Cambridge Water

Cambridge Water

Revised Draft Water Resources Management Plan 2024

Securing your water future

List of appendices

Appendix I	ValueStream Methodology Specification
Appendix J	ValueStream 1 Workbook for Supply Options
Appendix K	Artesia Demand Management Optimisation Report
Appendix K1	Artesia Demand Management Optimisation for revised draft plan
Appendix L	SEA for Demand Options
Appendix M	Demand Management Activities detail report
Appendix N	Supply options
Appendix N1	WRMP24 Supply options Reporting V2
Appendix N2	All preferred Supply Options Details
Appendix N3	WRMP24 unconstrained options list v12
Appendix N4	CW24-75DiiiOp2 Option Detail Report
Appendix P	SEA and other environmental reports
Appendix P1	INNS Assessment
Appendix P2	HRA Assessment
Appendix P3	BNG and NCA Assessment
Appendix P4	SEA Assessment
Appendix P5	WFD Assessment
Appendix Q	Board Assurance Statement
Appendix R	2022 Drought Review
Appendix S	No Deterioration Modelling Report
Appendix T	Scenario Analysis
Appendix U	Grafham Transfer Treatment Optioneering

1. Introduction to our water resources management plan

Overview

Every water company in England and Wales must produce a Water Resources Management Plan every 5 years. This plan looks at the predictions for water demand over the next 25 years, and what water supply is available to meet this demand. It then details how it will ensure it meets this demand through a potential range of demand management options and new supply options.

Our last plan was produced in 2019 and a lot has changed since then. Much of this relates to climate change and its impact on future water availability, both for public water supply and for environmental needs. In 2021, Cambridge Water was declared as an area of serious water stress by the Environment Agency. This means that either currently or in the future, the household demand for water is a high proportion of the current effective rainfall.

Even as we have been developing this plan, in 2022 our region was classified as being in drought, and the need to ensure our supplies are resilient to future periods of long dry weather is apparent. This WRMP looks to ensure a step change in drought resilience as we have undertaken studies to identify the actions required to make our system resilient to a 1 in 500 year drought, where the previous requirement was a 1 in 200 year drought. In reality, this means that the chance of an extreme drought reduces from 0.5% to 0.2% in any given year.

Our water is nearly 100% supplied by abstraction from chalk aquifers. These precious environments need restoring and protecting and we need to reduce our abstraction from them to do this. Due to the nature of chalk geology, these unique water environments react quickly to increases in abstraction that would be required to meet increases in demand through higher consumption and increased population growth.

And so a key focus of this plan is to ensure that we meet not only the water needs of our customers, but also that of our natural and historic environment. Our plan will ensure that abstraction reductions are delivered over the next 25 years from our existing sources in order to counteract the impacts of climate change and ensure the environment has the water it needs. This will also enable delivery of the Water Framework Directive (WFD) targets.

In addition, our population is growing. The Covid-19 pandemic saw customers use over 20 litres per person per day more than they did prior. This is due to people working from home more and increased hygiene practices. Even now, we are seeing this increase has not returned to pre-pandemic levels, nor has it been offset by a reduction in non-household usage. This means that demand for water has increased since WRMP19 and is set to increase across the lifetime of our plan.

Whilst the threat of climate change is not a new challenge, our understanding of it and the risk it poses to public water supply and the environment has evolved since our last WRMP in 2019. It is clear that our old method of developing WRMPs, where individual water companies prepare their own and focus only on their own requirements, will not alone solve the wider water issue in England.

This has led to the development of regional water resources planning groups across England. There are five groups, and Cambridge Water is part of Water Resources East. This regional group comprises of Cambridge Water, Anglian Water, Affinity Water and Essex & Suffolk Water, and has combined the supply and demand needs from each of these companies, and non-public water supply sectors, to create a regional water

resources plan. The five regional plans have been overlaid to create a national picture, which ensures that the best value plan, for both customers and the natural and historic environment, to meet the water needs of the country has been developed.

The WRMP has strong links to a number of other plans. It is a key building block of the PR24 business plan and the long term delivery strategy (LTDS) which we will submit to Ofwat in October 2023.

1.1 What is a water resources management plan?

Water companies are required by law to draw up, consult on and maintain a water resources management plan (WRMP), which sets out how they will manage resources in order to meet the requirements of the Water Industry Act 1991. This WRMP covers the period 2025 to 2050 and beyond, and takes into account factors such as population growth, climate change, water availability and the natural and historic environment. The plan is subject to annual review and companies need to write a new plan where circumstances change or the Secretary of State (SoS) at the Department for Environment, Food and Rural Affairs (Defra) requires them to. A new plan must be prepared at least every five years.

Our WRMP shows how we intend to maintain the balance between available water supply and the demand for water over the next 25 years and beyond. While South Staffordshire Water now incorporates the supply area of Cambridge Water, this WRMP applies only to the Cambridge Water operating area.

1.2 The process of developing a water resources management plan

The Water Act 2003 made WRMPs statutory documents which must be submitted to the SoS at Defra. Companies submit draft WRMPs and make them public; this is followed by a period of consultation where comments on the plan can be sent to the SoS. We then consider the comments received and make any necessary changes to the final WRMP before it is submitted to the SoS again for approval for final publication.

In addition to the statutory requirement to consult specified stakeholders the Environment Agency's 'Water resources planning guideline' specifies a pre-consultation stage and early engagement with regulators, customers and interested parties.

We recognise that we must ensure our plans represent a balanced view of customer priorities and views on key issues. We have built on the approach to customer engagement which we used for the 2019 WRMP and have integrated it more with the wider regulatory business plan (PR24) engagement process.

In line with statutory requirements, we contacted a range of stakeholders to invite views on what the WRMP should consider and invited them to webinars explaining the process.

- We held regular meetings with Environment Agency staff during the development of the draft WRMP.
- We appointed independent research consultants to carry out research on our behalf exploring customer priorities.
- The Independent Customer Panel has been kept informed and in particular consulted on the customer engagement.
- We met with Ofwat to present an overview of our approach to the WRMP and the potential supply/demand balance position.
- In July 2017, we carried out a metering study to understand customer reasons for not switching to a water meter.

- We carried out customer engagement on our WRMP and long-term plan to gain customer views of service levels, our plans and where we should invest to meet demand for water. This was facilitated by independent research specialists.
- Consultants have also facilitated online surveys, face to face Q & A sessions with different customer demographics, both household and non-household.
- We have been part of regional engagement, customer research and workshops facilitated through Water resources East (WRE)

A detailed discussion of our customer engagement is included in Section 4.

1.3 Statutory pre-consultation

There is a statutory requirement to consult the Environment Agency, Ofwat, the SoS and any licensed water supplier that provides water to premises in our area through our supply system before preparing a draft plan.

We also consult with wider key stakeholders, notifying them of our work to develop a new draft WRMP and asking them for initial views on issues to be considered. Letters were sent to the following organisations, and invitations were sent out to attend a pre consultation webinar that took place in March 2022.

- CCW, the water consumer watchdog
- Ofwat
- The Environment Agency
- Defra
- Natural England
- The Independent Customer Panel
- Anglian Water
- Affinity Water
- Local councils and councillors
- Local interest groups

We received a number of responses to the pre consultation, and a number of organisations attended our webinar, and engaged in Q&A. We received formal responses from:

- the Environment Agency
- Ofwat
- Wilbraham River Protection Society
- CCWater

These responses and our response on how our plan will represent these views are in Appendix A.

1.4 Public consultation on our draft water resources management plan

The Water Act 2003 states that companies must publish their draft plan within 30 days of notification that Defra is not proposing to give any direction (under section 37B(10) of the Water Act 2003) to amend the plan on the grounds of national security.

We published our draft plan on 24th February 2023 upon receiving notification from Defra. We notified key stakeholders (as specified in the WRPG) of the consultation period, directing them to the website and advising that a paper copy of the plan is available if required. These stakeholders included:

- the SoS
- the Environment Agency
- Ofwat
- licensed water suppliers within our area of supply
- Regional Development Agencies within our area of supply
- Regional Assemblies within our area of supply
- local authorities within our area of supply
- Natural England
- Historic England
- Anglian Water
- Water Retailers
- CCW

Our draft plan was out for consultation for 12 weeks, and so consultation closed on Friday 19th May 2023. We have now reviewed all of the feedback received and have published our statement of response to this feedback on 25th August 2023 and produced this updated revised draft WRMP which has been published on 29th September 2023.

1.5 Environment Agency liaison

The water resources planning guidelines specify that water companies should consult with their local Environment Agency team about the methods to be used when developing a plan.

We held regular meetings with Environment Agency staff during the development of our draft WRMP. These meetings provided the Environment Agency with early sight of particular areas of the plan and gave it the opportunity to seek clarification on any issues. Draft supporting documents, such as those prepared by consultants on our behalf, were shared with Environment Agency staff.

Feedback during these meetings and in response to draft supporting documents has helped shape our WRMP.

1.6 Timetable

The timetable for adopting the final WRMP is as follows:

- 24th February 2023: the start of a 10-week consultation period which closes on 19th May 2023.
- 25th August 2023: we will publish on our website our response to any representations we receive on our WRMP consultation.
- 29th September: we will submit our revised draft WRMP, any updated and additional appendices and associated data tables.

We will publish our final WRMP on our website once the Secretary of State has authorised us to do so. Copies will also be made available at our head office.

1.7 Links to other plans and context

1.7.1 Water Resources East – Regional Plan

The regional planning process and requirement for a regional water resource plan was initiated by the National Framework for Water Resources in 2020. Before this we have been working regionally with other companies, and

this was then formalised into a consistent planning approach in multiple regions. Our WRMP is closely aligned with the Water Resources East (WRE) draft plan which will be published in December 2023, following the emerging plan consulted on in January 2022. The draft regional plan can be found here www.wre.org.uk.

Figure 1 The WRE Vision

The WRE vision is to provide an integrated long-term strategy, prepared through multi-sector collaboration and planning, that takes account of the needs of all of those in the WRE region with an interest in the management and use of water. WRE's overall aim is to deliver a reliable, sustainable and affordable system of water supply to meet multi-sector requirements (including the environment) across the East of England for the next 50 years and beyond towards the end of the century. Within this overall aim, the objectives for the WRE project are to:

· Provide a framework for **collaboration and shared decision making** by stakeholders from across key sectors (Water Companies, Agriculture, Energy and Environment) together with Regulators (e.g. Environment Agency, Natural England).

· Deliver a water resource strategy to meet **unprecedented threats from growth and climate change**. The challenge is to provide reliable, affordable supplies of water from sustainable sources which are resilient to the effects of severe drought.

· To **protect and enhance the environment** beyond statutory requirements such as the Habitat Regulations and the Water Framework Directive to provide where possible a net gain in biodiversity

· Develop a strategy that supports the policy objectives of Government described in the water white paper "Water for Life"; in particular**, supporting economic growth** while simultaneously protecting the environment.

The WRE draft plan identifies the best value supply and demand options to meet the expected regional deficits for public water supply, whilst maximising benefits for other water using sectors such as power and agriculture. The regional plan supports companies WRMPs by developing a portfolio of solutions to meet the future needs of the water sector from environmental needs, growth, ensuring resilient supplies and climate change impact. It includes supply and demand options from all four water companies and determines options required under various uncertain futures which will also ensure the environment is restored and enhanced.

A common approach to use of data, modelling of regional problems and alignment of proposed solutions for companies ensures consistency between our WRMP, the regional plan and other water company plans. A number of regional low/no regret options that are consistently selected in portfolios are being progressed in WRMPs alongside individual company's options that are selected both in the regional plans and WRMPs.

In our WRMP, the Strategic Resource Option (SRO) Fens Reservoir features as a regional option that is selected in our plan to meet the licence reductions resulting from and the environmental need to achieve good ecological status and enhance designated sites and chalk rivers.

1.7.2 Strategic environmental assessment

In accordance with the strategic environmental assessment (SEA) directive[1] water companies have to consider whether the proposals within their WRMP could cause "significant environmental effects" and if so carry out an SEA to assess the potential impacts of options being considered.

This can then be used to inform the selection of WRMP schemes. The short-listed measures/options, including demand management, leakage reduction and resource development measures can be assessed against SEA criteria

[1] Directive 2001/42/EC of the European Parliament and of the Council of the European Union of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment.

and the resulting water resource management plan programme selected on the basis of a reasonable balance between cost and environmental and social impact.

An SEA must therefore be carried out at the same time as a WRMP is developed and be integrated into the development of the plan.

We decided that it was appropriate for us to carry out an SEA in conjunction with this WRMP. We undertook consultation with the environmental regulators on our approach to scoping the SEA. Our SEA and environmental assessment report and post-adoption statement are included as Appendix P and the associated annex. A summary of the SEA process and the results of the SEA are included in section 11.

1.7.3 PR24 business plan

Our WRMP has been integrated into the process of developing our business plan for the five years from 2025 to 2030, which we will submit to Ofwat in October 2023. Our plan will also contribute to the long term delivery strategy (LTDS) and has been progressed as a key workstream of the development of this.

We have carried out customer engagement to inform the WRMP as part of a wider programme of engagement covering all aspects of the business plan.

Our approach to modelling options for the WRMP has been developed to ensure that expenditure arising from WRMP drivers can be integrated with other aspects of expenditure – for example, on capital maintenance of existing assets.

1.7.4 Drought plan

The WRMP planning guidelines identify strong links with water company drought plans. Our latest draft drought plan was published for public consultation in summer 2021 and was finalised for publication in April 2022. Our WRMP has been prepared to be consistent with our latest drought plan.

We have considered potential links between our plan and Environment Agency drought plans, and identified river support schemes managed by the Environment Agency that might affect our ability to abstract water and whose operation may be restricted in a drought. There are two schemes of note – the Lodes Granta Groundwater Development Scheme and the River Rhee Groundwater Support Scheme.

The Lodes Grant scheme in particular supports a number of rivers that may be affected by our abstractions, and although licence conditions will be in effect to mitigate these impacts – and are included in our baseline deployable output (DO) – we will work closely with the Environment Agency in dry conditions to monitor the effectiveness of these measures and the river support.

The River Rhee scheme supports tributaries including sites of special scientific interest (SSSIs), all of which have been investigated in the National Environment Programme (NEP), and are complete.

Our population and property forecasts are based on the latest local authority development plans taking account of their projections for new housing needs. This is discussed in detail in section 5.

1.7.5 Local Authority plans

Our population and property forecasts are based on the latest local authority development plans taking account of their projections for new housing needs and we have worked closely with Greater Cambridge Shared Planning in our development of these.

1.7.6 River basin management plans

River basin management plans (RBMPs) include programmes of measures to comply with environmental legislation and meet the objective of improving the environment. Of particular relevance to WRMPs are the measures required to comply with the Water Framework Directive (WFD) 'no deterioration' clause. This is accounted for in the Water Industry National Environment Programme (WINEP) of obligations, which the Environment Agency compiles and provides to water companies.

All existing sources of water which are at risk of causing deterioration to the environment have the potential for the allowed abstraction volumes to be reduced and or capped. We have considered the potential impact of the uncertainty that this means for us in understanding how much water we will have available to use in the future and also the impact of our operations on the environment and have included the expected reductions in our baseline supply forecasts. This is in accordance with current Environment Agency advice and expectations.

1.7.7 Flood management plans

Our operating area covers the river catchment of the Cam and Ely Ouse and we have considered flood management measures identified by the Environment Agency and the other statutory partners such as the county council for the Anglian Cam and Ouse Catchment (including South Level) area as appropriate.

We have identified the following activities within our WRMP and have incorporated appropriate measures.

Protection in areas of flood risk: we will continue to design and install water supply infrastructure such that public water supplies are resilient against major flood events.
Flood storage and conveyance: where new infrastructure is planned in the flood plain we will agree and put in place measures to mitigate against any loss of flood storage or conveyance.
Discharges to surface water: we will continue to adhere to the appropriate environmental permitting process to ensure that all our discharges are sited appropriately so as not to increase flood risk in the receiving water body.

1.7.8 25 Year Environment Plan

In 2018 the Government published its 25 Year Environment Plan. This plan sets out government action to help the natural world regain and retain good health. The clear goals that the adoption of the plan is set to achieve are:

1. Clean air
2. Clean and plentiful water
3. Thriving plants and wildlife
4. A reduced risk of harm from environmental hazards such as flooding and drought
5. Using resources from nature more sustainably and efficiently
6. Enhanced beauty, heritage and engagement with the natural and historic environment

Cambridge Water are committed to playing their part in the delivery of these objectives, and we have ensured these goals are supported through the options developed in this plan.

1.7.9 Government Environmental Plans

1.7.9.1 The Environment Act 2021

November 2021 saw the Environment Act passed as legislation. This Act sets clear statutory targets for the recovery of the natural world in four priority areas: air quality, biodiversity, water and waste. It builds on the 25 Year Environment Plan by providing deliverables in these key areas to ensure pace of delivery.

The water demand target from the act states that the volume of potable water supplied per head of population in England should be 20% lower than that in 2019/20 by March 2038. We have included this target in our plan and section 11 covers how we propose to do this, through a range of activities to reduce leakage and household consumption.

1.7.9.2 Environmental Improvement Plan 2023

In early 2023, the Government published its Environmental Improvement Plan 2023 which looks to build on the Environment Act 2021. Goal 3 of the plan relates to clean and plentiful water, and describes a key policy to facilitate infrastructure projects, reduce leakage and increase efficiency in new developments and retrofits to promote a sustainable and resilient water supply.

The Environmental Improvement plan articulates the interim targets for achieving key sector targets, such as:

- Reduce the use of public water supply in England per head of population by 20% from the 2019 to 2020 baseline reporting figures, by 31 March 2038, with interim targets of 9% by 31 March 2027 and 14% by 31 March 2032.
- Reduce leakage by 50% by 2050, with interim targets to reduce leakage by 20% by 31 March 2027 and 30% by 31 March 2032.
- Reduce non-household water demand by 9% by 2037 and 15% by 2050.
- Restore 75% of our waterbodies to good ecological status.

Our plan achieves these targets, and we share the detail behind the demand management activities in section 9, and the actions and timescales we propose in order to achieve 75% of waterbodies to good ecological status in section 6.11.

1.7.9.3 Plan for Water

In April 2023, the Government published its “Plan for Water” which is an integrated plan for delivering clean and plentiful water. This further builds on the Environmental Improvement Plan and we have ensured our plan aligns to its aims and goals.

2. Scope of our plan

Overview

Our WRMP covers the Cambridge Water region, which operates as a single water resource zone. This means that any options we progress would impact upon the whole of the Cambridge Water area.

This plan looks to primarily ensure resilience to future climate change impacts, as well as meeting the increasing demand for water caused by a growing population.

Our key objectives for this plan are set out below:

- Deliver a sustainable and resilient supply of water for both our household and non-household customers now and in the future.
- Commit to reducing the amount of water we abstract from the environment over the lifetime of the plan in order to protect and enhance the natural and historic environment in which we operate.
- Identify the longer term uncertainties e.g. climate change, and, if required, provide adaptive pathways within the plan in order to ensure we can respond to future challenges.
- Be acceptable and affordable for our customers.

We are facing a number of challenges.

- We forecast an increase in demand driven by growing population and properties and need to make sure we have enough water to meet this demand.
- Some of our abstractions present a risk of deterioration to the environment and we need to address this through reducing and capping licences, which will drive the need for replacement resources.
- We need to further reduce existing licences in order to improve the environment and meet good ecological status, protect designated sites and chalk rivers.
- We need to become more resilient to future droughts and the impact of climate change.
- We want to go further on demand management; our regulators and customers expect and support this.

We have reviewed the challenges we face and the scale and complexity of them and our plan identifies the required measures, both supply and demand side, to address the challenges. We have identified the best value programme to deliver these measures over the planning period.

There is always uncertainty when developing long term plans, as these are built on assumptions of the scenarios which may come to pass in the future e.g. climate change, population growth. As such, we look to stress test our plan for a range of scenarios to ensure it is robust to changing situations. If there are larger areas of uncertainty, or the plan needs to be adapted in certain circumstances, we may need to consider an adaptive plan. We have reviewed our need for an adaptive plan, which would provide an alternative pathway if a future assumption were to change.

We have agreed common processes for developing our plans with the other companies in Water Resources East to ensure consistency in approach. In addition, we have sought assurance from Jacobs to ensure we have met our obligations in the Water Resource Planning Guidelines.

2.1 Challenges facing Cambridge Water

Cambridgeshire is one of the fastest growing regions in the country. It is also one of the driest. This presents us with significant challenges, including:

- substantial growth in population and properties driving demand upwards.
- environmental pressures to ensure that our abstractions do not cause deterioration to the environment, and measures to further improve the status of the environment.
- Customer expectations regarding our approach to demand management.

We have reviewed the challenges we face and the scale and complexity of them through an exercise of problem characterisation and have explored least cost and best value planning solutions. We have identified the most appropriate mix of supply and demand options going forwards.

The remainder of this WRMP is structured as follows.

- Customer views are described in detail in section 4.
- Our forecasts for baseline demand are described in section 5.
- Our problem characterisation exercise and multi-criteria approach to decision-making is described in detail in section 9.
- The environmental assessment of our plan is described in section 10.

2.1.1 Water stress

The Environment Agency developed a water stress classification methodology for water companies in 2007 for the purposes of Regulation 4 of the Water Industry (Prescribed Condition) Regulations 1999. If a water company is classified as 'water stressed' it must consider compulsory metering to balance supply and demand. If a company is not classified as water stressed it cannot impose compulsory meters on customers without seeking direct approval from Defra under separate water scarcity legislation.

The Environment Agency published an initial consultation on identifying areas of water stress in 2007 and followed this with a response in August the same year. It later updated its classifications in 2013, and again in 2021[2] following public consultation.

Each water company is classified as being not water stressed, in moderate water stress or in serious water stress. The assessments are carried out by the Environment Agency and are based on a Water Exploitation Index (WEI) linked to the status of water bodies within the area. Water stress is defined where 'the current household demand for water is a high proportion of the current effective rainfall which is available to meet that demand; or, the future household demand for water is likely to be a high proportion of the effective rainfall which is likely to be available to meet that demand'. For the previous Cambridge WRMP published in 2019, our area of supply was not classified as water stressed, however following the revised approach in 2021 the determination indicates that there may be environmental impacts caused by public water supplies, or need for further resources, which may be reduced by improved water efficiency through metering.

Water stress status can help to show where there is, or is likely to be, benefit from increased metering. It does not indicate that there will not be enough water for supplies or reflect water company performance.

Accordingly our plan has explored metering programmes, including universal metering as part of our demand management options. We have also explored customer views of universal metering in light of the challenges faces in

[2] https://www.gov.uk/government/publications/water-stressed-areas-2021-classification

the region. Together with water stress status, customer support for metering, and the demand management benefits that can be realised with smart meters, there is a strong case for universal metering.

2.1.2 Improving the environment

The National Framework for Water Resources review of public water supply in the WRE region has projected a deficit by 2050 of 580Ml/d, largely as a result of the need to abstract less water and leave more for the environment. This is to support achieving good ecological status, and provide extra protection for designated sites and chalk rivers. The need for new supplies also takes account of climate change impacts and ensuring resilience to future droughts, The framework acknowledges this is a generational challenge with considerable cost pressures.

These changes will be delivered by capping abstraction licences to prevent deterioration of the environment, and further licence reductions to meet future environmental destination scenarios, alongside increased demand management such as leakage reduction and metering programmes. It is estimated for the WRE region that licence caps for public water supply could be 136Ml/d, and environmental destination 338 Ml/d by 2050.

2.2 Performance against WRMP19

At WRMP19, we committed to various actions to reduce demand for water and increase our supply resilience. These are described in the table below, along with our performance against these commitments to date:

Table 1 WRMP19 commitments

Key elements of our plan	What we said we'd do	How have we done?
Leakage	By 2024/25, we will reduce total leakage on our network by 15% from 2019/20 levels. We will achieve this transformational reduction through a combination of pressure management, innovation and active leakage control. We will also make further leakage reductions from 2025 to 2045.	We are on track with our leakage ambition, despite challenging weather conditions experienced throughout the AMP. We have extensive plans for the remainder of AMP7 to ensure we continue to deliver our commitments. We have delivered the largest % reduction in leakage in the industry over the last three years.
Metering	We will aim to encourage an additional 500 households a year to switch to a water meter over the lifetime of our WRMP. This will give us a level of roughly 90% of customers with a water meter by 2044/45. We are looking at options for 'smart meter' devices that would help customers monitor and control how much water they use – something our customers said would be useful to them.	We are behind on our delivery of this target, predominantly due to the Covid-19 pandemic where we were unable to attend properties to fit meters. Since the pandemic, the cost-of-living crisis has significantly impacted on the number of customers wishing to switch to a meter as they fear the impact on their bills. We have a targeted plan for the last two years of the AMP to catch up this position and achieve the overall target position by 2025. This is also a key enabler for our plan to accelerate some of our household metering programme from this plan into 2024/25 through the Defra

		accelerating infrastructure investment delivery scheme. We have explored smart metering and every meter installed is now a smart meter, which we will continue to build on in AMP8 and beyond.
Water Efficiency	We will reduce the average amount of water each of our household customers use by 6% by the end of the five-year period from 2020 to 2025. We are looking at ways to incentivise developers to build more water efficient homes and estates. We have been working with the University of Cambridge on its 3,000-home Eddington development where a rainwater harvesting system sits alongside a conventional drinking water supply. This is the largest water recycling system project in the UK.	**PCC -** We have seen an increase in PCC since the Covid-19 pandemic. This is due to increased hygiene practices, more people hybrid working or working from home, and the increased value our customers have for their outside spaces since the pandemic i.e., we have seen an increase in outdoor water use. We are now seeing PCC reduce and we have employed an innovative improvement plan for the final two years of the AMP which will include household water efficiency audits, leaky loo audits and campaigns, deployment of flow-regulators and increased metering installation and reading in order to provide customers with more data and support to change behaviours.
		Developer Incentives - We have introduced a very successful developer incentive programme that has outperformed throughout AMP7. We continue to expand this and build on it, taking on board learnings from other water companies and incorporating best practice.
		Eddington – We are working closely with Defra and the Drinking Water Inspectorate to progress legislative changes that will enable this scheme, and future schemes, to be able to operate at its full potential.
Resilience	We will continue to liaise with our neighbours, Anglian Water and Affinity Water, and others involved in the WRE cross-sector group to further explore the long-term resilience of water supplies in the region.	We have worked closely with WRE and all its constituent companies to develop regional solutions to our water challenges and increase our available options. Our plan has two key collaborative options – the Fens Reservoir and the Grafham Transfer, the latter of which also links with Water Resources South East and is a prime example

		of the benefits that have been recognised through regional planning.
Sustainable Water Supply	The work to develop our WRMP has shown that, in the main, continuing to use our existing sources is the most efficient way to operate over the next 25 years. But we will manage our environmental impact by reducing the volume of groundwater we take from our sources by approximately six million litres a day where necessary to manage the risk of causing deterioration to the environment. We will invest in new treatment processes at three of our groundwater sources. This will enable them to be brought back into supply.	Our work through AMP7 has highlighted that our initial view of 6 Ml/d is much lower than that needed to prevent no deterioration in the future, and our WRMP24 plans for this higher number of nearer 30 Ml/d. We will make abstraction reductions in AMP7 as planned linked to our time limited licences. Our work to bring these groundwater sources back into supply is ongoing.

Despite the challenges we have seen since 2020 due to the Covid-19 pandemic and the drought of 2022, we have ambitious improvement plans in place to ensure we deliver our end of AMP7 target positions. Therefore, we start our planning in 2025 from this target position for all demand management areas.

2.3 Planning period

This plan covers the period 2025/26 to 2049/50. The year 2020/21 is the base year for the WRMP, with demand side reductions based on 2017/18 positions.

2.4 Water resource zone integrity definition

Our region of supply is defined as a single water resource zone (WRZ) with the risk of shortages of water being equal across the whole area of supply. The region is supplied by 26 groundwater sources which are linked by a highly integrated pipe network. Storage reservoirs are linked with large diameter mains, booster stations and remotely controlled valves to allow the transfer of water throughout our supply area.

The network comprises five supply zones – the Cambridge zone is the largest of these, in terms of both supply and demand. Sources which supply water direct into this zone provide more water than is needed there to meet demand, so the surplus water is transferred to other zones as required.

Supply zones in the north of our area do not have direct supplies and rely solely on this transfer. Other supply zones have direct input from sources and only rely on transfer from Cambridge zone at times of peak demand or outage. Some zones are highly flexible in terms of transfer options and connectivity, with a number of options to transfer water in and out, interconnectivity demonstrated by how we transfer water between zones.

We also provide a number of small bulk water supplies to our neighbouring water companies and receive a small number in return. These are small volumes supplying clusters of properties directly and are less than 1Ml/d. These are detailed in section 2.9.

We operate a Control Room that is manned 24 hours a day. The primary purpose of this is to monitor and manage the supply system on a day-to-day basis. All zonal transfer boosters and control valves can be operated remotely from the Control Room.

In a resource shortage situation, the highly interconnected supply system allows us to transfer water between service reservoirs such that supplies can be maintained to all customers through balancing the fall in all water storage reservoirs.

2.5 Planning scenarios

The Environment Agency's water resources planning guidelines detail the range of planning scenarios which a company may need to consider. In accordance with this we use the dry year annual average (DYAA) scenario for water resources planning purposes. A normal year demand forecast is developed initially and the key components of this demand which are influenced by dry weather are then adjusted to derive the DYAA demand forecast.

We have developed supply and demand forecasts for the peak week scenario since 2004. It is this scenario which influences requirements for peak treatment capacity at our works. This is particularly important as this influences decisions about future investment in these works.

The base year data for 2020/21 has been normalised and this is then used as the starting point of the demand forecasts for all planning scenarios.

We have presented a baseline forecast for each scenario and a final planning forecast for each scenario where there is a deficit in the supply demand balance to be resolved.

The WRMP does not include scenarios of very prolonged periods of high demand and reduced supply such as droughts. Droughts require additional measures and are planned for in our drought plan. There are strong links to the drought plan as described in section 6.

It should be noted that our WRMP is at the supply system overview level. Local transfer capacity difficulties as described above, for example, may still require investment. These issues are not considered within the WRMP, but where they require investment we included them in the final business plan.

2.6 Climate change

We have included an assessment of the impact of climate change on the availability of water supply in this WRMP. The best estimate for this impact is included directly in the supply forecasts and the uncertainty associated with estimating the impact is included in the assessment of headroom uncertainty.

A component for the impact of climate change on demand has been included within the household demand forecast. The uncertainty around this has been included in the headroom assessment.

We have followed the approach to assessing the impacts of climate change as set out in the Environment Agency's water resources planning guidelines.

2.7 Other licensed water undertakers in our area of supply

At the time of preparing this plan there are no licensed water undertakers who supply water through our supply system. There are a number of inset appointments – known as New appointments and variations (NAVs) or in our area of supply which provide a water service to customers in an area which was previously provided to customers by us as the incumbent provider, for which we provide bulk supplies. Details of these supplies are set out below.

Table 2 Licensed undertakers in our area

Site	NAV	Properties	Progress to date	Typical Demand Ml/year
Northstowe Phase One	Anglian Water	1500	Complete	237
Newmarket Road (Marleigh)	Independent Water Networks	1500	50% complete	215
St Neots Road, Hardwick	Independent Water Networks	175	Complete	24
Cherry Hinton North	Independent Water Networks	1500	commenced	244
Rampton Road Cottenham	Independent Water Networks	140	commenced	19
Babraham Rd Sawston	Independent Water Networks	280	commenced	38
Babraham Rd Cambridge	Independent Water Networks	230	Not started	32

2.8 Anglian Water and Affinity Water

Anglian Water borders our area of supply on the north, east and west. Affinity Water borders us on the south. We have worked with both of our neighbours as part of the preparation of this WRMP to discuss and agree a number of issues, including bulk supplies and Water Resources East (WRE) options.

For example, we have discussed the optimal use of sources in other undertaker's area of supply, and close to borders, as well as licence trading in the catchments that we operate. We will continue to explore the feasibility of trading or exchanging source ownership to enhance our operational resilience and efficiency, many of these are explicitly evaluated through WRE and the options assessment for WRMPs.

2.9 Bulk supplies

We export a number of small bulk supplies to Anglian Water and Affinity Water and receive a number of very small bulk imports across the border. We also have a number of emergency bulk supply points in case of localised operational events close to our border.

We have liaised with both Anglian Water and Affinity Water to agree planning assumptions on the scale of the imports and exports for the planning period.

Details of these bulk supplies and utilisation are presented below.

Table 3 Cambridge Water bulk supply arrangements

Name	Type	Typical utilisation Ml/d	Maximum agreed Ml/d	Comments
Barn X	Export	0.07	0.25	Within DI
Swaffham	Export	0	2.5	Emergency only
Odsey	Import	0.05	0.05	Potable import
Earith	Import	0.009	0.01	Potable import
Hadstock	Export	0.09	0.37	Potable export

2.10 Water trading and other options

During the pre-consultation stage of the development of the WRMP we have had contact with neighbouring water companies and water companies to explore opportunities for water trading in terms of being a recipient of a trade. Where we have considered options for trading of resources or licences, these are included in our unconstrained options and if appropriate the feasible list of options, as described in in section 9.

Our options appraisal has studied in detail all abstraction licence arrangements that exist in and around our areas of supply to understand how we can work with other parties (farmers, breweries and industry) to meet our differing needs while minimising environmental impact, enhancing resilience and optimising efficiency.

To further assist third party trading we publish our Water Resources Market Information (MI) in tables alongside our WRMP. We invite any interested third parties to contact us with details of proposals for supply- or demand-side schemes. We have not received any proposals through this route to date, but this channel remains open.

2.11 Retailers

Since April 2017 non-household customers have been able to switch water retailer – that is, the company which bills them and provides customer service. We have engaged with the retailers who operate within our area of supply seeking views on their plans to offer water efficiency to their customers.

While we did not receive responses from all the retailers we contacted, those that did respond suggested that they see water efficiency as a key part of their service offering. For smaller customers this may be through making advice available while larger customers may choose chargeable add-on services such as tailored water audits. The responses

indicate that, at this stage, retailers are still developing their plans and are not in the position to define a water saving target to include in our demand forecasts. We will work with retailers where appropriate to ensure consistent messages and advice can be offered and will update our demand forecasts as more detail becomes available.

We continue to work hard to build excellent relationships with our retail partners. This ambition was reflected in the positive responses we received from retailers during extensive survey and engagement work carried out in preparing this plan, and in support of the creation of retail satisfaction measures. While we strive to offer excellent customer service and engagement with retailers, water efficiency does not appear to currently be a key priority for them.

During 2022 we contacted retailers to enquire about their water efficiency initiatives with non-household customers, directly associated with the development of our WRMP. We contacted the following retailers, which account for more than 99% of market share by volume.

- Pennon Water Services.
- Water Plus.
- Anglian Water Business.
- Everflow.
- Business Stream.
- SES Business Water.
- Water 2 Business.

We received a limited response (only two updates) and these confirmed no specific retail targets within this area and that any activity would be a commercially focused additional service. This was recognised as a challenge within the water sector and, in 2017, wholesalers came together and formed the Waterwise Leadership Group for Water Efficiency and Customer Participation.

During late June 2018 retailers held their first meeting of the equivalent group – the Retailers Leadership Group for Water Efficiency. It is now expected that, as an output of this group, retailers will work up a form of public commitment to both water efficiency and to working with wholesalers to consider customer incentives and joint messaging. At this stage, however, these timelines are not clear. Within the context of water resources and water efficiency we remain open and committed to support any enquiries from retailers or directly from non-household customers.

2.12 Sensitivity analysis

When developing their WRMPs, water companies have to make assumptions affecting almost every part of the plan. Therefore, it is important to demonstrate the sensitivity of the plan to these assumptions. We have looked at sensitivity in two areas.

- The sensitivity of the supply/demand balance to data uncertainty is accounted for within the assessment of headroom, which is described in section 7.
- The sensitivity of the proposed actions in the plan to assumptions or changes in the supply/demand balance is accounted for in our best value modelling approach described in section 9.

2.13 Adaptive Planning

For WRMP24, there is the need to look at adaptive planning. An adaptive plan is a framework which allows you to consider multiple preferred programmes or options. The adaptive plan should set out how you will make decisions within this framework.

You can consider an adaptive plan if you have:

- Significant uncertainty, particularly in the first 5 years of your plan;
- A strategic decision in the plan's medium term, which has a long lead-in time;
- Large long-term uncertainty which might lead you to consider different preferred options.

We have considered the need for an adaptive plan and we describe this in more detail in section 11.8.

2.14 Governance and assurance of the plan

Cambridge Water is a core member of Water Resources East (WRE) and many of our decision around the approach to key elements of our planning have been agreed through workstreams within Water Resources East. This includes the approach taken to elements such as climate change modelling, environmental destination and growth projections.

In WRE, each workstream has a lead from one of the core water companies within the core delivery group. Key decisions regarding standardising the approach to certain variables are agreed in these workstream sessions with the workstream leads. Every month, a WRE Board meeting is held, with Director level representation all Board companies. All key decision areas are passed to this group to discuss and agree, to ensure that there is consistency across the companies and hence the region, and that there has been appropriate sign off within each organisation. The Board member is not the same individual that sits on the workstream delivery group in order to ensure there is an appropriate level of governance through the process. The Board are also responsible for the formal sign off of the regional plan, following individual company Board approval.

Within Cambridge Water we have a similar approach. The core delivery team, who are also involved in WRE, develop the plan with overview from the Head of Water Strategy. Monthly review meetings were held with the Director of Strategy & Regulation and the Managing Director – these sessions provided progress updates, key decision areas and alignment with Water Resources East.

Every month, a written update has been provided to both the Exec team and the Board of the company to share the progress, current overview of the plan and a forward look of activities and timelines. In addition, Board sessions were held at key intervals to ensure Board members were fully versed in the current position and to seek approval for key areas of the plan. These sessions and the specifics are detailed below:

- February 2021 – share recent classification as area of serious water stress and implications for WRMP24 i.e. review of compulsory metering.
- March 2021 – initial view of WRMP and changes since WRMP19, including initial overview of potential challenges.
- April 2022 – share details on sustainability abstraction reductions and scale of environmental destination for inclusion in plan. Seek approval for environmental destination scenario to be included in plan, aligned with WRW companies.
- May 2022 – provide overview of supply demand balance. Share supply side options and prioiritiation of these through best value planning.
- July 2022 – share demand management options and impact on supply side options required, including detailing trade offs, costs and envirionmental impacts. Seek approval for planned demand management strategy.
- September 2022 – share final overview of draft WRMP and seek approval for submission and signature of Board assurance statement.

- April 2023 – overview of ongoing work and initial consultation feedback.
- September 2023 – share overview of revised draft WRMP and seek approval for submission.

Cambridge Water has also maintained its independent customer challenge panel, and we have shared our plan with this group. In particular, we have regularly kept the group up to date with our customer engagement work and they have robustly challenged this throughout the process to ensure we have a thorough and meaningful enaggement piece. We have recorded our challenge log and submitted it as appendix B13 with the plan which details all of the challenges the customer panel have raised and the actions we have taken as a result. We have also submitted a statement from the Panel as appendix B14 which provides their independent overview of our approach to the WRMP and particularly the customer research element of this. This independent overview, focused on the customer voice, has ensured we can demonstrate that we have undertaken robust and meaningful customer engagement.

In addition, we have held progress updates with the Environment Agency, Ofwat and CCWater as we have developed the plan. These sessions have allowed us to share the progress of the plan and the proposed direction, as well as receive feedback to ensure compliance with the guideliness and expectations of our regulators.

We have employed the services of consultants Jacobs to carry out an independent assurance review of our draft WRMP. Jacobs' staff reviewed key aspects of the plan and the overall proposals. A report was produced following the audits and presented to our Board of Directors.

The audit report identified a small number of areas where further explanation or amendments could be considered. These were generally of a minor nature and presented no material impact to the overall supply/demand balance. We reviewed these areas and made amendments where appropriate. The audit report concluded that the draft WRMP meets the legal requirements, demonstrates a secure supply of water and complies with the Environment Agency's water resources planning guidelines. During September 2022 our Board of Directors reviewed and endorsed draft WRMP. We published this statement alongside our draft WRMP24 documents.

Following the conclusion of our draft plan consultation period, we have held sessions with the Environment Agency, Ofwat, Historic England, Natural England and Cam Valley Forum to discuss the feedback in more detail and ensure our understanding as well as sharing our proposed approach to feedback and likely outcomes. In September 2023 our Board reviewed and endorsed our revised draft WRMP and gave approval for submission.

3. Our WRMP in the wider context

Overview

The environment

We have considered the impact of our operations on the natural and historic environment and have included reductions in the amount of water we can take from those sources that are considered by the Environment Agency to present a risk of deterioration to the environment. Restricting our licences to address this risk will introduce an immediate deficit. There are significant challenges to meet the needs of the environment and growth in our area, which will drive large deficits in the supply demand balance. We have addressed these in our plan with supply side options and an extensive demand management programme.

Demand management

Government and regulators' policy is clear that water companies must be more ambitious with demand management. Customers echo this view. Ambitious demand management is at the core of our plans to meet the growth needs in our area and reduce the impact on the environment.

Our proposed programme includes:

- A 50% reduction in leakage by 2050, and triple the of the rate of leakage reduction in AMP8
- Per capita consumption (PCC) of 110 litres per person by 2050
- Reductions in non-household consumption of 9% by 2037
- Rollout of universal SMART metering between 2025-2035

Supply side options

We have evaluated a comprehensive number of supply side options and propose a number of significant investments to meet the deficits in supply due to environmental need. These include:

- Imports from Anglian Water
- Re-use and storage from water recycling works
- A partnership with Anglian Water to develop Fens Reservoir, a regional winter storage reservoir

Drought resilience

Our proposals will assist with our resilience to more extreme drought events in the long-term. Once all of our planned options are in place and before 2040, we will be resilient to a 1 in 500 drought event.

Options

We have considered all available options to balance supply and demand, both those at a regional scale and those that can be provided by third parties.

Innovation & partnership working

We continue to explore new and innovative approaches to water resources planning, such as working with developers to re-use and recycle water and make new dwellings highly water efficient. We have invested in satellite technology for detecting leaks and continue to work collaboratively to identify multi-sector and cross-border solutions and catchment approaches to improve raw water quality. As a key member of Water resources East, we work with other companies and sectors to identify long term solutions and are developing a strategic

resource option through RAPID[3] with Anglian Water. Working closely with local councils and other local stakeholders is also a key part of informing our plans.

3.1 Links to other policies and programmes

This WRMP is set within the context of some significant challenges and changes which have taken place in the water sector over the past five years. The table below summarises the key aspects of the framework within which we have developed our WRMP.

Table 4 Context for the WRMP

Statement or document	Owner	Key points of relevance for WRMP	Publication date
Water Industry Strategic Environmental Requirements (WISER) setting out statutory and on-statutory expectations for PR24	Environment Agency and Natural England	Regulators expect: • excellent environmental performance • enhancement of the environment • improving resilience …through innovation, understanding environmental valuation and partnership working. A range of statutory requirements are included.	May 2022
Final water resources planning guidelines specifying approach to WRMPs	Environment Agency	What to include in WRMPs and approach to take? Changes since the 2019 water resources management plan (WRMP19) include environmental destination, classification as water stressed area, increasing drought resilience to 1 in 500, and regional planning requirement.	February 2022
PR24 methodology	Ofwat	Specific water resources guidance: • Use of common reference scenarios to test plans • Adaptive planning should be applied if meets required criteria • Forecasts of supply/demand balance and capacity (as defined by water resources yield) are to be submitted with business plans (assumptions and outcome to be consistent with WRMP); • Costs in the WRMP should be reflected directly in PR24 submission.	Draft July 20122
25 Year Environment Plan and Environment Act targets **Environmental Improvement Plan**	Government	All provide direction and targets relating to water resources and biodiversity. Specific targets: • 50% leakage reduction by 2050, including interim targets. • 110 l/p/d by 2050, including interim targets. • 20% reducing to DI per capita by 2038. • 9% non-household consumption reduction by 2038, 15% by 2050.	2018, 2021 and 2023

[3] RAPID is the Regulatory Alliance for the Progression of Infrastructure Development, and is made up of our main regulators to support the funding and development of large regional resource schemes

Plan for Water			
Other plans and dependencies	Public Interest Commitments	**Water Industry:** commitments have been made across the industry relating to demand management. These are 50% reduction in leakage levels from 17/18 baseline by 2050 and achieving 110 l/h/d PCC by 2050.	Ongoing
	WRE	**Water Resources East (WRE):** collaborative project looking at strategic regional multi-sector solutions for water resources in the long-term.	Ongoing
	Customers	**Customer research**: both company and wider industry research shows customers want more leakage reduction, more help to save water, are generally in favour of metering and support current levels of service.	Ongoing

3.2 Customer expectations

We have carried out extensive customer research as part of our preparations for the PR24 business plan and our WRMP. We have triangulated the available research to develop a rounded view of customer expectations. This is described in detail in section 4 of this plan and the associated appendices. We have developed our WRMP to take account of customer views.

3.3 How we have incorporated these policies and programmes

3.3.1 Government Environmental Plans

The new Environment Act came into force in 2021, and this was followed in December 2022 by confirmation of the associated targets. This has been built on further by the release of the Government's Environmental Improvement Plan 2023 and the Plan for Water. Several of the goals and targets in these directly relate to the water industry and we have ensured that our plan meets the following targets stipulated within these:

- a 50% reduction in leakage by 2049/50, with interim targets in 2027, 2032 and 2038.
- a commitment to reduce PCC to 110l/p/d by the end of 2049/50, with an interim target of 122 l/p/d by 2038.
- a reduction in distribution input (DI) per capita by 20% by 2038, with interim targets in 2027, 2032 and 2038.
- a reduction in non-household consumption by 9% by 2038 and 15% by 2050.
- 75% of waterbodies to achieve good ecological status.

Government and regulators' policy is clear that water companies must challenge themselves more and be more ambitious with demand management. Customers echo this view. We have taken this on board and have set out ambitious plans to reduce demand. In order to achieve the above, we have also committed to the installation of universal smart metering across our region by 2035.

Smart metering underpins our ability deliver ambitious demand management savings. The information that frequent meter reads provides to us and our customers can help provide targeted support and actions. It will improve our ability to identify customer supply side leakage, as well as on our network, and we will then develop a programme to support customers with repairs. Metering also enables innovative options, such as the introduction of green tariffs to encourage customers to reduce their usage. These are options we will continue to work with our regulators and customers on to further develop in AMP8 and we will be undertaking a trial of innovative tariffs in 2025.

We will be building on our AMP7 engagement with developers to incentivise them to build more water efficient homes and estates. We have seen strong take up of our scheme by Developers in AMP7 and we propose to continue to develop this scheme to ensure we can increase our reach in this area and drive further reductions through support to schemes such as water neutrality and grey/rainwater reuse systems.

Our plan details the activities will we undertake to achieve the reductions required in the targets. However, we will continue to review the most effective options as new information and opportunities arise.

3.3.2 Environmental protection

We have considered the impact of our operations on the environment and discussed in detail abstraction reductions with the Environment Agency related to the Water Framework Directive, and no deterioration, as well as further environmental improvements to bring water bodies to good status. We have included reductions in the volume of water we can take from those sources included in the WINEP as at risk of causing a deterioration of the environment, and additional reductions for a future Environmental Destination to improve all water bodies. These are included over different timescales in the planning period, as we refine the certainty around the scale of reductions. The potential reductions to licences and abstractions are significant, and this has reduced our baseline available water (distribution output, or DO). The need to replace this reduction is driving the need for resource options.

We have applied least cost economic balancing of Supply and Demand (EBSD) and Best Value modelling (ValueStream) of options to review our whole portfolio of options to identify whether there are alternative sources or options to balance supply and demand and reduce natural and historic environmental impact.

Defra, Natural England, the Environment Agency and water companies have identified the transfer of raw water as a potential pathway for the spread of Invasive Non-Native Species (INNS), as noted in WISER. As part of our plan, we have considered how our current and future operations may cause the spread of INNS. We have liaised with the Environment Agency to identify raw water transfers that present a risk and have assessed these in our AMP7 WINEP investigations. We have also assessed the risk associated with the spread of INNS for all new options within the plan and ensured that risks are fully mitigated when considering scheme details and costs.

It is also essential to consider impacts to the historic environment and the significance of heritage assets and their setting.

3.3.3 Options

We have considered a wide range of options to balance supply and demand, including those that can be provided by third parties. Our unconstrained list and preferred options are detailed in the WRMP tables and in Appendices M and N and we discuss these in detail in section 9 of this plan.

We continue to identify and progress any further options for trading or provision of alternative supply and demand management options during and after the public consultation for our WRMP.

3.3.4 Resilience and droughts

The national water resources planning framework reviewed the possible effects of climate change, population growth, environmental protection measures and trends in water use and found that in some scenarios we are facing longer, more frequent, more acute droughts.

Our proposals for leakage reduction, metering and engagement with developers for more water efficient properties will assist with our resilience to these events.

Our assessment of drought resilience throughout the planning period shows our supplies are resilient for a range of droughts across the 25-year planning period – including those more severe, or less frequent than our design

droughts. We have revised our drought assessments since WRMP19 to make use of revised datasets and gone beyond assessment of 1 in 200 droughts to 1 in 500 for increased future resilience.

We are not putting forward any new drought management options in addition to those currently in our existing drought plan.

3.3.5 Innovation

Our ambitious demand management plans are based on developing new and innovative approaches. Through AMP7 and 8, we are delivering our "smart network" programme which will provide more live data cross our network to enable more efficient and timely delivery of our leakage and water efficiency programmes, as well as our day-to-day service offering to customers.

Our Cambridge Water region currently has metering penetration of around 73%. We intend to strive for universal metering by 2035. This will enable us to deliver further innovation in our water efficiency and leakage reduction work. One key example is around tariffs. Cambridge Water is working with customers to develop the basis of a green tariff structure that would incentivise customers to use less water. We have also tested the principle of community-based tariffs, where benefits for the local community could be delivered as an incentive. We will continue our engagement with customers and our regulators on the future of tariffs throughout AMP8 and beyond.

We have also been successful in our lead bid in the Ofwat Innovation Fund for our project which looks at understand the use of water in faith communities to help us understand how to better work with these communities to deliver water savings.

3.3.6 Partnerships and collaboration

On a local scale we are actively engaging with the agricultural sector, working with farmers and landowners to educate and encourage appropriate use of chemicals in catchments that provide public water supplies. We started this work in 2015, focusing on priority catchments where we had identified the most potential benefit. We have been expanding this work in AMP7 and engaging with a wider set of farmers. For AMP8, we are planning to expand this work further by moving into new catchments and working to address a wider range of pollutants and determinants. We will also be widening the remit to include Chalk Rivers and further measures in our PR24 WINEP for river restoration.

We continue to work with local groups to deliver on the ground water environment improvements as well as with catchment groups in the Cam Ely Ouse, and other water users and the environmental sector through water resources east. Cross-boundary, regional and multi-sector partnerships will be needed to maintain water supplies and minimise our impact on the environment in the long-term.

We will also work with Anglian Water to determine the long-term abstraction reductions needs through the Environmental Destination investigations we will undertake in our AMP8 WINEP programme. By collaborating on this, we can ensure we provide a whole catchment approach which will deliver the best outcome and will make the process more efficient and cost effective.

We are also working closely with Anglian Water and Water Resources East through the development of several of our supply side options, most notably the Grafham Transfer and Fens Reservoir. For the Grafham Transfer we are also working with Water Resources South East and Affinity Water, as well as Water Resources West and Severn Trent Water as the proposed transfer is dependent upon strategic resource options (SRO) being developed by these companies. This inter-regional planning has been fundamental in the development of options to solve the water resource challenge in the Cambridge area, as well as others, and we will continue working closely with all parties as we continue to progress our work on these options.

We are co-promoters of the Fens Reservoir scheme with Anglian Water on a 50:50 basis; this means we will receive 50% of the water from the reservoir and are responsible for 50% of the cost. We are not developing the reservoir in isolation however. We have initiated a working group of key stakeholders called the Fens Water Partnership. This group meets monthly and have been consulted throughout the development in AMP7 and been fundamental in inputting their experience and knowledge to elements such as site selection, multi-sector benefits and local considerations. We have also undertaken public consultation and continue to work with local stakeholders, landowners and members of the public as we continue our progression of the scheme.

We will continue to work collaboratively wherever appropriate. As the Environment Agency develops its next iteration of the National Framework, we expect the role of regional planning groups to expand, and we are committed to our role in this.

4. Customer engagement

Overview

To ensure our customers' and stakeholders' preferences sit at the heart of our plans, we have undertaken a robust engagement programme. This programme commenced in 2020 following the conclusion of the WRMP19 and PR19 business planning process.

Between WRMP14 and WRMP19 we delivered a cultural shift in our approach to engagement that was driven from our executive team's view that the customer voice should drive all the key decisions we make, now and in the future. Our engagement at WRMP24 goes further to allow us to gain a more robust set of preferences from a wider number of customers and other key stakeholders, than at WRMP19. We have also used new techniques to engage with customers to ensure we have detailed evidence to support our plans given the importance of the plan, with a marked shift towards on-going deliberative conversations over an extended period. This shift in approach has proved valuable and timely, particularly given the impacts caused by the COVID pandemic when conducting research. A comparison of the step change undertaken from WRMP14 to WRMP24 is detailed below.

Given the wide number of strategic water resource challenges the East of England region faces, we have also pro-actively engaged with other water companies to undertake a range of collaborative research studies to share resources, research costs and expertise and to ensure a consistent approach to the research. This engagement has complemented, without duplicating, our local engagement to deliver the most comprehensive programme we have ever undertaken to support our WRMP.

Our plans are based on a wide range of engagement activities that we have carried out in preparation to support our business plan submission. Below we have provided a summary of our engagement journey that has helped to significantly improve our understanding of our customer and stakeholder preferences. This is broken down into 3 key stages. Appendix B1 contains supporting material for each of these stages.

4.1 Laying the foundations and designing the engagement programme

During 2020 and into 2021, we ran a series of online activities on our H2Online Community to engage our 300+ members in discussing WRMP priority areas. The aim was to draw out key preferences and uncover themes to help shape our WRMP24 customer engagement programme. Although the Community feedback is mainly from a set of more engaged, informed group of household customers who are not fully representative of the wider customer base, our Community also has a group of less engaged and informed members who also take part less frequently in activities over time. As such, the feedback provides a robust cross-section of views across key demographics, including metering status, which is valuable for helping to inform wider research programmes and to understand the reasons behind customers' preferences. The activities covered a wider range of topics, including:

- leakage performance expectations
- metering preferences and reactions to trials to increase meter up-take
- views on messaging approaches and initiatives to encourage water saving behaviours given the impacts of COVID pandemic and more recently increases in the cost of living (including taking part in water dairy videos)
- reactions to support mechanisms to protect financially and PSR vulnerable customers in the context of changes to policies, such as universal metering
- Preferences for water recycling options and views on regional water resources planning approach.

The insights gained from these activities during 2020 were then taken into a comprehensive, independent desk research review undertaken by one of our preferred supply chain partnerships, Accent and PJM Economics. This review was conducted between November 2020 and February 2021, following several workshops to scope a brief for the review. The core objective for the WRMP24 customer research programme is to be able to demonstrably and transparently obtain and utilise customer insight to produce a WRMP that genuinely reflects customer and wider stakeholder preferences. Given this, the main objective of this study was to conduct a detailed review of customer engagement in the water industry in the context of water resources management planning, and the latest guidance, expectations, and regional method statements, with the aim of drawing out recommendations for SSC's WRMP24 customer engagement programme. The review materials were grouped thematically as follows:

- Our own customer engagement research (past and on-going)
- Research conducted by other UK water companies for WRMP19. The review focused on those companies that received for their research a rating of A or B by Ofwat
- Reviews of wider industry PR19 customer engagement by Ofwat and CCWater
- Key industry publications pertinent to PR24/WRMP24 requirements. These included publications by CCWater, the EA, UKWIR and Ofwat, including the Water Resources Planning Guidance.
- Relevant available publications on engagement strategies used by Water Resources West (WRW), Water Resources East (WRE) and Water Resources South East (WRSE) to engage with customers and stakeholders around resilience, environment, demand-side levers and supply-side solutions.

The outputs of the desk review report recommended that we implement a customer research programme organised around four main themes, corresponding to key customer input points during the WRMP development. These are illustrated in the figure below. See Appendix B2 for the full report.

Figure 2 Customer research reported themes

In addition to the four themes of the programme, we have also commissioned Impact Research to undertake a thematic review of all the insights to provide a robust evidence base to support our key policy decisions. See Appendix B3.

4.2 Implementing the engagement programme

To ensure consistency when implementing the WRMP24 engagement programme, we have also considered our wider PR24 approach. From our review of WRMP19/PR19 of the desk research we developed a series of high-level principles to guide our WRMP24 engagement programme. These principles have been applied consistently throughout our engagement programme to ensure we achieved robust, high-quality research outputs which can be used to support the decisions made in our WRMP24.

- Targeted and meaningful
- Robust but proportions
- Inclusive
- Adaptive/flexible
- Customer friendly
- Transparent
- Collaborative
- Ethical.

Central to the design of our programme was recognition that there is value in applying both qualitative and quantitative methodologies to exploring customer views in key areas. Qualitative research gives depth to the understanding of preferences and motivations behind these and enables richer discussions of topics, while quantitative research can help extract insights based on representative, but less informed samples. To maximise the value of the programme, we elected, where appropriate, to use the same key questions in both the qualitative and the quantitative research. This has allowed us to review the findings from both methods used to be interpreted jointly rather than separately. We explain the qualitative and quantitative in more detail below.

4.2.1 Qualitative customer engagement

The core of our local customer engagement programme is our WRAP Forum. This was carefully recruited in July 2021 to ensure it represented as many consumer voices as possible on an online Forum. At its heart, the WRAP is a group of household and business customers (and future customers) who are convened (multiple times) to feed into an organisation's thinking on their priorities, business plans, service or policy developments or strategic direction. This allows for a continuous, ongoing two-way dialogue with gradually more informed customers. This engenders trust on both sides and allows consumers to input into complex issues and ongoing debates within organisations.

This approach has given us a clear steer on consumers' views and priorities as well as offering a compelling narrative about the journey that participants went on throughout the WRAP process, both individually and collectively. It also allowed us to check back in with the Forum through the programme to ask them follow up questions and also share with them what other members of the Forum had said so that preferences could be further discussed.

When evaluating the insights from the Forum we have taken into account that those who participated in the Forum 'opted in' to the process, so it could be that those who did are different in some way than other customers / citizens. We have also considered that they become progressively more informed about the challenges we face and the detail of the demand and supply options available. This is a key reason why alongside the Forum we have run large scale, representative quantitative studies so that we can compare differences in responses and the potential reasons for these.

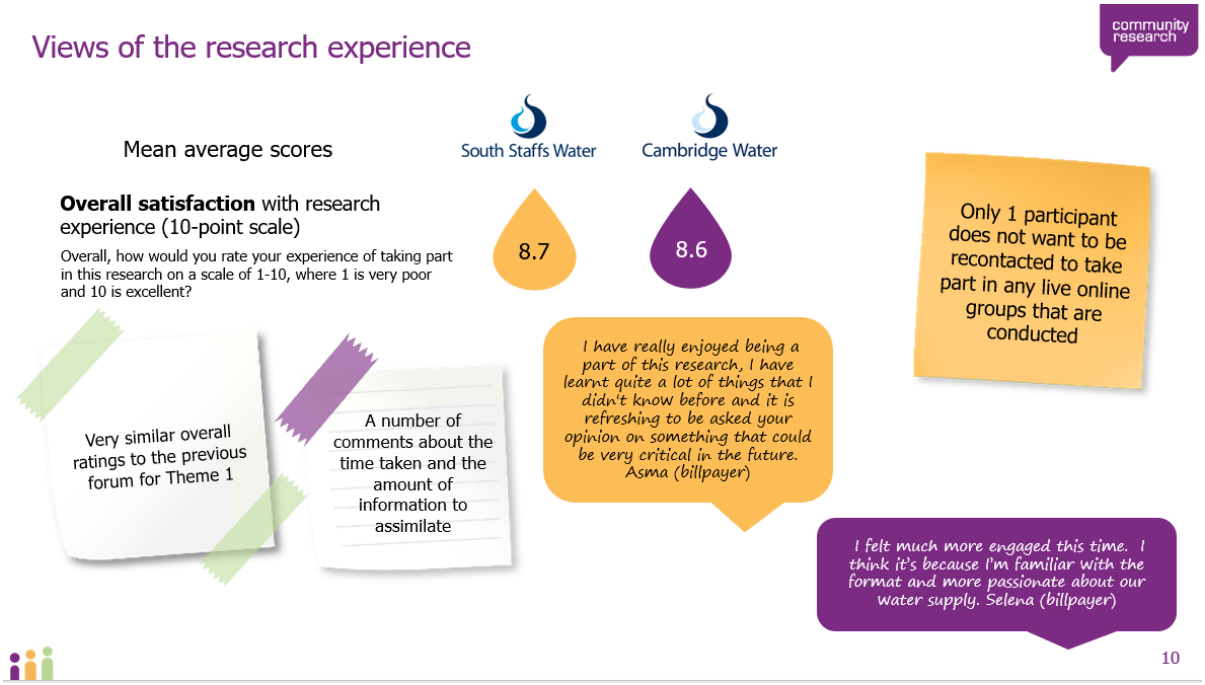
The engagement points in the WRAP Forum are detailed in Table 5 with references to supporting appendices, which detail all the insights gained. The project methodology statements are also provided as evidence of the approach taken.

Table 5 Engagement points with our WRAP Forum

WRAP Forum engagement	Supporting evidence
Theme 1: strategic choices, facilitated 2 week online Forum, July 2021	Appendix B4 (final report) Appendix B5 (methodology statement)
Theme 3: deep dives, facilitated 1 week online Forum, October 2021	Appendix B6 (final report)
Theme 3: deep dives follow ups, facilitated Zoom discussion group, February 2022	Appendix B7 (final report)
Theme 4: acceptability / affordability testing	We are planning to engage with our Forum again to discuss their thoughts on our final WRMP24 in 2023.

By taking a broadly representative group of consumers along a deliberative engagement path over an extended period, it increases their understanding and allows them to have a voice within our business. Views from the WRAP Forum members who took part in the engagement activity in October 2021 is shown below and highlights the positive feedback received in the end of Forum survey undertaken on their experiences of taking part.

Figure 3 Customer research reported themes



Source: Community Research Deep Dives final report, October 2021

In addition to the WRAP Forum, we have also engaged extensively with our H2Online Community members since 2020 to help shape our plan. Our Community is independently managed by Explain Research and all members are household bill payers. We will engage our Community again to show them our WRMP24 final plan in 2023 to close the loop through our "You Said, We Did" feedback approach, which will also explain the reasons for any changes made between draft and final plans that will impact them as customers.

4.2.1 Quantitative customer engagement

Our quantitative studies were carefully designed to follow the first two WRAP Forums and Accent, with input from Community Research, designed the stimulus materials for the studies and delivered the fieldwork and reporting. This enabled us to develop materials that would work in a 20 minute online survey which, where appropriate and feasible, would allow us to inform customers and ask them the same questions to compare the insights to those gained from the WRAP.

The two quantitative studies are detailed in Table 5 with references to supporting appendices, which detail all the insights gained and the methodology statement, which covers both studies.

Both studies achieved a robust sample across demographics which was then weighted to the 2011 Census data. Additional care was taken to conduct on-street-interviews and/or depth interviews with digitally disadvantaged and other customer segments who would not engage with the online survey. In both studies, 40% of customers were identified as being in a vulnerable situation which is consistent with other quantitative studies that we have run over the last two years. This provides evidence that we captured the preferences of customers who are more likely to be impacted by the decisions in our WRMP24, particularly those who are struggling to pay their water bills and/or those who have a medical condition that means they have a reliance on a reliable and safe water supply. As in all our major quantitative studies a sample of future customers (non-bill payers, aged 18-25) was also included.

Table 6 Engagement points with our WRAP Forum

WRAP Forum engagement – run by Accent	Supporting evidence
Theme 1 and 3: strategic choices and deep dives Quantitative online and face-to-face survey, Feb-Mar 2022.	Appendix B9 (final report)
Theme 2: wights and metrics Quantitative online and face-to-face survey, Dec 2021 to Mar 2022	Appendix B10 (final report)
Methodology statement – covering both studies	Appendix B11

There are two main quantitative studies that will be completed to inform our final WRMP24 submission in 2023. These involve:

- Working with our partners Turquoise to run a representative quantitative study in early 2023 to robustly acceptability and affordability test the final WRMP24 investments and associated bill impacts
- Delivering our PR24 Willingness to Pay Study is due to complete in November 2022 and will provide us with normalised WTP figures (per year) among our Cambridge Water customers (HH and NHH). Within this study there are service attributes directly applicable to WRMP investment decision making, including:
    - TUBS/NEUBs service levels
    - Leakage levels
    - Environmental protection – area of land managed
    - Number of properties with AMR meters.

4.2.2 Thematic reviews of insights

Impact's PR24 Thematic analysis report summarises the combined insights from a review of almost 40 pieces of evidence including research reports, literature reviews and white papers from local engagement programme and collaborative studies, other water companies and relevant third parties. See Appendix B3.

We have committed to the over-arching recommendations of the triangulation framework put forward by SIA/CCWater's extensive review of water companies' PR19 triangulation approaches and we have worked closely with Impact to develop a best practice approach we strongly believe is suitable for a thematic analysis to support our plan development. The analysis and report are structured under the following headings shown in Table 7.

Table 7 WRMP24 thematic review areas

WRMP24 key areas – thematic reviews	Specific areas of focus
Best Value Planning and investment priorities	
Environmental destination	
Service level and resilience to drought	
Balancing demand and supply side options	
Demand side options	• Leakage • Water recycling • Behaviour change and PCC • Metering – including smart technology • Supporting low-income and priority households
Source preferences, reservoirs and water transfers	Including associated water quality impacts
Acceptability and affordability of WRMP24 plan	

Alongside the Thematic report, an Excel Spreadsheet serves as the key data collation tool. The tool has one sheet per topic area and common columns to each, comprised of critical information about the data source including date of data collection, contextual environment, sample size, objectives of study, applicable region and method of data collection. See Appendix B12.

We are using the report to inform and guide the development of our final WRMP24 plans. The report will be updated in 2023 in light of further evidence from our customer engagement programme, including final plan acceptability and affordability testing, business as usual engagement, PR24 willingness to pay study, and feedback from wider stakeholders such as Ofwat over the next year.

Table 8 highlights how we have drawn on the expertise of our research supply chain to deliver our engagement programme.

Table 8 SSC's preferred supply chain partners

Workstream	Supply chain partner
WRAP Forum - qualitative research	Community Research
Theme 2 quantitative study	Accent (research elements) in partnership with PJM Economics (economic modelling)
Themes 1 and 3 quantitative study	Accent
Theme 4 – acceptability / affordability, quantitative testing	Turquoise – to deliver this element ahead of final plan submission

Theme 4 – acceptability / affordability, qualitative testing on H2Online Community	Explain Research
Thematic reviews – triangulation	Impact Research

4.3 Assuring the engagement programme

We have taken robust steps to ensure our customers, stakeholders and regulators can have confidence that our engagement is high-quality and so can be relied upon when making policy and investment decisions in our WRMP24. The steps we have taken are outlined in Table 9.

Table 9 Our assurance review process

Assurance review	Evidence
We have engaged with our customer panel, which formed a champions group of experts in 2021 to challenge and input into all stages of our WRMP24 engagement programme. This covered activities such as reviewing discussion guides, questionnaires, attending presentation de-briefs and commenting on research reports. A log detailing all the specific challenges raised and our response to these was kept and we have provided this as evidence of the level of challenge undertaken by our panel on behalf of our customers. A statement from the Chair of the WRMP24 champions group is found below.	Appendix B13
We have commissioned the consultancy Jacobs to undertake a review of the outputs of our engagement programme. The objective was to provide assurance in how we have demonstrated the evidence from stakeholder and customer engagement in its WRMP24 in the Cambridge Water supply region. This includes any justifications of why we may have chosen not to use customer or stakeholder engagement feedback in the WRMP24. Jacobs's independent report is provided as evidence of this assurance and that we have accurately reflected our customer and stakeholder preferences in our draft plan. We have taken on board their recommendations in our draft plan.	Appendix B14
We have engaged our executive team and our board with the insights from our engagement programme.	Board Assurance Statement

4.3.1 Customer Panel Statement

The statement for customer assurance can be found in Appendix B16.

4.4 Overview of customer and stakeholder engagement findings

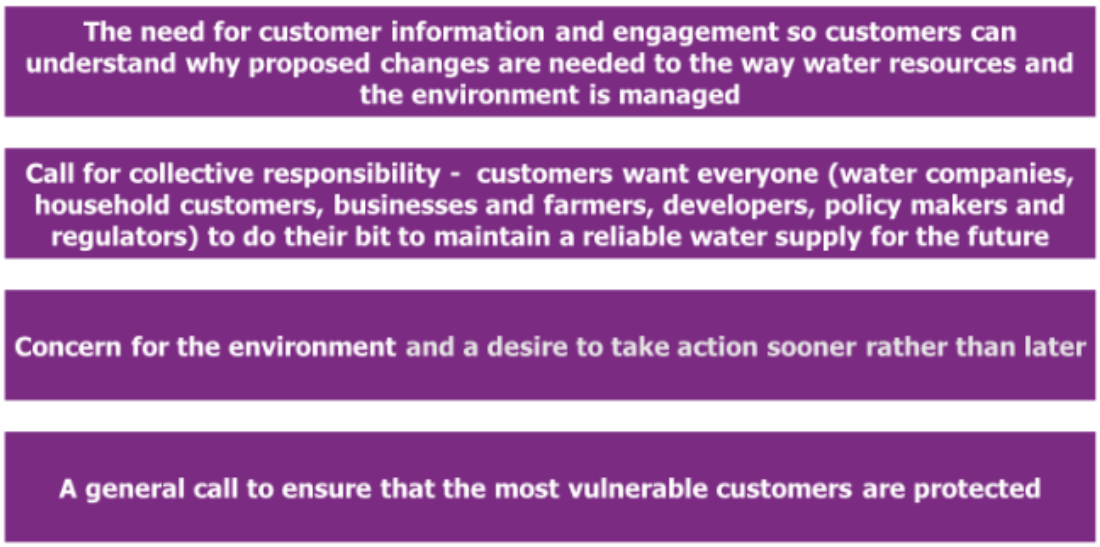
Our engagement programme has identified four 'golden threads' that are driving our customers' and stakeholders' preferences. Whilst customer segments and stakeholders may attach different levels of importance to these four threads in their individual responses, these are commonly observed across all customer household and business demographics and stakeholder representatives.

The threads were first uncovered from the Theme 1 strategic decisions WRAP Forum (July 2021) through the detailed comments that the participants left as they engaged with activities over the 2-week Forum. However, it is important to note that:

- The calls for collective responsibility and fairness in decision making and the need for customer engagement to inform people of why decisions have been made, what they need to and what support is available to help them play their part have remained consistent throughout the last 15 months, no matter what the external context.
- Protection for the vulnerable has remained an important thread that customers and stakeholders expect us to deliver on, but since 2022 increasing numbers of customers have started to turn their gaze more towards the impacts that the cost-of-living increases are having on their own household's financial situation.
- The qualitative evidence suggests that "concern for the environment" started to move for a notable number of customers from being an urgent short-term priority to address quickly in 2021, towards a longer-term priority to deliver on in 2022. This was driven by the rises in the cost-of-living increases impacting on a proportion of peoples' preferences and their willingness to support the company to go further and faster to protect the water environment in the short-term.

These 'golden threads' have underpinned the policy and investment decisions that we have made in our WRMP24. These threads are outlined in the diagram below.

Figure 4 Key customer engagement points



Our engagement since February 2022 has highlighted that the "increases in the cost-of-living" is now becoming an established 'golden thread' that must be considered further in our final plan and through the results of our on-going acceptability and affordability research studies of how our plan is being received by customers. We will also use our H2Online Communities and the Customer Priorities Tracker, detailed in Impact's Thematic Analysis, to monitor the impact of the increases in the cost of living on customers' preferences and priorities.

Impact's WRMP24 Thematic analysis report provides a detailed review of all the relevant insights we have drawn on (see Appendix B3). We have summarised the key points in the table below and our responses in our plan to these.

Table 10 Customer and stakeholder priorities and our subsequent plans

WRMP theme	What customers and other stakeholders told us	Our plans to meet expectations
Investment priorities	The top priorities have remained consistent across WRMP and broader customer priorities research studies since those identified for WRMP19:	We believe our plan delivers on these core priorities and provides the best balance between investments to

	• high-quality and reliable water supply • fair, accurate and affordable bills • reducing leakage on pipes • protecting natural environment – habitats, water sources • great customer service • helping those customers who may need extra support – both through financial and other targeted support Future top priorities that customers expect us to deliver, include: • giving consumers more control of their water usage (e.g. smart metering) and providing education on how to use water responsibly, particularly true for younger generations (16-25) • planning for population growth and managing the impact of climate change • ensuring affordability of bills vs ensuring long-term resilience of assets to meet future demand • meeting the challenge of rising energy costs by lowering our carbon footprint; and • investing in innovation to drive improvements in operational and customer services offered. Our qualitative research with our WRAP Forum in July 2021 found that customers are generally happy to pay for investments that will benefit future generations. They recognised that they already benefit from contributions paid for by previous generations for the benefit of all. Making sure the environment is fit for future generations is the responsible thing to do, not least because current customers have contributed to the problems. In our 2022 quantitative studies, customers overall had an even balance between keeping bills as low as possible for customers and making investments in long-term infrastructure and looking after the water environment. When tested qualitatively, the majority of customers continue to express a preference to have a smooth increase in their water bills over time, rather than being front or back loaded so that it can vary over time.	protect water supplies and the environment and ensure water bills are affordable for customers We will test the acceptability and affordability of our final plan robustly in 2023 to validate our plans with customers and take appropriate action to protect those customer segments who do not find their bills affordable.
Best value planning	Across all our engagement, the top three priorities for best value planning identified are; affordable water bills over the long term, making 'the most from what we have' (reducing leakage, encouraging customers to use less) and a plan that is adaptable in case of new/emerging conditions'. Options selected should meet, at minimum, three criteria to be considered "best value"; financially viable, low carbon; and effective in the long term. Options that appear short term stop gaps and/or poor environmentally, were largely rejected (including use of drought permits and water transfers).	Our plan offers a demand side set of options which aligns to customers preferences and help keep bills affordable in the context of the challenges we face. We are making use of adaptive planning to meet future challenges.
Environmental Destination	• As seen in the drivers of best value, environmental concerns are high on the agenda for most customers, having come to the forefront since engagement conducted for PR19 and WRMP19, usually featuring within the top five priorities for customers. Yet, despite being a priority, many customers were not willing to pay much	We propose to implement "environmental destination scenario BAU+" by 2050

	towards achieving environmental goals through their water bill and therefore, since 2020 when the pandemic initiated a rise in the cost-of-living, environmental concerns have slipped down the priority list for some, particularly during 2022, replaced by areas that serve personal interests more and protect the financial impacts on them as customers. • In our themes 1 and 3 quantitative study, 53% of customers wanted us to achieve the middle level of environmental destination level 2 (BAU+) compared with 29% wanting us to achieve the top level of destination. Customers who supported level 2 thought it was the best balance between protecting the environment and the cost to deliver. Only 19% wanted us to achieve level 1. • Amongst our more informed WRAP Forum, there was widespread concern when customers were informed about the current and future risks to the chalk streams and aquifers across the region when led to calls for greater environmental protection and restoration, with 18 out of 25 opting for us achieving level 3. It makes sense to customers that water companies should protect the water environment, in order to ensure water supply and to protect nature. The customers provided some useful advice to help validate our plans: o Work with others to protect the water environment – water companies are just one of the many stakeholders with a role to play. o When setting targets and timetables, weigh up what is practical (in terms of cost, timetable, disruption etc.) against what is ideal for the environment o If opting for ambitious targets, ensure the cost is acceptable to customers, and involvement of stakeholders is not onerous/overly time-consuming. o When communicating with customers about the water environmental problems, recognise that awareness and concern varies. • There were mixed views over speed of implementation. In our themes 1 and 3 quantitative study, 42% of customers said that 2050 was the right timescale to deliver their preferred level of environmental destination, but 38% said this was too late. Environmental stakeholders want us to deliver the highest level of environmental protection as quickly as possible. Our more informed WRAP members mainly wanted to see their preferred ambition delivered between 10-20 years. Faster than 10 years was seen as unachievable given what would be required. • In our 2021/22 brand tracking study 31% of customers agree that we are "a company that does a good job at protecting the environment in the areas we abstract water from". With over 1 in 3 customers not able to answer the question, this highlights how important education campaigns are to raise awareness of our plans to protect and restore the water environment and what the challenges are that these plans seek to address. • In our Theme 2 quantitative study, abstracting more water from underground aquifers was the least supported of any demand or supply side option tested, attracting only 2 points on a 0-100 priority preference scale.	We will work closely with the Environment Agency to understand the impact of our abstractions on key water courses and water bodies and have committed to investigations in AMP8 to understand the exact needs of catchments.
Service level and resilience to drought	**Severe drought restrictions**	We do not propose to make any changes to our levels of service for TUBs or NEUBs.

	• Customers and wider stakeholders remain universally opposed to severe drought restrictions (standpipes/rota cuts) being implemented. • In our Themes 1 and 3 quantitative study, 54% of our customers support the proposed move from 1:200 to 1:500 risk of drought restrictions being used, with 32% neither supporting nor opposing it. • Highest selected option (by 41% of customers) was to achieve the 1:500 resilience target by 2040. 30% wanted us to achieve the target sooner. **Service levels (TUBs/NEUBs)** • TUBs/NEUBs are not popular as a way of managing water resources when compared to other demand and supply options. In our Theme 2 quantitative study, they attracted only 2 points on a 0-100 priority preference scale when customers were asked to rank their preferences. • However, in terms of TUBs and NEUBs; multiple studies show customers would be willing to accept lower service levels than they experience at present. Business customers seemed more mixed in their views than household customers, partly because they see their usage as "essential" where others might define it as non-essential. • In our Themes 1 and 3 quantitative study, after reading about the challenges we face in meeting future demand and protecting the water environment, 57% of HH and 55% of NHH customers would support us bringing in temporary restrictions every time there is a long period of dry weather. Only 1% of customers wanted the current service levels to be improved. • There was also strong support (54%) for bringing in higher charges for high levels of non-essential use during periods of drought to help reduce demand. • The main caveat to these insights is that as so few customers have actually experienced a TUB/NUEB that their preferences when asked may not truly reflect their reaction if a ban we to be imposed on them (as evidenced by critical comments on social media over the summer of 2022 when customers in some areas of the country were subjected to a TUB, particularly in the context of the ongoing negative perceptions over leakage performance). • Qualitative support in a wider regional research study for harmonising levels of service across regional water resource areas – seen as the fairest way to manage the situation for all.	It is important that our plans provide the required level of resilience to ensure that severe supply restrictions never occur, now and in the future.

Balancing demand and supply side options	• Across all qualitative and quantitative engagement customers from all demographics have and continue to consistently prefer demand side options, rather than increasing supply side options. This is because customers say they are:
	  • Cost effective
	  • Common sense
	  • Environmentally sound
	• In particular, leakage gained the highest level of support of any demand or supply side option, attracting 40 points out of a 0-100 priority preference scale when customers were asked to rank 9 options in our Theme 2 quantitative study. Given the next highest option, "introducing universal water metering", only attracted 12 points and the highest supply side option "building a new regional
		We are committed to a demand led set of options, supported with medium and long-term supply side investments to meet the forecast Supply Balance Deficit.
		
		We will develop an engagement plan to communicate the key demand and supply side options that are needed, drawing on the insights to

	storage reservoir", attracted only 11 points, this clearly highlights the significant preference for a leakage led plan. • However, in our WRAP Forum, as customers become more informed about the challenges we face and the options available and what they can deliver to address future water demand and supply balance, calls grow for a well-balanced use of demand management and supply strategies. There was a recognition that that demand side options might not be sufficient, on their own, to allow for the needs of an increasing population and that there is a limit to how far these can solve the problem. • Of supply side options, increased water abstraction from underground aquifers was the least popular, and at times unacceptable to some customers. • Whilst the principle of sharing a vital resource between regions was well supported, water transfers were mainly viewed by less informed customers as a short-term gap stop solution only, as most do not want to become over reliant on transfers and some strongly disliked the negative environmental aspects these solutions can bring - such as increased carbon emissions and the transfer of invasive species. • In our WRAP Forum focus group in February 2022, a summary of possible water transfer options was sent to participants in advance of the session. This outlined options and gave some information on cost, control of environmental impact and resilience. At the discussion group the most popular of the four options presented was the shared new surface water reservoir and treatment works with a pipeline transfer into the Cambridge Water supply region. It was viewed as providing sufficient security and control for the company, whilst being lower cost than some of the other options. • If water transfers are to be used, customer cconcerns relating to the environment, quality of water and cost will need to be clearly addressed and the context for transfers clearly explained for them to be acceptable. • **The overall message is clear that, to be acceptable, our plan must make the best possible use of current water resources before investing in any large-scale supply-side options.**	help ensure customer concerns are addressed. We will do this through our public consultation upon publication of the draft plan.

Demand options - leakage	• Reducing our leakage levels further emerges as a clear and consistent priority among most customers.
	• Among a less informed, representative sample of customers in our themes 1 and 3 quantitative study 47% want to see leakage reduced to as close as zero as possible.
	• As customers become more informed around the challenges associated with reducing the volume of water lost, 79% support the national target for reducing leakage – just 3% oppose.
	• Customers who are more engaged with protecting the
	• environment are significantly more likely to have a higher level of support for the national target for reducing leakage. Key reasons for supporting the national target are:
	  • Wasting water doesn't make sense – 'we'll leave more water for future (if leaks are fixed)'
	  • Educate customers to be more aware of water usage/ shortages
	  • The right thing to do
	  • Impossible to reduce leakages to 0%.
	• Customers also flagged in discussions that they want to see interim targets set in the context of the 2050 national target, to hold the company to account on progress.
		We are committed to delivering the 2050 national leakage target.
		
		We will continue to explore the benefits of new technologies and approaches to identify if further leakage reductions can be gained.

	• Leakage also remains an emotive issue for customers, and some feel that levels must be reduced if people are to be motivated to play their part with water conservation. • However, despite this strong sentiment from customers, a notable proportion are reluctant to pay for this on bills and expect this to be funded by us in other ways. This situation has been exacerbated by financial hardship since Covid-19. • In addition, leaks on customer properties are unlikely to be effectively addressed without an education programme to inform customers of the scale of this problem, how to detect leaks and how to reduce them.	

Demand options – universal metering	• On balance, the majority of customers continue to support the principle that metering is the fairest approach to charging, although this is backed more strongly by customers who already have meters installed, and future customers.
	• Universal metering gained majority support among a less informed, representative sample of customers in our Themes 1 and 3 quantitative study. 59% supported the policy when uniformed about the benefits, with this rising to 66% once informed. Levels of support were significantly higher among metered customers (76%) vs unmetered (41%).
	• However, it is important to note that among unmetered customers 22% had a neutral view, with 22% against. The most commonly cited reasons for being against the policy was the fairness of taking away the choice of being or an unmetered charge and the fact that water is a basic human right and if it becomes too expensive it might impact on peoples' health as they have to cut back on usage. This highlights potential through engagement to shift views, particularly those who are neutral, to being supportive of universal metering.
	• In addition, universal metering attracted 12 points out of a 0-100 priority preference scale when customers were asked to rank the options in our Theme 2 quantitative survey, the second highest of any option, behind leakage. It was also the highest ranked option on our WRAP Forum, with 17 of 25 selecting it in their top 3 options.
	• Household customers in deliberative discussions on our H2Online Community often call strongly for universal metering, as do those representing environmental stakeholders.
	• Support from customers for universal metering is driven by 5 key reasons:
	  • Greater equitability
	  • Control and awareness
	  • Incentive to reduce consumption
	  • Protecting the environment
	  • Potential to save money
	• However, customers and stakeholders have some concerns about how to move unmeasured customers to universal metering, including concerns for vulnerable customers who might struggle to afford their charges and/or have a medical condition that means higher water usage is needed.
	• In our WRAP Forum in the summer 2021 the majority of customers wanted us to target areas of higher consumption first if rolling out universal metering. In our quantitative testing in 2022, minimising the cost of rolling out universal metering was the preferred option given by 39% of customers, with 32% wanting to target areas to reduce the
		Given the challenges we face we are committed to delivering universal smart metering by 2035.
		
		We will work with customers, stakeholders and other interested parties to put in place a communications plan and targeted support to customers who are struggling to pay their bills or who would be adversely impacted from having a meter due to a medical condition.

	demand for water the quickest – the drive towards lowest cost is linked to the rise in the cost of living • 62% of customers in our Themes 1 and 3 quantitative surveys said that they would pay at least £2.50 or more a year more to have smart metering rolled out by 2050. 27% said they would pay £4 more a year to deliver it by 2035. However, 1 in 3 customers in our quantitative study had no appetite to pay more to roll our universal metering any faster. In our WRAP deep dive Forum in October 2021, 19 of 20 said they would pay an extra £2.50 a year to have universal metering completed by 2050, with 14 of 20 saying they would pay an extra £4.00 a year to have this completed by 2035. • Metering is strongly believed to encourage behaviour change and is considered the fairest way of paying for water, so getting all customers on a new meter is therefore seen as more of a priority than updating older meters. However, when engaged in detail on the topic many of the WRAP Forum mainly supported a combined approach of fitting new meters for unmeasured customers and retrofit of older meters should happen at the same time from a fairness perspective. • Across all our wider research there is a consistent preference expressed by household customers for receiving water meter readings monthly or quarterly. There was also broad agreement across all our deliberative research that the current meter read frequency of twice a year is not fit for purpose for accurate billing and engaging consumers with water conservation. • However, in our Themes 1 and 3 quantitative study, 53% of customers said they were not prepared to pay more to have a more regular frequency of meter reads, a response significantly more likely to be given by those from lower social economic backgrounds. 30% said they would pay £2.50 a year more to have a monthly/bi-monthly meter read. • With regards to preferences for smart meter technology if rolling out universal metering, once educated, a small and informed group of customers from our WRAP Forum had a preference for AMI over AMR metering technology and some willingness to pay for the programme, due to a perceived small price difference between the two technologies and that it made sense to future proof the investment. • However, there were concerns raised over the use of AMI technology, such as how data security would be handled and how reliable the technology is to work in all locations.	
Demand options – water efficiency and behaviour change	• A wide range of research studies, including our local engagement, continues to indicate that a gap remains for many customers between considering the impact on the water environment when they turn on the taps. Many customers are not aware of rainfall levels, the true scale of population growth and the low proportion of water habitats which are rated as in good health. A proportion are also unaware that they live in a water stressed area. All these remain barriers to engagement with water conservation behaviours. • However, there has also been a significant drop in the number of customers in CCWater's Water Matters survey agreeing that they are "confident in the long-term supply of water" in their region – 62% in 201/22 down from 82% in 2017/18. This highlights the growing concern among the population around long-term resilience of supply. • All our deliberative engagement has shown that many customers go onto express real concerns about the potential shortfall in water supply and all agreed in our WRAP Forum that water companies must	We are committing to the national target of reducing PCC to 110 l/h/d by 2050. We will continue to encourage developers to build water efficient home through incentives. Policy approach will be agreed in our PR24 plan. We forecast that the Government Water labelling scheme from 2025 will deliver water savings through purchase of efficient white goods and other appliances.

	play a central to play in the solutions, but that we can't solve it all on our own and will require Government, consumers and other stakeholders to play their part.
	• On our WRAP Forum the national target for reducing customer demand for water (PCC) was largely acceptable to customers, although the stretch targets to 80 l/h/d seemed too difficult to achieve at this point. However, environmental stakeholders would prefer to see a stretched level of ambition achieved as quickly as possible to help protect the water environment.
	• The 110 l/h/d target is achievable as long as:
	  • Customers are educated and incentivised to change behaviours
	  • There is investment in changing infrastructure (water recycling, water efficient appliances) and developers are encouraged to build houses which help consumers use less water.
	  • Businesses are also set targets to reduce consumption.
	  • The impacts of the pandemic in terms of increasing PCC are not long term.
	• Many of our WRAP Forum say that the aspiration should be for the PCC target to be 'the sooner the better' – there is a need for action; 30 years is too long to wait we should be ambitious. However, some are more cautious and mentioned that behaviours can be slow to change.
	• There is appetite from stakeholders in the building sector and wider sectors (e.g. environmental) and customers for building in water recycling into new builds. Customers remain keen to have education on water efficiency strategies, whether via schools, directly to their homes or information on water saving strategies for large businesses.
	• Behaviour change is an area that overlaps with other demand and supply side options, but in general customers say they need to have a full understanding or any particular issue before any change is likely e.g. the amount of leakage that takes place on customer properties, or the benefits of smart metering versus the costs of installation. For the most part, customers agree they could save more water than they do at present (but need motivation to do so and barriers removed). Education and advice were the fourth most popular option when customers were asked to rank 9 options in our Theme 2 quantitative survey, attracting 10 points on a 0-100 priority preference scale.
	• All our NHH local engagement, including the NHH club project undertaken in 2022 indicates that the biggest barriers to the market engaging in water efficiency are:
	  • The lack of accurate and accessible meter data
	  • A lack of skills and knowledge to understand how to be more water efficient
	  • The lack of return on investment of becoming more water efficient and/or when they should become more water efficient
	  • There was also an overall lack of knowledge around water scarcity and the fact that at this time water restrictions are not seen as a business threat.
	  • There were no obvious incentives to drive them to save water and no consequences in place for not becoming more water efficient.
	• NHH customer engagement has also shown that:
	  • In-person audits and carefully designed leakage allowance policies can engage them effectively in water efficiency
		In the non-household market we are committing to universal smart metering - this programme will replace our existing meter stock with Enhanced Meter Technology (EMT) that will provide intelligent consumption information for use by businesses and Retailers to drive water efficiency savings.
		We are committed to delivering the proposed National Environment Act target of 9% reduction in consumption by 2037.
		We will continue to engage with customers about new ways of charring fore water as we develop options to trial.

	• Larger water users also fed back that more partnership working between energy and water around data and developing solutions to help the NHH customer meet sustainability targets is key and they expressed a greater interest in being engaged with water recycling initiatives through targeted support from wholesalers to help them with business cases and case studies. • Our H2Online community members have been vocal in telling us that we need a multi-channel approach to educating customers to encourage water conservation – from TV, radio, digital, print and face-to-face engagement. • Water recycling is a popular option across a number of our engagement studies, with both household and non-household customers, however the reality of installing a retrofit system provides challenges which would require education up front on the benefits and likely costs, potential subsidies to help customers accommodate the costs of retrofitting a system and information on how to maintain it. These would all need to be in place before large scale adoption is likely to take place. • From the start of our WRAP Forum there were spontaneous calls from some customers for water companies to bring in new tariffs to encourage water saving behaviours, particularly for use in periods of drought. Our early engagement around new tariff options suggests that tariffs which benefit the individual household are preferred over community-based ones. We will continue to engage customers on this area to develop our plans.	
Supporting low-income and priority households	• We have engaged extensively with our customers on how to manage the transition for customers from unmeasured to measured charges. There was no overall majority on the best way to approach this, but there was common agreement that is it fairest to give customers at least a year after their meter is fitted, to allow the opportunity to change their behaviours, before being switched to measured charges. • The use of guaranteed price caps during a transition period was also popular among some on our WRAP Forum and H2Online Community members to help protect against bill shock. • There was universal agreement that we must provide clear communication and a range of measures to help ensure customers are not adversely impacted by any of our investment and policy decisions, particularly those who are already struggling with paying their bills, or who have a medical condition that requires higher levels of water use. • Offering a price guarantee that ensures that medically vulnerable customers would not pay more than their current annual fixed rateable value charges was also seen as important for us to consider in our plan. • It was also important to customers that any new tariffs developed in the future which are linked to water consumption do not adversely impact on vulnerable customers groups. Fairness was a key consideration throughout the engagement.	We are continuing to engage with customers and other parties to review options for supporting customers during the introduction of universal metering We are also reviewing options with our customers and stakeholders for the use of “ghost metering” as part of our universal metering to allow customers a two-year period to get ready for being on metered charges following installing a meter at their property.
Source preferences, reservoirs and water transfers	• When asked to rank a range of demand and supply side options in our Theme 2 quantitative survey, building a new surface water reservoir was ranked second of the 9, attracting 15 points on the 0-100 preference scale and therefore was seen as a higher priority option to help meet the future supply and demand balance.	We are committed to the Fens Reservoir and Grafham water transfer to deliver our resilience and environmental ambitions.

	• Looking wider, we have undertaken extensive and wide-ranging research studies into customers' preferences for supply and demand options for water resource planning. These qualitative and quantitative research studies, undertaken at both a local and regional level, highlight that reservoirs are the preferred supply side option of the options tested. This view on why reservoirs are preferred as a supply side option is predominately driven by:
	  • Feeling they are a familiar, tried and tested option
	  • Ability to hold large volumes of water in an efficient way to meet future demand challenges
	  • Being seen as environmentally friendly, including helping reduce the amount taken from rivers, streams and underground aquifers
	  • They can help reduce flood risks if planned correctly
	  • Delivering an attractive community asset.
	• Water transfers received less support compared to reservoirs. When asked to rank a range of demand and supply side options in our Theme 2 quantitative survey, they were the second highest ranked supply option (6 of 9) attracting 15 points on the 0-100 preference scale.
	• Transfers are viewed by uninformed customers mainly as a short-term solution, only to be used if needed to meet future demand. Customers are often concerned about how reliant we could become on other water companies and some think water transfers should be a last resort, as this could affect other suppliers' resilience.
	• The more informed customers on our WRAP Forum generally supported water transfers as an option alongside others (such as demand options) but immediately questioned and were concerned about the effects this might have on the environment. The CO2 emissions associated with moving large volumes of water over a long distance especially provoked a strong reaction among some.
	• For any major supply side option, customers want to be informed about when they may happen and if there will be any effect on the quality of the water they receive.
		We will continue to test the acceptability and affordability of our plan with customers ahead of final submission.
		We will use the insights to help communicate these schemes effectively to customers and will continue to engage over time to ensure customers are fully aware of why these investments are needed and the impacts they will have on them and their local communities.

Acceptability and affordability of WRMP24 plan	• We will provide detailed feedback on our customers' views on our final plan in 2023 and the actions we have taken based on their feedback.	

4.5 Stakeholder Engagement

Throughout the development of the plan, we have also undertaken a corresponding stakeholder engagement plan. For our non-statutory stakeholders, such as retailers, eNGOs and other interested parties, we held a webinar during pre-consultation to share our thoughts or our draft plan and gain feedback. In addition, we held several roundtable events in October 2021 where we gained views from local businesses, councillors and community groups on their views on what our priorities should be and the potential elements within the plan.

We have also undertaken focused engagement sessions with the Environment Agency, Ofwat and CCWater during 2022 to provide updated on the progress of the plan, and gain feedback on our proposals.

All of the comments and feedback received from these sessions is included in Appendix A.

5. Baseline demand for water

Overview

Our baseline demand forecast incorporates a multitude of factors and assumptions. Through support from Artesia, we have produced population forecasts and both household and non-household consumption forecasts. We have reviewed the number of people we believe will be living in each household, which has a bearing on the average consumption of each individual.

It is also important to understand what makes up this household usage, and we do this through defining the micro-components, and we worked with Artesia to develop a new micro-component forecasting model for this WRMP. The balance between the values of these micro-components often varies with occupancy and it is an important area for us to understand if we are to target our water efficiency work appropriately.

One of the most significant changes for our WRMP compared to WRMP19 relates to our assumptions regarding metering penetration. In 2021 the Environment Agency designated our region an area of serious water stress, and as such we have looked at the option to deliver universal metering across our entire population. We have undertaken extensive customer engagement on this topic to understand the level of support and the concerns, and this is covered in section 4 above. This universal metering underpins some of our proposed demand management programme, and this is covered in more detail in sections 9 and 11.

We have updated our demand forecast for our revised draft plan. This ensures our plan is updated with the latest and most current information to ensure it is as accurate as possible. We've updated both the household and non-household forecasts. We have worked closely with Greater Cambridge Shared Planning as we develop these forecasts to ensure that they accurately represent the local plan data and the forecasted employment figures.

Since the draft plan was published, the Government has announced some additional ambitious growth targets for the Cambridge region, potentially looking to develop 200,000 – 250,000 new homes in the area by 2040-2050. This would more than double the current size of Cambridge. In addition, there is the desire to supercharge Cambridge as the "science capital of Europe" which means significant growth in the biomedical and technology sectors. As these are still potential proposals at this stage we have not included this growth forecast as our baseline position. However, we have run a scenario that looks at the impact of this scale of growth on our plan, and we cover this in section 11.7.

As a result of the population and non-household growth, our forecasts show that without intervention, demand continues to increase throughout the planning period. In the Cambridge area, the Environment Agency have objected to several planning proposals, which are part of the existing published local plan, on the basis of potential deterioration to the environment due to the water needs of these developments. We have worked closely with the planning authorities, DEFRA, the Environment Agency and developers as we have produced this revised draft plan so that we can clearly determine any potential risk associated with the existing proposed development, as well as ensuring our plan is robust for future growth.

We cover this challenge in more detail, and the ongoing work in this area, in section 11.

5.1 Overview of the baseline demand forecast

The WRMP tables present only the Dry Year Annual Average (DYAA) and peak week scenarios but both of these are built up from the normal year demand forecast. The following commentary is based on the development of the normal year annual average forecast and highlights how this is converted to DYAA and peak week.

The baseline demand forecast is built on latest forecasts of population and properties in conjunction with the continuation of existing policies around metering and leakage management. At this stage, it does not account for customers' views on what they want us to do in these areas going forward and does not include any preferred demand management options. The baseline demand forecast is the starting point for assessing whether we have sufficient water to meet demand over the next 25 years.

The final demand forecast resulting from our proposed programme of leakage reduction, metering and water efficiency is described in section 11.

We have followed the Environment Agency's water resources planning guideline and the following methodologies when developing our forecasts.

- UKWIR (2016), 'WRMP19 Methods – Household Consumption Forecasting'.
- UKWIR (2016), 'Population, household property and occupancy forecasting'.
- UKWIR (2006), 'Peak water demand forecasting methodology'.

The baseline demand forecast includes:

Baseline DYAA: climate change impacts, population growth, changes in household size, changes in property numbers and existing demand management policies; and
Baseline critical period: as above plus household consumption driven by sunny dry weather.

By the end of the planning period distribution input in the baseline dry year scenario is forecast to increase by almost 17Ml/d. Household water demand is forecast to rise by around 8.35 Ml/d and non-household consumption by around 8.44 Ml/d.

The non-household consumption increases by 55% by 2038 from the 2019/20 position as the area looks to expands its biomedical activity in particular, which was a key area of growth during the Covid-19 pandemic as Cambridge became a hub for research and development into the disease and vaccine.

Over the 25-year period the total household population is forecast to rise by approximately 89,650 people and it is forecast there will be an additional 46,040 homes by 2050. This is an increase in rate compared to the WRMP19 projections.

Under our proposed metering strategies an additional 145,000 meters would be installed increasing the meter penetration level of 77% to around 100% by 2034/35.

We forecast that non-household demand will rise over the planning period which reflects the rise in biotech and biomedical sectors, as well as the technology industry across the supply area.

We included total leakage in the baseline demand forecast at the current Ofwat performance commitment of 13.2Ml/d in the base.

We converted normal year demand to dry year demand by applying a dry year factor of 6.8% to household demand. We derived this factor from a review of climatic factors and per household consumption. We applied the adjustment to both the measured and unmeasured household demand in a normal year.

We included the central estimate of the impact of climate change on demand in the household demand forecast and included the uncertainty associated with the impact of climate change on demand within headroom.

5.2 Total population and property projections

Population data is collected every ten years through the National Census by the Office for National Statistics (ONS). ONS provides detailed census results at a number of spatial scales from local or unitary authority (LAUA) down to small scale 'output area' (OA) level where the mean population per OA is 300. ONS also provides annual updates of population and biannual 25-year forecasts of future population growth at the medium spatial scale – that is, lower super output area (LSOA) where the mean population per LSOA is 1,500.

The ONS datasets also provide information on the number and type of households and the age distribution (demography) of the population. Data on the type of households is used to distinguish the population who live in non-household ('institutional and communal') properties and includes those living in medical, care, defence, prison service and education establishments, and those living on farms.

We have worked with the consultancy firm Edge as part of the joint 'Water Resources East' Regional Planning group to ensure our approach to population and property forecasting meets the standards specified in the current guidance. Trend-based and plan-based projections were produced following UKWIR guidelines and taking into account further availability of data from the company and relevant local government bodies.

The project was carried out in four main stages.

1) Area reconciliation: the geographical area covered by Cambridge Water was defined in terms of individual unit postcodes. Postcodes that were found to straddle the boundary were split and treated as partly inside the area. Postcodes are smaller than Output Areas, and definition in terms of postcodes provides a detailed assessment of which Output Areas, and parts of Output Areas, lie within the boundary. This process used area boundaries as supplied by us to Edge.
2) Trend-based forecasts: forecasts were produced based on ONS trend-based projections of population and Department for Communities and Local Government trend-based projections of households. These fulfil the requirements for trend-based population, household and billed household forecasts as specified in UKWIR guidance.
3) Plan-based forecasts: forecasts were produced based upon Local Authority and County Council plans and forecasts. These fulfil the requirements for plan-based population, household and billed household forecasts as specified in UKWIR guidance (UKWIR 19 Methodology, 'Population, Household Property and Occupancy forecasting 15/WR/02/8'). Plan- based forecasts project higher levels of growth than trend-based-forecasts.
4) Reconciliation of plan-based forecasts with most recent billed household counts: the plan-based forecasts were adjusted to agree with counts of billed households for mid-year of the base year 2019/20.

Base year household population and property figures taken from our customer database and consistent with those reported in the '2020 Annual Review' were used to reconcile the base year data. For the revised draft WRMP, Edge undertook an updated population and property forecast which then enabled our household demand profiles to be updated accordingly. The detailed methodology for population forecasts is included in Appendix H.

The forecasts show that household population is expected to increase by 89,650 people by 2050 and that there are approximately 46,040 new homes forecast to be built. This is an increase of 32% in connected household properties.

This baseline forecast has been agreed with Greater Cambridge Shared Planning following some concerns through the draft plan consultation that our forecasts did not align fully with the local plan. We have shared our process and outputs and are confident our forecasts are now aligned with these local plans.

It is important for us to look at various different growth scenarios when developing the plan to ensure we understand the potential alternative scenarios. We also gather the ONS population forecasts as well as identifying any additional proposals or aspirations that may forecast a higher level of growth. As such, we have developed the following additional forecasts:

- ONS
- Local Plan plus aspirations
- Department for Levelling Up, Housing and Communities proposal

We then test our plan against these alternative scenarios, as we discuss in section 11.7. The ONS forecast is the lowest with the DLUHC proposal being the highest.

5.2.1 Non-household population and properties

We assume growth in new non-household properties to rise reflecting the growth in bio-tech, service sectors and technology round the emerging growth plans for the county. This includes where unmeasured non-household supplies are refurbished and supplies are split. We have again worked closely with Greater Cambridge Shared Planning on employment forecasts, as detailed in the updated appendix C2. Unmeasured non-household properties will continue to reduce because of commercial meter optant switchers and as a result of site developments.

Data on the type of households is used to distinguish the population who live in non- household ('institutional and communal') properties and includes those living in medical, care, defence, prison service and education establishments, and those living on farms. This is referred to as 'communal population' in the WRMP. Communal population is deducted from total population to give household population.

5.3 Metered household property projections

The Final Plan Metering strategies will result in a significant increase in metered households by the end of the planning period.

By 2049/50 there will be 82,110 more measured households arising from new connections and our targeted universal metering programme. This is described in more detail in section 9. This will effectively proactively switch our customer base to meters and drive the reduction in consumption in order to achieve the 'Per Capita Consumption' (110 PCC) target by 2050.

The number of unmeasured households fall directly related to the meter option and meter switching promotions as households opt to have meters installed. The metering strategy is aimed at switching all unmetered households to meters.

5.3.1 Free Meter optants

We have reviewed the actual number of meter optants required to achieve the reduction in the Base Line PCC to the ODI target of 110l/h/d by 2050 with the support of Artesia Consulting Ltd who ran a series of scenarios to optimise Demand Management Options (section 9).

We have based our forecasts on an average number of optants and switchers over the planning period in order to achieve 100% metering by 2035 and 110 l/h/d with the support of a Smart meter network and water efficiency initiatives (section 11).

5.4 Void properties and demolitions

Void properties are those that are unoccupied and therefore do not have an associated consumption. Supply pipe leakage allowances are applied to void properties. The forecast for void properties is based on an assumption that the total number of household and non- household void properties remains constant over the planning period. Household occupancy rates

5.5 Household occupancy rates

Artesia Consulting Ltd were commissioned to develop the Company's Household and Non-Household consumption forecasts (Appendix C). Embedded in the forecasts are modelled household occupancies derived from Artesia's experience from working across the industry. The purpose of modelling occupancies across the customer household types is to distribute the population between each of the customer groups so that the sum of them all is equal to the total household population estimate.

While there is an underlying trend for population to grow over the planning period, overall household occupancies are forecast to reduce. Overall occupancy falls from 2.54 people/property in 2024/25 to 2.34 people/property in 2049/50.

The household occupancies of different customer groups have independent profiles that reflect their characteristics.

The underlying occupancy rate for unmeasured households is forecast to rise reflecting larger family units (growing families) over the planning period as the metering strategy takes effect and we approach 100% meter penetration.

The underlying average occupancy rate for all measured households is a mixture of lower occupancy optants and lower occupancy, small, new-build houses until a point when the larger unmeasured household occupancies become metered.

New meter optant households have a lower occupancy than other customer groups. This is because optants are generally smaller households who use low volumes of water and therefore make a financial saving by opting for a meter and controlling their water bills through metering.

The average occupancy of a meter optant property is forecast to rise slightly over the planning period.

The average occupancy of a new supply property is forecast to reduce over the planning period as the demand for more new starter homes increases.

5.6 Baseline household demand

The current water resources planning guideline identifies the need for water companies to use methods for supply and demand analysis that are appropriate to the level of planning concern in their water resources zones (WRZs). The problem characterisation for our single WRZ identified a 'moderate' rating. The baseline household consumption forecast has been produced using micro-component modelling and forecasting, which is suitable for a zone with a moderate level of water resource planning concern. A new micro-component forecast model was developed for us for this WRMP by consultancy firm Artesia.

The model quantifies the water used for specific activities (for example, showering, bathing, toilet flushing, dishwashing and garden watering) by combining values for ownership (O), volume per use (V) and frequency of use (F). The micro-component model is combined with property, population and occupancy forecasts in a unique way in that the micro-components vary with occupancy. Certain components have a valid relationship with occupancy, and

others do not. This method is used to calculate base year OVF per household consumption (PHC) values, which are then calibrated to the WRZ normal year PHC values.

Forecasts of the property, population and occupancy are established by household segment through a model to allow for various assumptions and mathematical calculations as the meter penetration increases. Each household segment has a different base year OVF table/calculation; these are based on both measured differences between measured and unmeasured households, as well as assumptions made about devices within new properties and optant properties.

Micro-components are then forecast using a combination of longitudinal micro-component data and future market transformation programme derived micro-component values. These trends are applied to the normal year micro-component values. An additional occupancy specific trend is also added, to ensure that the varying occupancy within each of the household segments is captured.

Data from national studies was used to update previous micro-component estimates – from surveys, the Market Transformation (MTP) scenarios and other, older sources – and to consider upper and lower consumption forecasts.

Relevant data, existing survey results, and consumption data from metered customer billing records were all analysed and investigated, along with data collected in the 2016 UKWIR behaviour integration study, to estimate base year micro-component estimates.

Household customers were segmented based on meter status (measured/unmeasured), with sub-divisions for meter type (existing metered, free meter optants, new property). Data was used to determine how to account for differences in consumption between segments, and also the effect of meter switching. Normal year and dry year adjustments were made to the base year consumption and the consumption forecast.

Climate change impacts on consumption have been calculated in accordance with UKWIR 13/CL/04/12, 'Impact of Climate Change on water demand'. The model includes functionality to output forecasts with and without climate change factors. The additional demand from climate change is added to the external use micro-component only. The small additional volume attributed to climate change is included in the baseline forecasts.

A scenario approach to modelling uncertainty was used, to reflect the various uncertainties in consumption forecasts.

Best practice guidelines for household demand forecasting have been followed in deriving the baseline household demand forecast.

We provided the following data to enable Artesia to develop the model.

- Population forecasts.
- Property forecasts.
- Household survey data regarding ownership of water using appliances, frequency of use and household occupancy data taken from surveys carried out in 2014 and 2016.
- Reported annual return data for reconciliation with the base year.

Using the dry year and critical peak factors, we are able to develop NYAA, DYAA and DYCP household demand forecasts. The population and property forecasts enable the derivation of a demand forecast and also an individual consumption forecast to determine the PCC forecast. These forecasts were all updated for the revised draft WRMP following the updates undertaken to the property and population forecasts.

For the DYAA, baseline household demand is forecast to increase by 16% over the planning period, which equates to an increase of over 8 Ml/d increase.

Appendix C1 has been updated for the revised draft WRMP which details the household demand forecast approach and outputs.

5.7 Baseline non-household demand

Since the Water Market opened on 1st April 2017 non-household customers have been able to choose their retail service supplier. Those not eligible have remained with the incumbent water supply and form the retail market.

Following the separation of the Retail/Wholesale markets water companies have been unable to directly communicate with the retail markets and as a result water efficiency has been the responsibility of the billing company. This has led to some loss of knowledge of non-household customer consumptions.

However, WRMP24 will give water companies the opportunity to engage directly with the Retail market with a view to introduce consumption and waste reduction strategies. As a result we have submitted plans to reduce non-household consumption, as outlined in the Environment Act targets. We discuss the actions we will take on this in section 11.1.4.

Non-household consumption was analysed using a 'trend-based' approach at a high level, and subsequently, at individual sector level and consumption bands. Large users were also considered separately. The non-household demand was updated for the revised draft plan and also included employment forecasts as well as local plan information to inform the update.

Consumption figures were tested against a set of economic factors, including but not limited to:

- Unemployment;
- Gross Domestic Product (GDP); and
- population.

A set of forecasts was provided based on high-level trend and band analysis. With a variety of scenarios, it is clear that some may have different probabilities of occurrence, and that all forecasts are not equally probable. The most probable scenarios were used to calculate a mean forecast for use in the plan, as agreed with Greater Cambridge Shared Planning

Full details of the approach to non-household modelling are included in Appendix C2 which has been updated for the revised draft WRMP.

We did not apply an allowance for a dry year to non-household demand as we assumed dry year conditions do not significantly affect commercial water use. This is a consistent approach used across other water companies. As our demand forecasts are built up using historic data to understand potential fluctuations in non-household demand, we are confident this this method captures any variations accordingly.

Results indicate an increase in consumption over the plan period. Baseline increases from 27.99 Ml/d in 2024/25 to 36.43 Ml/d by 2050 which is a 30% increase over the planning period. However, this does not show the entire picture, as non-household demand has been increasing significantly since 2019/20. During the Covid-19 pandemic, Cambridge became a hub for biomedical research and development into the virus and the vaccine, and significant non-household growth was seen in a result. Since 2019/20, non-household demand has increased over 11% in three years. Cambridge plans to continue this expansion to become a leading location for biomedical and technological developments, and so non-household growth is forecast to increase by 55% by 2038 from this 2019/20 baseline. Non-household demand constitutes roughly 35% of all consumption in the Cambridge area.

Appendix C2 has been updated for the revised draft WRMP which details the household demand forecast approach and outputs.

5.8 Baseline leakage forecast

For the baseline demand forecast we have included total leakage across the period from 2024/25 of 13.2Ml/d.

We have committed to reduce leakage by 50% by 2040 in the final plan incorporating a number of innovative leakage management technologies and processes. The final plan leakage commitment follows a glide path that will achieve 7.3 Ml/d by the end of the plan period and meets the interim Environment Act targets. See section 11.1.2 for more details.

5.9 Minor components of water use

Minor components of water use include:

- distribution system operational use (for example, mains flushing and water quality);
- water taken legally but unbilled (for example, fire stations and standpipe use); and
- water taken illegally (for example, water theft and illegal connections).

The estimate of water use for these categories is based on our own specific data for the base year and is assumed to remain constant over the planning period and for all demand scenarios.

5.10 Dry year demand

We convert normal year demand to dry year demand by applying a dry year factor to household demand. This factor was derived as part of the Artesia modelling of household demand and is described in appendix C2.

We applied the resulting dry year factor (6.8%) to the normal year household consumption forecast uplifting it to the dry year scenario. We applied the adjustment to both the measured and unmeasured household demand in a normal year.

The impact of the dry year adjustment on the final planning normal year demand is shown in the table below. The figures in the table exclude supply pipe leakage.

All other elements of demand are considered to be unaffected by the characteristics of a typical dry year.

5.11 Critical period (peak week) demand

The critical period for us is demand in a peak week scenario. Peak week historically occurs in June or early July driven by household demand in conjunction with warm, sunny, dry periods. Summer weather does not tend to drive changes in leakage or non-household demand. More frequent shorter periods of high demand (peak hour and peak day) are effectively managed through network management and strategic storage supplies.

We have commented on the impact of Covid, particularly in the year 2020/21 when prolonged lockdown coincided with historic peak daily demand and periods of long, hot dry weather bringing about high demand from higher than usual garden water use.

The Artesia per household micro-component model produces a Critical peak week forecast. The derivation of the factor for peak week is described in the revised Appendix C. The peak week factor is 27.8%, which is applied to the components of use which are affected by summer weather. This ratio is applied across the period to convert normal year household demand to peak week household demand. This is an alternative forecasting methodology recognised by UKWIR 2006.

DI rose to 83.21Ml/d in 2020/21 compared to a typical annual DI of 81Ml/d. Household consumption rose from typically 43.5Ml/d to 49.5Ml/d. We are now seeing some return to pre-epidemic consumption although there is now a hybrid work/home culture whereby the ratio of home/office is typically 2 or 3 times a week.

We have updated the peak week forecast for the revised draft WRMP following the updates to properties and population.

5.11.1 UKWIR 2006 peak week demand forecasting methodology

Artesia has previously assessed peak week household demand (PWHH) for us using UKWIR's 2006 methodology. With five years of additional data the model has been reviewed again to take account of most recent data and determine the impact of metering on peak week household demand.

The report detailing this review and the findings is included in Appendix C.

The Artesia work found that temperature, sunshine and rainfall remain the key explanatory variables for peak week household demand. Meter penetration was also found to have a link although a much weaker relationship than the climatic variables.

A revised model was developed using the meter penetration relationship to allow an assessment of the impacts of future metering forecasts. The model produces predicted PWHH demand for 1 in 20 and 1 in 40 year events. The revised model showed a reduction in the predicted PWHH demand compared with previous models. The model was also used to determine how the PWHH demand would vary with increased meter penetration which is a forecasting option under UKWIR's 2006 methodology.

This forecasting approach for PWHH demand cannot be used in isolation as the model does not account for changes in the total number of households or further changes in customer water using behaviour and therefore the outputs from the model need further interpretation before they can be used in the critical period demand forecasts.

For WRMP24 the new model indicated a Critical Peak Week Household (PWHH) demand in the base year (2024/25) of 62Ml/d and predicted that it would rise to 72Ml/d by 2049/50.

5.11.2 Peak week household demand model

Artesia's per household micro-component model produces a Critical period peak week forecast. This uses a peak week factor which is applied to the components of use that are affected by summer weather. The peak week factor was derived using the ratio of the Artesia's predicted base year PWHH demand against the Artesia modelled base year normal year household demand. This gave a ratio of 1.278. This ratio was applied across the period to convert normal year household demand to peak week household demand. This is an alternative forecasting methodology recognised by UKWIR's 2006 methodology.

While the Artesia per household micro-component model accounts for population changes and changing numbers of measured and unmeasured households, it does not reflect fully the relationship between meter penetration and peak week household demand.

5.12 Demand forecast improvements

At draft WRMP stage, our work with our consultants highlighted some potential areas for improvement. We have detailed these in the table below, including our proposed actions.

Table 11 Demand forecasting improvements

Potential improvement activity	Response
The baseline and scenario forecasts are updated prior to the submission of the final water resource management plans.	We have updated this forecast for the revised draft plan.
Improve SSW's understanding of which Standard Industrial Classification category its non-household customers (supplied directly by SSW or indirectly via retailers) fit within	We continue to work with our retailers in order to improve the classification data we hold. This programme of work involves significant data gathering and also the development of an ongoing process to keep the information up to date. We propose to continue working with retailers to develop both of these areas.
Adopt a more "continuous" approach to non-household demand forecasting (rather than re-looking in detail only once every five year planning cycle)	We are working with our current consultant to develop a tool that can be owned and managed by Cambridge Water. This will enable us to manage our own demand management forecasts and mean we are able to review this more frequently. We will continue to work towards delivering this in AMP7.
Work with MOSL and retailers to improve the quality of non-household forecasts	We are part of an industry wide working group that are currently collaborating on a project to do this. This will not be completed in time for the WRMP24 but will be utilised once developed.
Consider a micro-component study (including new-build properties) to improve on the current approach (based on ageing national datasets)	Our consultant for this work is the primary consultant for demand forecasting across the industry and therefore has extensive data to utilise in the forecasting. We are reviewing the potential for us to undertake this work ourselves every three to four years to ensure it remains up to date.
Consider the company's resilience to prolonged duration hot, dry events such as summer 2018. This should include the Artesia (2020) project which assessed the magnitude of peak demand over different durations for water companies.	We have reviewed this as part of the revised draft WRMP, including the 2018 and 2022 drought year sequence, and have determined that any change would have a minimal impact and therefore not required at this stage. We will continue to monitor this as we move forwards.

6. Baseline supply forecast

Overview

Reductions to deployable output

There has been a significant reduction in the assessed dry year annual average (DYAA) deployable output (DO) of our sources since WRMP19, once sustainability reductions are applied to abstraction licences. Our declared baseline licence and deployable output shows a modest increase, due to WRMP19 supply options to address growth and resilience.

Sustainability reductions to DO for WFD No deterioration are included as abstraction reductions and for meeting Environmental Destination. The need to address the risk of causing deterioration to the environment is driving an immediate deficit in our baseline supply demand balance even within existing authorised licence limits. We have been investigating the impact of our abstractions on the environment to determine licence reductions, and the Environment Agency have provided an assessment of impacts and advised they view the likelihood of the risk to be high and therefore the reductions should be considered as a reduction to our DO assessment. The approach to determining reductions has developed since sustainability changes for no deterioration were considered for WRMP19, and this has significantly increased the number of reductions required.

The following changes forecast DYAA DO have been applied to the baseline:

- 6.46Ml/d of sustainability changes from our AMP7 agreed reductions for No Deterioration risk from 2025
- 2Ml/d of sustainability changes due to time limited licences not being renewed to prevent risk of deterioration
- 18Ml/d of additional sustainability changes to prevent risk of deterioration from 2031
- 35Ml/d of additional reductions for Environmental Destination from 2040.

Baseline licenced DO has increased from 99.1Ml/d in the 2019 plan to 102.7Ml/d for DYAA conditions, and from 118.3Ml/d to 138.1Ml/d for peak week conditions.

Drought resilience

We have evaluated our resilience to drought based on our current resources in the base year. We have considered drought scenarios with a severity up to a 1 in 500-year event. There is marginal difference between historic design droughts and more severe modelled events, and with existing licences and baseline deployable output we can meet demand in a 1 in 500 event without the need for restrictions.

We have also tested our drought resilience over the whole planning period with our forecast changes in demand and supply. Our analysis shows our supplies are resilient for a range of droughts across the 25-year planning period – including those more severe, or less frequent than our design droughts. Accordingly, we are not putting forward any new drought management options in addition to those currently in our existing drought plan.
One exception to drought resilience to 1 in 500 before 2040 is the timing of licence capping through sustainability changes and the impact of this loss to supply, as this would for the baseline put the SDB into deficit, and therefore not provide 1 in 500 resilience.

Climate change impacts on supply

The assessment of climate change impact has been reviewed since the previous WRMP, to align with the current Environment Agency guidance, latest supplementary information and to align with revised datasets also used for WRE companies, as this will ensure alignment in the assessments regionally. Our assessment of climate change impact has increased as a result of the revised methods – by the 2080's. We have undertaken a drought vulnerability assessment as the risk of drought is 10% of DO. The annual impact of climate change on DO has been included in our baseline and final plans.

Treatment works operational use (TWOU)

We have made no changes to the approach used for WRMP19 which was an improvement to the data collected for this component and approach used. A total TWOU allowance of 0.16Ml/d has been included in the supply forecast.

Planning allowance for outage

The DYAA allowance in our plan for outage has increased marginally from 4.8Ml/d in WRMP19 to 4.9Ml/d in our draft baseline forecast, for the 70th percentile for this and we describe our updated outage modelling in Appendix E.

6.1 Overview of the Cambridge Water operating area

Cambridge Water is responsible for public water supply across one of the fastest growing areas in the east of England. Our area of supply stretches from Ramsey in the north to Royston and Haverhill in the south, and from Gamlingay in the west to the east of Cambridge city.

6.1.1 Planning area – the water resource zone

For our WRMP19, following assessment using the WRZ integrity guidance (Environment Agency, July 2016), we agreed with the Environment Agency that we would continue to represent a single resource zone equivalent to our area of supply boundary. A map of the area of supply is shown in Figure 7 below. This assessment has been reviewed[4] against latest supplementary guidance from the EA and there have been no changes to our water resources zone boundary.

Figure 5 Cambridge Water supply area and water resource zone

[4] 2021 03 16 WRMP24 SG - Resource zone integrity

6.1.2 Supply sources

Our water resources are supplied wholly by groundwater, mainly abstracted from the chalk aquifer in the southern and eastern part of the supply area, with a small percentage of greensand aquifer sources. All these sources are linked by an integrated supply and transfer system. Less than 1% of supplies are currently derived from bulk imports from neighbouring companies. Our supply side proposals in this plan include options that will change some of our sources over time, by introducing further transfers from neighbouring companies and new resources, derived from surface water sources.

6.1.3 Levels of service (LoS) – update to include drought trigger work

Our published levels of service are based on the frequency of droughts previously experienced, and the likelihood of water use restrictions becoming necessary.

Our levels of service and drought triggers are based on a range of droughts observed in the historic record, specifically those of a severity or longevity where we required additional measures to manage supplies and demands, and the likelihood of restrictions being necessary. On this basis, we would not expect to need to restrict domestic customers use with a temporary use ban (TUB) more frequently than once in every 20 years. The calculated DO for this level of service models the available yields in drought conditions to ensure this level of service can be met with the available resource.

We have not had to resort to a non-essential use ban or ordinary drought order in previous droughts experienced and would not expect to for reference droughts in our drought plan more frequently than once in every 50 years.

We are also required to demonstrate that we can achieve the included reference levels of service from the water resources planning guideline. The levels of service to be assessed against DO are shown in the following table.

Table 12 Annual average percentage risk of restrictions – planned levels of service

Restriction	Company proposed levels of service	Average Annual risk
Temporary use bans (formerly hosepipe ban)	1 in 20 years	5%
Non-essential use (Ordinary Drought Order)	1 in 50 years	2%
Rota cuts or standpipes	1 in 200 years to 2036, 1 in 500 years from 2036 onwards	1%

The annual average risks shown in the table above are based on our levels of service and the following assumptions.

- We are not proposing any changes to our current levels of service for TUBs or NEUBs in our PR24 business plan, although we are undertaking a review of these levels of service, and may, following the appropriate consultation, align our temporary use bans level of service with other companies in Water Resources East.
- We do not change our levels of service between now and 2050, subject to the above review.
- We continue to meet, or exceed, these levels of service with a view to moving fully towards 1 in 500 drought resilience.
- Should any of these risks change during the 25-year planning horizon – for example, as a result of a changing climate – we can consider additional demand- or supply- side options that mean that we can still maintain these levels of service for our customers.

- New supply options – which make up a significant proportion of supply from 2036 - will be resilient to 1 in 500 events.

To derive the annual risks shown above we converted our levels of service from a 1 in X return period to a percentage risk. We calculated levels of service and the annual probability by using our historic design drought. Our design drought is based on historically observed data, but we have also modelled more extreme/severe events as described in our drought plan[5].

We published our most recent drought plan in April 2022, and this is reviewed regularly against any material change, and fully updated at least every 5 years.

Our plan achieves the 1 in 500 resilience level once the Fens Reservoir option comes online, and we discuss this further in section 11.12.

6.2 Deployable output

Available source output is limited by abstraction licences granted by the Environment Agency and constraints other than the licence limits which may restrict outputs for a given planning scenario. Further understanding the constraints on delivering this water into supply provides a total deployable output (DO) for our WRZ under observed conditions.

We have reviewed our existing licences and source outputs to determine if they are, or what proportion of the total volume, is sustainable with respect to WFD deterioration, and made adjustments as necessary as reductions to overall DO.

6.2.1 Method selection

The DO total used in the plan is an aggregate at the water resource zone (WRZ) level of the DOs derived from our source reliable output (SRO) study, which has been carried out in accordance with best practice techniques in the UKWIR handbook of source yield methodologies[6]. First carried out in 1997 and periodically updated to reflect changes to sources, the SROs for all sources were updated during 2012, and have been comprehensively reviewed again during 2017 with reference to the Environment Agency's 'Water resources planning tools', WR27[7].

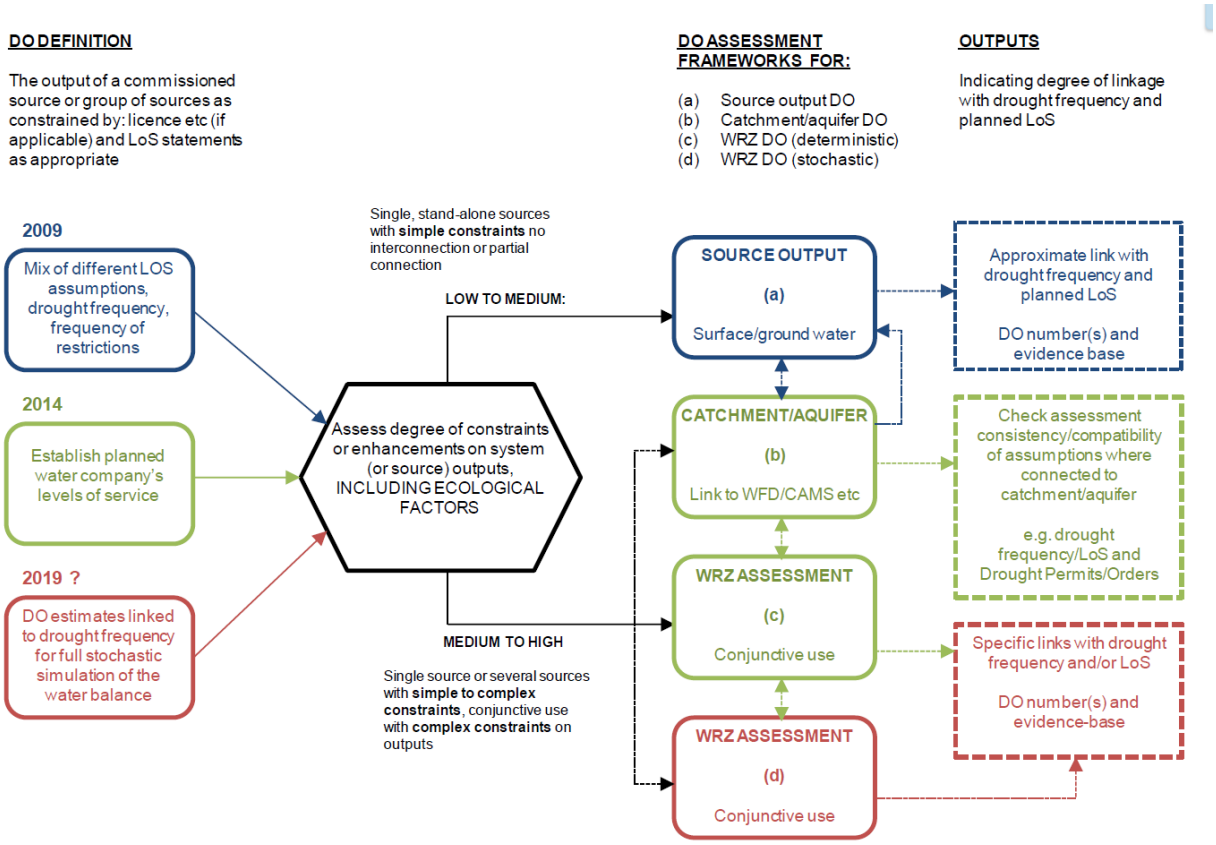
The SRO studies determine the quantity of water available from each of our sources to satisfy average and peak demands, under drought conditions. The DO from our sources has been assessed on a source output basis with reference to the appropriate UKWIR guidelines and is proportionate to the nature of our supply system and the risk to both supplies and the environment.

[5] https://www.cambridge-water.co.uk/media/3638/cambridge-water-final-drought-plan-2022.pdf

[6] 14/WR/27/7, 'Handbook of Source Yield Methodologies' (UKWIR, 2014).

[7] 'Water Resources Planning Tools 2012: Summary Report', 12/WR/27/6, UKWIR 2012.

Figure 6 UKWIR framework for groundwater source assessment



A source output approach assesses the maximum maintained output expected under drought conditions using water level and source output assessment to determine hydrological yield. The data used for this includes water levels and outputs recorded during the 1991/92, 1995/96 and 2005/06 dry periods. Our abstraction sources are standalone sources with limited connectivity and where there are multiple boreholes are considered as a single source for assessment purposes. In some cases, the output will be constrained by factors other than the hydrological yield, such as:

- Licence conditions, or other regulatory constraints – for example, the abstraction incentive mechanism (AIM). The AIM is an Ofwat mechanism to incentivise companies to reduce abstractions at environmentally sensitive sites, where no other mitigation is yet in place[8].
- physical limitations, such as aquifer properties.
- operational constraints, such as transfer ability, pumping plant, etc.
- Water quality or treatment constraints.

We regularly carry out a comprehensive review of reliable source capability and constraints which is reflected in our reported DO, in annual reviews and for the Peak Week Production Capacity value for our outage performance commitment.

6.2.2 Baseline deployable output results

The estimated DOs are shown in the following tables, together with those from the previous WRMP. Baseline licenced DO has increased from 99.1Ml/d in the 2019 plan to 102.7Ml/d for DYAA conditions, and from 118.3Ml/d to 138.1Ml/d for peak week conditions.

[8] 'Guidelines on the abstraction incentive mechanism', Ofwat, February 2016, www.ofwat.giov.uk/publications.

The changes to baseline licenced DO are due to WRMP19 options being completed and the deployable output available, capital investment at source works and treatment works to increase outputs, and as a result of our regular re-assessment of achievable outputs at sources. DOs for each of the individual sources within our WRZ are also listed in the Environmental Agency data table – '1. Base Year Licences'.

In addition, the following changes to our forecast DYAA DO have been applied to the baseline in the tables as sustainability changes;

- 6.46Ml/d of sustainability changes from our AMP7 agreed reductions for No Deterioration risk from 2025
- 2Ml/d of sustainability changes due to time limited licences not being renewed to prevent risk of deterioration
- 18Ml/d of additional sustainability changes to prevent risk of deterioration from 2031
- 35Ml/d of additional reductions for Environmental Destination from 2040.

Where there are treatment requirements where DO could be increased without environmental impact we have included these options within our feasible list of options for balancing supply and demand.

Table 13 Deployable output – dry year annual average conditions

Source name	WRMP19 Ml/d	WRMP24 Ml/d	Constraint	Deployable output following No Det cap
Abington Park	1.00	1.00	Annual licence	0.60
Babraham	7.17	7.17	Annual licence/ compensation flow conditions	4.45
Brettenham	8.25	8.25	Annual licence (from 2018)	8.44
Dullingham	3.6	3.6	DAPWL	1.65
Duxford Grange	2.88	2.88	BH performance DAPWL/drawdown	3.09
Duxford Airfield	4.56	4.56	Annual licence	2.25
Euston	8.00	8.00	Annual licence	4.17
Fowlmere	3.27	3.27	Annual licence	3.25
Great Chishill	1.06	1.06	DAPWL	1.06
Great Wilbraham	5.67	5.67	Annual licence	4.08
Heydon	1.13	1.13	DAPWL	0.97
Horseheath	1.80	1.7	DAPWL peak yield (as licence)	0.87
Linton	0.00	0	Licence HOF conditions	0.00
Lowerfield	3.40	3.4	Annual licence	3.09
Melbourn	7.20	7.2	DAWPL	6.11
Morden Grange	1.20	1.2	WFD no deterioration cap	0.95
Rivey	1.00	0.00	Licence HOF conditions	1.00
Sawston	1.49	1.49	Annual licence	0.98
Westley	10.60	10.6	Pump/network configuration	7.31
St Ives	0	1.5	Yield	1.5
Croydon	0	1.3	WFD no deterioration cap	1.01
Kingston	0	0.92	WFD no deterioration cap	0.92
Fulbourn	1.49	1.49	Annual licence	3.28

Weston Colville	2.92	2.92	DAPWL	
Hinxton Grange	5.77	5.77	Annual licence	5.23
Fleam Dyke 36	12.3	12.3	DAPWL	9.74
Fleam Dyke 12	3.27	3.27	Annual licence	
TOTAL	**99.12**	**102.74**		**76.0**

Table 14 Deployable output – critical period (peak weak)

Source name	WRMP19 Ml/d	WRMP24 Ml/d	Constraint
Abington Park	4.0	4.0	Licence
Babraham	7.17	7.17	compensation flow conditions
Brettenham	15.0	15.0	Licence
Dullingham	3.6	3.6	DAPWL
Duxford Grange	3.95	3.95	BH performance DAPWL/drawdown
Duxford Airfield	5.68	5.68	Licence
Euston	10.0	10.0	Licence
Fowlmere	5.40	5.40	Licence
Great Chishill	1.06	1.06	DAPWL
Great Wilbraham	9.09	9.09	Licence
Heydon	2.13	2.13	DAPWL
Horseheath	2.8	2.8	Licence
Linton	0.00	0	Licence HOF conditions
Lowerfield	4.27	4.27	Annual licence
Melbourn	7.20	7.20	Annual licence
Morden Grange	1.50	1.5	DAPWL
Rivey	1.00	0.00	Licence HOF conditions
Sawston	1.49	2.16	Licence
Westley	10.60	11.39	Licence
St Ives	0	4.5	Licence
Croydon	0	1.99	Licence
Kingston	0	1.18	Licence
Fulbourn	1.8	1.8	Licence
Weston Colville	2.92	2.92	DAPWL
Hinxton Grange	5.77	5.77	Licence
Fleam Dyke 36	12.7	12.7	Licence
Fleam Dyke 12	3.27	3.27	Licence
TOTAL	**118.31**	**138.10**	

6.3 Time-limited licences

Included in the assessment of DO above are a number of licences that have been time limited by the Environment Agency for future review. These have been considered for any risk that the time limits may pose to the availability of supplies. The details of this are presented below.

Table 15 Time-limited licences

Licence	Expiry	Details	Risk
Brettenham	March 2024	Reduction in temporary element of licence comprising 7.34Ml/d Annual average and 10Ml/d at daily peak	Previously the time-limited elements were expected to be renewed until 2027, following agreement with the environment agency, at the reduced volumes stated in our WRMP19 DO assessment, which included an annual total aggregate volume with Euston which represented a net reduction in annual licence. This was based on a WFD no deterioration licence cap advised by the EA at the time. Subsequent changes to the licence cap approach would not further reduce the temporary time limited element of this individual licence but would be included as future sustainability reductions for licence cap needs. The declared DO for this source is below the proposed cap that would be applied in 2030, or earlier on renewal, and therefore no further changes are required.
Euston	March 2024	Reduction in temporary element of licence comprising 2Ml/d annual average and 2.5Ml/d at daily peak	Previously the time-limited elements were expected to be renewed until 2027, following agreement with the environment agency, at the reduced volumes stated in our WRMP19 DO assessment, which included an annual total aggregate volume with Brettenham which represented a net reduction in annual licence. This was based on a WFD no deterioration licence cap advised by the EA at the time. Subsequent changes to the licence cap approach would remove the temporary time limited element of this licence (2Ml/d), as the proposed cap is less than the permanent element (6Ml/d). The reduction of the temporary element has therefore been included, as per EA guidance, for the time limited date in the baseline sustainability reductions to DO. The additional reduction to cap the permanent licence is included as future sustainability reductions for licence cap needs from 2031 when replacement supply options become available.
Fowlmere	March 2027	Increase in licence of 5.49Ml/d at annual average	We would need to submit a written environmental assessment of the impact of abstracting at the higher volumes and require written approval to abstraction taking place from the Environment Agency. Current rates of abstraction can continue and have been agreed with the Environment Agency as sustainable following completed NEP investigations. If the EA chose to cap the licence on renewal for No Deterioration, this would be a reduction of 0.35Ml/d. This has been included as a future sustainability reduction for licence cap needs.

6.4 Links to our drought plan

The DO presented in this plan is for source yields under dry conditions, assessed in accordance with UKWIR practice for groundwater sources and is constrained by various factors, including licence, treatment constraints, etc. Our design drought is based on actual data of the worst groundwater conditions observed in the historical groundwater record. Supply- and demand-side drought measures are not included in the DO, which is modelled as reliable under design drought conditions for which pump test data is available. This in most cases includes at least the 1991/92 drought sequence, the only occasion when we had to impose a temporary use ban (TUB), and all sources have been evaluated for worst case historical yield conditions. More than half of our available resource is constrained by licence and not hydrological yield and are therefore unaffected in drought conditions. See section 6 for a full explanation of how we calculated DO.

We are undertaking a review of our drought plan triggers and levels of service so that we can align more closely with the region is applicable and to apply more standard indices and indicators of drought. This will inform our next drought plan review, and accordingly update future WRMPs.

Following submission of our draft WRMP, we experienced a drought in 2022. As a result, we have undertaken a review of this drought and the lessons learned and included this as a new appendix, appendix R, to this revised draft WRMP.

6.4.1 Measures included within deployable output analysis for WRMP

The DO assessment does not include supply-side drought and demand-side drought measures, as the DO is modelling as the reliable source yield under design drought conditions. Drought measures included in the drought plan could have the effect of increasing supplies and reducing demands as they are implemented.

As per the guidance, we have included the benefits of drought measures that we regard as reasonable, under dry year conditions, from the drought measures appeals for restraint and temporary use bans. Non-essential use bans have not been included as these would be utilised only in a drought extending over 24-36 months and are less representative of typical single dry year conditions. We have also excluded extra promotion of water efficiency and additional leakage efforts as these may have more transient benefit through a full dry year and alongside our proposed WRMP demand management options.

Drought measures included in the drought plan are detailed in the following table.

Table 16 Drought measures included within the WRMP and drought plan

Drought measure	Supply-/ demand-side	Comments	Savings Ml/d
Extra promotion of water efficiency	Demand	Extra promotion of water efficiency, increased publicity	1
Appeals for restraint	Demand	Further enhanced publicity campaign	3
Increased leakage detection and repair	Demand	Yield dependant on conditions and leakage levels	2
Temporary use (hosepipe) ban	Demand	Yield estimated from UKWIR studies and previous historical experience	5
Non-essential use ban	Demand	Yield estimated from UKWIR studies	5
Rota cuts	Demand	Civil emergency measure only	n/a

The balance of available resources, with savings and additional yields is more than sufficient to counter the expected yields at sources under more severe drought conditions, supporting our chosen levels of service.

We have no drought permits in our current drought plan and only an Ordinary Drought Order for a non-essential use ban (NEUB), which would be implemented in a three dry winter drought sequence. This is not included in the WRMP DO assessments or the baseline supply/demand balance.

6.4.2 Additional measures within our drought plan

There are no additional measures within the drought plan.

6.4.3 Determination of extreme droughts

The government and regulators have asked water companies to consider how to increase the resilience of public water supplies to future drought conditions. For our WRMP19 we assessed our resilience to 1 in 200 drought return events or 0.5% chance per year without requiring severe restrictions such as rota cuts. For the WRMP24, we are required to reduce the chance of severe restrictions to 1 in 500, or a 0.2% chance per year, by 2040.

This requirement will mean more investment in supply sources in the future. Our planned proposals for developing Fens Reservoir, will include resilience for this resource to 1 in 500, and our existing groundwater resource shave been assessed for 1in 500, alongside our climate change assessment of impact to deployable output at the source level.

Our assessment of the impact of 1 in 500 drought on our baseline supply resource position in included alongside our climate change impact assessment in section 6.6. We have applied the same stochastic approach to determine impact, this also aligns regional planning approaches.

6.4.4 Assessment of resilience in base year

We have evaluated our resilience to drought based on resources and forecast demands for a dry year for the 2017/18 base year. We have considered five historic drought scenarios over the period 1920 to 2011, and a further scenario that has been created using a stochastic modelled synthetic dataset, to consider extreme droughts with a greater severity, for up to a 1 in 500-year event.

There is marginal difference between historic design droughts and more severe modelled events, and the supply/demand balance remains in surplus for the base year when drought measures are applied.

6.5 Outage

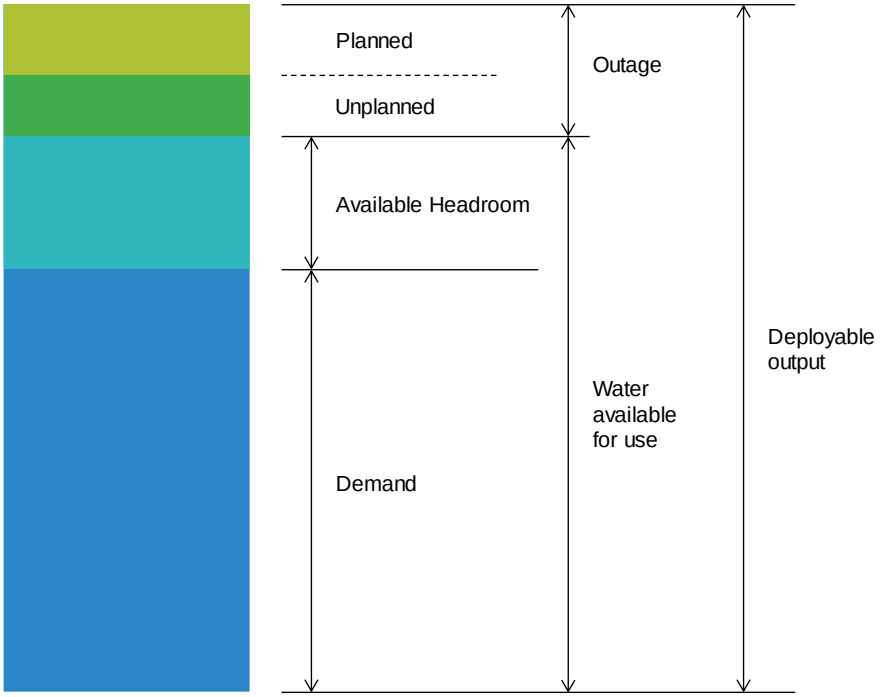
Within our WRMP we must include an assessment of outage, which is to accommodate potential short-term or temporary loss of the amount of water available for supply.

Outage is defined as a temporary loss of DO because of:

- planned maintenance and capital work (planned outage); or
- unforeseen events such as power failure, source pollution or system breakdown (unplanned outage).

The outage allowance is calculated according to a standard methodology developed and published by UKWIR[9] and in accordance with the expectations of the Environment Agency guidance[10]. We have also reviewed our approach against the latest EA supplementary guidance.[11]

Figure 7 Context of outage in the supply/demand balance



The 1995 methodology advocates the use of a probabilistic approach, based on Monte Carlo analysis. The analysis for all identified outage events and combining these to give an overall probability distribution for the outage allowance.

Historic events have been analysed and included from 2001 to 2021. The list of events was first reviewed to identify if events were legitimate outages. Non-legitimate events have been excluded from the data. Improvements in the quality of data from 2012 led to events before this time being excluded from the data analysis. The data were then grouped by source and by category and categorised as planned or unplanned events. The events were also reviewed to ensure that where two or more events were recorded as occurring at the same time and the same site, these were only counted as one event.

Events at sources no longer in supply were excluded to avoid overestimating overall magnitude (if DO has decreased) and prevent any bias in the outage calculation. Where capital investment has been made to reduce the likelihood of outage, or remove the possibility, these events are also excluded or adjusted as appropriate. Duration distribution was also adjusted to account for likely reductions to planned outages that would occur during a dry year scenario. Sensitivity analysis of the results was undertaken, and adjustments made as required. The methodology and results of the outage assessment are in Appendix E.

[9] 'Outage Allowances for Water Resource Planning', UKWIR/Environment Agency, March 1995.

[10] 'WRMP19 methods: outage allowance', Environment Agency, July 2016.

[11] 2021 03 16 WRMP24 SG - Outage

6.5.1 Outage results

The results of the outage assessment are presented in the table below, for both average and peak demand conditions. The results have been calculated from simulations using 10,000 iterations; this is deemed sufficient to ensure repeatability of the results in the analyses.

The results of both analyses are presented as Ml/d of our DO for various percentiles of risk.

Table 17 Outage assessment results

Percentile	DYAA outage (Ml/d)	DYCP outage (Ml/d
70%	4.9	3.2
80%	6.0	3.5
90%	8.0	4.1
95%	9.6	4.6

For WRMP19, the 70th percentile values for outage at both DYAA and DYCP were considered to be the most appropriate for capturing a suitable level of risk to our water supply availability to protect our level of service. For this WRMP, we have continued to use the 70th percentile.

The corresponding Baseline values for DYAA and DYCP outage are 4.9Ml/d and 3.2Ml/d respectively; these have been entered into the WRMP tables.

6.5.2 Reducing future outage

As part of our PR24 business plan development, we will include programmes of work that will improve the condition of our assets, make treatment processes more reliable, and increase the resilience of key assets within our network. Through this programme of capital maintenance, enhancements, resilience and water quality improvements, we will be making our assets more reliable and reducing the risk of their failure.

Some key areas we are proposing in our PR24 plan include:

- Increased borehole survey and maintenance programme
- Upgrades to treatment capacity and standards at several borehole sites
- Run to waste schemes at sites to reduce downtime.

Due to challenges with outage in AMP7, we have also updated our unplanned outage policy as part of our drought review process. We have introduced a traffic light system for outages that relates directly to the water resource position and demand levels:

- Green – water resources and demand are normal; unplanned outage to be responded to next working day.
- Amber – water resources are below average or demand is above average; unplanned outage to be responded to same day.
- Red – water resources are below average and we are below the drought monitoring curve; unplanned outage must be responded to within 2 hours.

These actions combined will help to reduce our planned and unplanned outage levels.

6.6 Climate change

We have assessed the impact of climate change on our future supplies. Our assessment follows the Environment Agency (2017) method, 'Estimating the impacts of climate change on water supply', as this is most appropriate to the supply system, vulnerability and available modelling tools. We have reviewed the methods against the Planning Guidelines supplementary documents on climate change[12] and 1 in 500 droughts.[13]

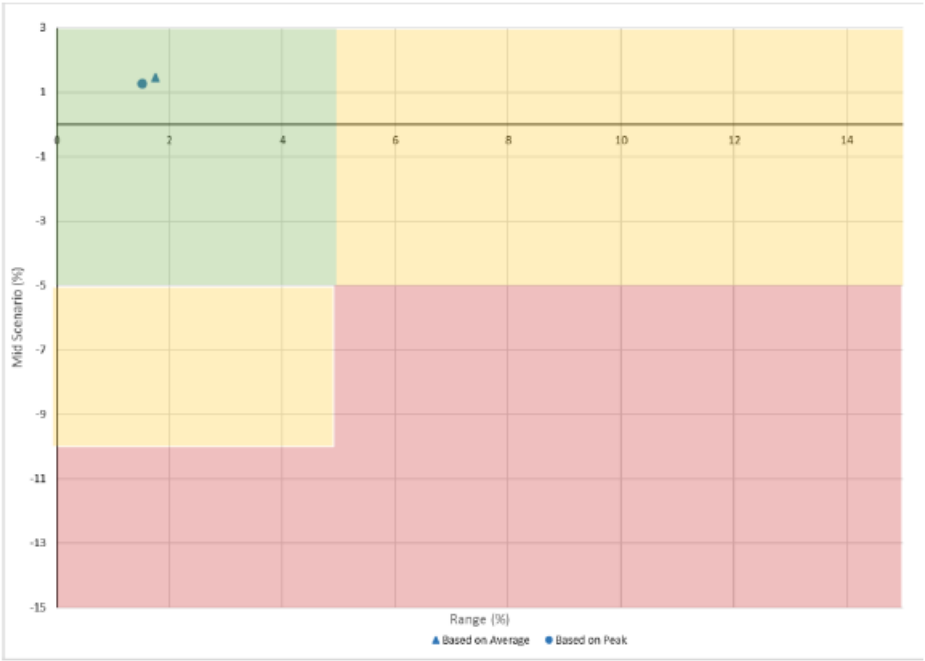
6.6.1 WRZ Vulnerability Assessment

The CAM WRZ was assessed for vulnerability to climate change for WRMP19, and the magnitude of vulnerability to climate change scenarios has not changed. This approach is detailed in an Appendix to WRMP19, Appendix M – CWC CC_Review_v3, available on request and the results presented below.

The vulnerability assessment is determined by reference to a vulnerability scoring matrix, set out in the guidance, which assesses magnitude vs sensitivity. We have assessed on a source-by-source basis as well as at the water resource zone (WRZ) level. The overall vulnerability of the CAM WRZ is categorised as low.

Figure 8 Magnitude versus sensitivity plot for the CAM WRZ, calculated two different ways

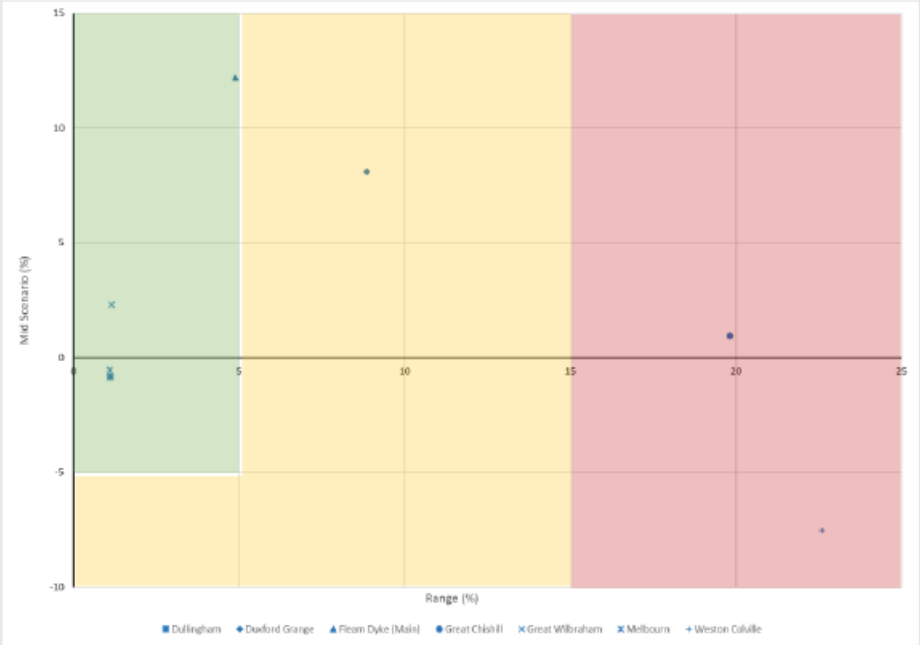
Uncertainty range (% change wet to dry)	Mid scenario (% reduction in DO)		
	<5%	>5%	>10%
<5%	Low	Medium	High
6 – 10%	Medium	Medium	High
11 – 15%	Medium	High	High
>15%	High	High	High



[12] 210318 WRMP24 SG - Climate Change

[13] 2021 03 22 WRMP24 SG - 1 in 500

Figure 9 Magnitude versus sensitivity plot for the CAM WRZ for sources identified as vulnerable



Of the 28 sources assessed for vulnerability to climate change, seventeen have been identified where climate change may impact the water levels and therefore the potential yield of the source. These sources were taken forward for further climate change assessment. Of these, thirteen sources could be constrained by climate impacts over and above other physical, or licence constraints to deployable output. These sources are also those that demonstrate the most vulnerability during low groundwater level conditions and have hydrogeological constraints on yields during 1 in 500 drought events. The potentially vulnerable sources are Dullingham, Duxford Airfield, Fleam Dyke 35 and 12, Fulbourn, Great Chishill, Heydon, Horseheath, Melbourn, Mordern Grange, Westley and Weston Colville.

6.6.2 Details of assessment

The Environment Agency methodology[14] includes a tiered approach to estimate the impact of climate change based on the basic vulnerability classification of each resource zone. Under the methodology a WRZ with a low vulnerability to climate change impacts requires a tier 1 analysis using future flows hydrology monthly change factors. This simple approach to assessing the impact of climate change on groundwater could be used for the CAM WRZ.

We have revised and updated the methodology to include the impact of climate change, 1 in 200 and 1 in 500 droughts on deployable output at source level, based on a tier 2 approach. Our approach meets some tier 3 analysis criteria as defined in the guidance. To predict the effect of climate change on groundwater levels, we developed a model to simulate yearly groundwater level minima, depending on the amount of recharge to the groundwater and the change in groundwater levels.

Since WRMP19 we have revised our approach to take account of updated data, and to align with the approach applied for Water Resources East in the regional simulator. We have used AquiMod groundwater models for each source and simulated loss of yield at vulnerable sources using MET office stochastic rainfall and PET datasets. The climate data used from the MET office was provided through WRE and is therefore consistent with the regional plan approach. This uses the latest climate change projections from UKCP18.

To undertake the impact analysis, Met Office stochastic climate data was used in a British Geological Survey AquiMod model to generate ground water levels under drought conditions, and the same approach applied to climate change under four different future climate change scenarios. The generated groundwater levels were then

[14] Environment Agency; GEHO0612BWPE-E-E, June 2012.

applied to the source reliable output yield diagrams to assess the predicted change in yield as groundwater levels decline. These scenarios are outlined in the table below.

Table 18 Climate change scenarios

Climate Scenario	Warming level in degrees Celsius
Future\wl123 (climate change)	1.23
Future\wl187 (climate change)	1.87
Future\wl284 (climate change)	2.84
Future\wl349 (climate change)	3.49

The BGS AquiMod model simulates a time series of groundwater levels at a location using rainfall, recharge and potential evapotranspiration data, and is calibrated against actual observed groundwater levels. The model also considers rainfall and soil moisture deficit (SMD), which has a direct correlation with temperature. The results take a worst-case view of the impact in the 2080s. The approach applied is detailed in appendix D.

6.6.3 Assessment results

The results of our climate change assessment on the most vulnerable sources indicate that of a total impact on DO of 10-16%, this is dominated by 3 individual sources. Note that the impact of long-term climate change is less than the shorter term impact of proposed sustainability changes discussed later in section 6.9. We have scaled the impact in the 2080s from climate change using the Environment Agency guidance[15] and applied this to the tables as an annual adjustment to deployable output.

Table 19 Impact of climate change and drought scenarios

DO Loss Ml/d						
	Average (with constraints)			Average (DO from SROs)		
Source (ABH)	1:200	1:500	CC	1:200	1:500	CC
Dullingham	0.2	0.3	0.4	0.2	0.3	0.4
Duxford Airfield	0.0	0.0	1.6	0.0	0.0	1.6
Duxford Grange	0.0	0.0	0.0	0.0	0.0	0.1
Fleam Dyke (12”)	0.4	0.5	0.6	0.2	0.2	0.3
Fleam Dyke (main)	0.6	0.6	0.9	0.6	0.6	0.9
Fowlmere	0.0	0.0	0.0	0.0	0.0	0.0
Fulbourn	0.1	0.2	0.4	0.3	0.4	0.6
Great Chishill	0.2	0.1	0.2	0.2	0.1	0.2
Great Wilbraham	0.0	0.0	0.0	0.0	0.0	0.0

[15] Environment Agency, ‘Water resources planning guideline: Interim update’, April 2017.

Heydon	0.0	0.2	0.7	0.0	0.2	0.7
Horseheath	0.0	0.0	0.3	0.0	0.0	0.8
Kingston	0.5	0.5	0.7	0.5	0.5	0.7
Lowerfield	0.0	0.0	0.0	0.0	0.0	0.0
Melbourn	2.0	2.2	2.7	2.0	2.2	2.7
Morden Grange	0.0	0.1	0.3	0.3	0.4	0.6
Westley	3.8	4.2	4.9	4.5	4.9	5.7
Weston Colville	0.9	0.9	1.1	0.9	0.9	1.1
Total DO loss	**10.3**	**11.4**	**16.5**	**11.4**	**12.5**	**18.2**
Baseline DO (Ml/d)	**102.9**	**102.9**	**102.9**	**113.1**	**113.1**	**113.1**
% DO loss	**10.0%**	**11.1%**	**16.1%**	**10.1%**	**11.0%**	**16.1%**

It is worth noting that in our preferred plan, the licence reductions included for no deterioration will, once in effect, remove the impact of climate change at these groundwater sources, as they will become licence constrained and not yield constrained which is impacted by climate change. New options that have been proposed have 1:500 resilience built into the declared yields and will be further assessed for climate change impacts in future plans.

6.7 Water transfers

We will always endeavour to utilise transfers or bulk trading of water resources where it is the most cost-effective and efficient means of ensuring robust water resources for supply to our customers, and where appropriate, those customers of neighbouring water companies.

6.7.1 Raw water and non-potable water transfers

We have no raw or non-potable transfers into our supply system, nor do we provide any raw or non-potable exports. Three of our source works abstract raw water for transfer to other treatment locations a few kilometres away through dedicated trunk mains. None of these transfers return any raw water to the environment, and therefore pose no risk for the transfer of invasive non-native species (INNS).

6.7.2 Potable water transfers

We currently have a number of cross-border metered supplies with Anglian Water and with Affinity Water both into and out of our area of supply. These serve small numbers of properties only, and are either operated under formal agreement, or under the terms of a standard commercial supply. The volumes concerned are small and do not significantly impact on the overall supply/demand balance. Nevertheless, these are included in our calculations.

The volume associated with these supplies is less than 1Ml/d and has been included in the water resources planning tables.

Table 20 Potable water transfers

Name & type	Volume agreed Ml/d	Receiving/donor Co.	Transfer limits Ml/d	Description/Notes

Odsey (import)	Demand based – typical 0.05	Affinity	0.5	Cross border supply
Hadstock (Export)	Demand based – typical 0.37	Affinity	1.0	Cross border supply
Earith Bridge (import)	Demand based – typical 0.01	Anglian	0.5	Cross border supply
Barnham X (Export)	Demand based – maximum 0.25	Anglian	0.25	Limited in agreement
Swaffham (export)	Emergency only 2.5	Anglian	2.5	Emergency only by agreement

Our plans propose a number of new transfer options, the details of these are in our options and preferred plan sections.

6.8 Treatment works losses and operational use

This component is required to calculate usage included in deployable outage that is not supplied into the distribution network as a result of it being used in treatment processes. This is typically discharged into surface water courses or into the main sewer.

The majority of our sources have very minor losses because of the volume of water passing through monitors and for water quality sampling as the treatment process is relatively simple and does not use much water. The exception is at ion exchange treatment plants used to remove nitrates, where the losses are measurable.

In our 2016 review of site losses, we used representative sample sources to derive typical values. Treatment works are classed as ‘simple’, ‘complex’, or ‘no treatment’. Typical TWOU losses for a complex site range between 0.29%–0.47%, and on average 0.38% of the normal site total DO. Of the total volume, losses attributable to treatment process at sources without ion exchange treatment – ‘simple’ treatment works – account for 0.003Ml/d.

A total TWOU allowance of 0.16Ml/d has been included in the supply forecast, of which 0.11Ml/d is from complex sites and 0.05Ml/d from all other sources (simple and no treatment).

6.9 Reductions in deployable output

6.9.1 Options to reduce outage

Our approach is to minimise the potential for and impact from unplanned and planned outages at sources through an effective capital maintenance strategy, and mitigation measures such as dual validation, duty/standby arrangements and standby power generation. A significant programme of investment will be completed during AMP7 involving refurbishment at the majority of source works, re-commissioning of sources out of use and upgrades

to new control and monitoring technologies. This will enhance reliability moving forward and improve unplanned outage performance. Planned outages required for major refurbishment works will also reduce overall.

Since publishing our draft WRMP for consultation we have reviewed the work we will complete during AMP7 and more fully incorporated the impact of this on our forecasted future overall outage performance. As a result, we have set our outage risk to the 70%ile to reflect this position in our preferred plan.

We will also continue to manage our forward capital programme to ensure planned works do not present an unacceptable risk to overall supply availability and all capital works aim to ensure robust operating processes going forwards to minimise unplanned outage. Accordingly, we have not included details of specific options to target a reduction in outage in the feasible list of options within this plan. These will be included in our overall PR24 plans for asset maintenance and borehole resilience schemes. We review our outage annually against our forecast through the WRMP annual review process.

6.9.2 Sustainability changes

We are committed to ensuring that our abstractions are sustainable and to minimise the impact from our operations on the environment. Where our abstractions may have an impact on environmentally sensitive sites or water bodies, then we work together with the Environment Agency to determine if there is an impact, and to identify any measures required to implement a solution.

To protect designated sites under the Habitats Directive and the Wildlife and Countryside Act, and sites such as Sites of Special Scientific Interest (SSSIs), Biodiversity Action Plan sites (BAPs) or locally important sites such as Local Nature Reserves (LNRs), and to deliver WFD or River Basin Management Plan (RBMP) objectives, the Environment Agency may require sustainability reductions to our abstraction licences.

The EA are also reviewing all abstraction licences for the Restoration of Sustainable Abstraction, for the requirements of the environment under the Water Framework Directive, to achieve good ecological status of all waterbodies and to prevent further deterioration from current status.

Our preferred WRMP delivers a demand reduction programme that delivers water savings that exceed the increase in demand proposed from the forecasted growth. This offsetting means there is no baseline increase in demand which means there will be no increase in abstraction due to growth. As a result, there is no additional risk of deterioration.

6.9.3 AMP7 No Deterioration and Implementation

We have included, as per WRMP19 and WINEP investigations, agreed sustainability changes of 6.46Ml/d to be implemented in AMP8 from 2025, based on the previous methodology of determining the no deterioration baseline for WFD. These are included in our baseline deployable output.

Our AMP7 WINEP programme of work included investigations into all of our existing licences to understand the risk of deterioration of the environment at existing levels of abstraction and for increases to fully licenced volumes, using the EA revised methodology (April 2022). These assessed the impact of groundwater abstractions on a source-by-source basis on both surface water bodies, for flow and ecology and the potential impact on groundwater levels where this may impact on base flows at sensitive sites, such as wetlands and chalk river headwaters.

These investigations have been completed and so we have included sustainability changes to account for the licence reductions associated with these investigations from the end of AMP8, in 2030, in this revised draft WRMP. The sustainability changes that we have included are in the baseline deployable output, as directed by the Environment Agency.

6.9.4 Time limited licence No Deterioration changes

Of the three time limited licences that we have for renewal in the planning period, two have caps to annual volumes within the time limited element of the licence as assessed by the Environment Agency's revised methodology for licence caps to prevent deterioration. As advised by the Environment Agency, we have included these reductions in the year of time limit expiry as the intention would be to revoke the licence to protect against risk of deterioration. These occur in 2024 and 2027 for Euston and Fowlmere respectively and are for 2.0Ml/d and 0.35 Ml/d.

6.9.5 No Deterioration changes – licence caps

The EA have informed water companies that licences will be capped against a historic reference period based on the level of environmental risk and provided us with their assessment of our licences. Licence capping can be made on a 'max historic peak' value for the historic period or an 'average' for the historic period depending on environmental status, risk and expected growth. The EA expectation is that these changes will be made in AMP8, by 2030, and that they would take the opportunity to change any licences that come up for renewal before that time.

We have used the EA assessment of historic baseline to inform the no deterioration licence changes expected in 2030 and have applied these licence cap figures and adjusted for deployable output impacts where applicable. With the earlier reductions to time limited licences, and for WRMP19 caps, this is an additional reduction of 18.02Ml/d. Therefore by 2030 we are forecasting licence capping for deterioration risk to total 26.83Ml/d.

We have estimated the earliest date that caps can be made at each source, and the deployable output may be further reduced from the capped licence volume because of dry year restrictions, such as groundwater impacts on yields, or licence conditions.

These licence caps have been shared with Board throughout the WRMP planning process and our approach to licence capping shared as part of the revised draft WRMP submission approval on 28th September 2023.

Table 21 Impact of Licence Capping on Deployable Output

Source name	Licence Reduction	DYAA Deployable output following No Deterioration cap	Catchment	Expected date implemented
Abington Park	0.40	0.60	Cam & Ely Ouse: Cam Rhee & Granta	2031
Babraham	2.72	4.45	Cam & Ely Ouse: Cam Rhee & Granta	2031
Brettenham	2.90	8.44	Cam & Ely Ouse: Little Ouse & Thet	2024
Dullingham	2.85	1.65	Cam & Ely Ouse: Cam Lower	2031
Duxford Grange	0.32	3.09	Cam & Ely Ouse: Cam Rhee & Granta	2025
Duxford Air	2.31	2.25	Cam & Ely Ouse: Cam Rhee & Granta	2031
Euston	3.83	4.17	Cam & Ely Ouse: Little Ouse & Thet	2024/2031
Fowlmere	0.35	3.25	Cam & Ely Ouse: Cam Rhee & Granta	2027
Gt Chishill	0	1.06	Cam & Ely Ouse: Cam Rhee & Granta	2025
Gt Wilbraham	1.59	4.08	Cam & Ely Ouse: Cam Lower	2031
Heydon	0.16	0.97	Cam & Ely Ouse: Cam Rhee & Granta	2025
Horseheath	1.43	0.87	Cam & Ely Ouse: Cam Rhee & Granta	2031
Linton	0.45	0.00	Cam & Ely Ouse: Cam Rhee & Granta	2031

Lowerfield	0.32	3.09	Cam & Ely Ouse: Cam Rhee & Granta	2031
Melbourn	1.83	6.11	Cam & Ely Ouse: Cam Rhee & Granta	2031
Morden Grange	1.32	0.95	Cam & Ely Ouse: Cam Lower	2025
Rivey	0.19	1.00	Cam & Ely Ouse: Cam Rhee & Granta	2031
Sawston	0.51	0.98	Cam & Ely Ouse: Cam Rhee & Granta	2031
Westley	4.08	7.31	Cam & Ely Ouse: Cam Lower	2031
St Ives	0	1.5	Cam & Ely Ouse: Ouse Upper & Bedford	n/a
Croydon	0.98	1.4*	Cam & Ely Ouse: Cam Rhee & Granta	2031
Kingston	0.07	0.92	Cam & Ely Ouse: Cam Lower	2031
Fulbourn	1.44	3.28	Cam & Ely Ouse: Cam Lower	2025
Wexton Colville			Cam & Ely Ouse: Cam Lower	2031
Hinxton Grange	0.54	5.23	Cam & Ely Ouse: Cam Rhee & Granta	2031
Fleam Dyke 36	6.23	9.74	Cam & Ely Ouse: Cam Lower	2028
FLeam Dyke 12			Cam & Ely Ouse: Cam Lower	2028
TOTAL	**35.7**	**76.0**		

*Variation as agreed with EA

6.9.5.1 Implications of these licence caps

The application of licence caps to prevent deterioration is being applied as soon as practicable, and prioritised on a risk bases for the surface water bodies where impact of deterioration could be the most serious. This is based on some modelling work we have undertaken to understand the impact of various scenarios, and we discuss this in more detail in the section below and section 11.7.

Our demand management programme offsets any potential increases to growth up to 2045 but cannot close the substantial gap left in our supply availability following application of these licence caps. All of the proposed licence caps can be accommodated upon the availability of the Grafham transfer supply option in 2031 and further supported by Fens Reservoir in 2036. As the Grafham transfer can be made available sooner than Fens Reservoir this is selected in our preferred plan for a five-year period until Fens Reservoir can supply additional resources. More detail on these options and their selection in our plan can be found in section 9.5 and 11.4.

The costs of these options are detailed in section 11.4 and the WRMP data tables, and the bill impacts for customers are shown in section 11.14.

6.9.5.2 Assessment by source

We have undertaken additional scenario analysis, as agreed with the Environment Agency, to review the robustness of our plan to changing circumstances, and then modelled the risk to the environment as a result under various abstraction scenarios.

Increased abstraction from the baseline period can increase the risk of deterioration risk classification, however our preferred plan does not propose to increase abstraction, so and changes to classifications are influenced by other abstraction or historic increases. The modelling indicates that Cat Ditch, Cam (Stapleford to Hauxton Junction), Cam (Audley End to Stapleford), Sapiston River and Little Ouse (Hopton Common to Sapiston) are sensitive to the abstraction scenarios modelled.

Demand management and the use of drought measures delivers demand reductions more than expected increases to baseline demand. Material increases to expected abstractions are only required in scenarios where demand management is 50% effective. The delivery of demand management is not considered to be exceptionally uncertain, and uncertainty is already included in our headroom sensitivity for demand measures, so this scenario is considered very unlikely. Our preferred WRMP delivers water savings that exceed the increase in demand proposed from the forecasted growth offsetting increased need for abstraction due to growth until 2045 and therefore there is no additional risk of deterioration, and there is no difference to the classifications for the reduced demand management effectiveness scenario for any water bodies.

The modelling results show that for many sources there is no or little risk of deterioration in all these scenarios, and the sensitivity to increased abstractions and change in risk classification is being driven by other abstractors where these abstractions have had to be modelled at higher future predicted rates than would be expected. The report on the additional modelling to inform deterioration risk is in appendix S and the summary table is shown below.

Table 22 Deterioration risk classifications for additional modelling work

Deterioration Risk									
Waterbody	WRMP 2030 (S27)	WRMP 2030 50% (S28)	WRMP 2036 (S29)	Current (S30)	WRMP 2030 peak (S31)	WRMP 2030 50% peak (S32)	WRMP 2036 peak (S33)	Current peak (S34)	All Peak (S35)
Rhee (DS Wendy)	Low risk	Low risk	Low risk	No risk	Low risk	Low risk	Low risk	No risk	Medium risk
Hobson's Brook	Low risk	Low risk	No risk	Low risk	Low risk	Low risk	No risk	Low risk	High risk
Millbridge and Potton Brooks	Low risk	Low risk	Low risk	No risk	Low risk	Low risk	Low risk	Low risk	Medium risk
Mill River	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Medium risk
Mel	Low risk	Low risk	Low risk	No risk	Low risk	Low risk	Low risk	No risk	Medium risk
Shep	Low risk	Low risk	Low risk	No risk	Low risk	Low risk	Low risk	No risk	Low risk
Rhee (US Wendy)	Low risk	Low risk	Low risk	No risk	Low risk	Low risk	Low risk	Low risk	Low risk
Soham Lode	No risk	No risk	No risk	No risk	Medium risk	Medium risk	Medium risk	Medium risk	Medium risk
Cherry Hinton Brook	No risk	No risk	No risk	No risk	No risk	No risk	No risk	No risk	Low risk
Bourn Brook	No risk	No risk	No risk	No risk	No risk	No risk	No risk	No risk	Low risk
Bottisham Lode - Quy Water	Medium risk	Medium risk	No risk	Low risk	Medium risk	Medium risk	No risk	Low risk	High risk
Swaffham - Bulbeck Lode	Medium risk	Medium risk	No risk	Low risk	High risk	High risk	Low risk	Low risk	Medium risk
Cam	No risk	No risk	No risk	No risk	No risk	No risk	No risk	No risk	No risk
New River	Low risk	Low risk	No risk	Low risk	High risk	High risk	Medium risk	Medium risk	High risk
Wendon Brook	No risk	No risk	No risk	No risk	No risk	No risk	No risk	No risk	No risk
Cat Ditch	High risk	High risk	High risk	No risk	High risk	High risk	High risk	High risk	High risk
Granta	Medium risk	Medium risk	Low risk	Medium risk	Medium risk	Medium risk	Low risk	Medium risk	High risk
Hoffer Brook	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
Stour (u/s Wixoe)	Low risk	Low risk	Low risk	Medium risk	Medium risk	Medium risk	Medium risk	Medium risk	Medium risk
Tributary of Cam	No risk	No risk	No risk	No risk	No risk	No risk	No risk	No risk	No risk
Cam (Stapleford to Hauxton Junction)	High risk	High risk	Medium risk	No risk	High risk	High risk	Medium risk	Low risk	High risk
Cam (Audley End to Stapleford)	High risk	High risk	High risk	No risk	High risk	High risk	High risk	Low risk	High risk

Waterbody	WRMP 2030 (S27)	WRMP 2030 50% (S28)	WRMP 2036 (S29)	Current (S30)	WRMP 2030 peak (S31)	WRMP 2030 50% peak (S32)	WRMP 2036 peak (S33)	Current peak (S34)	All Peak (S35)
Thet (DS Swangey Fen)	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
Sapiston River	Low risk	Low risk	Low risk	Medium risk	High risk	High risk	High risk	Low risk	High risk
Little Ouse (Sapiston Confluence to Nuns' Br)	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
Little Ouse (Hopton Common to Sapiston Confl)	Medium risk	Medium risk	Medium risk	Low risk	High risk	High risk	Medium risk	High risk	High risk

As a result of this analysis, our plan looks to delay a proportion of these licence caps, equating to circa 12.5 Ml/d of DO reduction, until the Grafham transfer is in place in 2031 as detailed in table 21 above.

6.9.6 Other changes to deployable output

We have not included any further changes to DO.

6.10 Changes since WRMP19

The table below details the changes we have seen in some of our key planning components between our final WRMP19 plan and the baseline for our WRMP24 plan. It outlines any difference in values for 2025 in the WRMP24 plan compared to this year in the WRMP19 plan and the reasons behind these differences.

Table 23: Differences between WRMP19 final plan and WRMP24 baseline

Key component	WRMP19 (Final Plan) 2025/26 (Ml/d)	WRMP24 (Baseline) 2025/26 (Ml/d)	Difference (Ml/d)	Explanation for differences
Company Supply Demand Balance	-3.59	-7.07	-3.48	Revised demand forecast using new growth projections. Updates and use of more recent data for water balance, supply and demand components used in forecasts.
Deployable Output	99.12	102.74	3.62	Impact of AMP7 supply side options being brought online
Climate change impact	-0.61	-0.89	-0.28	Updated datasets using latest stochastics
Sustainability Reductions (WINEP/ Licence capping)	-6.46	-8.46	-2.00	Additional time limited licence cap has been included
Environmental Destination	0	0	0	Environmental destination was not a requirement at WRMP19
1-in-500 resilience impact	0	0	0	Achieving 1 in 500 year drought resilience was not a requirement at WRMP19
Household demand	50.06	53.29	3.23	Revised demand forecast using new growth projections
Non-household demand	21.47	28.64	7.17	Revised demand forecast using new growth projections. Cambridge had significant growth in NHH during Covid due to increased biomedical and research activities

Target Headroom	3.39	3.26	-0.13	Updated using latest data and risk approach aligned to regional WRE approach
Outage	4.80	4.90	0.10	Updated using latest data
Process losses	0.16	0.16	0	n/a
Distribution Input	82.24	91.58	9.34	Revised demand forecast using new growth projections and increase in NHH demand observed in AMP7. Updates and use of more recent data for water balance and demand forecasting

6.11 Environmental Destination

The national framework for water resources sets out the ambitions for a future environmental destination, with different proposed levels of improvement, protection and enhancement of the environment. These scenarios look at measures required to achieve improved flows in water bodies, and good ecological status of all water bodies, designated sites and Chalk Rivers. There is some uncertainty associated with the abstraction reductions required for the various scenarios, and this will be investigated in AMP8 through the WINEP. We have adopted the environmental destination scenarios and calculated likely sustainability changes through a common approach used for WRE, so that all companies in the region plan in a consistent way.

Table 24 Environmental destination scenarios

Scenario	Description
BAU	Support the recovery of degraded rivers and water-dependent environments to meet existing targets and prevent further deterioration ('BAU') Achieve sufficient flows in waterbodies to support 'Good' ecological status under the Water Framework Directive (WFD), apart from waterbodies considered uneconomic to improve within River Basin Management Plans (RBMPs).
BAU+	Secure the resilience of internationally important habitats As 'BAU', with extra protection for European Protected Sites.
ENHANCE	Enhance the region's headwaters, chalk rivers and nationally important habitats ('Enhance') Achieve flows to support 'Good' in all waterbodies including those considered uneconomic within RBMPs. Extra protection for European Protected Sites. Enhanced protection for chalk streams, sensitive headwaters and SSSIs.

Our regulators have an expectation that BAU+ is the minimum improvement for the environment required by 2050, and it is this scenario that we have included in our baseline DO sustainability change adjustment. As this will require significant reductions in abstraction and substantial new investment in alternative water resources, this is driving supply side options at the regional scale such as Fens Reservoir.

Table 25 Environmental Destination summary licence reductions

	BAU	BAU+	ADAPT	ENHANCE
Remaining licence Ml/d	51.8	40.9	40.8	42.8
Reduction %	55	64	64	63
Reduction to DO Ml/d	24.1	35.0	35.2	33.2

The methodology for calculating likely reductions has been developed for WRE. We have included the minimum BAU+ reduction of 35.0 Ml/d from 2050 in our planning scenario – this is in addition to the licence capping for no deterioration risk applied by 2030.

Table 26 Environmental Destination licence reductions by source

	Expected DO post licence changes			
Licence	**BAU**	**BAU+**	**ADAPT**	**Enhance**
ABINGTON PARK	0.60	0.00	0.60	0.60
BABRAHAM	3.18	1.91	1.91	1.91
BRETTENHAM	8.44	4.64	4.64	4.64
DULLINGHAM	1.32	0.00	0.00	0.00
DUXFORD GRANGE	3.07	3.07	0.68	0.68
DUXFORD AIR	0.00	0.00	2.25	2.25
EUSTON	4.17	3.75	3.75	3.75
FOWLMERE	3.08	3.08	3.25	3.25
GT CHISHILL	0.00	0.00	0.00	0.00
GT WILBRAHAM	0.00	0.00	0.00	0.00
HEYDON	0.97	0.00	0.00	0.00
HORSEHEATH	0.46	0.46	0.46	0.46
LINTON	0.00	0.00	0.00	0.00

LOWERFIELDS	3.41	3.41	3.41	3.41
MELBOURN	6.11	5.20	6.11	6.11
MORDEN GRANGE	0.34	0.34	0.34	0.34
(RIVEY HILL)	0.42	0.42	0.42	0.42
SAWSTON	0.59	0.59	0.98	0.98
WESTLEY	4.02	4.02	0.00	0.00
ST IVES	1.62	1.62	1.62	1.62
CROYDON	0.78	0.85	0.85	0.85
KINGSTON	0.92	0.55	0.92	0.92
FULBOURN & WESTON COVILLE	2.00	0.58	0.96	2.97
HINXTON GRANGE	3.92	4.06	5.23	5.23
FLEAM DYKE	2.43	2.43	2.43	2.43

We have aligned with other companies in Water Resources East and have included BAU+ in our preferred plan. Unlike many areas of the country, as our geology is unique, BAU+ actually delivers great abstraction reductions than the enhanced scenario and we believe this is the appropriate level to plan for. We will deliver these abstraction reductions once the Fens Reservoir is online, and so we have committed to achieving these all by 2040.

We have tested our WRMP against a range of scenarios to understand any impacts on our plan of changing situations such as higher or lower demand, or changes to our climate change predictions. As a result of these scenarios, we may look to identify an alternative pathway that sits alongside our alternative plan should it be required. One scenario we have tested is to understand the impact if our planned demand management activity only delivers 50% of the benefit we expect. We see this has no impact on our timescales for delivering these abstraction reductions and we provide more detail on this in section 11.7.

6.11.1 Environmental Destination work in AMP8

The National Framework provides an early assessment of how much we may need to reduce abstraction by in order to meet the future environmental needs and goals. There is uncertainty in the exact volume changes required, as well as the most effective solutions. It is possible that for some of the catchments, the abstraction reductions shown above will not be sufficient, yet in others it may lead to increased flood risk.

Further work is required in AMP8 to accurately determine the scale of the abstraction reductions required for delivery in our area. As previously detailed, we are proposing to undertake a series of investigations through our WINEP programme which will confirm the scale of the reductions required, and the locations, and a priority and timescale for delivery. These investigations will also look at the historic environment and any risk and benefits

associated with the abstraction reductions required. We will work with Anglian Water on these investigations where appropriate as we share catchments. The outputs of these investigations with inform our WRMP29.

There are also non-public water supply abstractions in our catchments and WRE has undertaken an initial evaluation of the scale and sectors across the WRE region. Changes to these licences are also expected to be required in order to achieve the environmental goals. We will need to factor this into our investigation process during AMP8.

In addition, we are developing ambitious proposals to undertake flagship chalk stream river restoration projects. These will commence in AMP8 and deliver hydromorphological benefits to chalk streams in our area to help improve and enhance them in the short term, as we look to return flows to them in the future. Our AMP8 WINEP programme has a programme to restore seven rivers in our region, with a total cost of over £13m.

6.12 Drinking water quality

Our WRMP also has to include the requirement to meet drinking water quality standards and compliance levels set by the Drinking Water Inspectorate (DWI). An increase in nitrate concentrations as a result of agricultural land use has required investment in additional treatment and catchment measures in previous AMPs. We produce water that meets the standards of the DWI and complies with the Drinking Water Directive.

Our monitoring of groundwater nitrate concentration trends predicts future increases at a number of sources, and although we do not expect the need for any additional treatment in AMP8 as the existing treatment and blending with low nitrate water maintains our compliance with DWI standards, we are proposing additional treatment at Morden Grange in response to rising nitrate levels. We have made a small allowance in headroom for the impact of increased nitrate in groundwater at an increased trend above what is predicted which could have the potential to restrict existing blending capacities.

As discussed in later sections of the plan, future supply options from different sources of supply may present a customer perception challenge when these are implemented. We will be exploring approaches to reduce this, through both treatment and communication plans.

6.12.1 Catchment schemes

Our existing nitrate removal treatment plants will require refurbishment in the future, and so we have an existing catchment management programme to provide a twin-track approach to mitigation of nitrate in the future. At sources with rising nitrate trends where catchment management could be effective in delaying or removing a future need for treatment, we also employ catchment management as a sustainable long-term option as an effective solution to mitigate water quality risks.

This work allows us to mitigate water quality risks at source through joint working with local landowners and farmers. Through a grant and advice-based programme, we have delivered many benefits through nature-based solutions, including:

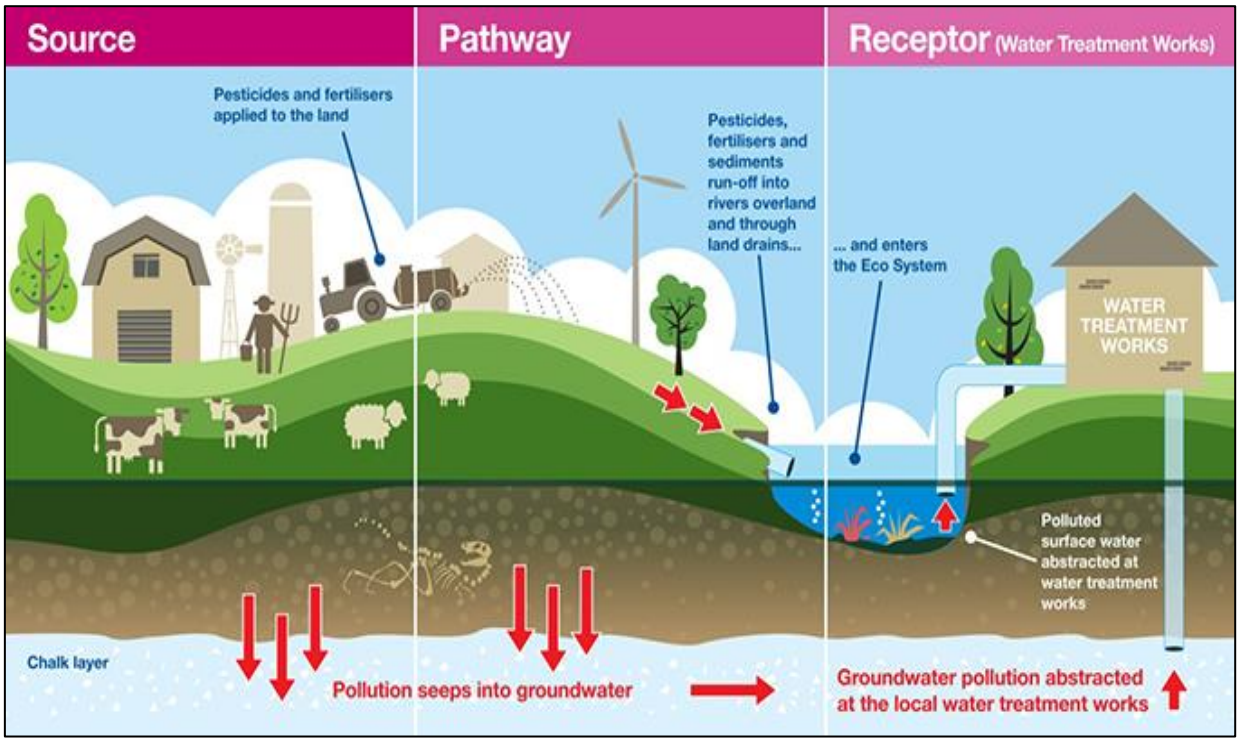
- Undersowing of crops to prevent bare fields and reduce run-off.
- Improved farmyard conditions to prevent escape of waste material and chemicals to watercourses.
- Trial crop planting to reduce fertiliser needs and increase yields.
- Support for rainwater harvesting systems.
- Soil sampling and nutrient management advice

The DWI, the Environment Agency and Natural England are supportive of our proposals for catchment management

projects at groundwater sources, and there is an expectation that these schemes should be in place wherever they have potential to mitigate water quality risks, additional treatment and to provide multiple benefits.

The figure below demonstrates our approach to catchment management.

Figure 10 Catchment Management focus



7. Headroom

Overview

We have assessed the uncertainty in our supply and demand forecasts using the target headroom approach. This is defined as the minimum buffer that a prudent water company should introduce into the annual supply/demand balance to ensure that its chosen level of service can be achieved. We have used the standard methodology developed and published by UKWIR and recommended in the water resources planning guidelines. We did not use this approach at the last WRMP and therefore this is an improved approach for us.

Target headroom provides a minimum buffer for the uncertainty in the supply and demand forecasts, to ensure we are able to achieve our chosen level of service. Target headroom has been reassessed using a more detailed stochastic methodology recommended in the guidelines developed and published by UKWIR[16], and has increased slightly from the WRMP19 allowance.

All components of target headroom uncertainty have been assessed and reviewed, with time series of uncertainty distributions defined from 2025 to 2100 for each component, reflective of dry year annual average (DYAA) and dry year critical period (DYCP) conditions.

A risk profile was selected in line with the WRMP guidelines and annual profiles aligned with Water Resources East companies for a common regional approach. The risk profile for medium resilience was applied starting at the 90th percentile and reducing each 5-year AMP until 2050 at 65th percentile. This reflects a moderately resilient WRZ, with some supply–demand uncertainty.

For the revised draft WRMP we have updated our headroom profile due to the updates made to both the supply and demand forecasting. We have also included component D4 which relates to uncertainty of demand management option delivery.

DYAA Target headroom is at 3.26Ml/d in 2025/26 at the start of AMP8, decreasing to 1.57Ml/d by the end of the planning period in 2050.

7.1 Review of headroom components

All components of target headroom uncertainty have been assessed and reviewed by Cambridge Water, with time series of uncertainty distributions defined from 2022 to 2100 for each component, reflective of dry year annual average (DYAA) conditions.

The distributions were uploaded into a tailor-made spreadsheet headroom model using @Risk Monte Carlo analysis. 10,000 iterations of the model were run to determine a comprehensive percentile distribution of headroom time series for DYAA conditions.

Component elements are split between supply side and demand side and are detailed in the table below.

[16] 'An Improved Methodology for Assessing Headroom', UKWIR, 2002.

Table 27 Supply- and demand-side headroom categories

Supply-side headroom categories	Demand-side headroom categories
S1 – Vulnerable surface water licences S2 – Vulnerable groundwater licences S3 – Time-limited licences S4 – Bulk transfers S5 – Gradual pollution causing a reduction in abstraction S6 – Accuracy of supply-side data S8 – Uncertainty of climate change on yield S9 – Uncertain output of new resource developments	D1 – Accuracy of sub-component data D2 – Demand forecast variation D3 – Uncertainty of climate change on demand D4 – Uncertainty of demand management solutions

7.1.1 Supply-side components

S1–S3 (vulnerable licences) – uncertainty over future reductions in abstraction licensing has been updated to include the latest DO and abstraction licence values (S1-S3 are only used for sensitivity analysis and are not included in target headroom).

No allowance for S4, bulk transfers, has been included because these are insignificant in the baseline supply/demand balance.

S5, gradual pollution of groundwater sources, is applied to allow for uncertainty associated with future long-term trends in nitrate pollution. No allowance is specified for borehole deterioration, which is not considered to present a significant risk to DO for Cambridge Water, and there are no mine water pollution risks. Temporary losses of DO relating to nitrate are quantified and accounted for in the outage allowance.

S6 comprises uncertainty in the accuracy of supply-side data. For every groundwater source, the constraining factor for DO is identified:

- abstraction licence
- infrastructure
- pumping water level (potential yield)
- treatment capacity
- water quality

For abstraction licences, the uncertainty relates to meter reading reliability. To avoid double-counting, only meters measuring abstraction separately to distribution input are included here. Infrastructure constraints carry uncertainty in pump outputs; yield constraints are subject to a number of uncertainties in the ‘source reliable output’ method. Trend uncertainty for water quality parameters is covered under S5.

Uncertainty of climate change on groundwater source yield (S8), is quantified using the results of regional groundwater modelling with monthly climate change perturbation for the 2080s. Wet and dry scenarios are interpolated for 2050 and a time- series of uncertainty input to the headroom model using the standard Environment Agency methodology.

For new supply options planned for completion, covered in S9, only options that are included in the WRMP24 deployable output are included where these are new when the plan commences and have some uncertainty on the

expected yield declared in the deployable output. These are included in baseline target headroom, but uncertainty from new options that may be selected in the preferred plan is excluded from headroom as these options would require further development and would not be in place until future WRMP iterations, and yield uncertainty is included in the optimism bias for the option itself.

7.1.2 Demand-side components

D1 accounts for uncertainty in the accuracy of sub-component data. As for S6, this reflects the reliability of meter readings, which could impact the accuracy of the demand forecast. To avoid double-counting, only meters measuring distribution input separately to abstraction are included here.

D2 comprises:

- uncertainty in population growth
- change in size of households
- measured and unmeasured consumption
- non-household consumption
- dry year correction
- peak period adjustment

These are input as time series of % uncertainty to the model.

D3, uncertainty of impact of climate change on demand, has been determined according to the UKWIR methodology, 'Impact of Climate Change on Water Demand' (2013), with time series of % uncertainty applied to household consumption.

For the revised draft plan, we have updated our headroom calculation and included component D4, uncertainty of demand management solutions.

The D4 component is computed from our preferred demand management programme by:

- Assigning uncertainty percentages to each option, to get upper and lower values for the yield.
- Compute the upper and lower yield for HH and NHH options per year.
- Calculate the min and max around zero per year (balanced around zero and with the correct sign for headroom).
- Building a triangular distribution around min, max and the mode (zero).

We have included the detailed D4 methodology in the updated appendix K1 and our updated headroom report is in appendix G, both of which are available alongside this revised draft WRMP.

7.2 Data analysis and results

The distributions were uploaded into a tailor-made spreadsheet headroom model using @Risk Monte Carlo analysis. Ten thousand iterations of the model were run to determine a comprehensive percentile distribution of headroom time series for both DYAA and DYCP conditions.

A risk profile was selected in line with the WRMP guidelines and the selection of a glidepath of percentiles has been applied using a WRZ risk-based approach common to WRE companies, so that the same profiles will be applied for companies where the WRZ risk is similar.

Table 28 Headroom profile percentiles

Headroom Profile	Percentile glidepath	Typical WRZ Characteristics
LOW RESILIENCE	95% initially (2025), reducing by 5% in each 10-year period to 2045 then remaining at 85%	Low resilience to climate change, significant risks from pollution etc; small, isolated resource zone with little or no raw water storage, small number of sources and/or limited supply flexibility.
MEDIUM RESILIENCE	90% initially, reducing by 5% in each 5-year period to 2050 then remaining at 65%	Moderate resilience to supply-demand balance uncertainty factors. Water supply system has some flexibility to mitigate loss of supply.
HIGH RESILIENCE	80% initially, reducing by 10% in each 5-year period to 2035, then 55% in 2040 and remaining at 55%	Low or no likely impacts from climate change (or significant climate change impacts already built into baseline supply-demand balance), high degree of flexibility / interconnectivity in water supply system.

For the CAM WRZ baseline we have selected the high resilience scenario, due to our integrated network, and low vulnerability to climate change for current sources, post these sources being increasingly licence constrained, and the resilience of proposed new supplies. The risk profile starts at the 80th percentile and reduces each 5-year period until 2035, from when it is set at the 60th percentile until the end of the plan, which reflects a precautionary approach to our plan and uncertainty. This approach has been applied consistently across companies in Water Resources East.

Headroom for DYAA conditions starts at 3.2 Ml/d and decreases to 1.57Ml/d by the end of the planning period in 2050. Further details are presented in the table below.

Table 29 Target headroom DYAA and DYCP – 2025 to 2100

Year	DYAA (in Ml/d)	DYAA (%ile)	DYCP/peak (in Ml/d)	DYCP/peak (%ile)
2025	3.26	80%	4.86	90%
2026	3.12	80%	4.91	90%
2027	3.39	80%	4.87	90%
2028	3.31	80%	4.79	90%
2029	2.22	80%	4.89	90%
2030	2.22	70%	4.93	85%
2035	1.28	60%	3.47	80%
2040	1.46	60%	2.32	75%
2045	1.55	60%	1.48	70%
2050	1.57	60%	1.32	65%
2100	0.21	60%	0.81	65%

The breakdown of target headroom by subcomponent shows that uncertainty is dominated by the accuracy of demand-side data (D1−D4), with non-household forecasts uncertainty increasing over the plan.

The target headroom was updated for the revised draft plan and a report detailing the headroom methodology and results is included in the revised Appendix G.

8. Baseline supply/demand balance

Overview

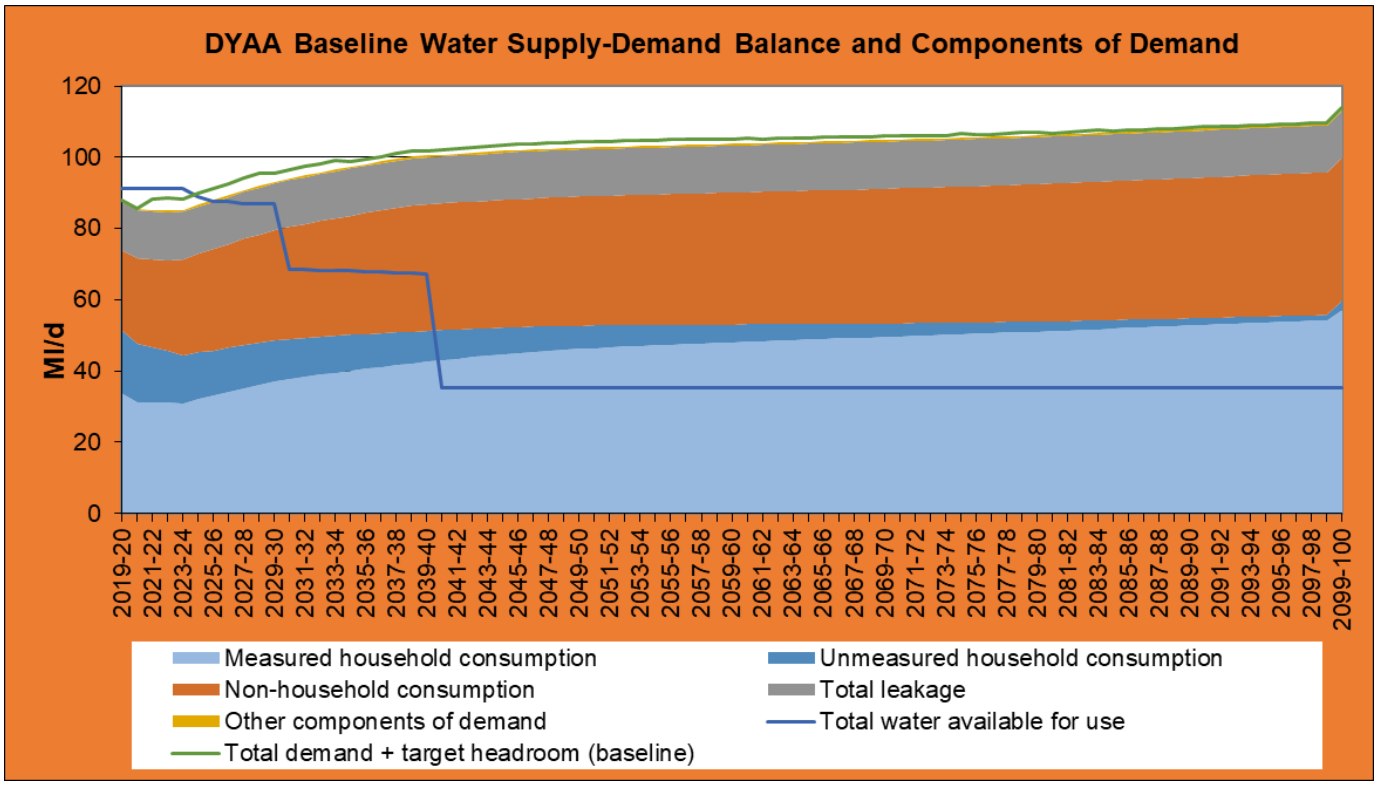
Our baseline supply demand balance is strongly influenced by growth in forecast demand, and by reductions to supply as a result of abstraction reductions to protect the environment against deterioration – as per Water Framework Directive objectives - and future reductions to further improve and enhance the environment for environmental destination.

As a result, our baseline supply demand balance shows an immediate deficit without drought measures in place.

8.1 Baseline dry year annual average supply/demand balance

The following chart shows the baseline supply/demand balance for the DYAA planning scenario. This is the predicted outcome if existing policies are continued without any further changes. It includes impacts from growth in population and properties, impacts on supply from climate change, reduced DO from improved modelling and groundwater source availability and reductions in DO to protect the environment. It does not include any drought measures. It shows an immediate deficit from the start of the planning period in 2025.

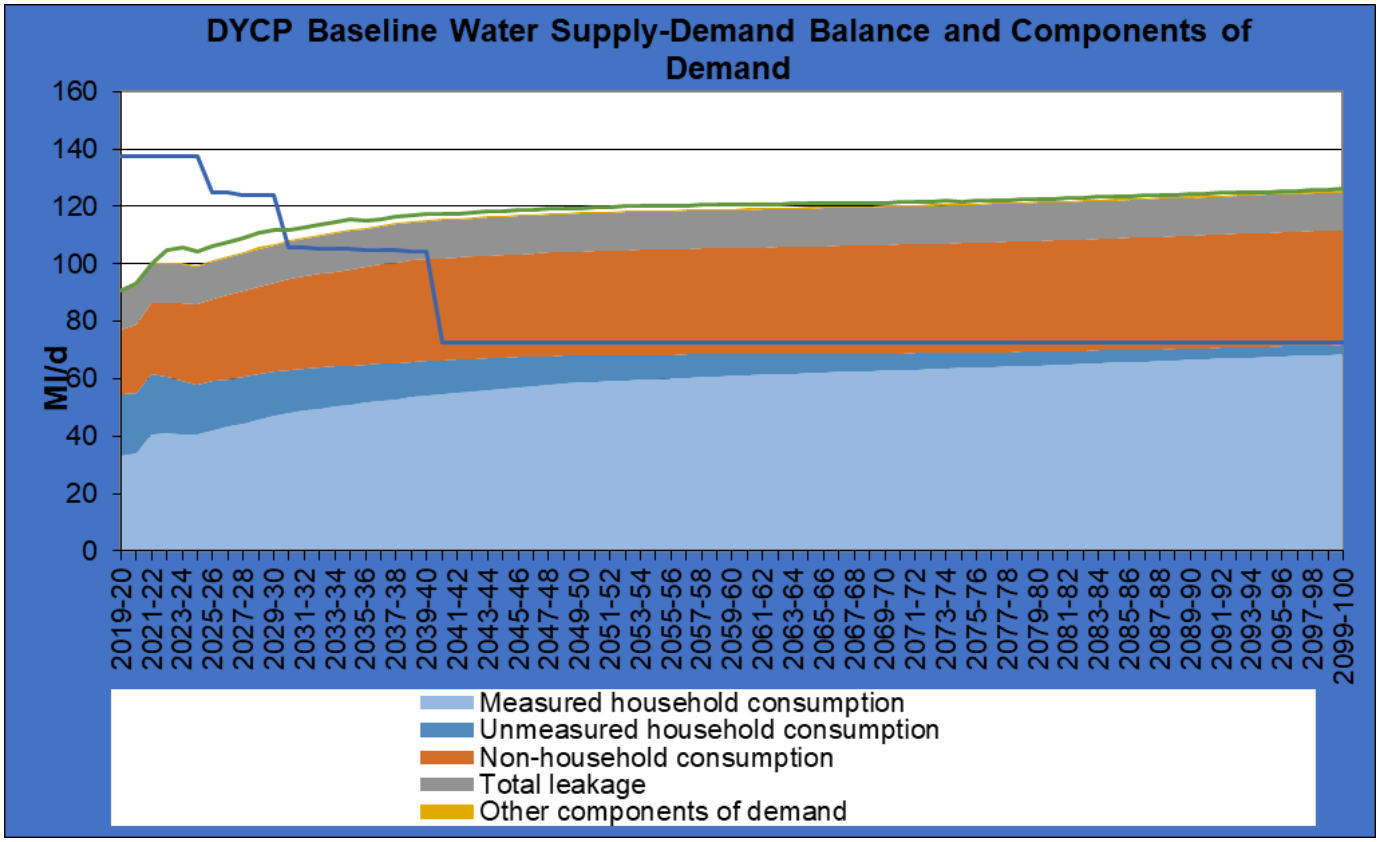
Figure 11 Baseline DYAA supply/demand balance and components of demand



8.2 Baseline critical period supply/demand balance

The following chart shows the baseline supply/demand balance for the critical period planning scenario. Target headroom is breached in 2029/30, and a significant deficit is shown in 2040 as a result of environmental destination.

Figure 12 Baseline critical period supply/demand balance and components of demand



9. Deciding on future options

Overview

We have followed the eight-stage approach outlined in 'WRMP 2019 Methods – decision making process guidance' (UKWIR, 2016) for the identification of options and selection of our proposed programme of work.

We have carried out a process of defining the challenge we are facing and quantifying the complexity and scale of it. This has helped us define the approach to decision-making which is appropriate for us and our circumstances. Growth and the needs of the environment are driving increases in expected demands and decreases in water availability respectively.

We have used a best value planning tool called Valuestream that includes weightings for customer preference, resilience, environmental, and carbon impacts to help inform our proposed programme alongside a least cost approach.

We have developed an unconstrained list of options, including:

- demand-side options
- supply-side options
- production options
- third party options
- resilience options

These have been screened and evaluated to define our list of feasible options. A strategic environmental assessment (SEA) has been carried out on all feasible options to help inform the proposed programme. All options have been modelled in our best value planning tool under a range of scenarios to test our plan.

We have developed our proposed programme taking account of:

- customer views
- cost
- resilience
- environmental impact
- deliverability

As part of the options development process, it is also key to understand any dependencies and enablers to any of the options. The water industry has made several commitments in recent years which must be factored into WRMPs:

- Achieving 50% leakage reduction (from 2017/18 level) by 2050
- Reducing PCC to 110 l/h/d by 2050
- Net zero operational carbon by 2030
- Environment Act target of 9% non-household consumption reduction by 2038

For demand management in particular, there are two key enablers required for Cambridge Water to meet the first two ambitious demand management reductions. These are:

- Universal smart metering
- Water labelling – a government led initiative to label white goods (in the same way they are currently labelled for energy) in order to drive reductions in water usage in households.

9.1 Overview

We have followed the Water Resource Planning Guidelines to develop our options.

We have also discussed the potential range of options, and the pros and cons of each, with our customers through our engagement work detailed in section 4. This has helped to determine priorities and preferences, which has been incorporated into our approach.

Therefore, a full range of demand management options and supply options including all existing sources have been developed for modelling. This allows the opportunity to re-evaluate the mix of resources for the future and ensure our assets are able to meet future demand scenarios.

Throughout the process we also consider:

- How do we ensure that our assets are fit for purpose?
- How do we ensure we meet our future demand scenarios?
- Can we improve our levels of operational and extreme drought resilience?
- How do we ensure the decisions meet current and future needs?
- How do we ensure our plans reflect our customers' priorities and preferences?

A full appraisal of capex, life cycle costs and opex (totex) for all options (existing resources and potential new resources as well as demand management options) ensures we can produce a least cost solution. The inclusion of other un-monetised attributes, natural capital valuation and the inclusion of carbon costs also allows us to optimise on other objectives for best value planning. This multi-criteria and best value planning approach is described in detail later in this section.

9.2 Problem characterisation

The problem characterisation assessment is a tool for assessing our vulnerability to various strategic issues, risks and uncertainties. This assessment enables the development of appropriate, proportional responses with regards to decision-making. We followed the approach set out in the latest guidance 'WRMP 2019 Methods – Decision Making Process'; this provided a robust and consistent approach that we applied to both our regions of operation.

There are two key areas to the problem characterisation assessment.

- How big is the problem? This assesses the scale of the strategic needs and the requirement for either new resources or demand management activities.
- How difficult is it to solve? This assesses the complexity of the challenge.

The National Infrastructure Commission report[17] in 2018 recommends that the water sector will need additional supply and demand reduction of at least 4,000 Ml/day through additional supply infrastructure by the 2030s. This is in response to climate change and ensuring resilience to drought, and to meet the needs of a growing population.

Water Resources East has used these findings and determined that this would be the equivalent over 600Ml/d of future water requirements for water companies operating in the East. Regional modelling using a water resources simulator indicated that the abstraction reductions required to meet these needs could be around 60Ml/d or 50% of our existing water supplies. As part of our pre-planning for pre consultation, we have modelled the expected supply demand balance by applying existing supplies, expected unconstrained demand forecasts, and sustainability reductions for environmental need. This work supported the order of magnitude of required future abstraction

[17] https://nic.org.uk/app/uploads/NIC-Preparing-for-a-Drier-Future-26-April-2018.pdf

reductions and supply needs. As a result, the revised problem characterisation for the CAM WRZ is of high complexity and significant scale.

Figure 13 Problem characterisation assessment

		Strategic Needs Score ("How big is the problem")			
		0-1 (None)	2-3 (Small)	4-5 (Medium)	6 (Large)
Complexity Factors Score ("How difficult is it to solve")	Low (<7)	PR14			
	Medium (7-11)			PR19 - CAM	
	High (11+)			PR24	

The key drivers behind the changes to the level of risk are:

- a wider appreciation of drought resilience, which means that we may be vulnerable to droughts that are different to those experienced historically and the requirement to become resilient to 1in 500 droughts.
- Cuts to existing abstraction licences, which are leading to sustainability reductions and restrictions on available groundwater resources to meet the needs of WFD No deterioration and future environmental improvements.
- long-term regional growth, which is being encouraged by the UK Government, but with large uncertainty over the amount and timing.
- limited supply-side options within the Cambridge region, meaning inter-company bulk imports or significant resource development would be required to replace supplies. These carry additional uncertainty in timing, costs and availability.

9.3 Best Value Planning Approach

In the past, we have followed the economics of balancing supply and demand (EBSD) approach to develop our preferred, which is a well-established framework and traditionally focused on monetisation and developing least cost portfolios to meeting supply and demand challenges. However, for the more challenging complex issues identified through the problem characterisation a more sophisticated approach to analysis is required.

At WRMP19 we worked with Arup and Hartley McMaster, our incumbent provider for asset management optimisation, and worked through the UKWIR guidance to develop our existing optimisation software, which follows EBSD for portfolio selection, and extended it to allow investment option performance against other objectives to be assessed and incorporated into the portfolio selection process using multi-criteria analysis (MCA) techniques.

For WRMP24, we needed to ensure we take a Best Value Planning (BVP) approach to developing our preferred plan, as laid out in the Water Resource Planning Guidelines. In addition, we need to ensure that our method for assessing best value is aligned with our other operating area, South Staffs Water, to ensure that our assessments are comparable for progression to our business plan for PR24.

Water Resources West (WRW), and the water companies within it (including South Staffs Water), commissioned HR Wallingford and PJM Economics to develop a multi-criteria analysis tool that would allow companies to assess the value of options, as well as then produce the best value plan to resolve the challenges in each company and the region overall. We have chosen to adopt this tool to compliment the least cost modelling, and the regional best value

planning undertaken for WRE for our Cambridge Water plan to maintain consistency with the South Staffs Water approach when assessing our plan against customer preferences.

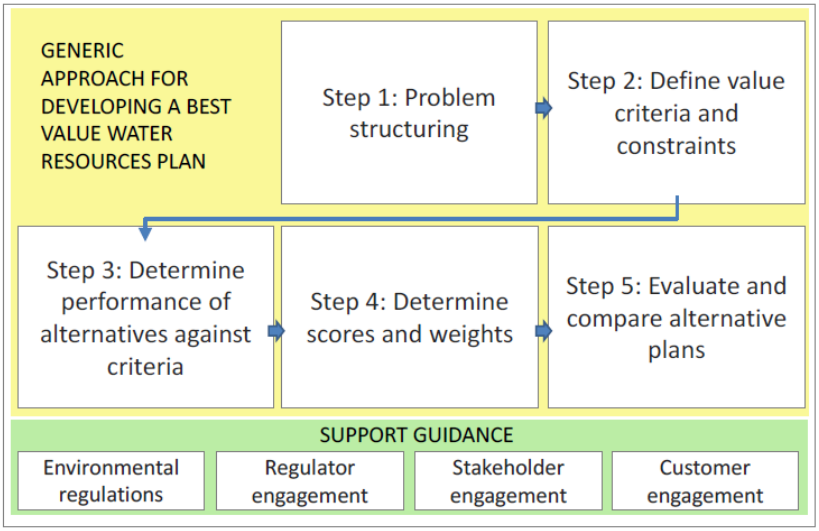
The UKWIR (2020) framework for best value water resources management plans sets out a multi-criteria decision analysis (MCDA) approach for developing a best value plan, and the tool developed follows this approach.

A report detailing the modelling approach is included in appendix I, and a summary of key aspects is included in the following sections.

9.3.1 Tool Specification

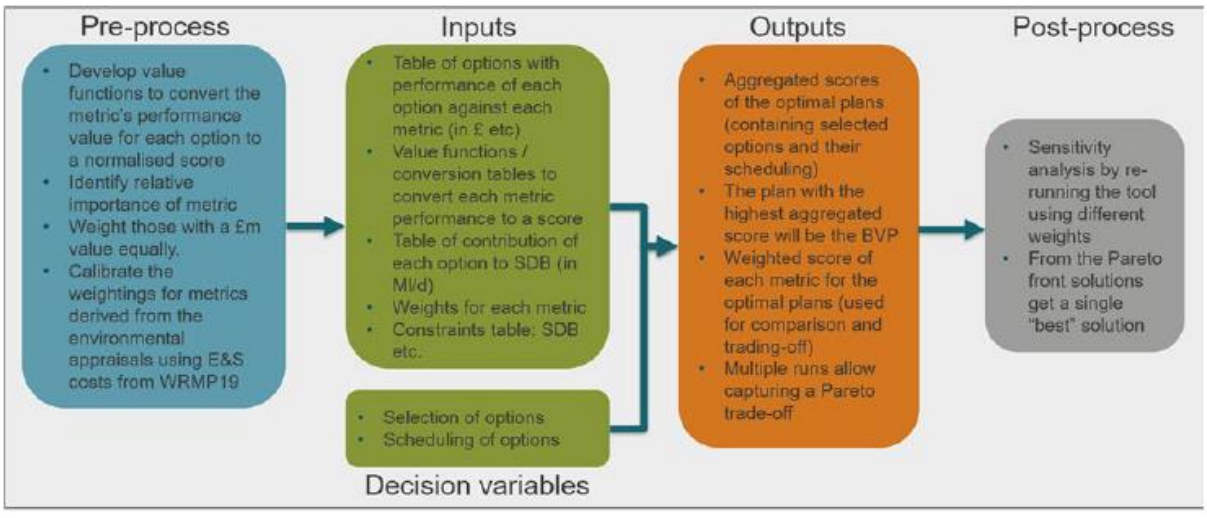
The diagram below shows the overview of the UKWIR (2020) framework for developing a best value water resources plan.

Figure 14 Overview of the UKWIR (2020) framework for developing a best value water resources plan



The multi-criteria decision tool was designed to facilitate specific tasks within steps 3, 4 and 5. Figure 14 below shows the components of the decision tool (i.e. the inputs and outputs) and the pre and post process steps required for using the tool. The overall approach is a weighed sum optimisation method for plan generation and selection.

Figure 15 Components for the decision tool (inputs and outputs) and pre and post process steps plan.



9.3.2 Value Criteria (metrics)

UKWIR (2020) best value plan framework details the need to define value criteria and constraints. WRW refers to value criteria as metrics, and therefore we will continue to refer to metrics throughout this narrative.

It was a requirement of the multi-criteria decision tool that it enables the consideration of several different types of metrics since this is a fundamental concept in best value planning. WRW carried out a workshop for deciding on the metrics that would be used for the development of the Regional Plan. Cambridge Water have also adopted the same metrics for creating its WRMP. These metrics are listed in the table below:

Table 30 Metrics decided at Water Resources West

Ref.	Metric name	Description
1	Cost	Assessed by water companies. Total net present value (NPV) based on capital expenditure (CAPEX, initial and replacement) and operational expenditure (OPEX, fixed and variable).
2	PWS drought resilience	Assessed by water companies. Supply-demand balance change at 1 in 500 level.
3	Carbon costs	Assessed by water companies. Total NPV of monetised carbon costs.
4	Flood risk	Assessment from Strategic Environmental Assessment (SEA).
5	Human and social wellbeing	Assessment from SEA, covering health, human environment, social and economic wellbeing, cultural heritage, air quality assessments.
6	Sustainable natural resources	Assessment from SEA, Natural Capital Assessment (NCA) and Biodiversity Net Gain (BNG).
7	PWS customer supply resilience	Assessed by water companies. Customer valuations of willingness to pay (WTP) NPV, including supply interruptions, water quality, and water resources from SEA.
8	Multi-abstractor benefits	Assessment from SEA. Water quality and quantity, water resources.

9.3.3 Scores and weights

Given that the MCDA considers different types of metrics, each requiring different types of units, each of these measurements needs to be covert into a common scale for the MCDA process. This scale is typically represented between 0 and 100, representing the worst possible and acceptable outcome/performance and best possible and achievable outcome/performance respectively. Score as used to determine how the different performances are valued.

Subsequently, weights are required to denote the relative value of performance changes on different metrics, or the trade-offs between metrics. The weights are a means to enable prioritising between the different metrics. In other words, they reflect how much we are willing to accept some disadvantages of a plan in order to get some of its other benefits. HR Wallingford facilitated workshops with Water Resources West members to develop the weights required.

These weightings are detailed below. A value greater than 1.0 indicates the metric is more important than the top metric in the group, and vice versa.

Figure 16 SEA and NCA Metric Weights

	SEA	NCA
Sustainable natural resources (neg)	**1**	**1**
Multi-abstractor benefits (neg)	0.45	0.75
Human + social wellbeing (neg)	1.05	0.38
Flood risk (neg)	0.15	0.38
Sustainable natural resources (pos)	**1**	**1**
Multi-abstractor benefits (pos)	0.45	0.75
Human + social wellbeing (pos)	1.05	0.38
Flood risk (pos)	0.15	0.38

Figure 17 Monetised Metric Weights

Cost (£NPV)	**1**
PWS drought resilience (£NPV)	1.00
Carbon (£NPV)	1.00
PWS customer resilience (£NPV)	1.00

Figure 18 SEA and NCA vs Monetised Metric Weights

	SEA	NCA
Sustainable natural resources (neg)	1	1
Carbon (£NPV: £0 to £140million)	0.75	0.75

9.3.4 ValueStream Tool

The tool that has been developed is known as “ValueStream”. ValueStream comprises two Excel workbooks:

- ValueStream1: This is the decision tool pre-processing workbook for metric scores and weights.
- ValueStream 2: This is the main decision tool workbook that solves and objective function to find a combination of options that solves the supply demand balance (SDB) taking into account the performance of options against a set of decision metrics (that are scored and weighted in ValueStream1).

9.3.4.1 ValueStream1

Valuestream1 facilitates the input of data from the SEA and NCA assessments, then elicits scores and weights. These outputs are then copied and pasted into ValueStream2.

For Cambridge Water, Ricardo undertook SEA and NCA assessments on feasible supply options. The outputs from these assessments were entered into the ValueStream1 workbook, which provided the scores and weights which were transferred directly into ValueStream2. The ValueStream1 workbook is found in Appendix J.

9.3.4.2 ValueStream2

ValueStream2 comprises several worksheets that enable the selection and scheduling of options to form a plan in order to meet a given SDB profile through the planning horizon.

Inputs are required for the following:

- Supply demand balance profile across the planning period
- Options, including constraints and their performance against each metric from ValueStream1
- SDB contribution of each options
- Metric weights

By changing the SDB profile and the constraints around the options, different planning scenarios can be tested to understand the best plan for different circumstances. It also enables sensitivity testing of a preferred plan to understand the need for any adaptive planning.

9.3.4.3 Best Value modelling and the link to our plan objectives

As stated earlier, our plan objectives are:

- Deliver a sustainable and resilient supply of water for both our household and non-household customers now and in the future.
- Commit to reducing the amount of water we abstract from the environment over the lifetime of the plan in order to protect and enhance the natural and historic environment in which we operate.
- Identify the longer term uncertainties e.g. climate change, and, if required, provide adaptive pathways within the plan in order to ensure we can respond to future challenges.
- Be acceptable and affordable for our customers.

By looking at the value of options rather than just cost alone, we are able to identify those options that deliver wider benefits to the environment and our customers. This enhances the sustainability of our plan and enables us to take into account the wider benefits that might support and enhance the natural and historic environment, as detailed above. Through the best value modelling, we are able to look at different scenarios and test our plan against these, and then develop alternative pathways as required.

Our customers, through our extensive engagement work for this WRMP, have told us they expect us to the right thing for the environment and to ensure we do not just look at the short-term cheapest options, but deliver sustainable and resilient options that can bring benefits to future generations. Our best value modelling enables us to do that through identifying multiple benefits and prioritising those based on the priorities of our customers and stakeholders.

9.4 Options development

9.4.1 Demand side options

Demand management options have been developed with the assistance of consultants Artesia. Details of the process of developing options and feasible options considered are included in Appendix K**.** The suite of options was developed by applying a number of key targets and optimisation of the costs and savings for all available demand options.

As there are a variety of commitments relating to demand management that the industry has already confirmed will be built into their plans, our demand management option process has been updated since WRMP19.

The public interest commitments (PICs) and now Government targets relating to demand management include:

- 9% reduction in non-household consumption by 2038
- Reduce PCC to 110 l/h/d by 2050
- 50% leakage reduction by 2050
- 20% reduction of distribution input per capital by 2038

Therefore, Artesia were asked to determine the optimal way of achieving these targets, both from a cost and deliverability point of view. This then produced a profile of activities over the planning period. This is shown in appendix K1.

A range of scenarios for each option were looked at as part of the process. e.g., for PCC reduction we also looked at how to achieve 120 l/h/d and 90 l/h/d. We discuss the different scenarios tested below. Within this are also some key dependencies. These are:

- Water labelling – the government led initiative to label white goods with water efficiency labels to drive customer reductions in usage.
- Universal smart metering – smart meters across the whole area unlocks additional activities to help drive demand reduction, such as smarter leakage detection and innovative tariff options.

9.4.2 Supply side options

Supply options have been developed with the assistance of consultants Atkins. Details of the process of developing options and the proformas for all feasible options are included in Appendix N. In accordance with Defra instructions and the Security and Emergency Measures Directive Advice Notes and Guidance we have not made this detailed Appendix available to the public. This report is only available to the Environment Agency.

We had no bids into our Market Information tables from third parties and so all of the third-party options were identified by the company and consultants on our behalf.

We have reviewed the existing WRMP19 options and all new options identified. These options have been costed, including with respect to carbon, and costs are provided at December 2020 baseline.

In addition, Ricardo have undertaken SEA and NCA environmental assessments for all our supply options, and SEA assessments on our demand management options (as included in appendix P).

Supply options include:

- **Investment in existing groundwater sources** – replacement boreholes based on asset condition, new treatment processes based on deterioration of groundwater quality
- **New groundwater sources** – remediation of mothballed sources, and trade or acquisition of sources from third parties
- **Potable imports**
- **New reservoir**
- **New surface water sources**
- **Water reuse**
- **Trades with third parties** – neighbouring water companies and other licence holders.

Options development has followed a dual streamed process from unconstrained through to feasible where SEA has been carried out alongside options development.

- Identification of unconstrained options through brainstorming events including both internal expertise together with leading industry consultants
- Environment Agency involved in both demand management options and resources options identification
- Initial screening using criteria such as feasibility, etc
- Further review of screening following more detailed scheme description
- Environment Agency views sought on resources options
- SEA scoping occurring concurrently

The process followed, and the options considered are shown below.

Figure 19 Options development process

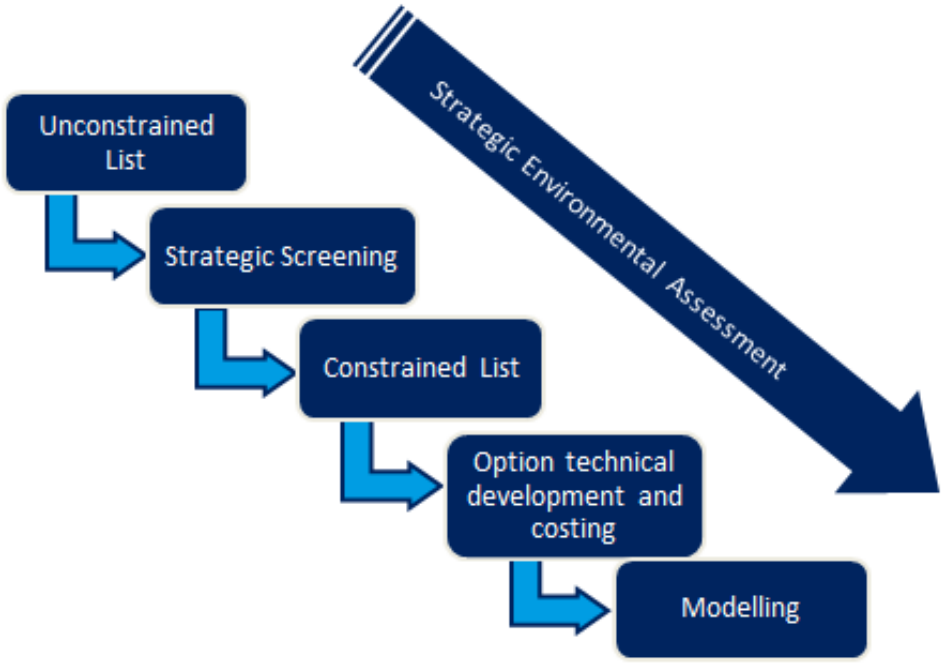


Table 31 WRMP options considered

Option type	Number of unconstrained options	Number of streamlined options	Number of feasible options in DMF	Comments
Maintenance of existing groundwater	24	9	2	Options relate to capital maintenance of existing sources including replacement boreholes and new treatment requirements to maintain existing DO and abstract to full licence
New groundwater	7	2	0	Options include additional boreholes at existing groundwater sources to provide greater peak output, reinstatement of sites currently unused because of treatment requirements and new locations providing additional resource.

New surface water	27	19	3	Options to develop new surface water sources, reservoirs and new associated treatment plants.
Transfers	23	16	6	Transfers of raw or potable water into existing network or new assets
Third party water and trades	21	7	0	Licence trading, water trades or third party resource options
Other	22	12	4	Options such as sea tankering, desalination, iceberg import, ASR and re-use/recycling
Total	**124**	**65**	**15**	

Outline scheme design and costs were developed for each of the options included on the feasible list for least cost and best value modelling. The criteria used to evaluate each option in is described in the following section and follows the requirement set out in section 8 of the planning guidelines. An initial unconstrained list of 106 options was increased to 129 to be reviewed for feasibility. The final list of constrained options was 15, and further sub options were developed as these were progressed to detailed options. These options were also provided to WRE to be included in the regional simulator and modelling.

We have evaluated a comprehensive number of supply side options that have been screened from our unconstrained list to feasible options and propose a number of significant investments to meet the deficits in supply due to environmental need. These include:

- Imports from Anglian Water
- Optimising our sustainable licences
- Re-use and storage from water recycling works
- A partnership with Anglian Water to develop Fens Reservoir, a regional winter storage reservoir
- Development of rainwater harvesting schemes
- Installation of greywater recycling schemes

9.5 Feasible options included in Modelling

All of the options have been reviewed and screened according to the criteria below which summarises how we evaluated options. A rejection log and tracking log of this approach is in Appendix N3.

Table 32 Option screening criteria

Criteria	Considerations	Scoring considerations
Location of scheme benefits		
Scale	Yield and consideration of whether option DO is proportional to the estimated supply-demand deficit	Yield (high to low)
		Appropriate in scale to area of demand deficit (high to low)
Location	Option is within, or can serve, the area of estimated supply-demand deficit	Is it in the correct place for distribution network and location of demand deficit?

		Are there constraints in terms of location e.g. difficult to obtain access, likely to be developed on?
Future proofing	Ability to mitigate against future DO losses due to external events - climate change, licence reduction etc	Ability to mitigate future losses
Statutory / Regulatory / Legal Constraints		
Planning and Environmental	Likely to be acceptable in terms of planning and statutory environmental constraints	Likely to be acceptable in terms of planning and statutory environmental constraints
WFD	Scheme does not cause deterioration of a WFD water body	Scheme does not cause deterioration of a WFD water body
HRA	Scheme does not impact on Natura 2000 site.	Scheme does not impact on Natura 2000 site.
Other	Are there any other environmental constraints /showstoppers	Are there any other environmental constraints /showstoppers (likely to cause NE concern)?
Meet customer / stakeholder needs		
Customer	Scheme complies with customer acceptability	Customer acceptability
Internal Stakeholder	Compliments SST business plan, strategy and is in line with corporate objectives	Compliments SST business plan, strategy and is in line with corporate objectives
External Stakeholder	Likely to be acceptable to third party group including local stakeholder groups.	Likely to be acceptable to third party group including local stakeholder groups.
Option Robustness		
Flexibility	Option can be scaled and flexed operationally to meet supply-demand needs	Option can be scaled and flexed operationally to meet supply-demand needs
Favourable	Option is favourable in comparison to other options available	Option is favourable when considering potential costs and other options available/other alternatives
Viability	Option is technically feasible	Option is technically feasible and likely to work in this instance/SEW has experience in delivering similar solutions
Known technologies	Option is achievable without significant R&D / trials	Option is achievable without significant R&D / trials, SEW has experience/option considered likely to work in this instance
Licensing	Abstraction licence is likely to be secured	Abstraction licence is likely to be secured and retained in the long term
Delivery risk	Are the risks and uncertainties acceptable	Are the risks and uncertainties acceptable (likelihood of failure/outages, vulnerable to future regulatory/legislation changes etc)

We have costed our supply options using a robust methodology using industry standard models (TR61, WRc) and our WREMP19 cost models (Atkins), COPI uplifted accordingly. These costs are bottom up and modular as far as is possible, and representative of the maturity of the options, and will continue to be refined for options as they are developed. The full methodology is available on request (subject to commercial confidentiality) - 5211472-ATK-RP-7.9-074 CAM dWRMP24 Methodology for Estimating Option Costs V2.

9.5.1 Maintenance of existing groundwater sources

Options relating to existing groundwater sources contributing to baseline DO are included for the baseline in our modelling.

Capital maintenance requirements have been identified separately for PR24 to ensure that decisions regarding new options are considered alongside options to maintain existing sources and that continuation of output from existing sources is included in our costs.

When considering capital maintenance schemes, the potential impacts on DO due to WFD no deterioration have been factored into the expected future yield, in particular for peak outputs. Expected sustainability changes and licence reductions are included in the adjusted baseline DO. Where options to re-instate sources on existing licences are included, then the DO has been reviewed to ensure that the option remains environmentally feasible and sustainable.

We excluded sources that are not in operation, but may be licensed, from the baseline DO. These have been reviewed in the options screening process to determine inclusion or otherwise in the constrained list.

9.5.2 New sources

9.5.2.1 New groundwater sources

All options identified for new groundwater sources have been screened out from the feasible list. This is due to the Cam and Ely Ouse CAMS status for the groundwater catchments in our area and surrounding area being classified as no water available, or with limited water available that would not provide the required yield throughout a dry year scenario. Options to reinstate sites currently unused because of treatment requirements have also been reviewed in our screening process. Two options relating to an existing source in the shallow gravel aquifer – not assessed in CAMS – have been included in the feasible list.

Table 33 New groundwater sources options

Option	DYAA Yield Ml/d	CP Yield Ml/d	Major investment requirements
CW24-1A: Combined Ouse gravel sources - Fenstanton to St Ives (01A).	0.44	0.55	Existing licence, mothballed source. River gravels/shallow aquifer. Extensive rebuild required.
CW24-1B: Combined Ouse gravel sources - Fenstanton to St Ives (01B).	2.0	2.0	Existing licence plus additional licence volume, at mothballed source. River gravels/shallow aquifer. Extensive rebuild required.

9.5.2.2 New surface water options

There are limited available surface water resources within or close to our area of supply. The majority of chalk rivers typical of the area are unsuitable for large public water supply (PWS) abstractions and already are subject to environmental impacts.

A number of surface water options with new reservoirs were considered on the unconstrained list, building on WRMP19 and consistent with WRE regional options. Further screening of these options identified that many utilised the same source of water as Fens Reservoir, a strategic resource option (SRO) being developed and promoted through both WRE and in Anglian waters adaptive WRMP19 plans.

Subsequently this SRO has been accepted into the RAPID process and we have joined this process in partnership with Anglian Water to develop this option with 50% of the costs and DO benefit. We joined the process at Gate 1 and have been co-developers of the project since this time, with the scheme successfully passing the Gate 2 checkpoint in November 2022. Development in ongoing through AMP7 with the next checkpoint in January 2024 an Gate 3 in September 2024.

In addition to the Fens Reservoir, we have identified a single additional source of water, with flows supported by water recycling discharges from an Anglian Water water recycling centre, that can be considered a surface source or an effluent re-use scheme. There are two schemes:

- SW24-57 – A new surface water abstraction from the River Cam to provide additional raw water than will be stored in an embankment reservoir. This raw water would then be treated in a new water treatment works and transferred to Cherry Hinton Reservoir for deployments into the Cambridge Water network. This stretch of the River Cam is supplemented by effluent discharge from Milton WWTW, and Anglian Water site.

- CW24-71 – Effluent discharged from Milton WWTW, an Anglian Water site, will be directly treated in a new water treatment works and transferred to Cherry Hinton reservoir for deployment into the Cambridge Water network.

These options are mutually exclusive and would each deliver 7 Ml/d based on the available abstraction for the River Cam over 120 days of the year, depending on Hands off Flow (HOF) conditions.

These options are summarised in the table below.

Table 34 New surface water sources options

Option	DYAA yield Ml/d	CP yield Ml/d	Major investment requirements
CW24-57: River Cam abstraction & treatment works.	7	7	New intake and treatment works, associated infrastructure, new reservoir and transfer pipelines, raw and potable
CW24-71: Milton WWTW Effluent re-use post effluent discharge.	7	7	New intake and treatment works, associated infrastructure, new reservoir and transfer pipelines, raw and potable
Fens Reservoir	44	44	New intake and treatment works, associated infrastructure, new reservoir and transfer pipelines, raw and potable

9.5.3 Transfers

We have held detailed discussions with Anglian Water and Affinity Water to consider the opportunities for bulk water trades. The WRE regional water resources strategy group also considers a variety of transfer options, and large resources options from all companies are included in the regional modelling. Some transfer options may be dependent on a larger resource being developed by one of the other companies to increase available resource to facilitate the trade and WRE considers these issues.

The screening process has identified a preferred single transfer location with Anglian Water, with variations on the option for different volumes and treatment philosophy. This has been developed in conjunction with an Anglian Water strategic transfer option with a link to provide a time limited surplus and spare capacity in the transfer to Cambridge water before larger regional options can be developed.

In our initial draft we considered up to a 15Ml/d option, which was dependent on Anglian Water developing a new drought permit/curve for Ruthamford South surface water treatment works in AMP8 to support the transfer. However, this has been further developed since the first draft. The reliance on a drought permit was deemed unacceptable following feedback from the Environment Agency during draft plan consultation. As a result, the original transfer options are no longer feasible, and a new Grafham Transfer option has been developed.

This new option is dependent on Affinity Water's Grand Union Canal scheme which will temporarily reduce their need to fully utilise the transfer from the Grafham water treatment works. The surplus at Grafham can then be transferred to Cambridge Water via the surplus capacity in the new Anglian Water pipeline which will be installed from Grafham to Rede in AMP8 and runs through the Cambridge Water area. The capacity of this transfer will be up to 26Ml/d with full capacity being delivered in 2032.

We have also included a transfer option associated with the development of Fens reservoir. This aligns with the potable transfer included in the RAPID scheme for Fens Reservoir which is covered in more detail in section 9.5.5 below.

The table below shows our updated feasible transfer options.

Table 35 Transfer options

Option	DYAA yield Ml/d	CP yield Ml/d	Major investment requirements
CW24-75DiiiOp2: Potable transfer through CAM area 26Mld partial treatment	26	26	Cross-connection from AWS new strategic pipeline and breakpoint chlorination Reliant on delivery of Minworth SRO and Grand Union Canal SRO
CW24-73A: Fens Reservoir potable water transfer	44	44	New reservoir (SRO scheme), transfer from Fens reservoir to Bluntisham and Madingley, storage reservoir and polishing treatment associated infrastructure

9.5.4 Other options

The only additional options that remain viable as a result of our screening are water re-use and recycling at large new development sites. These are included as supply options and not demand management options as they could include significant infrastructure that we could construct and maintain. These options would however, require support and buy-in from the developers of large sites in our area of supply.

These options would build on the successful development of the Eddington scheme in Cambridge which Cambridge Water have delivered. This development is able to achieve a consumption level of 80 l/p/d when in full operation. However there are some key legislative impacts currently which prevent the site from operating as desired, due to the requirement from the Drinking Water Inspectorate (DWI) that the greywater be treated to potable standards. This is currently under review by Defra in order to enable additional developments of this style to be progressed and achieve the full scale of benefits available.

Table 36 Other options

Option	DYAA yield Ml/d	CP yield Ml/d	Major investment requirements
CW24-37A Site-scale greywater re-use	0.5	0.5	Site-scale greywater reuse scheme incorporated into large scale development (at full build out 10k properties). Dual pipe network, storage and treatment required
CW24-38 Site-scale rainwater harvesting	0.9	0.9	Site-scale rainwater harvesting scheme incorporated into large scale development (at full build out 10k properties). Dual pipe network, storage and treatment required

9.5.5 Fens Reservoir

Our feasible options include transfers from Fens Reservoir to the CAM WRZ. Fens Reservoir is a strategic resource option (SRO) that is being developed in partnership with Anglian Water, through the RAPID process. The scheme is being developed so that we share the resource proportionally. From the modelling a 50Mm3 reservoir has been selected which allows the resource to be shared equally between companies. To reflect this, we have modelled the costs and benefits for the Fens reservoirs as 50% of the total. The Anglian Water WRMP requires the Fens reservoir in 2036 which aligns to Cambridge Water's needs.

The reservoir is selected by regional WRE modelling under most, if not all, extreme future scenarios. With a start date on site of 2029 Fens Reservoir could be in supply between 2035 and 2037. Fens Reservoir is an embanked winter storage reservoir, with 55Mm3 of storage providing a useable volume of 50Mm3 with a proposed yield of 88 Ml/d, shared equally between Cambridge and Anglian water. The Fens Reservoir could potentially unlock many multi sector benefits for agriculture, habitat, amenity and recreation, and is an essential option to meet the future environmental needs identified in our plan.

As the Fens Reservoir is being developed as an SRO through development consent order and the need is primarily identified through the WRE modelling and water resource simulator, including SEA and environmental assessment we have not explicitly included it in our feasible list. We have however included the costs in our tables as these will be shared with Anglian Water and are a fundamental part of implementling our WRMP.

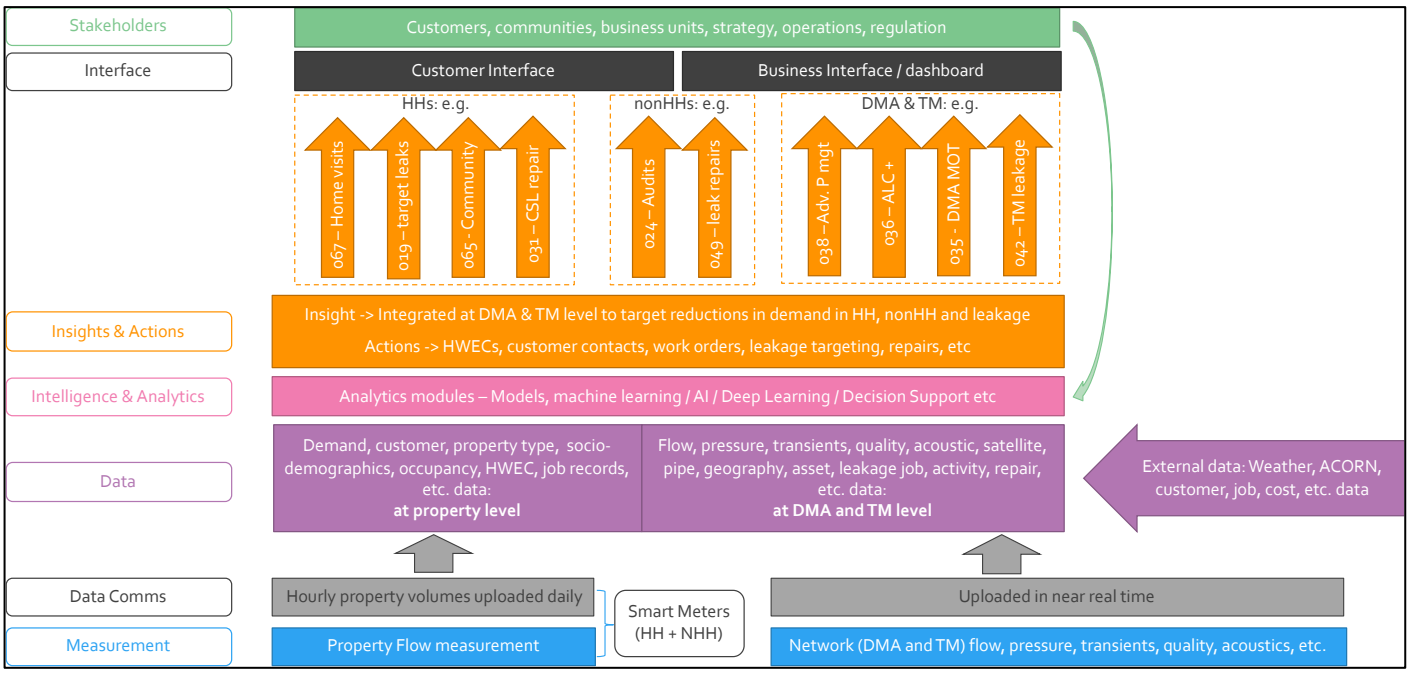
9.5.6 Demand Management Options

Appendix M provides more detail on each of the options within each section below.

9.5.6.1 Smart Networks and Metering

As part of our demand management plan development we have considered Smart Network scenarios, which represents an integrated approach to demand management built on the foundation of installing smart meters on all households. Our view of smart networks is represented below and details the key elements for smart networks, the dependencies and interfaces and how that drives activities that support and enable demand management.

Figure 20 Smart Networks in South Cambridge Water



During AMP7 we have been progressing our smart network programme and this is set to continue through AMP8. The diagram shows clearly the important stream of data that metering provides, and so we now need to look at how we support this smart network further with more smart data from meters. As a result, we have assessed multiple different scenarios for metering:

- Universal metering by 2030
- Universal metering by 2035
- Universal metering by 2040
- Current optant level of metering across planning period

In our draft WRMP we stated that installing meters on its own does not deliver demand reductions, but rather facilitate demand reductions across households, non-households and leakage through behaviour change and targeting savings in specific locations. Following feedback received during consultation, we have reviewed this and updated our view of the benefits achieved directly through installing smart meters.

During AMP7, several companies are undertaking extensive smart metering programmes, including Anglian Water, SES and Thames Water. Through discussion with these companies and a detailed review of the results they have achieved through AMP7, we are proposing to adopt a 13% saving due to behavioural change upon installation of a meter to an unmetered property with the customer switching to being charged based upon measured volume. We have also assumed a behavioural change demand reduction of 2% when replacing a dumb meter with a smart meter. These estimates are based on the results seen by both Anglian Water and Thames Water and are in line with the experience in the energy sector.

As part of the scenario testing, we have assessed the deliverability of the metering schemes, again taking information and lessons learned from Anglian Water and SES in particular. We have also looked at the impact the metering programme has on delivering the leakage targets as well as the PCC targets, and what timescales we need to have metering in place by in order to achieve these. Importantly, we have also assessed the full range of benefits of each of these scenarios, particularly when compared to the cost e.g., installing a smart meter where there is currently no meter will provide a 13% saving in demand for that household. However, there is a very similar cost for upgrading a dumb meter to a smart meter, but it only provides 2% demand saving.

We have also discussed universal smart metering with our customers, as described in section 4.

9.5.6.2 Water labelling

Water labelling is also used as an enabler in the optimisation of demand management activities. When looking at how to achieve the leakage and PCC targets, we have compared the programmes required based on the following water labelling scenarios:

- Water labelling introduced with minimum standards
- Water labelling introduced with minimum standards with delayed benefits
- Water labelling introduced with no minimum standards
- Water labelling introduced with no minimum standards with delayed benefits
- Water labelling is not introduced

The water savings from water labelling are described in table 6 of the final report for the WaterUK PCC pathways project. After consultation with Water Resources South East, all companies have agreed to include the 'lower savings estimate' for water labelling without minimum standards as the agreed option.

For the optimiser, these savings are netted off the PCC pathway for household consumption reduction before the optimiser is run.

We make the assumption that government starts to implement water labelling in 2025 but that benefits will be delayed until 2029, as we believe it will take time for customers to become aware of the scheme and that change will not be immediate, particularly in the current economic climate.

9.5.6.3 Leakage Reduction

We have assessed a range of different leakage activities that could be undertaken in order to achieve the 50% leakage reduction by 2050. We have also assessed the following scenarios as represented in the table below.

Table 37 Leakage scenarios assessed

Scenario Reference	Name	Description
LEA_01	Linear to NIC	Linear leakage reduction from 2025 to 50% of the 2018 leakage value by 2050 as per NIC recommendations.
LEA_02	PIC plus NIC	Linear leakage reduction to the PIC target in 2030, then a linear reduction to the NIC target in 2050.
Scenario_01	Environment Act Targets - interim	All environmental targets met, including interim
Scenario_02	Environment Act Targets - all	Achievement of 50% leakage target by 2050, plus all interim targets as defined in Government environmental plan.
Scenario_03	AMP8 20%	20% reduction by AMP 8, plus Env act target
Scenario_04	50% by 2035	50% leakage reduction achieved by 2035 and then sustained
Scenario_05	50% by 2040	50% leakage reduction achieved by 2040 and then sustained

Leakage activities assessed in each of these scenarios are included in the table below.

Table 38 Leakage activities assessed

Leakage Activity	Description	Benefits (relating to UKWIR Zero leakage by 2050 outcomes)
Proactive trunk mains leakage reduction	Introduce continuous monitoring network across trunk main network, including service reservoirs. This allows more traditional awareness, localisation and repair approaches to then be applied	We can confidently quantify leakage and demonstrate when it is zero. All new leaks are found quickly after they break out.
Advanced pressure management	Installation of pressure loggers to monitor pressure transients, then utilise this information to optimise pressure profiles and deliver lower leak flows, reduced bursts and lower leakage rate of rise.	New leaks on existing networks are minimised.
Customer supply pipe repair or replacement (smart networks)	All customer supply pipes in a DMA are graded based on smart meter data. Clustering techniques are then used to create a risk grade for each customer supply pipe and identify specific DMAs that can be targeted for cost effective CSP repair or replacement.	All new leaks are found quickly after they break out. Repairs are quick economic and with minimum disruption. Background leakage is eliminated.
Customer supply pipe repair or replacement (non-smart networks)	As above, however this option is less efficient as the targeting is less successful without smart network data.	Repairs are quick economic and with minimum disruption. Background leakage is eliminated.
DMA Active Leakage Control Plus (smart networks)	A step change in DMA data analytics to make efficiency gains in targeting DMAs and allocating resources. Gather all DMA information together and classify the DMAs into cohorts. Build baseline leakage predictions for each based on specific DMA characteristics and then allocate the company target across these through economic optimisation. Develop a weekly prediction of the leakage profile and target ALC activity and priorities based on this, using traditional and new technology and data as it is developed.	New leaks on existing networks are minimised. We can confidently quantify leakage and demonstrate when it is zero. Background leakage is eliminated. All new leaks are found quickly after they break out.
DMA Active Leakage Control (non-smart networks)	As above, however this option does not have smart network data available and therefore is less efficient as the targeting of resource is less successful.	New leaks on existing networks are minimised.

		We can confidently quantify leakage and demonstrate when it is zero. Background leakage is eliminated.
DMA MOT (smart networks)	Using leakage-driven asset renewal, a DMA is targeted for mains replacement or rehabilitation. Whilst the LDAR is carried out, a "DMA MOT" is also carried out. Therefore, in addition to doing the repair or replacement, the DMA is subjected to a full STEP test or alternative sub-DMA leak localisation method. The result will be that the leakage within each pipe-length can be quantified and recorded. Appropriate active leakage control methods can then be applied to this DMA and a new minimum level of leakage achieved, and the DMA should be able to be held at this new level.	All new pipework is leak free. New leaks on existing networks are minimised. Repairs are quick, economic and with minimum disruption. Background leakage is eliminated.
DMA MOT (no-smart network)	As above, however this option is less efficient as the targeting is less successful without smart network data.	All new pipework is leak free. New leaks on existing networks are minimised. Background leakage is eliminated.
Distribution mains/comm pipe replacement	Replacement of company owned pipework following active leakage detection and delivering the outputs of a leakage-driven asset renewal programme.	New leaks on existing networks are minimised. Background leakage is eliminated. All new pipework is leak free.
Non-household customer supply pipe repair or replacement (no enhanced meter technology)	Repairing or replacing leaking pipes on non-household properties, where identified through DMA MOTs or active leakage control. Assumes no meter data from the NHH property and therefore could be more efficient with this, assuming this was installed. Also links to NHH consumption reduction programme in 9.5.1.5.	Repairs are quick economic and with minimum disruption. Background leakage is eliminated.

9.5.6.4 Household consumption (PCC) reduction

For the draft WRMP, we considered three PCC pathways which reflect on low, medium and high levels of ambition for PCC reduction by 2050. The medium pathway is based on the national framework for water resources target of 110 litres/person/day. The high and low pathways represent lower / higher ambitions for PCC targets and are shown in the table below. For the revised draft WRMP, we have assessed another scenario based on the newly introduced Environment Act targets. These scenarios are represented in the table below.

Table 39 PCC reduction scenarios assessed

Scenario Ref	Name	Description
PCC_01	PCC_LOW	120 l/h/d by 2050
PCC_02	PCC_MED	110 l/h/d by 2050
PCC_03	PCC_HIGH	90 l/h/d by 2050
PCC_04	PCC Environment Act	122 l/h/d by 2038, 110 l/h/d by 2050

For this optimisation, water labelling is included as an enabler. Three scenarios of water labelling are also tested – no water labelling, water labelling with minimum standards, and water labelling with no minimum standards. This has shown that water labelling is required in order to achieve the 110 l/h/d. In addition, the timing of the smart network and smart meter rollout also has a significant impact on cost and deliverability of this target.

As agreed at Water Resources East, we have agreed to include water labelling with no minimum standards as our option, and have taken the lower savings estimate for this. In this situation, and with a smart network and metering installed by the end of AMP9, the following activities are included in the optimiser:

- **Community rainwater harvesting** - an intervention for new developments where water collected through roof runoff and a sustainable drainage system is collected in a lake on the development. This water then undergoes basic treatment before being supplied through a separate supply system for toilet flushing, outside use and potentially clothes washing.
- **Water neutrality** - the additional demand from new development is minimised as far as possible and then offset by reducing demand in the surrounding area. Offsetting could also be done by reducing leakage and/or non-household demand.
- **Household water efficiency programme (partnering approach, home visit) -** provision of water saving kits, plumber installed retrofits, and encouraging behaviour change.
- **Housing associations, targeted programme** - direct company liaison with housing associations to promote water efficiency to residents. An initial audit or communication is followed up with regular communications as new water saving techniques and devices enter the market. The most efficient delivery would be for housing associations to use existing contractors to carry out the installations and so a partnership approach with the housing authority would result in a lower cost to deliver this option.
- **Innovative tariffs** - This intervention assumes smart metering as a pre-requisite and therefore can only be delivered within Smart Network programme. New tariffs are developed and introduced to encourage water saving behaviours through incentives. Tariffs can be targeted to deliver reductions in consumption based on individual household consumption patterns. The framework for tariffs for water services are determined by Ofwat. This intervention would therefore also require input from this regulator.
- **Home retrofit rainwater harvesting/greywater reuse** - This intervention would require a widespread programme to encourage the retrofitting of rainwater or greywater systems to existing housing stock. Rainwater systems are likely to be more successful at present due to the maturity of the technology and

lower maintenance requirements. Retrofit options for greywater recycling products are less popular, more complex and require more maintenance.

- **Increased media campaigns and school education** - This intervention would build on the baseline activity and pilot studies that Cambridge Water is already undertaking, but would be higher profile, more consistent and co-ordinated at a regional level. The effectiveness of this campaign would vary depending on whether it was part of a co-ordinated programme, underpinned by smart metering. There are therefore two variants of this intervention, with and without smart networks. We will build on the success of our Can for the Cam campaign, and use all available channels to reach customers over a wide range of mediums such as bills, website, social media, apps etc.
- **New homes standards, voluntary** - At present, all new homes in England must meet the mandatory national standard set out in the Building Regulations, of 125 litres/person/day. Where there is a clear local need, local planning authorities can set out Local Plan policies requiring new dwellings to meet the tighter Building Regulations optional requirement of 110 litres/person/day. This option would be applied at a development scale through consultation and agreement with stakeholders, particularly the local authority, developers and main contractors. The target would be to achieve a new home standard below the current baseline forecast for new households.
- **Targeting properties for leak repairs or efficiency audits -** Home water efficiency visits can result in useful reductions in water use through the provision of water saving kits, plumber installed retrofits, and by encouraging behaviour change. Implementing this option after smart meter installation, as part of a Smart Network programme means that specific properties with the highest rates of consumption can be targeted for engagement, to determine the reason for the high water use. Repairs to internal leaks, e.g., from leaky loos can be made and advice given if water use is much higher than it should be. The savings associated with this option are based on reported losses from leaky loos. There are also two variants of this intervention, with and without smart networks.
- **Community Water Efficiency Scheme** - This option is based on the results of the St Albans pilot study of the 'Save 10 a Day' campaign, focusing on the benefits estimated from the households engaged most with the programme, by ordering water saving devices through the GetWaterFit app. We would deliver campaigns to encourage households to adjust their water use behaviours and practices. The incentives could be either individual or community based. Individual schemes could be incentivised with a loyalty scheme where customers receive a reward if they achieve a certain percentage reduction in consumption. Community schemes could provide towns, villages or neighbourhoods with a community level reward based on consumption reduction across that area. There are also two variants of this option but where a more modest customer uptake is achieved based on less targeted intervention and communication due to no smart network data availability.

9.5.6.5 Non-household consumption reduction

The following options have been reviewed in order to deliver the targeted 9% reduction in household consumption by 2037:

- **Non-household water efficiency programme (company led, self-install)** - An analysis of business and water use would be undertaken, then depending on business type and volume of water used per annum a range of options could be promoted. This programme initially proposes provision of cistern displacement device or dual flush retrofit devices and taps inserts and provision of saving your business water use information and is installed by the non-household company themselves.
- **Non-household water efficiency programme (company led, site visit with install)** – as above, but Cambridge Water to undertake the installation work on site.
- **Retailer Incentive Mechanism** - This option encourages retailers to promote water efficiency for non-household customers. An analysis of non-household use would be undertaken. Retailers are incentivised to encourage with payments relating to volume saved.
- **NHH Enhanced Meter Technology** - upgrading or replacing selected non-household customers' meters, particularly the largest customers and/or where businesses are in close proximity. Artesia's recent study as

part of MOSL's Strategic Metering Review found a strong benefit case for water companies rolling out enhanced metering technology to non-household customers. We would look to upgrade or roll out 'smart' meters for domestic customers and include non-household customers at the same time. The data provided with provide retailers, Cambridge Water and customers with a means to identify leaks and highlight opportunities to improve water efficiency or reduce consumption at non-household customers.

- **Metering of leftover commercials** - install meters at unmetered non-household properties. It is estimated at the end of AMP7 there will be approximately 450 non households that pay via an unmetered bill. This option assumes that 80% of these 450 can be metered, with the rest being infeasible due to shared supplies and difficulties in metering some properties. Due to the nature of the left over commercial a higher installation cost is assumed. This option includes an estimate of savings from supply pipe repairs that occur as a result of an increased metering rate.
- **Water audits retail** – Cambridge Water intervention to carry out audits on non-household properties, based on water use and business type where we can then recommend appropriate options for reducing consumption.
- **Rainwater harvesting for new NHH properties** - Using estimates of costs and water savings for rainwater harvesting in new builds from the Waterwise report[18] for small and medium collection areas and low demand the saving is 592 l/prop/day (equivalent to 216 m^3 per property per year). Assume Cambridge Water provide £5k grant to encourage this for 10 new non-households per WRZ per year (CAPEX). All other costs will be met by the developer/owner of the property.

9.5.7 Drought Options

We have included the demand drought measures as identified in our recently published drought plan in the WRMP planning tables as options. These are detailed in table 6, as well as tables 4 and 5. The planning tables represent a 1 in 500 year scenario which equates to level 4 in our drought plan. Our drought plan states we would deploy demand saving actions prior to this at levels 2 and 3, and these are:

- Appeals for restraint – saving of 3 Ml/d
- Temporary Use Ban (TUB) – saving of 5 Ml/d
- Non-essential Use Ban (NEUB) – saving of 2 Ml/d

As these demand management activities have no financial cost associated with them, have no negative environmental benefits and focus on reducing demand before developing new supply side options, they are key options for deployment in the preferred plan. As such, appeals for restraint and TUBs are selected as preferred options in our plan. We have not included NEUBs though as the continued use of a non-essential use ban would cause significant challenges for multiple businesses in our area which would have significant economic implications and therefore this is not a sustainable option for selection.

9.6 Demand Management Optimisation

We are committed to delivering the demand reductions outlined in the recent Government environmental plans. Whist these are important targets, we also need to demonstrate that they do deliver a best value plan for our customers and the environment, at a cost that is affordable. We have various options, outlined above, that we can utilise to deliver the targets, but we must ensure that these options, and the scale at which we deploy them, are deliverable, balance the cost against the benefits, minimise disruption for our customers and meet their expectations around service, delivery and priority.

[18] https://www.susdrain.org/files/resources/evidence/Ricardo_Independent-review-of-costs-and-benefits-of-RWH-and-GWR-Final-Report.pdf - see figures in the spreadsheet *RWH option figures from Ricardo report.xlsx.*

An example might be leakage – customer supply side leakage constitutes 30% of all leakage, and repair of customer side leaks is one of the lower cost leakage options in our plan. One option could be to deliver a large-scale programme of work in this area to provide a low-cost option. However, this is a highly disruptive option for our customers, it relies on customer approval and support for us to work on their property, and only tackles a proportion of the total leakage. As we get closer to zero customer side leakage, the cost increases dramatically. And importantly, leakage is one of our customer top priorities – it will not be acceptable to our customers for us not to be heavily focusing on our own network.

In order to determine the most appropriate activities and the scale of these, we worked with Artesia on their development of a demand management optimiser. The optimiser focuses on the savings delivered, the cost for doing so, and the deliverability and risk of each option. It looks at various enablers, such as smart networks and Government water labelling, to understand the impact this has on the deliverability of targets and how this enables new and innovative options, such as green tariffs.

For each of the key demand management areas i.e., PCC, NHH consumption and leakage reduction, we tested several scenarios in the optimiser to understand what impact it has on the plan. These scenarios looked at changing the timescales for achieving various demand reductions, as well as some of the dependencies e.g., different water labelling deliverables and timescales for the delivery of smart networks. The scenarios for each area have been discussed in section 9.5 above.

The outputs from these scenarios are included in section 11.7 as we have assessed some alternative scenarios following the confirmation of the Environment Act targets for demand reduction.

For each area, we have then compared the outputs of these scenarios to understand any interdependencies, overlay our customer engagement feedback on priorities and willingness to pay, as well as review deliverability and affordability. We have ensured we have aligned our assumptions for water labelling with those of the other companies in Water Resources East to ensure consistency in approach.

In section 11.1 below, for PCC, NHH and leakage reduction, we detail which scenario we have selected for our preferred plan as well as explain the reasons why, based on the outputs of these scenarios.

9.7 Customer support for options

Our approach to customer engagement and the findings from that work are described in detail in section 4.

In general terms, customers are more in favour of all aspects of demand management including:

- leakage reduction
- metering
- education to help change behaviours

Customers have not expressed a desire to improve levels of service and reduce the frequency of temporary use bans.

9.8 Decision Making Constraints

As detailed in previous sections in section 9, we have applied a modelling process to identify the best value and least cost approaches to resolving the supply demand deficits in our area. However, before agreeing our preferred programme, there are some constraints that we must make to our decision-making process, as outlined below.

- **Deliverability** – it is critical that our preferred plan is deliverable. We are keen that it is ambitious, particularly with relation to demand management and meeting the environmental needs, but we need to

ensure that whatever we propose can be delivered in the timescales we state. We have liaised with our supply chain to ensure our proposals can be achieved and identify any potential issues.

- **Customer preferences** – we have undertaken extensive customer research as part of the development of this plan and have looked to incorporate this into our decision-making process where possible. Our customers are keen that we deliver on demand management before we look at investing in new supply options. They also believe it's important that we demonstrate we are delivering significant leakage reductions as a priority before asking them to reduce demand. Our customers want us to deliver improvements for the environment, but in a timescale that balances the associated costs for our customers over the horizon of the plan. They are keen that we deliver the required abstraction reductions as soon as possible, but not if it creates a supply risk or the need for additional short term/temporary investment.
- **Affordability** – We need to ensure our plan is affordable for our customers whilst still achieving the ambitions that we believe are important. Where possible, we will aim to smooth the bill impact to ensure our plan is balanced and manageable for our customers, rather than show sudden increases or decreases in costs.
- **Risk** – We have to be confident that our plan does not introduce new risks to our supply demand balance and our day-to-day operation. Our plan needs to mitigate any existing risks as far as possible through activities and options that are deliverable and affordable. We have ensured that any assumptions we have made are clear and logical and have not selected options where we feel there is a high risk to them e.g., reliant on third party delivery, are previously untested elsewhere in the industry, or where costs and/or benefits are unknown or currently unquantifiable. We are keen to balance innovation and advancement with certainty of delivery.
- **Combined impact of South Staffs Water WRMP** – South Staffs Water and Cambridge Water produce separate WRMPs but produce a single 5-year business plan. As such, we look, where possible and appropriate, to ensure our plans are based on the same assumptions and methodologies so that our business plan is built the same way. We also look to identify where there are areas where we can align, such as metering programmes, in order to deliver as efficiency and as cost effectively as possible.
- **Financeability** – As described above, our business plan includes both South Staffs Water and Cambridge Water. As water only companies, the WRMPs form a substantial part of the business plan, but we also need to take into account other work required outside of these, such as water quality improvements and network resilience. Our Cambridge Water WRMP has demonstrated the need for not only an ambitious demand management programme, in line with the South Staffs Water plan, but also substantial supply side schemes to meet both the high level of growth forecasted and environmental needs of the chalk streams in this area. One of these supply side schemes involves jointly developing a reservoir in the Fens with Anglian Water which we have been progressing with in AMP7 as part of the RAPID process. These costs are enhancement spend in the business plan, and as a smaller company, we must balance the financeability of our programme whilst ensuring we deliver all of the key elements required as part of both WRMPs and our other operations. Therefore, we have looked at where there may be choices around the level of spend in AMP8, e.g., metering, in order to ensure that our programme is balanced. We have used a multi-criteria analysis tool Copperleaf to help support this decision making.
- **Regional consistency** – We are keen to ensure that our plan is developed in a consistent way to the other companies in Water Resources East. By making the same assumptions in the development of our plan, we will be able to clearly assess the needs of the region and identify areas of need and opportunity. Our plans will be truly comparable and ensure an accurate regional view is created. This has led to consistent agreement of core elements of the plan development such as climate change scenarios, headroom profiles and demand forecasting.

The below details specific areas where we these constraints have had an impact on our preferred programme.

- **Universal Metering** – Our modelling shows it is better value to deliver smart metering as quickly as possible because this enables additional options that are more effective and cost efficient. However, the following elements have led to us deciding to complete this work over 10 years rather than five years.

- **Deliverability** - We have taken the learning from companies such as Anglian Water, Thames Water and SES who have ambitious metering rollout programmes in AMP7. This has outlined the complexities of large-scale rollouts and the realistic deliverables. We have also discussed possible programme options with our supply chain and have factored in the current supply issues with meter availability as well as resources to deliver. Nearly every water company is looking at large scale meter rollout programmes from AMP8 onwards and the meter supply and contract chain is highlighting there could be significant delivery issues. However, we believe our projected rollout profile is manageable within this.
- **Financeability** – If we were to deliver universal metering in AMP8 alone, the cost impact of this is significant for the enhancement element of our business plan. In this situation, it would leave little capacity for additional enhancement spend in the business plan. We have assessed universal metering alongside other elements we have identified for enhancement cases to ensure that our overall business plan, as well as our WRMP, presents best value. This work shows that spreading the delivery over two AMPs provides overall better value.
- **Affordability** – We have to look at our overall programme and understand the impact on customer bills, and how our proposals balance against what our customers have told us are their priorities. The cost impact on the overall plan if universal metering is rolled out over 10 years rather than five is not significant, and therefore we have looked to ensure that our plan balances costs across the AMP periods where possible and where appropriate.

- **Environmental Destination** – we have developed a profile for the delivery of the abstraction reductions needed to meet the BAU+ environmental destination. We have factored the following elements into developing this profile:
  - **Customer preferences** – our customers have stated that they want us to deliver the BAU+ scenario, due to the level of uncertainty regarding the level of reductions required. They believe it is an appropriate level of ambition based on the information known at this stage, and that we should look to obtain clarity as soon as possible, which supports our investigations we will undertake in AMP8.

9.9 Defra Accelerated Spend

In October 2022 we applied to Defra for funding to enable us to start several of our AMP8 proposals early, including to start the delivery of our universal smart metering programme ahead of AMP8. The proposal included the fitting of household and non-household meters. In March 2023 we were informed we had been successful in this bid.

The proposal covered metering for both our Cambridge Water and South Staffs Water regions. However, we have not achieved our existing AMP7 plan for household meter installations to date. This is because the number of customers requesting a meter (optants) has significantly fallen due to the Covid-19 pandemic, where we were also unable to fit new meters during lockdowns, and due to the cost-of-living crisis as customers are reluctant to make changes that could impact on their bills. Therefore, we propose to undertake an extensive programme in 2023/24 and 2024/25 to catch up this backlog of meter installations by fitting “ghost” meters – this is where we install meters but do not immediately charge the customer based on the meter consumption. We are unable to accelerate any metering until we have caught up on our current programme.

In addition, the Fens Reservoir was not part of our WRMP19 or PR19 plans. We have joined the process during AMP7 and as 50:50 partners with Anglian Water, we are responsible for 50% of the development costs throughout AMP7. These costs were obviously not budgeted for at PR19 and therefore we have had to seek support from our investors to fund this activity in AMP7. We submitted our Gate 2 submission for this in November 2022, where we identified a significant cost increase for the rest of AMP7 as a result of now having a preferred site and concept design, as costs can be more accurately forecast. This will lead to total AMP7 costs in the region of £25m.

As a result, we are unable to accelerate our universal metering as per our proposal. This additional pressure on our costs means we do not have the additional funding available to progress the work as we need to ensure Fens Reservoir continues at its currently accelerated pace due to the importance of this option for both Cambridge Water and Anglian Water future customer and environmental water needs.

9.10 Ofwat's Public Value Principles

Ofwat have developed a set of principles to help guide companies in exploring and delivering better social and environmental outcomes, recognising that this is a complex area with multiple stakeholders, judgements and trade-offs. The principles are intended to provide a framework, some parameters and flexibility to enable companies to develop the best solutions. It is important that companies should seek to create further social and environmental value in the course of delivering their core services.

Table 40 Ofwat's public value principles

Ofwat Public Value Principles		How these have informed our decision making and approach throughout this plan
1	Companies should seek to create further social and environmental value in the course of delivering their core services, beyond the minimum required to meet statutory obligations. Social and environmental value may be created both in direct service provision and through the supply chain.	Our plan looks to deliver the environmental destination abstraction reductions sooner than the dates in the National Framework. Our customers have consistently told us they expect us to be ambitious when it comes to environmental improvements, and this will provide benefits to the environment as well as our customers.
2	Social and environmental benefits should be measurable, lasting and important to customers and communities. Mechanisms used to guide activity and drive decision-making should support this, for example through setting and using company purpose, wide external engagement and explicit consideration of non-financial benefits.	Our plan looks at best value, rather than just cost. Value is measured across a range of metrics including natural capital, biodiversity, flood mitigation, agriculture and climate regulation. Through our extensive customer engagement we have shared these principles with our customers and they are supportive of assessing whole impacts rather than cost alone.
3	Companies should be open with information and insights on operational performance and impacts (both good and bad). This will support stakeholder engagement, facilitate collaboration and help identify opportunities for delivering additional social and environmental value.	We will look to share our performance against our WRMP and will continue our customer and stakeholder engagement. We will look to expand on the information we share with our customers and we further explore open data and the opportunities it provides.
4	Delivery of social and environmental value outcomes should not come at greater cost to customers without customer support.	We have undertaken extensive customer engagement throughout the development of this plan to understand customer properties and willingness to pay. We believe our plan aligns with these priorities

		and customer support for key areas such as leakage and environmental improvements.
5	Companies should consider where and how they can collaborate with others to optimise solutions and maximise benefits, seeking to align stakeholder interests where possible, and leveraging a fair share of third-party contributions where needed. Companies' public value activities should not displace other organisations who are better placed to act.	Through our involvement and contribution to Water Resources East, we have ensured alignment and consistency in approaches which in turn will deliver a more consistent customer experience. We have identified new supply options and worked together to create efficiencies e.g., joint development of key areas of the plan which has in turn reduced costs. Through the WRE environmental destination workstream where we have collaborated to create a regional wide view of the environmental needs and improvements and are proposing to work jointly with WRE and Anglian Water on our environmental destination investigations to ensure a thorough consistent view of each catchment and deliver it more cost efficiently for our customers.
6	Companies should take account of their capability, performance and circumstances in considering the scope for delivering greater social and environmental value.	As a smaller water only company, we recognise that our size could hinder some of our ambitions. To ensure this does not happen, we have, and will continue to, worked collaboratively with other water companies in our region and outside of it. We are keen to create additional third-party partnerships to enable additional resources and opportunity to delivery more environmental benefits. Our plan is focused on demand management, and we know that Covid-19 has had a significant impact on our ability to deliver against some of these measures in AMP7. However, we are confident that we have robust and extensive improvement plans in place that will deliver our required outturn by the end of AMP7 and therefore have confidence that our plan is deliverable.

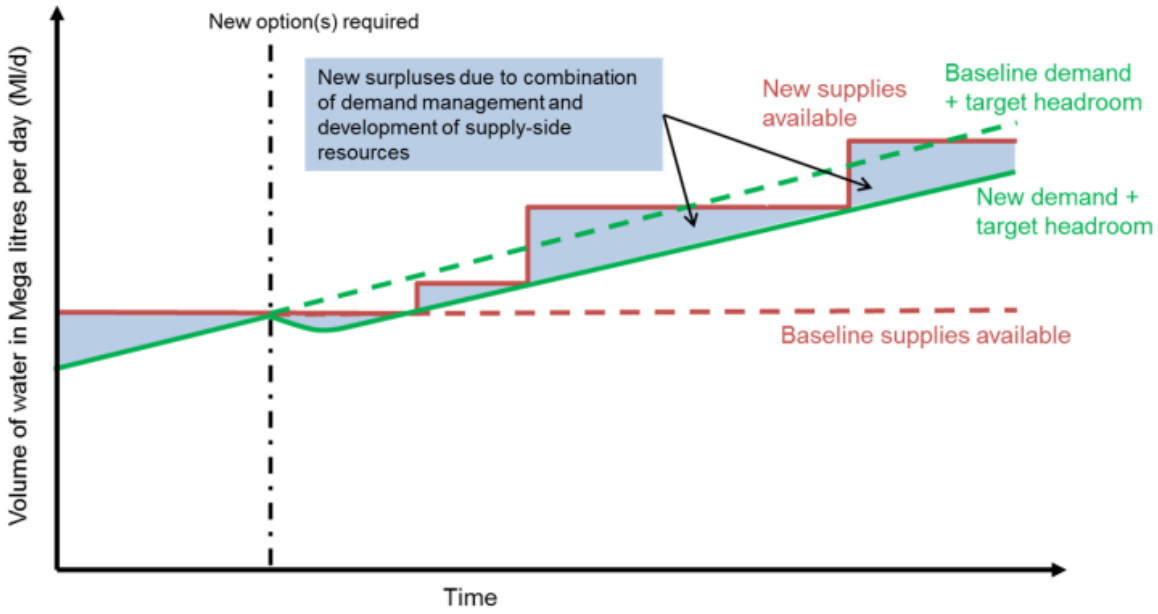
10. Modelling results

10.1 EBSD and the Least Cost Plan

As covered to in section 9.3, we have chosen to use the ValueStream model to determine our Best Value Plan. We have also continued to use the Economics of Balancing Supply and Demand (EBSD) model to determine our Least Cost Plan using the same tools and approach developed by Atkins and the University of Manchester for WRE, to ensure consistency. The EBSD model produces a comprehensive long-term supply and demand balance (SDB) that considers a number of different parameters.

For the purposes of producing our least cost plan, EBSD has considered the capex and opex costs of each option and balanced this against the WAFU (water available for use) that they provide. As figure 21 details below, when a deficit in the planning period occurs, EBSD will look for a suitable option that will resolve the supply-demand balance while considering the cost implications and WAFU of the option.

Figure 21 EBSD's approach to investment modelling to solving supply-demand balance deficits



10.1.1 Modelling Considerations

EBSD is capable of producing both a baseline supply-demand balance without options and a refined supply-demand balance with a full portfolio of selected options with respect to both DYAA and DYCP constraints. We have also used demand management options (DMOs) in all of the EBSD runs to ensure that the modelling is consistent with ValueStream's outputs (the DMOs used in ValueStream are covered in section 9.4.1). The model considered five different scenarios across twelve different runs and included demand management options. These runs and scenarios are detailed below and shown in table 41. BAU+ has been selected as the baseline DO scenario for our preferred plan so will be the focus of our options selections. Outputs of the runs are detailed graphically in the following section.

The environmental destination scenarios used in the modelling are:

- BAU (business as usual)
- BAU+
- Enhance
- Adapt
- No Environmental Destination (No ED)

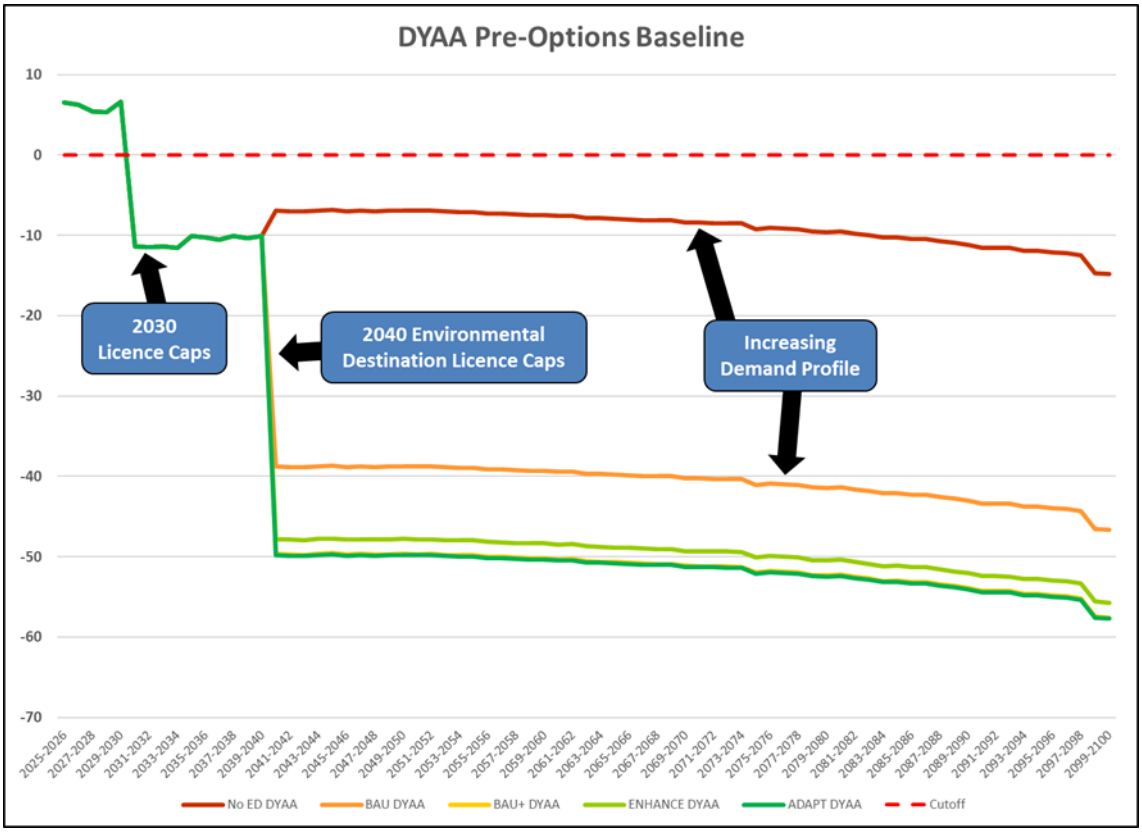
Table 41 Runs and Scenarios used in EBSD modelling

Run	Demand Profile
Baseline	Greater Cambridge Housing Plan P
OFWAT Climate Change Low	Greater Cambridge Housing Plan P
OFWAT Climate Change High	Greater Cambridge Housing Plan P
OFWAT Technology Scenario 1	Greater Cambridge Housing Plan P
OFWAT Technology Scenario 8 Enhanced WE	Greater Cambridge Housing Plan P
OFWAT Compound Low	ONS Growth
OFWAT Compound High	Cambridge Emerging Plan
Low Growth	ONS Growth
High Growth	Cambridge Emerging Plan
Extreme Growth	Extreme Growth
High Growth with Staggered Environmental Destination	Cambridge Emerging Plan
50% DMOs Effectiveness	Greater Cambridge Housing Plan P

10.1.2 Modelling Outputs

Figures 22 to 24 below represent the different runs including two pre-options baseline graphs for the DYAA and DYCP runs. These graphs include annotations describing when supply options are selected for the different scenarios across the planning period. All of the graphs in section 10.1.2 can be found in Appendix T.

Figure 22 Supply-Demand Balance from 2025 to 2100 as modelled by EBSD without any options



The five scenarios considered by EBSD differ in the severity of the environmental destination licence caps that are due to be implemented in 2040, as can be seen above. While all scenarios will see a decline in their SDB due to increasing demand, the 2025 and 2030 licence caps as well as the 2040 environmental destination licence caps will have the greatest impact on the supply-demand balance; the only period without a deficit is before the 2030 licence caps from 2025-2029. As the following figures will show, the selected options will improve the SDB throughout the planning period, although some deficits will still remain across certain runs. A summary of the dates that each supply option is selected for its preferred scenario is included in table 42.

Table 42 Dates of preferred plan supply options selection for each run

			Options					
Best Value Plan Testing Scenarios	Demand Forecast Scenario Name	Selected Scenario	**01B**	**37Aii**	**38B**	**57**	**73A**	**75DiiiOp2**
Central Plan	WRMP24 Final Preferred Plan	BAU+	2069-70	2083-84	2088-89	2040-41	2036-37	2031-32
OFWAT Climate Change	Low	BAU+	2069-70	2083-84	2088-89	2040-41	2036-37	2031-32
	High	BAU+	2069-70	2083-84	2088-89	2040-41	2036-37	2031-32
OFWAT Technology	OFWAT Scenario 1	BAU+	2069-70	2083-84	2088-89	2040-41	2036-37	2031-32
	OFWAT Scenario 8 Enhanced WE	BAU+	2069-70	2083-84	2088-89	2040-41	2036-37	2031-32
OFWAT Compound Scenarios	OFWAT Compound Low	BAU+	-	-	-	2040-41	2036-37	2031-32
	OFWAT Compound High	ADAPT	2040-41	2040-41	2040-41	2040-41	2036-37	2031-32
Growth	ONS Growth	BAU+	-	-	-	2040-41	2036-37	2031-32
	High Growth	BAU+	2040-41	2040-41	2040-41	2040-41	2036-37	2031-32
	EXTREME Growth	BAU+	2035-36	2040-41	2040-41	2040-41	2036-37	2031-32
	High Growth with Staggered ED	BAU+	2045-46	2045-46	2047-48	2046-47	2036-37	2031-32
DMOs Less Effective	DMOs 50% Effective	BAU+	2040-41	2040-41	2040-41	2040-41	2036-37	2031-32

Figure 23 Supply-Demand Balance from 2025 to 2100 as modelled by EBSD with all options

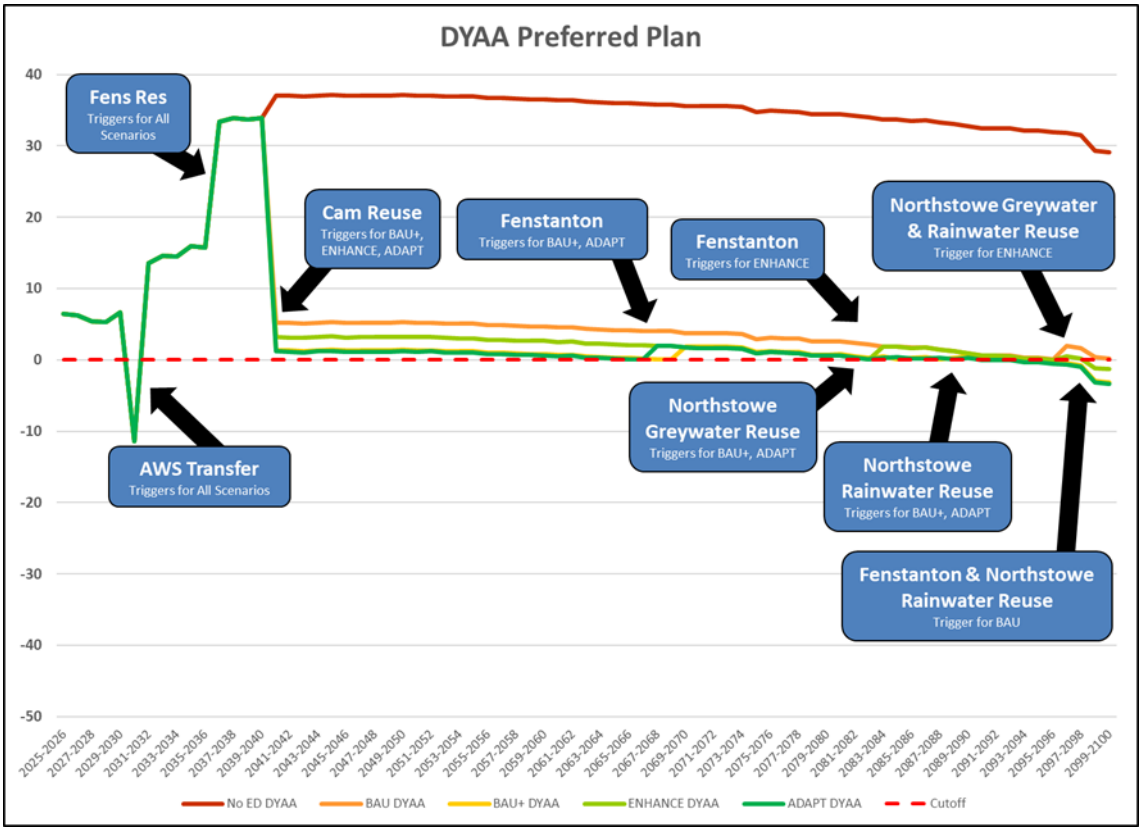


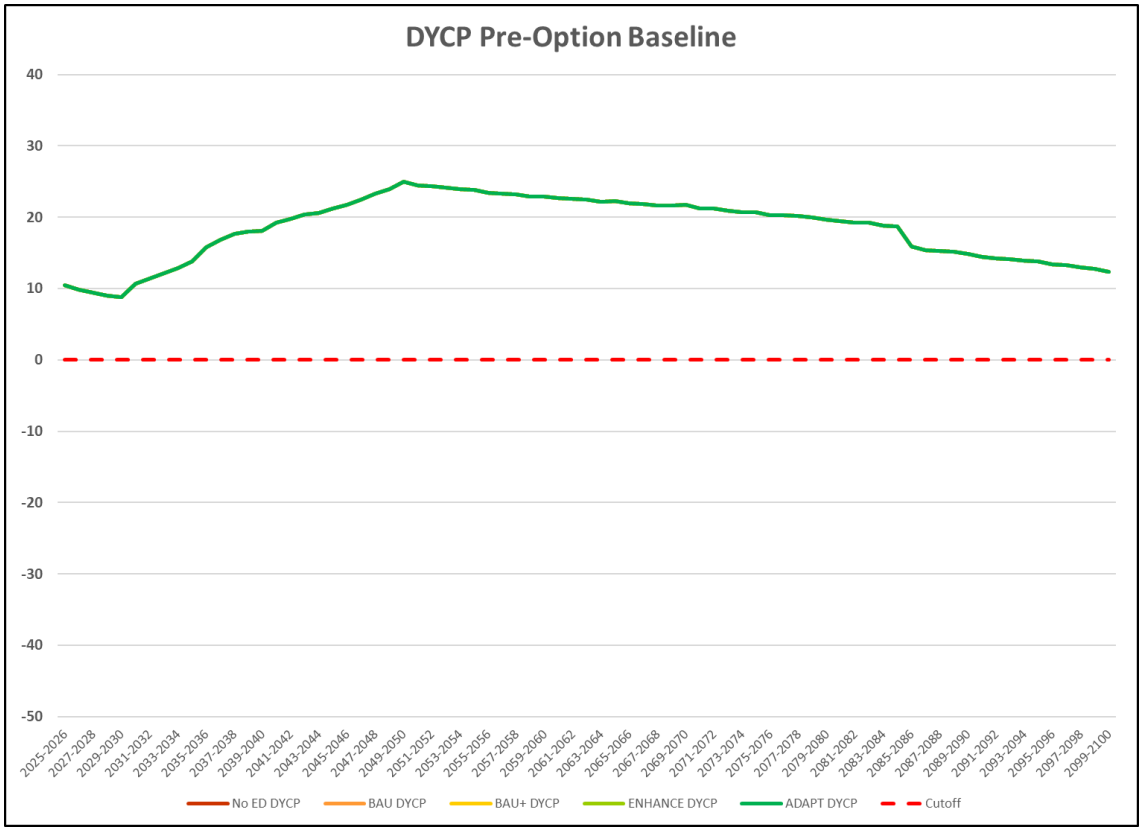
Figure 23 shows our baseline selected options portfolio in a DYAA scenario, based on the climate change RCP6 scenario and the Greater Cambridge Housing Plan P growth forecast. Our earliest option, the Grafham Transfer (CW24-75DiiiOp2) starts in 2031 for all scenarios, so there is still a deficit in 2030 before the option starts. Our major strategic option, Fens Reservoir (CW24-73A) will provide a strong surplus for all scenarios when it is operational in 2036. This is supplemented by the Cam Reuse (CW24-57) option for BAU+, ENHANCE and ADAPT in 2040, with the Northstowe Greywater (CW24-37Aii) & Rainwater (CW24-38B) options selected later in the planning period. There is no other deficit in the planning period. Our data tables look out to 2100 and several other options are selected in the late 2060's and in the 2080's to maintain a positive SDB to 2100.

The near-term deficit from 2030 to 2031 (until the Grafham Transfer triggers) cannot be fully solved by the current supply options, even when all of the available feasible options have been picked. This has also been evidenced in other runs that consider different availabilities of options, as the following figures show.

We include the detail of all the scenarios ran and the outputs in section 11.7 and in appendix T.

It is also important to note that EBSD has produced DYCP modelling data alongside DYAA information. Below in Figure 24 the DYCP no-option baseline is always positive in terms of its supply-demand balance. This means that no options are needed to be selected as there is no deficit to solve. This does not, however, circumvent the DYAA findings and so all options are needed for the least cost plan.

Figure 24 Supply-Demand Balance from 2025 to 2100 DYCP baseline showing no deficit

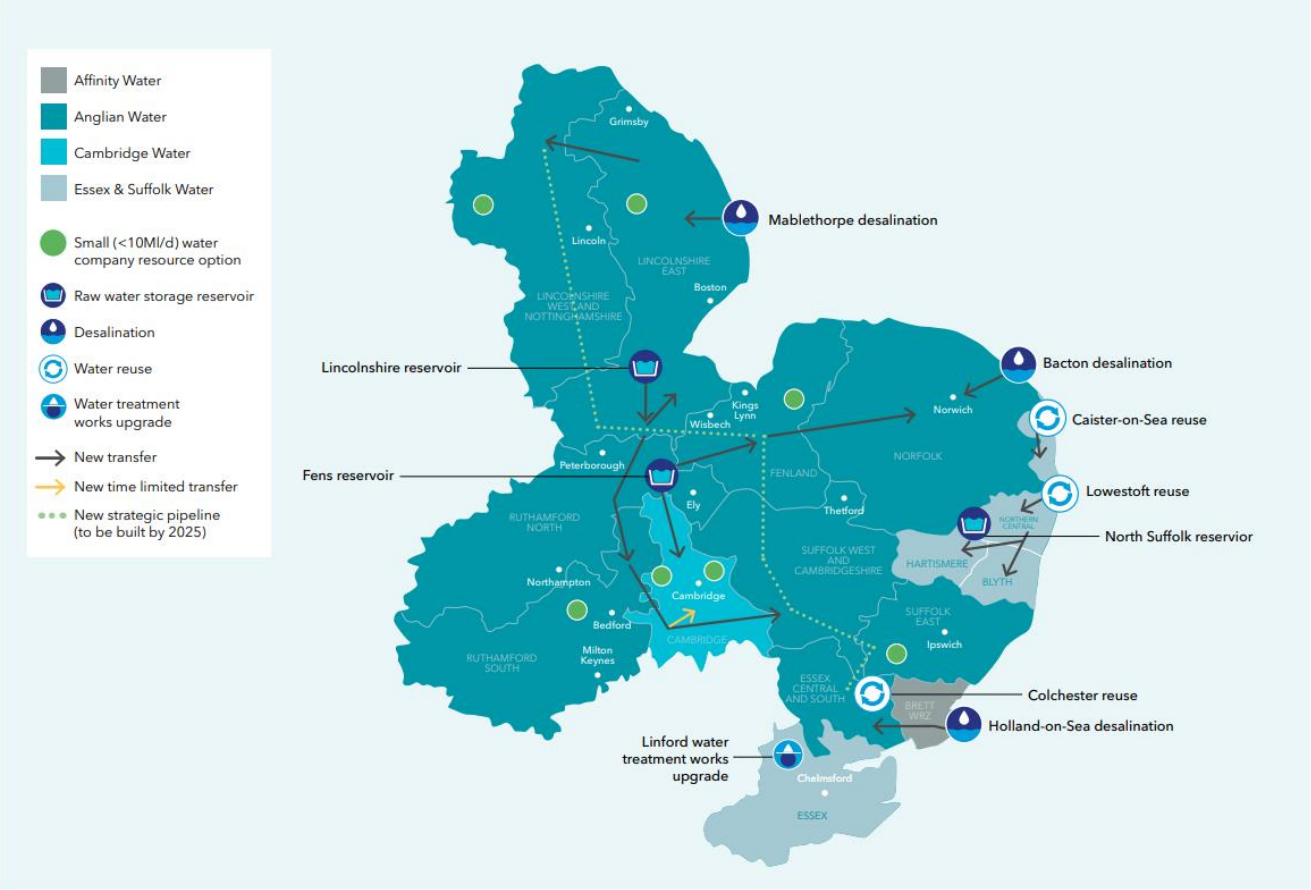


10.1.3 WRE Regional Plan

WRE uses the regional simulator to test combinations of feasible options and operating regimes over a wide range of potential scenarios for 2050, reflecting uncertainty in demand forecasts, climate change, weather patterns, and also the different Environmental Destination scenarios. The simulator iteratively tries out (through over one hundred thousand runs) different combinations of options to maximise system performance. This process reveals trade-offs. It is not possible to deliver the optimum water supply outcome for all sectors in all catchments and deliver all environmental targets simultaneously at minimum cost. So, the Technical Delivery Group identified acceptable performance levels for each metric, bringing in the ability for levels of compromise to be tested. For example, increasing acceptable costs to allow greater environmental performance. Portfolios of options that allow the system to perform within these acceptable ranges are considered ‘good performing’ portfolios. This system reflects our own Valuestream model.

By looking across all of these good performing portfolios we can see how often each supply option forms part of a plan, for each Environmental Destination scenario. Some options appear in every or almost every portfolio (90% or more) for each Environmental Destination scenario. This includes the Fens Reservoirs and the Grafham Transfer, which directly aligns with our own modelling outputs. The figure below shows the WRE best value plan.

Figure 25 WRE Best Value Plan



10.1.4 Modelling Summary

Both the EBSD and ValueStream modelling have shown a clear relationship in their supply-demand balance predictions. The two models have seen a large deficit occur in 2030 due to licence capping, with an even steeper deficit in 2040 caused by the environmental destination licence caps. All of our feasible options with the highest water available for use (WAFU) have been selected to cover these predicted deficits across the different environmental destination scenarios and modelling runs to create our preferred plan. These selected options have gone some way to reducing the SDB deficit, particularly with the expected activation of the Fens Reservoir in 2036.

As shown in our preferred plan of supply options, the Grafham Transfer and Fens Reservoir will provide significant increases to our SDB. Their 26 Ml/d and 44 Ml/d of respective supply input will greatly contribute to reducing the modelled deficits in the medium term. The River Cam effluent reuse will help to additionally reduce the SDB deficit and counter demand throughout the planning period.

These preferred options have gone a long way to mitigating the deficit: a pre-options SDB deficit of 49.9 Ml/d in 2040 through to a 57.7 Ml/d deficit in 2100 from EBSD has become a 1.2 Ml/d surplus in 2040 and this surplus is maintained to 2100. However, even with all options selected there are still instances of a negative SDB in the preferred plan, and the near-term deficit in 2030 has been created licence caps from 2030.

The majority of the modelled runs do not experience many deficits until the end of the planning period. However, the runs with higher growth forecasts – such as the Cambridge Emerging Plan and the Extreme Growth runs – will see significant deficits across the majority of the plan. Combined with the 2040 environmental destination licence

caps, this increased growth will pose a significant risk to the supply-demand balance as it will force many scenarios back into a deficit.

Ultimately EBSD and ValueStream both select the same options to utilise and when. We have assessed our least cost plan against the same metrics as the best value plan to ensure consistency and we have seen that both plans show a deficit in 2030 and in the 2090s through their modelling. As such, our least cost and best value plans are the same.

11. Our proposed programme

Summary

Demand Management

Our proposed programme has an ambitious demand management programme as its first commitment. The proposed demand management will offset the proposed increases in demand forecasted due to the growth planned for the region. Our plan will achieve:

- 50% reduction in leakage (from 2017/18 levels) by 2040
- 110 l/h/d household consumption by 2050
- 9% reduction in non-household consumption by 2038, based on 2038 forecasted demand

Key enablers for this delivery are:

- Delivery of the Government's water labelling scheme for white goods by 2025
- Universal smart metering installed across the region by 2035

Our customer engagement shows that our customers support a plan that prioritises demand management, particularly leakage. They are also supportive of universal metering; however, there is a strong theme that we need to ensure we have the appropriate support mechanisms in place to protect vulnerable and large families. We are developing these support packages and plans as part of our business plan submission PR24.

Supply options

In order to deliver the environmental needs of our region, we need to include a number of supply options in our plan in order to provide supply from alternative sources and enable us to make significant abstraction reductions from the chalk aquifers. These new supply options are:

- 26 Ml/d of time limited transfers
- 44Ml/d of new regional reservoir and transfers (Fens)
- 7Ml/d of new resource – effluent re-use

We have stress tested our preferred plan against various scenarios, as reflected in the Ofwat common reference scenarios produced for PR24. These include:

- Demand reduction activities only deliver 50% of their projected savings.
- Ofwat compound high scenario e.g., high climate change, high environmental destination.
- Ofwat compound low scenario e.g., low climate change, low environmental destination.

We also identify where an alternative pathway or plan may be required to meet these scenarios and how we will monitor our performance against the plan.

For the revised draft WRMP, we have updated our demand forecasts and as a result we have updated our preferred programme of activities. Specific activities include:

- Updated benefits associated with installing smart meters.
- Reviewed and updated costs for activities.
- Run additional scenarios to explore the best value plan, as well as alternative options.
- Detail around how we will deliver this ambitious demand management programme.

This section now also includes detail about the impact our preferred plan has on our greenhouse gas emissions, broken down into key activities, and we share our plan to achieve net zero operational carbon by 2030. We provide more detail on the scenarios we have tested our preferred plan against to ensure it is robust and to evidence low regrets options. Finally, we share the bill impact of our preferred programme, both for the next five years, and in total.

11.1 Demand management proposals

11.1.1 Metering

At WRMP19, our customer engagement found that customers did not support a compulsory metering approach. Since then, Cambridge Water region has been declared an area of serious water stress by the Environment Agency. As a result, we have again explored the concept of compulsory metering with our customers for WRMP24.

It is important to understand the background changes since our last round of customer engagement at WRMP19. Energy smart meters are now commonplace in homes as technology over the last five years has increased. With the recent energy price rises, customers are turning more and more to smart meters to have better information and take control of their usage. Having access to this level of data is now seen by customers are necessary, rather than a nice to have. Throughout our surveys, those customers with smart meters acknowledged that they had changed their behaviours as a result to reduce their usage and save money.

As a result, we saw a change in attitude to compulsory metering among our customers at WRMP24. It should be noted that we have used the term “universal metering” to customers, although we have explained the link to compulsory metering. This is because our aim would be to achieve universal metering over a set period of time in order to better inform our own activities and to help customers change their behaviours.

As evidenced in section 4, customers viewed increased metering as a necessary and important approach for us to undertake. They believe it to be a fair way for all. However, they did raises concerns around affordability especially in the most recent customer engagement completed in the summer of 2022 as the cost-of-living crisis intensified, and wanted Cambridge Water to ensure they made provisions to support vulnerable and large families. We discuss our planned approach to support our customers through this transition in section 11.1.1.3.

As also explained in section 4, we did receive majority support from our customers for universal metering. We take the issue of affordability extremely seriously and are developing plans that will be included at PR24 detailing how we will build on our existing support packages and offerings. We will also look at options such as “host metering” – in this case, we would install meters but not immediately convert the customer to a metered bill. Over a period of one or two years, we would provide regular information to the customer to share the bill impacts of transferring, with the aim to convert customers to metered bills sooner where savings are achieved or enable customers to prepare adequately or seek support from us in situations where bill increases would be seen.

Smart networks, and smart metering in particular, are a key enabler for other demand management activities. An example would be innovative tariffs – without smart metering in place we are unable to create green or community tariffs that incentivise customers to use less water. Not only does smart metering enable new and innovative activities, but it also enables us to build on our existing activities to make them more efficient and cost effective, particularly for leakage reduction activities. For example, the increased data available to us will allow us to target our

activity better which reduces costs, resources and response times. The additional data also provides us with clearer information to better target our education and communication campaigns, as well as our individual customer support offerings in order to influence customer choices and deliver behavioural change for water usage and consumption.

When assessing the benefits of smart metering, we have identified the following additional benefits to those already described:

- Reduced consumption and leakage mean reduced abstraction and treatment of water. This saves energy due to less pumping and treatment requirements, as well as a reduction in chemical costs.
- This reduction in energy and chemicals also leads to a reduction in our greenhouse gas emissions and reduces our carbon footprint.
- Environmental benefits of leaving more water in the environment through reduced abstraction needs, helping to achieve Water Framework Directive objectives relating to flow.
- Improved resilience during peak demand.

As part of our demand management optimisation process we looked at the impact smart metering has on delivering other targets such as leakage, PCC and DI per capita. We ran various scenarios which looked at:

- Installing smart meters across our entire customer base by 2030
- Installing smart meters across our entire customer base by 2035
- Installing smart meters across our entire customer base by 2040
- Not undertaking a universal smart metering programme and relying on optants

Our analysis showed that without a universal smart metering programme we cannot achieve all of the Environment Act targets, and that if we take 15 years to roll these out and deliver them by 2040, we also miss many of the interim targets. We already have a high metering penetration at 74% and therefore the remaining ones are likely to be more difficult to fit. As such, we believe deliverability to be a key factor in the programme we have chosen. We have engaged with companies such as SES and Anglian Water who have had significant roll out programmes in AMP7 and taken the learnings from this to inform our decision-making process.

Therefore, our plan looks to install smart metering across our entire customer base, achieving 100% penetration (or as close to this as feasibly possible, accepting there will be properties where this is not possible, such as shared supplies), by 2035. This 10 year roll out programme will be achieved efficiently by rolling out meters geographically, focusing on DMAs with high water usage first in order to make the biggest impacts.

Table 42 HH metering rollout programme (including optants)

	AMP8					AMP9				
	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
Meter no's.	3,104	3,104	3,104	3,104	3,104	3,104	3,104	3,104	3,104	3,104
Benefit Ml/d	0.71					1.42				

Our plan assumes these smart meters will all be AMI capable but will operate as AMR meters in AMP8. This is because the infrastructure in our area of operation is not currently in place to support AMI meters readily, and therefore the increased costs for installing this mean the costs outweigh the benefits. We do expect this to change over the lifetime of our plan, hence our plan to install AMI capable meters that are easily, and cheaply, converted to full AMI operation. We expect this shift to occur during AMP9 and beyond, and this is reflected in the split of meter installs we're proposing from then, with an assumption of 50% of each from AMP9, and 100% AMI from AMP10 onwards.

We will prioritise the highest usage DMAs first for installation. This will enable us to deliver the maximum benefits quickly and provide useful information to further explore customer side leakage and provide bespoke water efficiency advice to customers. We will also deliver our programme geographically to ensure it is as efficient and cost effective as possible. To this end, we also propose to combine the non-household enhanced meter technology rollout that we discuss in section 11.1.4 in order to deliver both programmes as efficiently as possible. Many of our non-household customers are very close to households, for example shops and hairdressers, and will be more efficient to do both activities in a geographical area at the same time. It will also enable clearer communication to all our customers and a more successful behavioural change campaign associated with the rollout. We will develop the detail of this rollout plan before 2025 and ensure we develop an extensive communications plan to engage with our customers. We have engaged with the companies already doing this work in AMP7 and will take on board lessons learned to ensure we deliver the best possible customer support and experience through the process.

In order to maximise the benefits outlined above, we are proposing to invest in a universal metering solution. This is driven by:

- The need for a way of reading legacy smart meters in a smart way and mitigating outdated reading equipment.
- Our current capability means we would only be able to retrieve basic data from c75% of our network which limits our ability to recognise the benefits of meter reading for PCC, leakage and C-MeX.
- Greater assurance for future meter supply and cost efficiency as this would mean we are not dependent upon a single meter supplier.
- Requirement to transfer data and provide analysis opportunities to all of our meters.
- Future adaptability as technology advances and the need to have a flexible system to allow us to adapt.
- More efficient meter reading routes by planning geographically.

A new universal metering solution would enable us to address the above which not only future proofs our metering activity but also delivers cost efficiencies and ensures we are able to recognise the PCC and leakage benefits we have outlined.

11.1.1.1 Defra Accelerated Infrastructure Spend – impact on programme

In section 9.9 we detailed our successful application to accelerate our household metering programme through the Defra accelerated infrastructure development programme. This decision was communicated in March 2023, potentially allowing two years of acceleration of our programme.

However, as our AMP7 existing metering programme was behind schedule due to the impact of the Covid pandemic, we have proposed to focus our activities in AMP7 on catching up our metering programme which is imperative to deliver the benefits we have already committed to. We have also entered into the RAPID process with Fens Reservoir which has led to circa £25m of cost in AMP7 which was unfunded and therefore we are not in a position to finance any additional work outside of PR19. As a result, our metering programme will not be accelerated and be delivered by 2035.

11.1.1.2 The cost of metering

We have included the cost of our proposed household metering programme in the following table. These include the costs to achieve universal metering – it does not take into account any replacement of meters at the end of their life; this will be picked up through business plan submissions in future AMPs.

Table 43 Cost of our proposed household metering programme

	AMP8	AMP9
Metering install programme	£2.51m	£2.51m
Smart meter infrastructure	£0.93m	£0m

11.1.1.3 Supporting our customers through the transition

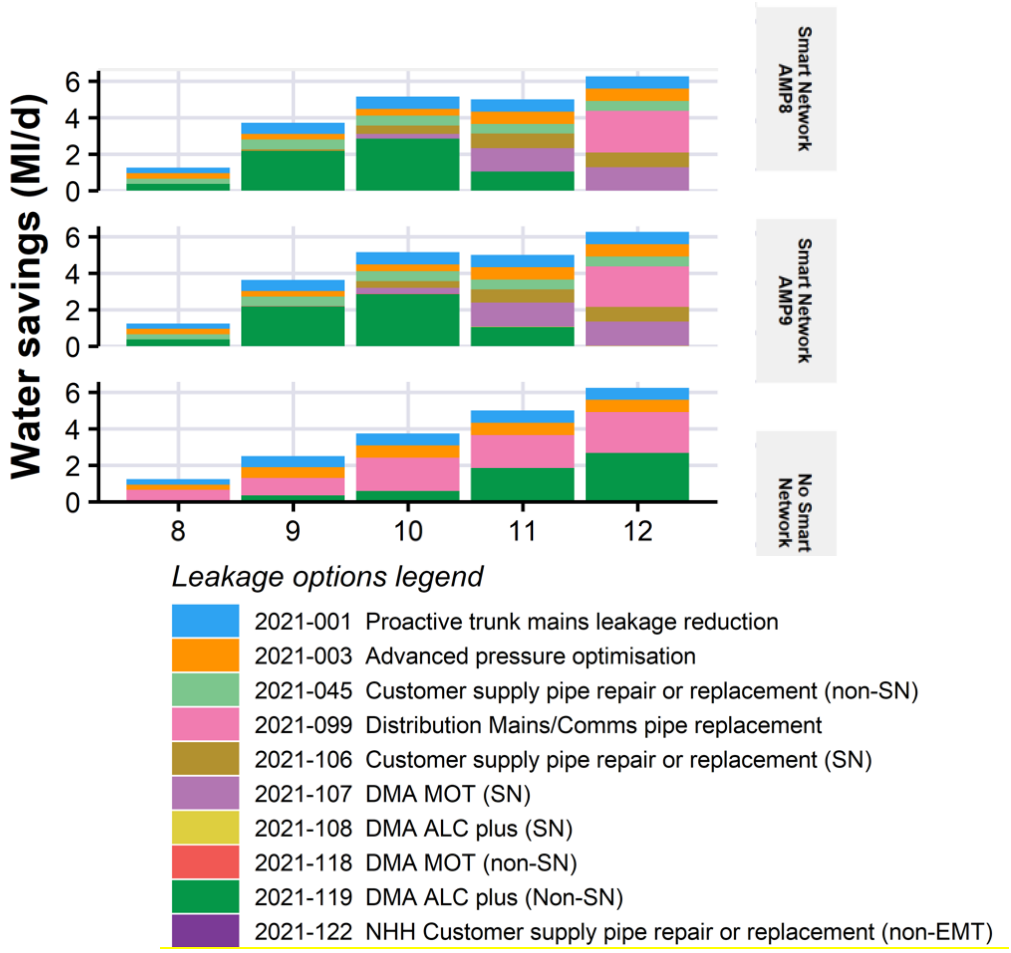
In our draft WRMP we acknowledged the concerns raised by our customers and highlighted that we were working through our plan to support customers as part of our PR24 process. We take the issue of affordability extremely seriously and we have now undertaken further customer research on the potential options and have agreed the following approach:

- We aim to have a maximum of 3% of our customers in water poverty by 2035.
- We will expand our existing Assure programme to support nearly twice as many customers in AMP8 as we are supporting in AMP7.
- We will provide a 2-year grace period for meter rollout. Customers will have 2 years from the date of meter installation before we switch to metered billing so we can provide them with regular consumption and proposed bill data. This will enable them to understand the impacts and plan for the potential changes were required.

11.1.2 Leakage reduction

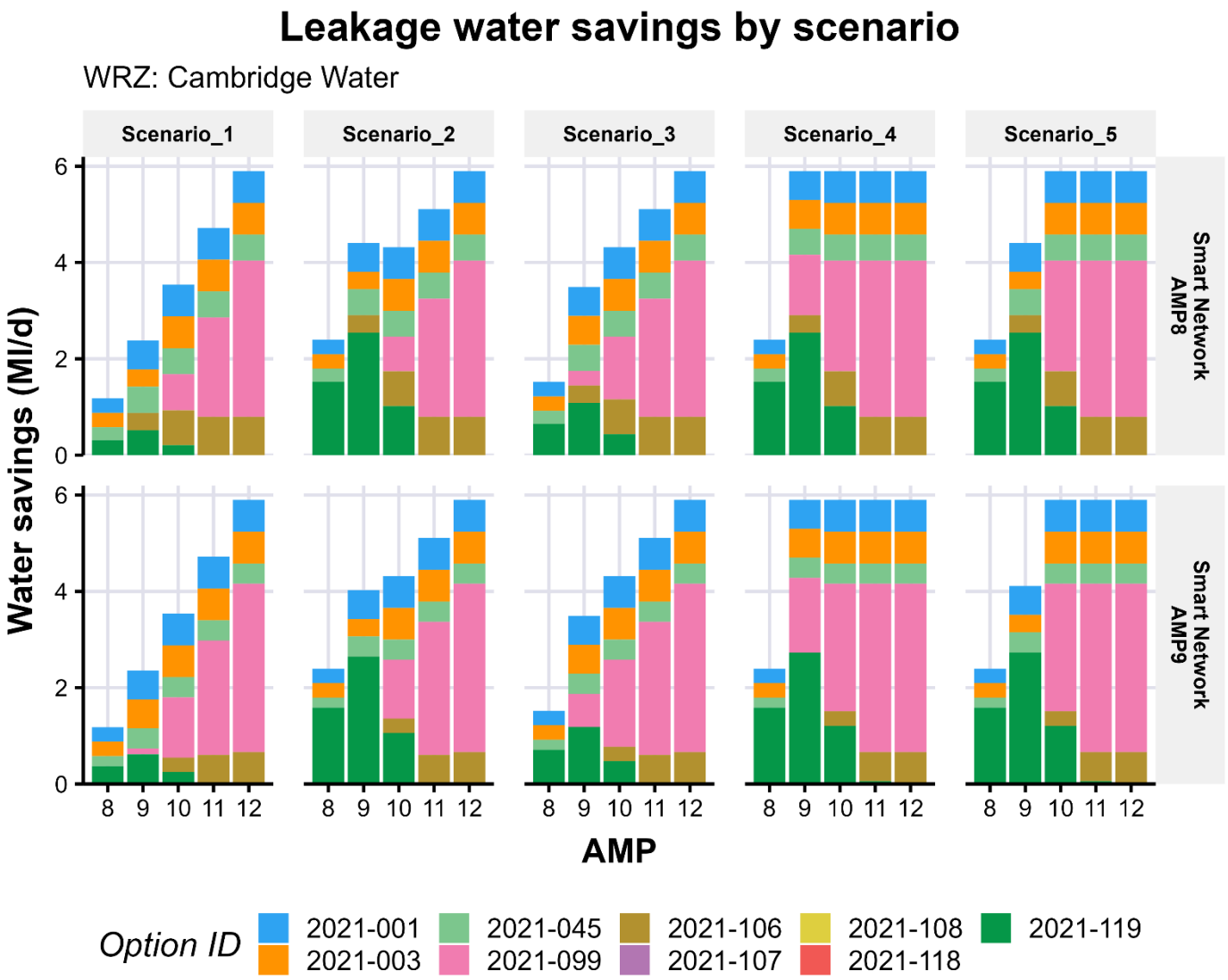
We are including delivery of the 50% leakage reduction by 2040 in our proposed plan as well as the interim targets of 20% reduction by 2027, 30% by 2032 and 37% by 2038. As detailed in section 9.5.6.3, we explored several scenarios for achieving the targets and made changes to key dependencies such as pace of smart metering rollout and assumptions around water labelling. The below graphs show how the combination of activities are proposed in order to deliver the 50% reduction, as per the results from the optimiser.

Figure 26 Leakage reduction activities for draft WRMP



For the revised draft plan, we have also explored five more scenarios which look at ensuring we now achieve the interim Environment Act targets, which have been published since the draft plan was submitted, and the potential to accelerate the 50% reduction target. For each scenario, we looked at the impact of having a smart network in place at the end of AMP8, end of AMP9 and end of AMP10. The outputs of these are shown below.

Figure 27 Leakage reduction activities for revised draft WRMP



The optimiser showed that we need a smart network (including smart metering) to be in place in order for the target to be achieved. It also shows that there is little difference in activities and cost for the overall leakage programme between implementing smart networks in AMP8 or AMP9.

Table 44 Cost of our leakage scenarios

Scenario	Cost of leakage programme £m	
	Smart Metering delivery by end of AMP8	Smart Metering delivery by end of AMP9
Scenario 1 - 50% leakage reduction by March 2050 (no interim targets)	20.14	21.55

Scenario 2 - All environmental targets met, including interim	21.20	22.92
Scenario 3 - 20% reduction by AMP 8, plus Env act targets	20.68	22.23
Scenario 4 - 50% by 2035 and then sustained	21.95	23.79
Scenario 5 - 50% by 2040 and then sustained	21.69	23.47

As evidenced in section 4, our customers have been very clear on their preferences regarding levels of leakage.

- Reducing our leakage levels emerges as a clear and consistent priority among most customers.
- There is a strong and consistent view that we need to do more to reduce leakage from current levels.

We are also cognisant of the short-term water resources challenge we have in AMP8 and AMP9 due to the no deterioration licence caps we need to implement. Therefore, we are keen to accelerate leakage as far as is reasonably practicable in order to reduce the demand for water. Our optimisation work shows there is little cost difference between the overall programmes in doing this, and it also supports the clear direction we got from our customers. We also know that our customers are much more likely to respond positively and engage with water efficiency activities if we can demonstrate that we are playing our part and driving leakage down.

With this in mind, we looked at key risks with scenario 4 and scenario 5. Scenario 4 would deliver benefits quicker but our analysis showed that deliverability is a key concern in this scenario, and that the delivery of a smart network would significantly support delivery of the target as it provides more information on customer side leakage (which constitutes 30% of all leakage) as well as enables additional activities that have a higher success rate. It also enables advancements in technology and innovation to help support the delivery. As a result, we have selected scenario 5 in our preferred plan.

Table 45 below shows the benefit each individual activity provides over the lifetime of the plan.

Table 45 Demand savings per leakage activity

				Cumulative benefit by AMP				
Activity	**ID**	**Year activity starts**	**Total benefit by 2050 Ml/d**	**AMP 8**	**AMP 9**	**AMP 10**	**AMP 11**	**AMP 12**
Proactive trunk mains leakage reduction	2021-001	2025	0.66	0.30	0.60	0.66	0.66	0.66
Advanced pressure optimisation	2021-003	2025	0.66	0.30	0.36	0.66	0.66	0.66

Customer supply pipe repair or replacement (without smart networks)	2021-045	2025	0.42	0.21	0.42	0.42	0.42	0.42
Distribution Mains/Comms pipe replacement	2021-099	2035	3.50	0	0	2.65	3.50	3.50
Customer supply pipe repair or replacement (with smart networks)	2021-106	2035	0.66	0	0	0.30	0.60	0.66
DMA ALC plus (without smart networks)	2021-119	2025	0	1.59	2.73	1.21	0.06	0
		Total	**5.9**	**2.4**	**1.71**	**1.79**	**0**	**0**
				In AMP reduction				

In the draft plan, the outputs highlighted a concern around proactive trunk mains leakage reduction. This activity was very high cost per megalitre of water saved, and so we reviewed both the costing and whether this activity is best value for the revised draft WRMP.

Our costing was based on some work undertaken at the end of AMP6 in our region. Here we undertook a trunk main renewal programme on the A505 due to leakage volumes and frequency, which in turn delivered 0.5 Ml/d of benefit. Our trunk main approach for this WRMP was to identify similar opportunities and replicate this. Hence the higher cost due to long lengths of trunk main replacement.

We have been reviewing this process over the last 18 months and now found there are no other trunk main large scale renewal projects that we can identify in our area. We have also used new technology in AMP7, such as satellites, which has enabled us to better pinpoint leakage and undertake localised repairs.

As such we have updated the specific trunk main option (2021-001) for the revised draft and the activity and cost is now based on use of our active leakage control (ALC) approach for trunk mains.

Our leakage plan looks to build on existing leakage activities and technologies in the first years on the plan – these activities are well understood and tested, and therefore confidence in delivery is high. As we move through the planning period, the introduction of smart metering enables additional activities or allows existing activities to be undertaken more cost effectively and efficiently.

Alongside this, we will continue to identify innovative opportunities to identify and reduce leakage. We are part of several bids as part of the Ofwat Innovation fund that relate to leakage e.g. a proposal to explore dark fibre to identify leakage. These activities will help to supplement the existing methods and technologies to support delivery of our ambitious targets.

Our preferred programme includes customer supply pipe repair or replacement activities. This is a hugely important area of leakage reduction as private side leakage accounts for approximately 30% of the total leakage we have. We currently have a policy for customer side repair and replacement activities and propose to maintain this policy moving forwards. Our policy states that if we identify a leak on a customer property, although the supply pipe is the responsibility of the customer to repair, we want to help out where we can. As such, we offer an assisted leak repair service to help ensure the leak can be fixed as quickly as possible. This process involves:

- Visiting the property, identify the leak and ensure the customer is aware who is responsible for the repair.
- Guide customers to the Watersafe website so they can find a local contractor who can complete the repair.
- Provide advice to the customer on replacing the pipe and how to claim a contribution should they relay the pipe.
- Provide information on how to claim a burst allowance for household customers on a water meter.
- An "Assisted repair" – here we would carry out the repair if the situation is appropriate.

For an assisted repair, we will not repair leaks on rented properties, or for customers who have insurance policies that cover this work. We will also only repair one leak per property and will not undertake repairs that are under buildings or permanent structures. As part of our approach, we are able to assist vulnerable and water dependent customers, something which we are keen to expand as we move forward in the planning period. We will also look to replace lead supply pipes where we identify them as part of this work.

11.1.2.1 Leakage reduction costs

We have included the cost of our proposed leakage reduction programme in the following table.

Table 46 Cost of our proposed leakage reduction programme

	Option ID	AMP8 £M	AMP9 £M	AMP10 £M	AMP11 £M	AMP12 £M	Total £M
Proactive trunk mains leakage reduction	2021-001	1.96	1.96	0.39	0	0	*4.31*
Advanced pressure optimisation	2021-003	0.05	0.01	0.05	0	0	*0.11*
Customer supply pipe repair or replacement (without smart networks)	2021-045	0.11	0.13	0.04	0.04	0.04	*0.36*
Distribution Mains/Comms pipe replacement	2021-099	0	0	11.59	4.25	0.73	*16.57*
Customer supply pipe repair or replacement (with smart networks)	2021-106	0	0	0.11	0.13	0.06	*0.3*

DMA ALC plus (without smart networks)	2021-119	1.42	0.27	0.13	0.01	0	*1.83*
	Total	**3.54**	**2.37**	**12.31**	**4.43**	**0.83**	***23.48***

11.1.2.2 Compliance with Environment Act Target for leakage

The Environment Act target looks to reduce leakage by 50% from the 2017/18 baseline level. For Cambridge Water, this level was 14.6 Ml/d. The below table shows how our plan delivers against this target and the interim targets defined in the Act.

Table 47 Performance of our leakage reduction plan against the Environment Act 2021 targets

Date	WRMP leakage level Ml/d	WRMP % reduction from 17/18	Env Act requirement Ml/d
31/03/2025	13.20	10%	n/a
31/03/2027	12.24	16%	20%
31/03/2032	10.12	31%	30%
31/03/2038	8.02	45%	37%
31/03/2050	7.30	50%	50%

As stated previously, our plan achieves 50% leakage reduction by 2040. However, our plan does miss the 2027 interim target due to the leakage position at the end of AMP7. At PR19 we did not receive the full funding we requested to deliver the leakage ambition we included in our WRMP19 and as such our target with Ofwat is reduced from this to 13.2 Ml/d. This also takes into account a change in leakage methodology that all companies have had to comply with that occurred in early AMP7.

In our analysis, we were unable to achieve the 2027 interim target from a deliverability perspective in just two years. However, our plan catches up quickly and we are ahead by the next interim target, before going on to exceed the remaining targets.

11.1.3 Water efficiency

It is important to note that PCC reductions in AMP7 remain a challenge following the Covid-19 pandemic. Whilst levels of household usage are reducing, we are not yet seeing pre-Covid levels despite extensive water efficiency

work above our proposed WRMP19 programme. The uncertainty of what the new "normal" will be, with hybrid working more established as a working pattern since the pandemic, will be monitored through our annual WRMP reviews.

As a result of the change in consumption patterns that we saw as a result of Covid-19, we undertook a significant review and update of our day-to-day water efficiency activity during AMP7. Early in the AMP we focused on offering water efficiency audits to customers as well as providing advice and water saving devices through the platform Get Water Fit. We also had an extensive school education programme, as well as attending local events in our area such as food festivals and summer fayres in order to share water saving advice and products. Once the pandemic was underway, most of this activity had to stop and we moved our education and Get Water Fit to purely online offerings, which hindered our ability to maximise savings. Coupled with increased hygiene practices and more customers working from home, we needed to take a different approach post pandemic in order to reduce PCC back to our target levels. We brought in a new "Water on Wheels" role into our organisation, where an employee is a mobile presence in the community at events, supermarkets, garden centres and other community locations to promote the benefits of metering and provide water efficiency advice. We also utilised evidence and best practice from across the industry to develop a challenging plan for 2023 to 2025, which involves two key phases:

- Phase 1 - "Summer Ready" quick wins
    - Open data demand sprints
    - Behavioural change campaign – "Can for the Cam" urging customers to swap the hosepipe for a watering can
- Phase 2 - Establish and embed new projects
    - Eco tariff trial
    - Sustainable village campaign

We have a similar approach for our South Staffs Water area with different elements in the plan, so that we can analyse the success of all activities and look to expand successful elements into each region. For Cambridge Water we are delivering the following:

- Phase 1 - "Summer Ready" quick wins
    - Increase meter reading frequency
    - Expand innovative trials e.g., bin lorry trial for smarter reading
    - Better targeting of initiatives based on the impact of Covid
- Phase 2 - Establish and embed new projects
    - Installation of flow regulators
    - Home efficiency visits
    - Leaky loos find and fix
    - More ambitious "meter my street" campaign

We have participated in several Ofwat Innovation fund bids relating to water efficiency and were successful in obtaining funding for our lead bid relating to water efficiency in faith and diverse communities. The project seeks to establish a deeper understanding and evidence base on how water is used and valued in different faiths and cultures. The aim is to develop a more comprehensive water efficiency engagement and support framework which water companies can adopt in the future. It will introduce new bespoke water saving interventions and behaviour change campaigns linked to faith/culture. This could be revolutionary and lead to significant environmental and social benefits, such as reducing per capita consumption, building trust and public value, as well as supporting hard to reach vulnerable customers by opening new channels of engagement and communication. We propose to take the learnings from all the above into AMP8 and beyond as we look to build on the successes and refine our programme. By delivering the above, we believe we can achieve our end of AMP7 target PCC level and therefore this plan starts from that position.

11.1.3.1 Water Labelling

As previously mentioned, the introduction of water labelling provides large volumes of proposed savings to household efficiency. By providing information on water consumption to customer buying white goods and bathroom fittings, evidence from a similar scheme in Australia and the rollout of the energy labelling scheme in the UK has shown that it does drive changes in customer behaviour.

It is therefore critical that the Government progresses with the proposed scheme, which consulted upon in autumn 2022. We are also keen that the scheme should develop to include minimum standards for buildings, as this would help deliver additional savings in the future.

When developing the benefits, we have assumed a delayed start to the benefit recognition of the scheme. This is for two reasons:

1. We are now less than two years away from the proposed implementation of the scheme but as yet there has been no additional confirmation of how the scheme will work and the proposed timelines. Therefore, there is a risk that the scheme may be delayed.

2. It will take time for customers to learn about the scheme and to engage with it, as seen with the energy labelling scheme. Customers will only change their white goods when there is a problem with an existing appliance, and so it will take time for the initiative to yield benefits.

As such, we have delayed the benefits recognition of the scheme until 2029. The below table highlights the level of savings proposed through water labelling:

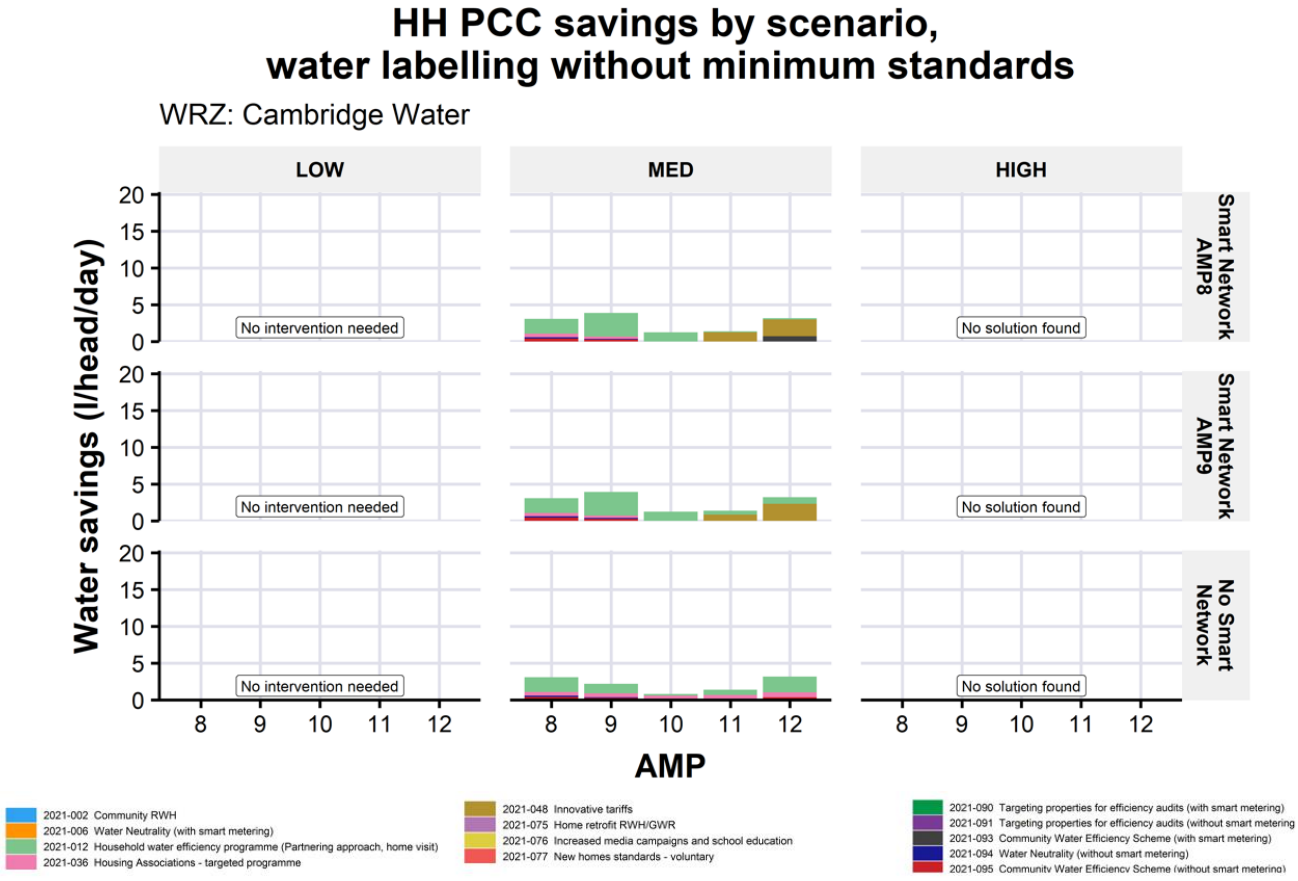
Table 48 Water labelling demand savings for Cambridge Water

				Cumulative benefit by AMP				
Activity	**ID**	**Year activity starts**	**Total benefit by 2050 Ml/d**	**AMP8**	**AMP9**	**AMP10**	**AMP11**	**AMP12**
Water labelling no minimum standards	WL_02	2025	4.70	0.13	0.85	2.42	4.07	4.70

11.1.3.2 Our proposed water efficiency plan

We are including delivery of 110 l/h/d by 2050 in our proposed plan, including delivering the interim Environment Act target of 122 l/h/d by 2038. The below graph from our draft plan shows the combination of activities that were proposed in order to deliver this household consumption reduction, as per the results from the optimiser shown in figure 28 below. This shows clearly that there is no achievable path with the current list of options and interventions that can deliver 90 l/p/d across the population.

Figure 28 Water efficiency activities



For the revised draft plan, we have updated our assumptions around the benefits delivered by metering, as outlined in section 9.5.6.1, meaning that a programme delivering universal metering will deliver its own direct benefits, as well as enable others. As a result, we ran updated scenarios to understand the impact this has on the water efficiency targets, and to then look at what additional activities are required to meet the targets. The following scenarios were run, all looking to achieve 110 l/p/d by 2050 and the interim 2038 target of 122 l/p/d:

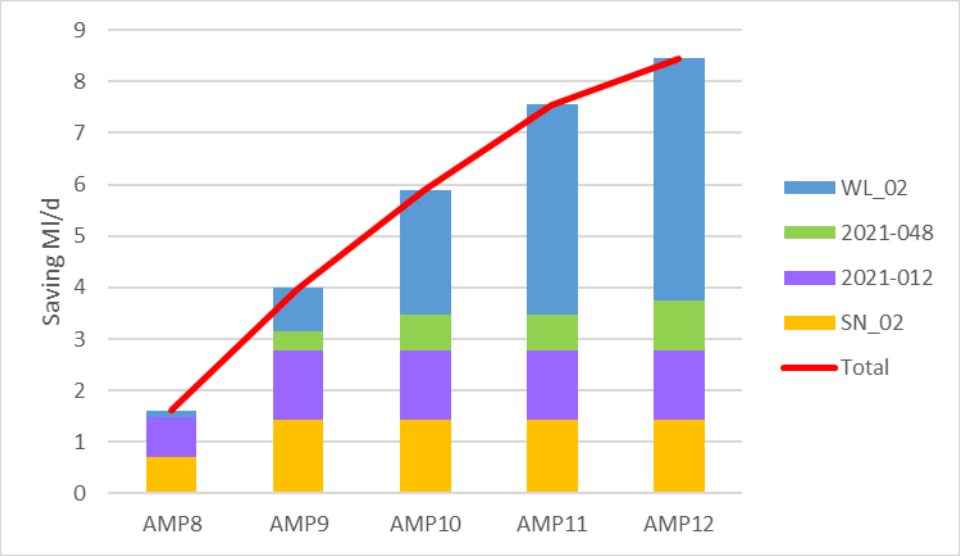
- Smart network AMP8, no water labelling
- Smart network AMP9, no water labelling
- Smart network AMP8, water labelling with minimum standards
- Smart network AMP9, water labelling with minimum standards
- Smart network AMP8, water labelling with no minimum standards
- Smart network AMP9, water labelling with no minimum standards
- Smart network AMP8, water labelling with minimum standards (delayed)
- Smart network AMP9, water labelling with minimum standards (delayed)
- Smart network AMP8, water labelling with no minimum standards (delayed)
- Smart network AMP9, water labelling with no minimum standards (delayed)

The optimiser showed that we need a smart network (including smart metering) to be in place in order for the target to be achieved. As detailed in section 11.1.1 above, our plan looks to deliver this by the end of AMP9 as we cannot

achieve the leakage targets if we take a longer period of time, and it is not cost beneficial or deliverable to do it in a shorter period of time. Smart metering enables utilising innovative tariffs on a larger scale once deployed, and this forms a large part of our water efficiency programme from AMP10 onwards when we have universal metering in place. Before then, we look to build on the existing programmes we have and undertake water efficiency home audits to deliver a targeted programme of water efficiency advice and water efficient device installation.

As detailed previously, we have opted for the water labelling with no minimum standards, as per the Government proposal, with the benefits delayed. The graph below shows the optimiser output for this scenario:

Figure 29 Water efficiency profile



As evidenced in section 4, our customers have stated that they want us to do more to educate customers in their water usage and the ways to save water. As well, they want us to share more information to all of our customers of why this is so important; so to share more on our water stress status, the future challenges and the link between demand and the environment.

The table below shows the benefit each individual activity provides over the lifetime of the plan.

Table 49 Water efficiency demand savings for Cambridge Water

				Cumulative benefit by AMP				
Activity	**ID**	**Year activity starts**	**Total benefit by 2050 Ml/d**	**AMP 8**	**AMP 9**	**AMP 10**	**AMP 11**	**AMP 12**
Universal metering	SN_02	2025	1.42	0.71	1.42	1.42	1.42	1.42
Household water efficiency programme (partnering approach, home visit)	2021-012	2025	1.35	0.77	1.35	1.35	1.35	1.35

Innovative tariffs	2021-048	2035	0.98	0	0.37	0.71	0.71	0.98
Water labelling	WL_02	2025	4.70	0.13	0.85	2.42	4.07	4.70
		Total	**8.45**	**1.61**	**2.38**	**1.91**	**1.65**	**0.90**
				In AMP reduction				

We also propose to continue with our developer incentive programme, which has helped to deliver reductions in proposed demand throughout AMP7 and we will include these proposals in our PR24 submission. Examples include:

- Incentivise developers to build more efficient homes through reduced connection charges.
- Work with developers to install water butts at all new properties.
- Working with developers to develop rainwater harvesting systems and approaches.

11.1.3.3 Water efficiency costs

We have included the cost of our proposed water efficiency programme in the following table.

Table 50 Cost of our proposed water efficiency programme

	Option ID	AMP8 £M	AMP9 £M	AMP10 £M	AMP11 £M	AMP12 £M	Total £M
Household water efficiency programme (partnering approach, home visit)	2021-012	4.1	0.36	0.20	0.20	0.20	**5.06**
Innovative tariffs	2021-048	0	0.14	0.13	0	0.10	**0.37**
Water labelling	WL_02	0	0	0	0	0	**0**
	Total	**4.1**	**0.5**	**0.33**	**0.20**	**0.30**	**5.43**

11.1.3.4 Compliance with Environment Act Target for water efficiency

The Environment Act target looks to reduce PCC to 110/l/p/d by 2050, with an interim target of 122 l/h/d by March 2038. Our plan outperforms the interim target by reaching 117 l/p/d by 2038 and goes on to deliver 107 l/h/d by 2050 and therefore outperforms the targets set in the Act.

The Act also introduces a new target for the distribution input per capita – this means it includes all of the water that we put into our networks that is either then used by our customers (consumption), lost as leakage, or used for operational use e.g., network mains flushing for water quality. The measure covers both household and non-

household population and accounts for increases in population – the target looks to ensure that the water entering our system per person reduces by 20% by 2038 from the 2019/20 baseline position.

The below tables show how our plan delivers against these targets and the associated interim targets defined in the Act. Our programme outperforms all of the targets.

Table 51 Performance of our water efficiency plan against the Environment Act 2021 DI target

Date	**WRMP DI per person l/day**	**WRMP % reduction from 19/20**	**Env Act requirement l/d**
2019/20 baseline	249.8	-	-
31/03/2027	223.2	10.6%	9%
31/03/2032	207.5	16.9%	14%
31/03/2038	197.6	20.9%	20%

Table 52 Performance of our water efficiency plan against the Environment Act 2021 PCC target

Date	**WRMP24 PCC l/p/d**	**Env Act requirement l/p/d**
31/03/2038	117	122
31/03/2050	107	110

11.1.4 Non-Household Consumption

In the Cambridge Water region, we have 8,700 non household properties and they constitute approximately 35% of the overall demand for water. As such, there is an important role for these customers in helping us to drive down demand through reducing consumption, wastage and leakage. During AMP7 we have not undertaken any proactive work to reduce demand among our non-household population, but we believe there is significant opportunity here that can be explored through collaborative working.

As such, following the introduction of the new Environment Act and the proposed targets within, we have sought to include the reduction to non-household consumption by 9% by 2038 in our preferred plan. We worked with Artesia in the development of our NHH options for our draft WRMP and have included the enhanced metering technology for all NHH as one of these options using the benefits identified in their report for MOSL delivered in 2022.

Our baseline demand profile shows by 2038, the non-household demand for water will have increased 55% from the 2019/20 position. We have seen significant increases in non-household demand in AMP7, with 2024/25 demand

forecast to be 24% higher than 2019/20, just five years previous. This is as a result of the Covid-19 pandemic which resulted in growth in the biomedical and life sciences industries as Cambridge became a hub for analysis of the virus and development of a vaccine. The city is looking to build on this in its existing and aspiration plans up to 2040 and further grow these sectors and the technology sectors.

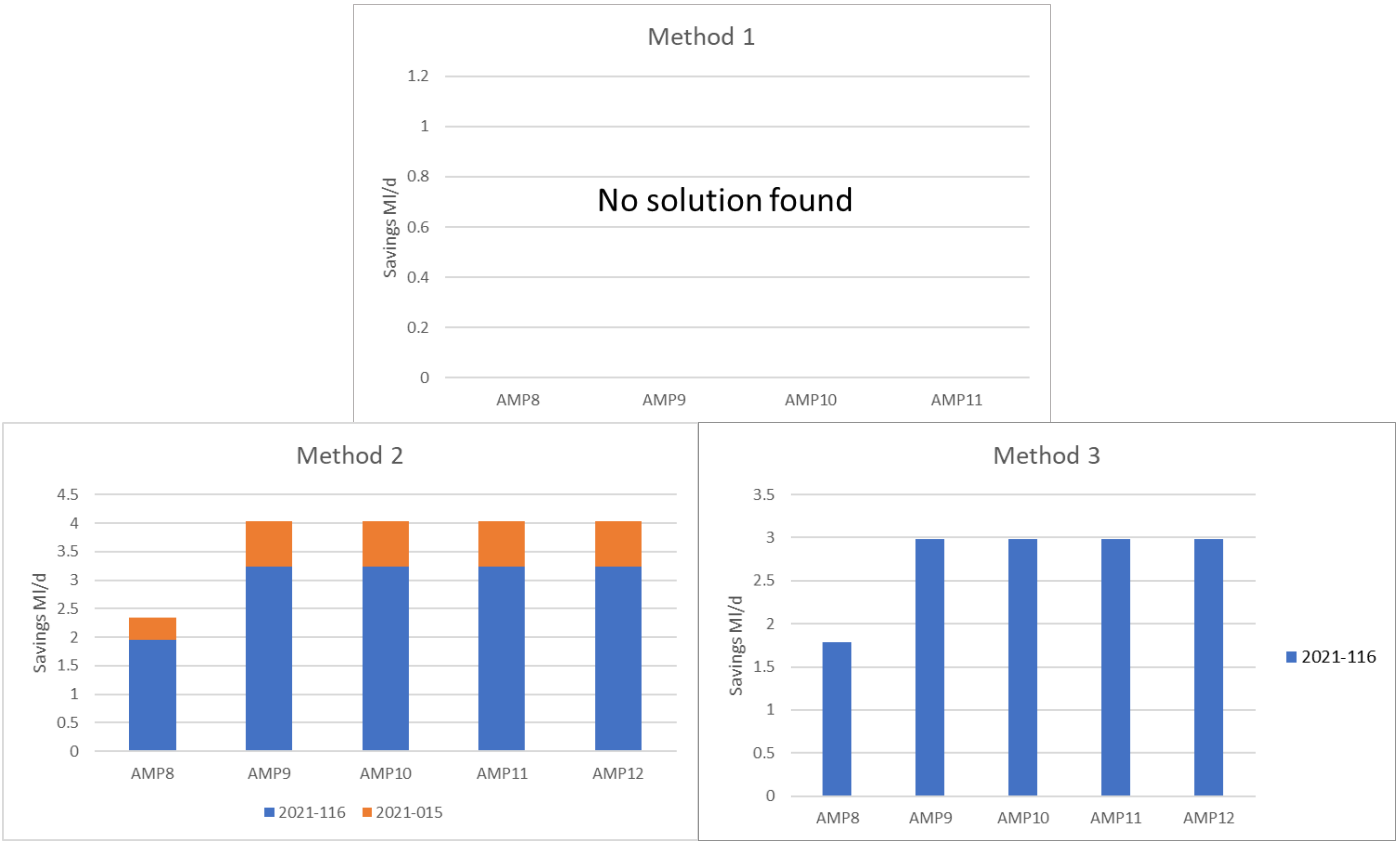
The medical sector tends to use more water than some other sectors, and there are less opportunities for water reuse and recycling options due to the need for sterilisation and the risk of contamination. As a result of this, and the scale of the growth, our optimisation work has been unable to identify a pathway to achieving 9% reduction from the 2019/20 baseline. It would mean that all future non-household growth would need to be water neutral, we would need to offset all of the AMP7 growth (circa 5 Ml/d) that has already occurred through retrofitting these or other non-household premises, as well as reducing the existing non-household demand.

Therefore, we looked at three scenarios:

- Method 1 – Reduce non-household consumption t0 9% below the 19/20 demand level by 2038. This would equate to 14.5 Ml/d.
- Method 2 - Reduce non-household consumption by 9% of the forecasted 2037/38 demand level by 2038. This would equate to 3.16 Ml/d.
- Method 3 - Reduce non-household consumption by 9% of the 19/20 demand level by 2038. This would equate to 2.03 Ml/d.

Due to the short-term water resource challenges in the area, we have chosen to reduce non-household consumption by 9% of the forecasted 2037/38 demand level by 2038. The below figure shows the activities required in both scenarios and the cost.

Figure 30 NHH scenario outputs



The optimisation work by Artesia showed that the largest benefit can be achieved through fitting Enhanced Meter Technology to all of our existing non-household customer base. This would provide 3.24 Ml/d demand saving. Due to the critical role the NHH demand plays in our supply demand balance, we are proposing to deliver this enhanced metering scheme by the end of AMP8.

Method 2 looks to maximise this by fitting enhanced metering to all NHH, whereas method 3 only looks at a proportion. We feel this is a missed opportunity when we are already undertaking extensive metering campaigns, and therefore also supports our choice of method 3.

The below table shows the annual profile of delivery. We will develop the detailed rollout plan over the next 12 months and ensure we engage with both retailers and non-household customers to communicate this. We will prioritise those properties with no existing meter and will look to combine our NHH and household rollout programmes, where appropriate, to deliver a more efficient rollout programme.

Table 53 NHH metering rollout programme

	AMP8				
	2025/26	2026/27	2027/28	2028/29	2029/30
Meter no's.	1728	1729	1729	1729	1729

We will look to prioritise our support to the highest water users initially, including a review of continuous flow users. We believe this will enable to us to identify the largest savings first. As the programme progresses, we will move to medium users.

Many of our large multi-site customers have sustainability leads who have a strong focus on energy and water and therefore we will work with these teams to provide advice and support. In reality, there may be few gains to be had here, and we will focus on large single site users who may not have the internal support for this activity already.

We are proposing a programme of household water efficiency audits (options 2021-015) and will adopt the same approach for small non household customers in the same area where appropriate e.g. hairdressers, shops etc. We will also take the same approach with our metering rollout. This is because we believe there are efficiencies to be recognised by combining these NHH customers with the local HH customers.

We have undertaken some engagement throughout the WRMP process, and continue to do so, with Retailers in order to understand how we can better work with them to support and incentivise water efficiency proposals to non-household customers. This could be supporting with on-site audits for non-households, providing leakage detection and water efficiency advice. We are conscious that Retailers own the relationship with non-households since the market opening in 2017, but we see a key role for water companies to play to support demand reduction in this area. We will continue to work with other water companies and Retailers to agree the best way to help deliver support and incentives in this area.

We undertook a club retailer engagement Club project with the other WRE companies to identify the best mechanisms to reduce water efficiency and how best to engage with retailers and non-householders in order to deliver our plan. We believe this is important so that retailers can expect a consistent approach from the various Wholesalers with whom they work. This will lead to the most efficient way of engaging and operating with both retailers and non-household customers in order to deliver the maximum benefits.

Throughout AMP7, Thames Water have undertaken a substantial programme to fit NHH enhanced meter technology and deliver water efficiency visits to NHH customers to identify potential water savings and leakage. They have seen significant success through this approach, finding approximately 3000l/prop/day average savings for 3000 visits per year with an average cost of £250k per Ml/d saving. We have reviewed this and adapted it for our modelling. We have far fewer NHH customers, and therefore much fewer larger users in our area. Therefore, we believe it is more appropriate to assume a reduced saving of 500 l/prop/day. This is because our average NHH consumption is 3,100 l/prop/day. Whilst there will be obviously some very large users where the savings potential is much greater, we are keen to ensure we look at all NHH customers with specifically tailored programmes based on the size of the customer. We also believe that our costs will be higher as we start up a new activity and develop the programme, in addition to the lower benefits we are expecting. Therefore, we have modelled a cost of £750k per Ml/d saving.

We have worked with retailers to identify the highest consumers for water efficiency reviews and leakage detection. We will look to prioritise our support to the highest water users initially. We believe this will enable to us to identify the largest savings first. As the programme progresses, we will move to medium users.

Many of our large multi-site customers have sustainability leads who have a strong focus on energy and water and therefore we will work with these teams to provide advice and support. In reality, there may be few gains to be had here, and we will focus on large single site users who may not have the internal support for this activity already.

We will look to incorporate the smaller NHH customers with our household water efficiency audits as the requirements are similar e.g., leaky loos, and it will be more efficient to address these on a geographical basis, prioritised by reviewing DMAs of high usage. Likewise, we will also align our metering programmes for NHH and household in order to maximise the efficiencies and enable clearer communication for our customers and more successful water saving education and advice that will be undertake at the point of rollout.

Thames Water have also seen significant success from undertaking a review of continuous flow. Continuous flow is classified as a minimum of one litre per hour registered on the meter every hour for 14 consecutive days, indicating that if there may be a leak or wastage event on the premises. Twenty-five per cent of all water used by businesses is classed as continuous flow, and MOSL's report estimates that 10% of this would be reduced through self-fixes if the information was shared with businesses. This is something we propose to incorporate into the water efficiency audit programme as the smart meters are rolled out and can provide us with this data, so will likely start this work in earnest at the end of AMP8 and start of AMP9. We plan to continue our work with retailers and other stakeholders to determine how we most efficiently enable the delivery of these programmes, and whether retailers may be best placed to undertake some of this activity.

Since the draft WRMP submission we have met with multiple developers, particularly in the biomedical and service sectors, to discuss opportunities for reducing the demand for water from their proposed developments. We are working with one particular developer to identify a collaborative approach to mitigation and undertaken chalk river restoration together. We have also been involved in discussions with Cambridge University regarding water usage, how we can better understand and influence this, and the opportunities for water efficiency across this network. We will continue to further these discussions with developers and existing non-householders in order to identify and delivery water efficiency measures.

We looked at a scenario for our plan where we state that we are unable to support any addition non-household demand until a sizeable supply side option is available. We discuss this scenario in more detail in section 11.7. This would equate to circa 4 Ml/d less demand. In our revised draft preferred plan, our demand management offsets all proposed increase in demand from growth, and therefore we are proposing no additional abstraction as a result of either household or non-household growth. Also, through the recent Government announcements regarding the desire to "supercharge Cambridge to be the science capital of Europe" through increased non-household growth in the biomedical and life sciences industries in particular, it is clear that this scenario will not be palatable from an economic position, and the Government has set up the Water Scarcity Group in Cambridge to determine how this level of non-household growth can be delivered. As a result, we do not believe that issuing a moratorium on all additional non-household demand is appropriate or required.

The table below summaries our proposed non-household activity in our preferred plan.

Table 54 Demand savings per NHH consumption reduction activity

				Cumulative benefit by AMP				
Activity	**ID**	**Year activity starts**	**Total benefit by 2050 Ml/d**	**AMP 8**	**AMP 9**	**AMP 10**	**AMP 11**	**AMP 12**
Enhanced meter technology	2021-116	2025	3.24	1.95	3.24	3.24	3.24	3.24
Non-household water efficiency programme	2021-015	2025	0.8	0.4	0.8	0.8	0.8	0.8
		Total	**4.04**	**2.35**	**1.69**	**0**	**0**	**0**
				In AMP reduction				

11.1.4.1 Non-household consumption reduction costs

We have included the cost of our proposed non-household reduction programme in the following table.

Table 55 Cost of our proposed non-household programme

	Option ID	**AMP8 £M**	**AMP9 £M**	**AMP10 £M**	**AMP11 £M**	**AMP12 £M**	**Total £M**
Enhanced meter technology	2021-116	1.51	0	0	0	0	1.51
Non-household water efficiency programme	2021-015	0.30	0.30	0	0	0	0.60
Total		**1.81**	**0.30**	**0**	**0**	**0**	**2.11**

11.1.4.2 Defra Accelerated Infrastructure Spend – impact on programme

In section 9.9 we detailed our successful application to accelerate our household metering programme through the Defra accelerated infrastructure development programme. This decision was communicated in March 2023, potentially allowing two years of acceleration of our programme.

However, as detailed in that section, during this time he had confirmation of additional cost pressures for AMP7 created by the Fens Reservoir. As the Fens Reservoir was not part of our WRMP19 plan, or therefore our PR19 business plan, we are not funded for this activity and must recover the AMP7 costs at PR24. As such, we have had to seek an additional £25m from our investors through AMP7 to progress this work, and therefore there is little scope for any additional funding availability at this time.

As such, we have had to reduce the volume of work we are able to do to meet the financial constraints we have as a business. Therefore, we have made the decision that we will not be accelerating the non-household programme. We will commence this as originally planned in 2025.

11.1.4.3 Compliance with Environment Act Target for NHH consumption reduction

The Environment Act has the following targets relating to NHH consumption reductions:

- 9% reduction from 2019/20 baseline by 2038
- 15% reduction by 2050

As detailed above, the significant level of forecasted growth in the region means that it is not possible to achieve a 9% or 15% reduction from the 2019/20 level. We have instead looked to deliver reductions from the forecasted NHH demand in 2038, and our preferred plan delivers a 11.5% reduction from the forecasted position. Our headroom analysis shows that there is increasing uncertainty in the NHH demand forecasts post 2040, and so we have focused on the 2038 target position primarily.

Our proposed plan delivers notable reductions in demand early in the plan. This is due to the benefits we can realise from the enhanced metering programme, and this early intervention will also enable the delivery of the 20% reduction to DI per capita target. We have not undertaken non-household water efficiency work in AMP7 and therefore are keen to deliver swift benefits in an area that we feel can play a significant role in demand management and assist in the short-term water resource challenges in the region.

11.2 Final planning demand forecast

As a result of our ambitious demand management proposals the final planning DYAA demand forecasts are 18.39 Ml/d lower than the baseline forecasts by 2050. The savings are broken down as follows:

Table 56 Summary of demand management savings by option

Demand Management Option	Saving by 2050 / Ml/d
50% leakage reduction	5.90
110 l/h/d (including water labelling)	8.45
NHH consumption reduction	4.04

11.3 Delivery of our demand management proposals

Demand management is the bedrock of our plan. Our demand management proposals are ambitious and offset the level of planned growth in the early and mid-stages of the plan. We also need to ensure we meet ambitious demand reduction targets as expected by our customers and as outlined in various Government plans.

Therefore, it is critical that we have a robust process for the delivery of the various activities, as well as the monitoring and reporting of our performance. This will ensure we are able to react quickly should we meet any challenges or issues relating to the delivery of or the benefits recognised by any of the activities.

There are various risk factors that may impact our delivery:

- Weather – increased dry weather spells or freeze thaw events may have a material impact on the level of leakage on our network due to ground movement.
- Government delays – delays to the rollout of the water labelling scheme may lead to a delay in the benefits being recognised.
- Third party influence – some of our activity relies on collaborative working with retailers and developers. Where priorities and goals are not aligned, this could reduce the benefits recognised.
- Customer behaviour – we have an ambitious programme that looks to provide advice and support to customers to influence behavioural change, as well as practical measures, but this is an element not wholly within our control and must be sustained for the benefit to continue.
- Current affairs – all companies have substantial smart metering campaigns and sourcing these meters is currently challenging due to external factors in other countries. This has the potential to delay the rollout of programmes and the benefits recognised as a result.
- Covid #2 – by this we mean the next significant unforeseen event that has a significant impact on demand for water. Covid-19 saw PCC increase significantly and has had a lasting impact on the level of demand.

We plan for some uncertainty through our headroom assessment which allows us some scope for small changes to profiles across the planning period. We also test our plan against various different scenarios to understand the impact these would have on our plan. These allow us to ensure our plan is robust and can cope with uncertainty.

However, we do not want to include expenditure to ensure our plan can meet all scenarios as this may lead to unnecessary investment in options that have little or no utilisation. This is not best value for our customers or the environment. However, we do need to ensure we have a way to adapt should some of these scenarios come to pass. Therefore, we use the outputs of these scenarios to develop an adaptive pathway that we can take should we see the scenario come to pass. Our adaptive pathways have clear trigger points. This is the stage where we would need to switch onto the adaptive pathway. We discuss the scenario testing we've undertaken on this plan in section 11.7 and the adaptive pathway we have developed as a result, including the trigger points, in section 11.8.

The critical first step though is to ensure we understand and monitor our performance closely and reliably. This means we can react quickly to any changes we see that are impacting on our plan. We have several mechanisms for monitoring our performance as shown in the table below.

Table 57 Demand management reporting

Mechanism	Frequency	Reported to who?
Weekly status overview for leakage performance	Weekly	Internal – Head of Leakage and Director of Customer Operations
Monthly reporting for key components: DI Leakage PCC NHH consumption	Monthly	Internal – reported monthly to Exec and Board
Quarterly reporting of performance against Performance Commitments for PCC and leakage	Quarterly	Internal – reported monthly to Exec and Board

WRMP annual review	Annual	Environment Agency
Annual Performance Review, including Performance Commitments for PCC and leakage	Annual Monthly progress is reported to Exec and Board	Ofwat

Where delivery or benefits are identified as off track, this is managed through internal action plans and increased reporting. These action plans will identify the appropriate action to take to rectify the issue, and these may include (but are not limited to):

- Deep dive into performance issue to identify improvements.
- Review benefits and costs of activities and compare to WRMP assumptions. Understand factors negatively influencing this and adjust accordingly.
- Review balance of activities – if one delivers less benefit than assumed, adapt the programme to ensure delivery of the required benefits for the cost identified.
- Increasing resource to enable additional capability.

From our planning work, we know that other options have potential to deliver more benefit e.g. innovative tariffs could deliver more savings if we expand our operation of this. We would look to utilise these areas to bring back any delivery that is off track.

In addition, we will continue to identify additional opportunities for partnership and collaborative opportunities to deliver benefits in this area. We will continue to seek and support innovation to enable delivery, reduce the risk profile and deliver the benefits required more cost efficiently. We have already actively participated in the Ofwat innovation fund for demand management ideas and have been successful in a bid we led on this. We are continuing to explore these opportunities and welcome the Ofwat fund to boost new approaches towards water efficiency.

We have also participated in the WaterUk leakage roadmap and are part of the group working towards the water efficiency roadmap. We are actively engaged in the Waterwise Water Efficiency Forum, as we seek to work across the industry to deliver the required benefits.

Demand management is a huge focus for all water companies, and we firmly believe that we need to work together across the sector in order to deliver the ambitious targets. We will have a higher level of success in key areas such as influencing customer behaviour to reduce consumption if we are all delivering the same message at the same time. This consistency is important for both our household and non-household customers, and a combined effort will also be the most cost beneficial. We will continue to strive for this collaboration through groups such as WaterUk, and involvement in industry wide projects by Artesia and UkWir. We will also continue our work in club engagement projects working with other companies to engage retailers in order to establish ways of working that can deliver benefits for all.

We are therefore supportive of the proposal for a demand management equivalent of the regulatory alliance RAPID, that is being proposed by CCWater. We are seeing large scale progress on new water resource projects through the alliance of regulators RAPID (Regulators Alliance for Progressing Infrastructure Development) working together with regional water resource planning groups under a clear governance regime, an agreed funding stream, and explicit government support. We believe a similar approach focused on demand management is required to support the ambitious programmes required across the industry. ARID (Accelerating Reductions in Demand) would ensure that demand management measures are understood in terms of their impact on water use and that innovative measures are developed and tested, as well as increase the awareness of the importance of water to society, economy and the natural and historic environment.

11.4 Supply Proposals

Our modelling confirms the initial views that the baseline supply demand balance (SDB) is dominated by growth in demand and reductions to supplies as a result of environmental reductions to our existing licences. Our least cost Economic Balancing of Supply & Demand (EBSD) modelling of our feasible list of supply and demand options selects all available options under most future scenarios – the only difference is related to timing of implementation, and the immediate effect of Fens reservoir creating a temporary surplus prior to environmental destination impacts.

For the screening and evaluation of available supply options, we reviewed an initial list of 106 options for feasibility, which increased by 25 through the process. The screening process then reviewed each supply option, and options unsuitable for progression rejected, these were mainly due to technical feasibility and environmental sustainability. Our screening approach is detailed in Appendix N2, and the options log which details the decision-making process for screening from unconstrained to feasible in Appendix N3. Due to the environmental constraints and the nature of our small supply area and water resources zone, 18 options were progressed to the constrained list. The full list of options details in included in Appendix N1.

11.4.1 Supply options selected

All feasible options were put into the EBSD modelling which selected the options with the highest deployable output, as soon as they are available to be selected, allowing for any interdependencies of options. Those options that are mutually exclusive of any others are selected are in the table below. Despite selecting all supply options available, alongside the preferred demand management options, there remains a deficit from the beginning of the planning period, once licence caps are applied as sustainability changes. This deficit is primarily a result of the need to reduce abstraction licences for no deterioration, and of the assessment period being historical, along the assessment approach for no deterioration baseline changing from WRMP19. Our demand management measures offset a large proportion of growth in demand, however these will take some time to become fully effective.

Practically, we are unable to produce a plan that shows a deficit, and therefore we have explored further options that would ensure no deficit. These include applying drought management measures each year in the dry year scenario, and, deferring some of the licence cap reductions, until additional new supply options can be implemented. The former may require a variation to our drought planning principles and levels of service, whilst the latter is in effect an exemption to meeting the objectives, as defined by EA methodologies, under Regulation 19 of the water framework directive (WFD) Regulations 2017[19]. This is covered in section 11.4.2 below.

For the Grafham transfer, we assume 100% utilisation upon commissioning and for the length of the transfer availability. For Fens Reservoir we also assume 100% following a phased increase to the yield availability following commissioning but effectively assuming that 100% would be available from 2036 and enables the potential to deliver ED reductions earlier.

The table summarises the supply side options selected in our preferred plan.

Table 58 Supply options selected in preferred plan

Option	DYAA yield Ml/d	CP yield Ml/d	Year of selection
CW24-75DiiiOp2: Potable transfer from AWS grid main crossing West to East through CAM area of supply (26Ml).	26	26	2031-32

[19] https://www.legislation.gov.uk/uksi/2017/407/made

CW24-73A: Fens Reservoir potable water transfer	44	44	2036-37
CW24-71: Milton WWTW Effluent re-use post effluent discharge.	7	7	2039-40

11.4.1.1 Grafham Transfer

As detailed in our draft plan, we proposed the acceleration of our original Grafham Transfer option as part of the Defra Accelerated Scheme, as did Anglian Water, in order to accelerate the pace at which we could deliver water into the Cambridge region and ensure that the licence caps required by 2030 could be met. However, due to concerns regarding the reliance of the scheme on an Anglian Water drought permit, the scheme was rejected, and as detailed previously, this option was then removed from our feasible option list.

We have updated this option as described in section 9, and this option is selected in both the Water Resources East regional plan and in our WRMP preferred plan in all scenarios tested, thus ensuring this is a no regrets option.

Our plan selects the option as soon as it becomes available in 2031/32 at full utilisation. The availability of this water is time limited to 2040 when Anglian Water no longer have capacity in the pipeline to support the transfer and Affinity Water need the full scope of their existing transfer. Our plan selects the Fens Reservoir in 2036, as detailed below, and therefore deselects the Grafham Transfer at this stage, and therefore our plan utilises this option for five years.

We will link the network feasibility for both the Grafham transfer and Fens reservoir schemes to ensure that we deliver the most cost efficient connections that work for both schemes so that we do not have disused assets, wherever possible, as a result of the transfer.

We have included the requirement and costs for this scheme in our PR24 business plan submission to Ofwat, including a timetable for delivery over the five years of AMP8, which commences in 2025, although we have already undertaken some network feasibility and will be building further on this through AMP7. Since the draft plan, we commissioned Atkins to review the water quality considerations of this scheme and to determine what needs to be in place with respect to treatment. As a result, we have included breakpoint chlorination, and this is included in our delivery costs and plan. The Atkins report can be found in appendix U.

The delivery of the Grafham transfer pipeline will be conducted in parallel with the Grafham to Rede strategic main by Anglian Water. This presents opportunities for co-delivery with Anglian Water which will have a number of advantages;

- Cost efficiency through economies of scale
- Direct management by a single contractor of the physical interface design and construction
- Direct management by a single contractor of the timing of interface construction

Opportunities to deliver as a joint client or with separate client contracts utilising the same contractor will be further explored with Anglian Water during the feasibility phase.

Delivery of this scheme will be monitored through the WRMP annual review and also through the price control deliverable mechanism with Ofwat reported through the annual APR process.

This option is required to meet the full range of the no deterioration licence caps which can only be met upon commencement of this transfer.

11.4.1.2 Fens Reservoir

Our preferred plan selects 44 Ml/d from Fens Reservoir in 2036/37 which is as soon as the water can become available.

WRE stress tested how well each portfolio of supply-side options perform in a range of future growth, climate change and demand scenarios and this is how we can evidence the options included in the final portfolio are robust and provide a no regrets solution. The options proposed in the plan are those that would make sense to implement almost regardless of what the future might bring.

WRE also consider whether more water could be transferred between the region and adjacent regional planning areas. The merits of such transfers were tested with the other four groups as part of a 'regional reconciliation' process. The regional groups took turns to present their respective options and plans to make sure all groups' plans complement each other in the national interest. As a result of that process, WRE's plan is based on no additional transfers of water to other parts of the country given the region's water-stressed status and a preference for Water Resources South East to receive water from the Water Resources West region.

The reservoir is selected by regional WRE modelling under most, if not all future scenarios. The simulator picks the earliest start date possible of being on site 2029, meaning Fens Reservoir could be in supply between 2035 and 2037. Fens Reservoir is an embanked winter storage reservoir, with 55Mm3 of storage providing a useable volume of 50Mm3 with a proposed yield of 88 Ml/d, shared equally between us and Anglian water. As such the Fens Reservoir is identified as a low regret option as part of the WRE Multi-Objective Robust Decision-Making process (MORDM) and the regional modelling has informed the size of the reservoir.

The regional simulator tested combinations of feasible options and operating regimes over a wide range of potential scenarios for 2050, reflecting uncertainty in demand forecasts, climate change, weather patterns, and also different environmental destination scenarios. In nearly every simulation the strategic resource option Fens Reservoir was picked – proving to be the best value way of securing the regions water future. In addition, the regional best value plan also concluded that the new reservoir will lead to a net increase in habitat units across the region, whereas other supply options led to a loss of habitat units.

The table below details the other supply side options that were considered and why they were discounted.

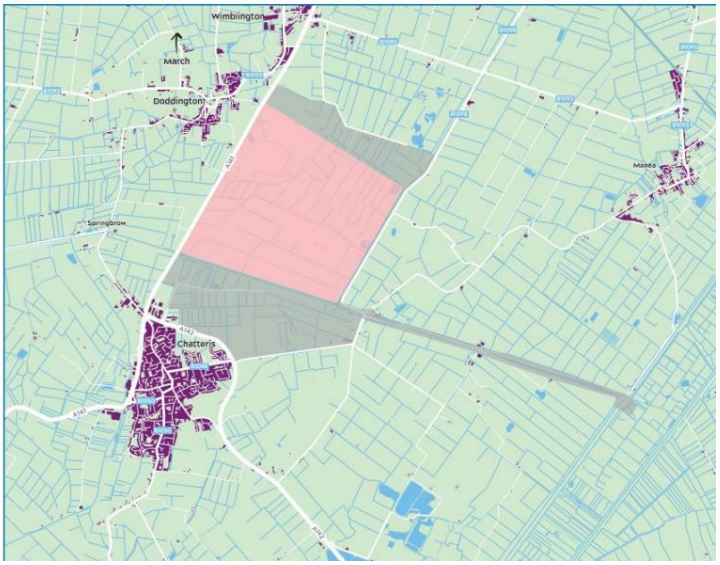
Table 59 Fens reservoir comparison

Option	Reason
De-salination	• These options have a far greater whole-life cost than any reservoir option, high in carbon and perform significantly worse in key SEA metrics. If we bring 10% net gain into the assessment criteria, de-sal solutions do not score well when compared to reservoirs. • Technological advances, especially in terms of operating costs, could make these options more cost beneficial – they are also easier to scale – both suggesting that these are options to be delivered later in the planning period once the scale of environmental destination is confirmed.
South Lincs Reservoir	• The length of the pipeline required to transfer the water from the reservoir to the Cambridge region, as well as the ongoing operational costs and environmental impacts of this transfer means water from the South Lincs reservoir would be more costly for Cambridge Waster than water from Fens Reservoir and has a higher environmental impact.
Grand Union Canal	• This is an enabling option for us, it requires water quality investment at Minworth treatment works, to enhance the raw water quality envelope leaving the work, which in turn enables the Grand Union Canal to provide a raw water source to Affinity, which means they can then release their current take from Grafham.

	• There is no additional water available, greater than the transfer we already have in our dWRMP. In addition, post 2040 this volume of water is required by Affinity Water and therefore no longer available to us. • The transfer relies on network capacity in Anglian Waters strategic grid network – this capacity is only available until 2040, as Anglian will need the water to meet their own growth requirements. • Our enhancement programme includes the infrastructure for a 26Mld transfer from Anglian water's Grafham reservoir. This is a no regrets solution as it is essential for meeting the short-term demand needs in our Cambridge region, and our licence caps

Following a comprehensive site selection process, the best performing site located east of the A141, between the town of Chatteris in the south and the village of Doddington in the north. The site, shown below, covers 5 square kilometres, and is dominated by arable fields, drainage ditches and minimal tree cover. The new embanked reservoir is designed to be 55 million m^3 with a useable volume of 50 million m^3, supplying c.250,000 households. As part of the development, we have identified opportunities for further future development, should it be required, including developing a reservoir system and /or additional reservoir connections.

Figure 31 Fens reservoir location



The water will be abstracted from a range of potential sources including the River Great Ouse, River Nene, Middle Level, Ouse Washes and Counter Drain (Nene). Water will only be abstracted when river flows allow.

The estimated cost of the reservoir is £1.96 billion. The project follows the same long-term programme as the South Lincolnshire Reservoir with efficiencies to be gained in delivering two DCOs in parallel. However, the earthworks programme for the Fens Reservoir is shorter than for the South Lincolnshire Reservoir, and therefore a start-on-site date of 2029 would enable the Fens Reservoir to enter supply between 2035 and 2037.

There are significant multi-sector benefits that could be unlocked by the Fens Reservoir. These include water for agriculture, new habitats and nature connectivity, navigation, amenity and recreation, flood protection and water level management. Reservoirs give the opportunity to provide outdoor spaces and recreation opportunities, something desalination (and water reuse) does not. This has been verified using by an independent study which used a range of methodologies and economic impact modelling. The review found that the key socio-economic benefits delivered by reservoirs stemmed from recreational activities and public access to green space. These benefits include mental and physical health, education, tourism and wider economic benefits due to increased visitors to surrounding areas.

Based on an initial economic impact assessment we believe that reservoir development and construction has around 30% greater potential for localised employment opportunities and economic activity compared to desalination. This is because it is expected there would be a lower need to recruit staff and other specialists from elsewhere in the country or abroad.

Health benefits are associated with reservoirs with public access and recreation facilities as access to the outdoors provides opportunities for activity, improving physical health. These outdoor areas also have the opportunity to improve mental wellbeing, providing people with the opportunity to participate in shared social activities, providing a sense of belonging.

Access to reservoirs can provide educational benefits for members of the public. This could be in the form of formal educational benefits, such as hosting school trips, public events and classes, or through informal visits which stem from visitors undertaking their own exploration and investigation of surroundings.

The development costs for the reservoir have been included in table 8 of the data tables and tables 5a-c. These costs have been updated for the revised draft WRMP and reflect those included in Anglian Water's WRMP. As the scheme will be delivered through an alternative mechanism such as DPC or SIPR, the cost implication and timing for customer is yet to be determined.

The Fens Reservoir is passing through the RAPID gated process where timelines are set, and progress is monitored. Our current programme of works has been built on a risk-based approach e.g. there is additional time scheduled for the DCO process compared to published timescales in order to manage any delays. Section 11.5 details the work currently being undertaken through the Cambridge Water Scarcity Group which is looking specifically at how Fens Reservoir, and the Grafham Transfer, can be accelerated. Discussions around changes to the planning process would mean any risk of delay is mitigated and the programme may even then be able to be accelerated. We are part of the Water Scarcity Group and are supporting recommendations that may accelerate these processes and remove risk of delay.

11.4.1.3 Milton reuse scheme

Our preferred plan selects option CW24-57 in 2040/41. This is the option that develops a new surface water abstraction on the River Cam, which is augmented by flows from the Milton WWTW. This scheme relies on the effluent from Anglian Water's Milton WWTW and therefore we will continue to work closely with Anglian Water to progress the further feasibility and development of this scheme.

This option involves indirect reuse and therefore we will need to build on the work undertaken by other water companies such as Thames Water and Southern Water who have undertaken direct engagement with customers on schemes they are proposing through the RAPID process to ensure we address all customer views and concerns.

As this scheme has a build cost of over £200m, it is likely that it would be delivered through the DPC route rather than delivered in house. This is appropriate for larger schemes where there is sufficient cost and complexity to identify alternative delivery mechanisms that may deliver better value for customers. This is discussed further in section 11.5 below.

11.4.2 Deferral of AMP8 licence caps

In producing our WRMP, we have had regard to the objectives in the RBMP as per the WFD Regulations. We have accordingly made adjustments to our baseline deployable output as sustainability changes, as advised by the Environment Agency. The approach to defining no deterioration licence caps has been provided by the Environment Agency, and this has been revised since our WRMP19 plan, with a considerably greater impact on deployable output.

Growth in demand is offset by our demand management programme, and we do not propose any new licence permits, or for increases in abstraction to meet growth and maintain a positive supply demand balance.

As discussed in section 6.9.5, our preferred plan proposes to extend the timing to meet the requirement for some of the identified licence capping and reductions to prevent deterioration under WFD until our Grafham supply option is in place. As we propose no abstraction growth the need for a Regulation 19 exemption would be largely driven by the scale of licence caps to a historic level of abstraction. As there is no growth or additional risk from our alternative plan scenarios we have not selected Regulation 19 exemptions in this instance. However, this does not preclude us from utilising Regulation 19 inside the planning period. If in future, we use this option we would undertake a full Regulation 19 assessment at the licence and waterbody scale to ensure the lowest risk approach is taken.

11.4.3 Drought Management measures

We have included the benefits of both appeals for restraint and temporary use bans, as outlined in our most recent drought plan which was published in 2022, for the dry year scenario. This is in line with the Environment Agency guidance for completion of the WRMP tables, and recent discussion post our original submission of our draft plan.

This totals 8Ml/d as a result of our appeals for restraint communications, and restrictions on use for domestic purposes under temporary use bans (TUBS). We have not included any savings associated with commercial activities under ordinary drought orders (non-essential use bans – NEUBs) as, through our discussions with the non-household sector in the development of this plan, we believe the disruption it would cause would be significant and would therefore have an economic impact and is therefore not a suitable option to include.

However, this approach means that there is a risk that our approved Drought Plan triggers and levels of service may now become inconsistent with the WRMP dry year scenario. This is because the triggers for TUBS are derived from a 2 dry winter drought sequence. Therefore, in a single dry year scenario as presented in the WRMP, our drought triggers for these demand management options may well not be reached. This means we may not trigger those options as stated in our drought plan.

As we have included the demand management benefits in our WRMP we will need to review both our drought triggers, and potentially our drought plan, to ensure we maintain consistency. This may result in a change to current published levels of service if we adapt our drought plan triggers to allow for restrictions to be applied in any single dry year scenario. Therefore we have committee to undertake a review of our Levels of Service and a review of the trigger levels in the drought plan. We will consult with stakeholders on the outputs of this review and update our drought plan if required.

11.4.4 Achieving 1 in 500 year drought resilience

We achieve the 1 in 500 level of resilience once the preferred option of Fens Reservoir comes on line in 2036. However, the timing of Fens Reservoir in the plan is not driven by the 1 in 500 date requirement, it is driven by the environmental destination abstraction reductions required for Cambridge Water as well as to meet the no deterioration licence reductions for Anglian Water. Therefore the option to delay reaching the 1 in 500 resilience level would mean delaying the implementation on Fens Reservoir, which in turn would cause delays to meeting statutory licence reductions. Therefore this approach would mean statutory obligations are not met and is not a suitable option.

11.4.5 Enhanced monitoring

Our WFD No deterioration review of the receptors which may experience impacts due to increasing licenced abstraction above recent actual has indicated a number of locations where, if this was to occur, there is a risk of deterioration. For these water bodies we have also created detailed monitoring plans, to assess the baseline conditions and any changes to flows and ecology if we needed to increase abstraction. Some of these waterbodies are also included for mitigation above, others have been assessed as less suitable for river restoration mitigation measures appropriate for our WINEP – for example if discharges, or other impacts on status are not attributable to

abstraction, or abstraction mitigations unlikely to be effective measures. The waterbodies with enhanced monitoring included to support our WRMP are;

- Bottisham lode
- Cherrry Hinton Brook
- Hobsons Brook
- Lt Ouse River
- Millbridge Common
- River Granta

Monitoring plans at various sites on these waterbodies would include as a minimum spring and autumn macroinvertebrate sampling, monthly spot flow gauging and groundwater level recording, alongside daily abstraction rate records. Monitoring frequency can be adapted according to level of risk as abstraction and results develop over time.

Our enhanced monitoring programmes are not published as WRMP appendices but are available on request.

11.5 Delivery of our supply side proposals

The delivery of the Grafham Transfer is a relatively large project in terms of project delivery by Cambridge Water both historically and with regard to the AMP8 capital programme, the scale of the pipeline is not significant with regard to the markets capacity to deliver, it should be considered in the context of a transition from AMP7 to AMP8 with the expected increase in investment in pipeline delivery. Although delivery is phased for AMP8 years 3 onwards, it is intended to work collaboratively with Anglian Water to commence the process of identifying and securing commitment from a delivery contractor in AMP8 year 1.

Procurement and delivery would be under a standalone contract. A standalone contract will enable a 2 phased contract commission approach, to carry out a feasibility and reference design development commission prior to the main construction contract commission award giving improved certainty of delivery and cost outturn.

The delivery of the Grafham transfer pipeline will be conducted in parallel with the Grafham to Rede strategic main. This presents opportunities for co-delivery with Anglian Water which will have a number of advantages;

- Cost efficiency through economies of scale
- Direct management by a single contractor of the physical interface design and construction
- Direct management by a single contractor of the timing of interface construction

Opportunities to deliver as a joint client or with separate client contracts utilising the same contractor will be further explored with Anglian Water during the feasibility phase. We will work with AWS and their delivery partners to deliver the point of connection to the AWS AMP8 strategic main project from Grafham to Rede. We will also have to report on our delivery through a Price Control Deliverable (PCD) mechanism to Ofwat which ensures we deliver what we have been funded for by the timescales defined.

Due to the cost and complexity of Fens Reservoir, it will be delivered either by Direct Procurement for Customers (DPC) or the Specified Infrastructure Project Regulation (SIPR). Principally due to the size and complexity it was considered that SIPR was the most appropriate model and the suitability case was submitted to Ofwat Autumn 2022. We believe this is the quickest way that Fens can be developed and brought into service and would see a new Infrastructure Provider (IP) be granted a projected licence by Ofwat or Defra. The asset build and ownership would be with the IP, with Cambridge Water and Anglian Water paying annual revenues to the IP. As the mechanism is not yet finalised, the full cost and impact on customer bills is still uncertain at this stage.

The proposed cost of the River Cam treatment works option means that this would also be considered for delivery by DPC. Here there would essentially be a build and operate contract for a period of typically 25 years with a Competitively Appointed Provider (CAP), with Cambridge Water still being the licensee for the asset. Cambridge Water would pay an annual cost over the period of the contract, and at the end of the contract period, the site would revert to Cambridge Water ownership.

11.6 Current growth challenges and Government ambition

In July 2023, the Prime Minister and Secretary of State for Levelling Up, Housing and Communities (DLUHC) set out further plans[20] for regeneration, inner-city densification and housing delivery across England, which includes significant plans for Cambridge.

Proposals will see Cambridge supercharged as Europe's science capital, with substantial development in the biomedical, life sciences and technology sectors promoted. This is looking to build upon the success of Cambridge in these areas during the Covid-19 pandemic where it became a key hub for research into the disease and vaccine.

These ambitious plans also look to address the current lack of affordable housing in the city whilst ensuring additional housing is developed to meet the proposed increase in employment in the area. Estimates predict that up to 250,000 new homes could be included in the plans for delivery by 2040. Cambridge currently has approximately 140,000 homes, and so this scale of development would more than double its current size, which will inevitably have a substantial impact on the water requirements of the city.

As a result of this, the Government has initiated a Cambridge Delivery Group, which will work to turn this vision into a reality. One of the immediate actions undertaken was to convene a Water Scarcity Working Group to address the water issues which present a barrier to these proposals. This group has convened in September 2023 and Cambridge Water is a part of the group along with the Environment Agency, Ofwat, central and local government and innovators across industries. Key areas of focus include:

- Understand opportunities to accelerate the building of Fens Reservoir.
- Improve water efficiency of existing homes and commercial property across Cambridge, to help offset demands created by new developments in the local plan, supported by a £3 million funding pot.
- Support the council to ensure new developments are as sustainable as possible and determine whether new homes can be made more water efficient.
- Work to unblock the development which has stalled in Cambridge.

As outlined in this final bullet point, there are currently several developments identified in the existing adopted local plans that are on hold in the Cambridge region due to objections lodged by the Environment Agency on environmental impact grounds. This equates to 9,000 proposed dwellings and 300,000m^2 of research space.

Cambridge Water have undertaken some additional analysis to inform the current planning process and appeals. These scenarios have tested our preferred plan to understand the impact of key variables such as benefits recognition from our demand management programme and changes to the level of growth. This work has then informed some additional modelling to determine the level of risk of deterioration to our current sources of water should any of these scenarios come to pass. We include the details of this work, plus additional scenario testing we have undertaken, in section 11.7 below.

Homes England have commissioned Arcadis to deliver a report outlining the challenges and the potential solutions. This looks at three key areas:

[20] Long-term plan for housing - GOV.UK (www.gov.uk)

- Unblocking the current development and enabling delivery up to AMP8.
- Supply demand gap between 2030 and 2032.
- Long term plan needed to meet the Government's 2040 ambitions for Cambridge.

This report will inform the Water Scarcity Group and determine the actions proposed. The Group will feed these outputs into Government in time for the Autumn Budget in November 2022. As part of this work, there are inevitably going to be recommendations and proposed activities that potentially accelerate activities within this WRMP or go beyond it. However, the WRMP is a statutory document aligned to statutory timescales and as such we have delivered this based on the Water Resource Planning Guidelines (WRPG).

We will continue to be active participants in the Water Scarcity Group as we work collaboratively with all key stakeholders in Cambridge to identify any additional actions required and determine the appropriate funding and delivery route for these actions. It is likely that some actions may be delivered by third parties such as developers or local planning authorities, and funding will also need to be determined for these elements. This work will look at the broader water needs for the area and will therefore feed into Water Resources East and the regional multi-sector plan as appropriate.

11.7 Scenario testing

The Ofwat common reference scenarios look at various different factors and the impact they may have on planning. It is important that our plan is based on the most likely scenarios to ensure that it is robust and doesn't over- or under-estimate investment needs. We have outlined below our view of the most likely scenarios for each of the Ofwat common reference scenarios:

- **Climate change** – The high climate change scenario looks at RCP8.5 from the UKCP18 projections, whilst the low climate change scenario represents RCP2.6. Our preferred plan is based on RCP6.0. This is because we believe this to be the most likely scenario based on current commitments and ambitions on global warming. When reviewing the high and low climate change scenarios against our preferred plan, the low scenario reduces the climate change impact by 0.7 Ml/d, and the high scenario increases it by 2.3 Ml/d by 2035. Future climate change impacts are resolved through implementation of the Fens reservoir and the reduction in groundwater abstraction that we deliver as a result. As a result, climate change does not drive any changes to our option selection or the timing of these.
- **Technology** – This scenario looks at the impact that technological advancement may have on our ability to deliver benefits relating to carbon reduction and more efficient and effective demand management. The high scenario includes 100% smart meter penetration by 2035, smart networks in place by 2035 and low-emission HGVs and fleet by 2030. The low scenario has a smart network in place by 2040, with full smart meter penetration by 2045, a low emission fleet by 2040 and carbon-free baseload electricity by 2035. Our proposed plan is more aligned with the high technology scenario as this represents our existing trajectory through AMP7 and beyond, with many elements already in progress. Slower delivery increases the overall cost of the programme as it takes longer to recognise the efficiencies that new technology can unlock.
- **Demand** – The impact of different growth projections is the key factor of this scenario. The high scenario looks at using the emerging local plan ambition from Greater Cambridge Shared Planning, whilst the low scenario uses ONS population and household projections. Our preferred plan uses the published local plan data, as per the water resource planning guidelines. The low demand scenario leads to a demand forecast which is 2.8 Ml/d lower by 2050 than our preferred plan. The high demand scenario increases demand by 18.4 Ml/d compared to our preferred plan.
- **Environmental ambition** – These scenarios look at the different ranges of abstraction reductions that may be required to meet long term sustainable abstraction. The low scenario represents that BAU scenario, whilst the high represents the adapt scenario, as our enhanced scenario actually outlines a lower level of abstraction reduction than BAU+. Due to the chalk geology in our region, all of the scenarios indicate very

similar levels of reduction, as outlined in section 6.11. Our preferred plan includes BAU+ and therefore aligned with the low scenario. The high scenario would increase reductions by 0.2 Ml/d.

In order to ensure that our plan is robust and capable of dealing with changing circumstances, we have stress tested this plan against different scenarios. These scenarios are directly related to the Ofwat Common Reference Scenarios proposed for the PR24 business plan. We have also looked at testing some other key areas:

- What if we only achieve 50% of the demand reductions we're proposing?
- Ofwat Compound High scenario
- Ofwat Compound Low scenario

The detail of the compound scenarios is included in the table below. The demand management scenario has been agreed across all planning groups to ensure consistency. Here we assume that all demand management activities are only 50% effective. We remove the D4 component from headroom in this scenario as this relates to uncertainty around delivery, otherwise we are double counting some impact.

Table 60 Compound scenarios

Scenario	Environment	Demand	Climate change
Low	BAU+ scenario and use local reviews to remove waterbodies with significant uncertainty about whether the reduction is needed	ONS 2018 principal projections	RCP 2.6
High	Enhanced	Local plan based projections Retain policy target 110PCC and 50% leakage reduction	RCP 8.5 (RCM)

Through discussions with the Environment Agency local team, the low environmental destination scenario we have tested is the BAU+ scenario. This is because the local team felt there were no reductions suitable for removal to create a lower scenario. As demonstrated in section 6.11, the enhanced scenario actually implies a lower level of abstraction reductions required than BAU+ so we have selected the adapt scenario for our high environmental destination scenario.

We have also looked at some bespoke scenarios for Cambridge Water based on the water resource challenges we're facing and the need to ensure our plan is robust:

- Impact of stating no new NHH growth can be accommodated before the Grafham Transfer in 2031/31
- Extreme growth scenario – this relates to the recent Government announcement in July 2023 which proposes 250,000 extra homes by 2050

In order to test our plan based on these scenarios, we update the supply and demand figures based on the differing elements within each scenario. The preferred options selected have been selected using the WRE EBSD model, and these results have been refined using our Valuestream model where the least cost option(s) may not be the only available option to produce a preferred plan. We have assumed that demand management remains the same (except in the 50% demand management efficiency scenario) as the preferred plan includes the reductions required to achieve the Environment Act targets and therefore we cannot slow down this activity for a lower impact scenario.

The table below summarises all of the scenarios we have run as part of the development of our plan.

Table 61 Summary of scenarios tested

Area	Scenario	Detail	Impact on plan		Detail
			Cost	Timing of supply options	
Climate change	Low	RCP2.6	n/a	n/a	Impact is small and therefore drives no change to preferred plan
	High climate change	RCP8.0	n/a	n/a	Impact is small and therefore drives no change to preferred plan
Technology	Low	Smart metering by 2045	+ £4.41m	n/a	Delays to metering leads to higher leakage and water efficiency costs
	High	Smart metering by 2035	n/a	n/a	This scenario is aligned with our preferred plan
Environmental ambition	Low	BAU+	n/a	n/a	Our preferred plan includes BAU+
	High	Adapt	n/a	n/a	This changes the timing of options post 2050 but not within the planning period
Demand	Low	ONS forecast	n/a	n/a	No change to options selection in planning period
	High	Greater Cambridge emerging plan	+ 76.97m	3 options brought forward into planning period	Fenstanton boreholes, greywater reuse and rainwater harvesting options all required in 2040/41. Note: deficit occurs in 2040 that cannot be resolved even with these options.
	Extreme	Government ambition circa 250,000 homes by 2040	+ £80.16m	3 options brought forward into planning period	Fenstanton borehole required in 2035/36, greywater reuse and rainwater harvesting options required in 2040/41. Note: deficit occurs in 2040 that cannot be resolved even with these options.
Compound	Compound low	BAU+, ONS, RCP2.6	n/a	n/a	No change to options selection in planning period

	Compound high	Adapt, GC emerging plan, RCP8.0	+ 76.97m	3 options brought forward into planning period	Fenstanton boreholes, greywater reuse and rainwater harvesting options all required in 2040/41. Note: deficit occurs in 2040 that cannot be resolved even with these options.
DMOs 50%	50% demand management	Demand management activity only 50% effective	+ £76.97m	3 options brought forward into planning period	Fenstanton boreholes, greywater reuse and rainwater harvesting options all required in 2040/41. Note: deficit occurs in 2040 that cannot be resolved even with these options.
NHH	NHH moratorium	No NHH growth or new connections before 2031/32	n/a	n/a	Supply side options are required to deliver environmental needs so are selection remains unchanged from preferred plan

The scenario which looks at 50% demand management effectiveness shows that up to 2040 we are still able to deliver the level of growth required. However, it does highlight a concern that a deficit will occur in this scenario as soon as the environmental destination abstraction reductions are delivered. This scenario assumes that leakage and water efficiency activity will only be 50% effective; however, in reality, this is a very unlikely situation. We have a strong record of delivering our leakage performance and have achieved all of our targets in AMP7 to date, as highlighted in Ofwat's 2022/23 annual review below.

Figure 32 Overview of water industry leakage performance, Ofwat 2022/23 Annual Performance Report

Company	Performance (three-year average)		
	Actual	Commitment	
	% Reduction from baseline		
Anglian Water	-7.5	-8.5	
Dŵr Cymru[4]	11.5[4]	-7.3	
Hafren Dyfrdwy	-4.4	-6.4	
Northumbrian Water[2]	-3.7; -7.5	-6.0; -7.2	
Severn Trent Water	-9.3	-5.7	
South West Water[4]	-9.1	-9.0	
Southern Water	-0.2	-9.0	
Thames Water	-10.7	-14.1	
United Utilities	-5.9	-3.7	
Wessex Water	-9.3	-6.9	
Yorkshire Water	-9.5	-9.4	
Affinity Water	-15.8	-14.0	
Bristol Water	-9.3	-15.8	
Portsmouth Water	-2.8	-9.2	
South East Water	-0.6	-2.0	
South Staffs Water[2]	-9.4; -16.7	-7.8; -8.0	
SES Water	-8.7	-6.2	
Sector	-7.2		

Cambridge Water's performance is shown against South Staffs Water, as the parent company, and our performance is the second number shown, which demonstrates the highest percentage reduction in the industry over the last three years. The dark blue colour in the righthand column denotes that our performance is at or better than our performance commitment level.

As we have a strong record of leakage reduction, we are confident that the risk of 50% effectiveness moving forwards is low.

Our plan also includes conservative savings for our non-household water audits when compared to the success seen by Thames Water. This is because this is a new scheme for us across a smaller network, but companies such as Thames saw benefits significantly above predicted levels for this activity and we are confident we can build on their learning to deliver the benefits outlined.

We discuss our approach to demand management monitoring, mitigation and reporting in detail in section 11.2, which highlights the actions we will take should we notice any performance issues on our demand management programme.

The area that has the largest impact on the options selected in the plan relates to demand and the scale of growth as demonstrated in the graphs below. In the high growth scenario, we have a deficit immediately in AMP8 due to the short-term growth aspirations in this scenario, and these cannot be resolved through additional demand management due to the scale of this which is circa 9 Ml/d in 2027-28.

Figure 33 High growth scenario

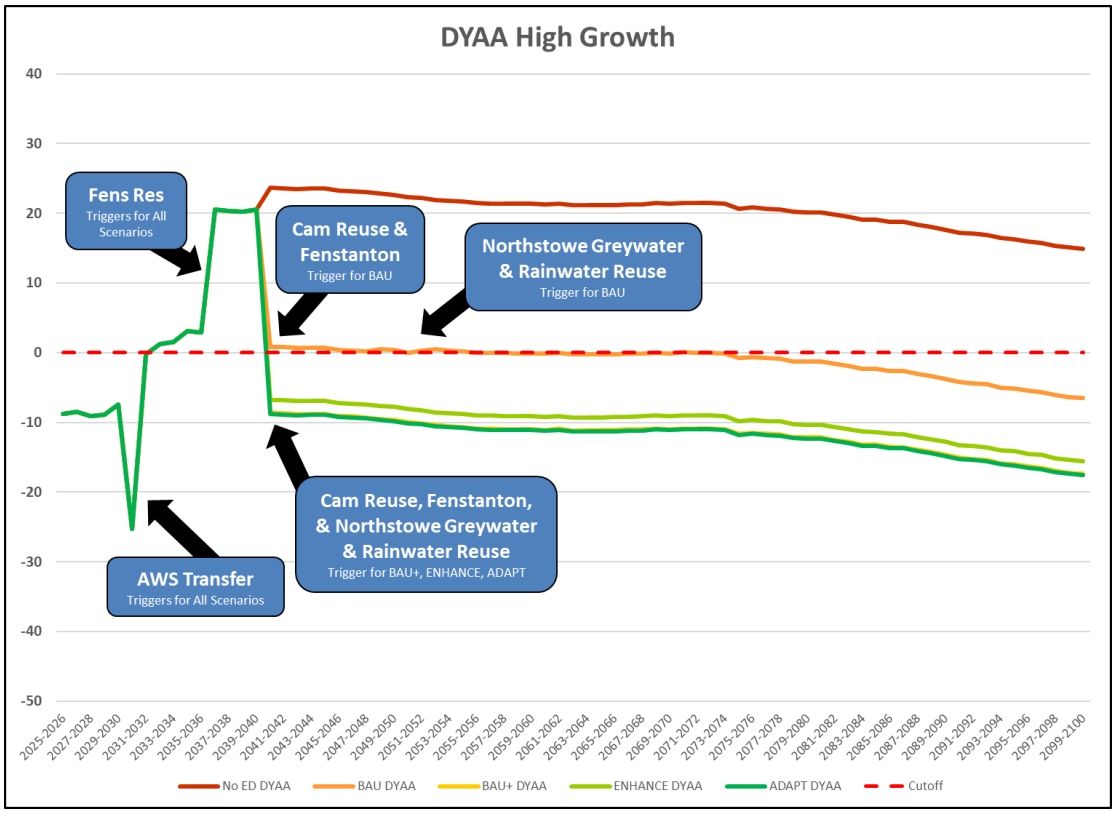
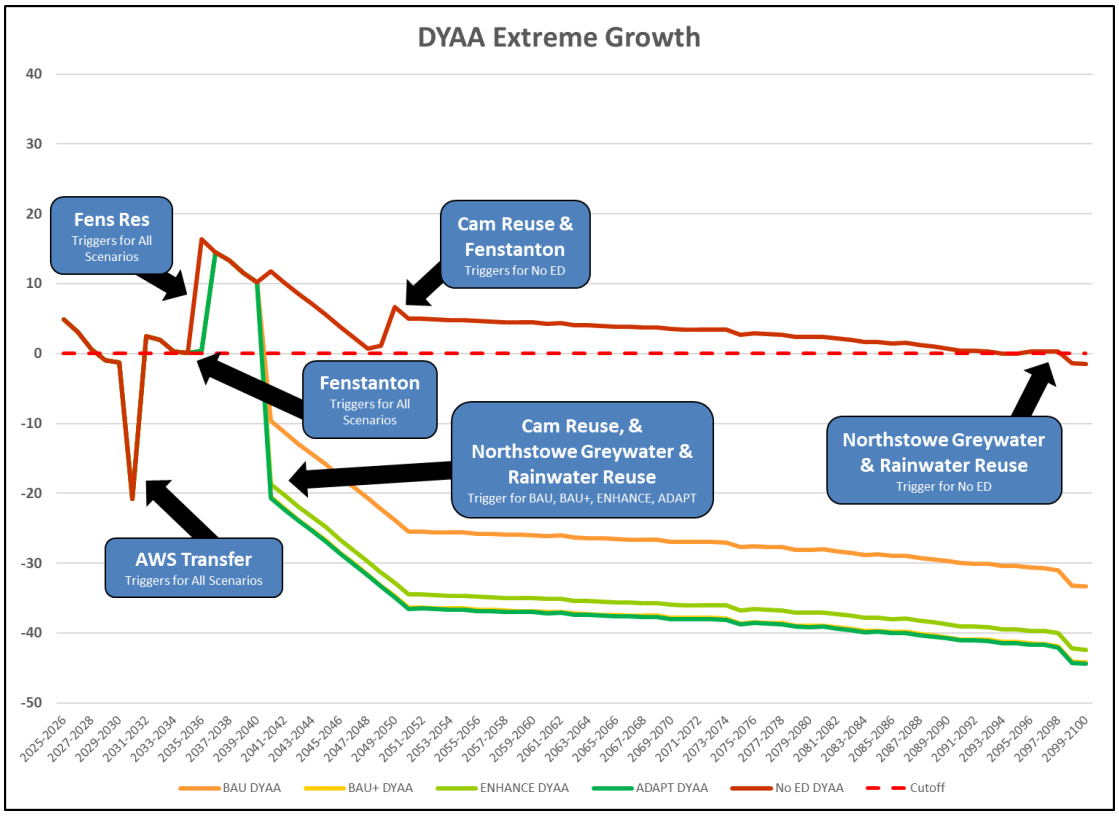


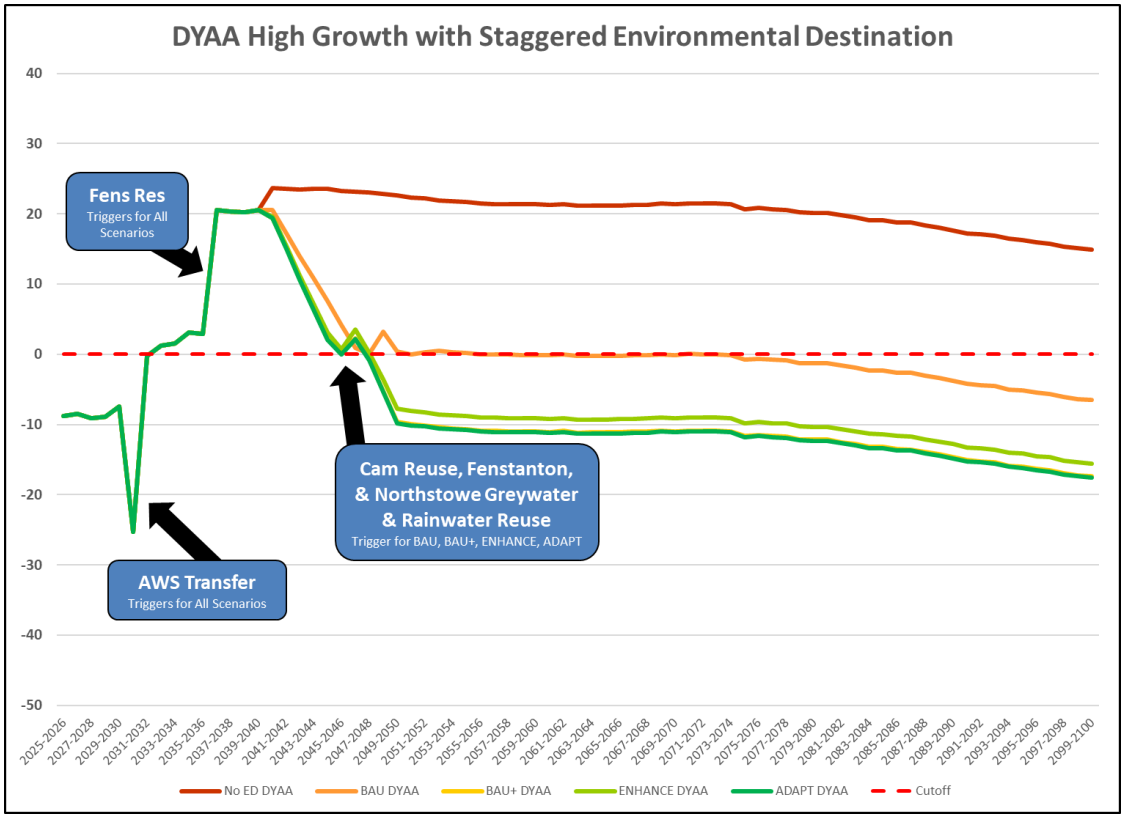
Figure 34 Extreme growth scenario



Both the high growth and extreme growth scenarios accelerate the development of supply side options wherever possible, and brings forward options that were previously selected outside of the planning period in the 2070's and 2080's. However, even with these options, we see a deficit as soon as the environmental destination abstraction reductions are applied as we have no further feasible options available to resolve this deficit.

In order to look at variances of this, we also ran a scenario that looked at staggering the environmental destination abstraction reductions between 2040 and 2050 to see the impact and the graph of this scenario is shown below.

Figure 35 High growth with delayed environmental destination reductions



Whilst this approach delays some of the option selections, the overall programme cost within the planning period doesn't change and we still enter a deficit in the planning period in 2047-48. However, delaying some of the reductions would enable more time to develop any large-scale option required to fill this deficit and so, subject to liaison with the Environment Agency, this could be a potential option to support the process and still ensure the reductions are met by the 2050 National Framework timescale for the reductions.

As detailed in section 11.6, the Government has convened the Cambridge Water Scarcity Group to identify what additional work is required, some of which will be outside the scope of Cambridge Water to fund and deliver, in order to potentially achieve these higher growth scenarios.

The above scenario testing also contributed to the work undertaken between the draft and revised draft WRMPs in order to inform the current development challenges in the region, as we described in section 6.9.5.

All of the scenario analysis outputs are outlined in appendix T.

11.8 Adaptive planning

As shown in section 11.7 above, some of the scenarios we tested led to alternative pathways being taken in order to manage these scenarios. It is important for us to monitor our preferred plan to check that all of our planning assumptions remain true and identify when any of these alter so that we can quickly progress any resulting actions we need to take. This is the basis of adaptive planning, and as well as monitoring we also need to identify clear trigger points in our plan where we would take an alternative pathway should it be required.

We outline in section 11.2 that we review our WRMP performance annually and report to the Environment Agency and Ofwat on this. During this process, we highlight any areas where key assumptions may have changed or where

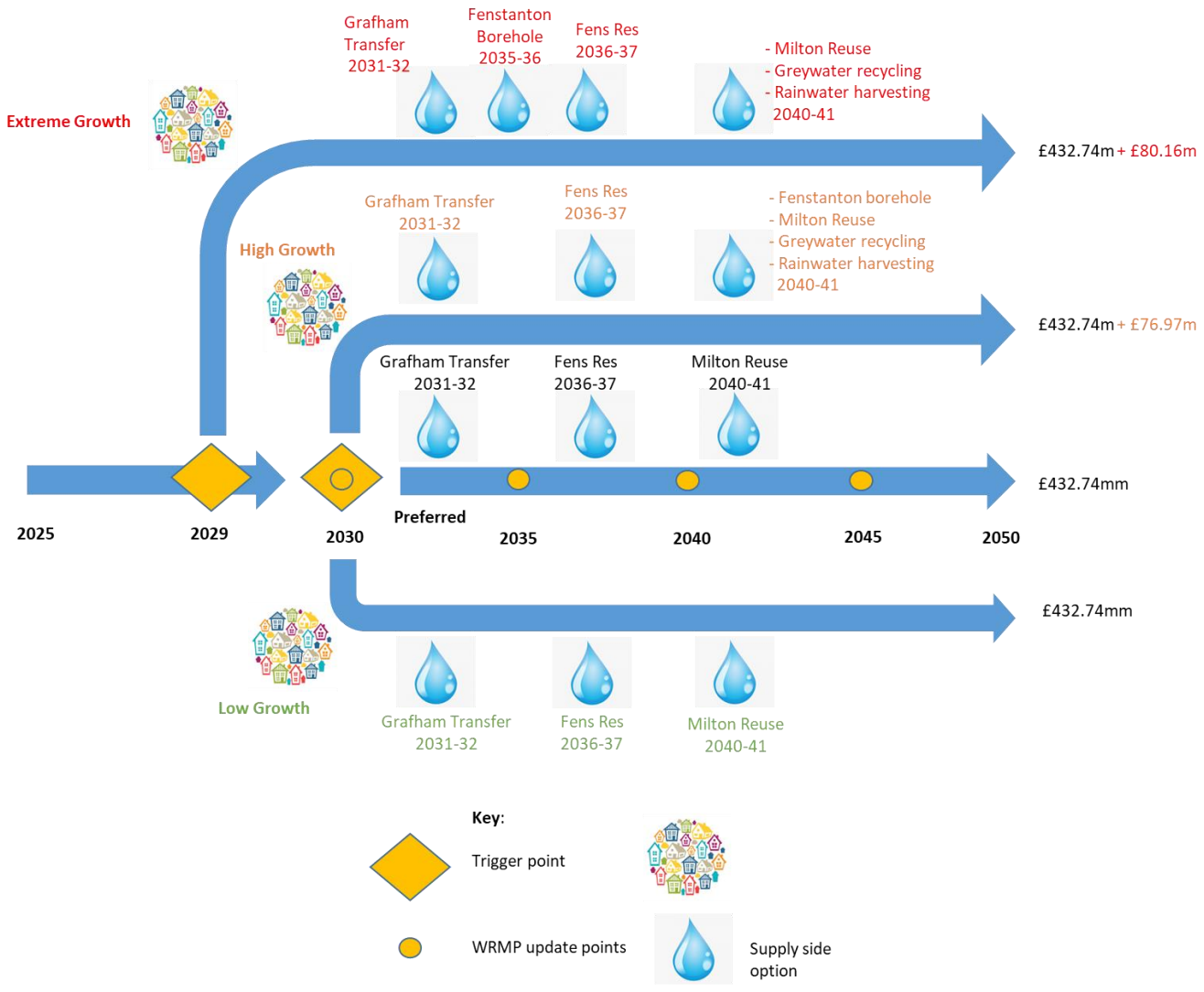
areas may be off track. These will then feed into improvement plans to rectify where possible or will feed into trigger points at scheduled time intervals that will determine an alternative pathway to our preferred plan.

The key scenarios identified above that require an adaptive pathway are:

- Demand management only 50% effective
- High growth
- Extreme Growth

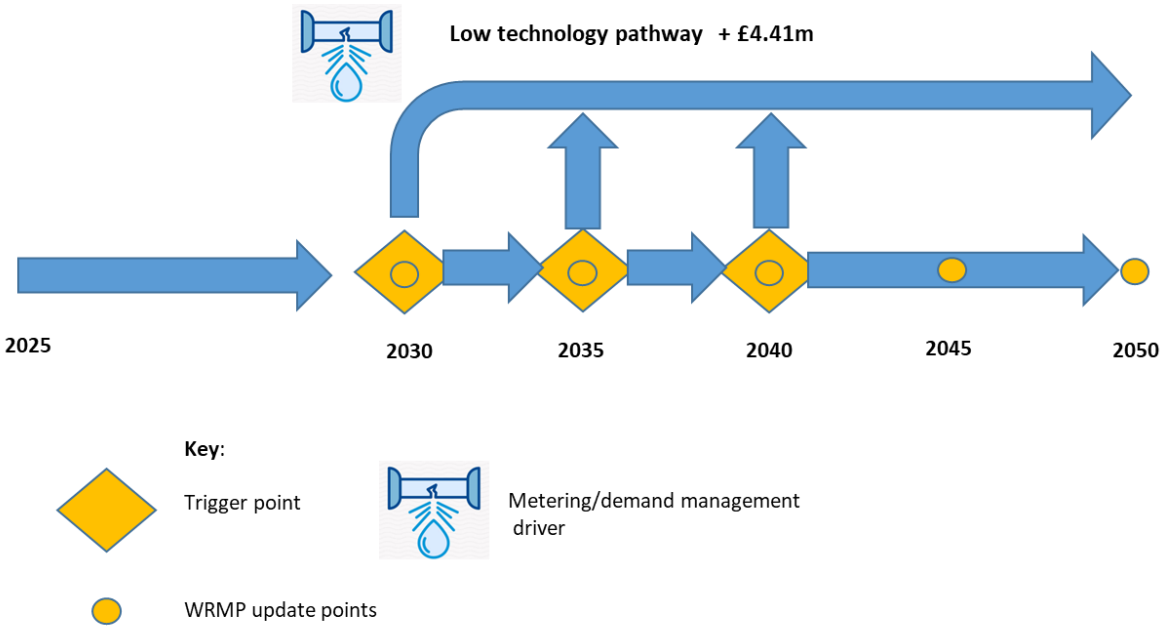
The below diagram represents the different pathways that would be adopted based on the growth profiles identified including key trigger points.

Figure 36 Growth adaptive pathways



The low technology scenario also shows a change to the programme, but this cost changes refers to the range of demand management activities we would undertake for leakage and water efficiency and the increased cost of these without smart meter data. We would monitor performance through our annual WRMPs. The figure below shows our adaptive plan for this activity.

Figure 37 Low technology adaptive plan



Our scenario analysis shows that changes to the level of environmental destination does not create changes to our preferred plan and therefore this does not require an adaptive plan. Following the completion of the investigations in AMP8 to determine the true scale and location of abstraction reductions required, we will reflect this in our WRMP29.

We will continue to monitor our WRMP performance and the assumptions within it annually and take the necessary actions to address any demand management risks immediately through the development of an improvement plan, which we will share with our regulators. If we determine that any assumptions have changed that would have a material impact on our plan, we will share these with our regulators and identify the relevant adaptive pathway detailed above that is required and work collaboratively to progress this as required.

11.9 Alternative Plans

Ofwat's definition of the core pathway looks at the investment that is necessary to meet future low scenarios, as well as any investment required to keep future options open (such as enabling work). The core pathway also includes no and/or low regrets investments, e.g., investments that are required in both low and high scenarios.

The compound low scenario would give us a more favourable supply demand position of 2.7 Ml/d by 2050. We cannot reduce the amount of demand management delivered or we would not be able to meet the Environment Act demand targets, although we could slow down our leakage activity to achieve 50% reduction by 2050 instead of 2040. This would only reduce the cost of the overall programme by £0.4m and would have little impact on AMP bill profiles. It also does not impact on our supply options selection. However, we believe this scenario to be highly unlikely and the ONS data is significantly lower than the existing published local plans, and the Government is looking to enable an even higher level of growth through the Cambridge Delivery Group.

Our preferred plan represents the most likely scenario. Whilst this is not the true definition of a core pathway, our true core pathway would not meet the WRPG. Therefore, we believe our preferred plan is our core pathway because it includes low regrets actions that allow for further feasibility in the future, should that come from worsening climate change or an increased environmental ambition (as detailed in the previous section). Our adaptive plan has a clear trigger point for alternative pathways should a more adverse scenario recognised and does not require any enabling works.

The investments included in our preferred plan will deliver under a wide range of plausible future scenarios, as shown previously. Examples of this low regrets investment include:

- Smart metering – smart metering is a key enabler of demand reductions as we currently have over 50% of our customer base unmetered. In addition, it enables a range of water efficiency and leakage activities that deliver demand savings at a lower cost that traditionally, as the smart meter data allows us to be more efficient and effective. It also enables new options, such as innovative green tariffs, where we can potentially deliver large savings for very low cost. Through this delivery of both direct and indirect benefits, it is a low regrets option.
- Customer supply pipe leakage repair and replacement – 30% of all leakage is on customer properties and so it is important that we step into this leakage challenge as well as that on our own network. As we can work directly with customers, offering different levels of support and assistance depending on the situation, this is also a lower cost leakage option. Through this engagement with customers, we can share water efficiency messaging and raise awareness, and therefore there are multiple benefits to this lower cost demand reduction activity, hence its low regrets status.
- Innovative tariffs – these rely on the installation of smart meters and look to incentivise customers to reduce their consumption by charging less for lower water use or provide community funding for local green projects for communities that can reduce their water use below a certain level. This is a low-cost activity that helps raise awareness and delivers benefits to the customer, the company and the environment.
- Fens Reservoir – the regional modelling undertaken by Water Resources East selects Fens Reservoir in nearly every scenario run as being the best option to resolve the regional water resource needs and support the needs of both Cambridge Water and Anglian Water. Fens Reservoir performs better than alternative options such as desalination for environmental impact and whole life cost.

The optimisation of activities described previously means our preferred plan is also our least cost plan.

We also need to look at a version of our plan that is best for the environment and society. This means it should deliver real quantifiable benefit for the environment and society, as well as delivering multiple benefits such as improvements to water quality or reduction in greenhouse gases. There are three key approaches to this:

- Biodiversity net gain
- Natural capital
- Strategic Environmental Assessment

We have completed an SEA for our plan which reviews our options. We have also undertaken natural capital and biodiversity net gain assessments for all supply options. There are particular challenges around assessing demand management options, particularly using natural capital assessment and biodiversity net gain. This largely relates to the difficulties of valuing water left in the environment. This includes both the value to the environment and wider society. Due to these complexities, we have not undertaken a natural capital assessment of demand side options. As policy is a large driver of demand management, we have considered our demand management programme selection separately in our decision-making.

Our plan that is best for the environment and society includes the adapt environmental destination scenario as this offers the largest abstraction reductions and therefore benefit to the environment. We have also used Valuestream to ensure that options are selected on environmental value. Our best environment and society plan is the same as our preferred plan, with the only change being the selection date of the Fenstanton borehole option which is brought forward two years in the 2060's, as outlined in the table below. This is because the adapt scenario and the BAU+ scenario are very close in scale, as outlined in section 11.6.

Table 62 Best Environmental Plan comparison

		Options					
Best Value Plan Testing Scenarios	Selected Scenario	**01B**	**37Aii**	**38B**	**57**	**73A**	**75DiiiOp2**
WRMP24 Final Preferred Plan	BAU+	2069-70	2083-84	2088-89	2040-41	2036-37	2031-32
Best Environmental Plan	ADAPT	2067-68	2083-84	2087-88	2040-41	2036-37	2031-32

11.10 Strategic environmental assessment

The SEA of our WRMP includes a scoping and an assessment stage. The scoping stage and scoping report included our proposed SEA methodology and was issued for a 5-week statutory consultation period. The methodology is based on the Cambridge Water Environmental Assessment Scoping Report which has been previously agreed with the statutory consultees (Natural England, Environment Agency and Historic England).

All feasible options for the WRMP were appraised and SEA appraisal matrices populated incorporating information from the Natural Capital Assessment, (NCA), Biodiversity Net Gain (BNG), WFD, Invasive non-native species (INNS) assessments and Habitats Regulations Assessment (HRA) screening as this information informs appraisal against several SEA topics.

Any material adverse effects identified from the SEA assessments have been incorporated into review of the options for the final feasible list to include mitigation measures to reduce any significant effects. The SEA report and assessment summaries are in Appendix P.

11.10.1 Water Framework Directive Regulations Assessment

Our approach has been primarily based on that set out in the updated UKWIR Guidance[21] of a sequential 3-stage process for undertaking WFD compliance assessments to deliver a proportionate WFD compliance assessment that complies with statutory requirements and regulatory guidelines. The sequential stages are as follows:

1. Option-level assessment: Each option will go through an option-level assessment which consists of the following steps:

- Step 1. Screening based on activities - to either exclude options from further assessment where it could be reasonably expected that the option would not have an influence on any WFD status elements or supporting elements, or identify which activities require progressing to Steps 2 or 3 assessment.
- Step 2. Screening based on magnitude of hydrogeological/hydrological impact and water body context - to either exclude options from assessment where they are negligible or low hydrological/hydrogeological impact, or identify which activities require progressing to Step 3 assessment.
- Step 3. Impact assessment – either using existing assessments or an expert judgement approach based on source-pathway-receptor to establish likelihood of compliance with agreed WFD Assessment Objectives in all relevant water bodies. A confidence rating will be given to all assessments to reflect the amount of uncertainty in the design, environmental baseline and magnitude of impact.
- Step 4. Detailed impact assessment - specific to the option using measured baseline data, including additional bespoke collected evidence, and detail on design and operating pattern. (Note: This level of detail would be by exception and is not currently costed for).

[21] UKWIR (2021) Environmental Assessment Guidance for Water Resources Management Plans and Drought Plans. Report Ref. No. 21/WR/02/15

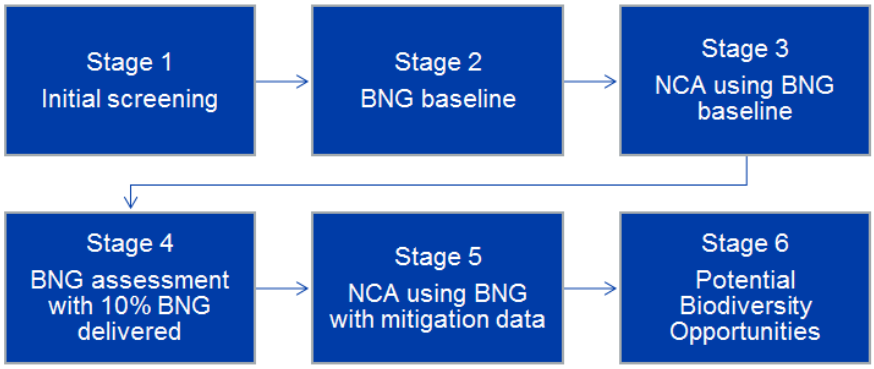
2. Programme level assessment: The options selected for the preferred programme will be cross-referenced, using the option-level assessment, to identify those that impact the same water body. Where this occurs, a cumulative assessment will be undertaken against the agreed set of WFD Assessment Objectives. (Note: costing has assumed that only the preferred programme will be generated and the assessment of alternative programmes is not currently costed for).

3. Preferred plan WFD compliance statement: This involves a statement of the compliance of the preferred plan against each of the WFD compliance objectives (set out below). This involves assessment of the set of options within the programme, both alone and in combination with other options within the WRMP and with the WRMPs for other water companies.

11.10.2 Biodiversity Net Gain and Natural Capital Assessment

Our approach to BNG and NCA follows the recommendations in the in the WRPG supplementary guidance and the revised UKWIR guidance. The UKWIR guidance accounts for all most up to date published guidance and requirements for England, including for example, the All Company Working Group (ACWG) recommendations, and the UKWIR Best Value Water Resources Plan. The NCA compliments the SEA, HRA, and WFD assessment, and follows the steps in Figure 38.

Figure 38 BNG and NCA screening



We have undertaken a high-level assessment of the biodiversity that is present in the feasible supply options and undertaken a RAG rated score to support the assessment of options noting where habitat is likely to be affected and high-level opportunities that may present to potentially achieve 10% BNG. The RAG rating will inform the NCA stages.

The Defra's BNG metric 3.0 calculator has been used to identify mitigation and compensation requirements, to be used together with local biodiversity strategies and plans to identify high level biodiversity opportunity areas. A summary of BNG units is included in the BNG report and this is integrated into the SEA assessment for options.

The NCA approach incorporates data and metrics for the following:

- Biodiversity
- Climate regulation
- Natural hazard regulation
- Recreation
- Water Regulation & Purification
- tourism
- Agriculture

The report on Biodiversity Net Gain and Natural Capital Assessment is in Appendix P3 which have been updated for the revised draft WRMP to take into account the changes to options.

11.10.3 Invasive Non-Native Species (INNS) Risk Assessment

The latest Water Resource Planning Guidelines requires a review of current abstraction operations and future solutions against the risk of spreading INNS or create pathways which increase the risk of spreading INNS. Where there are increased risks, we must propose measures to manage that risk. The Environment Agency guidelines indicate that all water companies should consider:

- Pathways of spread (understanding and reducing the risk from different pathways)
- Preventing spread (controlling, eradicating or managing INNS to prevent spread where this will contribute to WFD prevention of deterioration)
- Action on INNS to achieve conservation objectives of SSSI and Habitats Directive sites

These have been assessed for the feasible options for the construction, operation and maintenance stages, and the full report is in Appendix P1.

11.10.4 Habitats Regulation Assessment (HRA)

An HRA determines whether there will be any likely significant effects on any European site as a result of proposals in this WRMP being implemented, either individually or 'in-combination' with other plans or projects.

This HRA report documents the HRA Stage 1 Screening for the feasible list of options in the draft WRMP24. It also identifies those options where Stage 2 Appropriate Assessment would be needed if the option were to be included in the preferred programme of the WRMP24. Stage 2 assessment would be required if the options are carried forward and agreed in our final plan. The draft assessment report is in Appendix P2 and the Stage 1 screening results presented below.

Table 63 Screening of supply-side feasible options for impacts on European sites

Option No.	Option Name	HRA Outcome	Comments
CW24-01A	Combined Ouse gravel sources - Fenstanton and St Ives (01A)	LSEs identified – construction and operation	The Ouse Washes SAC/SPA and Ramsar is located downstream at approximately 8.85km. Construction works in proximity to the River Great Ouse could give rise to site-derived pollutants (principally oils and other contaminants) and sediment entering the watercourse. Additional abstraction during operation of the boreholes may affect water availability downstream (uncertain). As such, a Stage 2 Appropriate Assessment will be required if this option is selected within the preferred programme.
CW24-01B	Combined Ouse gravel sources - Fenstanton and St Ives (01B)		
CW24-37A	Site-scale greywater reuse	No LSEs anticipated	There are no European sites within 10km of the scheme components, or impact pathways over a greater distance.
CW24-38	Site-scale rainwater harvesting		

Option No.	Option Name	HRA Outcome	Comments
CW24-57	River Cam abstraction & treatment works	LSEs identified – construction only	Fenland SAC includes spined loach *Cobitis taenia* as a qualifying feature. Spined loach may be present within the River Cam of which the confluence is located ~700m from Fenland SAC. Site-derived pollutants (principally oils and other contaminants) and sediment from construction activities may enter the watercourse and affect off-site supporting habitat. No new abstraction licence is required for the option, and the abstraction of water will be managed through the Hands Off Flow arrangement. As such, no LSEs during operation are anticipated.
CW24-71	Milton Wastewater Treatment Works (WWTW) Effluent re-use surface water abstraction post effluent discharge	No LSEs anticipated	There are no European sites within 10km of the scheme components, or impact pathways over a greater distance. The ultimate downstream receptor is The Wash and North Norfolk Coast SAC. None of the qualifying features are migratory fish species, where use of functionally linked habitat within the River Cam could have been an issue. Similarly, freshwater input is not identified in the SACO as a key attribute/target. The Wash SPA and Ramsar, are considered sufficiently distant such that the River Cam does not provide functionally linked habitat for any of the qualifying features.
CW24-73A	Fens Reservoir internal potable water transfer - Chatteris	LSEs identified – construction only	The Ouse Washes SAC, SPA and Ramsar is located downstream of the option components, construction of which could lead to site-derived pollutants and sediments entering the watercourse and causing deterioration to supporting habitat. Option 73A does not include an abstraction of water, or increase in water abstraction only the transfer of the potable water from the new Fens reservoir (being assessed separately) therefore no operational LSEs are anticipated.
CW24-75A	Potable transfer from AWS grid main crossing West to East through CW area of supply 5Ml/d	LSEs identified – construction only	The Ouse Washes SAC, SPA and Ramsar is located downstream of the option components, construction of which could lead to site-derived pollutants and sediments entering the watercourse and causing deterioration to supporting habitat. The availability of surplus water has been identified by Anglian Water. The option does not require an abstraction licence, or change to abstraction licence, therefore no operational LSEs are anticipated.
CW24-75B	Potable transfer from AWS grid main crossing West to East through CW area of supply 10Ml/d		
CW24-75C	Potable transfer from AWS grid main crossing West to East through		

Option No.	Option Name	HRA Outcome	Comments
	CW area of supply 15Ml/d		

11.10.5 The Historic Environment

We recognise that historic heritage assets and landscapes may be impacted by our planned options and proposals, however at this stage of the planning process these are considered within the overall SEA criteria with limitations on the data available for assessment and screening. As our options become more developed and refined there will be more detailed information on constraints and opportunities arising from the historic environment. For this we would apply the principles and guidance published by Historic England.[22]

11.11 AMP8 Water Industry National Environment Programme (WINEP)

11.11.1 Chalk stream river restoration

To support our WRMP and our environmental ambitions before our supply side options can be effective, we have undertaken an assessment of waterbodies which may be impacted by our abstractions for mitigation measures and improvement work to be included in our Water Industry National Environment Programme (WINEP) proposals for PR24. We have screened seven of these where WFD status may be most at risk from abstraction and other pressures, and where we can implement river restoration measures to support WFD status and prevent deterioration. These are:

- Cherry Hinton Brook
- Hoffer Brook
- Mill River
- River Granta
- River Mel
- River Shep
- Vicars Brook

Each waterbody has been surveyed and a bespoke programme of proposed mitigation measures to support and improve WFD ecological status developed for inclusion in our WINEP. Implementation of these will be phased so that risk of deterioration can be appropriately mitigated. The technical reports for these proposals are not published as appendices to the WRMP but may be available on request.

These reports have been used to develop a programme of chalk stream river restoration projects. These projects align with the National Chalk Restoration Strategy and we are building on our work on this which we started in AMP7 on the River Granta, working with local landowners and stakeholders to deliver restoration, flood mitigation and retention measures as well as habitat improvements.
The restoration options considered are listed below, these will vary for a specific water body.

[22] https://historicengland.org.uk/research/results/reports/19-2017).
(https://historicengland.org.uk/research/heritage-counts/heritage-and-environment/).
Lakes and Water Features | Historic England

Table 64 Chalk stream river restoration activities

Restoration Options
Gravel Augmentation
Bank Reprofiling
Riparian buffer
In-channel Features
Riparian Tree Planting
Gravel Augmentation (for higher winter flows)
Tree Management (Thinning)
Riparian Buffer (Planting)
Weir Removal
Removal of hard bank reinforcement
Replacement with clear span bridge
Channel Realignment
Removal of bank reinforcement
Tree management (thinning)
Removal of weir/bed reinforcement
Removal of hard bank reinforcement
Bank Reinstatement
Sluice Removal
Ford Removal
Channel Realignment
Wetland
In channel features (Berms)
High flow channel
Floodplain reconnection/secondary high flow channel
Addition of further features/restore existing features (replanting etc
Designated drinking area/trough
Formalise Ford
Wetland/floodplain connection
Floodplain re-connection/wetland
Tree management
Tree Thinning
Gravel Augmentation (finer gravel for spawning habitat)
Addition of further in-channel features/restoration
Riparian buffer
Wetland/floodplain connection

We are proposing circa £14 million of spend on this between 2025 and 2030 through our WINEP programme and also have agreed work for the following five-year period totalling around £7 million to continue this. We are committed to the long term and sustainable restoration of the chalk streams, not just through our abstraction reductions but through improvements measures such as these.

11.11.2 Environmental Destination Investigations

As highlighted in section 6.11.1, we will undertake extensive investigations during AMP8 to understand the true nature of the abstraction reductions required to achieve the required environmental destination. This will involve

working with Water Resources East to understand the specific needs of particular waterbodies and determine the priority and scale of reductions required. This will inform our WRMP29 plan.

11.11.3 Additional WINEP activities

Previously, our catchment management programme has formed a large part of our WINEP programme. For AMP8, this work now moves into our business as usual activity and will be included in our PR24 business plan. We propose to continue our efforts in our region to deliver improvements to groundwater quality at source. Our Spring programme, working with local farmers and landowners, has seen significant success in reducing nitrates and metaldehyde, and we plan to expand both the area we cover with this scheme, but also the range of pollutants we tackle. This will help deliver improved raw water quality which will ensure we are able to maximise our existing raw water resources.

We are also looking to develop a 25-year environment plan over the next couple of years that will align with the Government 25-year environment plan and will provide a clear line of sight for the environmental protection and improvements we wish to deliver over the lifespan of this WRMP.

Our plan also looks at supporting other key areas such as delivering biodiversity improvements, supporting removal of invasive species such as mink, the protection of species and river restoration work.

11.12 Greenhouse gases and our journey to Net Zero carbon

We commissioned Atkins to identify and produce embodied and operational carbon cost data for each of our feasible supply options. This data then fed into our ValueStream modelling to help determine our best value plan. The operational carbon costs for supply options have been derived from each options' total power (kWh) usage multiplied against a grid carbon factor (tonnes CO2e/kWh) over the 80-year period from 2025. This grid carbon factor has been taken from the government's 'Greenbook supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal', data tables 1 to 19[23]. From this spreadsheet, Table 1's electrical emission factors provide long-run marginal estimates for commercial and public sector consumption base.

The table below outlines the carbon impact of each of the feasible supply side options.

[23] Reference: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

Table 65 Operational and Embodied carbon (tonnes) used for each feasible option

		Operational	Embodied
Ref	**Option name**	**Total tonnes of operational carbon over lifespan (80 years) - DYAA**	**Total tonnes of embodied carbon (initial investment, excludes capital renewal)**
CW24-01A	Combined Ouse gravel sources - Fenstanton to St Ives (01A)	41	27
CW24-01B	Combined Ouse gravel sources - Fenstanton to St Ives (01B)	200	274
CW24-37Ai	Site-scale greywater re-use – large storage	289	846
CW24-37Aii	Site-scale greywater re-use – small storage	289	867
CW24-38A	Site-scale rainwater harvesting – large storage	256	207
CW24-38B	Site-scale rainwater harvesting – small storage	256	207
CW24-57	River Cam abstraction & treatment works.	2669	2303
CW24-71	Effluent re-use post effluent discharge	721	2610
CW24-73A	Fens Reservoir potable water transfer Site A	5446	2598
CW24-75Diii Op2	AWS Potable Transfer (26 Ml) with partial treatment	28	658
CW24-75Diii Op3	AWS Potable Transfer (26 Ml) with full treatment	4007	844

For demand management options, we have calculated the impact on carbon based on the saving each option generates in Ml/d. This is because we understand our carbon impact for each megalitre of water we produce, and so for every megalitre less that we need to produce, there is a direct saving of power and chemicals that can be quantified in tonnes of carbon and cost of carbon.

Using the Defra intensity metrics, we have updated the 2021/22 calculation of kg of carbon per megalitre of water produced (kgCO2e/Ml) by including an uplift for purchased electricity and estimated chemical usage. We calculate our carbon output to be 319.77 kgCO2/Ml.

As required by Direction 3(d) we have described the “the emissions of greenhouse gases which are likely to arise as a result of each measure which it has identified in accordance with section 37A(3)(b).” The following table shows in numerical format our estimates of greenhouse gases that are likely to result from our current and future operations. These estimates show the difference between our baseline and our final plan, this difference incorporates the impact of the options selected in our preferred plan based on our DI.

Table 66 Operational greenhouse gas comparison of current operations and preferred plan

Total annual carbon /tonnes	2021/22	2024/25	2029/30	2034/35	2039/40	2044/45	2049/50
Current operation & baseline plan	10,586	10,586	11,302	11,820	12,187	12,350	12,472
Preferred plan	-	-	10,558	10,445	10,387	10,321	10,363
WRMP19 plan	9,640	9,503	9,626	9,643	9,655	9,663	n/a

The table below details how each activity contributes to the overall reduction in carbon. Overall, our demand management programme delivers a reduction of 2,148 tonnes of carbon.

Table 67 Estimated greenhouse gas emission reductions from our demand management programme

tCO2e saved (cumulative)	Year 5	Year 10	Year 15	Year 20	Year 25
	2029/30	2034/35	2039/40	2044/45	2049/50
Household customer metering	83	166	166	166	166
Leakage reduction	280	480	689	689	689
Water efficiency commitment	105	300	523	715	821
Non-household consumption reduction (inc metering)	274	472	472	472	472

We are committed to ensuring that our options development focuses on how we can reduce carbon emissions through design. In AMP7, in our South Staffs region, we have been progressing with our major upgrade at our River Severn Works. Upon commencement of the project, we identified a greener solution, and we were successful in our bid for Green Recovery funding. As a result, will have installed the largest ceramic membrane treatment plant in the UK by the end of AMP7. This will reduce our carbon emissions and shows our ambition to drive forward innovation in our options development to ensure reduced carbon.

Our Grafham transfer option looks to utilise existing pipework belonging to Anglian Water to reduce not only the cost and environmental impact of the scheme, but specifically the carbon costs. We are also identifying key options within the development of the Fens Reservoir to identify key areas for carbon impacts such as:

- Transporting materials via waterways rather than roads
- Identifying multi-sector benefits that can be achieved through the reservoir e.g. peatland wetting that will enable capture of carbon
- Biodiversity net gain delivery above the 10% Environment Act target
- Opportunities for renewable energy
- Utilisation of existing assets to reduce greenhouse gas emissions

Also, to signpost where further information on this can be found outside of our WRMP, we as the South Staffordshire group, report our estimates of greenhouse gas emissions in our annual reports.

11.12.1 Our journey to Net Zero operational carbon by 2030

Net zero means achieving a balance between the greenhouse gases put into the atmosphere and those taken out. When what we add is no more than what we take away, we reach net zero.

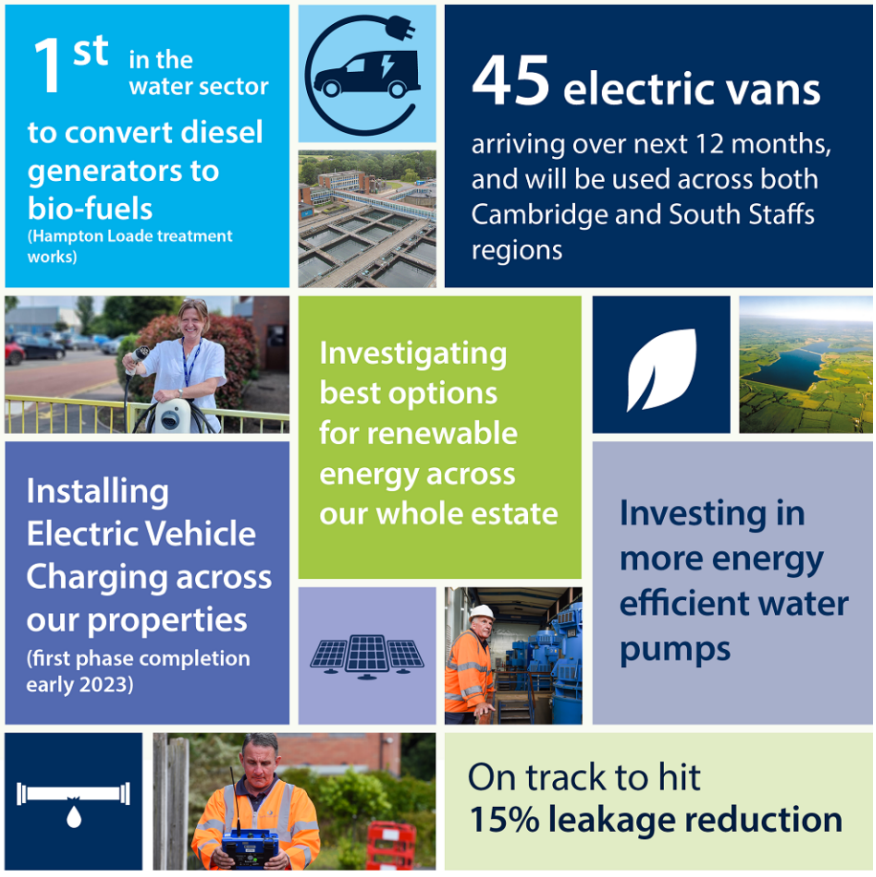
Water companies are not like other businesses. We provide a vital public service hinged on major infrastructure and yet we're also a large landowner and custodian of the natural environment. Moving and treating water is an energy-intensive process leading to millions of tonnes of greenhouse gas emissions each year.

In November 2020, water companies unveiled a ground-breaking plan to deliver a net-zero water supply to customers by 2030 in the world's first sector-wide commitment of its kind.

Our plan focuses on gross operational emissions associated with:

- Wholesome water (extraction, treatment, pumping and transport for maintenance).
- Bioresources/sludge management (treatment and transportation). *Note: Sludge to land emissions not included.*
- Administration activities and business travel

The below infographic shows what we have achieved so far on this journey to net zero during AMP7.

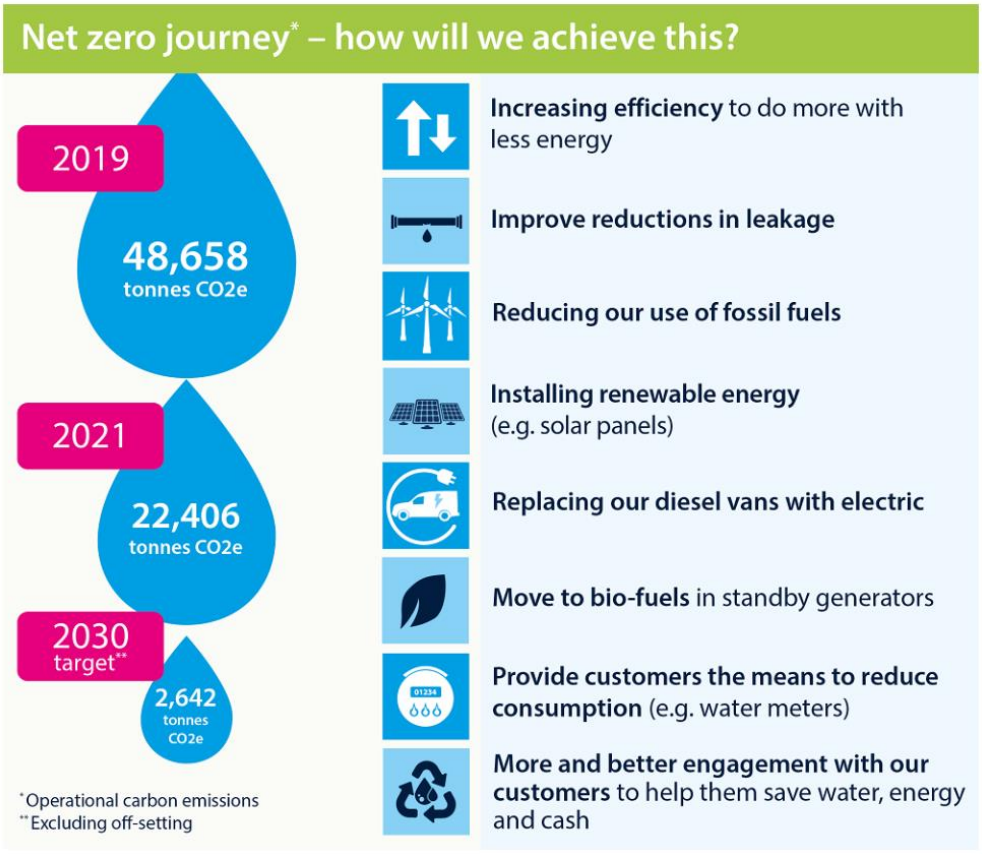


We are currently:

- Deploying Vauxhall e-combo electric vans to replace diesel across both regions (we have 14 electric vans in service at end March 2023).
- Carrying out a full estate assessment renewable energy assessment which will be completed by June 2023.

- Assessing all energy efficiency opportunities including existing programs (conversion of standby generation to biofuels, re-use of heat from existing operations rather than replacing boilers, installing low energy lighting, installing metering and energy management controls, etc.).
- Assessing, prioritising and accelerating leakage reduction projects.
- Benchmarking across the sector best practice in order to learn and replicate at pace and least cost.
- Continuing to deploy our Pump Efficiency Program (PEP) – 10 sites have been identified and surveyed for 2023.
- Reviewing and updating our systems to better measure and analyse the true cost (£, energy and carbon) of each litre of water.
- Targeting better engagement with our customers e.g., through our new initiative called "the Net Zero Citizens Jury".

However, we recognise there is much still to do. We have demonstrated above that through reducing the demand for water, we in turn reduce the greenhouse emissions we make as a business, and this supports our journey to net zero. The below infographic shows the key additional activities we are delivering to achieve the operational net zero commitment by 2030.



11.13 Summary of our proposed programme

The table below summarises the key activities within our plan, and the demand savings associated with each throughout each AMP during the planning period.

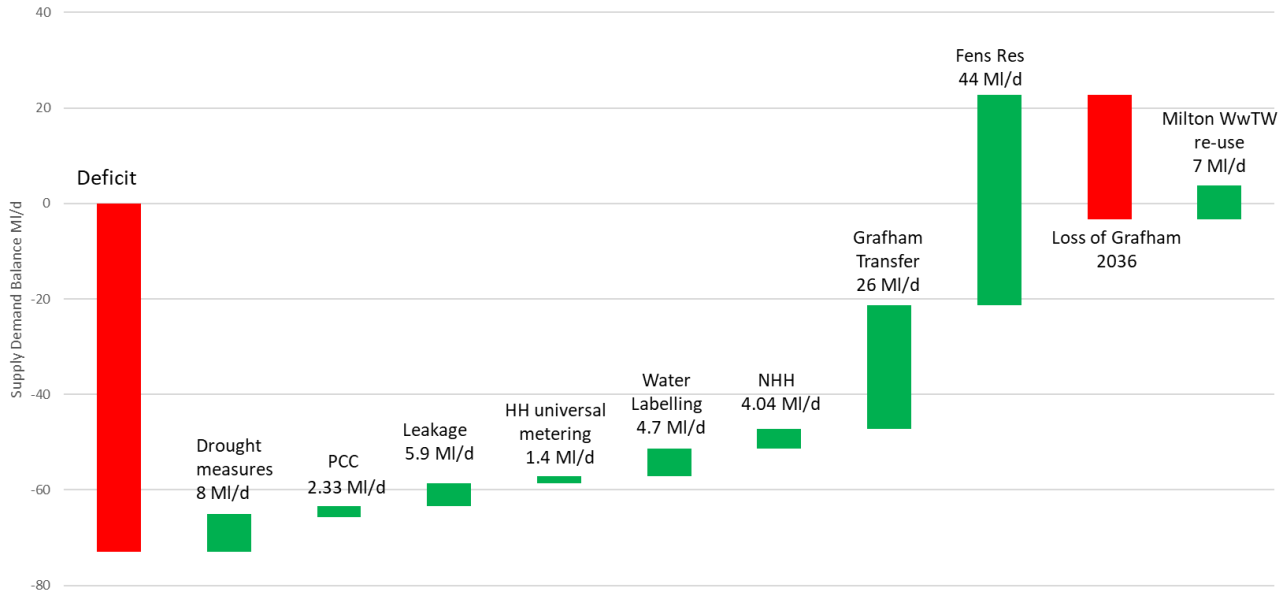
Our proposed programme is included in table 5 of the accompanying WRMP tables.

Table 68 Summary of our proposed programme

		Cumulative benefit by AMP Ml/d					
Activity	**Total benefit by 2050 Ml/d**	**AMP8**	**AMP9**	**AMP10**	**AMP11**	**AMP12**	**Total Cost £m**
Water labelling no minimum standards	**4.70**	0.13	0.85	2.42	4.07	4.70	**0**
Universal Metering	**1.42**	0.71	1.42	1.42	1.42	1.42	**5.95**
PCC 110 l/h/d by 2050 (excl WL & metering)	**2.33**	0.77	1.72	2.06	2.06	2.33	**5.43**
50% leakage reduction by 2040	**5.90**	2.4	4.11	5.9	5.9	5.9	**23.48**
Non-Household consumption reduction	**4.04**	2.35	4.04	4.04	4.04	4.04	**2.11**
Grafham Transfer	**0**	0	26	0	0	0	**89.14**
Fens Reservoir transfer	**44**	0	0	44	44	44	**61.84**
Milton reuse scheme	**7**	0	0	0	7	7	**244.79**
Totals	**69.39**						**432.74**

The figure below shows how these individual components contribute to resolving the supply demand deficit.

Figure 39 Summary of our proposed programme



One of the planning requirements for the WRMP24 was to achieve 1 in 500 drought resilience by 2040, and to demonstrate that this is best value for customers. We achieve this level of resilience upon commissioning of the Fens Reservoir in 2036. It should be noted though that the selection of Fens Reservoir in our plan is not timed in order to deliver this resilience, it is required to meet the level of growth and primarily the significant abstraction reductions that both Cambridge Water and Anglian Water need to meet to deliver the environmental destination. It is these elements that drive the timescale for the development of the Fens reservoir.

Our WRMP covers the statutory planning period of 25 years to 2050. However, our data tables extend to 2100. Whilst the level of uncertainty in forecasts increases the further out we look, we feel it is important to show the longer term trajectory too.

For the data tables, we project demand forecasts out to 2100 based on pre 2050 growth. We hold demand management at the level we achieve in 2050. We also assume no further abstraction reductions. These assumptions will be updated at each round of WRMPs. Under these circumstances, our plan shows a deficit occurring in 2069, and so our EVSD modelling includes three further options to maintain a positive supply demand balance to 2100, and these are summarised in the table below. In 2100, our plan has a positive supply demand balance of 1.11 Ml/d.

Table 69 Post 2050 supply option selection

Option ID	Option detail	Benefit Ml/d	Selected date	Capex cost £m
CW24-01B	Combined Ouse gravel sources Fenstanton to St Ives 01B	2	2069/70	4.46
CW24-37Aii	Northstowe greywater reuse or similar growth small storage	0.5	2083/84	20.52
CW24-38B	Northstowe rainwater harvest or similar growth small storage	0.9	2088/89	48.37

11.14 Bill Impact

The below table shows the AMP8 cost of our plan, as well as the total cost of the plan, and the impact this will have on customer bills as a result. This includes the cost of the transfer of water from Fens Reservoir but not the remaining costs associated with the build, as how this will impact on our customers is yet to be determined. The cost of the WRMP programme including Fens costs is £1,009.28m.

Table 70 Summary of programme costs and bill impact

	AMP8	**Total WRMP24**
Cost of programme (£m)	22.1	432.74

Benefits delivered (Ml)	6.36*	95.39
Bill impact (£)	£8.57 (by 2030)	£92.24 (by 2050)

*This benefit does not include the Grafham Transfer as this will deliver supply benefits in AMP.

The total WRMP bill impact shown is based on total costs for schemes as though they are all delivered in house. In reality this will not be the case due to the cost of these schemes, which will both be suitable for DPC or SIPR delivery as outlined in section 11.4 due to being over £200m. This would impact on the timing of costs and the customer bill impacts, and these will be explored further in AMP8 as we progress with the development of Fens Reservoir and develop the River Cam option further.

This is obviously an uplift from our WRMP19 plan due to the additional growth now planned in our region, and primarily due to the improved understanding of both our short term and long-term environmental needs. At WRMP19 our programme was predominantly demand management based, with some investment in three mothballed sources to improve resilience. Whilst our demand management offsets the additional demand from growth, our WRMP24 highlights the need for significant supply side option development and as such there is a cost increase associated with this.

12. Final supply/demand balance

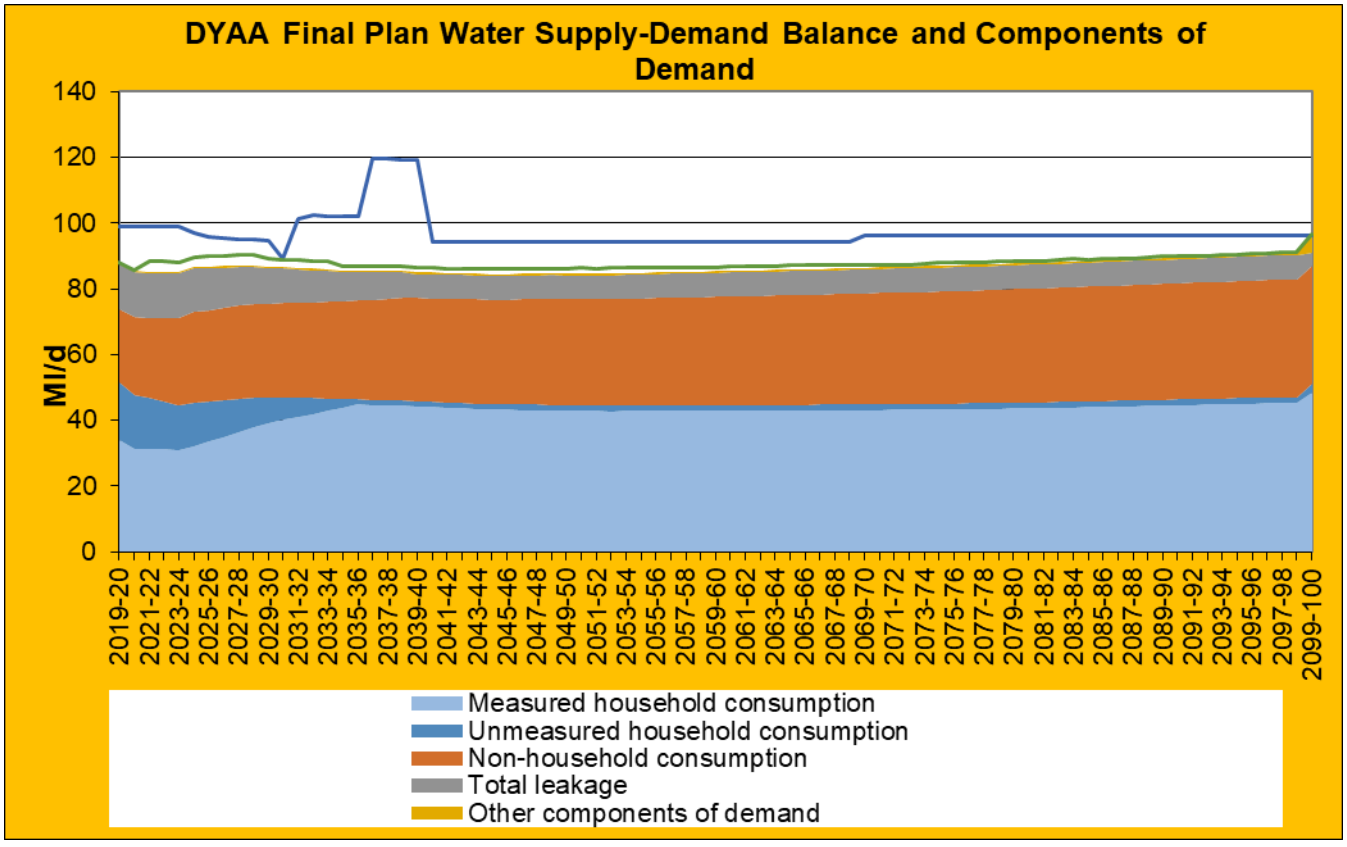
Our proposed demand management programme delivers an 18.39 Ml/d reduction in demand by 2049/50. This largely offsets the growth in demand associated with population increases in our region. In order to meet the environmental needs of the chalk streams in our area, our plan sees the development of three supply side options which combined deliver 77 Ml/d of additional supply to ensure we are able to sustainably meet customer demand.

The charts below show the final planning supply/demand balance for the DYAA and DYCP scenarios.

12.1 Dry Year Annual Average

The chart below shows the final planning supply/demand balance for the DYAA scenario.

Figure 40 Final planning DYAA supply/demand balance and components of demand



12.2 Peak Week critical period

The chart below shows the final planning supply/demand balance for the critical period scenario. The options remove the initial deficits and maintain a surplus throughout the planning period.

Figure 41 Final planning critical period supply/demand balance and components of demand