environment Agency – Item from Environment Advisory Group meeting agenda 01/11/21: Expectations for long term environmental destination in final plans

options and increasing supply through supply options. Our preferred approach to meeting a deficit is to reduce demand, as this reduces the amount of water we need to take from the environment. However, our regional plan shows that we cannot rely solely on demand reduction in the Yorkshire Grid zone and therefore we also needed to identify new and sustainable options for increasing supply.

The options identification process started by reviewing the potential choices available ('the unconstrained list') and assessing which are suitable for addressing the risks that have been identified ('the constrained list'). Any option considered not 'feasible' was excluded from the constrained list and the 'feasible options' were then developed further. An option may have been considered unfeasible if there are technical limitations that make it undeliverable or if a risk to the delivery of the option is judged too high to proceed.

Approaches to identifying the initial set of options in the unconstrained list included:

- review of WRMP19 list of options
- review of the options suggested in the WR27 Water Resources Planning Tools, UKWIR 2012 report.
- consideration of bulk transfer opportunities in consultation with other water companies including both intra-region and inter-region transfer.
- consultation with third parties to review existing third-party options and identify new options.
- consultation within the water companies with staff who have knowledge of the supply system and operations, water production planning and service delivery
- review of the specific system constraints and associated risks to the network e.g. learning from the dry period of 2018 and investigating which areas of the Yorkshire Grid network were under stress (links to the critical period scenario)
- review of new and existing techniques and network improvements for driving leakage down

Options to meet public water supply needs

Supply options

Our options for increasing supply are a combination of increasing use of existing available resources and introducing new supplies. Options have been developed in zones where there are strategic supply-demand planning problems to solve. From the perspective of the WReN area, the focus of supply options identification and appraisal was on addressing material forecast deficits in the Yorkshire Grid area, supported by work in the Kielder zone, particularly regarding the viability and impacts of exports of available water in the Kielder reservoir (which makes use of surplus water as opposed to development of new resources).

The range of different types of supply options that are available and have been considered within the development of our plan to meet the deficit in the Yorkshire Grid include:

- Groundwater and surface water enhancement: greater use of existing resources that we are already permitted to abstract.
- New groundwater and surface water sources: require abstraction permissions to be granted by the Environment Agency.
- Aquifer recharge: discharge water to groundwater when the water is not needed in supply and conserve for when it is needed.
- Bulk supply transfer: raw, potable or partially treated import water from neighbouring zones or regions including the import of raw water from the river Tees (supported by Kielder reservoir and Tyne Tees Transfer)
- Conjunctive use
- Desalination
- Tidal abstraction (as an alternative to desalination)
- New reservoirs / reservoir expansion: to provide further resilience through additional storage such as through dam raising and new pumped storage reservoir options (not selected on safety risk and /or environmental concerns) and a tidal abstraction reservoir (adaptive pathway option)

There is also one supply option to meet growth in non-potable water demand for industrial customers on Teesside. This involves the recommissioning of an intake on the River Tees and includes applying for a variation to the abstraction licence to increase licensed quantities back to 2016 levels, and to install eel screens prior to the river intake being used again. Given that this option involves an existing intake and designed specifically to supply industrial Teesside, the Environment Agency agreed that it was reasonable not to consider alternative supply options to meet Teesside industrial demand.

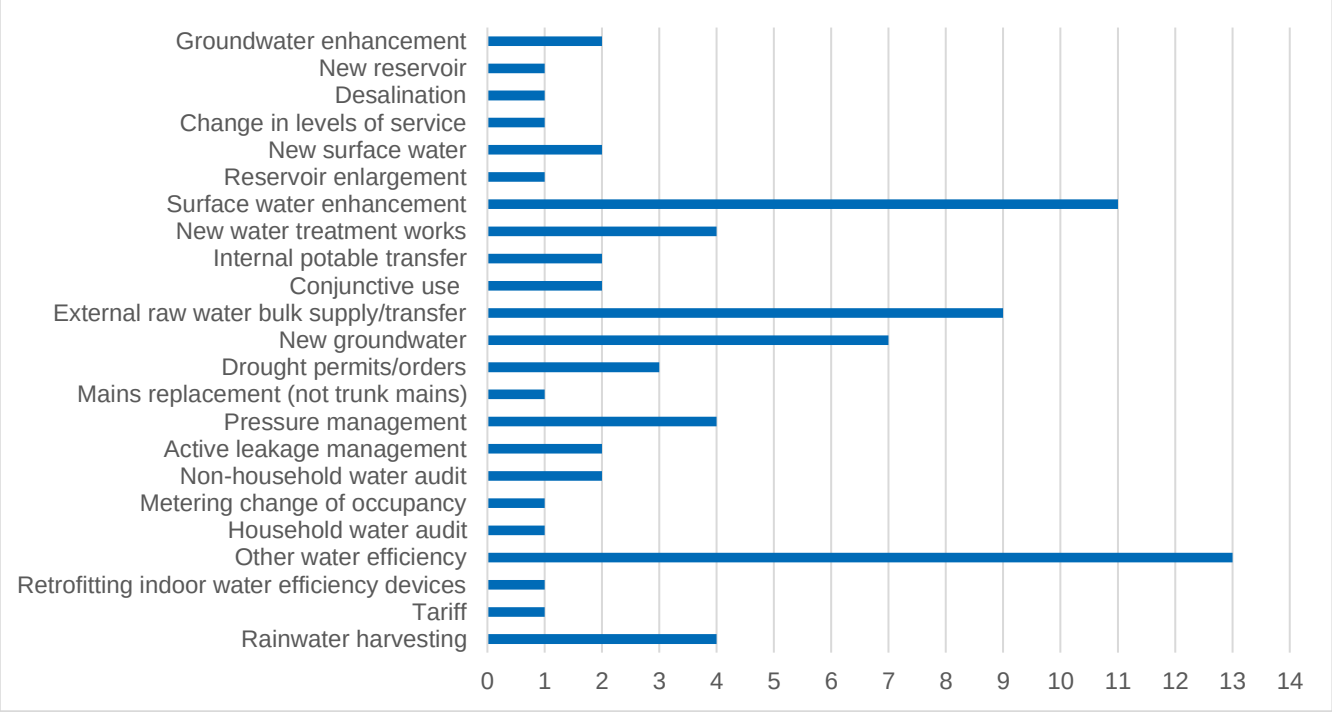
The plan does not include catchment or nature based solutions (NbS) because these options do not provide a direct deployable output benefit. However, NbS schemes are being progressed as part of AMP8 delivery through an integrated collaborative approach with other water abstractors and stakeholders. We recognise that catchment stewardship is crucial to improving catchment resilience and, in combination with reducing unsustainable abstraction, achieving holistic catchment management will bring wider benefits for abstractors (such as improved water quality, more catchment sustainable flows, and better ecological status.

The feasible supply options by option type and number identified to meet Yorkshire Grid deficit are shown **in** Figure 5-3.

Many of our supply options are alternative uses of the same source, allowing for choices to be made around where a resource can provide most benefit in a given scenario. Our focus has been on strategically relevant options to the regional plan. Further details on the Yorkshire Grid zone supply options can be found in **Appendix 5**.

Options that supported regional decision making (inter-regional imports or exports) and considered in the regional reconciliation process were:

- **Exports of raw water from Kielder reservoir to United Utilities (UU) in the WRW region**; These were explored but not selected by WRW (see **Section 6.3**) as due to significant cost and environmental implications surrounding the options (including an INNS risk), other better value options were chosen . However, companies within WReN and WRW (Northumbrian Water, Yorkshire Water and United Utilities) have collaborated to develop the Kielder SRO RAPID project. This will further review the potential raw water exports from the underutilised Kielder Reservoir to Yorkshire Water or United Utilities whilst ensuring sufficient resources are available for non-household growth, particularly for industrial Teesside. The Kielder SRO programme of work has now formally started as of Spring 2025.
- **South Yorkshire Sources SRO (formerly Upper Derwent Valley Reservoir Expansion):** This option was originally scoped to avoid the loss of the existing import from WRW to WReN in 2035 whilst also addressing supply-demand deficits within the WRW region by expanding the Derwent Valley reservoir. However, due to regulator and stakeholder concerns over environmental and heritage impacts the planned scheme has been rescoped. The SRO is now being developed to explore alternative sources to provide backfill options to offset the impact of the cessation of the STW transfer in the Yorkshire Grid zone.
- **WReN to WRE transfers:** Inter-regional transfers from WReN to WRE have been explored to address deficits in WRE resource zones. However, the WRE zones in surplus are geographically much closer to the WRE zones in deficit than the WReN zones and



transfers are not justified or included within the plans on the basis of high cost, carbon and environmental impact.

Demand side

Demand options are an important part of our plan as they reduce the daily average volume of water needed for supply and hence reduces the gap between supply and demand. Demand reduction activity can help lower peaks in demand and help conserve supplies for longer. The types of measures available to us are:

- **Leakage reduction measures**:
  Reducing water lost when transferring water from our treatment works to our customers such as pressure management and new ways to detect and locate leaks (active leakage control).
- **Metering household and non-household (NHH) properties:**

  Helping our customers reduce the water they use in their homes to decrease the average daily per capita consumption (PCC) through installation of meters, as metered properties tend to use less water on average.
- **Water efficiency:**
  Enabling our customers and businesses to use less water on average in their homes and places of work through water efficiency measures such as targeted media campaigns and audits.

There are a number of demand management options identified to address the deficit in Yorkshire Grid Zone, meet national targets on leakage and per capita consumption reduction, and to support resilience in other WReN areas, particularly where there is decreasing surplus. **Error! Reference s ource not found.** presents the types of different options available to meet demand reduction for the main WReN zones. It should be noted that it does not represent the breakdown of how we will meet the policy requirement.

Non-household water efficiency

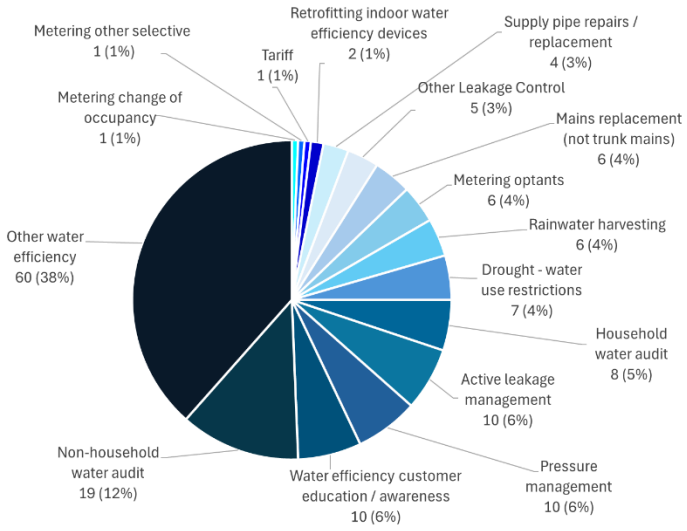
Since retail competition was introduced for non-household customers, the relationship with the customer has changed from being direct with water companies to more indirect as the retailer is now responsible for most customer interactions.

It is therefore recognised that water retailers are key to the relationship with customers and have a huge part to play in supporting non-household customers and water companies in achieving the targets set out. The approach to demand reduction measures will aim to be collaborative and supportive to the needs and requirements of all stakeholders across the market and will involve consultation with retailers on intended approach and plans (e.g. for targeted media campaigns and smart metering for NHH properties). Yorkshire Water are proposing to offer incentives to water retailers to support sustainably reducing their customer's usage in AMP8 and beyond as well as exploring options to incentivise NHH customers to make changes for delivery of significant and sustained reduction in their water usage.

In the previous round of Business Plan submissions, each company developed a Bid Assessment Framework[35] for submission of third-party options to the WRMP process. We fully considered any third-party options that were submitted via this route and considered whether they were relevant to the strategic regional plan or WRMP only. No third-party options have been proposed that would contribute to the loss of the STW transfer and support the national approach. We will continue to develop options for future iterations of our plans and through the WRMPs and are open to considering new or innovative solutions including assessing third party options via the bidding market. More information on how to submit into this market can be found in our water companies' Bid Assessment Frameworks on their respective websites.

[35] Found for each of the 3 Companies at https://www.ofwat.gov.uk/regulated-companies/markets/water-bidding-market/water-resources-market-information/

Figure 5-4 Number of feasible demand reduction options by type for key zones



AGRICULTURE SECTOR

WReN recruited dedicated agriculture sector resources who have:

- ✓ ***Engaged widely across the region*** with farmer and grower groups creating awareness of WReN and regional planning, and gaining insight to actual on the ground experiences
- ✓ ***Identified potential pressures*** which outline the priority catchments with water supply pressures, and the priority sectors driving water demand.
- ✓ ***Identified further Water Abstractor Group opportunities*** in priority agriculture sectors to drive responsible and sustainable water use within the agriculture community including Local Resource Options (LROs)
- ✓ ***Developed an interventions evaluation method*** to support in determining appropriate interventions by allowing for a range of different factors regarding the suitability and implementation of interventions to be considered

ENERGY SECTOR

WReN and the Energy sector have collaborated and expanded engagement on water resources regional planning through a three level approach:

1. Strategic and overarching
   - ✓ Expanded umbrella / trade groups coverage including CCSA, Hydrogen UK and Energy Institute, ***promoting and raising visibility of water in energy planning***
2. Known/define new energy developments and clusters
   - ✓ Commenced direct engagement activity ***increasing WReN visibility in energy clusters - Humber and Teesside***
3. Existing abstractors / energy sector supplier
   - ✓ Engagement with a wider group of existing abstractors for ***informing and understanding environmental risks, and future abstraction changes***

Options to meet non-public water supply needs

Options to meet other sector needs, outside those of public water supply, may be broadly split into those that solely and specifically address other sector needs (in their own right), and those that could be jointly developed to also meet public water supply deficits in a holistic manner.

There are no non-PWS solutions identified for this iteration of our regional plan. However, a significant amount of work has been undertaken in WReN to develop further understanding on how to drive non-PWS solutions for water resources regional planning, in particular in the agriculture and energy sectors.

We will continue to explore potential multi-sectoral opportunities (such as final effluent reuse) as we continue to engage with other sectors to understand non-public water supply needs as outlined in **Section 3.4** and **Section 4.5**.

5.4. Regional plan reconciliation process

One of the most important drivers for the adoption of regional level planning is the opportunity to explore

water resource resilience at a national and regional level, rather than purely at a water company level. The regional planning scale helps to promote and facilitate the exploration of water transfers both within and between different regions, and support development of a coherent national set of plans.

The exploration of water transfers is particularly important for regions under serious water stress, who may have difficulty sourcing sufficient supply within their own region to meet demand for water. The transfer of water from a region (to another) may be possible due to there being a material existing surplus, or through creation of new supplies via the development of new options to facilitate the export of water. In the latter case, even where a supply-demand deficit exists (or could plausibly occur in future) in the region from which the transfer of water takes place, it may be possible that more cost-effective options could be developed compared to equivalent new resource option development in other regions, enabling transfers still to take place. Options could potentially have lower environmental impacts or offer wider benefits over those in more water stressed areas.

Each region has its own issues, risks and challenges to overcome in the next 25 years and beyond (our regional plan looks as far out as 2080). Nevertheless, the regional planning process gives rise to opportunities for collaboration with different regions and other water sectors to develop sustainable solutions which benefit both people and the wider environment. As such, the process is designed to offer more freedom, especially in the early stages, to explore strategic issues in advance of the statutory WRMPs.

Considering that all regional groups work to the same timeline, delivery of a coherent set of best-value plans across all regions requires effective and planned collaboration. In recognition of this, regional planning groups and regulators worked to develop an inter-regional 'reconciliation' process. This process aimed to ensure that regional plans iteratively appraise solutions and align with each other as far as is feasible in the available timescales.

The first round of reconciliation was conducted in autumn 2021 to inform the Emerging Regional Plan for consultation, and a further round of reconciliation occurred in spring 2022 to develop the draft Regional Plans and WRMPs. All regions conducted a jointly coordinated set of plan stress tests, to ensure that the resulting reconciled outputs were suitably robust at this stage in the process. With reference to the 'Ofwat common reference scenarios', WReN undertook low scenario[36] and high scenario[37] stress tests, in addition to various environmental destination[38] and demand[39] scenarios stress tests. Testing of the impacts of flexing in / out of the plan specific transfer options was also completed between regions, this included the STW transfer (at the draft plan stage) and the Kielder export from Northumbrian Water in a WReN context. The third round of reconciliation[40] in summer 2023 has informed this Final Regional Plan. Taking into account consultation on the draft plans, the position on transfers was revised and/or reaffirmed between regions, with justification of the final position documented and subject to a regulator workshop.

Our regional plan is consistent with the outcomes of reconciliation in terms of inter-regional transfers, so that it is suitably aligns with the plans of other regions as part of the broader national picture.

5.5. Decision making process for best-value

Options appraisal overview

As part of their WRMP development, each water company must ensure *'Their plan is a best value plan for managing and developing their water resources, so they are able to continue to meet their obligations to supply water and protect the environment and is based on sound and robust evidence including relating to costs'* (based on the Water Resources Planning Guideline, WRPG). The Environment Agency's Best Value Plan supplementary guidelines specifically defines a best value plan as *'one that considers factors alongside economic cost and seeks to achieve an outcome that increases the overall net benefit to customers, the wider environment and overall society'*.

[36] With the following assumptions – Environment: known or confirmed environmental destination requirements, Demand: ONS 18 projections, inclusive of government water labelling, and Climate change: RCP2.6.

[37] With the following assumptions – Environment: enhanced environmental destination requirements, Demand: Housing plan, exclusive of water labelling, and Climate change: RCP8.5.

[38] Low and enhanced.

[39] 50% achievement of PCC savings and 50% achievement of leakage and PCC savings.

[40] This is fully documented within the Inter-regional reconciliation 3 summary report - https://www.waterresourcesnorth.org/globalassets/wrmp/wren/inter-regional-reconciliation-3---summary-report---v1.0---final-for-publication.pdf.

The WReN decision-making process is intrinsically linked to this, being based upon the options appraisal of individual water companies where there is a supply-demand need to address[41]. However, our activity as part of WReN has complemented water company level planning by facilitating in particular, the effective consideration of in-region and inter-regional transfer options, where appropriate. The WReN best value plan therefore aims to meet the region's objectives and that of the constituent water companies, and which aligns with other regions and supports the national objectives. The full list of options as well as a more detailed description of the options appraisal procedure considered within this process is available in **Appendix 5.**

The emerging plan consultation confirmed that the WReN decision making approach and support tools for the regional plan development are seen as appropriate to the scale of the problem faced in the region.
The assessment of future needs in our region has highlighted a significant PWS deficit in the Yorkshire Grid zone, in part driven by the outcome of inter-regional level scale planning through loss of the transfer from STW as outlined earlier in this document. This risk requires a best value plan to be identified through the options appraisal and decision-making process. The Yorkshire Water Enterprise Decision Analysis (EDA) model has been used for the purpose of appraising the solution to this deficit[42], supported by work with Northumbrian Water in particular, regarding the viability and impacts of exports from the Kielder zone.

We have selected a Multi-Criteria Analysis (MCA) approach as it allows options to be assessed against multiple objectives to produce a solution based on both monetised and non-monetised criteria. The criteria or metrics are derived from pre-defined objectives. This builds on the more traditional Economics of Balancing Supply and Demand (EBSD) aggregated methodology (programme optimisation based on least-cost to meet supply-demand deficits over time). The outputs of the EBSD optimisation model are assessed against wider metrics (i.e., other than cost) to evaluate both financial and non-financial impacts and benefits. Our process allows for consideration of "trade-offs" in selecting a best value plan.

Metrics and trade-offs

Metrics sit beneath the overarching WReN objectives. They describe the performance of alternative optimised solutions and selected portfolios (at a programme level) considered in determining our plan. However, this is not to say that the metrics used will (or should) cover all aspects of our planning considerations in line with our objectives. For example, we may be completing long-term work towards environmental destination that brings benefits of a non-supply-demand nature, and so cannot be reflected in an options appraisal process aimed at solving supply-demand resource needs. However, metrics are the key descriptors of programme performance when assessing how best to meet future supply-demand needs (including potential water exports). Over time, if new needs manifest, metrics could be added to the process in future iterations of the plan.

The development of our objectives and metrics has been completed taking into account, on balance:

- Regulatory and policy aspirations (**Section 1.1);**
- Customer preferences (**Section 3.3**); and,
- Stakeholder engagement[43] (**Section 3.4**).

As part of the process, we have attributed how each metric would influence the optimisation. For example, metrics may be defined by whether they should be achieved, optimised (to minimise or maximise), or for the purpose of a specific options appraisal, set as a scenario constraint (where a particular objective outcome may be constrained into the plan to compare to alternative programmes). These concepts are explained further in **Appendix 4**, with extensive additional detail on the development and definition of our objectives and metrics, including taking into account associated engagement.

Our current metric areas included in our options appraisal are shown in **Table 5-1** below:

[41] As described later in Section 7, at this stage options appraisal to meet the acute needs of the Yorkshire Grid is key for the WReN plan.
[42] As such, the full detail of the options appraisal modelling is detailed in the Yorkshire Water WRMP24 main report, but also detailed further in **Appendix 5**.
[43] As described above, this is not to say that it is possible for all such views to change the metrics used in technical options appraisal process, but rather may influence the future plans in other ways, or identify future required activities to better define tangible needs in future plan revisions.

Table 5-1 Decision-making metrics summary (Detailed metric technical definition is included in Appendix 4)

Metric areas	Planning status
PWS Drought resilience	Achieve or enhance
Biodiversity	Optimise
Natural Capital	Optimise
Leakage reduction	Achieve or enhance
PCC reduction	Achieve or enhance
Flood risk management	Optimise
Multi-abstractor benefit	Optimise
Carbon	Optimise
Customer preferred option type	Optimise
Human and social well-being	Optimise
Financial Cost	Optimise
Option Deliverability	Optimise
Resilience	Optimise

Presenting metrics in the regional plan

We compare the metric performance of candidate solution programmes to identify if there is a best performing solution programme that should be put forward as the preferred or best value plan. The metrics represent a range of criteria each measured by a qualitative unit or a quantitative scale that is appropriate for that particular criterion. This makes it difficult to compare programme metric scores using the measured values as they are not consistent, therefore we have normalised the values to a scale from 0 to 100 to provide consistent units. A score of 100 is the most optimal value for all metrics. When comparing solution programmes, a score of 100 will be applied to the programme that presents the best value for an individual metric. All other programmes are applied a normalised score that is relative to the optimum programme for that metric.

Building the best-value plan

We have created a best value plan that addresses both the DYAA and critical period scenario deficits over a 60-year planning period. During the process of determining the best value plan we produced multiple optimised solutions using our DMF optimiser model. Initially we used the optimiser to create least-cost solutions that optimised based on cost (financial capital) alone. Only feasible options that had passed screening as part of the options identification process were included in the optimiser.

A preliminary stage of optimisation was first undertaken to address baseline supply-demand deficits in the Yorkshire Grid zone with different levels of drought resilience prior to 2040. This also included runs with and without the demand management and leakage policy aspirations being met, to understand how this changed the options portfolios. Sensitivity testing was conducted to understand the most optimal timing for the adoption of the 1 in 500-year drought resilience, this is described further in **Section 6.2**.

As part of the publication *PR24 and beyond: Final guidance on long-term delivery strategies (April 2022)*, Ofwat set out good practice for scenario

testing as part of development long-term adaptive strategies. We have followed this guidance to complete our own plan testing, which uses the 'Ofwat Common Reference Scenarios' for the purpose of testing sensitivity around our baseline position. The Common Reference Scenarios (CRS) set out a set of plausible bounds or extremes for key uncertainty areas for testing. Optimisation runs were also completed using the low and high abstraction reductions (environment) and high climate change scenarios, given these materially affected the supply-demand challenge to be solved.

The preliminary optimisation runs allowed us to understand the frequency of selection of options across a range of scenarios, initially on a least-cost basis. However, the least-cost solution may not provide best-value for meeting other objectives. In addition to the least-cost runs we produced further optimisation runs to minimise carbon, and to maximise the environmental and social benefits of the options.

We used the outputs of the least-cost and best value optimisation runs to create a portfolio of supply options for consideration in the preferred plan. The portfolio was used to create candidate solution programmes to be considered as the best value plan. The aim of the candidate solution programmes was to improve on the metric values compared to the least-cost solution and create a best value plan. The candidate solution programmes were compared against each other using the MCA approach of comparing metric values at a programme level. The candidate solutions were created through the optimiser model by mandating options into the solution to meet key objectives.

At the draft plan stage, five candidate solutions were produced, but only four were taken forward to the metric assessment stage. Trade-offs were explored in determining the best value plan. For this Final Regional Plan, we developed four solution programmes representing different potential emphasis for the plan: least-cost, best for social and natural capital, least-cost optimised to achieve high ED, and the best plan for resilience. The use of these is shown further in **Section 0** and detailed in **Appendix 5** (noting that the date to meet the 1 in 500-year drought resilience scenario differed slightly between these portfolios).

Adaptive planning scenarios and pathways

Not all risk and uncertainty can be quantified accurately and, although our forecasts incorporate the most up to date information available to us, our plans are still based on estimates, and we must consider this in our final preferred plan. The known risks in our plan allow us to incorporate an appropriate level of flexibility and divert to an alternative future if required. Our regional plan should be adaptive, and as part of the process we have included alternative pathways representing key future uncertainty areas for our plan.

A pathway is akin to a 'plan within a plan', allowing us to show how our solutions would change if a different path or branch was followed. Hypothetically, any of the material plan uncertainty areas could trigger alternative pathways in the regional plan. In line with the EA supplementary guidance, pathways should be kept to a small number to aid communication and clarity on the plan.

Risks, such as the environmental destination licence reductions, can be linked to key dates that trigger an alternative pathway. To ensure we are prepared for diverting to an alternative plan, we identify decision points in advance of the pathway diverging. There are other significant uncertainties in our plan that are not determined by a point in time, such as the impact of climate change on supply and the outcome of demand reduction interventions. Ongoing monitoring of risks against our pathways in future is critical.

We have created alternative pathways with reference to the Ofwat CRS, where appropriate in the context of material supply-demand risks. The alternative pathways included in the development of our best-value plan are:

- **Pathway 1: Preferred plan (most likely) scenario**, which includes loss of the existing STW transfer in 2035
- **Pathway 2: High (Enhanced) environmental destination,** where environmental needs on the River Derwent are greater than assumed in the preferred pathway, along with higher impacts of changes to groundwater licences.

Pathway 3: Low environmental destination, where there would be no abstraction reductions on the groundwater sources or the River Derwent.

- **Pathway 4: Low demand,** where greater benefits are achieved from Government initiatives for water labelling and building regulations.

- **Pathway 5: Half Demand Benefit**, recognises the success of our planned demand reduction activity cannot be guaranteed and assumes the year-on-year combined benefits of leakage reduction and PCC reduction (through smart metering/ networks and water labelling) will be half that assumed in our preferred plan pathway.

- **Ofwat core scenario,** this pathway represents the minimum interventions required to ensure the future risks are mitigated and we are resilient to future drought events. This includes options needed in both the benign and adverse scenarios, which are needed to be undertaken to meet short-term requirements.

By looking at how the solutions change between these scenarios, we have sought to identify potential options or solutions that are more adaptive or allow us to minimise the risks of a sub-optimal plan in the future.

Environmental assessment within the options appraisal process

The regional plan must ensure appropriate environmental appraisal is carried out on options to suitably inform the plan decision making. The aim of the environmental appraisals within the plan is to provide for a high level of protection of the environment, integrating environmental considerations into the preparation and adoption of the plan with a view to contributing to sustainable development. Throughout development of the plan the environmental appraisal seeks to identify, describe and evaluate the likely significant effects on the environment of implementing the plan and propose measures to avoid, manage or mitigate any significant adverse effects and to enhance any beneficial effects.

For water resources planning purposes, these assessments consist of Strategic Environmental Assessment (SEA), Habitats Regulation Assessment (HRA) and Water Framework Directive (WFD) assessments, including Invasive Non-Native Species (INNS) and natural capital considerations. Biodiversity Net Gain (BNG) has also been incorporated into the SEA framework through the inclusion of a specific SEA objective. In addition, historic heritage assets and landscapes are considered within the overall SEA criteria as it is recognised that they may be impacted by the plan option.

Environmental assessments have been undertaken following the most up to date guidance, including the Water Resources Planning Guideline (WRPG) for WRMP24[44], Environment Agency Direction, UKWIR decision making/best value report and UKWIR environmental assessment guidance[45]. Where there are potential risks to heritage sites we discuss understanding and mitigation of these with Historic England and local authority heritage services as more information on the constraints and opportunities become understood through options development.

Water companies are required to undertake assessments at a WRMP level. Many options for consideration at the regional plan level come from WRMPs, and the regional plans also feed into the WRMPs via identification of new options to consider and by providing planning solutions with which WRMPs need to align. Hence, WRMP24 and WReN options are assessed in an integrated way to ensure consistency and allow comparable assessments.

Consideration is made of how the environmental assessment findings actively inform and add value to decision-making, alongside other considerations such as cost, affordability, resilience and customer service expectations. The outputs from the environmental assessment workstream were used to inform the environmental, societal and resilience decision-making metrics which were included in the

[44] Environment Agency (2021) Water resources planning guideline, July 2021. Available at Water resources planning guideline - GOV.UK (www.gov.uk)

[45] UKWIR (2021) Environmental Assessment Guidance for Water Resources Management Plans and Drought Plans. Report Ref 21/WR/02/15.

WReN option appraisal process. Further input from the environmental assessment workstream was also considered in a qualitative review during development of planning solutions.

A BNG of 10% has been provided for any option within the plan that needs planning permission to offset the biodiversity impacts of the options with a 10% net gain (where applicable costs have been added for achieving this). This demonstrates there are significant opportunities for biodiversity net gain within our preferred plan. As our schemes are further developed it will be necessary to undertake a full biodiversity net gain assessment with identification of habitat restoration and creation and to agree detailed on-site and off-site enhancement measures to ensure our plan achieves significant net gain.

The methodologies for environmental assessment are documented in the environmental assessment Scoping Report[46], which is available on the WReN website. The Scoping Report was issued for consultation with the Environment Agency, Natural England and Historic England as well as wider stakeholders e.g., members of the WReN steering group to seek agreement on the scope and approach. Following consultation, the comments received were reviewed and amendments to the scope and/or approach have been made (where relevant). A table detailing comments received, and our response is provided as supporting information to **Appendix 8** and is also provided as an appendix to the SEA Environmental Report.

5.6. Non-PWS approach

Whilst we have been undertaking significant work with other sectors to better understand their resource needs and risks (see **Section 4.5**), the understanding of future supply-demand need for other sectors is significantly more ambiguous than that for public water supply. For the WReN area, this has represented a particular challenge, and therefore we consider that at this stage it is impractical to define targeted options that solely and specifically address other sectoral needs across the region.

We are undertaking significant work across other sectors to support the second regional planning cycle, but in the context of this Final Regional Plan, our focus has been three-fold: to understand the current and future water needs of non-PWS abstractors in the region; to understand the challenges individual sectors are facing; and to look forwards as to how the regional planning process can facilitate the creation of opportunities for joint solutions moving forwards.. Furthermore, through our stakeholder and non-PWS sector groups and other targeted engagement, we have shared experiences and best practice to increase our understanding of water efficiency in the key sectors and are building this into the approach moving forward.

We invited representatives from non-PWS sectors to input into the plan. These inputs are summarised in **Table 5-2** and detailed further in **Appendix 8**. They reflect the current understanding on three key sectors (agriculture, navigation and energy, noting that latter also covers wider industrial aspects associated with industrial clusters) gained from our on-going liaison and discussions. Major progress has been made in this first regional planning round on the mutual and cross-understanding between sectors, and of the constraints and challenges they face in future. We continue to build on this as the time of publishing this Final Regional Plan.

[46] Ricardo Energy & Environment (2021) Water Resources North Regional Plan – Environmental Assessment. Scoping Report. Available at https://www.waterresourcesnorth.org/about-us/document-library/

Table 5-2 Summary of key challenges and opportunities provided by non-public water supply sectors (agriculture. energy and navigation) in WReN region

Sector	Current and future water needs	Challenges for the sector	Next steps (towards Regional Plan 2)
Agriculture	**Data availability** The agricultural sector needs to have projections of demand and supply demand balances for each CAMS catchment. This needs to be based on likely irrigation needs under a range of future scenarios e.g. likely water availability and climate change. This will highlight the scale of the challenge and the geographical focus of the challenge. Only then, can the sector understand the possible range of solutions that could be practical and applicable and only then, can the sector understand what multi sector opportunities could be achieved. **Environmental destination** More detailed analysis of the environmental destination scenario implications are required. Including an analysis of how this is applied to individual businesses. **Abstraction Licensing / Licence capping** The agricultural sector needs to further develop the method of engagement on the Environment Agency's sustainable abstraction licence review process. The sector/ abstractors need longer notice periods to allow time to adjust and invest in the right solutions for their businesses. An example may be in the form of constructing a winter storage reservoir to move from summer abstraction to winter abstraction. This process requires alignment and streamlining of the planning process, obtaining an abstraction licence and tying in with grant funding if available	The next revision of the National Framework which is due to start in 2025 and not complete until 2029 will not address the short and medium term challenges faced by the agricultural sector. To meet the full potential of the Regional Plan requirements (as set out in the WRNF), the agriculture sector propose that funding needs to be made available for the following: • to the Water Resources Regional Groups to facilitate the collaboration of all sectors into a regional plan i.e. technical program that brings sectors data together (regional water resources simulator) and leads on policy development. The Regional Groups then seek to perform the duty of an enabler within the regional planning process and remove barriers which could prevent multi-sector planning. • to the sectors to allow them to carry out planning. The aim is for the agriculture sector to be on the same footing as PWS with regards to being seen as an essential water user and with the planning capability to support this. For the agricultural	The need and ask of the agricultural sector is for appropriate funding to be available for the sector to continue to be included and involved in the water resources regional planning as outlined. The regional plan needs to build on the work initiated in 2024 to form groups of abstractors/businesses that can effectively collaborate in bringing solutions to the challenges faced by the sector with changes to licencing. Facilitation of this engagement requires an understanding of the risks posed to abstractors businesses on a geographic basis –i.e. 'heat maps' of areas with specific challenges. The EA initiated work on SDBAs and LROs needs to be expanded to enable greater coverage of the region and offer more farmer and multi-sector groups options to adapt. The data that underpins risk mapping and SDBA analysis ideally needs to be available so the evidence behind what is shown is transparent and so that water abstractor groups can develop and propose options. Opportunities such as smart farming should be explored where these offer better use of

Sector	Current and future water needs	Challenges for the sector	Next steps (towards Regional Plan 2)
	In addition, the construction of infrastructure is a long term investment for agricultural businesses. Long term security of abstraction licences to support this planning is required. E.g. A 25 year investment in a reservoir cannot be underpinned by an abstraction licence which has a 6 yearly review period which will be implemented within the Environmental Permitting Regulations and is currently observed through the common end dates on time limited licences. When considering proposed licence capping based on the WRNF data, the baseline used is outdated and not reflective of current water usage, including covering periods of recent drought. **Multi-sector planning** Multi sector planning means a plan for water resources which balances the needs of the environment alongside public water supply, energy and agriculture. The agriculture sector needs assurance that water for food production is seen as essential water use. The Government in the Food Strategy are asking for fresh fruit and veg to increase by 30% per capita but the sector needs assurance, certainty and confidence that access to water for food production is a priority and will be provided.	sector this includes funding to develop & grow abstractor groups, including where these are not already in place. This will allow the planning work to be undertaken at local level, directly with abstractors. WReN only has a couple of informal abstractor groups but has a significant number of grower groups for the potato and field vegetable sectors. Such grower groups would be a good starting point to create a more formal abstraction focused group. Whilst within water resources we often reflect on water scarcity and drought, flooding occurs across the region and impacts on farm businesses and the agricultural sector. Working in a multi sector way, we must look at how we can manage water better. An analysis of high-risk flooding areas and the potential water storage opportunities is recommended. This would tie into further environmental opportunities and look to provide a water source for another partner. Working in this multi-sector arena will provide opportunities to collaborate and deliver through the PWS WINEP programmes which will provide benefits for all.	available water through technology. This will need to be combined with abstraction licencing reform that is more flexible and able to adjust according to flows to account for variable and more extreme weather events. There may be opportunities with licence trading and water reuse that need both a robust and responsive licencing platform to prove viable. Farm business water supplies need better consideration within the planning process, particularly where farms may need to access supplies in response to changes in abstraction licencing or during dry weather conditions. For drought conditions we recommend pre-emptive communications be written into drought plans that inform potentially vulnerable farms and local authorities of the options available to them where private water supplies are at risk.

Sector	Current and future water needs	Challenges for the sector	Next steps (towards Regional Plan 2)
Energy	Towards the end of the decade, the demand for water from power and hydrogen production, as well as from carbon capture, utilisation and storage (CCUS) technology is likely to begin to increase, with increasing uncertainty into the 2030s and beyond. Individual power station sites have data on their water consumption which is submitted to the EA. Data is not collected centrally by the sector. A fixed abstraction volume is required to operate a station at full load. Abstraction licence reductions could render power stations inoperable, resulting in stranded assets. Future investment at sites to contribute to net-zero targets, such as through the deployment of CCUS, requires certainty that the water rights will be available for the lifetime of the asset. The Joint Environment Programme (JEP)[47] has rerun its projection of water use by power/hydrogen producers model for the modelled sites that sit within the WReN boundary using FES21 – the future energy scenarios produced by National Grid in 2021. This provides a range of potential water uses by future power and hydrogen production in the region. It is important to understand that there is significant uncertainty resulting from the range of potential	• The competitive nature of power production and competition law prevent power companies from collaborating and there can be no power sector plan. • For a power station there is a significant difference between availability of water on an annual basis and the reliability of an abstraction at a particular point in time. • Power stations operate 24 hours a day in a dynamic market with half hourly trading of electricity. Therefore unavailability of water for just half an hour can have an impact on both commercial performance and system security. • The power sector does not have easy access to Environmental Flow Indicators on river reaches that are of interest to the sector. This makes it difficult for a potential power project developer and investors to evaluate the site specific risk of water unavailability. • Historically power sector water abstraction licences have been robust. Increasing pressure on water resources, the move to time-limited abstraction licences and 12 or potentially 6 yearly reviews under the	• Continue to work with WReN and the strategic energy sub-group, including collectively continuing to raise the profile of water as a potential constraint to energy development • Important to continue to understand likely future demand scenarios for power, CCUS and hydrogen production associated with public water supply as well as from non-PWS • Understanding the implications of new EA environmental destination information provided for the second planning round • JEP to continue to update its projection of water use by power producers model when significant new information becomes available and communicate results • Continuing, as part of WReN and at organisational level, to promote the importance of water as a potential constraint to energy sector developments, including with regulators and government bodies as appropriate • Consideration of national studies, such as the Anglian Water's work on non-potable water reuse[49]. This study proposed a water re-use hierarchy which should be considered within the provision of water for both public and non-public water supplies especially in the case of the energy sector.

[47] Scenarios for the projection to 2050 of Water Use by Power Producers – updated using FES21, A Moores, Joint Environmental Programme, Report ref. ENV/695/2021

[49] Anglian Water Services (2025), Non-Potable Water Re-Use: A Review of Opportunities. Available at: https://www.anglianwater.co.uk/corporate/strategies-and-plans/non-potable-water-reuse-a-review-of-opportunities/

	pathways to net zero and the location of future plant. Power plant operators and developers make decisions based on market conditions, there is no duty to develop power plant projects. Therefore it is not possible to know what type of future plant will be developed where and by whom. Whilst some future energy sector developments are likely to reuse existing inland power sites, some development of low carbon energy is likely to be in the industrial clusters defined by the government[48]. This also includes CCUS clusters as part of the Government's CCUS cluster deployment programme. The industrial clusters most relevant to WReN are Teeside and North Humber Bank. For CCUS, the East Coast Cluster is within WReN's remit and is a Track-1 cluster, bringing together industry in Teesside to deliver the CCS infrastructure needed to decarbonise this key industrial heartland of the UK, including the UK's first CO2 transport and storage infrastructure and the world's first gas-fired power station with carbon capture and storage which is expected to begin operations in 2028. Given multiple potential users of water in these clusters and the dependence upon investment decisions, there is significant uncertainty in future water needs. Water requirements may be met by direct abstraction and/or water supply from the public water supply system (potable or non-potable). Whilst the exact water needs are uncertain, it is certain that water will be required to ensure investment in and operation of low carbon energy developments. CCUS specifically needs access to reliable sources of water for the duration of the asset life,	transfer of abstraction licencing to the Environmental Permitting Regime increases the uncertainty in water availability and therefore increases the risk for investors in dispatchable low carbon power projects, including CCUS. • Currently it is not clear if sufficient water will be available for power/hydrogen developments in the WReN region, as future developers and locations of power/hydrogen plant are unknown, but also because there is uncertainty in future water availability and abstraction licence reviews. • There is currently no funding mechanism for joint research and development of water resources for all users. Water companies have access to funding for projects that benefit PWS customers, but this is not available for non-PWS. Providing regional groups with funding to facilitate full multi-sector consideration and assessment would be a step forward. • Currently no long term solution to ensuring that the power sector has access to the water it is expected to need in the future to decarbonise and provide electricity system security. • Existing technologies and methods available for addressing the challenges are not advanced. There is a pressing need to raise awareness and accelerate the development and adoption of new	

Sector	Current and future water needs	Challenges for the sector	Next steps (towards Regional Plan 2)
	whether that is for a power CCUS or industrial (e.g. lime, cement, refining etc) application. The transition to net-zero, with significant CCS and hydrogen developments, is likely to increase water demand with increasing uncertainty out to 2050 and beyond. Both CCS industrial and power applications as well as hydrogen production need long-term certainty that the water needed to operate plants will be available. Without long-term certainty, the necessary investment to build the plant is unlikely to take place, without an option for adequate government compensation to cover losses from early closure of new plants. It is equally important that water abstraction licences have certainty for the duration of a plant's lifetime in order for them to continue to contribute to decarbonisation once they have been commissioned.	technologies across various sectors to ensure more effective management and mitigation. • Lack of awareness across all stakeholders—including technology providers, technical associations, individuals, companies, governments, public bodies, and associations—around what water risk technologies are available for the various sectors.	
Navigation	The WRNF data does not include navigational abstraction by the Canal & River Trust (the Trust) as these were previously exempt from licensing. The Trust provided WReN with data to present in the Regional Plan alongside the non-PWS data, however, this data does not capture all abstractions as some are still exempt or are groundwater abstractions which are not included. The data provided by the Trust are an estimation of average abstractions during 2011-2018. Where gauged records are not available, abstraction estimations are based on considerations of the hydraulic dimensions of	• Licencing / New authorisation renewals - Abstraction licence renewals have the potential to reduce water availability. Risk of conditions being applied which limit the amount available to abstract when applying for licenses on abstractions that have previously been exempt and were brought into the licensing system with less onerous transitional provisions. • Existing canal transfers play an important role for public water supply. Abstraction reductions for environmental destination and actions to prevent WFD status	• The Trust is currently updating modelling to better understand its future water resource requirements. Once available, this should be considered in the WReN regional plan going forwards. • The Trust is currently working on an example case study to demonstrate the potential to unlock water resources with 3rd party investment, far beyond the Trust's affordability. • The Trust is currently working on an example case study to exemplify cross

[48] Further context is available within *CCUS Net Zero Investment Roadmap*, *Hydrogen Net Zero Investment Roadmap* and *net-zero-strategy-beis.pdf*. Most recently, the government have published their Clean Power 2030 Action Plan, which may be found at *Clean Power 2030: Action Plan: A new era of clean electricity*.

Sector	Current and future water needs	Challenges for the sector	Next steps (towards Regional Plan 2)
	each site (as well as donor catchment flow data) therefore there is still a degree of uncertainty of the overall data. The Trust abstractions have been treated as fully consumptive as although water may return to the system, there is considerable spatial and temporal variability in where it is returned. Hence, there is a risk of over-estimating abstraction for the Trust, nevertheless the Trust are a significant abstractor. There is no significant growth in abstraction expected for this sector. However, canal demands for water are complex: abstraction supports environmentally sensitive water bodies and ecological needs, as well as statutory navigation functions. The Canal & River Trust was previously exempt from abstraction licensing; however, they have recently transitioned into the licensing regime.	deterioration (i.e. licence capping) is likely to have an impact upon levels of service experienced by canals. • Navigational drought – impacts of drought conditions include restrictions and closures of canals and waterways. • Resourcing / funding challenges - RAPID funding not available directly to the Trust to investigate opportunities, only available through Water co's. • Demands have been assumed to stay the same due to a lack of modelling work (to date) to identify if there may be increased or decreased demand. Though demands will increase if they are to make up shortfalls due to abstraction reductions and lack of maintenance.	catchment transfer capabilities across the Trusts' waterways. • Through our regional planning, we are seeking to facilitate opportunities to change canal operations for wider benefit (environment / society / economy). Canals are already used for water transfers in our region and have the potential to supply and transfer more. The Canal & River Trust is currently updating its water resources strategy and Water Resources North is providing support in this regard. Currently there are several opportunities for transferring water between regions, using the existing canal infrastructure. • Explore transfer opportunities with other sectors

5.7. Non-drought resilience considerations

In line with the company WRMPs in the previous planning round, generally we do not consider that there is a significant non-drought resilience need or risk at regional scale that warrants specific assessment. For example, Hartlepool has a single source of supply, but assessment and appraisal of this is very much a local issue rather than a regional one. Aspects such as asset flood risk and water quality are mainly addressed by company business plans, or in design standards within options development completed by engineering teams. We will ensure that any options meet relevant minimum design standards as they are implemented. In addition, our options appraisal process included an overarching flood resilience metric and a multi-abstractor benefit (e.g., water quality) metric, both of which measured option impacts qualitatively, using SEA objective outputs. See **Appendix 4** for further details.

The loss of the existing STW transfer from the WRW area to WReN would fundamentally change the configuration of the Yorkshire Grid, which leads to specific additional resilience considerations as part of options and solutions development. This has been accounted for as part of exploring the impacts and candidate solutions to address a loss of the import (**Section 7**). In the development of the Yorkshire Water WRMP24, a specific resilience metric was introduced to help facilitate the identification of the preferred plan as part of a further, more detailed examination of this issue.

6. Strategic choices

When developing a regional plan there are a vast array of potential considerations, choices and asks of the plan that need weighing up. As we are creating a strategic plan, it is not feasible to focus on every nuance and choice at a regional scale, with more detailed local questions being covered by the individual company WRMPs. In this section we outline the key strategic question areas of our regional plan, which we presented and consulted upon in the draft Regional Plan. This section summarises our Final Regional Plan position.

Our emerging regional plan included a set of strategic questions which would help guide our development of the plan. During the consultation period on the emerging plan in January and February 2022, we received comments from a range of stakeholders including regulators and statutory bodies, water retailers, energy sector, industry consultants and suppliers and landowner associations such as National Farmers Union and Country Land and Business Association. These were further developed and consulted upon in the 2022 Draft Regional Plan.
Consultation comments have been collated, reviewed and incorporated into the development of this Final Regional Plan.

The strategic question areas are summarised as follows:

- Should we continue to plan for meeting **demand management and leakage government aspirations** by 2050? (**Section 6.1**)
- What **pace and profile** should we pursue towards achieving the long-term **demand management and leakage** reduction targets? (**Section 6.1**)
- If there is a **deficit prior to 2039**, should our strategy be to **adopt a lower 1 in 200-year drought resilience level** to help meet that deficit? (**Section 6.2**)
- Are any **water export options to other regions** being selected by adjacent regional groups, and if so, is that supportable in our best-value plan? (**Section 6.3**)
    - ➢ Linked to the above, what is our **best-value adaptive plan** to address *loss of the existing Derwent transfer into the WReN area*? What key **alternative solutions** are there? (**Section 7**)
- What is our current view of **Environmental Destination** impacts? How far should we pursue **evidence** of flow-based benefits prior to adopting into our core plans? (**Section 6.4**)

The above list does not include every potential question we considered in developing our regional plan; however, it summarises the most tangible choices we have had to make or explore.

In the sections below we cover the strategic choice areas for the regional plan, taking into account feedback from consultation on the emerging and draft plans where appropriate.

6.1. Demand management and leakage reductions

In defining our demand management strategy for the plan, we considered the feedback we received from our customers and stakeholders after the publication of the emerging regional plan in January 2022, and the subsequent draft Regional Plan. We know that driving consumption down and tackling leakage are priority areas for our customers before we implement supply-side options. As such, they form a critical part of our plan to address the supply-demand deficits summarised earlier in this document.

The feedback from regulators such as the Environment Agency and Natural England indicated that our emerging plan did not present sufficient detail in relation to the actions to drive down PCC and tackle leakage. Regulators told us they will expect us to clearly evidence our demand management strategy and stress test the plan to an alternative future where we might not be able to achieve our demand management targets.

In response to this feedback, we have undertaken more work to refine our supply-demand balance and define our demand management strategy alongside our chosen supply options, to ensure we can cover the deficits we will encounter in the future. Further details are included in the water company WRMPs, beyond the summary provided in the regional plan. Targets and delivery are owned at a water company level.

Water efficiency

Yorkshire Water created a new long term water demand reduction strategy, aligned with the Waterwise UK Water Efficiency Strategy to 2030 (published in September 2022)[50], which they also helped develop, with water efficiency being a key theme throughout the four underpinning components (namely customer behavioural change, targeted interventions, technological advancement and wider industry contribution). The company strategy sets out initiatives which support the four pillars to enable household and non-household demand reduction targets to be met and has included additional options to consider within its decision-making process. These were tested within Yorkshire Water's optimisation process (described in **Section 5.5**) to understand the most cost-effective way to achieve statutory demand reduction targets for PCC and non-household demand.

Northumbrian Water also endorse the UK Water Efficiency Strategy, playing an active role in its creation and implementation, and through aligning its household and non-household water efficiency strategies across several of the Strategic Objectives contained within. Anglian Water (Hartlepool) and therefore the WReN region are fully aligned with the national strategy, with the strategy acting as an enabler in meeting the PCC targets (subject to successful and timely implementation of government initiatives).

Level of aspiration by 2050

Overall, we plan to meet the 50% reduction in leakage reduction policy (from 2017/18 levels) and 110 l/h/d PCC target by 2050. However, meeting the government policy aspirations for PCC is not only the responsibility of water companies; to meet these targets we are reliant on the introduction and timing of government initiatives on water labelling and future building regulations, as per the Roadmap to Water Efficiency, included in Chapter 3.5 of the government's Plan for Water (published in January 2023)[51]. Importantly, if successful, this would help us overachieve the PCC reduction target to 105 l/h/d (surpassing the national target by 5 l/h/d) in the Yorkshire Grid which is where our biggest PWS challenges are.

We have outlined our demand management options in **Section 7.1**. Our plan is supported by investments in active leakage management (through an optimised leakage delivery plan – see *Pace and profile of delivering reductions* section below), and smart metering and water efficiency programmes (see *Water efficiency* section above), including water labelling. We also explore the assumptions and uncertainties related to the achievement of our ambitions. These are mainly around the technological improvements that would allow us to tackle leaks more effectively and the successful rollout of the water labelling initiative.

Consideration was given as to whether lower or higher levels of aspiration should be pursued for leakage. NWL have committed to delivering a 55% reduction in leakage by 2050 in their WRMP, up by 5% compared to the draft WRMP and the national target. Anglian Water's (Hartlepool) cost benefit analysis concluded that achieving 50% leakage reduction would cost over £20 billion to customers, in contrast to £4 billion expenditure associated with their 30% target (recognising they already have one of the lowest leakage rates in the UK), deemed feasible with current technology available. Yorkshire Water assessed leakage reduction scenarios up to 60%, with their cost benefit analysis indicating that targeting reductions above the 50% would not be beneficial to customers. This was also supported by testing the impact of lower levels of aspiration where this interacted with supply-side investment (Yorkshire Grid zone). Whilst it was concluded that options to meet the policy aspirations by 2050 should be included in the best-value plan, going beyond these was discounted due to the risks and uncertainty upon the plan.

[50] https://database.waterwise.org.uk/wp-content/uploads/2022/09/J37880-Waterwise_Water_Efficiency_Strategy_Inners_Landscape_WEB.pdf

[51] https://www.gov.uk/government/publications/plan-for-water-our-integrated-plan-for-delivering-clean-and-plentiful-water/plan-for-water-our-integrated-plan-for-delivering-clean-and-plentiful-water#chapter-3-securing-a-plentiful-supply-of-water

Although meeting the policy aspirations is considered feasible, it is considered extremely challenging. With current leakage reduction techniques and costs, it would not be possible to achieve the target by 2050. There is a high reliance upon future innovation beyond existing leakage techniques and methods. As the planning period progresses, we will actively seek measures to make current leakage reduction techniques more efficient and we expect new technology to make further reductions feasible at a lower cost. We produce WRMPs and business plans every five years and with each iteration, we will review the leakage techniques available and the costs and benefits. It is also for this reason, we do not consider it appropriate to go beyond policy aspirations, reiterating that the extent of PCC reduction is a function of policy interventions in place to achieve them. As seen earlier, affordability of the plan is also key, and further expenditure must be weighed up with environmental and delivery requirements.

The non-household business demand targets (a new performance commitment from AMP8) set by the UK Government, are a 9% reduction by 2038 and 15% by 2050[52]. To this end, both Yorkshire Water and Northumbrian Water have committed to reduce business demand by 9% (in relative terms, as opposed to absolute) by 2038 (excluding growth) based on a 2019/20 baseline. As part of their non-household water efficiency strategy, both companies have sufficient options in place to achieve the interim 9% reduction target by 2038, including smart metering, water efficiency audits, water retailer incentives, and rainwater harvesting systems. Anglian Water (Hartlepool) expect their non-household options to achieve a ca. 8% reduction by 2038 and a 15% reduction by 2050 (including growth). The companies will continue to review and develop non-household options for consideration in the next plan iteration to build a strategy to achieve the 15% reduction by 2050.

Recognising the scale of the challenge, in addition to the Ofwat Common Reference Scenarios, we have also stress tested our plan to a scenario that assumes only half the demand reductions are possible for the Grid zone (see **Section 7.2**). The results show that the Yorkshire Grid would be at risk of deficit in this scenario, although this would only materialise from 2060 onwards. To mitigate against this risk, the progress against the per capita consumption (PCC) and leakage targets will be monitored year on year. Should there be any indication that we are starting to follow a low demand reduction trajectory, we will prepare to bring in planned supply options sooner than otherwise required in the preferred plan. We will also consider further mitigation measures in the form of additional demand management options in WRMP24.

Pace and profile of delivering reductions

The pace of PCC and leakage reductions at regional level is shown in **Table 6-1**. Each company has considered an appropriate pace for each of their zones and/or areas taking account the specific challenges in water resources terms and both in the affordability and deliverability of plans.

More specifically, analysis on alternative leakage scenarios (including a profile for reducing leakage faster in AMP8, with the remainder of the planning period to 2050 having a linear delivery profile) undertaken by NWL, showed that it would be more expensive to reduce leakage quicker and then maintain at a lower level over the planning period, as such opting for a linear delivery profile.

Anglian Water (Hartlepool) undertook cost benefit analyses of various demand management portfolios, with their “Aspirational” portfolio deemed cost beneficial in the near term (i.e. AMP8), in addition to allowing a significant contribution to the national leakage target over the 25-year planning horizon.

Yorkshire Water built up leakage reduction activities and glidepaths through optimisation runs, deploying optimisation techniques (namely the RPS SoLow[53] tool) to determine the optimal leakage reduction strategy (in terms of option makeup, reductions and maintenance / replacement needs). With respect to PCC, a combination of optimisation, consultant outputs and trial data was utilised by Yorkshire Water to create reduction glidepaths for best value plan options. The options were set as objectives within the optimisation process which resulted in a set of preferred options that achieved the relevant demand reduction targets whilst still being cost efficient. These options were adopted into Yorkshire Water’s Best for Resilience (or Best Value/Preferred) Plan and informed the timing of options. Yorkshire Water

52 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1168372/environmental-improvement-plan-2023.pdf page 105

53 Strategic Optimisation of Leakage Options for Water resources

plans to achieve the 110 l/h/d target by 2043. Therefore, this ambitious plan over-achieves the national target of 110 l/h/d for PCC by 2050 and so it was considered inefficient from a cost and deliverability perspective to achieve this target any earlier.

Table 6-1 Regional PCC and leakage reductions over time (final planning DYAA)

Regional	2029/30	2039/40	2049/50
PCC (l/h/d)	126.9	114.3	107.1
Total leakage (Ml/d)	332.1	273.8	225.6

Given the sizeable deficit to address in the preferred plan (**Section 7**) for the Yorkshire Grid, pace and delivery is key to regional investment decisions, and the timing or selection of supply-side schemes impacting multiple zones. **Table 6-2** shows the specific reduction profile for this zone.

Table 6-2 Yorkshire Grid PCC and leakage reductions over time (final planning DYAA)

Grid zone	2029/30	2039/40	2049/50
PCC (l/h/d)	121.8	112.4	105.4
Total leakage (Ml/d)	222.2	182.6	160.0

In defining this pace of delivery, the following aspects were taken into account:

- Profiles assume the combined benefits of smart metering/networks included in our plan, and water efficiency initiatives. The assumption is that by installing smart meters into new households, meter optant properties and switching existing meters to smart we can reduce the PCC of metered customers by 3% on average.

- Smart metering will be installed to both household and non-household properties from 2025 onwards (i.e. from the start of the planning horizon), building on recent trials. From 2025, all new developments will be provided with smart meters, and any customers choosing to switch from an unmetered to metered supply (optants) will be fitted with a smart meter. A smart meter retrofit programme will also occur over 15-years, recognising the scale of this undertaking.

- The interaction with the selection of supply-side schemes as part of the options appraisal process was explored (**Section 7**). The pace of leakage delivery was also determined in the context of the need for long-term innovation to achieve future reductions in a cost-efficient and deliverable manner; therefore, reductions have to be suitably spread over time.

- The timing of wider government initiatives on water labelling and building regulations is key to reducing consumption. Initially company level initiatives have the largest impact, but over time water labelling benefits increase and by the 2040s has the greater impact. A Water UK/Defra project developed a number of demand management scenarios based around the potential impact of government-led interventions on PCC. A scenario for water labelling (without minimum standards) was suggested to achieve 11 l/h/d by 2050. However, a Water Resources South East (WRSE) study in 2021 reviewed the outputs and the predicted benefits, including evidence from Australia and concluded that the benefits from water labelling could not be disaggregated from benefits of other initiatives running at the same time. A more conservative water labelling benefit of 6 l/h/d was therefore proposed. The Yorkshire Grid is based on a 6 l/h/d benefit by 2050. For this zone, the 11 l/h/d used by other companies (including Nothumbrian Water and Hartlepool Water in WReN) was not considered realistic, given it already has one of the lowest average PCCs in England.

6.2. Drought resilience

In line with the Government's 25-year Environment Plan, water companies should plan to be resilient to a 0.2% annual chance (1 in 500-year) of failure caused by drought by 2039 (where failure is defined as implementing an emergency drought order).

Our refined supply-demand balance assessments have shown that, in line with government

expectations to be resilient to a 1 in 500-year drought event, Northumbrian Water is capable of maintaining a surplus in both water resource zones across the planning period under this resilience standard once demand management and leakage reductions have been taken into account (**Section 7**). On the other hand, and as a result of incorporating new approaches and datasets in their WRMP24 supply forecast, the Yorkshire Water's Grid zone is in immediate deficit at the start of the planning period. As such, a decision was made to implement a 1 in 100-year drought resilience standard at the beginning of the planning period (i.e. from 2025/26 to 2026/27), followed by the 1 in 200-year drought resilience standard from 2027/28 to 2038/39, and a switch thereafter to a 1 in 500-year drought resilience standard in 2039/2040. This decision was taken as a lower drought resilience standard in the interim is required to reduce deficits until demand management and supply-side options are implemented.

Yorkshire Water customers research results indicated that the level of service is typically seen as a low priority for investment, although this may in part be caused by the infrequency of experiencing such events; the duration of events (when they occur) is probably more important than the frequency. Therefore, the decision to remain at a reduced level of service until 2040 is compatible with customer research, taking account also of the affordability of investment over time.

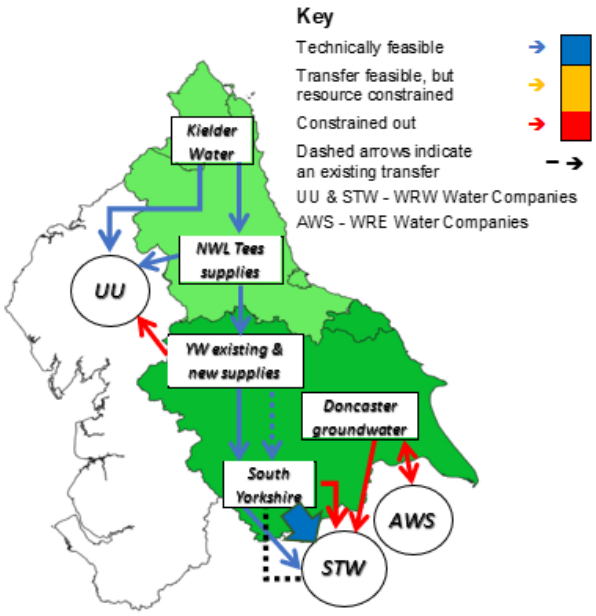
With respect to the timing of meeting the 1 in 500-year drought resilience target, Yorkshire Water sensitivity tested the aforementioned 1 in 500-year constrained scenario under three scenarios (namely by 2035, 2040 or 2045). Based on comparisons of the optimisations, achieving the 1 in 500-year drought resilience by 2039/40 was found to be the lowest cost solution.

6.3. Water transfers

As per the regional planning expectations outlined in **Section 1.1**1.1, we have completed significant work to determine whether we can support national water resources resilience. This includes both transfers from areas with surplus or, if new water resources in our region were to be developed, to subsequently transfer water from new options to others outside the region (i.e. if a further surplus was created). We also explored whether these transfers may offer better value and more sustainable solutions than those developed purely at a local level in other regions, as part of the inter-regional reconciliation process (**Section 5.4**).

Figure 6-1 provides a conceptual representation of eight key[54] WReN options we explored in further detail for the potential transfer of water between regions.
It should be noted that these key transfers are just a sub-set of options originally discussed or explored, with 'early stage' unconstrained or small-scale options not being depicted. Further details of these transfer options are provided in **Appendix 5**.

Figure 6-1 Key transfers explored by WReN



Scheme Name	Status
Yorkshire Grid network to STW	
Kielder to UU transfer	
Cow Green to UU transfer	
Tees to STW via YW	
Doncaster to STW	
Bi-directional Doncaster to AWS	
Sheffield to Peak District (YW to STW)	
York to UU transfer	
Reduce STW import to YW	

In practice, no exports from the region have been selected by other regions, albeit there has been a significant change (essentially a 'reverse trade')

noting that there may be options variants for certain transfers, representing different potential capacities.

[54] As part of the WRMP process, there are a number of smaller transfer options that have been explored that are not depicted. Only larger strategically relevant transfers are depicted in the context of the regional plan. It is also worth

through cessation of the existing Severn Trent transfer in 2035 as described in **Section 4.4**. This is due to current lack viable alternatives to meet environmental drivers in a specific zone for Severn Trent, as opposed to a collective 'best value plan' choice. STW have stated that there is no current circumstance where the cessation of the existing transfer would not occur, and this has been reflected in the Final Regional Plan as well as company WRMPs.

Export options to STW were not included in the plans, recognising also that for Yorkshire Grid there is an underlying deficit (compared to the traditional view of this zone being in surplus for export) that would require further supply options to be developed to facilitate an export. The extent of options required, and thus the price point for such exports is therefore significantly greater than may have been anticipated at the start of the regional plan development process. Therefore, whilst the transfers may be technically feasible, the resource position constrains their practical application. In the case of the Tees to STW transfer via YW, the feasibility of this option for export is also impacted by our own plan position (**Section 7**).

In the case of the use of Kielder or Cow Green Reservoirs to support UU, significant further modelling work has been completed between NWL and UU to explore the level of availability to export water (noting that this work did not consider exports to both UU and YW at the same time). On the basis of availability alone, both options are viable to export water under a typical central SDB scenario, although in high scenario stress testing there is the potential for limitations to the transfer that could occur.

Despite this, UU did not select either of these options as part of their plans. Given the strategic prominence of Kielder Reservoir, WReN and WRW specifically explored the potential for export as part of inter-regional reconciliation. Kielder was not selected by WRW mainly on the basis of cost (driven by the assets needed to facilitate a transfer, as opposed to the cost of raw water provision by NWL) and carbon impacts. The cost difference to alternative options at this time was significant. WReN, NWL, WRW and UU will continue to explore the use of Kielder as part of work in AMP8 as a Strategic Resource Option with RAPID.

It is worth noting also that a RAPID commissioned modelling study by The University of Manchester[55] also concluded that there were few, if any, cost-effective inter-regional transfers originating from WReN, and that with respect to accessing Kielder, the distance between this source and areas that require the water significantly increases the costs of possible transfers.

Transfers to WRE

This aspect was also revisited during inter-regional reconciliation, and no transfers have been included from the WReN to WRE regions. This is because:

- YW, which adjoins WRE, does not have a long-term surplus in its grid zone without significant intervention (i.e. offsetting options), and so it is highly likely that water exported to WRE would need to be from the Kielder zone, resulting in long transfer distances. The Yorkshire Grid zone is already in significant deficit, requiring supply options to be developed even after demand management and leakage reductions (**Section 7**).
- Transfers have previously been explored as part of exploring strategic options between WReN and WRE, but the export would geographically send water to Lincolnshire, whereas WRE deficits require water into the Cambridge and Essex areas of the region. The Anglian system has numerous resource zones. Whilst there is a degree of interconnectivity by 2025, no additional capacity remains because existing transfers are largely utilised in response to WRMP19 drivers including peak licence caps and 1 in 200-year drought resilience.
- From the points above, in combination, transfers were not pursued by WRE on the basis of high cost, high carbon and environmental impact.

In the 3rd round of reconciliation the latest position on license capping in Lincolnshire reduces water transfers within the Anglian area, therefore opening up the possibility that new connectivity being implemented by Anglian could be fed via an import from the WReN region. Modelling conducted by Anglian of a hypothetical longer-term import from WReN to WRE indicated the availability of such an

[55] Slaughter, A., Harou, J.J., Tomlinson, J., Matrosov, E., Wilson, J., Dennis, J., Read, M., Dunford, T., Stokes, M., O. Walker, A. Widmaier, 2021, "A water supply-demand model for England and Wales", RAPID commissioned report

option could alter WRE's long-term supply option portfolio. However, due to significant uncertainty around imports from WReN, the regions have agreed to review their position more formally in future rounds of planning.

Given that no transfers have been selected by other regions as such, our plan choices are focussed on addressing the loss of the Derwent transfer from WRW / STW in 2035, and considering how transfers between areas of our region may help resolve water resources pressures concentrated on the Yorkshire Grid. Transfers within the region have been explored to meet WReN's own needs and challenges for consideration in the preferred plan (**Section 7**).

6.4. Environmental Destination

The environmental destination component of our regional plan has initiated a broader conversation with stakeholders and regulators to understand what changes to abstraction may be required in the long term. One of the first steps in developing our plan was the prioritisation of catchments for further review based on national model scenarios. Prioritisation ensured that we could focus on those catchments with the greatest environmental risks and opportunities.

In support of the emerging plan, we conducted an online survey with a targeted group of stakeholders to explore local concerns and aspirations. Initial observations indicate that:

- There is a common view that whilst water abstraction is not currently a significant pressure, it is likely to be in the future
- Measures which deliver the greatest long-term resilience include nature-based solutions, flood-plain reconnection, variable reservoir releases / linking flood mitigation with water resources, plus improving water storage through better drainage.
- Various organisations, and in particular NGOs and water companies through local partnerships, are best placed to deliver solutions.
- Perceived barriers to implementation of resilient solutions include resource (financial and human) and lack of catchment-scale strategic planning or inclusion of natural capital into decision making.

We will build on the initial outputs from this survey in subsequent engagement activities (and alongside individual water company business planning in support of the next Price Review).

The common reference scenarios for environmental destination allow us to adaptively plan for environmental destination reductions that were not otherwise included in the emerging plan. We presented the environmental destination modelled scenarios in **Section 4.2** and the adaptive pathway for environmental destination is presented in **Section 7.3**.

At this time, the uncertainties around the final abstraction reductions required to deliver environmental destination are high. Noting the affordability concerns of customers and the need to deliver long-term effective solution as desired by stakeholders, we have based our plan upon the BAU+ scenario in the reported or central supply-demand balance in our plan (this includes bringing forward the date of potential loss of licence from the River Derwent from 2050 to 2040 following engagement with Natural England and the Environment Agency).

At this stage in the process, we do not consider planning higher levels of abstraction reduction to be appropriate, until further investigations at a site level. We have ensured our plan is adaptable to the alternative environmental destination scenarios. To develop the evidence base underpinning the adaptive plan, we have identified a range of short, medium and long-term priorities for environmental destination. These are set out in detail in **Section 7.4**.

7. Our Final Regional Plan

Our Final Regional Plan includes a full revision of our supply-demand forecasts in line with Company WRMP submissions. Prior to applying further demand management and leakage reductions, drought measures and any further required supply options, the Kielder and Grid zones have forecast deficits.

In the case of Kielder, a healthy supply-demand balance results in our final planning position once the benefits of further demand management and leakage reductions are applied. For the Grid zone, further supply options are required to address the sizeable deficits in this zone, along with the loss of the existing import from Severn Trent in 2025 to meet environmental drivers in the Water Resources West area.

We have completed a full options appraisals to determine the benefits and disbenefits of our feasible options, to best guide our choices for the draft plan. Once the options have been selected, we tested the plan against a variety of scenarios to understand how the plan might change if the future supply demand balance is different from what we envisage. We have also presented alternative pathways as part of our plan, to show how the plan can suitably adapt to future potential changes.

As we move to the next planning round, we will continue to engage closely with other sectors to understand their future needs and the potential for joint opportunities or solutions. Following active dialogue with the energy sector around the Teesside industrial cluster, specific interventions to reinstate mothballed non-potable supplies are also included in the plan to ensure water availability to meet those future needs.

7.1. Best value plan

Drivers of change

As shown by the baseline supply-demand position presented in **Section 4.4**, the two largest resource zones in our region present deficits prior to implementation of further options in our plan.

For Northumbrian Water, the Kielder zone shows a deficit of around 29 Ml/d by 2029/30, rising to around 45 Ml/d by 2049/50. The deficits in the Kielder zone are mainly driven by the incorporation of the latest estimates of supply availability under 1 in 500-year drought conditions combined with the impacts of climate change. The benefits of drought measures are also excluded from the baseline forecasts[56].

When looking at Yorkshire Water, the Grid zone presents a deficit of around 137 Ml/d from the start of the planning period, rising to 312 Ml/d in 2049/50. The underlying deficit is mostly caused by the implementation of the latest estimates of supply availability in drought, combined with climate change.

However, the significantly increasing deficit over time is driven by (in order of magnitude):

- Phasing in of abstraction reductions to meet the environmental destination (impacting the supply demand balance from 2035/36, but with the majority of the impact in 2040/41 driven by changes on the River Derwent)
- The termination of water imports from Severn Trent (impacting the supply demand balance from 2035/36), noting that this causes localised supply integrity issues that also need to be resolved
- Further incremental climate change impacts over time.

As the Yorkshire Grid zone is showing a large and immediate risk of deficit at the start of the planning period, as stated previously in **Section 6.2**, we have decided to operate at a lower level of service (1 in 100-year drought resilience level) for the first couple of years (2025/26 to 2026/27), with a switch to the 1 in 200-year drought resilience standard from 2027/28

[56] In the Emerging Plan the general position for Kielder was presented as being in supply-demand surplus. Whilst the supply-demand position has been fully refreshed Regional Plan, it is worth noting that inclusion of the benefits of demand side drought measures such as Temporary Use Bans (TUBs) would broadly result in the zone either being in balance or in surplus. However, for the Final Regional Plan, the planning tables require these to be excluded for the purposes of presenting the baseline forecasts.

to 2038/39. From 2039/40 onwards, we are then resilient to a 1 in 500-year drought severity.

Yorkshire Water produced an equivalent baseline DYAA supply forecast for the Grid zone 1 in 200-year level of service drought scenario for emergency drought orders. The new 1 in 500-year drought resilience level is expected to be met by 2039 at the latest, based on the Water Resources National Framework. When comparing the 1 in 200-year to the 1 in 500-year drought resilience standard forecasts, there is still a material deficit of around 138 Ml/d by 2035/36. Whilst the baseline supply-demand figures do not include the benefit of drought measures, this result reaffirms the underlying risks and need to invest in both supply and demand interventions to ensure we are resilient to future dry weather conditions.

Options selected in the preferred plan

Given the above position, options are needed to bridge the deficits in the Kielder and Yorkshire Grid zone. For Northumbrian Water, no supply options have been selected in the preferred draft plan since demand management options needed to meet government expectations (as covered by our strategic choices in the previous section) alone are sufficient to cover deficits in the Kielder zone. For Yorkshire Water, investment in both supply and demand reduction options is required, and so, is the focus of best-value plan choices through options appraisal related to our region.

Demand options

We have identified demand management options that will meet government aspirations with regards to achieving 50% leakage reduction and reducing PCC to 110 l/h/d by 2050 (Table 7-1). Yorkshire Water and Northumbrian Water have committed to delivering non-household water efficiency options that reduce business demand (relative to a baseline) by 9% by 2038 (excluding growth). Both companies will continue to review its options in delivering the longer term target of a 15% reduction by 2050. Hartlepool Water expect their non-household options to achieve an ~8% reduction by 2038 and a 15% reduction by 2050 (excluding growth)

Table 7-1 Demand options benefiting Company zones with supply-demand deficit (Kielder and Grid)[57]

Water company	Option name	Benefit at 2050 (Ml/d)
NWL	Active Leakage Control to reduce leakage by 55% by 2049/50	52.76
NWL	Metering - Replacement of existing meters with smart meters by 2035 and Enhanced Optant Smart Metering	15.82
NWL	Water Efficiency Programme - In home interventions and digital engagement to reduce PCC to 110l/h/d by 2049/50	44.93
NWL	NHH Water Efficiency	12.91
YW	Smart Metering and Water Efficiency	100.93
YW	Active Leakage Control, Pressure Management and Mains Replacement	78.00

In developing our demand management options, we have considered customer preferences which we confirmed through customer research. Customers place a high emphasis on leakage reduction and to support them in reducing their own water use. Active leakage control and smart metering are a key component of our plans. As stated in **Section 6.1**, we are also reliant on the successful delivery of the government's water labelling initiative and future building regulations, as set out in their Roadmap to Water Efficiency. Further details of the demand options applied to each company and zone are included in their WRMP24 submissions.

For Northumbrian Water, those demand reduction measures required to meet government expectations alone are sufficient to bridge all deficits in the Kielder zone, and results in a sizeable supply-demand surplus (see **Table 7-3** later in this section). Stress testing of the Ofwat Common Reference Scenarios has shown this resulting surplus to be robust to change.

[57] Further options are also applied in zones with surplus, towards the government policy aspirations.

In the case of Yorkshire Water, the scale of the deficit is significantly reduced, although not eradicated. Demand management equates to a demand reduction benefit of 100.93 Ml/d in the Yorkshire Grid zone by 2049/50, and with the addition of leakage reduction benefits this increases to 178.39 Ml/d.

Demand management policy assumptions and uncertainties

We are set to achieve the PCC target of 110 l/h/d requirement in our region. As described in Section 6.1 and earlier in this section, there is a degree of reliance on benefits derived from the introduction of the water labelling initiative and changes to building regulations by the government to help us achieve this target. The success of water labelling is dependent on government action, and those of appliance manufacturers, so there is a risk that the water labelling will not have the outcome we expect. Moreover, we are assuming that technology for leakage reduction will improve and become more economic over time, and that customers will respond positively to water saving initiatives. These assumptions create uncertainty in the solution programmes as we cannot guarantee that the policy reductions will be achieved. Tracking and monitoring progress as part of future planning cycles will be critical.

The eventual benefit achieved is particularly important for the Yorkshire Grid zone given the scale of the deficit, as any shortfall would have to be made up by other options. With water labelling, the average PCC is projected to be 105 l/h/d by 2050; without labelling it is projected to be 111 l/h/d, therefore missing the 110 l/h/d target. To ensure that our plan is suitably adaptive, we have stress tested our best value plan against a scenario which assumed that we can only meet half of the demand reductions we envisage now (see **Section 7.2**).

Supply options

Our preferred plan contains a variety of supply options required to bridge deficits in the Yorkshire Grid zone. The supply solutions selected from our options appraisal process are presented in **Table 7-2** (the relative best value plan performance presented later in this section). This includes those to meet deficits beyond 2050 in our longer-term forecast period to 2084/85 used to inform the plan. For full definition of the options the reader is referred to the Final Yorkshire Water WRMP24.

As described earlier, there are other measures that will be implemented to mitigate deficits in the earlier part of the planning horizon. For example, operating at 1 in 200-year level of service (after two years at the initial 1 in 100-year resilience level) and implementing drought measures during dry weather are necessary to preserve supplies until we become resilient to more extreme droughts (i.e. 2039 at the latest). These measures have an immediate effect on the supply-demand balance.

Due to regulator and stakeholder concerns over feasibility and potential environmental and heritage impacts, the planned Upper Derwent Valley reservoir expansion SRO scheme has been rescoped and renamed South Yorkshire Sources SRO. It is now being developed to provide backfill options to offset the impact of the cessation of the STW transfer to the Yorkshire Grid Zone. DV8(v)A and DV8(iv)A(ii) are included in **Table 7-2** as backfill options.

Kielder Strategic Resource Option
Companies within WReN and WRW (Northumbrian Water, Yorkshire Water and United Utilities) have collaborated to develop the Kielder SRO RAPID project. This will review potential raw water exports from the under-utilised Kielder Reservoir to Yorkshire Water or United Utilities (in greater detail than previously) whilst ensuring sufficient resources are available for non-household growth, particularly for industrial Teesside. The Kielder SRO will also consider further variants of the DV7a(vi) Tees transfer (Table 7-2). The Kielder SRO programme of work has now formally started as of Spring 2025.

Table 7-2. Preferred (best value) plan supply-side solutions

Preferred plan supply-side solutions	First year of benefit	Benefit (Ml/d) on full implementation
R13 East Yorkshire groundwater option 2	2028/2029	6.0
R37b(ii) River Aire abstraction option 4	2073/2074	33.5
R3a River Ouse licence variation 1	2027/2028	0.3 (15.0 maximum)
R8g Sherwood Sandstone Boreholes support to North Yorkshire	2035/2036	15.0
DV8(iv)A(i) New north to south internal transfer connection A	2035/2036	39.72
DV8(v)A New York WTW 2	2035/36	10.28
DV7a(vi) Tees to York Pipeline - NWL import 140 Ml/d	2040/2041	140.0
R31a Additional bankside storage at York WTW	2082/2083	10.6
R3 Increased River Ouse pumping capacity	2028/29	10.0
R91 New internal transfer to North Yorkshire WTW 2	2028/29	5.0

Looking ahead to WRMP29, Yorkshire Water commit to undertaking an extensive review of feasible options in collaboration with third parties and WReN as appropriate. This allows us to consider if there are further options that may form part of our best-value plan in the long-term, given the significant deficits now forecast based on our work in this planning round.

Third parties can submit their own options ideas (water resource, demand management or leakage reduction) via our Bid Assessment Framework, accessible via the link below:

https://www.yorkshirewater.com/about-us/get-involved/water-bidding-market/

Transfers

As described earlier in **Section 6.3**, exports to other regions have been explored, but none have been selected as part of the inter-regional reconciliation process. We have also explored transfers between companies and zones in the WReN area to meet in-region needs.

A range of raw water export options from the River Tees (Northumbrian Water) to Yorkshire Water have been considered, supported by Kielder reservoir via the Tyne Tees Transfer system. A range of options sizes have been assessed, including modelling to test the impacts and interventions on the Kielder zone. The 140 Ml/d River Tees to Yorkshire Water option is included in the best value plan, by allowing areas of deficit in the region to benefit from those with surplus, albeit it is not required until 2040.

The Tees transfer option was previously included in Yorkshire Water's draft WRMP and RP for implementation in 2050. Principally, the transfer addresses deficits caused by reductions in the River Derwent abstraction, and so the timing of the Tees transfer is linked to the expected point of licence change. However, following consultation, an earlier date of licence change of 2040 has been included for the Derwent so that environmental improvements are delivered as early as possible, bringing forward in turn the Tees transfer in the final RP. This date has

been agreed by both YW and NWL to be used in their respective preferred pathways for their WRMPs. YW will continue to further assess all current options and once this is complete, they will confirm whether the Tees transfer scheme will remain in their preferred plan. If this is the case, delivery will commence in 2029.

A 10 Ml/d export of treated water from Northumbrian Water's Darlington Water Treatment Works (WTW) to Yorkshire Water has also been considered, but this has not been selected in the best value plans of either water company.

Supply options deliverability risks

The benefits from new supply solutions also carry some uncertainty that we must factor into our planning. The near-term solution risks were considered when forming the preferred plan. However, there are further investigations required to conduct in future to:

- firm up the benefit of the options
- consider the environmental and social impacts and how to mitigate the effects of options
- achieve a 10% biodiversity net gain
- reduce our operational carbon to align with carbon net zero targets.

This creates a further risk that the time to implement could take longer than predicted, especially if the impacts and mitigation measures are complex. The risk of delivery is offset in the medium term as our plan includes sufficient supply and demand options to create a surplus. If early investigations show any of the supply options included in our best value plan will not achieve the assumed benefit, we can bring forward the implementation of options that make use of existing supplies. For the longer-term risks from 2050 onwards, we will have sufficient time to monitor the progress of our plan and bring in more options in future WRMPs if the solutions are not achieving the benefits.

Whilst modelling to understand the availability of the export from the Kielder zone has been completed, given the potential for severe dry years such as 2022 we will continue to work to explore how availability may change under different drought events and/or future utilisation patterns. The new RAPID Kielder SRO project outlined above provides a platform to explore the use of Kielder to a greater level of detail.

Final supply-demand balance position

By comparison to the baseline supply-demand balance shown in **Section 4.4**, a final planning supply-demand balance position summary (with target headroom) is presented for each WRZ in **Table 7-3** (which also includes the demand management and leakage reductions for zones not in baseline deficit).

As seen from this table, the Kielder zone is in significant surplus following implementation of our plans. This is due to demand side drought measures increasing the 1 in 500-year deployable output, along with demand for water decreasing as a result of metering, water efficiency and leakage strategies. The Yorkshire Grid zone sees a reversal in the large deficits presented in the baseline supply-demand balance, owing to demand management and supply side options.

Table 7-3. Supply-demand balance (including headroom). Figures have been rounded and are under DYAA unless specified otherwise.

Zone	2029/30	2039/40	2049/50
East SWZ	+4.84	+4.99	+5.03
Grid zone	+5.69	+12.34	+93.21
Grid zone (DYCP)	+38.29	+126.27	+218.99
Kielder	+37.53	+103.56	+136.93
Berwick and Fowberry	+1.55	+2.12	+2.61
Hartlepool	+9.21	+3.97	+5.19

Level of Service sensitivity testing

The National Framework for Water Resources requires resilience to a 1 in 500-year drought by 2040. Three scenarios were compared for the Grid zone, optimised for cost. These scenarios were meeting 1 in 500-year drought resilience by 2035, 2040 or 2045. Based on these optimisations, achieving the 1 in 500-year by 2039/2040 presents the lowest cost solution.

Best value plan performance

We developed several plans (i.e. a selection of options or solutions with an implementation schedule) through the water resources management planning process. This allows us to compare the performance of different or 'alternative' plans against a 'preferred plan', as described in **Section 5.5** It is important that our plan considers cost and that we aim to meet the objective to produce a plan that is

affordable and sustainable over the long term. Therefore, we compared the metric scores of our least-cost plan to the metric scores of other candidate plan solutions and the best-value or preferred. The least-cost plan is determined using only economic cost information and as its name suggests, is the plan with the lowest cost to restore a supply surplus in all years of the planning period with a baseline supply deficit forecast. The least-cost plan does not consider other monetised criteria such as carbon or other societal and environmental impacts and benefits.

For Kielder, the least-cost plan essentially performs the same as the best value plan and core plan, as only demand management solutions are required to meet the government policy objectives.

For Yorkshire Water Grid, the different candidate plans perform differently (**Figure 7-** overleaf). The candidate solutions[58] differ as stated below (Table 7-4):

Table 7-4 Basis of candidate solutions

Candidate solution	Basis
Least-cost benchmark	Optimised solution for most likely scenario to achieve 1 in 500-year drought resilience by 2039/40. Relies on level 1 to 3 drought options until 2038/39.
Best for social and natural capital	Optimised solution to most likely scenario to achieve 1 in 500-year drought resilience by 2039/40 whilst maximising natural and social capitals. Relies on level 1 to 3 drought options until 2038/39.
High ED plan	Least-cost optimised solution to high ED scenario to achieve 1 in 500-year drought resilience by 2039/40. Relies on level 1 to 3 drought options until 2038/39.
Best for resilience (Best Value Plan)	Plan to most likely scenario to achieve 1 in 500-year drought resilience by 2039/40. Relies on level 1 to 3 drought options until 2028/29.

As seen in **Table 7-5** the total highest score is given by the least-cost benchmark solution, with the lowest score given by the High ED plan.

The least-cost benchmark solution has the highest score for eight of the metrics, however it scores the lowest on option deliverability and programme resilience. This is because the solution contains fewer supply options compared to the other candidate solutions. The solution has limited flexibility and no resilience if demand management is not achieved.

The best solution for social and natural capital scores lower than the least-cost benchmark solution for all metrics besides option deliverability and programme resilience.

The High ED solution scores more highly on option deliverability and programme resilience in comparison with the least-cost benchmark as it selects a greater number of supply options. It also scores slightly higher than the least-cost benchmark on PCC reduction by 2050 and equals it's score for leakage reduction. However, the High ED solution scores the lowest for biodiversity, carbon, flood risk, human and social well-being and cost.

The best for resilience solution scores the same as the least-cost benchmark with respect to the plan cost metric, albeit with lower scores for carbon, biodiversity, leakage, PCC, flood risk management, human and social well-being and customer preference. The above notwithstanding, the best for resilience plan includes a greater number of supply-side options, at the same time improving on cost, carbon and biodiversity metrics when contrasted with the high ED plan.

The best for resilience solution has been selected as the preferred best value plan. This has greater short-term resilience whilst maintaining a similar cost to the least-cost benchmark. It performs better overall in comparison to the high ED solution and provides flexibility to alternative futures by providing an array of supply options.

It is important to note that the best value (preferred plan) portfolio has not been selected from these alternatives through metric performance alone, but also through the outcome of testing of options appraisal modelling outcomes across a range of

[58] Further detail available in **Appendix 5,** and within the YW WRMP24 submission, depending on the level of interest of the reader.

pathways and scenarios. Options that were selected most frequently can be considered better value than others. As model runs were optimised on cost alone, further analysis was needed to identify if any of the options not selected in the least-cost runs should be included in the candidate solution portfolio based on their wider value. The approach is summarised in **Section 5.5**, along with **Appendix 5** and the Yorkshire Water final WRMP24 submission.

Table 7-6 allows the reader to compare the alternative options selected under different candidate solutions, should they be interested in the location and nature of specific options.

Section 7.3 explains the adaptive pathways used to explore options and plans under different situations.

Figure 7-1 Normalised metric performance between alternative candidate solutions

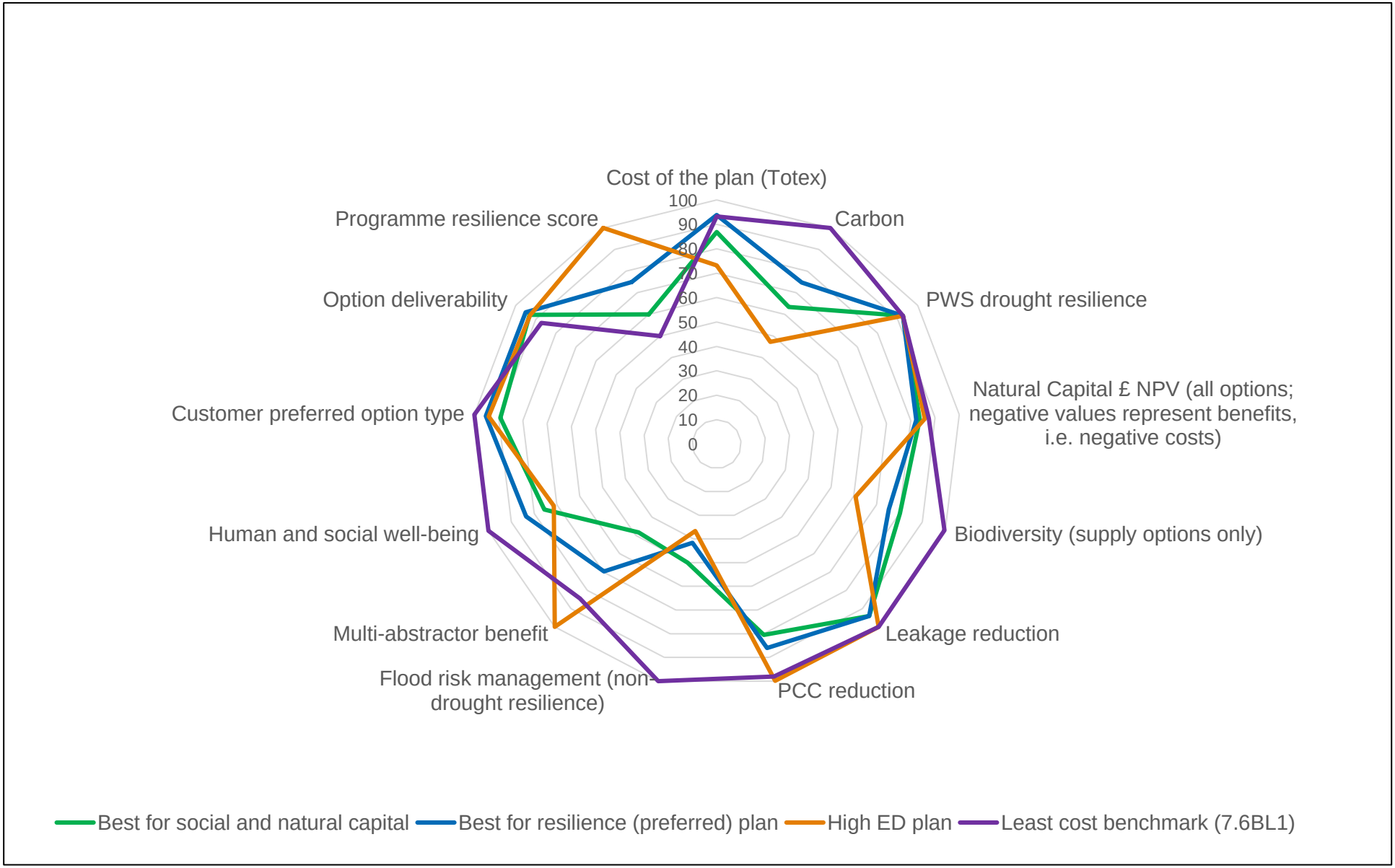


Table 7-5 Comparison of metric normalised scores between WReN regional reconciliation candidate solutions to address Grid deficit metrics compared to a least-cost (with supply options only) scenario

	Cost of the plan (Totex)	Carbon 000s tCO2	PWS Drought resilience	Natural Capital £ NPV	Biodiversity (supply options only)	Leakage reduction Ml/d	PCC reduction 2050 l/h/d	Flood risk management (non-drought resilience) (SEA)	Multi-abstractor benefit (SEA)	Human and social well-being	Customer preferred option type	Option Deliverability	Programme resilience score	Total normalised score
Least-cost benchmark	93	100	93	87	100	100	98	100	84	100	100	87	50	**1192**
High ED plan	73	47	93	86	61	100	100	37	10	71	94	93	100	**965**
Best for resilience (Preferred / Best Value Plan)	94	75	93	82	75	94	86	42	70	83	95	95	75	**1059**
Best for social and natural capital	87	63	93	84	80	94	80	50	48	76	89	93	60	**997**

**Values are normalised not absolute values, with 0 representing the worst performance and 100 representing the best performance.*

Table 7-6 Candidate solutions comparison (options selected) – Best value plan Vs alternatives, including least-cost

Option type	Ref.	Solution Name	Least-cost	Best for environment (High ED)	Best for resilience (Preferred / Best Value Plan)	Social and natural capital
HH WE	C1d	Household customer audits and water efficiency retrofits	✓	✓	✓	✓
NHH WE	C6a	Non-household customer audits and water efficiency retrofits (schools, leisure centres and hospitality)	✓	✓	✓	✓
Leakage & metering	LSM	Leakage reduction and smart metering	✓	✓	✓	✓
NHH WE	C12a3	Rainwater harvesting for commercial customers	✓	✓	✓	-
HH WE	C27d	School visits	✓	✓	✓	✓
HH WE	C28e	Household water efficiency media campaign	✓	✓	✓	✓
NHH WE	C34a	Non-household water efficiency media campaign	✓	✓	✓	✓
NHH WE	C35c	Non-household water efficiency incentive scheme	✓	✓	✓	✓
HH WE	C15d	Installation of internal household flow regulators	✓	✓	✓	✓
Leakage & metering	C4	Metering on change of occupancy	✓	✓	-	✓
Govt	C30a	Water labelling	✓	✓	✓	✓
NHH WE	C6a(ii)	Non-household customer audits and water efficiency retrofits (general domestic use only)	✓	✓	✓	✓
HH WE	C32c	Rainwater harvesting for households- new developments	✓	✓	✓	-

NHH WE	C23b1	Rainwater harvesting for agriculture	✓	✓	✓	✓
HH WE	C13c	Household tariffs	✓	✓	✓	✓
HH WE	C29c	Household Incentives	-	-	-	✓
HH WE	C21c	Housing Associations	-	-	-	✓
Resource	DV8B	New York WTW and Dual Main South Yorkshire Pipeline	✓	✓	✓	✓
Resource	DV7a(vi)	Tees to York Pipeline - NWL import 140 Ml/d	✓	✓	✓	✓
Resource	DV3	Magnesium Limestone new GW supply	✓	✓	-	-
Resource	R37b (ii)	River Aire Abstraction option 4	✓	-	✓	✓
Resource	R3a	River Ouse licence variation 1	-	-	✓	
Resource	R3	Increased River Ouse pumping capacity	-	✓	✓	-
Resource	R91	New internal transfer to North Yorkshire WTW 2	-	-	✓	-
Resource	R13	East Yorkshire Groundwater Option 2	-	-	✓	✓
Resource	R8g	Sherwood Sandstone Boreholes support to North Yorkshire	-	✓	✓	✓
Resource	R31a	Additional bankside storage at York WTW	-	✓	✓	✓
Resource	R8f	Sherwood Sandstone and Magnesian Limestone Boreholes option 6	-	✓	-	-
Resource	R86	West Yorkshire new WTW	-	✓	-	-

Resource	R85	Rebuild Kirklees WTW	-	✓	-	-
Resource	R78	Tidal Abstraction Reservoir	-	-	-	-
Resource	R87	Rebuild Northallerton WTW	-	-	-	-
Resource	C61	Desalination Hull	-	✓	-	-
Drought option	DO03	Supply rivers drought permits- ends in 2038- DYAA	✓	✓	✓	✓
Drought option	DO08	Supply reservoir compensation drought permits- ends in 2038- DYAA	✓	✓	✓	✓
Drought option	DO13	Drought demand reduction- ends in 2038- DYAA	✓	✓	✓	✓

A best-value plan for the region

As described in Section 5.5, as the key supply-demand challenge occurs in the Yorkshire Grid zone, the options appraisal process is driven by the Yorkshire Water WRMP24. However, through WReN, the potential for export from Northumbrian Water has been undertaken in a collaborative manner, allowing areas of surplus to support those in deficit within our region. YW has ensured that the selected export does not impinge on Northumbrian Water's plan position and broader regional impacts have been taken into account. In line with customer feedback, Yorkshire Water are undertaking significant demand-side action in addition to drawing on new supply-side schemes. Our approach to metrics (e.g. carbon, environmental impacts). has ensured that the costs and impacts cover assets in the Northumbrian Water area developed by/for Yorkshire Water to facilitate the transfer.

Stochastic water resources simulation modelling by Northumbrian Water has shown that there is sufficient raw water within its Kielder WRZ to meet its own forecast customer demand over the planning period, forecast demand on Industrial Teesside, and to provide a 140 Ml/d raw water transfer to Yorkshire Water from 2040. The modelling has informed the definition and infrastructure requirements of the option to facilitate a transfer. It showed that to maintain a 1 in 500-year DO in the Kielder WRZ, significant investment is needed by Yorkshire Water in upgrading pumping capacity on the River Tyne. The 1 in 500-year drought resilience standard is not impacted by the transfer of water for Northumbrian Water, whilst helping to deliver improved resilience in the Yorkshire Grid. Operationally any impacts of the scheme are modest, given the regulated nature of the export from existing Northumbrian Water sources, whilst supporting significant environmental improvements to be delivered elsewhere in the region. Northumbrian Water and its customers receive some financial benefit from the export, reflecting a fair transfer of 'value' within the region for the use of available surplus water.

Best value plan costs and bill impacts

We know that a reliable supply of water is a priority for customers. The investment that Ofwat allows for these plans will help us to continue to provide this essential service long into the future, but the cost of investments will be added to customer bills.

We know that this is a difficult time for customers with the current cost of living pressures that we are experiencing. We continue to work hard to make sure that our bills remain affordable for all. It is important to remember that the cost of the best value plan is spread across the planning horizon (2025 to 2085). The costs are also proportionate to each area, according to the level of investment needed to meet deficits. This means that the bill impact for Yorkshire Water customers will be higher than that for Northumbrian Water customers, due to the supply options (including the transfer of water from Northumbrian Water) required in the Yorkshire Water area.

In Northumbrian Water's WRMP, the impact of the 'best value plan' would increase the typical bill between 2025 and 2030 by 1.1% in their region. For Yorkshire Water, the bill impact will be ~£6/annum in the period 2025-2030, rising to ~£23/annum by 2050. It is important to note these bill impacts are purely in relation to the enhancement identified as part of company's water resource management plans and is based on initial estimates.

7.2. Stress tests

A WRMP24 requirement is to undertake sensitivity testing to different planning assumptions, to understand how the best value plan might have to adapt if the future is different from what we envisage now. Ofwat has set out common reference scenarios with high and low parameters for climate change, demand, technology and abstraction reductions (environment). These are set to simulate futures where for example, climate change may be more or less severe, or more abstraction reductions may be required to protect the water environment. The lower scenarios typically relate to 'core' or low regrets investments that are required in all cases.

The scenarios are not exhaustive and within our region, we have also created other scenarios to test against. Stress testing is an important step required to inform the planned investment and solutions, so that they can suitably meet the needs of the future if the forecast position changes as part of the best-value adaptive plan.

For Kielder zone, no long-term abstraction sustainability reductions under environmental destination are required, so they have not been included in the scenario testing. Results show that no supply deficits are caused by any of the common reference scenarios. Hence, their best value plan is sufficient to maintain a 1 in 500-year supply surplus in both WRZs and is a no regrets plan.

Grid zone stress testing scenarios

The best value plan has been stress tested against multiple alternative DYAA scenarios for the Grid zone. These stress tests were based on Ofwat's common reference scenarios and are detailed further in **Appendix 5**.

During consultation, some stakeholders emphasised the importance of us being resilient to future climate change, with the potential for higher levels of impact that that included within our supply-demand balance. Our high climate change scenario tested the best value plan against the deficits presented under the RCP8.5 high emissions scenario.

Appendix 3 provides more information on how climate change has been accounted for by WReN in our supply forecasts.

On the Grid zone, the stress testing scenarios have been adjusted to incorporate the benefit of planning to a 1 in 200-year drought return period and the assumed benefit from drought measures until 2038/39. From 2039/40 onwards, any deficits represent a DYAA 1 in 500-year level of service and no assumed benefit from drought measures. This aligns to the position upon which our Best Value Plan is based (rather than the baseline position).

The high climate change scenario shows a surplus until the early 2060s, whilst the high environmental destination scenario presents a surplus until the mid-2050s; however, without the benefit of water labelling, they would be in deficit from the late 2030s. Under the hydrogen scenario, where there is additional NHH demand from hydrogen energy, the best value plan presents a surplus besides some years in the 2070s.

As the high stress test scenarios' risks are beyond the first 25 years of the planning period, there would be time to monitor the impacts of climate change and to plan for the enhanced environmental destination outcome. To demonstrate mitigation of these risks, Yorkshire Water have included the tidal abstraction reservoir (R78) option as an alternative scenario to their best value plan. This gives us time to complete the investigations before the risks emerge.

Testing also been completed on the sensitivity of the preferred plan on the Grid zone to demand reduction uncertainties. This scenario assumes half the assumed benefits, included in the preferred plan for leakage and PCC reduction. In this scenario, the zone is in deficit at the start of the planning period (2025/26), which is then closed by drought and resource options until 2039. The zone returns to deficit in 2039 when the switch to a 1 in 500-year level of service occurs. This deficit cannot be met by drought options so additional investment would be required. We would need to develop further options for the longer-term deficit, and we shall consider this in the next planning round.

7.3. Adaptive pathways

In **Section 7.2** above we explained the results of our sensitivity testing to understand whether our central (most likely) final plan supply demand balance, and therefore our Best Value Plan, is sensitive to less likely (low or high) planning assumptions on demand, climate change, technology and environmental abstraction sustainability reductions. The final step in formulating our plan was to create an adaptive plan that enables it to be flexible to the uncertainties and divert to an alternative future if required.

Adaptive planning is a framework that is used to manage risk and uncertainty in the Best Value Plan. An adaptive plan presents:

- a central pathway and preferred programme representing the most likely future (based on the uncertainties); and,
- alternative pathways and programmes should our supply and/or demand forecasts manifest differently.

It is important to highlight that adaptive pathways are based on the risks that are most material and do not represent all the uncertainties. To plan for all uncertainties would be overly complex and the outcome may become unmanageable. There is also

a risk of over investing if we do not balance our actions with the time our plan can allow for the risks to develop.

For the Kielder zone, the sensitivity testing has shown that under all scenarios, a supply surplus is maintained across the planning period. Consequently, the preferred Best Value Plan does not need to be an adaptive plan.

For the Yorkshire Grid zone, some additional options are required to mitigate large deficits in some scenarios, with key dates that trigger an alternative pathway. To ensure we are prepared for diverting to an alternative plan, we identify decision points in advance of the pathway diverging.

The decision points and triggers for the six potential pathways on the Yorkshire Grid Zone are shown in **Figure 7-** later in this section. The associated pathway positions are explained below:

Pathway 1- Preferred (most likely): This is the most likely pathway represented by the baseline supply-demand balance tables. The best for resilience plan has been selected to close the deficit in the Grid SWZ DYAA and critical period baseline scenarios. The solution benefits are represented in the Grid SWZ WRP Tables 3b and 3e.

Pathway 2- High (enhanced) environmental destination: This pathway represents enhanced environmental destination and the risk of additional deficit if the outcome of both the WINEP investigations on groundwater sources and the River Derwent investigations is more severe than assumed in our preferred pathway. Under this scenario we would follow the preferred pathway until 2039. In this year, the R86 West Yorkshire new WTW option is triggered, and the decision point would be in 2030 to allow time to construct the WTW. This option is mutually exclusive with the R37b(ii) River Aire Abstraction option 4 option included in the preferred plan in 2073/74 and the R37b(ii) scheme would no longer be available. Due to the potential for the decision to be made in 2030 we will start enabling work for the Aire and Calder in AMP8.

In the longer term six further supply side options (see **Table 7-7**) are needed from 2066 onwards. This includes a new abstraction from the Humber Estuary that would be stored in a tidal abstraction reservoir (R78) or used at a desalination plant in East Yorkshire (R61). Use of the Humber Estuary would require environmental investigations in advance to ensure the water was available and further scoping to understand which of the two options would be implemented.

The trigger for the pathway is 2040 when the CSMG target will be applied on the River Derwent. The decision point is well in advance of this date in 2027. The time between the decision and the trigger allows for the complexities of this pathway to be resolved. Currently the scale of the loss is unknown, but could be high (130Ml/d or more). This reduction in our available supply would have a significant impact particularly if we were also following the half demand benefit pathway. We have allowed time for understanding the impact and ensuring we have sufficient options implemented that can reliably secure supply to our customers.

Pathway 3- Low ED: In the low ED pathway there would be no abstraction reductions on the groundwater sources or the River Derwent. This pathway is the same as the preferred plan until 2035 when the R8g Sherwood Sandstone support to grid option would be delayed until 2039. The decision would be made in 2025 when the groundwater WINEP investigations will reach conclusion.

Later in the programme the preferred plan could deviate again following the conclusion of the River Derwent investigations and finalisation of the CSMG target in 2027. If there is no reduction to our abstraction the DV7a(vi) Tees transfer option will be delayed until 2062 and the capacity will be reduced from 140 to 50Ml/d. Other minor changes would occur post 2050, when the R37b(ii) River Aire option and R31a Bankside storage options are delayed by one year.

Pathway 4- Low demand: In the low demand pathway greater benefits are achieved from Government initiatives for water labelling and building regulations. This delays the R8g Sherwood Sandstone support to grid option to 2039 and the Tees transfer is not needed in 2040. Later in the period the R37b(ii) and R31a options are not required either.
The trigger for moving to this pathway is in 2035. As both the R8g and DV7a(vi) options are needed in the majority of pathways and the low pathway has high uncertainty we will make a decision on this pathway in 2030.

Pathway 5- Half Demand Benefit: This pathway recognises the success of our planned demand reduction activity cannot be guaranteed and

assumes the year-on-year combined benefits of leakage reduction and PCC reduction (through smart metering/ networks and water labelling) will be half that assumed in our preferred plan pathway. It would trigger both R86 West Yorkshire new WTW and the R31a Bankside storage options in 2035 (and exclude R37b(ii)). The decision point for both schemes would be 2030 and we discuss enabling work for these options in our core pathway description below.

In the longer term six more supply-side options are needed from 2066 onwards. This includes the R78 tidal abstraction reservoir and the R29 reservoir desilting option. Both options would require significant enabling work and environmental assessments. However, due to the timescales this work does not need to start in AMP8 as there is sufficient time to review the need in future WRMPs.

Core pathway: The core pathway includes options needed in both the benign and adverse scenarios, and that are needed to be undertaken to meet short-term requirements. Option delivery is the same as the preferred plan except that the post 2050 options are excluded. However, enabling work for the development of the R86 option (also relevant to R37b(ii)) is also included in the core as there is potential for this option to be triggered earlier in the planning period and investigation are needed to confirm the scope.

The options included in each of the alternative pathways are presented in the table overleaf. This shows a consistent selection of a 'core' of options across most pathways, and a smaller set of options as described are subject to change across pathways.

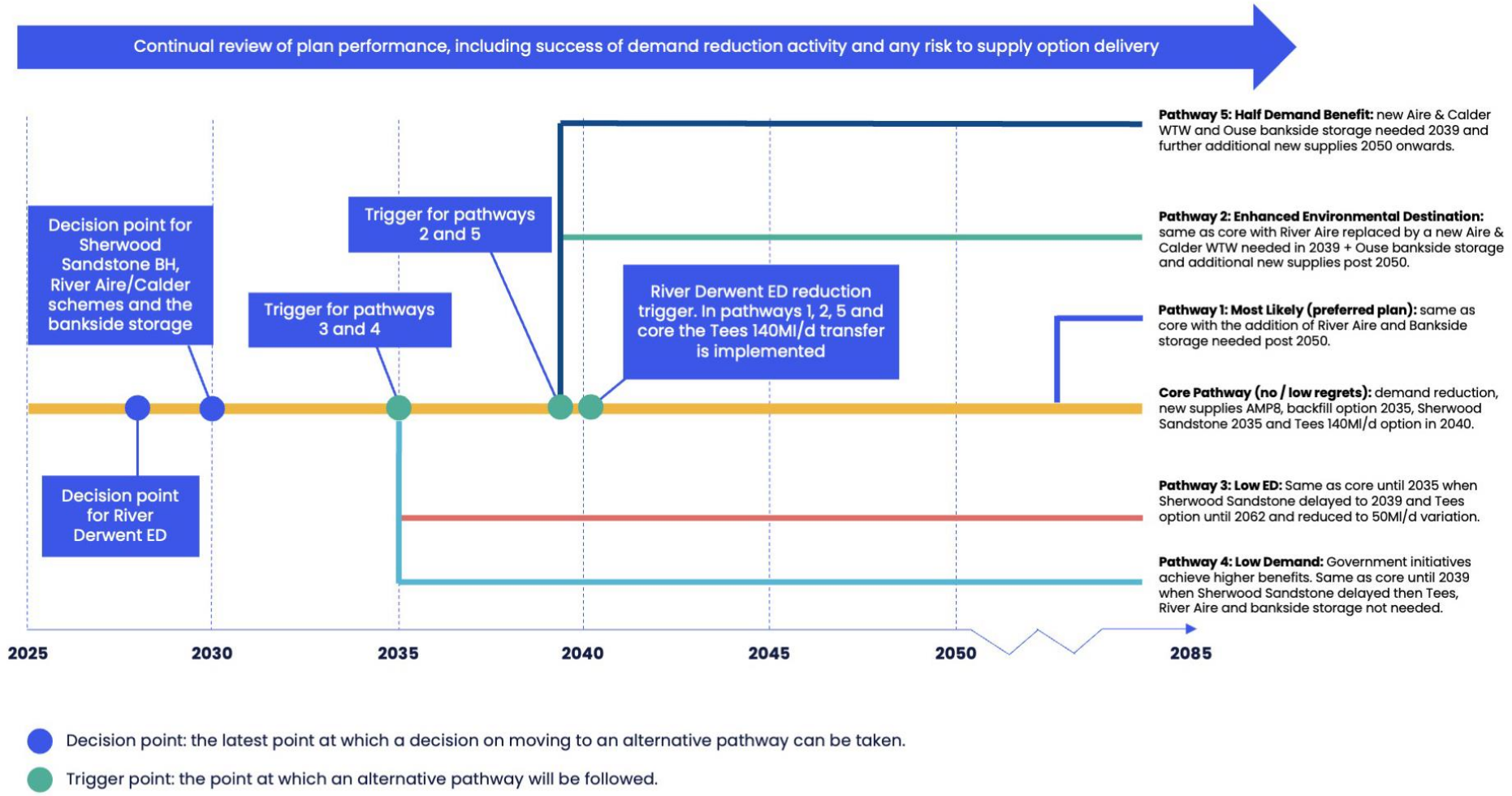
Table 7-7. Options included in different adaptive pathways

Option ref.	Option Name	Core pathway	Pathway 1: Preferred (Most Likely)	Pathway 2: High (enhanced) ED	Pathway 3: Low ED	Pathway 4: Low demand	Pathway 5: Half Demand Benefit
R48	Reduce level of service to 1 in 100 to 26/27 and then 1 in 200 (27/28 to 38/39)	2025	2025	2025	2025	2025	-
R48b	Reduce level of service to 1 in 100 to 26/27 and then 1 in 200 (27/28 to 38/39)	-	-	-	-	-	2025
C1d	Domestic customer audits and retrofit	2025	2025	2025	2025	2025	2025
C6a	Non-household customer audits and water efficiency retrofits (schools, leisure centres and hospitality)	2025	2025	2025	2025	2025	2025
LSM	50% Leakage Reduction + 0.66% 10yr Mains Renewal + Smart Metering (94.62ML/D)	2025	2025	2025	2025	2025	2025
C12a3	Rainwater harvesting - commercial customers	2025	2025	2025	2025	2025	2025
C27d	School Visits	2025	2025	2025	2025	2025	2025
C28e	Household Media Campaign	2025	2025	2025	2025	2025	2025
C34a	Non Household Media Campaign	2025	2025	2025	2025	2025	2025
C35c	Water Retailer Incentives	2025	2025	2025	2025	2025	2025
C6a(ii)	Non-household customer audits and water efficiency retrofits (general domestic use only)	2025	2025	2025	2025	2025	2025
C15d	Household flow regulator-internal	2025	2025	2025	2025	2025	2025

Option ref.	Option Name	Core pathway	Pathway 1: Preferred (Most Likely)	Pathway 2: High (enhanced) ED	Pathway 3: Low ED	Pathway 4: Low demand	Pathway 5: Half Demand Benefit
C30a	Water Labelling Conservative Baseline	2025	2028	2028	2028	-	2028
C30b	Water labelling – low demand	-	-	-	-	2025	-
DO03	Supply rivers drought permits- ends in 2038- DYAA	2025-28	2025-28	2025-38	2025-38	2025-38	2025-38
DO13	Drought demand reduction- DYAA	2025-28	2025-28	2025-38	2025-38	2025-38	2025-38
DO08	Drought Supply Reservoir Compensation Drought Permits	2025-28	2025-28	2025-38	2025-38	2025-38	2025-38
C32c	Household Rainwater Harvesting- New Development	2025	2025	2030	2030	2030	2030
R3a	River Ouse licence transfer at low flows	2027	2027	2027	2027	2027	2027
R3	Increased River Ouse pumping capacity	2028	2028	2028	2028	2028	2028
R91	New internal transfer to North Yorkshire WTW 2.	2028	2028	2028	2028	2028	2028
R13	East Yorkshire Groundwater	2028	2028	2028	2028	2028	2028
C23b1	Rainwater Harvesting- agriculture	2030	2030	2030	2030	2030	2030
C13c	Household Tariffs	2030	2030	2030	2030	2030	2030
DV8B	New York WTW and Dual Main South Yorkshire Pipeline	2035	2035	2035	2035	2035	2035
R8g	R8g Sherwood Sandstone Boreholes support to North Yorkshire	2035	2035	2035	2039	2039	2035
DV7a(vi)	Tees to York pipeline - NWL import (140Mld)	2040	2040	2040	-	-	2040
R37b (ii)	River Aire Abstraction option 4	-	2073	-	2074	-	-
R31a	Bankside storage at York WTW	-	2082	2066	2083	-	2039
R8f	Sherwood Sandstone and Magnesian Limestone Boreholes option 6	-	-	2070	-	-	2066
R86	West Yorkshire new WTW	-	-	2039	-	-	2039
R85	Rebuild Kirklees WTW	-	-	2074	-	-	2072
R78	Tidal Abstraction Reservoir	-	-	2077	-	-	2074
R87	Rebuild Northallerton WTW	-	-	2083	-	-	2079
DV3	Magnesium Limestone	-	-	2084	-	-	2080
C4	Change of Occupancy metering	-	-	-	-	-	-

Option ref.	Option Name	Core pathway	Pathway 1: Preferred (Most Likely)	Pathway 2: High (enhanced) ED	Pathway 3: Low ED	Pathway 4: Low demand	Pathway 5: Half Demand Benefit
R29	Reservoir Desilting	-	-	-	-	-	2082
DV7a(iv)	Tees to York Pipeline - NWL import 50 Ml/d	-	-	-	2062	-	-

Figure 7-2 Best value plan core adaptive pathways for tackling the Grid zone deficit within WReN[59]



[59] Further details on options development and implementation schedules over time are presented in the YW draft WRMP24 main technical document.

7.4. Environmental destination

Our stakeholder engagement revealed that our environmental destination has general support but there is further work needed to fully understand and prioritise changes required to water abstraction, to further understand the long-term view and evidence an agreed way forward.

It is recognised that WReN has a good level of information at catchment level and can build on this to frame future ambition with catchment stakeholders including continued dialogue with other sectors and environmental regulators, gathering additional information to prioritise needs.

In pursuing our long-term environmental destination, we also need to recognise the overlaps between this and WINEP investigations. The investigations might reveal information that can then be used to make decisions about licence changes or other measures to improve the water environment for the longer-term.

In the first five years of the plan (2025-2030) our focus is to undertake investigations that will provide a robust evidence base for our long-term environmental destination and the strategic choices/trade-offs that may be required. In the following five years (2030-2035), we will implement licence changes (where identified as required) to meet WFD objectives and continue our strategic options development and assessment. In the following 10 years (2035-2045), we will aim to progress the solutions identified in previous years, to support long-term environmental destination. In the period 2045 to 2050 (or sooner, if appropriate), we anticipate implementing all licence changes required to support the long-term Environmental Destination.

The outcome of our plan in the context of the Environmental Destination driver is that WReN will continue to support the principles of the Enhanced WRNF scenario whilst maintaining resilient water supplies. To this end, our short, medium and long-term priorities for environmental destination are described in **Table 7-8**.

Table 7-8. Short, Medium and Long-Term priorities for environmental destination

Short to Medium Term (0 – 15 years)		Long Term (15 years +)
Complete review of outcomes of AMP7 WINEP investigations to improve understanding of individual and cumulative impact of abstraction licences and relevance to regional plan. Implement AMP7 WINEP Implementation Schemes Prioritise further investigation for AMP8 in line with EA WINEP guidelines . Iterative implementation of future ED datasets (e.g. Water Resources National Framework 2 ED data) Continued engagement with stakeholders to understand long-term aspirations and trade-offs, in particular for priority catchments. Explore alignment of regional planning activities with other initiatives (e.g., chalk stream restoration strategy and lowland peatland taskforce), where appropriate.	Undertake AMP8 investigations. Improve understanding of future use from other sectors and incorporate into future plans. Continue to review plans within adaptive planning framework, iterating the approach to environmental destination as required. Reflect outcomes of AMP7 investigations and agree magnitude of license changes in company water resources plans / regional plan Undertake further investigation, where identified as being required following finalisation of first regional plan. Implement co-created WINEP.	Continue to review plans within adaptive planning framework, iterating the approach to environmental destination as required. Continue to implement co-created WINEPs

Planned AMP8 activity and investigations

AMP8 investigations and collaboration with other sectors will improve understanding and inform future plans.

Yorkshire Water AMP8 investigations include:

- Catchment-scale WINEP investigations to identify a sustainable long-term solution for the Lower River Derwent protected areas.
- Regional-scale WINEP options appraisals to develop and assess the feasibility of solutions to achieve environmental destination.
- Other WINEP options appraisals to identify sustainable water resources solutions at various groundwater sources.
- Exploring alternative approaches to reservoir compensation flow management that could increase ecological, water resources and flood resilience in the region in the long-term.

Similarly, Northumbrian Water has worked closely with regulators and stakeholders and has agreed schemes to be included in the WINEP for delivery in AMP8 (2025 to 2030). A challenge to aim for even more ambitious environmental outcomes for AMP8 has been set by regulators and in response, Northumbrian Water has been 'thinking big' around the delivery of more positive outcomes for the water environment and customers. Some of the proposals build on investigations undertaken in AMP7, while others build on the success in supporting partners to deliver holistic environmental projects. To this end, Northumbrian Water is working closely with other environmental organisations to identify the opportunities to develop bigger and better projects which will deliver multiple benefits for the environment.

Wider environmental work

We also contribute to wider environmental improvements that may not give a direct water resource benefit but offer wider environmental benefit (e.g. catchment solutions, flood risk benefits, wetland/peat restoration etc.). These include:

- Further improvements in water quality, quantity available and biodiversity through continuing and extending Yorkshire and Northumbrian Water's catchment management schemes via the PR24 WINEP process.
- Continuing to grow water company support for our region's Rivers Trusts and CaBA to deliver meaningful improvements in river water quality and to remove obstructions, to provide the greatest ecological benefit to our region's rivers.
- Exploring alternative approaches to reservoir compensation flow management that could increase ecological, water resources and flood resilience in the region in the long-term.
- Continuing to work with upland stakeholders to deliver restoration of valuable blanket bog habitats, for a range of benefits including water quality, water retention, biodiversity and carbon sequestration.
- Improving our understanding of how WReN can support lowland peatlands through engagement with the Lowland Agricultural Peatland Task Force.
- Co-creating individual water company business plans with stakeholders in support of the next Price Review (PR24) to ensure local knowledge and aspirations accounted for in our investment plans.
- Continuing to work in partnership across various catchments to support the removal of barriers to migration and improving spawning habitats for Salmon through river restoration and the appropriate timing/volume of reservoir releases. This includes building on the success of the return of Atlantic Salmon to the River Don in Yorkshire.
- Supporting Defra's Chalk Stream Restoration strategy to protect and enhance the UK's most northerly chalk stream habitats in the East Riding of Yorkshire, including through the Chalk Stream Restoration Flagship programme in the Hull Headwaters.
- Protecting and enhancing priority species through Yorkshire Water's Biodiversity Enhancement programme.

Nature-based Solutions

Nature-based solutions (NbS) are not included in the regional plan specifically as options because they do not provide a quantifiable direct Deployable Output benefit. However, they are included in the PR24 WINEP plans for Yorkshire Water and Northumbrian

Water, recognising that they have wider benefits other than to water resource availability (e.g. water quality). Both companies are committed to putting nature first by preferring NbS over engineered solutions.

The types of NbS that have and will be used include:

- **River restoration** - restore natural river processes to reduce the impact of our operations on river health.
- Use **sustainable drainage (SuDS)** to reduce flood risk and storm overflow operations.
- **Construct wetlands** to balance nutrients within catchment and to treat flows at wastewater treatment works.
- **Working in partnership at landscape scale** to improve raw water quality and bathing waters while also slowing the flow of water through the catchment.
- **Upland peat restoration** to sequester carbon and improve reservoir water quality

These solutions, along with others, will help deliver low carbon, regenerative and resilient long-term outcomes for the WReN area.

7.5. New non-PWS Growth

Engagement with non-PWS sectors has been key for WReN moving towards the second regional planning round, with huge steps forward in the mutual understanding of the composition and challenges facing each sector. We have in particular engaged with the agricultural, energy and navigation sectors.
In planning for growth, the energy sector is particularly key, given that two of the three major industrial clusters for hydrogen power and carbon capture in England are situated in our region (Teesside and the Humber). These will increase the future demand for water in these areas.
There is an existing industrial supply zone in the Kielder zone that supplies non-potable industrial demand on Teesside. The demand from Teesside businesses has been forecasted, supported by extensive engagement activity, and it has been concluded there is no further need for adaptive pathways (a precautionary approach has been taken to these forecasts and the demand impacts existing assets). As a result of our plans, there is a planned reinstatement of a mothballed river intake, and abstraction applications are being submitted to the Environment Agency via the Canal and Rivers Trust to return licensed quantities in line with the capacity of the river intakes and pumping stations.

For the Yorkshire Grid zone the future energy demand is highly uncertain, and we continue to engage with various stakeholders to understand the likely range of future demands over time. As such, we have accounted for this through target headroom uncertainty allowance on the supply-demand balance and the adaptive pathway process. We have also tested a specific hydrogen planning scenario to explore the impacts on our plan under such an eventuality.
We continue to engage with all sectors as we look to the next planning round. Reflecting the potential growth in energy sector demand and/or abstraction in our region, along with the specific structure of the energy sector, WReN is engaging with the energy sector at three levels:

Strategic and overarching

- Medium-long term horizon scanning / forecasting
- Identification and screening of risks / new needs + developments
- Promoting and raising visibility of water in energy planning
- Consultation responses (e.g. guidance, planning framework etc.) on behalf of WReN; influencing government and regulatory process to adequately account for the energy sector etc.
- Review / feedback / ideas on regional plan approaches (e.g. cluster and abstractor levels)

Known/defined new energy developments and clusters (currently Humber and Teesside focussed)

- Direct engagement and joint planning activity where tangible energy development / parties identified
- Future scenarios of use (explore / identify tipping-points)
- Impacts of water abstraction / supply, potential joint / alternative at high-level
- Potential case for more detailed options development, subject to funding

Existing abstractors/energy sector supplies (as part of catchment level activities)

- Future scenarios of use / changes in future abstraction
- Informing and understanding environmental risks & licence changes

As described above, this engagement is ongoing and will inform WReN's non-PWS approach for the second regional planning round.

8. Next Steps

We have actively sought feedback from our customers, stakeholders and regulators on our draft regional plan alongside the water companies' draft WRMP24 We have reviewed this feedback along with the expectations of the revised Water Resources National Frameworks (WRNF2) to further shape our final regional plan and our future commitments and actions for the next water resource planning round, with a key focus on multi-sector planning and collaboration.

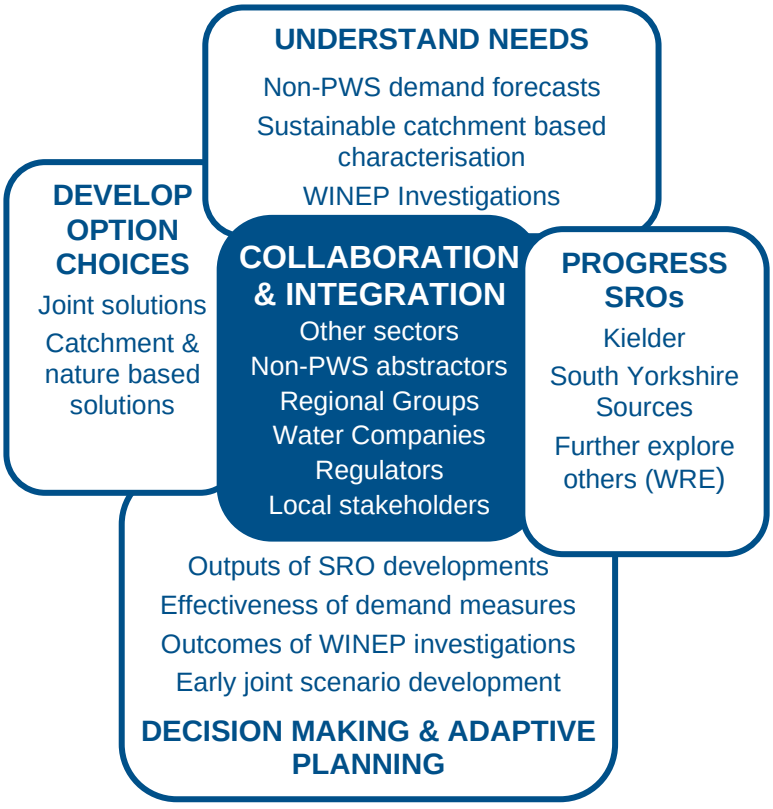
Commitments for the next planning cycle

Our Final Regional Plan has been developed alongside the water companies' final WRMP24 and represents the best available data at the time.

The final WRMPs can be found on the water company

Yorkshire Water
Northumbrian Water
Anglian Water

We will follow through on the commitments and actions set-out in this Regional Plan as we move towards the second regional planning process with a key focus on working with other sectors and non-PWS abstractors alongside regulators to move further towards multi-sector planning.



Drought management and wider benefits

The Environment Agency's draft expectations for regional groups includes an expectation (a must) that regional groups will:

- Produce a statement of intent on drought; and
- Actively seek drought management options that include wider benefits, such as resilience to floods and droughts, improvements to water quality, and resilience improvements to drainage and wastewater systems, in alignment with Drainage Wastewater Management Plans.

Part of WReN's intent on drought is to have a regional drought group. This group will add to and complement existing drought groups including Area Environment Agency drought meetings, National Drought Group and public water supply, agriculture and comms subgroups.

The group will act as a catalyst to identify and champion opportunities for improved water resources allocation and management across sectors.

Water Resources National Framework – 2025

The Environment Agency will be publishing the revised WRNF2 in summer 2025 which will incorporate updated expectations of the role of the regional groups. They have consulted on draft expectations, and we know that it reflects an evolution of the role of Regional Water Resources with a focus on:

- Multi-sector planning
- Integrated water management including links to catchment-scale planning and cross-collaboration
- Adaptive planning to manage future uncertainty

Over the last 3 – 6 months we have focussed on 'setting-up' activities in preparation for the next planning round so that we can deliver WRNF2 expectations. A summary of setting up and forward looking activities is presented in **Figure 8-1**.

Figure 8-1 Activities and next steps for the second regional planning round

Setting-up activities delivered

GOVERNANCE

Governance **structure** updated and roles defined

Governance **meeting** reviewed and rebooted ahead of the second regional planning round

Overarching and sector level **Programmes** established and tracked

Determine and deliver **WReN's role** along with **the process** for presenting multi-sector consultation responses (e.g. Sir J Cunliffe Review of water sector)

STAKEHOLDER

Stakeholder **representation** reviewed and expanded across existing sectors (e.g. energy sub-groups) and new organisations (e.g. NAVs, Wildlife Trust, etc.)

Stakeholder Plan developed with a process for keeping 'live'

RESOURCES

Funding gaps & needs for FY26 reviewed

Case for **additional resources** set out and recruitment underway for
- Independent Chair (IC)
- PWS Delivery Lead (DL)
- Non-PWS DL
- Agriculture resources

PWS DL and Agriculture Strategic Lead & consultants **recruited**

PLAN DELIVERY

Review WRNF2 (draft expectation) - asks and implications for RP2 (preparedness review)
Conduct lessons learned from (1st Regional Plan) and preparedness review

PWS
- SROs inceptions / project initiation
- Early start investigation for Derwent commenced

Navigation
- Progression of CRT water resources strategy, analysis and modelling

Energy
- Commencement of activity to increase WReN visibility in energy clusters

Agriculture
- Strategic Plan produced for sector
- Report on WAGs, SDBA, LROs for the WReN region prepared
- Sectoral regional plan approach produced with recommendations including Stakeholder Plan, Programme and tool for intervention evaluation

Activities to go (next 3 – 6 months)

GOVERNANCE

Set-up **data / information** storage and sharing platform

Establish **additional governance meetings:**
- Technical cross-workstream groups
- WReN Drought Group

Further **Programme development** focussing on the next 12 months:
- all sectors / workstreams

Working with other regional groups and the Strategic Steering Group to understand the process for reporting progress against the Regional Plan (i.e. a **bi-annual 'check-point' report**)

STAKEHOLDER

Further expansion and **integration** of stakeholder representation (e.g. DWMP)

Ongoing development and **delivery of Stakeholder Plan** for the next 12 months including significant energy and agriculture sector engagement

RESOURCES

Review of resources:
Agriculture sector resources post March

Recruitment of WReN Independent Chair

Review of **funding,** including from sector organisations

PLAN DELIVERY

Review WRNF2 (FINAL) – check against current plan / activities
Understanding needs and approach to the second regional planning process

PWS
- Definition of regional modelling framework
- Assess WRZ definitions; potential for change
- Zonal problem characterisation and PWS modelling needs
- SDB annual WRMP reviews + SDB view
- Kick start technical workstreams and produce methodology statements

Energy
- Understand & communicate EA environmental destination updates - existing abstractors / water availability for developments
- Further develop Teesside / Humber specific engagement & approach (including visibility of water supply constraints across demand envelope)
- Understand further engagement / influencing actions (e.g. NESO)

Agriculture
- Deliver recommendations, Programme and Stakeholder Plan to embed Agriculture needs into the second regional plan including:
- Further engagement to target a high touch approach to priority segments including glasshouse agriculture & horticulture, field vegetables & potato production and dairy.
- Understand license reduction risks

Navigation
- Develop map to demonstrate ability to transfer water within WReN
- Review of needs/opportunities from CRT water resource strategy
- Opportunities workshop (navigation transfer / options opportunities)
- Case study examples

Glossary

Abstraction Licences	An abstraction licence gives you a right to take a certain quantity of water from a source of supply (inland water such as rivers or streams or an underground source).
Adaptive plan	An adaptive plan is a framework which allows you to consider multiple preferred programmes or options and sets out how you will make decisions within this framework. It responds to future uncertainties by setting out a sequence of manageable steps or decision-points, when these are required and how it will be monitored.
Adaptive pathways	Adaptive pathways indicate how the plan would change within an adaptive plan according to the decisions and steps that could be taken over time. Each pathway is a portfolio of options with a schedule of dates for when each option will be implemented.
AISC	Average Incremental Social Cost
Alternative plans	Several plans (as selection of options with an implementation schedule) may be developed through the water resources management planning process. Different or 'alternative' plans can be compared against a 'preferred plan'.
AMP	Asset Management Period (5-year price review period)
AMP6	Planning period 2015-16 to 2019-20
AMP7	Planning period 2020-21 to 2024-25
AMP8	Planning period 2025-26 to 2029-230
Baseline	A description of the present and future state, before any the adjustments due to changes or losses (e.g. due to development).
Best Value	An approach that considers other factors alongside costs when comparing different options e.g. other factors such as the environment, resilience and customer preferences
Catchment Based Approach (CaBA)	The Catchment Based Approach (CaBA) is a community-led approach that engages people and groups from across society to help improve our precious water environments: Home - CaBA (catchmentbasedapproach.org)
CAMS	Environment Agency's Catchment Abstraction Management Strategies (local licensing strategies that set out how water resources will be managed within a catchment area)
Catchment Plan (CP)	A catchment plan identifies the main issues within a catchment and prioritises work which will improve the catchment as a whole. This puts the catchment in a better position to achieve Water Framework Directive (WFD) targets, as well as other environmental and social goals: Catchment Planning | The RRC (https://www.therrc.co.uk/catchment-planning)
Decision-making metrics	Decision-making metrics are associated with developing an optimised best value plan. They sit beneath the overarching objectives to be achieved in the plan and might include measures of cost, environmental, social, and supply-demand benefits. Each metric is a criterion used to appraise option programmes or portfolios, towards identifying an overall best-value plan. They describe wider

	aspects of interest to regional water resources planning, beyond simply meeting supply-demand at least-cost as in traditional water resources planning.
Defra	Defra is the Department for Environment, Food and Rural Affairs and is the UK government department responsible for water resources in the UK.
Deployable Output (DO)	Deployable output is a building block in determining water supplies available for use and is defined as the output for specified conditions for a water resources system as constrained by; hydrological (source) yield; licensed quantities; abstraction assets; raw water transfer assets; treatment; water quality; and levels of service.
Dry Year Annual Average (DYAA)	Represents a period of low rainfall and unrestricted demand and is used as the basis of a water company's resources management plans.
DWI	The Drinking Water Inspectorate (DWI) was formed in 1990 to provide independent reassurance that water supplies in England and Wales are safe and drinking water quality is acceptable to consumers.
Environmental Destination (ED)	Describes a long-term destination (to 2050 and beyond) for environmental improvement and sustainable abstraction considering factors such as climate change impacts and future demand.
Environment Agency (EA)	The Environment Agency (EA) is an executive non-departmental public body, sponsored by the Department for Environment, Food & Rural Affairs. They are responsible for environmental regulation in England and includes producing and updating River Basin Management Plans.
Feasible options	A set of options that are suitable to assess for inclusion in the preferred plan. Feasible options are identified from a longer list of options by a process of *screening* to remove options with constraints that make them unsuitable for further promotion.
Habitats Regulations Assessment	A competent authority must decide if a plan or project proposal that affects a European site can go ahead. A European site is protected by the Conservation of Habitats and Species Regulations 2017 as amended (known as the Habitats Regulations). A habitats regulations assessment (HRA) under the Habitats Regulations, is applied to test if a plan or project proposal could significantly harm the designated features of a European site in England and Wales and their inshore waters (within 12 nautical miles of the coast).
HW	Hartlepool Water (Anglian Water Services)
Headroom	The difference between water available for use and demand at any given time.
Level of service (LoS)	Frequency with which the different types of specified actions would need to be taken during dry weather periods to help maintain the water supply.
l/h/d	Litres per head per day
Ml/d	Mega litres per day or millions of litres per day
Multi-criteria analysis (MCA)	Multi-criteria analysis is a structured technique for assessing options against a number of distinct objectives whose performance can be measured against a number of distinct objectives. It can also be used to explicitly explore the trade-offs between different candidate plans to inform the selection of preferred or alternative plans.
National Framework	The Environment Agency's National Framework explores England's long-term water needs and sets out the scale of action required for a resilient water supply that meets the needs of the future generation. It sets out a greater level of

	ambition for restoring, protecting and improving the environment that is the source of supply.
Natural Capital	The environment's stock of natural assets that support life including water, soil, air, minerals and ecosystems.
Non-Governmental Organisations (NGOs)	NGOs are typically voluntary groups of individuals or organizations that are not affiliated with any government and are formed to pursue purposes of public interest.
Non- Households	Properties receiving portable water supplies that are not occupied as domestic premises.
Non-public water supply (non-PWS)	Non-public water supply is any water supply that is not provided by a water company.
NWL	Northumbrian Water Limited
Ofwat	The Water Services Regulation Authority, or **Ofwat**, is the body responsible for economic regulation of the privatised water and sewerage industry in England and Wales. The Environment Agency is responsible for environmental regulation, and the Drinking Water Inspectorate for regulating drinking water quality
Per Capita consumption (PCC)	The amount of water typically used by one person per day.
Preferred options	The set of water resources options included in the preferred plan.
Preferred Plan	A set of options that has been selected through the water resources planning process which are shown to perform better against the objectives of the plan.
PR19	Price Review submission to Ofwat in 2019
PR24	Price Review submission to Ofwat in 2024
Regulators' Alliance for Progressing Infrastructure Development (RAPID)	RAPID was formed to help accelerate the development of new water infrastructure and design future regulatory frameworks and is a joint team is made up of the three water regulators Ofwat, Environment Agency and Drinking Water Inspectorate.
Regional Climate Model (RCM)	A regional climate model is a numerical climate prediction model forced by specified lateral and ocean conditions from a general circulation model (GCM) or observation-based data set that simulates atmospheric and land surface processes, while accounting for high-resolution topographical data, land-sea contrasts, surface characteristics, and other components of the Earth-system. https://glossary.ametsoc.org/wiki/Regional_climate_model
Regional plan	A long-term multi-sector adaptive water resource plan.
Representative Concentration Pathway (RCP)	A greenhouse gas concentration trajectory adopted by the Intergovernmental Panel on Climate Change (IPCC). Different pathways were used for climate modelling representing different climate futures which could arise depending on the volume of greenhouse gases emitted over time.
River Basin Management Plan (RBMP)	River basin management plans (RBMPs) describe the challenges that threaten the water environment and how these challenges can be managed and funded. The plans are based upon a detailed analysis of the pressures on the water bodies within the river basin district and an assessment of their impacts They set out the environmental objectives for the water bodies and a summary of the programme of measures that will be taken to achieve them.

Screening	The process where options are filtered using a set of screening criteria that determines whether they have constraints that make them unsuitable for further promotion. Defined screening criteria are used to ensure options are screened consistently. There may be several iterations of screening before a feasible list of options is determined.
STW	Severn Trent Water
Site of Special Scientific Interest (SSSI)	Site of Special Scientific Interest (SSSI) is a conservation designation and protects an area that's of interest to science due to particular features within its boundary e.g. rare species of fauna or flora or important geological / physiological features
Special Area of Conservation (SAC)	Special Area of Conservation (SAC) is a conservation designation to protect one or more special habitats and/or species – terrestrial or marine – listed in the Habitats Directive.
Special Protection Areas (SPAs)	Special Protection Areas (SPAs) are protected areas for birds in the UK.
Strategic Environmental Assessment (SEA) European Directive 2001/42/EC	'An assessment of the effects of certain plans and programmes on the environment'. Transposed into UK law via The Environmental Assessment of Plans and Programmes Regulations 2004
Strategic choices	Strategic choices are the key decisions to be taken in developing the plan and maybe regional or company or zone specific.
Strategic Resource Options (SROs)	Large-scale, inter-region strategic transfers of raw water being considered by companies and regional groups and supported by *RAPID* (see above).
STW	Severn Trent Water Limited
Stress Testing	A process to test the resilience of a plan against future uncertainties.
Supply demand balance (SDB)	Supply minus demand and target headroom. An annual average presented for each year of the planning horizon (2025-2085).
SWZ	Surface Water Zone
Sustainability reduction	A sustainability reduction is the reduction in water company deployable output due to a sustainability change to a licence, driven by environmental legislation or need. A sustainability reduction is calculated by the water company and included in its WRMP, and would be linked to expected or possible interventions to be included in the WINEP.
Target headroom	This is a quantified *headroom* based on statistical analysis of uncertainties which is factored into the supply and demand balance estimates.
Unconstrained list of options	A list of possible water resource options that could reasonably be used in the plan before they are filtered (screened) using a set of defined screening criteria which will determine those that are unsuitable for further promotion.
UKCP09	United Kingdom Climate Projections 2009
UKCP18	United Kingdom Climate Projections 2018
UU	United Utilities
WAFU	Water Available For Use

Water Framework Directive (WFD) 2000/60/EC	A piece of EU legislation that requires all member states to make certain steps to protect and improve the quality and quantity of water within water bodies such as lakes and rivers.
Water Resources Management Plan (WRMP)	WRMPs are developed and published by water companies. They set out how water companies intend to achieve a secure supply of water for their customers and a protected and enhanced environment. The plan forecasts supply and demand over at least the statutory minimum period of 25 years. If a deficit is forecast, then the plan should consider supply-side options to increase the amount of water available and demand-side options to reduce the amount of water required. These plans are prepared every 5 years and reviewed annually and the two numbers following 'WRMP' indicate the year the plan is published.
Water Resources National Framework (WRNF)	A national framework for water resources - Meeting our future water needs, Environment Agency (March 2020)
Water resources planning guideline (WRPG)	Water resources planning guideline - GOV.UK (www.gov.uk), UK Government, 2021
Water Resource Zone (WRZ)	The WRZ is the principal building block used by companies to develop forecasts of supply and demand and produce a supply-demand balance (SDB). UKWIR/Environment Agency defines the WRZ as: "The largest possible zone in which all resources, including external transfers, can be shared and hence the zone in which all customers will experience the same risk of supply failure from a resource shortfall."
What-if scenarios	This approach is applied to test proposed plans and explores what would happen if the future was different to that assumed in the forecast. For example, what if the impacts of climate change were more than assumed for the forecast or population growth was lower than forecast
WINEP (Water Industry National Environment Programme)	WINEP represents a set of actions that the Environment Agency have requested all 20 water companies operating in England, to complete between 2020 and 2025, in order to contribute towards meeting their environmental obligations.
WTW	Water treatment works
YW	Yorkshire Water Services Limited

Appendices

A range of supporting appendices have been additionally supplied by WReN to complement this summary report. The appendices below have been previously consulted on regulators and other stakeholders (e.g. alongside the January 2022 emerging plan). They have continued to be developed and refined and incorporate feedback received from stakeholders and regulators. We will review any feedback received from the consultation of this draft regional plan where appropriate will update, shape and improve the Final Regional Plan that will be submitted in 2023.

The following documents are available as standalone files to go alongside this draft region emerging plan for consultation:

- Appendix 1. Meeting the needs of the National Framework
- Appendix 2. Data input assumptions & commentary
- Appendix 3. Drought resilience and climate change
- Appendix 4. Objective and metric development
- Appendix 5. Option identification and appraisal
- Appendix 6. Environmental destination
    - Catchment dashboards – *Available on request*
- Appendix 7. WReN customer engagement report June 2021
- Appendix 8. Stakeholder engagement and collaboration
- WReN Strategic Environmental Assessment (SEA) Environmental Report.

How to find out more

More information about Water Resources North, including our publications and how you can contact us, is available on our website, www.waterresourcesnorth.org.

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