PR24

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ESSEX & SUFFOLK WATER
WATER RESOURCES MANAGEMENT PLAN 2024
DRAFT FINAL

April 2024

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Approver	Heidi Mottram	23/04/24	On behalf of Northumbrian Water Board

Northumbrian Water is a trading division of Northumbrian Water Limited which is a group company of Northumbrian Water Group Limited

Registered in England & Wales No. 2366703

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BOARD ASSURANCE STATEMENT

Having reviewed the draft final WRMP24, the Northumbrian Water Limited Board made the following statement:

- The Board is satisfied the plan represents the most cost effective and sustainable long-term solution;
- The Board believes it has sufficiently collaborated with customers, partners, and regulators to develop a strong understanding of future needs, explore every option, and build consensus on delivery plans;
- The Board confirms the integrity of the risk assessment process put in place for all of our water supplies;
- The Board confirms our plan reflects Water Resources East's regional plan which has been developed in accordance with the national framework and relevant guidance and policy; and
- The Board is satisfied that the WRMPs take account of all statutory drinking water quality obligations and plans to meet all drinking water quality legislation in full including the Drinking Water Directive.
- The Board has challenged and satisfied itself that the WRMP and the expenditure proposals within them are deliverable in the context of the wider PR24 business plan proposals.

The Board confirms that Northumbrian Water complies with its duties on drinking water quality matters in its broader resilience and resource planning arrangements.

Date: 23 April 2024

Signed for and on Behalf of the Board:

Heidi Mottram

Chief Executive Officer

EXCLUSIONS ON THE GROUNDS OF NATIONAL SECURITY

Northumbrian Water Limited has not excluded any information from this plan on the grounds that the information would be contrary to the interests of national security.

Under Section 37B(10)(b) of the Water Industry Act 1991, as amended by the Water Act 2003 ("the Act"), the Secretary of State can direct the Company to exclude any information from the published Plan on the grounds that it appears to him that its publication would be contrary to the interests of national security.

NON-TECHNICAL AND TECHNICAL SUMMARY DOCUMENTS

This document is a technical document written primarily for our regulators and technical stakeholders. We have prepared two separate documents including a:

- Executive Technical Summary; and
- Non-Technical Summary

Both summary documents can be found on our WRMP24 webpage - www.nwg.co.uk/wrmp.

ESSEX & SUFFOLK WATER – OUR STORY

Welcome

We are pleased to present our draft final Water Resources Management Plan 2024 (WRMP24), which sets out how we intend to maintain a secure supply of water for our customers and businesses while protecting and enhancing the environment.

East Anglia is one of the driest parts of the country and has been classified by the Environment Agency as a Serious Water Stressed Area. The climate is changing, and the latest projections indicate that while winters may well be wetter, summers will be drier, and we can expect summer river flows to be lower. We recognise that we must provide resilient supplies and look after the environment for our current customers, and that we must do the same for future generations.

In the early 1990s we identified that we would not have sufficient water supplies to meet long term forecast demand and so we started a twin track approach to reduce customer demand and increase supplies.

Reducing demand

We are proud that overall leakage from our network and from our customers' homes is at one of the lowest levels in the water industry. However, we continue to aim to improve, and our preferred plan is to reduce leakage by a further 40% from 2017/18 levels by 2050.

When customers pay for the amount of water they use it is the fairest way of charging them and we have widely promoted the benefits of this. The majority of our customers, nearly 70%, now have a water meter and are charged for how much water they use. Given that the majority of our customers are metered and that our supply area is a serious water stressed area, we now plan to compulsory meter all our customers which means that all customers will pay for the amount of water they use by 2030 in Suffolk and 2035 in Essex.

We are planning for all household and non-household meters to be smart meters by 2035, similar to the ones used for electricity and gas. They will allow our customers to make more informed choices about how they use water. They will also help to identify when they might have a leaking pipe or toilet and will help us support customers who use high levels of water become more water efficient.

We are proud of our award-winning water efficiency programmes. These have included our Water's Worth Saving home visits to the highest users, the Ripple Effect educational resources for children and our Leaky Loos programme repairing leaking toilets of customers for free. We plan to upscale this important work from 2025 to help our customers use less water.

Our metering and water efficiency strategies will help us meet national targets for reducing customer water demand including reducing per capita consumption (PCC) to 122 litres/head/day by 2038 and 110 litres/person/day by 2050.

We have also developed a new non-household water efficiency strategy to support reductions in Business Demand. Working collaboratively with business, retailers, local planning authorities and the Environment Agency, we are forecasting that our strategy will enable us to reduce business water demand by 9% by 2038.

Increasing supplies

We were the first water company to build a Water Reuse scheme in 2000. The scheme intercepts effluent from a water recycling centre that would otherwise be discharged to the sea and treats it to a very high quality so that it can be discharged into a river instead. This increases flows in the river to support and protect our downstream abstraction as well as the river environment.

We also started a major project in the 1990s to improve our Abberton Reservoir in Essex. We carried out extensive environmental assessments and eventually invested £150m to increase its storage capacity by 60% or 15 billion litres. In doing so, we created one the best wetland sites for birds in the country, a great early example of biodiversity net gain. Construction works were completed in 2013 with the reservoir filling to its new top level in 2014.

Protecting and enhancing the environment

We want the best outcome for the environment, and we know that if it is not protected, not only will important habitats and species be lost but the water quality in our rivers and reservoirs will deteriorate. This would mean using more energy and chemicals to treat the water before we can distribute it to our customers.

We have always monitored the impacts of taking water from rivers and groundwater and taken timely action to make sure the environment is not damaged as a result. A great early example of this came in the 1990s when we closed down one of our groundwater abstractions that was having an adverse effect on Redgrave and Lopham Fen in Suffolk. However, as our understanding of the environment improves, so does our understanding of how much water it needs. For this WRMP24, we have completed abstraction sustainability investigations and have agreed with the Environment Agency new lower sustainable levels of annual abstraction, starting from 2026, for each of our abstraction licences.

Our WRMP24

Reducing some of our water abstractions, the effects of climate change and new demand from households and businesses mean that we will not have enough water. Consequently, we need to act now and develop new supply schemes to make sure our customers are not affected. These are presented in our preferred plan in this WRMP24 and for Suffolk include new strategic pipelines to allow us to move water around our supply areas more efficiently, a new Water Reuse scheme and a new winter storage reservoir. In South Essex, we to plan to construct a new groundwater treatment works.

The table below provides a summary of our Best Value Plan and describes the changes made between our draft WRMP24 (dWRMP24) (which we consulted on) and our subsequent final WRMP24.

Table 1: Best Value Plan Summary including changes from draft WRMP24

WRMP24 BEST VALUE PLAN COMPONENT		DRAFT WRMP24 PREFERRED FINAL PLAN	FINAL WRMP24 PREFERRED FINAL PLAN	DIFFERENCE
Demand Reduction	Leakage Reduction	40% reduction by 2050	40% reduction by 2050	No
	Compulsory Metering	All household and non-household properties to be compulsory metered by 2035	All household and non-household properties to be compulsory metered by 2035	Given the moratorium in our Hartismere water resource zone, we have committed to compulsory meter all Suffolk customers by 2030/31
	Smart Metering	All household and non-household properties to have smart meters by 2035	All household and non-household properties to have smart meters by 2035	No
	Water Efficiency Programme	Water efficiency programme to support meeting national household water consumption targets	Water efficiency programme to support meeting national household water consumption and business demand reduction targets	Inclusion of new programme to reduce business demand in line with the national non-household demand reduction target
Essex Supply Schemes	Linford New WTW 10	Yes – 7 Ml/d scheme	Yes – 10 Ml/d scheme	Our final WRMP24 includes a 10 Ml/d rather than 7 Ml/d scheme
	Abberton Raw Water Pumping Station & Langford Clarifiers	Not included	Included	Scheme to allow DO gain from the Abberton to Langford Pipeline
	Langford Nitrate Scheme	Not included	Included	New scheme to reduce unplanned outage due to elevated raw water nitrate concentrations
	Langford UV	Not included	Included	New scheme to reduce unplanned outage due to cryptosporidium in raw water
	Langham Nitrate Scheme	Not included	Included	New scheme to reduce unplanned outage due to elevated raw water nitrate concentrations
Suffolk Supply Schemes	Suffolk Strategic Pipelines including: - Barsham WTW Saxmundham Tower - Holton WTW Eye Airfield	Included	Included	This scheme should now be delivered in 2028/29 instead of 2030/31 as was forecast in our draft WRMP24
	Lowestoft Water Reuse for Ellingham Mill and Transfer	Included	Included	In our draft WRMP24, we forecasted to deliver this scheme in 2032/33. However, we have bought that forward to 2030/31, subject to detailed design prior to the 2027 adaptive programme review point confirming this is possible. This will enable the

WRMP24 BEST VALUE PLAN COMPONENT		DRAFT WRMP24 PREFERRED FINAL PLAN	FINAL WRMP24 PREFERRED FINAL PLAN	DIFFERENCE
				Hartismere WRZ non-domestic moratorium to be lifted once Lowestoft Reuse is operational. This is also prudent to do given the uncertainty of Habs Regs sustainability reductions which will not be confirmed by the EA until late 2024/25.
	North Suffolk Winter Storage 7500 and Transfer	Included	Included	No
	Barsham Nitrate Scheme	Not included	Included	New scheme to reduce unplanned outage due to elevated raw water nitrate concentrations
	Bungay wells to Broome WTW transfer and Broome to Barsham WTW transfer	Included	Included	Although included in our draft WRMP24, this scheme now extends the main to Barsham WTWs

Our final WRMP24 preferred final plan will allow us to meet national targets for leakage and demand reduction including:

- **Leakage:** Although our Essex & Suffolk Water (ESW) target is to reduce leakage by 40% by 2050, at a group level, we will be reducing Northumbrian Water Group (NWG) leakage by 50% by 2050.
- **Per Capita Consumption:** 122 litres/head/day by 2038 and 110 litres/head/day by 2050
- Non-household demand reduction: 9% reduction by 2038

Consultation

We would like to thank all those who submitted a response to the consultation on our dWRMP24. We have reviewed them all and prepared a consultation Statement of Response. This confirms the changes we have made to our draft WRMP24 as a result of the consultation responses and the reasons for doing so. We submitted our revised draft WRMP24 to the Department of Environment, Food and Rural Affairs (Defra) on 31 July 2023. We then provided Further Information in support of our Statement of Consultation to Defra on 29 March 2024 and this draft final WRMP24, which includes further updates. We envisage, subject to Defra approval, that we will publish our final plan in Autumn 2024.

We look forward to sharing our final WRMP24.

Heidi Mottram

Chief Executive Officer

CONSULTATION

We developed our dWRMP24 between April 2020 and October 2022 taking account of:

- pre-consultation feedback from regulators; and
- feedback received during and following a pre-consultation webinar in January 2022 where we shared our initial baseline supply demand balance position, the planning assumptions used in developing the forecasts and our ambition to reduce leakage and customer demand (per capita consumption or PCC).

We submitted our dWRMP24 to Defra on 3 October 2022 and then invited statutory consultees, our customers, and other interested stakeholders to comment on it. The consultation took place over a 12 week period between Wednesday 21 December 2022 and Wednesday 29 March 2023. Our dWRMP24 was available for review on our website here.

We asked consultees to share their views on our dWRMP24 including those on:

- our projection of future water needs including those of our customers, businesses, and the environment; and
- our preferred plan including:
  - our demand management options to reduce leakage by 40% by 2049/50; smart metering; and water efficiency programmes; and
  - our supply side options including a new Water Reuse scheme, Winter storage reservoir and strategic pipelines in Suffolk and anew groundwater treatment works in Essex.

Consultees were asked to send their written representations on our dWRMP24 to the Secretary of State for Environment Food and Rural Affairs which were then made available to us at the end of the consultation period.

Our regional water resources group, Water Resources East (WRE) has also prepared a regional plan which sets out how it will address the need for resilient and sustainable water supplies at a regional and national level. WRE's regional Plan has informed our dWRMP24 and was consulted on at the same time as our draft Plan.

We have prepared a consultation Statement of Response which is available here and describes:

a. our consideration of the consultation responses;
b. the changes that we have made to the dWRMP24 as a result of the consultation responses and the reasons for doing so and where no change has been made to the dWRMP24, the reason for this; and
c. how we have taken account of the third round of regional reconciliation planning in which water transfers between companies and regions were agreed.

If our Statement of Response and rdWRMP24 are approved by Defra, we envisage that we will be directed to publish our final WRMP24 on our website (www.nwg.co.uk/wrmp) in Autumn 2023.

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GLOSSARY

Term / Acronym	Definition
AA	Appropriate Assessment
AAD	Advanced Anaerobic Digestion
ACWG	All Companies Working Group
AMI	Advanced Metering Infrastructure
AMP7	Asset Management Plan 7 (April 2020 – March 2025)
AMP8	Asset Management Plan 8 (April 2025 – March 2030)
AMR	Automated Meter Reading
ANEP	Annual Non-Exceedance Probability
ASR	Aquifer Storage and Recharge
AZNP	Average Zonal Night Pressure
APR	Annual Performance Reporting
ASB	Abstraction Sensitivity Band
BH	Borehole
BL	Baseline
BNG	Biodiversity Net Gain
BVP	Best Value Plan
CACI	Leading specialists in location planning- CACI Ltd
CBA	Cost benefit analysis
CC&B	Our customer billing database
CMOS	Central Market Operating System
CSMG	Common Standards Monitoring Guidance
DAPWL	Deepest Advised Pumping Water Level
DEFRA	Department of Environment, Food and Rural Affairs
DI	Distribution Input
DMA/DA	District metering areas / Drainage areas
DMO	Demand Management Option
DO	Deployable Output
DWI	Drinking Water Inspectorate. DWI has responsibilities under the Water Industry Act 1991 relating to the sufficiency and quality of water supplies.
DWP	Department for Work and Pensions
dWRMP	Draft Water Resources Management Plan
DYAA	Dry Year Annual Average
DYCP	Dry Year Critical Period
EA	Environment Agency. The Environment Agency is a statutory consultee for WRMPs. It leads on producing guidance for water companies to use in compiling their WRMP. It has a statutory duty to secure the proper use of water resources in England. The Environment Agency works with water companies as they prepare WRMPs and provide a representation as part of water companies' WRMP consultation. At the statement of response stage, its role changes and it becomes a technical advisor to the Department for Environment, Food & Rural Affairs (Defra) and the Secretary of State.

EBSD	Economics of balancing supply and demand
ED	Environmental Destination
EFI	Environmental Flow Indicator
EIA	Environmental Impact Assessment
EOETS	Ely Ouse to Essex Transfer Scheme
ESA	Ecosystem Services Assessment
EST	Energy Saving Trust
ESW	Essex & Suffolk Water
FL	Full licence
GHG	Greenhouse Gas
GOGS	Great Ouse Groundwater Scheme
GVA	Gross Value Added
GWDTE	Groundwater Dependent Terrestrial Ecosystems
Habs Regs	Habitats Regulations
HH	Household (Domestic use customers)
HLS	High-level Environmental Screening
HMWB	Heavily modified waterbody
HOF	Hands off Flow
HRA	Habitats Regulations Assessment
IEA	Integrated Environmental Assessment
IROPI	Imperative Reasons of Overriding Public Interest
l/hd/d	Litres per head per day (litres per person per day)
l/min / l/hr / l/yr	Litre per minute / litre per hour / litre per year
l/p/d	Litres per property per day (litres per premise per day)
LA	Local Authority
LHN/OAHN	Local Housing Need / Output Area Housing Need
LPA/DPA	Local Planning Authority / District Planning Authority
LSE	Likely Significant Effects
Max Peak or MP	Maximum Peak abstraction is the maximum volume of water abstracted in any one year during the representative abstraction period. For the Norfolk, Suffolk & Essex EA area the representative period is taken to be calendar years 2005-2015 (Iain Page pers comm. March 2022). The definition of Max Peak (Operational) was updated in July 2022, so that the capped licence would receive conditions of: a six-year rolling annual average of 6 x the annual RA quantity to keep average use to the RAA over a 6-year period (Iain Page pers comm. July 2022). Licences capped to Max Peak (Original) allow some growth of abstraction towards the new Max Peak level.
MCA	Multi Criteria Analysis
MDMS	Meter Data Management System
MHCLG	Ministry for Housing, Communities and Local Government's
Ml/d	Megalitres per day
Ml/yr	Megalitres per year

MLE	Maximum likelihood estimation
MOSL	Market Operator Service Ltd
MTP	Market Transformation Programme
MUR	Meter under- registration
NAVs	New Appointments and Variations
NC	Natural Capita
NCA	Natural Capita Assessments
NE	Natural England
NERC	Natural Environment and Rural Communities
NHH	Non-Household (Business customers who primary use of water is non-domestic)
NPP	National Population projections
NPV	Net Present Value
NSERV/SERV1/SERV2	Non-service non-household industries / Service industry group 1 / Service industry group 2
NW	Northumbrian Water
NWG	Northumbrian Water Group
NWL	Northumbrian Water Limited
NYAA/ DYAA/ DYCP	Normal Year Annual Average / Dry Year Annual Average / Dry Year Critical Period
OBR	Office for Budget Responsibility
ODI	Outcome Delivery Incentive
Ofwat	Ofwat is the economic regulator of the water industry. It is a statutory consultee for WRMPs, has been key stakeholder during the development of our plan and will provide a representation as part of our consultation. Our WRMP will primarily inform the supply demand balance part of our business plans which we will submit to Ofwat. Ofwat determines the extent to, and conditions under which, we can recover the costs of investment through our charges to customers.
OPI	Overriding Public Interest
p.a.	Per annum (per year)
PC	Performance Commitment
PCC	Per capita consumption
PET	Potential evapotranspiration
PHC	Per household consumption
Planning Horizon	Refers to the forecasted years from 2024/25 until 2079/80.
PRV	Pressure Reducing Valve
PR19	Price Review 2019 – Business Plan 2020-2025
PR24	Price Review 2024 - Business Plan 2025-2030
Price Review or PR	Ofwat is the economic regulator of the water industry and every five years it sets the investment and service package that customers receive including the price water companies charge their customers. Ofwat carry out a review of these price limits known as a Price Review every five years. The current Price Review will be completed in 2024 and so is known as PR24 and will set customer bills for the period 2025 to 2030. As part of the Price review process, water companies submit a business plan which sets out the investment and outcomes for customers and the environment that they are required to deliver and how this would impact customer bills. The Business Plan will include the investment needed to deliver the WRMP24 Best Value Plan.

RAA	Recent Actual Average abstraction. Defined by the EA as the total volume of water abstracted during the representative recent actual (RA) period divided by the number of years in that period. Defined in 'Water resources planning guideline supplementary guidance – actions required to prevent deterioration' (April 2022). For the Norfolk, Suffolk & Essex EA area the representative period is taken to be calendar years 2010-2015 (Iain Page pers comm. March 2022). This definition was updated in July 2022, so that the capped licence would receive conditions of: A 6-year rolling annual average of 6 x the annual RA quantity to keep average use to the RAA over a 6-year period; An annual peak set as the max annual actual peak used within the RA period (2010-15) (Iain Page pers comm. July 2022)
RAPID	Regulators' Alliance for Progressing Infrastructure Development (RAPID) RAPID will help accelerate the development of new strategic water infrastructure and inform future regulatory frameworks. It is made up of the 3 water regulators in England: Ofwat, Environment Agency and DWI. It also works closely with Welsh Government and Natural Resources Wales. Find further information on RAPID's website. Some water companies received additional funding to investigate and develop strategic regional water resource options in the 2019 price review (PR19) final determination. These companies should account for progress made on these options through a gated process. RAPID will then make recommendations on the solutions and Ofwat will make decisions on funding. You must present the need for these schemes, their timings, and the justification for your decisions in your regional plan and WRMP.
RBMP	River Basin Management Plan
RCM	Regional Climate Model
RCP	Representative Concentration Pathway
rdWRMP24	Revised draft Water Resources Management Plan 2024
RoC	Review of Consents
RWPS	Raw Water Pump Station
SAC	Special Area of Conservation
SAG	Stakeholder Advisory Group
SAGS	Stour Augmentation Groundwater Scheme
SAM	Small Area Monitor (unmeasured consumption monitor in NW)
SEA	Strategic Environmental Assessment
SELL	Sustainable Economic Level of Leakage
SIC	Standard Industry Classification
SNPP	Sub-National Population Projection
SPA	Special Protection Area
SPL	Supply Pipe Leakage
SR	Sustainability Reductions
SRO	Strategic Resource Option
SSSI	Site of Special Scientific Interest
SWU	Study of Water Use (individual unmeasured consumption monitor in ESW)
THR	Target Headroom
ToLS	Test of Likely Significance
UARL	Unavoidable Annual Real Losses
UKCP09	UK Climate Projections 2009
UKCP18	UK Climate Projections 2018

UKWIR	UK Water Industry Research
Void households	Empty (unoccupied) households
WAGS	Waveney Augmentation Groundwater Scheme
WAM	Whole Area Metering
Water Industry National Environment Programme (WINEP)	A programme of actions (Investigations, options appraisal and implementation schemes) water companies are required to take to meet the environmental legislative requirements that apply to water companies in England.
WFD	Water Framework Directive
WFH	Working from home
WRc	Water Research Commission
WRE	Water Resources East regional group
WReN	Water Resources North regional group
WRMP19	Water Resources Management Plan 2019
WRMP24	Water Resources Management Plan 2024
WRNF	Water Resources National Framework
WRPG	Water Resources Planning Guideline
WRSE	Water Resources South East regional group
WRZ	Water Resource Zone
WTW	Water Treatment Works

1. INTRODUCTION

1.1. PLANNING FOR A SECURE, SUSTAINABLE SUPPLY OF WATER

Under sections 37A to 37D of the Water Industry Act 1991, we are required to prepare and maintain a Water Resources Management Plan (WRMP) every five years (reviewed annually) which sets out how we intend to achieve a secure, resilient, and sustainable supply of water for our customers and a protected and enhanced environment, both now and in the long term.

This document is our draft final WRMP and has been developed as part of the Price Review 2024 process (PR24) and so is known as Water Resources Management Plan 2024 (WRMP24). This draft final has been updated to take account of our consultation statement of response and further information in support of that statement of response, both of which are published on our website (www.nwg.co.uk/responsibility/environment/wrmp/esw-draft-water-resources-management-plan-2024-consultation/) and confirms if and how we have taken into account each of the consultee's responses. It has also been updated to take account of further responses we have provided to Defra (16 April 2024).

It forecasts supply and demand for our four Water Resource Zones (WRZ) from 2025 to 2050:

- **Essex Supply Area**
  - Essex WRZ
- **Suffolk Supply Area:**
  - Northern Central WRZ
  - Blyth WRZ
  - Hartismere WRZ

What is Price Review 2024?

Ofwat is the economic regulator of the water industry and every five years it sets the investment and service package that customers receive including the price water companies charge their customers. Ofwat carry out a review of these price limits known as a Price Review (PR) every five years. The current Price Review will be completed in 2024 and so is known as PR24 and will set customer bills for the period 2025 to 2030.

As part of the Price review process, water companies submit a business plan which sets out the investment and outcomes for customers and the environment that they are required to deliver and how this would impact customer bills. The Business Plan will include the investment needed to deliver the WRMP24 Best Value Plan.

In this WRMP24 and supporting technical reports, we refer to our Suffolk supply area. However, our Northern Central WRZ extends into Norfolk where we have surface and groundwater sources within the Broads National Park and where we supply customers in Great Yarmouth and the surrounding villages.

We use our supply and demand forecasts to identify appropriate solutions to meet future pressures albeit with a focus on the statutory minimum 25 year planning period (2025 to 2050). The statutory minimum 25 year planning period aligns

to the long-term planning period that Ofwat uses when appraising water company business plans which WRMPs feed into.

Our current Water Resources Management Plan 2019 (WRMP19) is the starting point for our new draft WRMP24 (dWRMP24). For example, our supply and demand forecasts take account of investment in new water supply schemes and customer demand reduction programmes up to 31 March 2025.

We are required to produce a final plan with no supply deficits in any of our water resource zones over the final planning period. Consequently, where we have forecast a supply deficit, we have considered a twin track approach including:

- demand-side options which reduce the amount of water our customers require; and
- supply-side options to increase the amount of water available to us.

To determine our preferred programme, we have identified and appraised a range of options and justified the selection of the options included in our preferred Best Value Plan.

Our preferred Best Value Plan also covers our water resource zones (WRZ) where a 1 in 200 year drought supply surplus is forecast. This is because we need to provide 1 in 500 year drought resilience by 2039 and, in line with government expectations, we will still need to reduce leakage from our network (and support customers in reducing leaks from their water pipes and fittings) and support customers in reducing their water demand.

In producing our Best Value Plan, we have considered government policy as set out in the Water Resources Management Plan Direction 2022 and in a regulatory document called Government Expectations for Water Resources Planning (Defra, 2022) including the requirement to:

- Provide a secure and clean water supply as expected by customers in a way that provides value for customers, society and the environment over the long term.
- Improve supply resilience by planning to raise customer levels of service for a level 4 drought plan restrictions (standpipes and rota cuts) from 1 in 200 years to 1 in 500 years by 2040.
- Reduce household per capita consumption (PCC) to 110l/head/day by 2050 as well as working with retailers to implement actions to reduce business demand by 9% by 2037/38 (excluding growth).
- Reduce leakage by 50% from 2017/18 levels by 2050 with water companies helping customers reduce water demand and water lost through leaks by adopting consistent approaches to support repair and replacement of supply pipes.
- Install smart meters as a standard.
- Consider compulsory metering in regions assessed by the Environment Agency (EA) to be a serious water stressed area. The Essex and Suffolk Water (ESW) region is currently classified as a serious water stressed area.
- Adapt to climate change.
- Demonstrate a step change in rectifying overreliance on unsustainable water sources.

We have prepared baseline supply and demand forecasts which forecast what water resources we will have over the planning period as well as how customer demand will change without any additional water company interventions. The final plan adjusts our baseline forecasts to take account of the demand management and supply-side measures that

are included in our preferred Best Value Plan to reduce customer demand and to increase water resources. There are uncertainties associated with preparing both baseline and final plan supply and demand forecasts and therefore with our Best Value Plan. For example, there are uncertainties around:

- How water company and government measures to reduce customer demand, known as per capita consumption (PCC), will reduce over time.
- How quickly the climate will change and as it does, how this will affect rainfall patterns and totals, river flows, reservoir refill and groundwater recharge.
- How resilient the environment will be to climate change and whether water company abstraction licences will need to be reduced further in the future to ensure enough water is left in the environment so that it is able to be resilient to future climate change.

We have considered these uncertainties by undertaking stress testing of our final preferred plan (see Section 8.7).

Consequently, our Best Value Plan is an adaptive plan and includes:

- a central pathway and preferred programme representing the most likely future (based on the uncertainties); and
- alternative pathways and programmes should our forecasts (e.g., customer demand forecast) out-turn differently.

1.2. OUR PREVIOUS WATER RESOURCES MANAGEMENT PLAN

Our WRMP19 was published in 2019 and forecast a final plan supply surplus across the full planning period. As such, no supply schemes were required. However, it does include demand management options including reducing leakage by 17.5% by 31 March 2025 as well as a smart metering pilot and water efficiency programmes to reduce per capita consumption to 118 l/head/day by 2040. The Covid-19 pandemic and associated lockdown restrictions hindered the delivery of these programmes although we have worked hard to catchup and are forecasting to meet our 2025 targets.

Our baseline dWRMP24 supply and demand forecasts for our Essex, Blyth and Hartismere WRZs result in a supply deficit when planning to provide a 1 in 500-year level of resilience. This return period is the level of service for Level 4 restrictions on customer demand and specifically relate to the use of standpipes and rota cuts. The supply deficits are caused by:

- **New abstraction sustainability reductions:** These are applied where a Water Industry National Environment Programme (WINEP) environmental investigation has concluded that an abstraction is not sustainable (i.e., it could have an adverse impact on the environment). Consequently, the abstraction licence annual licensed quantity (i.e., the amount of water we can abstract from an abstraction point, such as a river intake, in a 12-month period) is reduced to a sustainable level as agreed with the EA. Our baseline WRMP24 supply and demand forecasts have taken account of the conclusions of our Asset Management Plan 7 (AMP7) WINEP abstraction sustainability investigations. In some cases, the annual licensed quantities on our groundwater abstraction licences have been reduced.

- **Climate change:** We have used the latest UK Climate Projections 2018 (UKCP18) which have had a more significant impact on summer river flows, and therefore Deployable Output (DO), than the previous UK Climate Projections 2009 (UKCP09) did.
- **Non-household demand:** Our latest non-household demand forecast includes new demand from meat processing (particularly in the Hartismere Water Resource Zone) as well as from hydrogen production and new nuclear power stations at Sizewell in Suffolk and Bradwell in Essex.
- **1 in 500 supply resilience:** We are required to plan for 1 in 500-year supply resilience from 2040.
- **New methods:** We have used new statistical methods for forecasting supply and demand, specifically the use of stochastics for supply forecasts.

1.3. REGULATORY FRAMEWORK

The PR24 water resources planning process is significantly different to that in previous PRs, with both national and regional tiers to consider.

1.3.1. National Framework

The EA published the Water Resources National Framework (WRNF) in March 2020 following publication of reports from WaterUK in 2016, and the National Infrastructure Commission in 2018.

The WRNF sets out the long-term needs of all sectors in England that depend on a secure supply of water. This includes public water supplies to homes and businesses, direct abstraction for agriculture, electricity generation and the water needs of the environment.

Figure 1: PR24 water resources planning framework

The WRNF identifies that with climate change and growth in customer demand, if no action is taken between 2025 and 2050, around 3,435 million extra litres of water per day will be needed for public water supply to address future pressures.

Traditionally, water company WRMPs have focussed primarily on the supply needs of public water supply within their supply areas. However, given long-term water resources pressures, particularly in the South and East of the country, the WRNF confirmed the need for consideration of regional and inter-regional solutions to support national water resources resilience. Consequently, the WRNF set out the EA's expectations for five regional water resources planning groups (see Figure 2) with respect to solving regional supply deficits and increasing abstraction sustainability.

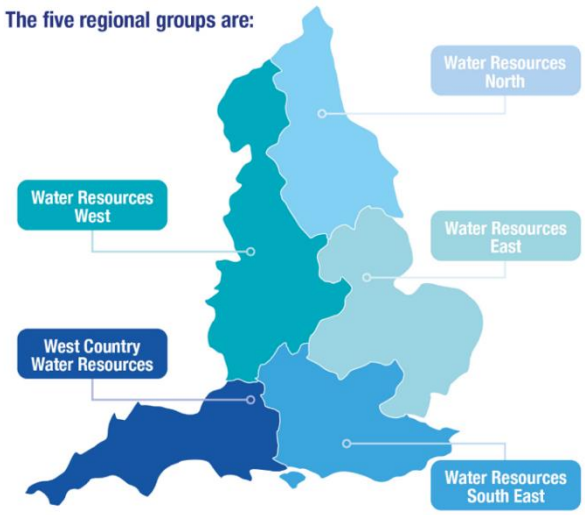


Figure 2: Regional groups

The WRNF defined expectations for regional water resources planning, and specifically defined a set of “must, should and could” requirements for the plans (see

Figure 3).

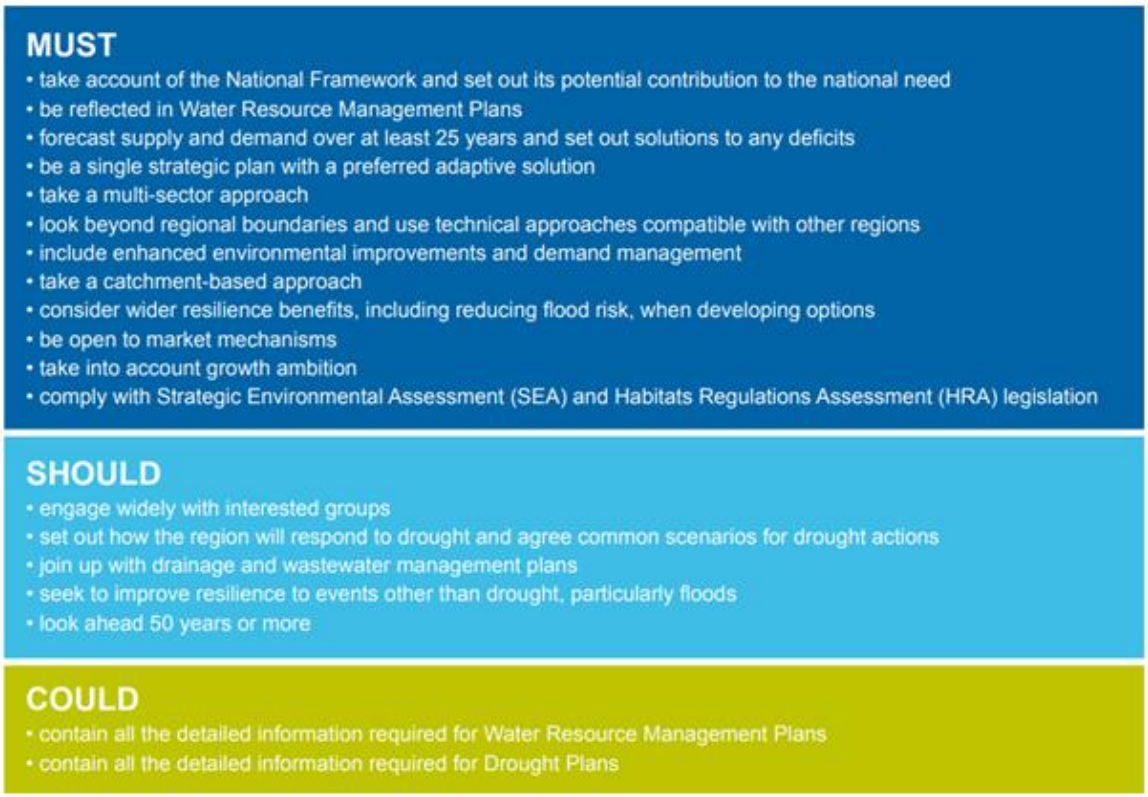


Figure 3: WRNF requirements of regional water resources groups

A key requirement for each regional group is to set out how they will contribute to the national need. For example, some regions are under serious water stress and have difficulty sourcing sufficient supplies within their own region to meet demand for water. Consequently, those regions with a surplus of water may be able to support those regions with a supply deficit through new inter regional transfers of water.

This requirement has presented opportunities for collaboration between regions and other water sectors to develop sustainable solutions, especially in the early stages, in advance of preparing water company WRMP24s.

The EA intends to update the WRNF in early 2023 following the current round of regional and water resources planning.

1.3.2. Regional Planning

Overview

Our operating and supply area is covered by Water Resources East (WRE) (www.wre.org.uk/) which has used the WRNF expectations summarised above to help shape its approach to regional planning and its draft regional plan.

WRE's core water company members include Essex & Suffolk Water, Anglian Water and Cambridge Water as well as environmental, energy and agricultural sector representatives.

The region, in Figure 4, comprises of Lincolnshire, Norfolk, Suffolk, and Essex as well as parts of Nottinghamshire and Cambridgeshire.

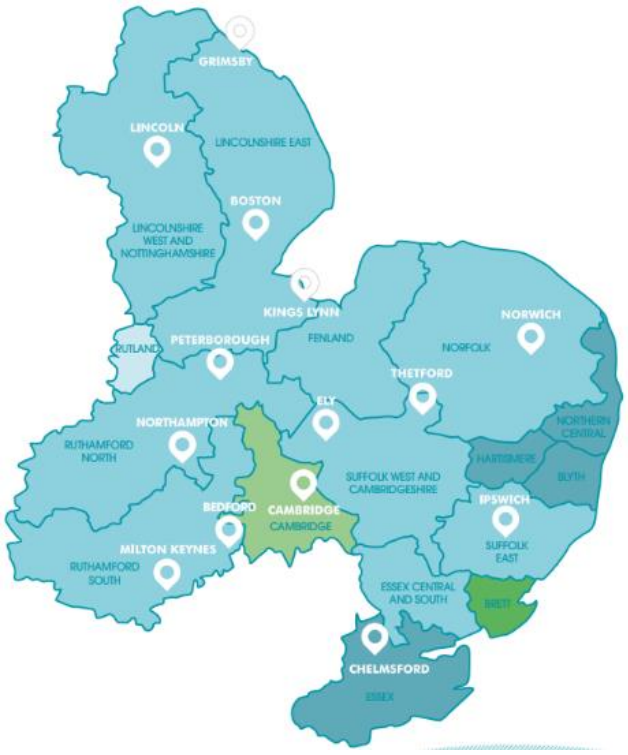


Figure 4: Water Resources East Area

WRE, along with all other regional groups, has developed and consulted on a regional plan which supports the Government's 25 year environment plan which has an objective to '…leave the environment in a better condition than we found it'. It has:

- undertaken a resource assessment informing the needs of the region including that from public water supply, other sectors (including energy and agriculture) and the environment; and
- prepared a preferred Best Value Plan with an agreed level of environmental ambition that identifies the best value strategic options to meet multi-sector water demands.

WRE's Regional Plan can be found at The Regional Water Resources Plan - Water Resources East (wre.org.uk). It sets out how WRE has explored water resource resilience at a national, regional and water company level and has considered water transfers within and between different regions including Water Resources Southeast (WRSE) and

Water Resources North (WReN). To ensure that regional groups have iteratively appraised solutions and to ensure their plans are aligned with each other as far as is feasible, national reconciliation workshops have been held through 2021 and 2022.

Importantly, WRE's regional plan informed the water companies' dWRMP24s although it has allowed them to refine smaller, local level solutions that are not strategically significant at a regional level.

Regional plans and strategic options have been developed in parallel with our dWRMP24 and the other water company WRMPs. We have ensured alignment through a series of regular sessions with all the water companies within the regional plan, through weekly meetings to discuss modelling between companies and at regional level.

An overview of how WRE's plan has informed our WRMP24 is presented below.

Baseline and Final Plan Supply Demand Balance

Baseline supply demand balance forecasts covering the planning period 2025 to 2100 have been prepared at a regional level for public water supply as well as for the energy and agricultural sectors. These compare the baseline supply and demand forecasts to determine when there is a supply deficit or a supply surplus at any point across the planning period.

For public water supply, the individual water companies have prepared their own baseline supply demand balance forecasts and have provided them to WRE for use in regional modelling. For consistency, the same baseline forecasts have therefore been used for both the regional and water company plans.

Per Capita Consumption (PCC)

The Government requires water companies to plan to reduce per capita consumption (PCC) to 122 l/head/day by 2038 and 110 l/head/day by 2050. Along with WRE, we have adopted this planning assumption and have developed demand management options to achieve these targets accordingly.

Leakage

Water companies within WRE plan to reduce leakage to different levels reflecting their local positions but have shared the demand savings achieved with WRE.

The national water industry target is to reduce leakage by 50% from 2017/18 levels by 2050. This is a target for the industry as a whole and not for individual water companies.

Our current leakage performance is near industry leading and so we do not believe that it is fair on our customers to reduce leakage by a further 50%. This is because we have already exhausted the cheaper leakage reduction options and so would need to replace significant parts of our distribution network. This would place a larger cost burden on our customers. We also do not believe that it is technically feasible for us to reduce leakage by 50% by 2050 in some parts of our supply area as leakage would need to be reduced to a level never achieved in the UK or Europe. We are therefore planning to reduce leakage by 40% by 2049/50.

Environmental Destination

The Government's 25 Year Environment Plan aims to improve the environment for the next generation with specific targets for sustainable abstraction. The WRNF builds on this, setting clear expectations for achieving and maintaining sustainable abstraction to 2050 and beyond. Some abstraction licences have annual licensed quantities which are already considered unsustainable and so will be reduced through the application of "sustainability reductions" either on renewal of time limited abstraction licences, or else by 2030. Other abstraction licence annual licensed quantities are considered unsustainable in the longer term (e.g., 2040 to 2050) and may need to have sustainability reductions applied then in order to leave more water in the environment to ensure it is resilient to the effects of future climate change. The sustainable level of abstraction in the longer term is known as Environmental Destination (ED).

The EA provided regional groups with an initial assessment of long-term abstraction sustainability under several scenarios including:

- Business As Usual
- Business As Usual Plus
- Enhanced
- Adapt

WRE has then undertaken further analysis and assessed what the sustainability reduction should be at a water company abstraction licence level. Along with other WRE water companies, we have then applied the Business-As-Usual Plus sustainability reductions to our baseline supply forecasts. We have also undertaken sensitivity analysis to see how the other scenarios impact our final Best Value Plan.

Intra and Inter-regional Water Transfer Options

Overview

We have a baseline supply deficit in both our Suffolk and Essex supply areas from 2025 and so we have not been considered as a donor water company. The same applies to our neighbours Anglian Water and Thames Water.

The opportunity for inter-regional transfers between Water Resources East and Water Resources South East and Water Resources East and Water Resources North has been assessed by the regional groups. However, it was agreed at national reconciliation workshops that these would not provide best value.

However, we have considered intra- and inter-regional transfers with both Thames Water and Anglian Water.

Thames Water

Following the enlargement of Abberton reservoir in our Essex WRZ, we agreed a 20 Ml/d export of raw water to Thames Water for the period 2015 to 2035. Given we are now forecasting a baseline headroom deficit in our Essex WRZ, we have worked with Thames Water to understand whether the agreement can be terminated early. Initially, Thames Water's preferred plan included a Water Reuse Scheme which would have been delivered by 2030 and would have allowed the agreement to be terminated in the same year. However, the Reuse scheme was later discounted following

regulator and stakeholder consultation. Thames Water's next preferred scheme is also a Reuse scheme, but it will not be delivered until 2035, the same year that our export agreement ends.

Since publishing our dWRMP24, we have reconfirmed with Thames Water its position on transfers. It has confirmed that it does not have any surplus water to trade with ESW and that it is not possible to terminate our existing 20 Ml/d raw water transfer agreement (export to Thames Water) with them until 2035 which is when the agreement ends in any case.

Based on our final WRMP24 supply and demand forecasts, once the Linford new WTW and borehole(s) are in supply in AMP8, it is possible that the 20 Ml/d raw water trade agreement could be extended. We have illustrated this in a scenario in Section 8.3.3.

Anglian Water

We have worked closely with Anglian Water and WRE regarding identifying and developing supply options and in appraising options for developing our respective Best Value Plans, as well as potential inter-company transfers and have undertaken sensitivity modelling at the regional level to aid decision-making. However, this has confirmed that due to planned sustainability reductions, like us, Anglian Water does not have surplus water to share, either currently, or once their planned new resources are in supply. However, we will continue to liaise with Anglian Water, particularly once the EA has completed its Norfolk Broads Habitats Regulation investigations and confirmed the size of the additional Sustainability Reductions that will be applied to our abstraction licences that supply Ormesby WTWs.

We have collectively considered the following options which would facilitate regional transfers of water:

- **North Essex to Central Suffolk Transfer:** We have carefully considered the potential for put and take options across our borders with Anglian Water, where one company transfers water into one part of the system and then takes same amount out in another location. However, there are several challenges that have led us to discount this option currently.
    - Primarily, we have discounted this option because both we and Anglian Water face considerable uncertainty with regards to the Habitats Regulations sustainability reductions that will restrict our abstractions within the Broads Special Area of Conservation (SAC), and elsewhere, which are not yet confirmed. This uncertainty makes it impossible to commit to new long-term water trade agreements. Therefore, we have discounted any new inter-company transfers in the planning horizon. However, as new resource options become available, we will reassess potential opportunities in the future, and continue to work closely with Anglian Water directly and through Water Resources East.
    - Secondary reasons for discounting the options were:
        - In relation to the challenges associated with the configuration of our respective neighbouring networks and the ability to balance an equitable trade between the two companies. For example, as the demand for water varies throughout the day and the year, due to behaviour and weather, the donor company must provide the necessary volumes while maintaining system pressures. The potential impact of these factors on the resilience of our Essex WRZ was deemed unacceptable.

  - The risk of water quality issues where water is imported into a less constrained zone. Fluctuations in supply and demand, as well as potential pressure differentials, would increase the risk of unsatisfactory water quality in the receiving zone.

- **Water Reuse Options:** We have considered various Reuse options. The Lowestoft Water Reuse scheme is included in our preferred plan and in the regional plan. It was not chosen in Anglian Water's preferred plan as it would need to be transferred to Norwich and other better value options have been chosen instead. We also considered a Colchester Reuse scheme although we agreed to discount it from our feasible options list primarily because the scheme provided better value for Anglian Water as well as potential environmental effects with regard to the discharge of water into our Abberton reservoir.
- **Desalination Options:** We have considered various desalination options along the Essex, Suffolk and Norfolk coast although none have been selected for inclusion in our Best Value Plan. However, a desalination scheme on Canvey Island in Essex is selected in the Best for Environment and Society Plan which assumes significant sustainability reductions are applied to our Essex water resource zone abstraction licences. The actual size of the reductions will be confirmed via AMP8 WINEP Environmental destination Investigations.
- **Fens Reservoir:** Anglian Water and Cambridge Water are developing a new reservoir on the Fens known as the Fens Reservoir. We considered an option with Anglian Water and WRE whereby the reservoir could enable treated water transfers from near to the new reservoir to be transferred via new strategic pipeline to Norwich and then across to our Northern Central WRZ. However, the option has been discounted because the full DO of the Fens Reservoir is included in Anglian Water and Cambridge Water's preferred plans. The DO of the Fens Reservoir will be utilised by Anglian Water via onward transfers to satisfy deficits in Suffolk and Norfolk. Similarly, Cambridge Water will utilise their share of the resource to meet their own needs, without surplus.
  Even though the scheme has been discounted, the North Suffolk Reservoir, which is included in our preferred plan, provides better value being local to demand with lower pumping and carbon costs.

  WRE's Best Value Plan, which incorporates all our Best Value options, is illustrated in Figure 5.

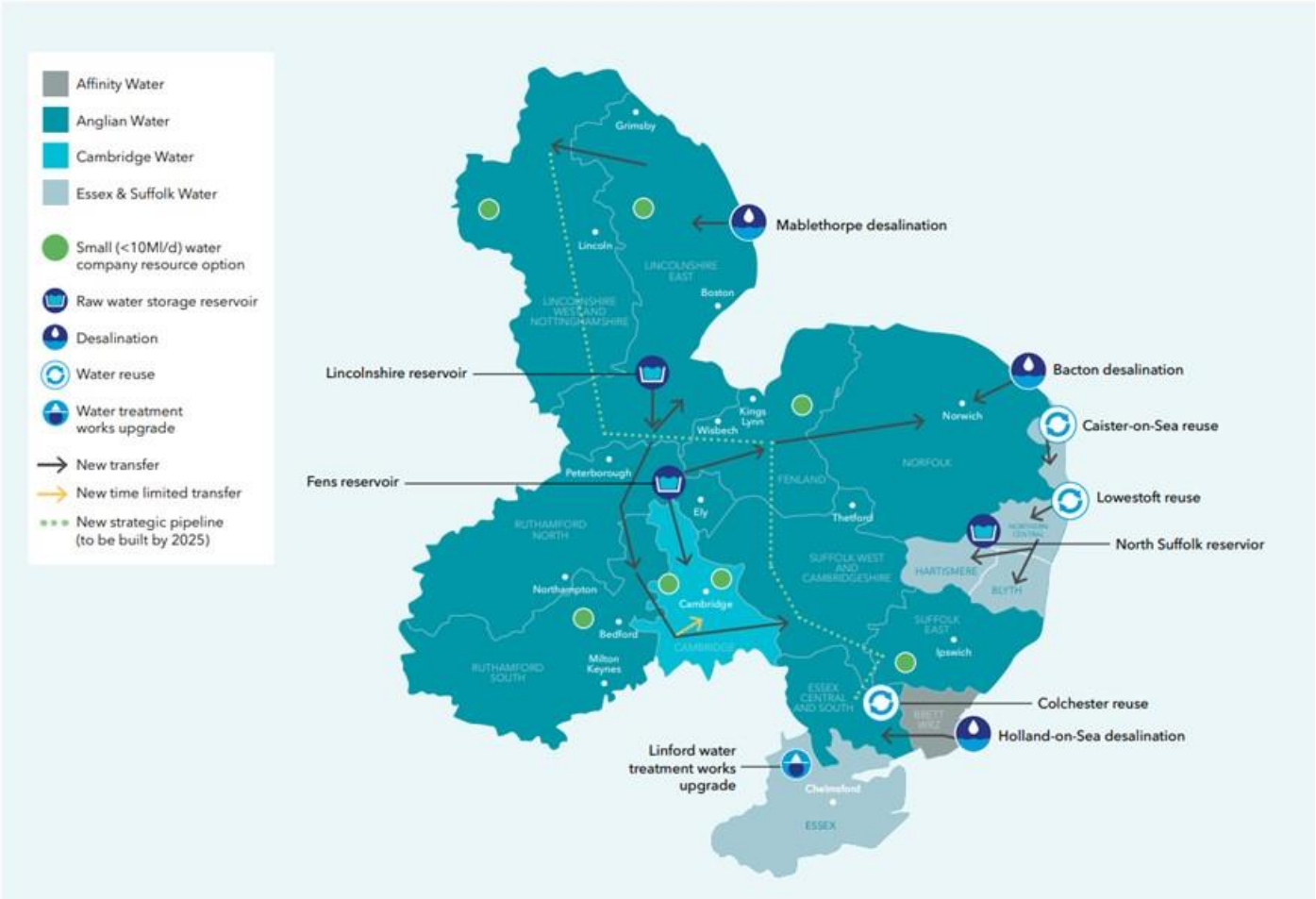


Figure 5: WRE's Best Value Plan

1.3.3. Local Planning

In compiling this dWRMP24, we have actively engaged with customers and stakeholders at a local / catchment level and specifically with a wide range of stakeholders through pre-consultation webinars held in January 2022. We engaged with 49 individuals representing a wide range of organisations, including:

- Regulators – Environment Agency (EA) and Natural England
- Councils – Essex, Chelmsford, Braintree, Maldon, East Suffolk, and Great Yarmouth
- Environmental stakeholders - Essex Wildlife Trust, Suffolk Wildlife Trust, Essex and Suffolk Rivers Trust
- Landowner groups – National Farmers Union (NFU) and Country Land and Business Association (CLA)
- Other Water Companies – Anglian Water Services, South Staffs Water, and Albion
- New Anglian Local Enterprise Partnership (LEP)
- Wholesale Water retailers – Wave Utilities and Independent Water Networks (IWNL)
- Infrastructure – Associated British Ports

A significant amount of engagement regarding supply, demand and environmental ambition has been undertaken at a regional level through Water Resources East and its Stakeholder Steering Group. Representatives include those from Energy UK, Natural Farmers Union, Catchment Groups, Broads Authority, the EA and Water Companies.

At a water company level, we have agreed with the EA planning assumptions with regards to abstraction sustainability and the future need for further long-term abstraction sustainability reductions.

We have engaged with local planning authorities to:

- inform our household property and population forecasts and household demand forecasts; and
- understand future non-household growth to inform our non-household demand forecast.

We have engaged directly with non-household retailers, businesses and specifically with large users to inform our non-household demand forecast.

We have now developed our AMP8 WINEP including new integrated catchment schemes that will support the delivery of outcomes both for the Government's 25 Year Environment Plan and also Local Nature Recovery Strategies.

1.4. CONSULTATION

We recognise the importance of engaging with both stakeholders and customers throughout the process.

In compiling our WRMP24, we have actively engaged with customers through online surveys with current bill payers, a panel survey with future customers and non-household customers and face-to-face surveys to reach audiences that are digitally disengaged or people who haven't been sufficiently engaged through the online survey.

We have also engaged with stakeholders at a local / catchment level through pre-consultation webinars held in January 2022. We engaged with 49 individuals representing a wide range of organisations, including regulators, councils, environmental stakeholders, landowner management groups, other water companies and retailers.

A significant amount of engagement regarding supply, demand and environmental ambition has been undertaken at a regional level through Water Resources East and its Stakeholder Steering Group. Representatives include those from Energy UK, Natural Farmers Union, Catchment Groups, Broads Authority, the EA and Water Companies.

WRE undertook deliberative research across various groups comprising a mix of existing household customers, future customers and citizens, as well as a range of non-household customers. The non-household sessions were held with a mixture of water dependent businesses (e.g., farmers) and non-water dependent businesses. Whilst this type of approach typically engages a lower number of customers than quantitative survey approaches, it benefits from a much greater dialogue and opportunity for those involved to really understand the nuances of water resources management. This allows for more informed feedback on customer priorities for future plans, especially where topics are relatively complex or multi-faceted.

The key focus areas for the research were:

- Objectives and metrics for developing a Best Value Plan
- Environmental destination
- Water trading
- Opinions on option types

At a water company level, we have agreed with the EA planning assumptions with regards to abstraction sustainability and the future need for further long-term abstraction sustainability reductions.

We have engaged and will continue to engage with local planning authorities to:

- inform our household property and population forecasts and household demand forecasts; and
- understand future non-household growth to inform our non-household demand forecast.

Continuous engagement with local authorities is vital to ensure our plans are aligned and therefore we will encourage ongoing conversations with our local authorities.

We have engaged directly with non-household retailers, businesses and specifically with large users to inform our non-household demand forecast.

We have now developed our AMP8 WINEP including new integrated catchment schemes that will support the delivery of outcomes both for the Government's 25 Year Environment Plan and also Local Nature Recovery Strategies.

In addition to our regular liaison meetings with the EA, we have also held formal pre-consultation meetings with the EA and Ofwat in January and July 2022 respectively.

We consulted on our dWRMP24 between 21 December 2022 and 29 March 2023 and have taken account of the consultation responses in the development of our WRMP24. Our consultation Statement of Response confirms the consideration we have given to each response and if a change to our WRMP24 has been made, the reason for doing so.

As we further develop and implement each of the schemes in our preferred final plan, we will seek opportunities to work collaboratively across the system to improve water, nature and the environment.

1.5. ASSURANCE

Our WRMP24 has been audited by Jacobs consultants to confirm that:

- we have met obligations in developing our plan;
- our plan reflects Water Resources East regional plan;
- we have developed a best value plan for managing and developing our water resources so we can continue to meet our obligations to supply water and protect the environment; and
- we have developed a plan that is based on sound and robust evidence including relating to costs.

Our Board Assurance Statement is presented on page 3 of this document and provides further detail on how the Board has engaged, overseen and scrutinised all stages of development of our plan and the evidence it has considered in giving its assurance statement.

In summary, we have involved our Board in the development of our WRMP and have kept them appraised of our baseline supply and demand forecasts, assumptions regarding Environmental Destination, our baseline supply demand balance, the development of our preferred demand management options and how we have considered utilising our surplus resource for intra and inter-regional exports of water.

1.6. LINKS WITH OTHER PLANS

In preparing our WRMP24, we have considered a number of other plans as summarised in Table 2 to Table 4.

1.6.1. Government's 25 Year Environment Plan

Table 2 summarises how we have considered the Government's 25 Year Environment Plan.

Table 2: 25 Year Environment Plan considerations

REQUIREMENT	CONSIDERATION IN OUR WRMP24	WRMP24 SECTION
Set out your destination for environmental sustainability and resilience	Our WRMP24 supply forecasts are based on an agreed position for abstraction licence sustainability reductions under both WINEP and Environmental Destination.	3.3 and 3.4
Support Nature Recovery	Our Best Value Plan contains demand management options to meet ambitious targets for leakage reduction and customer demand (per capita consumption or PCC). These options will reduce the amount of water we need to abstract from the environment in order to meet customer demand. We are developing our PR24 Water Industry National Environment Programme which will bring environmental benefits supporting nature recovery. As well as including statutory schemes, it is likely to include non-statutory schemes under the 25 Year Environment Plan driver.	8.3.1 9.4
Use natural capital in decision making	We have used a multi-criteria assessment approach that uses natural capital in decision making	9.2.4
Use a catchment approach	We are taking a catchment approach to developing our WINEP. We have held catchment workshops in the first instance with the EA and Natural England and then with wider stakeholders. We are developing catchment schemes under the 25 Year Environment Plan Driver that if supported by our customers and regulators, will deliver multiple environmental benefits through collaborative working. We will continue with our catchment based drinking water catchment management work which is not business as usual as well as putting forward a new capital grant scheme to support land managers in improving water quality, flow and the wider environmental.	9.4
Deliver net gain for the environment	Over and above 10% Biodiversity Net Gain requirements, net gain for the environment is an important consideration in our best value planning process. Additionally, subject to customer support and regulatory approval, we expect WINEP schemes with a natural environment and rural communities (NERC) driver and a 25 Year Environment Plan driver to deliver gain for the environment.	9.2.5

1.6.2. Water Company Business Plans

Business plans set out the investment plans for the next asset management plan and are the mechanism to achieve the planned outcomes set in our WRMP24 as well as delivering wider water system resilience.

Table 3 summarises how we have considered Ofwat's guidance 'PR24 and Beyond: Final Guidance on Long-term delivery strategies'.

Table 3: Business Plan guidance considerations

REQUIREMENT	CONSIDERATION IN OUR WRMP24	WRMP24 SECTION
Clear links between WRMPs and business plans	Our WRMP24 sets out our preferred demand management and supply options and programme that we intend to deliver to achieve leakage and PCC targets and to maintain a supply surplus in each of our WRZs. These schemes have been costed and will be transferred to our draft Business Plan along with a robust business case.	8
Use of long-term adaptive planning	We have considered long term adaptive planning (i.e., with review and change points to an alternative pathway taking place through Business Planning process). We are putting forward three adaptive programmes with review and change points within AMP8.	8.6
Planning for common reference scenarios	We have undertaken sensitivity analysis using the Ofwat common reference scenarios. As summarised above, a supply surplus is maintained in all cases.	8.3 and 8.7
Linking new plans to delivery of previous ones	Our previous WRMP19 forecast a supply surplus in all four of our water resource zones across the full planning period and so our final plan included demand management options only. Our WRMP24 baseline supply demand balance forecasts show we will have a supply deficit in our Suffolk WRZ and a headroom supply deficit in our Essex WRZ. Our WRMP24 baseline demand forecasts assume we will have met our WRMP19 targets for leakage and PCC by 31 March 2025.	1.2 and 2
Using robust and consistent cost estimates	We have used a consistent process for costing our demand management options (no supply options required). The costs of the WRMP24 demand management options will be the same as those used for our Business Plan.	8.2

1.6.3. Drought Plans

This WRMP24 is complemented by our Drought Plan (www.nwg.co.uk/droughtplan) which sets out the short-term operational steps we will take if our region faces a drought in the next 5 years. It describes how we would enhance available supplies, manage customer demand, and minimise environmental impacts as the drought progresses.

Whilst our planned demand and supply side investment has resolved our forecasted baseline supply deficits in both our Essex and Suffolk WRZs, we are changing our planned levels of service for Drought Plan drought actions Level 1 Appeal for Restraint and Level 2 Temporary Use Plan, in our Suffolk region. Our proposed planned levels of service are detailed in Section 2.5.

It is appropriate we minimise abstraction in dry years because of our moratorium on new non-domestic supplies in Hartismere and the requirement to delay the imposition of some of our sustainability reductions until new supply

schemes are operational. Changing our planned levels of service does not result in increase in DO but does result in a reduction in demand. Once we have published our final WRMP we will review the triggers in our Drought plan to reflect this change.

1.6.4. River Basin Management Plans

The EA's River Basin Management Plans (RBMPs) include environmental objectives (classifications) for each water body. Table 4 summarises how our WRMP24 supports meeting river basin management plan objectives.

Table 4: River Basin Management Plan considerations

REQUIREMENT	CONSIDERATION IN OUR WRMP24	WRMP24 SECTION
Prevent deterioration and support achievement of protected area and water body status objectives	Our AMP7 WINEP investigations have indicated where our abstractions are at risk of causing deterioration or not allowing waterbodies to meet their Water Framework Directive (WFD) objectives. This means many of our groundwater abstraction licences will have the annual licensed quantity reduced to a recent actual level of abstraction from 2030. Additionally, a number of our Essex river abstraction licences will have new Hands Off Flow conditions. These new abstraction licence conditions have been allowed for in our baseline DO assessment. In Suffolk, AMP7 WINEP abstraction licence sustainability reductions in 2030 will remove most of our supply headroom. Consequently, to maintain abstraction at or below current sustainable levels of abstraction, we have a moratorium on accepting applications for new supplies in our Hartismere Water Resource Zone where the water will be used for non-domestic purposes. This will be in place until new WRMP24 supply schemes are in supply. Consequently, we have concluded that our preferred plan will not result in a deterioration of the environment (or in the RBMP water body classification).	3.2.5, 3.2.8 and 3.3
Have a secure and sustainable set of options to supply your customers	We have taken account of all known abstraction licence sustainability reductions in our baseline supply forecasts. Our WRMP24 confirms that both demand management options and supply options are required to maintain a supply surplus. All options have been assessed as part of our overall Integrated Environmental Assessment.	7, 8.3 and 9
Are contributing to sustainable catchments by ensuring supplies are managed well in a drought	Our Best Value Plan sets out the demand management and supply options that will be needed to provide 1 in 500 year resilience by 2040 and that will reduce the frequency in which Level 3 drought action (drought permits) will be required. Our Drought Plan (www.nwg.co.uk/droughtplan) has recently been approved by Defra. It sets out the demand management options that we will take to minimise demand. It also sets out the supply side options we will take in order to maintain target river flows and increase available supplies.	8.3
Are demonstrating how you will help your customers to use water wisely	Our WRMP24 sets out how we will support our customers to reduce their water use.	7.3.3 and 8.3.1

REQUIREMENT	CONSIDERATION IN OUR WRMP24	WRMP24 SECTION
You should identify integrated catchment-based solutions in your plan. These should deliver multiple benefits, for example reducing flood risk and improving resilience of the environment to droughts.	As part of our agreed AMP8 WINEP we have an ambitious programme of river enhancement and restoration schemes planned, which will complement our planned abstraction reductions. We also have investigations planned to explore opportunities to take a more holistic approach to water management in key catchments. Our catchment team will continue to work with the farming community in all our catchment areas during AMP8 to deliver improvements to water management on farm and to improve the water quality reaching our rivers. Within our AMP8 WINEP we have included a scheme to work across our area to contribute to delivering the Strategic Plans for water resources and nature conservation through participation in partnership projects. This is in addition to our existing Branch Out grant scheme which funds delivery of a wide range of environmental improvement schemes via grants to third parties.	9.4

1.6.5. Drainage And Wastewater Management Plans

Essex & Suffolk Water is a Water Only Company with Anglian Water providing wastewater services to our water supply customers. Anglian Water's first draft drainage and wastewater management plan was submitted to Defra earlier this year. We have ensured our long-term planning for water supply and wastewater is aligned by aligning our methodologies for growth and climate change assumptions.

1.6.6. Drinking Water Safety Plans (Or Risk Assessments)

Drinking Water Safety Plans and the risk assessments which inform them provide a means of identifying hazards and hazardous events that could arise in the catchment area, from the source up to the customer's tap. We have drinking water safety plans for all our existing supplies of water from source to tap. However, we are forecasting a supply deficit in both our Essex and Suffolk supply areas with new supply schemes included in our preferred plan. We have undertaken a drinking water safety plan risk assessment for these options which is summarised in 1.6.6.

1.6.7. Local Authority Plans

Local authority plans set out future development, such as housing. Our WRMP24 reflects local growth ambitions and plans to meet the additional needs of new businesses and households (Section 4.3)

1.6.8. Local Nature Recovery Strategies (England)

The Environment Act 2021 introduced Local Nature Recovery Strategies for areas in England. Section 9.4.3 of our WRMP24 sets out how our PR24 WINEP will support recovery and enhancement of biodiversity.

2. DEVELOPING OUR PLAN

2.1. OVERVIEW

This section of our Water Resources Management Plan 2024 (WRMP24) covers the process we have followed in preparing our WRMP24 preferred plan.

2.2. DEFINING OUR WATER RESOURCE ZONES

We have geographically separate supply areas, known as the Essex supply area and Suffolk supply area. Water is supplied to approximately 1.76 million customers in the Essex supply area and 0.28 million customers in the Suffolk supply area.

In line with the Water Resources Planning Guidelines (WRPG), our WRMP24 is based on assessments undertaken at a water resource zone (WRZ) level. The definition of a WRZ (from Water Resources Planning Tools (WR27), UKWIR, 2012a) is:

The largest possible zone in which all resources, including external transfers, can be shared and hence the zone in which all customers will experience the same risk of supply failure from a resource shortfall.

We have four WRZs, one in Essex (the Essex WRZ) and three in Suffolk known as the Blyth, Hartismere, and Northern Central WRZs. Schematic diagrams of the WRZs and associated infrastructure are shown in Figure 6 and Figure 7 respectively.

None of our WRZs have changed since we published our Water Resources Management Plan 2019 (WRMP19). The resource zones used for water resources planning purposes are described below.

2.2.1. Suffolk WRZs

The Blyth WRZ is bounded by the Suffolk coastline in the east stretching from Aldeburgh in the south to Walberswick in the north. The WRZ stretches as far west as Earl Soham, and as far north as Chediston, and includes the towns and villages of Saxmundham, Leiston, Framlingham, Peasenhall and the southern side of Halesworth. The Blyth WRZ is predominantly rural in nature.

All the water supplied within the Blyth WRZ is sourced from groundwater via Chalk and Crag boreholes.

The Hartismere WRZ is bounded to the north by the River Waveney, from its source at Redgrave in the west, to Mendham in the east. The zone stretches as far west as Rickinghall and Wyverstone Street, and as far south as Mendlesham Green and Aspall. The WRZ includes the town of Eye, situated on the River Dove, a major tributary of the River Waveney. The Hartismere WRZ is also predominantly rural in nature and the landscape is characterised by arable farming.

All the water supplied within the Hartismere WRZ is sourced from groundwater abstracted from Chalk and Crag boreholes. It should be noted that Syleham Treatment Works is located within the Hartismere WRZ although receives a raw water import from boreholes located in the Northern Central WRZ.

The Hartismere WRZ was particularly affected by the 1995 -1997 drought. As a result, we made a large number of improvements in the zone, including the commissioning of new groundwater sources near Bedingfield and Syleham, and network improvements to enable water to be more easily transferred around the WRZ.

The Northern Central WRZ is bounded by the River Waveney and River Bure to the west, and the Suffolk coastline from Southwold to Winterton-on-Sea in the east. The WRZ includes the towns of Lowestoft, Great Yarmouth, north Halesworth, Bungay and Beccles. Demand in the WRZ is heavily influenced by the large population centres of Lowestoft and Great Yarmouth.

Approximately 70% of the water supplied in the Northern Central WRZ is sourced from surface water, and 30% sourced from groundwater in the south of the WRZ.

Surface water is provided via four sources, namely the River Waveney near Beccles, the River Bure near Wroxham, and groundwater fed lakes called Ormesby Broad, and the Lound Ponds and Fritton Lake. Water from the River Waveney is treated at Barsham River treatment works, water from the River Bure and Ormesby Broad is treated at Ormesby water treatment works (WTW) and water from Lound Ponds and Fritton Lake is treated at Lound treatment works.

A smaller component of raw water from groundwater can be sourced from remote Chalk groundwater sources near Wroxham in the north of the WRZ, which is treated at Ormesby WTW. Larger quantities of groundwater produced in the south of the WRZ are sourced from Chalk groundwater sources near Halesworth, Holton and Beccles and Crag and Gravel wells near Southwold and Broome respectively.

The Northern Central WRZ is named to reflect the fact that historically it effectively operated as two ‘sub-zones’ called the Northern WRZ and the Central WRZ, although it is no longer appropriate to consider these as separate resource zones. The Northern ‘sub-zone’ contains Ormesby treatment works and Lound WTW, whilst the Central ‘sub-zone’ contains Barsham treatment works and all the groundwater sources, except those near Wroxham.

2.2.2. Essex WRZ

The Essex WRZ is bounded by the Thames Estuary in the south and the Essex coastline up to Salcott in the east. The WRZ stretches as far north as Silver End and as far west as the London Boroughs of Redbridge, Barking and Havering. The WRZ includes the towns of Southend-on-Sea, Chelmsford, Witham, Brentwood, Billericay, Basildon, Grays, Dagenham, and Romford.

The intrinsic water resources include the rivers Chelmer, Blackwater, Stour and Roman River, which support pumped storage reservoirs at Hanningfield and Abberton, and treatment works near Langford, Langham, Hanningfield and Layer. The remaining water sourced from inside the Essex WRZ (approximately 2% of total water supplied in the zone) is

derived from groundwater via Chalk well and adit sources in the south and southwest of the zone near Stifford and Roding.

Water transferred into the Essex supply area comes from two sources, namely the Chigwell raw water bulk supply from Thames Water Utilities (TWU) Lea Valley Reservoirs and the Ely Ouse to Essex Transfer Scheme (EOETS).

Of the potable water supplied in the Essex WRZ, approximately 20% is provided via the Chigwell raw water bulk supply. The raw water is pumped directly to our treatment works for treatment and then into distribution.

In a dry year, flows in the River Stour and River Blackwater can be supported by the EOETS which is owned and operated by the Environment Agency (EA). Raw water is transferred via pipelines and pumping stations, from Denver in Norfolk to the headwaters of the River Stour and River Blackwater.

Additionally, in dry periods the EA may operate its groundwater river support schemes, particularly when transfers via Denver are limited or not possible. The two schemes with potential to support river flows in Essex are the Stour Augmentation Groundwater Scheme (SAGS) and the Great Ouse Groundwater Scheme (GOGS).

The Essex rivers and their associated intakes, the pumped storage reservoirs near Abberton and Hanningfield, and associated raw water transfer pipes, pumping stations and treatment works are collectively known as the ‘Essex System’. This reflects the nature of the supply network in Essex, which is a highly integrated one, with a large degree of flexibility for moving raw and potable water around the zone to where it is required.

The preferred mode of operation of the Essex treatment works during the summer is for Langham, Langford, Layer and Chigwell treatment works to provide a reasonably constant baseload, with output from Hanningfield treatment works varying to meet the remaining demand.

At the end of 2003 we completed works to construct an innovative effluent recycling scheme near Langford. The Scheme intercepts effluent from Chelmsford Sewage Treatment Works and treats it to a very high standard at a purpose-built treatment plant near Langford. Once treated, the water is discharged into the River Chelmer 3km upstream of our abstraction intake where it augments the natural flow. It is then available for re-abstraction via existing intakes supporting both Langford treatment works and storage into Hanningfield Reservoir. The Scheme can provide up to an additional 20 Ml/d of water during May to November for use within the Essex System during dry periods.

2.3. PROBLEM CHARACTERISATION

2.3.1. Overview

The problem characterisation assessment is a tool for assessing a company’s vulnerability to various strategic issues, risks, and uncertainties. The results of this assessment are used to determine the economic and best value modelling approaches a company should adopt to review its Water Resources Management Plan (WRMP).

Figure 6: Map of Suffolk WRZs

Figure 7: Map of The Essex WRZ

The purpose of undertaking a problem characterisation exercise is to help guide planners to the most appropriate decision-making tools given the planning problem that they face (UKWIR, 2016).

The problem characterisation assessment scores individual water resource zones against both the size of the strategic need and the level of complexity associated with solving the need. The strategic need is defined as the supply-demand balance deficit that is required to be solved in each water resource zone.

Complexity factors assess how easy it is to solve the deficit (i.e., based on the type of options available to a company, and the likely size of these). These scores are combined to show the level of vulnerability faced and the resulting complexity of the decision-making approach ("modelling complexity") that is therefore justified, as shown in Table 5.

Table 5: Summary of vulnerability level and recommended approach

LEVEL OF CONCERN	RECOMMENDED MODELLING APPROACH
Low level of concern	Current approaches (Economics of Balancing Supply and Demand or EBSD) should be adequate, and specific complexities can be examined through the steps recommended in the parallel UK Water Industry Research (UKWIR) *Risk Based Planning Methods* project (to assist in the derivation of deployable output (DO), incorporation of uncertainty etc).
Moderate level of concern	Extended approaches to modelling may add considerably to a company's understanding. 'Extended' refers to methods not previously widely used in WRMPs, but which have been tested to at least the 'proof of concept' stage for actual UK water resource systems and have outputs that can be readily understood by planners. For example, for Aggregate approaches, this may mean the use of Real Options Analysis, whilst for System Simulated approaches this may mean the use of non-scheduled methods or methods that examine limited portfolios without optimisation.
High level of concern	More than one of the 'Extended' approaches to decision making could be applied, or even the use of the 'Complex' approaches, as these could add considerably to the company's understanding. Here, 'Complex' approaches refer to more advanced, conceptually complex methods not yet applied to the UK water resources context, although these may be under current investigation in academia.

The company should ensure that an appropriate modelling and decision-making approach is used to reflect the level of concern identified.

Our approach to Problem Characterisation can be found in Section 4 of our ESW PR24 Problem Characterisation Report.

2.3.2. Problem Characterisation Results

The problem characterisation results for each water resource zone are summarised in Table 6 to Table 9.

Table 6: Essex Water Resource Zone problem characterisation results

		STRATEGIC NEED SCORE ("HOW BIG IS THE PROBLEM")			
		0 (None)	2 (SMALL)	4 (MEDIUM)	6 (LARGE)
Complexity Factors Score **("How difficult is the problem to solve?")**	Low (<7)			X	
	Medium (7-11)				
	High (11 +)				

Table 7: Blyth Water Resource Zone problem characterisation results

		STRATEGIC NEED SCORE ("HOW BIG IS THE PROBLEM")			
		0 (None)	2 (SMALL)	4 (MEDIUM)	6 (LARGE)
Complexity Factors Score **("How difficult is the problem to solve?")**	Low (<7)			X	
	Medium (7-11)				
	High (11 +)				

Table 8: Hartismere Water Resource Zone problem characterisation results

		STRATEGIC NEED SCORE ("HOW BIG IS THE PROBLEM")			
		0 (None)	2 (Small)	4 (MEDIUM)	6 (LARGE)
Complexity Factors Score **("How difficult is the problem to solve?")**	Low (<7)				
	Medium (7-11)				X
	High (11 +)				

Table 9: Northern Central Water Resource Zone problem characterisation results

		STRATEGIC NEED SCORE ("HOW BIG IS THE PROBLEM")			
		0 (None)	2 (SMALL)	4 (MEDIUM)	6 (LARGE)
Complexity Factors Score **("How difficult is the problem to solve?")**	Low (<7)			X	
	Medium (7-11)				
	High (11 +)				

2.3.3. Implications For Best Value Planning

Our assessment has shown that there is a relatively large deficit problem to solve. However, the issues associated with this are of low to medium complexity and so well understood. These include:

- Impact of climate change
- Sustainability Reductions
- Environmental Destination
- Impact of Covid on household and non-household demand forecasts

This confirms that 'Current' approaches (EBSD) should be adequate, and specific complexities can be examined through the steps recommended in the parallel UKWIR Risk Based Planning Methods project (to assist in the derivation of DO, incorporation of uncertainty etc.).

2.4. DROUGHT VULNERABILITY ASSESSMENT

We carried out a partial assessment which uses the principles of the UKWIR 'Drought Vulnerability Framework' (17/WR/02/12), for our 2022 Drought Plan.

The Drought Vulnerability Framework assessed the resilience of the Essex System to droughts of a range of durations (6, 12, 18, 24 and 36 months) and return periods (100, 200, 500 and 1000 years). The assessment looked at droughts ending in October and December. The demand used to drive the model was based on the 2018/19 actual distribution input (DI), which was the latest designated Dry Year for the Essex and Suffolk Water (ESW) system. The DI of the Essex System (Hanningfield, Langford, Langham, and Layer) was 319.69 Ml/d, and the DI of the total Essex WRZ was 395.39 Ml/d. An explicit allowance for outage was not deemed necessary since actual outage is incorporated in these numbers. The target headroom allowance is 33.48 Ml/d. The DI of the Essex System was 81% of the total WRZ, therefore a figure of 27.07 Ml/d was used for target headroom.

This made DI + Target Headroom = 346.76 Ml/d for the Essex System, which was the demand placed on the Aquator model demand centre for all runs.

The number of days of failure of the system were recorded for each drought, with failure occurring either when the demand could not be met, or the emergency storage level of a reservoir was reached. The ESW system was resilient to all but the December-ending 1000yr 24-month duration drought.

In 2022, the UK experienced the warmest year on record, with extreme heatwaves in the summer months that included temperatures in excess of 40˚C being recorded for the first time in the UK. It was the also the driest January-August period since 1976 and drought conditions were declared across parts of England and Wales including East Anglia.

We have set out the lessons we have identified as a result of our experiences during the prolonged dry weather / drought event in 2022 in our ESW Lessons Learnt from 2022 Drought Report, and how this has impacted our WRMP24.

2.5. PLANNED LEVELS OF SERVICE / RESILIENCE

During long or very intense droughts we may need to place some restrictions on customer water use to ensure we are always able to maintain reliable supplies should the dry weather turn into an extreme drought. Without these levels of service, we would need to develop new or larger water supply schemes than otherwise would be the case.

Restrictions on Water Use are categorised into four levels as summarised in Table 10.

Table 10: Restrictions on water use

RESTRICTION LEVEL	RESTRICTION DESCRIPTION
Level 1: Appeal for restraint	Ask customers to use water wisely. For example, watering plants at night and not watering the lawn because grass is resilient to drought.
Level 2: Temporary Use Ban	Applies mainly to the domestic use of water and stops the use of a hosepipe or sprinkler for any garden watering or cleaning.
Level 3: Drought Order Ban	Bans what has been applicable to the domestic customer under the Temporary Use Ban to non-domestic or commercial customers. These bans have economic consequences for businesses and must be used as sparingly as possible.
Level 4: Reduced supply at customer tap	A temporary reduction or nil supply of water at the customer tap. For example, reduced pressure at the customer tap (and therefore reduced flow), Rota cuts (e.g., 12 hours normal supply, 12 hours no supply); or Standpipes where supplies to customer's taps are turned off leaving customers to fill containers from an in pavement standpipe tap.

Planned levels of service set out the most likely frequency of restrictions on customer water use during a drought. Our current and proposed WRMP24 planned levels of service for our customers in our Essex area are summarised in Table 11, and for our Suffolk customers in Table 12.

Table 11: Planned levels of service - Essex

ESSEX SUPPLY AREA DROUGHT ACTION LEVEL OF SERVICE	WRMP19		WRMP24	
	FREQUENCY OF RESTRICTION	ANNUAL CHANCE OF RESTRICTION	FREQUENCY OF RESTRICTION	ANNUAL CHANCE OF RESTRICTION
Level 1: Appeal for restraint	1 in 10 years	10% probability in any one year	1 in 10 years	10% probability in any one year
Level 2: Phase 1 Temporary Use Ban	1 in 20 years	5% probability in any one year	1 in 20 years	5% probability in any one year
Level 3: Phase 2 Drought Order Ban	1 in 50 years	2% probability in any one year	1 in 50 years	2% probability in any one year
Level 4: Reduced supply at customer tap	1 in 200 years	0.5% probability in any one year	**2025/26 to 2030/31:** 1 in 200 years **2031/32 onwards:** 1 in 500 years	**2025/26 to 2030/31:** 0.5% probability in any one year **2031/32 onwards:** 0.2% probability in any one year

Table 12: Planned levels of service - Suffolk

SUFFOLK SUPPLY AREA DROUGHT ACTION LEVEL OF SERVICE	CURRENT (WRMP19)		PROPOSED (WRMP24)	
	FREQUENCY OF RESTRICTION	ANNUAL CHANCE OF RESTRICTION	FREQUENCY OF RESTRICTION	ANNUAL CHANCE OF RESTRICTION
Level 1: Appeal for restraint	1 in 10 years	10% probability in any one year	1 in 5 years	20% probability in any one year
Level 2: Temporary Use Ban	1 in 20 years	5% probability in any one year	1 in 10 years	10% probability in any one year
Level 3: Drought Order Ban	1 in 50 years	2% probability in any one year	1 in 50 years	2% probability in any one year
Level 4: Reduced supply at customer tap	1 in 200 years	0.2% probability in any one year	**2025/26 to 2032/33:** 1 in 200 years **2033/34 onwards:** 1 in 500 years	**2025/26 to 2032/33:** 0.5% probability in any one year **2033/34 onwards:** 0.2% probability in any one year

In our draft WRMP24 (dWRMP24), because of the small supply surplus in AMP8, we proposed to temporarily change our levels of service for Level 1 and 2 drought actions in both Essex and Suffolk as follows:

- Level 1: 1 in 10 years to 1 in 5 years
- Level 2: 1 in 20 years to 1 in 10 years

However, with the additional new supply schemes included in our revised plan, we are now able to maintain our current (WRMP19) planned levels of service in our Essex supply area. Our system Deployable Output (DO) assessments, for the Essex WRZ, are based on our current levels of service. We will provide a 1 in 500-year level of service for our Level 4 drought action from 2031/32. However, this could be deferred until 2035/36, when our 20 Ml/d Thames Water trade agreement ends if PCC outturns at or above our high PCC forecast.

In our Suffolk supply area, we propose to keep the dWRMP24 planned levels of service, as set out in Table 12. This is because our WINEP investigations have concluded that in some cases our abstractions are at risk of causing deterioration or not allowing waterbodies to meet their Water Framework Directive (WFD) objectives, and so we must keep abstraction at or below recent actual levels until 2030 when some of our new supply schemes are available. Our final WRMP24 levels of service for Suffolk means that we will introduce Level 1 Appeals for Restraint and Level 2 Temporary Use Bans marginally earlier, and therefore potentially more frequently. The associated demand savings will therefore help us minimise abstraction.

Once demand savings are delivered through our preferred demand management options and supply increases are delivered through our WRMP24 supply schemes, then our Level 1 and 2 planned levels of service will return to the current Water Resources Management Plan 2019 (WRMP19) levels. We expect that to be in 2033/34, once Lowestoft reuse is operational.

2.6. PLANNING ASSUMPTIONS

Our plan is based on:

- A baseline design scenario, which is our estimate of supplies which are available in a drought-caused failure with a likelihood of once in 500 years or 0.2% annual probability. Where a final plan supply deficit is forecast which cannot be resolved with demand management and supply options, then our final plan will be based on 1 in 200 years (0.5% annual probability) until the new supply schemes allow us to move to 1 in 500 year resilience. We expect this to be in 2030/31.
- Forecast Dry Year Annual Average (DYAA) demand, when demand for water is at its highest before temporary use bans are imposed.

We have also considered a 'Dry Year Critical Period (DYCP)' scenario to show how we will plan for a period of peak strain on our system, e.g., high seasonal demand such as during a heatwave.

Other baseline water resources planning assumptions are as follows:

- Assumes leakage remains static from 2025/26 throughout the whole planning period.
- Includes our forecast of customer consumption without any further water company or government intervention. We have assumed we end our water efficiency programmes and metering programmes after what we have been funded to deliver in AMP7.
- Includes existing transfers to the extent of the agreed bulk supply agreements.
- Includes abstraction licence sustainability reductions.
- Includes the benefits of capital maintenance.
- Includes risks to groundwater and surface water sources due to declining water quality.
- Excludes contributions from any demand or supply drought measures.
- Includes benefits of schemes that will be delivered by 2025 including the Abberton to Langford Pipeline and the Layer WTWs Enhancement Scheme which will reduce water quality unplanned outage.
- Forecasts for non-potable water demand and supply have been included as additional lines in the water resources planning tables.
- Includes an assessment of the demand we would expect during a 1 in 500 year drought event.

Data have been reported at a water resource zone level using the water resources planning tables.

Our preferred plan addresses deficits in our Dry Year Annual Average and critical period scenarios.

2.7. TECHNICAL REPORTS

Technical reports have been prepared for the following areas when developing our plan which are available to download here.

Table 13: List of technical reports

TECHNICAL REPORTS
Allowing for Uncertainty
Best Value Planning
Demand Forecasting
Environmental Destination
Environmental Report
Groundwater Deployable Output and Climate Change
Leakage*
Least Cost Planning
Metering*
Lessons Learnt from 2022 Drought
Options Appraisal
Outage Allowance
Raw Water and Process Losses
Problem Characterisation
Stakeholder and Customer Engagement
Supply Forecasting
Sustainability Reductions
Water Efficiency*

*Detailed costing for the demand management options can be found in each of these technical reports.

3. OUR BASELINE SUPPLY FORECAST

3.1. OVERVIEW

The baseline supply forecast confirms the amount of Water Available For Use (WAFU) in Ml/d in each water resource zone (WRZ) across the planning period.

WAFU can then be plotted on a graph against forecast demand (see Section 4) to present a supply demand balance (see Section 6). Where demand is greater than supply in a given year, then a supply deficit is forecast. If demand management options to deliver government targets for leakage reduction and per capita consumption (PCC) do not restore a supply surplus, then new supply schemes may be required.

The Water Resources Planning Guidance (WRPG) states that our baseline supply forecast should be based on the response of our raw water system, system response is preferable to rainfall or effective rainfall. This is due to the problems in presenting duration, rainfall patterns and start and finish months when evaluating the return period. Using a system response approach means that the supply forecast will adequately capture our system constraints, conjunctive use capability and operational response.

WAFU is the Deployable Output (DO) of each source (or group of sources) totalled for the WRZ less:

- future changes to DO from sustainability changes, including your long-term environmental destination, a changing climate, and any other changes you expect;
- existing transfers and schemes where planning permission is already in place;
- an allowance for short term losses of supply and source vulnerability, known as outage;
- any operational use of water or loss of water through the abstraction-treatment process; and
- a supply forecast that combines all the elements described into WAFU.

Each of the above components of WAFU is described below.

3.2. DEPLOYABLE OUTPUT ASSESSMENT

3.2.1. Overview

In developing the WRZ Supply Demand Balance (SDB), we are required to estimate the yield of our resource zones in terms of DO, a building block in determining WAFU. DO is defined in the 'Handbook of Source Yield Methodologies' (UKWIR, 2014) as:

"The output for specified conditions and demands of a commissioned source, group of sources or water resource systems as constrained by:

- hydrological yield;
- licensed quantities;

- environment (represented through licence constraints);
- pumping plant and/or well/aquifer properties;
- raw water mains and/or aqueducts;
- transfer and/or output main;
- treatment;
- water quality; and
- levels of service.

3.2.2. Essex System Surface Water

3.2.2.1 Methodology

There is a significant step change in the definition of DO from that of Water Resources Management Plan 2019 (WRMP19) to Water Resources Management Plan 2024 (WRMP24). Previously DO was based on the worst historic drought on record for the relevant WRZ. The updated guidance states that our baseline DO should be resilient in a drought with a 1 in 200-year return period until 2039/40, and then a 1 in 500-year return period, i.e., a 0.5% and 0.2% annual chance of failure, respectively, caused by drought. Additionally, the supply forecast, and therefore the DO of a WRZ, should be based on the response of your system rather a single drought event. A system response approach is preferable to historic rainfall events due to the uncertainties in defining critical drought durations, rainfall patterns and the start and finish months when evaluating the drought return period. This method ensures that our supply forecast sufficiently represents our system constraints, conjunctive use capability and operational drought actions, and also corresponds to the frequency with which our customers will be affected by drought shortages.

Our methodology for calculating surface water DO is set out below:

- Acquisition of a portfolio of stochastic datasets (400 timeseries of 48 years in length) of precipitation and potential evapotranspiration (PET) that are spatially coherent across the region, from a regional weather generator.
- Stochastic datasets were then applied in calibrated rainfall-runoff models of the pertinent East Anglian rivers and the Ely Ouse to produce river flow data to be used in Aquator® models.
- System response DO was then calculated by using the permitted failure method, where a water resources model is run multiple times using a long hydrological record and incrementally increasing demand.
- The number of years with a failure, or event such as level of service implementation, are counted at each demand step and translated into a plot showing DO versus return period in years.
- The 1 in 200-year and 1 in 500-year DOs are then derived, corresponding to an annual probability of failure of 0.5% and 0.2%, respectively.
- Baseline DO is assessed excluding demand reductions from Levels 1, 2 and 3 drought actions, i.e., Appeals for Restraint and Temporary Use Bans.

3.2.2.2 Results

The Baseline model runs calculated the Essex system 1-200 year and 1-500 year DOs (based on combined level of service four failures and demand failures) to be 444.2Ml/d and 428.0Ml/d respectively.

The Baseline model was run again but with the level of service demand savings turned on. When these savings were applied it increased the 1-200 year and 1-500 year DOs by 16Ml/d to 460.2Ml/d and 444.0Ml/d

3.2.3. Suffolk Surface Water

As part of our WRMP24 work we created an Aquator® XV model for the Ormesby-Bure part of the Norfolk-Suffolk supply area, which is the only part of the supply area that requires stochastic modelling to define drought DOs. It is operated as a conjunctive-use scheme and therefore has a single DO. This has been calculated as 27.4 Ml/d for both the 200-year and 500-year return period droughts. The reason the DOs are both the same is due to the system remaining constrained by licence conditions, even in extreme droughts. For this reason, in the baseline scenario there is no benefit to be derived from imposing levels of service reductions.

The Dry Year Annual Average (DYAA) DOs of 17.84 Ml/d and 9.56 Ml/d for the River Bure and Ormesby Broad respectively, and 8.09Ml/d for Lound Ponds and Fritton Lake, we are using for our WRMP24 are consistent with our WRMP19. The derivation of these figures is detailed in our Supply Forecasting Technical Report.

As part of our WRMP24 work we stochastically derived a DO of 20.5 Ml/d for the River Waveney, for which we have an Aquator® model. However, the sustainability of our Shipmeadow abstraction on the River Waveney has been under investigation as part of our Asset Management Plan 7 (AMP7) Water Industry National Environment Programme (WINEP). The Environment Agency (EA) confirmed that for WRMP24 planning purposes we should cap the DO of the River Waveney to 18 Ml/d from 2030/31, and then 16 Ml/d from 2032/33. This also represents the solution for this surface water body under the EA's 'No Deterioration' requirements. Both have a delivery date of 31/03/2030 (end AMP8).

The Shipmeadow intake abstraction is supported by the EA-owned and operated Waveney Augmentation Ground Water Scheme (WAGS) under drought conditions. The DO under 200-year and 500-year drought conditions is therefore licence constrained at this figure of 16 Ml/d.

3.2.4. Groundwater Deployable Output Assessment

3.2.4.1 Methodology

In line with the EA's WRPG (December 2021) we need to be able to plan to be resilient to a 1 in 200-year drought up to 2039 and to a 1 in 500-year drought to the remainder of the planning horizon. Events more severe than a 1 in 500-year drought have also been considered as stated in the EA Supplementary Guidance – 1 in 500 (EA, 2020). Furthermore, as a minimum, the EA requires a resilience to these droughts under medium future climate change conditions for each groundwater source (WRPG Supplementary Guidance – Climate Change, EA 2020). Climate change is discussed further in Section 3.5.

The WRPG (EA, 2021) states that estimated DOs for groundwater sources should be carried out using the standard unified method. It also states that "*provided you express the 1:500 event in terms of expected DO for the sources affected, the assessment will meet the standard.*" And that "*you should plan to a minimum 1:200 level of service until you can find a solution to increase resilience to 1:500 by 2039 at the latest.*" (EA, 2021).

The analytical approach in the UK standard methodology for determining outputs of groundwater sources (UKWIR, 1995) has been followed, creating a drought curve for every source using the best available data. The approach was chosen as groundwater levels are calculated for continuous pumping so that maximum source outputs are estimated. Each curve is drawn on a water level – flow graph and forms the lower boundary of all historical data points plotted, whilst reflecting the drawdown response of each individual borehole (BH). The DO is constrained by either the Deepest Advised Pumping Water Level (DAPWL), or the abstraction licence, whichever the curve crosses first. This allows a historical minimum DO to be calculated for each groundwater source. The groundwater DOs are displayed in the results below.

The combination of following the unified method approach whilst also addressing the consideration of a wide range of drought events, including the impacts of events that are more severe than 1 in 500-year droughts meets the standard set out in the WRPG Supplementary Guidance – 1 in 500 (EA, 2020).

To assess our resilience to drought, regional groundwater modelling was carried out whereby stochastic rainfall and potential evapotranspiration (PET) generated by Atkins (2021) were used to create realistic 1:200-year and 1:500-year drought scenarios. Each scenario produced estimates of aquifer drawdowns providing differences in groundwater level that could be mapped onto the drought curves to estimate the DO for each source.

However, due to the nature and resolution of the modelling, the aquifer levels cannot be directly related to the water levels in the boreholes. Therefore, individual source analysis was carried out to determine the average, seasonal rest level in the production boreholes using nearby observation boreholes as reference to assess the impact of drawdown due to drought.

The EA has proposed to change abstraction licences to prevent environmental deterioration by capping abstraction licences in areas at risk of deterioration. These licence caps are mainly due to be applied from 2030, with the exception of Blyth sustainability reductions in 2026, and some Essex sustainability reductions in 2028. Any changes in our groundwater DO due to these sustainability reductions are presented in the results section below.

The best available data have been used to determine the groundwater DOs. Following the calculation of our groundwater DOs, we were informed by the EA that groundwater sustainability reductions in our Blyth WRZ would be implemented from 2026. Continuous improvement in data collection and analysis, and available information, may result in changes to our groundwater DOs in the future.

Further information on the methodology can be found in our WRMP24 Groundwater DO and Climate Change technical report (ESW, 2022).

3.2.4.2 Results

Under average demand, the total groundwater baseline annual average DO of our Essex and Suffolk area has been reduced by 1.35 Ml/d for all WRZs from PR19 to PR24, from 56.32 Ml/d to 55.00 Ml/d. This is due to using an updated analytical method and drought curves bounded by historical minima. The North Essex Borehole 1 group which has a combined surface water licence has not been included in this comparison as it was not included in PR19. If included, the PR24 DO would exceed that of PR19 by 18.86 Ml/d.

Using the approved methodology, 23 of the 30 groundwater sources in our Essex and Suffolk WRZs were constrained by abstraction licence (average DO), while five were constrained by DAPWL. The remaining two are emergency use boreholes.

Table 14 to Table 17 summarise the WRMP24 baseline groundwater DOs determined for the Essex, Blyth, Hartismere and Northern Central WRZs.

Table 14: Essex WRZ groundwater DO

SOURCE	AVERAGE DO		PEAK DO	
	(ML/D)	CONSTRAINT	(ML/D)	CONSTRAINT
South Essex Well 1	2.61	DAPWL	2.61	DAPWL
South Essex Well 2	3.64	DAPWL	3.64	DAPWL
Colchester Borehole 1	1.93	Annual Licence	2.76	Daily Licence
Essex System (North Essex Borehole 1)	20.18	DAPWL	21.22	DAPWL
Total	**28.36**		**30.23**	

Table 15: Blyth WRZ groundwater DO

SOURCE	AVERAGE DO		PEAK DO	
	(ML/D)	CONSTRAINT	(ML/D)	CONSTRAINT
Blyth				
Blyth Borehole 1	3.17	Distributed Annual Licence	4.41	Treatment Works Capacity
Blyth Borehole 2	2.21	Annual Licence	2.72	Treatment Works Capacity
Blyth Borehole 3	2.27	Annual Licence	2.26	Treatment Works Capacity
Blyth Borehole 4	3.11	Annual Licence	3.82	Treatment Works Capacity
Blyth Borehole 5	0.29	Distributed Annual Licence	1.14	Daily Licence
Blyth Borehole 6	0.78	Distributed Annual Licence	0.87	Treatment Works Capacity
Blyth Borehole 7	2.85	Distributed Annual Licence	3.86	Distributed Daily Licence
Total	**14.68**		**19.08**	

Table 16: Hartismere WRZ groundwater DO

SOURCE	AVERAGE DO		PEAK DO	
	(ML/D)	CONSTRAINT	(ML/D)	CONSTRAINT
Hartismere				
Hartismere 1	0.55	Annual Licence	1.03	Treatment Works Capacity
Hartismere 2	0.63	Annual Licence	1.03	Treatment Works Capacity
Hartismere 3	0.45	Annual Licence	0.90	Daily Licence
Hartismere 4	0.00	Emergency Use Only	0	Emergency Use Only
Hartismere 5	3.02	Annual Licence	3.28	Daily Licence
Hartismere 6	1.25	Annual Licence	1.29	Daily Licence
Hartismere 7	2.75	Annual Licence	3.43	Treatment Works Capacity
Total	**8.65**		**10.96**	

Table 17: Northern Central WRZ groundwater DO

SOURCE	AVERAGE DO		PEAK DO	
	(ML/D)	CONSTRAINT	(ML/D)	CONSTRAINT
Northern Central				
Northern Central Borehole 1	7.12	Annual Licence	7.27	Daily Licence
Northern Central Borehole 2	2.84	DAPWL	3.12	DAPWL
Northern Central Borehole 3	2.00	Annual Licence	1.62	Treatment Works Capacity
Northern Central Borehole 4	2.25	Annual Licence	2.25	Daily Licence
Northern Central Borehole 5	0.47	Annual Licence	6.76	Daily Licence
Northern Central Borehole 6	1.35	Distributed Annual Licence	2.27	Distributed Daily Licence
Northern Central Borehole 7	1.49	Distributed Annual Licence	2.39	Distributed Daily Licence
Northern Central Borehole 8	0.54	Distributed Annual Licence	4.94	DAPWL
Northern Central Borehole 9	1.90	Distributed Annual Licence	1.56	DAPWL
Northern Central Borehole 10	2.28	Annual Licence	2.28	Daily Licence
Northern Central Borehole 11	1.23	DAPWL	1.63	DAPWL
Northern Central Borehole 12	0	Emergency Use Only	0	Emergency Use Only
Total	**23.49**		**35.26**	

DOs were derived from the modelled 1:200-year and 1:500-year droughts at each groundwater source. If this caused a reduction in DO from the historical DO then this has been recorded in the results.

Applying the methodology above, nearly all groundwater sources showed resilience to the drought scenarios, with only one exception. Northern Central Borehole 11 did not show resilience, causing a reduction in the DO. This is due to the coastal nature of the BH which may undergo saline intrusion, in turn, giving rise to difficulties in the groundwater aquifer modelling. The consequence is abnormally large declines in aquifer level (~15 m). Resilience to these events could therefore not be demonstrated resulting in 0Ml/d DO from this source.

Table 18: groundwater sources with a reduction in DO due to a 1:200-year drought and 1:500-year drought scenarios. Units in Ml/d

Source	DO	DO with 1:200yr Drought Scenario	DO with 1:500yr Drought Scenario
Northern Central Borehole 11	1.23	0.00	0.00

Table 19: Northern Central WRZ baseline DO and a DO with a 1:200-year drought and 1:500-year drought scenario. Units in Ml/d

WRZ	Total DO	DO with 1:200yr Drought Scenario	DO with 1:500yr Drought Scenario
Northern Central	23.49	22.26	22.26

In Hartismere WRZ, the planned EA licence caps are due to be implemented on all sources from the start of the planning horizon. In Blyth, three sources are capped from the start of the planning horizon, two more in 2026/27, and a further two in 2030/31. In the Northern Central WRZ, two sources are capped from the start of the planning horizon, two in 20026/27, and the remaining four in 2030/31. Two sources in Essex will be capped in 2026/27. The change in DO of our groundwater sources due to the licence caps are presented in Table 20.

Table 20: WRZ total Baseline DO, 1 in 200-year and 1 in 500-year DO, pre and post 2030 EA licence caps

WRZ	BASELINE DO		1 IN 200-YEAR DROUGHT DO		1 IN 500-YEAR DROUGHT DO	
	Pre Licence-Caps	Post Licence-Caps	Pre Licence-Caps	Post Licence-Caps	Pre Licence-Caps	Post Licence-Caps
Essex	28.36	13.26	28.36	13.26	28.36	13.26
Blyth	14.68	8.68	14.68	8.68	14.68	8.68
Hartismere	8.65	6.38	8.65	6.38	8.65	6.38
Northern Central	21.23	18.91	21.23	18.91	21.23	18.91
Totals	**72.92**	**47.23**	**72.92**	**47.23**	**72.92**	**47.23**

Further information on our groundwater DO can be found in the Groundwater Baseline Deployable Output and Deployable Output with Drought and Climate Change Technical report.

3.3. SUSTAINABLE ABSTRACTION

There are many demands placed on water in our region and sustainable abstraction is essential to support healthy ecology and the natural resilience of our rivers, wetlands, and aquifers. Those environmental water needs are determined and defined by our regulators. Within our WRMP24, environmental water needs are covered in the short to

medium term (up to 2030) by the planned sustainability reductions to deliver agreed outcomes from our AMP7 WINEP investigations, to prevent deterioration (Water Framework Directive driver) and Habitats Regulation sustainability reductions in the Broads Special Area of Conservation (SAC) and Waveney and Little Ouse Valley Fens SAC, and over the longer term (to 2050) by Environmental Destination (ED) sustainability reductions. With our regulators, we also have an agreed programme of environmental investigations and improvements called the WINEP, which also contributes to meeting environmental water needs. This is covered more fully in Section 9.4 of this report. The sustainability reductions we are including in our WRMP24 support the achievement of environmental objectives for water resources in the Anglian RBMP by preventing deterioration and supporting achievement of protected area and water body status objectives, as well as not preventing a water body from reaching 'good' or 'good potential' status in the future.

The sustainability reductions we are including in our WRMP24 are significantly higher than those included in our WRMP19 and derive from four sources:

- Delivery of agreed licence reductions for some groundwater licences during AMP8, arising from AMP7 WINEP investigations and options appraisals;
- Application of EA advised licence caps to groundwater sources by March 2030, or earlier for expiring time limited licences, licences with expiring time limited clauses or on licence variation, to reduce the risk of waterbody deterioration under the Water Framework Directive (WFD) (so-called 'No Deterioration' caps);
- Implementation of new Hands off Flow (HOF) conditions on some surface water abstractions during AMP8, arising from AMP7 WINEP investigations, to achieve Environmental Flow Indicator (EFI) compliance at full licence abstraction.
- Application of EA advised sustainability reductions and / or stricter HOF conditions for up to eleven groundwater and surface water sources by 2026/27 to meet the requirements of the Conservation of Habitats and Species Regulations 2017 (the Habitats Regulations), due to the effects of abstraction on the Broads SAC and Waveney and Little Ouse Valley Fens SAC.

The reductions arising from the first three sources have been included within our baseline and / or preferred plan, the total reduction in groundwater licence by March 2030 being 49.06 Ml/d[1].

As part of Defra's feedback on our Revised Draft WRMP24 (rdWRMP24) we have also been asked to assess the additional risk to DO for those licences that may pose a high or medium risk of deterioration under the WFD before 2030, as in such cases the EA may need to apply a 'No deterioration' cap earlier than previously advised. While work on assessing these licences remains ongoing, we have not amended the timing or value of the licence or DO reductions in our baseline and / or preferred plan at this stage.

The potential sustainability reductions for up to eleven groundwater and surface water sources by 2026/27 to meet the requirements of the Habitats Regulations (Habs Regs), have been included as an adaptive programme within our WRMP24.

[1] Data from Cell O35 in '2019 hydrology summary table update, March 23 – CL edited.xlsx' – ESW Abs reduction Q tab.

Where the confirmed or likely sustainability reductions cause our WRZs to fall into deficit we have included options in our WRMP24 to move the WRZ back to surplus.

More technical detail regarding how the sustainability reductions have been calculated is provided in the accompanying ESW Sustainability Reductions WRMP24 Technical Report.

3.3.1. Sustainability Reductions Included In The PR24 Baseline

The EA's current stated policy is to apply the WFD 'No Deterioration' licence caps to time limited licences on licence renewal. All the abstraction licences within our Hartismere WRZ need to be renewed before the start of the AMP8 planning horizon and the No Deterioration caps on these licences (Hartismere Boreholes 2, 3, 4, 5 & 7 group licence; Hartismere Borehole 1; and Hartismere Borehole 6) have been incorporated within our baseline supply demand balance position. This puts us in deficit from the beginning of the planning horizon in our Hartismere WRZ and means that we have had to request a delay to the imposition of these caps via an application for an exemption to Regulation 19 of the WFD on the grounds of Overriding Public Interest (OPI). This is reflected in line 6.3FP of Table 3b for Hartismere in our Water Resources Management Plan (WRMP) planning tables.

It is also the EA's current stated policy to apply 'No Deterioration' caps to permanent licences if they are submitted for a variation, for example to add a new standby borehole. We expect that we will need to do this for our Blyth Boreholes 1, 5 & 6, and Northern Central Boreholes 1 & 9 licences before the start of AMP8 and we have built the 'No Deterioration' caps for these sources into our baseline position.

Also, within our PR24 baseline position, we are including the sustainability reduction for our North Essex Borehole 1, which is subject to a sustainability change within our AMP7 WINEP by December 2024. The sustainability reduction of 4.5 Ml/d stated in our original AMP7 WINEP (from March 2020) was included within our PR24 baseline for our draft WRMP24 (dWRMP24). The AMP7 WINEP investigation related to this sustainability change, a joint investigation with Anglian and Affinity Water regarding impacts on flows in the River Brett, concluded that the impact of Essex and Suffolk Water's (ESW) North Essex Borehole 1 on flows in the Brett is small[2]. Despite this, the EA has stated an intention to apply a Max Peak (Original) cap, equivalent to a reduction of 9.95 Ml/d to the existing licence from December 2024. We have included this updated sustainability change in our PR24 baseline for our WRMP24.

At the time of writing, we don't think that these caps will create a final plan supply demand balance deficit in our Blyth, Northern Central or Essex water resource zones. However, we are keeping the situation under review, and if the caps do create a deficit, we would likely have to request a delay to the imposition of these caps via an application for an exemption to Regulation 19 of the WFD on the grounds of OPI.

Taken together the licence reductions associated with the sustainability reductions included within our PR24 baseline, across all four of our WRZs total 15.25 Ml/d. We have had to request a delay to the imposition of the 2.26 Ml/d of licence

[2] Groundwater modelling undertaken as part of the joint River Brett investigation identified that ESWs licence 8/36/15/*G/0092 has a 0.21 Ml/d impact on river Brett at Q95 (model run sx446) at Higham and a 0.33 Ml/d impact at Hadleigh gauging station at recent actual abstraction.

reductions within our Hartismere WRZ via an application for an exemption to Regulation 19 of the WFD on the grounds of OPI. However, until the outcomes of these applications are determined by the EA, we have included these licence reductions in our baseline. The licence changes associated with the sustainability reductions that we have included within our PR24 baseline are summarised in Table 21. More technical detail regarding the sustainability reductions for each licence is provided in the accompanying ESW Sustainability Reductions WRMP Technical Report.

If any sustainability reductions applied to water company abstraction licences result in actual returns of water to the environment, we are not aware that there is a guarantee currently that this would leave more water to meet the environment's needs and would not be abstracted by other abstractors within their existing licence limits.

Table 21: Sustainability reductions incorporated into our PR24 baseline[3].

WRZ	Groundwater reductions in Ml/d by WRZ
Northern Central	1.12
Hartismere	2.26
Blyth	1.91
Essex	9.95
Total	**15.25**

3.3.2. Sustainability Reductions Due To Implementation Of AMP7 WINEP Outcomes And Remaining No Deterioration Caps During AMP8

Beyond our PR24 baseline reductions, the total additional reduction in groundwater licences by March 2030 arising from the delivery during AMP8 of agreed AMP7 WINEP actions and remaining WFD 'No Deterioration' licence caps, is equivalent to 33.81 Ml/day[4] across all our Essex & Suffolk Water WRZs. The likely timings of these reductions by WRZ are shown in

[3] Data from Data from Cells F31-J35 in '2019 hydrology summary table_Update March 23 – CL edited.xlsx' – ESW Abs reduction Q tab.
[4] Data from Cell O41 in '2019 hydrology summary table_Update March 23 – CL edited.xlsx' – ESW Abs reduction Q tab.

Table 22[5]. Although the WINEP delivery date for most of the sustainability reductions in

[5] Data from Cells Q39:X45 in same spreadsheet.

Table 22, is 31 March 2030, some of the reductions are on licences which have time limited clauses expiring in March 2026 or March 2028. The EA's current stated policy is to cap time limited licences on licence renewal. Hence, we are planning for the WINEP and No Deterioration reductions on these licences to be implemented at the point of licence renewal.

Table 22: Groundwater licence sustainability reductions in Ml/d by year[6].

GROUNDWATER REDUCTIONS IN Ml/D BY WRZ	BY 31-MAR-2026	BY 31-MAR-2027	BY 31-MAR-2028	BY 31-MAR-2029	BY 31-MAR-2030	TOTAL BY WRZ
Northern Central	0	0	0	0	19.32	19.32
Hartismere	0	0	0	0	0	0.00
Blyth	4.183	0	0	0	2.05	6.32
Essex	0	0	2.606	0	5.65	8.25
Total	4.183	0	2.606	0	27.02	33.81

The reductions in 2026 and 2028 are due to groundwater licences that will expire wholly or in part during AMP8, (i.e., 31 March 2026 for the licences associated with the Blyth Borehole 4, Northern Central Boreholes 6 & 7, and Blyth Boreholes 7 & 9 and 31 March 2028 for the North Essex Borehole 2 and Colchester Borehole 1). At the time of writing, we don't think that these caps will create a final plan supply demand balance deficit in our Blyth, Northern Central or Essex water resource zones. However, we are keeping the situation under review, and if the caps do create a deficit, we would likely have to request a delay to the imposition of these caps via an application for an exemption to Regulation 19 of the WFD on the grounds of OPI.

Of the reductions during the period 2025-2030 described in Table 22, 4.39 Ml/d are due to AMP7 WINEP outcomes being delivered via our AMP8 WINEP and the remaining 29.42 Ml/d are those arising as an outcome of the application of EA caps on groundwater sources to prevent deterioration under the WFD and the values for these have been provided to us by the EA.

The reduction to source DO arising from sustainability reductions is shown in

[6] Data from Table 5 in ESW Sustainability Reductions WRMP Technical Report.

Table 23.

Table 23: Reduction to groundwater source deployable output arising from sustainability reductions[7]

	Sustainability Reduction - Impact on DO (Ml/d)[8]									Total
	Pre-AMP8	2025-26	2026-27	2027-28	2028-29*[9]	2029-30	2030-31	2031-32	2032-33	
Blyth WRZ										
Blyth Borehole 1	1.43									
Blyth Borehole 6	0.35									
Blyth Borehole 5	0.13									
Blyth Borehole 4			1.46							
Blyth Borehole 7			0.85							
Blyth Borehole 2							1.14			
Blyth Borehole 3							0.64			
Total DO reduction	**1.92**		**2.31**				**1.78**			**6.00**
Hartismere WRZ										
Hartismere Borehole 1	0.05									
Hartismere Borehole 2	0.15									
Hartismere Borehole 3	0.11									
Hartismere Borehole 6	0.60									
Hartismere Borehole 7	0.65									
Hartismere Borehole 5	0.71									
Total DO reduction	**2.27**									**2.27**
Northern Central WRZ										
NC Borehole 7			0.01							
NC Borehole 6			0.01							
NC Borehole 1	0.6									
NC Borehole 9	0.2									
NC Borehole 10							0.32			
NC Borehole 2							0.06			
NC Borehole 4							0.61			
NC Borehole 3							0.54			
Total DO reduction	**0.8**		**0.02**				**1.53**			**2.35**
Annual total change	**4.98**		**2.33**				**3.31**			**10.62**

A further reduction in DO by 31 March 2030 of 5 Ml/d in the Essex WRZ is attributable to the application of new HOFs on the lower River Stour and Roman River. There is also a reduction in DO of 4.5 Ml/d in the Northern Central WRZ on the Waveney surface licence, in two steps of 2.5 Ml/d by 2030/31 and a further 2.0 Ml/d by 2032/33, reducing the DO to 16 Ml/d. The HOFs are preliminary at this stage and will be agreed with the EA as part of our AMP8 WINEP delivery.

Our forecasts confirm that the sustainability reductions applied Pre-AMP8 in Hartismere, from 2026/27 in Blyth WRZ, and from 2030/31 in Northern Central WRZ, result in baseline supply demand balance deficits (see Section 6.2). This is the case even with our planned moratorium on supplying new water for non-domestic purposes, such as manufacturing and processing, in our Hartismere WRZ.

[7] Data from Table 6 in ESW Sustainability Reductions WRMP Technical Report.
[8] Data source: Derogation table (SR) tab in 'ESW Revised Draft WRMP24Tables Supply Lines_v1_Habs Regs AP Worse #2.xlsx'
[9] Orange shading shows transfer from NCZ to Blyth and Hartismere operational from 2028/29. Grey text indicates need for REG19 exemption until at least 2028/29.

For our dWRMP24 we had anticipated that once our Suffolk Strategic Network & Storage Enhancement scheme was operational in 2028/29, linking our Northern Central WRZ to Blyth and Hartismere, this would allow surplus water within the Northern Central WRZ to be transferred into Hartismere and Blyth to offset the sustainability reductions required for No Deterioration in those zones. However, now with the likely additional Habs Regs sustainability reductions required earlier in our Northern Central WRZ (see Section 3.3.4), this is likely to (more than) fully utilise the available headroom within this WRZ, leaving no surplus to be transferred elsewhere until we are able to deliver sufficient demand reductions and/or supply side schemes to replace the reduced DO. Our Habs Regs Adaptive Programme presented in Section 8.7.4, indicates this is likely to require two new supply side schemes, which may not be fully delivered until 2032/33. It is likely therefore, that we would have to request a delay to the imposition of at least some of the 'No Deterioration' sustainability reductions on our permanent groundwater licences via an application for an exemption to Regulation 19 of the WFD on the grounds of OPI to possibly beyond 31 March 2030.

3.3.3. Risk of WFD Deterioration before 2030

As part of Defra's feedback on our rdWRMP24, we were asked to assess the additional risk to DO and supply for those licences that may pose a high or medium risk of deterioration under the WFD before 2030, as in such cases the EA may need to apply a 'No deterioration' licence cap earlier than previously advised.

Work to do this assessment is ongoing and this section describes our planned approach. The first step is to derive an estimate of 'future predicted' abstraction in 2030 for each of our groundwater sources and compare this with actual abstraction during the 2010-2015 Recent Actual period (used within WFD assessments) and actual abstraction during the subsequent 2016-2021 period, to see where there has already been actual growth in average abstraction between the two periods and how 'future predicted' abstraction compares with actual recent abstraction during these two periods.

For abstraction sites where the 'future predicted' abstraction is greater than actual abstraction in the 2010-2015 period we will then use the recently issued EA guidance 'Preventing water body deterioration due to increased abstraction by water companies - Guidance for AMP8', released in February 2024, and look at the waterbodies potentially affected by each abstraction and their level of 'WFD deterioration' risk with increasing abstraction, focusing on the four WFD quantitative groundwater tests, compliance with the EFI and the 'hydrology supports good' test for surface waterbodies and the presence or absence of abstraction 'reasons for not achieving good' (RNAGs). We will do this based on future predicted abstraction for our WRMP24 baseline scenario and our WRMP24 final plan scenario, to indicate abstractions where there may be a risk of 'WFD deterioration' if future performance does not meet that forecast in the final plan.

The output of this initial analysis will indicate whether some of our abstraction sites may pose a risk of deterioration to associated waterbodies before 2030. As we are already planning to implement licence caps to 'recent actual' levels earlier than 2030 for some abstraction sites, as an output arising from our AMP7 WINEP investigations, or where we are renewing abstraction licences before 2030, we consider much of the potential risk to our licences and DO to already be included within our preferred WRMP24 and the additional risk to be relatively low. It is likely that there may be some abstraction sites where licence caps are currently planned for March 2030 but where there may be a risk of deterioration if abstraction does not reduce in line with levels forecast in our WRMP24 final plan. There may be a risk to our licences and DO from this, which should be viewed alongside the larger uncertainties associated with ongoing Habitats

Regulation sustainability reduction investigations. Further details of the work we have planned, is provided in our accompanying Sustainability Reductions Technical Report.

While work on assessing these licences remains ongoing, we have not amended the timing or value of the licence or DO reductions in our baseline and / or preferred plan at this stage.

3.3.4. Sustainability Reductions Due To Habitats Regulations

We are including an adaptive programme within our WRMP24 due to the uncertainty around the application of EA advised sustainability reductions and/or stricter HOF conditions by 2026/27 for up to eleven groundwater and surface water sources in our Northern Central and Hartismere WRZs, to meet the requirements of the Conservation of Habitats and Species Regulations 2017 (the Habs Regs), due to the effects of abstraction on the Broads SAC and the Waveney and Little Ouse Valley Fens SAC. The likely need for these sustainability reductions was advised to us in letters from the EA in November 2022 and September 2023, respectively, which was too late for their inclusion within previous drafts of our WRMP24.

The extent of likely sustainability reductions required to meet the requirements of the Habs Regs is not yet known, as the EA has an ongoing investigation to determine this. We have therefore worked with the EA to agree some likely sustainability reduction values in our WRMP24 as an adaptive programme. These are included in a separate section of the accompanying WRMP24 Sustainability Reductions Technical Report for completeness.

The licence changes we have included within our Habs Regs adaptive programme are summarised in Table 24.

Table 24: Potential Habs Regs licence reductions included as adaptive programme[10]

LICENCE NAME	POTENTIAL LICENCE REDUCTION ASSUMED (Ml/YR)	REMAINING LICENCE (Ml/YR)	REMAINING LICENCE (Ml/D)	COMMENT
NC Boreholes 5 & 8	4973	64	0.175	The recent actual average (RAA) condition used to derive the 6-year rolling total abstraction for the WFD No Det reduction is more severe than Habs Regs scenarios discussed with the EA, so we will bring forward the WFD No Det sustainability reduction to 2026/27 to represent a possible Habs Regs reduction.
Ormesby surface abstraction	1735	1735	4.753	We calculate the Recent Actual peak abstraction (2010-2015) to be 3470 Ml/yr. We have halved this to derive a sustainability reduction based on the rationale that it is a halfway step towards the Environmental Destination reduction for Ormesby Broad which is 100% loss of the abstraction under all scenarios (BAU, BAU+ & Enhanced). We will take this figure as the basis of an individual annual max licence for the Broad (it is currently part of the aggregate group licence and doesn't have an individual licenced volume).
Bure surface abstraction				New HOF set possibly at a new assessment point upstream of confluence with Ant. Effectively limits DO to 0 as abstraction would likely be prohibited at lower flows.
NC Borehole 13	0	380	1.04	All waterbodies compliant at full licence abstraction under WFD. In the absence of any better information, no Habs Regs sustainability reduction to be included.
NC Boreholes 3 & 4 (NC BH 3 site only)	460	1130	3.10	In the absence of any better information, we will bring forward the WFD No Det sustainability reduction for the whole licence to 2026/27 to represent a possible Habs Regs reduction just at NC BH3.
Waveney surface abstraction				Assume change to HOF agreed as part of AMP7 WINEP outcome but delivered by 2026/27. New licence condition limiting abstraction to 16 Ml/d supported by WAGS.
NC Borehole 12	470	622	1.71	The only available figures derive from the original modelling undertaken for the Review of Consents (RoC) work back in 2009, where the sources were all modelled with a 43% reduction of their annual licensed quantity, irrespective of their relative contribution to the modelled impact.
NC Borehole 10	358	474	1.30	
NC Borehole 2	536	710	1.95	
NC Borehole 1 & 9[11]	1466 (from Full Licence or FL) 1290 (from new Peak Max Original cap)	1943	5.32	
Hartismere Boreholes 2, 3, 4, 5 & 7[12]	928	1571	4.30	Assumed complete loss of licence associated with Hartismere 5 borehole, based on losing Recent Actual Average (RAA) (2010-2015) value for this site from the Group annual licence.

[10] Data source: Table 8 in Sustainability Reductions Technical Report
[11] The NC 1 & 9 boreholes are likely to have their WFD No Deterioration licence cap applied as part of the PR24 baseline, due to our need to vary this licence during 2023/34. The reduction for Habs Regs in the table therefore assumes the No Det licence cap (Max Peak Original) has already been applied to these sources and represents the balance of the Habs Reg 43% reduction from the original full licence, after the application of the No Det reduction.
[12] The Hartismere BH 2, 3, 4, 5 & 7 group licence is currently being renewed. While two individual points are subject to licence caps, the group annual licence is not. Therefore the assumption for Hartismere 5 BH is the complete loss of its RAA value from the group annual licence.

Hartismere Borehole 6[13]	455 (from FL) 216 (from RAA cap)	0	0	The EA has advised us to assume the worst case scenario of the complete loss of this licence.
TOTAL (Ml/yr)	11,381 (from FL) 10,967 (from PR24 baseline)			
TOTAL (Ml/d)	31.18 (from FL) 30.04 (from PR24 baseline)			

Assuming the Habs Regs sustainability reductions are applied in 2026/27 they would be in addition to any sustainability reductions included for the same sources in our PR24 baseline. This applies to Northern Central Boreholes 1 & 9 and Hartismere Borehole 6. The remaining WFD No Deterioration licence reductions for these sources and the AMP7 WINEP outcome HOF change for the River Waveney licence would then be re-calculated based on the remaining licence in 2030.

The interaction between the DO reductions due to sustainability changes for WINEP and WFD 'No Deterioration' and those due to the Habs Regs are illustrated in Table 25 below.

[13] The Hartismere BH6 licence is currently being renewed. While we have submitted a request for a Regulation 19 exemption to delay the implementation of the no deterioration licence cap, this has yet to be determined so we have included the capped value in our PR24 baseline.

Table 25: Interaction of DO reductions from Habs Regs SRs alongside other reductions[14]

Habs Regs SR Adaptive Programme	Sustainability Reduction - Impact on DO (Mld) [WFD No Det in Blue; Habs Regs in orange]								Total
	2025-26	2026-27	2027-28	2028-29*	2029-30	2030-31	2031-32	2032-33	
Blyth WRZ									
Blyth Borehole 1	1.43								
Blyth Borehole 6	0.35								
Blyth Borehole 5	0.13								
Blyth Borehole 4		1.46							
Blyth Borehole 7		0.85							
Blyth Borehole 2						1.14			
Blyth Borehole 3						0.64			
7.2 BL Total confirmed DO reductions to restore sustainable abstraction	1.92	2.31				1.78			6.00
Hartismere WRZ									
Hartismere Borehole 1	0.05	→	→						
Hartismere Borehole 2	0.15	→	→						
Hartismere Borehole 3	0.11	→	→						
Hartismere Borehole 6	0.60	0.7	→						
Hartismere Borehole 7	0.65	→	→						
Hartismere Borehole 5	0.71	2.3	→						
7.2 BL Total confirmed DO reductions to restore sustainable abstraction				5.24					5.24
Northern Central WRZ									
NC Borehole 7		0.01							
NC Borehole 6		0.01							
NC Borehole 1	0.6	2.99							
NC Borehole 9	0.2								
NC Borehole 10		0.98	←	←	←	0.32			
NC Borehole 2		0.89	←	←	←	0.06			
NC Borehole 4		0.61	←	←	←	0.61			
NC Borehole 3						0.54			
Ormesby System**		20.96							
River Waveney		4.50	←	←	←	2.50	←	2.00	
7.2 BL Total confirmed DO reductions to restore sustainable abstraction									
Annual change	0.80	30.95				0.54			32.29
Cummulative	0.80	31.75	31.75	31.75	31.75	32.29	32.29	32.29	
NCZ REG19/64 Derogation Option (Mld)		17.48	18.42	21.92	19.10	8.72	8.24		
Proportion of Total SR derogation required (%)		55%	58%	69%	60%	27%	26%		

*PWT from NCZ to Blyth and Hartismere operational from 2028/29.
**Ormesby System: modelled in Aquator, includes River Bure, Ormesby Broad, Juby Farm and Grange Farm BHs.
Green arrows indicate where Habs Regs SR supersedes No Det SR and no further reduction required under No Det after 2026/27.
Orange arrow indicates need for REG19 Derogation
Purple arrow indicates need for both REG19 and REG62 Derogation

We expect that, if the scale of licence reductions under the Habs Regs is as severe as we anticipate, this will put our Northern Central WRZ and Hartismere WRZ into deficit when these are applied in 2026/27. The likely period of deficit would be at the earliest 2032/33, when we expect to be able to bring two new resources into operation. Our Least cost modelling has selected Lowestoft Reuse and Caister Reuse schemes to meet the deficit, as these have shorter lead-in times than the North Suffolk Reservoir, which would be the more sustainable option. We therefore anticipate that we would have to work with the EA to develop a 'glidepath' of sustainability reductions and compensatory measures between 2026/27 and the date by when we are able to deliver sufficient demand reductions and / or supply side schemes to replace the reduced DO. For the part of the Habs Regs sustainability reductions that we are not able to deliver in 2026/27, we would likely need to request a delay to the imposition of these caps via an application for a derogation to Regulation 64(5) of the Habs Regs on the grounds of Imperative Reasons of Overriding Public Interest (IROPI).

[14] Data source: Table 9 in Sustainability Reduction Technical Report

3.3.5. Preferred Plan Sustainability Reductions Summary

In summary, the sustainability reductions that we are including in our preferred PR24 WRMP comprise:

- A total reduction in groundwater licence across all the ESW WRZs of 15.25 Ml/d to give our PR24 baseline position. This is due to the delivery of our AMP7 WINEP sustainability reduction on our North Essex Borehole 1 licence by December 2024 and the delivery of 'No Deterioration' sustainability reductions on our Hartismere Boreholes 2, 3, 4, 5 & 7, Hartismere Borehole 1, Hartismere Borehole 6, Northern Central Boreholes 1 & 9 and Blyth Boreholes 1, 5 & 6 licences before the start of AMP8, due to the expiry of time limited clauses or the need to voluntarily accept the 'No Deterioration' caps on licence variation.
    - The need to renew all the abstraction licences within our Hartismere WRZ before the start of the AMP8 planning horizon and the 'No Deterioration' caps on these licences (Hartismere Boreholes 2, 3, 4, 5 & 7, Hartismere Borehole 1 and Hartismere Borehole 6) puts us in a deficit position from the beginning of the planning horizon in our Hartismere WRZ and means that we have had to request a delay to the imposition of these caps via an application for an exemption to Regulation 19 of the WFD on the grounds of OPI. This is detailed in the WRMP planning Table 3a, where we have entered the WAFU reductions as a result of the caps in 7.2BL, and then applied the Regulation 19 exemption in 6.3FP, Table 3b.
- A total further reduction in groundwater licence of 33.81 Ml/d by 31 March 2030 across all the ESW WRZs due to the delivery of the remaining 'No Deterioration' licence caps and the agreed licence changes to groundwater sources arising from our AMP7 WINEP investigations and options appraisals.
    - Of this, a sustainability reduction of 4.39 Ml/d equivalent, is a result of the delivery of sustainability reductions identified from AMP7 WINEP investigations. All of this reduction comes from the Blyth WRZ, from the North Central Boreholes 6 & 7, Blyth Borehole 7 & 9, Blyth Borehole 4, and Blyth Borehole 8 sources. The AMP7 WINEP outcome for these licences, agreed with the EA, is to cap the first three licences to Recent Actual Average (RAA) and revoke the Blyth Borehole 8 licence by 31 March 2030. However, as the Northern Central Boreholes 6 & 7, Blyth Boreholes 7 & 9 and Blyth Borehole 4 licences all require renewal by 31 March 2026, and the EA's stated policy is to cap time limited licences to RAA on licence renewal, it is likely that the WINEP changes on these licences (a licence reduction of 4.183 Ml/d) would have to be implemented by 31 March 2026, with the remaining 0.205 Ml/d associated with the revocation of Blyth Borehole 8 being delivered by 31 March 2030.

- At the time of writing, we don't think that these caps will create a final plan supply demand balance deficit in our Blyth or Northern Central water resource zones. However, we are keeping the situation under review, and if the caps do create a deficit, we would likely have to request a delay to the imposition of these caps via an application for an exemption to Regulation 19 of the WFD on the grounds of OPI.

- The sustainability reduction balance of 27.02 Ml/d equivalent by March 2030, across all WRZs is a result of capping remaining uncapped groundwater licences to prevent deterioration under the WFD. Of this the reduction[15] in Northern Central WRZ is 19.32 Ml/d, Hartismere is 0 Ml/d (as all licences are already assumed capped), Blyth is 2.05 Ml/d and Essex is 5.65 Ml/d. Our current modelling indicates that the imposition of these licence caps in 2030, before ESW is able to bring online any additional PR24 WRMP new supply options, will create a supply demand balance deficit in every WRZ, and that ESW would likely have to request a delay to the imposition of these caps via an application for an exemption to Regulation 19 of the WFD on the grounds of OPI.
- In some cases, the effect of these licence reductions and licence caps is not identical to the resulting change in DO. This can arise, for example, if the 1 in 500-year drought DO is less than the capped licence value. The reductions in groundwater DO arising from the WINEP measures and the licence caps for 'No Deterioration' are 2.35 Ml/d in Northern Central WRZ, 2.27 Ml/d in Hartismere, 6 Ml/d in Blyth and 0 Ml/d in the Essex WRZ.
- The final reduction in DO included, due to sustainability reductions within our preferred plan, is on surface water licences due to the imposition of new HOFs to protect flows for fish and ecology. This equates to a provisional loss of DO of 5 Ml/d in the Essex WRZ by March 2030 and a reduction in DO of 4.5 Ml/d on the Waveney surface licence, in two steps of 2.5 Ml/d by 2030/31 and a further 2.0 Ml/d by 2032/33, reducing the DO to 16 Ml/d.

3.3.6. Risk of WFD Deterioration before 2030 Summary

As part of Defra's feedback on our rdWRMP24, we were asked to assess the additional risk to DO for those licences that may pose a high or medium risk of deterioration under the WFD before 2030, as in such cases, the EA may need to apply a 'No deterioration' cap earlier than previously advised. While work on assessing these licences remains ongoing, we have not amended the timing or value of the licence or DO reductions in our baseline and / or preferred plan at this stage. Further details regarding this ongoing work is provided in our accompanying Sustainability Reductions Technical Report.

3.3.7. Habs Regs Adaptive Pathway Sustainability Reductions Summary

The potential sustainability reductions for up to eleven groundwater and surface water sources by 2026/7 to meet the requirements of the Habs Regs in our Northern Central WRZ and Hartismere WRZ have been included in our WRMP24 as an adaptive pathway (see Section 8.8.5).

The severity of likely sustainability reductions required to meet the requirements of the Habs Regs is not yet known, as the EA has an ongoing investigation to determine this. We have therefore worked with the EA to agree some likely sustainability reduction values in our WRMP24. The licence reductions that we have included in our Habs Regs adaptive programme total around 30 Ml/d, in addition to the licence caps already included within our PR24 baseline.

We expect that, if the scale of licence reductions under the Habs Regs is as severe as we anticipate, this will put our Northern Central WRZ and Hartismere WRZ into deficit when these are applied in 2026/27. The likely period of deficit

[15] Data source: Cells W39 to W45 in '2019 hydrology summary table_Update March 23 – CL edited.xlsx' – ESW Abs reduction Q tab.

would be at the earliest 2032/33, when we expect to be able to bring two new resources into operation. Our Least cost modelling has selected Lowestoft Reuse and Caister Reuse schemes to meet the deficit, as these have shorter lead-in times than the North Suffolk Reservoir, which would be the more sustainable option. We therefore anticipate that we would have to work with the EA to develop a 'glidepath' of sustainability reductions and compensatory measures between 2026/27 and the date by when we are able to deliver sufficient demand reductions and / or supply side schemes to replace the reduced DO. For the part of the Habs Regs sustainability reductions that we are not able to deliver in 2026/27, we would likely need to request a delay to the imposition of these caps via an application for a derogation to Regulation 64(5) of the Habs Regs on the grounds of IROPI.

For our dWRMP24 we had anticipated that once our Suffolk Strategic Network & Storage Enhancement scheme was operational in 2028/29, linking our Northern Central WRZ to Blyth and Hartismere, this would allow surplus water within the Northern Central WRZ to be transferred into Hartismere and Blyth to enable the sustainability reductions required for WINEP and WFD 'No Deterioration' to be delivered in those zones. However, now with the likely additional Habs Regs sustainability reductions required earlier in our Northern Central WRZ, this is likely to (more than) fully utilise the available headroom within this WRZ, leaving no surplus to be transferred elsewhere until we are able to deliver sufficient demand reductions and / or the Lowestoft Reuse and Caister Reuse schemes to replace the reduced DO. This may not be fully delivered until 2032/33. It is likely therefore, assuming the Habs Regs reductions take precedence over the WFD 'No Deterioration' reductions, that we might have to apply to delay the delivery of at least some of the 'No Deterioration' sustainability reductions in the Blyth and Northern Central WRZs, via an application for an exemption to Regulation 19 of the WFD on the grounds of OPI, and further extend the Reg 19 exemption within the Hartismere WRZ, beyond 2030.

A linked, but separate, longer-term consideration is the work led by the regional water resource planning group, Water Resources East (WRE), on Environmental Destination for abstraction. The additional sustainability reductions required by 2050 to meet these objectives are addressed in a separate Environmental Destination Technical Report and summarised in Section 3.4.

3.4. LONG TERM ENVIRONMENTAL DESTINATION

While the sustainability reductions identified in the previous section are to meet our current WFD and Habs Regs obligations in the shorter term, we are also working with our regional water resources group, WRE, to identify a longer-term environmental destination for our region, to deliver longer term sustainability and environmental resilience. The ambitious licence and abstraction reductions proposed under environmental destination are to achieve and maintain sustainable abstraction to 2050 (and beyond), accounting for climate change impacts and future demand.

The EA's policy document 'Meeting our Future Water Needs: A National Framework for Water Resources' (2020) (the 'National Framework') identifies that a step change is required in order to improve the water environment and address unsustainable abstractions from it, in order to improve resilience to drought, climate change and increase environmental protection, by 2050. The National Framework sets out, amongst other things, a range of environmental destination scenarios that Regional Water Resource Groups and their constituent water companies need to build into the water

resources management plans in their areas to deliver the step change in resilience and environmental protection required. The scenarios carried forward into the WRE companies' WRMPs are:

- Business as Usual (BAU) - the same percentage of natural flows for the environment that currently applies continues for the future. Excludes uneconomic waterbodies. Deemed to be the regulatory minimum under WFD. Aims to achieve the EFI elsewhere.
- Business as Usual Plus (BAU+) – aims to achieve the EFI everywhere and thus includes waterbodies that were classed as uneconomic in RBMPs. This has become WRE's central planning scenario.
- Enhanced – aims to achieve the EFI everywhere, includes uneconomic waterbodies, gives additional protection for chalk streams, protected sites and sensitive headwaters (i.e., recovery to flows in excess of the EFI – Common Standards Monitoring Guidance (CSMG) targets).

We have used the groundwater and surface water licence reductions as set out in the WRE BAU+ ED scenario in our baseline supply forecast for our three Suffolk WRZ and used the WRE BAU and Enhanced scenarios to assess sensitivity of our preferred plan. We have included the higher-level Enhanced abstraction reductions in our High Environmental Destination Adaptive Programme. We have also used the WRE Environmental Destination scenario groundwater licence reductions in our Essex WRZ. However, our approach to surface water abstraction reductions for our Essex WRZ has not utilised WRE's licence reductions. Instead, we have developed an alternative BAU+ scenario which protects the aquatic environment through the implementation of Hands-Off Flow conditions on our Essex river abstractions. Using this combined approach (i.e., using the WRE groundwater ED reductions with our HOFs for surface-water abstractions), we have created our own 'ESW BAU+' ED scenario, which we have used in our WRMP24 preferred plan and provided to WRE for use in their least cost modelling at the regional level. These ED reductions are considered in our preferred plan in addition to sustainability reductions already arising from our WINEP and the EA No Deterioration licence capping process, and the same ESW BAU+ ED scenario is used within our Habs Regs Adaptive Programme.

Table 26 summarises the total DO reductions for each of our Water Resource Zones under the BAU+ Environmental Destination scenario, incorporated into our preferred WRMP24 plan. We have assumed that half of the reductions will be met from 2040/41, and the total reductions from 2045/46. These figures are entered into the planning tables in line 7.3BL, Table 3a for each WRZ.

Table 26: WRMP Preferred Plan Environmental destination BAU+ scenario deployable output reductions

WRZ	TOTAL DEPLOYABLE OUTPUT REDUCTION (ML/D)	DEPLOYABLE OUTPUT REDUCTION (% OF WRZ BASELINE DO)
Essex[1]	2.00	0.5
Blyth[2]	1.72	12
Hartismere[2]	0.65	8
Northern Central[2]	35.35	46
ESW Total	39.72	8

[1]ESW BAU+, [2]WRE BAU+

The BAU+ ED scenario results in a total reduction of nearly 40 Ml/d across ESW by 2050, which is 8% of DO, in addition to the reductions arising from the AMP7 WINEP and EA licence capping processes. In some cases, the BAU+ scenario represents a severe or complete loss of abstraction at several of our key surface water abstractions in Suffolk and Norfolk. Whilst we have incorporated the DO reductions associated with these licence reductions into our WRMP24 supply demand balance, we recognise that further work is needed to refine and better understand the rationale behind the scale of these reductions.

We recognise that we still have further work to do to refine and increase confidence in the abstraction reductions required to meet the agreed Environmental Destination outcomes. We have agreed with the EA, through our AMP8 (2025-2030) WINEP (programme of schemes and investigations to deliver environmental improvements) several investigations to address the current uncertainty around the scale and location of the Environmental Destination sustainability reductions. We are at the early stages of working with other water companies and with WRE on a joint Environmental Destination Options Development study to explore the range of options that may be available to address environmental destination, so that there is more clarity on the schemes required by PR29.

Specific investigations we are planning to include in our AMP8 WINEP relating to Environmental Destination include:

- A joint Environmental Destination Options Development study, with other water companies in our region and WRE, to explore the range of options that may be available to address environmental destination.
- Investigations into the compliance of surface waterbodies associated with our abstractions under modelled future EFI conditions.
- Investigations into the freshwater requirements of estuarine habitats for the estuaries and transitional waterbodies associated with our abstractions.

Within our AMP8 WINEP we also have investigations under the 25 Year Environment Plan driver to explore opportunities for more holistic water management including embracing the catchment approach, working with natural processes to develop new ways of managing water, supporting nature recovery, and contributing to natural capital where possible, which might contribute to meeting Environmental Destination outcomes. However, the scope for catchment-based options may be limited, given the likely scale of abstraction reductions required, which will likely require the development of significant new sources of water, with certainty over the DO of the schemes identified.

In terms of timings of the abstraction reductions proposed under ED, although the National Framework initial assumption was by 2050, we have taken a two-phase approach to implementing the ED reductions: half by 2040/41, and the remaining half by 2045/46. This approach recognises that we are already incorporating significant reductions in licence and abstraction far earlier in our WRMP planning horizon to meet the WFD and Habs Regs requirements. These are detailed in our Sustainability Reductions Technical Report and summarised in Section 3.3 above. This allows the AMP8 and AMP9 WINEP investigations to increase our certainty in the scale, location and timing of the additional abstraction reductions required for Environmental Destination and for WRMP24 new supply side options to become available.

We have undertaken engagement, via workshops in May 2022 with our regulators (EA and Natural England (NE)) and during July 2022 with a broader group of stakeholders and partners to develop various aspects of our AMP8 WINEP programme and our environmental destination.

More detail of the abstraction changes and licence changes that are needed to achieve our preferred plan Environmental Destination are set out in the accompanying Environmental Destination Technical Report. The Technical Report also details the impact that potential licence and DO reductions within our Habitats Regulations Adaptive Programme would have on subsequent changes still required to meet Environmental Destination ambitions.

In addition within our Technical Report we have presented the reductions generated by different ED scenarios as part of the sensitivity testing of our WRMP24 and we have presented a 'High ED' adaptive programme which assumes the delivery of the 'Enhanced' ED scenario.

3.5. CLIMATE CHANGE

The UK Climate Projections 2018 (UKCP18) Regional Climate Model (RCM) data have been selected as the most appropriate climate change data set as it supersedes the UK Climate Projections 2009 (UKCP09) data used for WRMP19 climate change analysis. However, the datasets are only available for Representative Concentration Pathway (RCP) 8.5, which is a "high" emissions scenario, with warming of around 4 degrees Celsius above the 1981-2000 baseline by the 2070s.

3.5.1. Surface Water Climate Change Analysis

Atkins were appointed to develop 12 sets of monthly climate change factors for rainfall and potential evapotranspiration (PET) based on the UKCP18 RCP8.5 data. Mott MacDonalds then perturbed the stochastic rainfall and PET data using these monthly climate change factors, the GR6j rainfall runoff models were then run with the perturbed climate change rainfall and PET input data, no other changes to the GR6j models were made.

Following completion of the GR6j modelling, Mott MacDonald provided hydrology data for the 12 RCM climate change scenarios, this included 12 sets of 31 stochastic timeseries of river flows for 19,200 years (plus rainfall and evaporation data for Abberton and Hanningfield).

For the climate change analysis, a subset of data was required. For each RCM scenario, 100 scenarios of 48 years were selected to be used in the Aquator® XV modelling work. Hydro-logic carried out system response DO modelling

for the 12 sets of RCM scenarios (100 timeseries of 48 years) along with post processing analysis to determine 12 plausible DOs for the various climate change scenarios.

3.5.2. Surface Water Climate Change Results

The results of the modelling using the UKCP18 data showed that the expected impact of climate change was significantly greater than was shown by the UKCP09 data used for WRMP19. This is partly because the RCM data is based on a high emissions scenario (RCP8.5, 4 degrees temperature increase) rather than a medium emission scenario. In order to assess the climate change impacts under a medium emissions scenario, in the absence of spatially coherent RCM data at medium emissions, we have scaled back the high emissions (RCP8.5) impacts to the medium emission (RCP6) impacts using a method developed by Atkins that uses a temperature-based scaling equation (Atkins - WRSE Climate Data Tools Scaling Report v0.4, 2021)

The outputs of the RCP8.5 modelling along with the results of scaling RCP8.5 to RCP6 are shown in Table 27, the RCP6 scaled results have been used in our supply-demand balance for the Essex WRZ.

Table 27: Change to deployable output under RCP8.5 and RCP6

CLIMATE CHANGE SCENARIO	RCP8.5 IMPACT ON DO (ML/D)	RCP 6 IMPACT ON DO (ML/D)
RCM01	-72.73	-34.9104
RCM04	-67.2	-32.256
RCM05	-75.25	-36.12
RCM06	-92.87	-44.5776
RCM07	-42.73	-20.5104
RCM08	-82.5	-39.6
RCM09	-86.76	-41.6448
RCM10	-90.45	-43.416
RCM11	-92.48	-44.3904
RCM12	-68.44	-32.8512
RCM13	-99.95	-47.976
RCM15	-40.51	-19.4448
Min	-78.875	-37.86
Median	-99.95	-47.976
Max	-72.73	-34.9104

The EA guidance recommends using the following linear scaling equation,

$$Time\ scale\ Factor = \frac{Year - 1990}{2070 - 1990}$$

However, as stated in the Atkins report (WRSE Climate Data Tools Scaling Report v0.4, 2021) rates of warming and temperature related impacts are typically non-linear. Consequently, Atkins proposed an alternative scaling equation, based on an assessment of the rates of warming in UKCP18 climate models,

$$Time\ Scale\ Factor = a\,(Year - 1990)^b$$

Where **a** is 0.0056 and **b** is 1.1835. This has been shown to fit all RCPs well, with the exception of RCP2.6 as the rate of warming levels off at the end of the century. Both these equations assume that warming starts from 1990, therefore there will be some impacts of climate change between 1990 and 2024/25, where 2024/25 is the base year of the water resources plan. Table 28 shows the variation in DO due to climate change when scaled to the RCP6 and scaled over the planning horizon.

Table 28: Change to Essex WRZ deployable output scaled to RCP6 over the planning horizon

YEAR	IMPACT ON DO, ML/D
2025-26	-14.2486
2030-31	-16.6881
2035-36	-19.1843
2040-41	-21.732
2045-46	-24.327
2050-51	-26.9656
2055-56	-29.645
2060-61	-32.3625
2065-66	-35.1159
2070-71	-37.9032
2075-76	-40.7226
2080-81	-43.5727

Suffolk surface water sources

There are three surface water sources in the Suffolk WRZs and none of them are considered to be vulnerable to climate change.

Shipmeadow intake on the River Waveney
The Shipmeadow abstraction is supported by the Waveney Augmentation Groundwater Scheme (WAGS), which is owned and operated by the EA. The scheme was designed, built, and operated to support the ESW abstraction. Pending licence reviews the EA has committed to continue this support and the source is therefore not vulnerable to climate change in its present configuration.

Fritton Lake and the Lound Ponds between Lowestoft and Great Yarmouth
Fritton Lake and the Lound ponds, having no significant surface water courses flowing into them, are predominantly spring-fed, and are therefore considered as sourced from groundwater. Climate change groundwater modelling undertaken across Suffolk at all our other borehole sources has indicated negligible impact on aquifer levels and we expect this to be the same for the Lound Ponds.

Ormesby-Bure system in Norfolk
Like Fritton Lake and the Lound Ponds, a significant proportion of the inflow to the Trinity Broads (one of which is Ormesby Broad) is groundwater, and also like Fritton Lake and the Lound Ponds, they are not considered to be vulnerable to climate change.

3.5.3. Groundwater Climate Change Analysis

To assess the climate change impacts under a medium emissions scenario, a similar methodology to surface water was used. In the absence of spatially coherent RCM data at medium emissions, we scaled back the high emissions (RCP8.5) impacts to the medium emission (RCP6) impacts using a method developed by Atkins that uses a temperature-based scaling equation (Atkins - WRSE Climate Data Tools Scaling Report v0.4, 2021). This method is described in more detail in the preceding surface water climate change section.

To assess our resilience to climate change, regional groundwater modelling was carried out whereby stochastic rainfall and PET generated by Atkins (2021) were used to create realistic 1:200-year and 1:500-year drought scenarios (Wood, 2022). Climate change scenarios were generated based on the UK Climate Projections 2018 (UKCP18) Regional Climate Model (RCM). Each scenario produced estimates of aquifer drawdowns providing differences in groundwater level that could be mapped onto the drought curves to estimate the DO for each source.

In accordance with the WRPG (EA, December 2021), the drought and medium climate change scenarios have been included to determine groundwater DO. The low and high climate change scenario DOs have been calculated to allow for uncertainty within the Target Headroom analysis (Section 5).

3.5.4. Groundwater Climate Change Results

Using the approved methodology, 22 of the 29 groundwater sources in our Essex and Suffolk WRZs were constrained by abstraction licence, while five were constrained by DAPWL. When assessing the impacts of drought and climate change, two groundwater sources did not show resilience, consequently having a reduction in DO.

DOs were derived from the modelled 1:200-year and 1:500-year droughts with low, medium, and high recharge climate scenarios at each groundwater source. If this caused a reduction in DO from the historical minimum baseline DO, as presented in Section 3.2.4, then this has been recorded in the results. Reductions in DO due to drought and climate change are only a result of the drought curve being constrained by the DAPWL or Pump Level.

Applying the methodology outlined in the ‘Groundwater Baseline Deployable Output and Deployable Output with Drought and Climate Change Technical Report’ (ESW, 2022) all groundwater sources showed resilience to the drought and climate scenarios except two. Northern Central Borehole 11 (unused due to Bacteriological contamination), and South Essex Well 2 both saw a decline in DO for all scenarios, which are detailed in

Table 29 to Table 33.

Table 29: Groundwater sources with a reduction in DO due to 1:200-year drought and climate change scenarios (in Ml/d)

SOURCE	DO	DO WITH 1:200 YR DROUGHT SCENARIO	DO WITH MEDIUM CLIMATE CHANGE AND 1:200 YR DROUGHT SCENARIO	LOW CLIMATE CHANGE AND 1:200 YR DROUGHT SCENARIO	HIGH CLIMATE CHANGE AND 1:200 YR DROUGHT SCENARIO
Northern Central Borehole 11	1.23	0.00	0.00	0.00	0.00
South Essex Well 2	3.64	2.71	3.45	3.45	3.49

Table 30: Groundwater sources with a reduction in DO due to 1:500-year drought and climate change scenarios (in Ml/d)

SOURCE	DO	DO WITH 1:500YR DROUGHT SCENARIO	DO WITH MEDIUM CLIMATE CHANGE AND 1:500YR DROUGHT SCENARIO	LOW CLIMATE CHANGE AND 1:500YR DROUGHT SCENARIO	HIGH CLIMATE CHANGE AND 1:500YR DROUGHT SCENARIO
Northern Central Borehole 11	1.23	0.00	0.00	0.00	0.00
South Essex Well 2	3.64	2.71	3.45	3.45	3.49

Table 31: WRMP WRZ total DO for 1 in 200-year with climate change DOs

SOURCE	1:200 DROUGHT	MEDIUM RECHARGE CC 1:200	LOW RECHARGE CC 1:200	HIGH RECHARGE CC 1:200
Essex	27.43	28.17	28.17	28.21
Blyth	14.68	14.68	14.68	14.68
Hartismere	8.65	8.65	8.65	8.65
Northern Central	22.26	22.26	22.26	22.26
Total DOs	**73.02**	**73.76**	**73.76**	**73.76**

Table 32: WRMP WRZ total DOs for 1 in 500-year with climate change

SOURCE	1:500 DROUGHT	MEDIUM RECHARGE CC 1:500	LOW RECHARGE CC 1:500	HIGH RECHARGE CC 1:500
Essex	27.43	28.17	28.17	28.21
Blyth	14.68	14.68	14.68	14.68
Hartismere	8.65	8.65	8.65	8.65
Northern Central	22.26	22.26	22.26	22.26
Total DOs	**73.02**	**73.76**	**73.76**	**73.76**

Table 33: WRMP WRZ total DO for 1:200 and 1:500-year with medium climate change pre and post 2030 EA licence caps

WRZ	MEDIUM CLIMATE CHANGE 1:200YR DROUGHT DO		MEDIUM CLIMATE CHANGE 1:500YR DROUGHT DO	
	PRE 2030	POST 2030 CAP	PRE 2030	POST 2030 CAP
Essex	28.17	13.26	28.17	13.26
Blyth	14.68	8.68	14.68	8.68
Hartismere	8.65	6.38	8.65	6.38
Northern Central	22.26	19.09	22.26	19.09
Totals	**73.76**	**47.41**	**73.76**	**47.41**

3.6. WATER TRANSFERS

3.6.1. Current Transfers

We currently have only very small transfers of potable water between ourselves and Anglian Water.

In the 1928 South East Waterworks Act we have an agreement to supply Anglian Water with an export of 3.05 Ml/d from seven locations of our Essex WRZ. In the last regulatory reporting year the export was 2.86 Ml/d. For planning purposes, we have included the export at the contractual rate of 3.05 Ml/d.

In Northern Central WRZ we have an export agreement with Anglian Water as well for two bulk supplies totalling 0.73Ml/d.

We also have a small transfer of potable water between ourselves and Anglian Water. Our contractual agreement is for 1 Ml/d import at Cressing, Essex, which has been included within our plans.

New appointments and variations (NAVs) are increasing within our area with a total of 19 either already in place or expected in the near future, served by a total of four appointees. The majority (95%) of NAV's are for new housing developments within specific areas. A bulk supply to the NAVs (the incumbent) is agreed based upon the size of the development (e.g., the number of houses on a site) and this agreed export is what is included within our plans. The total contractual export for all NAVs in our area is 8.68Ml/d.

Both the import and export are seen as secure in all circumstances and so no amendments to them are necessary under drought conditions.

3.6.2. Potential Future Transfers

Neither WRE's or our Best Value Plans include new transfers to other water companies or regions. At a regional level, this was agreed through the national reconciliation works.

3.7. OUTAGE ALLOWANCE

3.7.1. Overview

Outage is defined in the UK Water Industry Research (UKWIR) report Outage Allowances for Water Resource Planning (1995) as:

"A temporary loss of deployable output".

Outage events can be divided into planned outage and unplanned outage. The UKWIR report defines planned outage as:

"A foreseen and pre-planned outage resulting from a requirement to maintain source-works asset serviceability".

Unplanned outage is defined as:

"An outage caused by an unforeseen or unavoidable legitimate outage event affecting any part of the source-works and which occurs with sufficient regularity that the probability of occurrence and severity of effect may be predicted from previous events or perceived risk".

The recommended methodology described in the UKWIR report Outage Allowances for Water Resource Planning (1995) was used as the basis for calculating outage allowance for previous Water Resources Management Plan submissions. This guidance has not been superseded and so has been used again as the basis for assessing outage allowance for PR24. Although the UKWIR methodology provides a good basis for assessing the outage data, it leaves several areas open to interpretation. Therefore, several assumptions must be made, and the methodology adapted to the available data and the resulting modelling software output.

All planned outage is subject to our internal Co-ordination Planning process which determines the risk to meeting demand and whether planned works can proceed. As part of our coordination planning process, we will include checks on whether Level 1 and 2 drought actions have been implemented.

3.7.2. Data Collection And Calculation

To assess the level of actual outage at each WTW, the maximum daily treatment capacity and Distribution Input (DI) has been collated from our Water Supply team along with commentary on any constraints to WTW capacity when it is less than maximum design capacity.

Historic outages for each WRZ have been analysed, considering the following:

- Inclusion of all historic unplanned outage for full and partial events.
- Exclusion of historic planned outage where the reason for the outage is not to be repeated in the planning horizon.
- Inclusion of future planned outage where the outage is known and inflexible, for example due to multi-year capital projects.
- Longer-term unplanned outage events, for example permanent and instant loss of source or progressive increase in pollution, to be included in target headroom calculations.

There are residual deficits in the Essex WRZ under the Dry Year Critical Period (DYCP) Final Plan scenario, early in the planning horizon. Therefore, after liaison with the EA, we have removed historical Planned outage events from the assessment of outage allowance but maintained the use of the 90th percentile. We feel this reflects how we would manage the Essex system in a drought period, for which we are planning to, where we would delay planned outage. Our triggers to minimise, and then delay all planned outage, would be implementation of our Level 1 Appeal for Restraint and Level 2 Temporary Use Bans.

The occurrence and daily magnitude of outage in the historic record was calculated following the process illustrated in Figure 8.

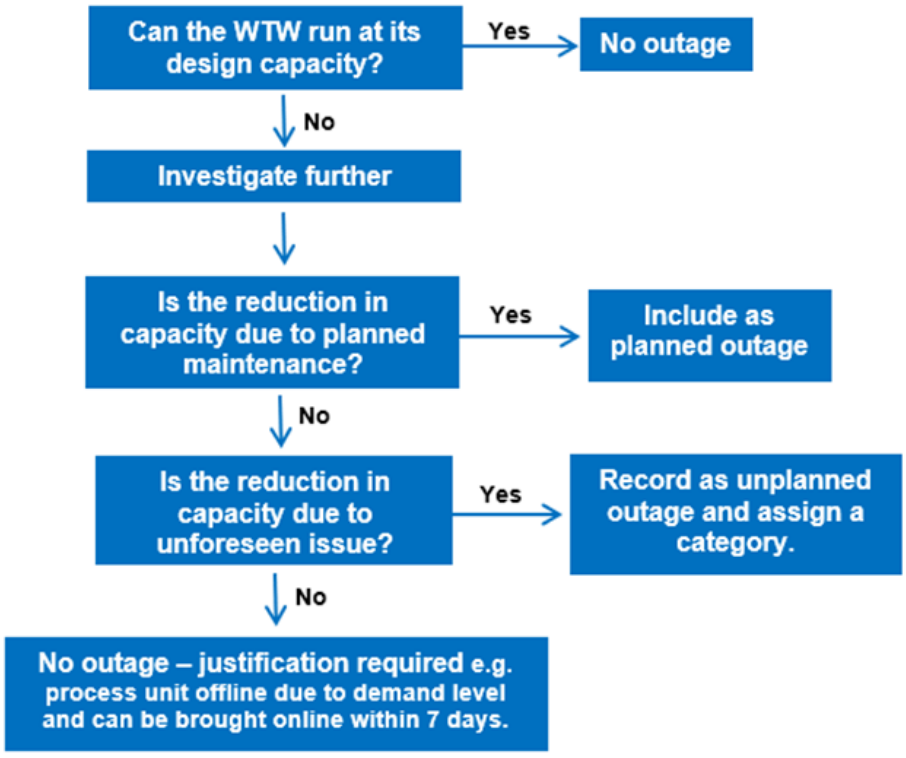


Figure 8: Outage allowance process

For WRMP19, the outage allowance was based on Monte Carlo simulations using a normal distribution to reflect the possible outages at each WTW. For WRMP24 this has been updated to a 'histogram approach' where actual outages for each WTW were used to create a discrete distribution, based on bins, for each WTW that was then ran through a Monte Carlo simulation.

Where outage allowance is calculated using WTW maximum design capacity, when combined for each WRZ, this is significantly greater than the 1 in 200-year and 1 in 500-year deployable output (DO) of the WRZ. Therefore, the following calculation is made to calculate the actual outage allowance to be used in the calculation of WAFU across the planning horizon. This allows for the assumption to be made that an amount of outage can occur before the 1 in 200-year and 1 in 500-year DO is impacted. If the full outage allowance was deducted from the drought DOs, it would be an over-estimation of the impact of outage.

Actual outage allowance = WRZ 1 in 200 or 500-year DO – (WRZ treatment capacity – total outage allowance)

This process is followed within the Essex supply area. For the three Suffolk areas, this buffer calculation is applied at an individual works level.

3.7.3. DYAA Outage Allowance

The results associated with the percentiles 0 to 100, in 5% increments were extracted from the Monte-Carlo simulations. These represent the total combined outage for each WRZ. The UKWIR report 'WRMP 2019 Methods – Risk Based Planning' states that, *"a planning allowance in the range 75% to 90% should be used".* We have chosen to use the figure associated with the 90th percentile giving an outage allowance for each WRZ for the following reasons:

- It is consistent with our previous WRMPs and with investment made to reduce unplanned outage, we are now out-turning in-line with our WRMP19 outage allowance.
- To use a percentile lower than 90th in AMP8 and AMP9, a step change in base capital maintenance would be required to further reduce unplanned outage.
- Broadly aligned with other WRE companies.

The results of the outage allowance calculation described above, using the figure associated with the 90th percentile, are shown in Table 34.

Table 34: DYAA outage allowances

WRZ	COMBINED MAXIMUM WTW CAPACITY (ML/D)	COMBINED 1 IN 200-YEAR DO (ML/D)	COMBINED 1 IN 500-YEAR DO (ML/D)	OUTAGE (ML/D) (90TH PERCENTILE)	OUTAGE ALLOWANCE (ML/D)	
					1 IN 200-YEAR	1 IN 500-YEAR
Essex	572	444	424	134.02	5.70	0.00
Blyth	18	16	16	0.68	0.68	0.68
Hartismere	14	11	11	0.04	0.04	0.04
Northern Central	72	71	71	8.83	8.83	8.83

N.B. The outage allowance is calculated at individual works level using the 1:500 / 1:200 buffer for each of the Suffolk zones. For Essex it is applied after the calculation of the outage value as a zonal calculation.

Combined Maximum Capacity (572.32) – Combined 1:200 year DO (444.00) = Buffer (128.32)

90% Outage Allowance (134.02) – Buffer (128.32) = Outage Allowance (5.70)

3.7.4. DYCP Outage Allowance

Our baseline (and final plan) supply forecast is based on a DYAA scenario, representing an 'average' year supply output that is available with a return period of 1 in 200 year or 1 in 500 years. The guidelines state the supply forecast should also be presented as a DYCP scenario for each WRZ where applicable, i.e., if there is a forecast deficit. DYCP is defined as the peak week, seven day rolling average of daily output.

Our assumption is that our full maximum WTWs capacities would be available during a critical period. We have excluded Planned outage events from our DYCP outage assessment for all WRZs, presuming that during a critical period, all planned outages would be delayed. This reflects how we would manage our assets in a critical period during a drought year, for which we are planning to. Our triggers to minimise, and then delay all planned outage, would be implementation of our Level 1 Appeal for Restraint and Level 2 Temporary Use Bans. Our DYCP outage allowances are shown in Table 35.

Table 35: DYCP outage allowances

WRZ	COMBINED MAXIMUM WTW CAPACITY (ML/D)	OUTAGE (ML/D) (90TH PERCENTILE)	DYCP OUTAGE ALLOWANCE (ML/D)
Essex	572	88.04	0.00
Blyth	18	0.48	0.48
Hartismere	14	0.04	0.04
Northern Central	72	7.58	7.58

3.7.5. Outage Reduction Schemes Assessment

An assessment was made for the outage reduction expected from the planned installation of nitrate removal plants at Langford, Langham and Barsham, and a UV plant at Langford to reduce the effect of Cryptosporidium.

The Monte Carlo analysis was rerun for these three works with all Nitrate events eliminated. In total, these new treatment streams identified a potential reduction to the Essex WRZ outage value by 3.70 Ml/day and the Northern Central WRZ outage value by 2.15 Ml/day.

Additional work was undertaken utilising four years of river quality data to attempt to determine the individual benefits at Langford where Nitrate removal and UV treatment for Cryptosporidium is planned. The initial prediction at Langford is that the Nitrate removal could reduce outage by 2.75 Ml/d and UV treatment could reduce outage by 0.2 Ml/d. At this stage these values should be treated as indicative only.

3.8. LOSSES FROM PROCESSING AND TREATMENT

In-line with EA (2021) supporting guidance, we have considered the following components as part of our determination of total raw water and treated water process losses:

Table 36: Components of raw and treated water process losses.

RAW WATER LOSSES:	Net loss from the resource system comprised of mains/aqueduct (pressure system) losses, open channel/low pressure system losses, and losses from break-pressure tanks and small reservoirs (NRA/UKWIR, 1995a).
RAW WATER OPERATIONAL USE:	Regular washing-out of mains due to sediment build up and poor quality of source water (NRA/UKWIR, 1995a).
TREATMENT WORKS LOSSES:	Made up of structural water loss and both continuous and intermittent over-flows (NRA/UKWIR, 1995a).
TREATMENT WORKS OPERATIONAL USE:	Treatment process water i.e., net loss that excludes water returned to source water (NRA/UKWIR, 1995a).

All treatment works losses and operational use at WTWs in the Essex WRZ is incorporated into our Essex WRZ Aquator® system model. There are losses accounted for at our East London groundwater fed WTWs at Stifford and Roding and the process loss at Langford WTWs. Process losses at all other WTWs are returned to source waters and are re-abstractable. Therefore, there are no losses required to be incorporated into the WAFU calculation in line 8BL as a reduction in DO.

The process losses for each of the Suffolk WRZs, as a percentage of total WRZ deployable output, are 3.7% for Blyth, 4.5% for Hartismere, and 11.8% for Northern Central.

The WRMP tables requires figures for raw water losses, treatment works losses and raw and treated water operational use to be entered in Ml/d. This requires a recalculation of the losses when the DO of sources changes across the planning horizon. This occurs when the DO of sources is reduced by:

- Sustainability reduction licence caps.
- Environmental Destination.

In each instance, if the DO of a source changes, and it impacts on the total process loss for the WRZ, the process loss in Ml/d has been recalculated for the WRZ and this revised figure entered in the applicable years of the planning horizon in the WRMP tables. The results of these calculations are presented in our WRMP24 Raw Water and Process Losses Technical Report.

We continue to invest to reduce out process losses. For example, between 2020 and 2025, we will have upgraded Barsham WTWs and replaced Rickinghall WTW in Suffolk, reducing future process losses. We have accounted for this in our calculations.

3.9. WATER AVAILABLE FOR USE

Future water supplies are forecast by calculating the Water Available for Use (WAFU). WAFU is calculated by quantifying the 1-500 DO of our raw water sources and treatment works within each water resource zone. Outage, process losses, sustainability reductions (e.g., where our abstraction licences has been reduced to ensure they are sustainable), and Environmental Destination reductions (BAU+) are then subtracted from DO to give WAFU. Water (raw and potable) imported and exported are then added/subtracted from the WAFU figure to give a Total WAFU value for the WRZ.

The WAFU values, across the planning horizon, for our WRZ's are summarised in Table 37.

Table 37: WAFU values per WRZ

ESSEX WRZ	2025/26	2030/31	2035/36	2040/41	2045/46
DO	428	428	428	428	428
Climate Change Impact	-17	-20	-23	-26	-29
Sustainability Reductions	0	-5	-5	-5	-5
Environmental Destination	0	0	0	-2	-2
Outage*	0	0	0	0	0
Process Losses	0	0	0	0	0
WAFU (own sources)	411.27	403.40	400.47	395.48	392.43
Water Imported**	1	1	1	1	1
Water Exported (incl. NAVs)	-29	-32	-11	-11	-11
Total WAFU	383.59	372.59	390.17	385.18	382.13

Blyth WRZ	2025/26	2030/31	2035/36	2040/41	2045/46
DO	14.6	14.6	14.6	14.6	14.6
Climate Change Impact	0	0	0	0	0
Sustainability Reductions	-1.92	-6.00	-6.00	-6.00	-6.00
Environmental Destination	0	0	0	-0.86	-1.72
Outage	-0.68	-0.68	-0.68	-0.68	-0.68
Process Losses	-0.54	-0.32	-0.32	-0.30	-0.27
WAFU (own sources)	11.54	7.68	7.68	6.84	6.01
Water Imported	2.27	1.39	1.39	1.32	1.32
Water Exported	-1.38	-1.38	-1.38	-1.38	-1.38
Total WAFU	12.43	7.69	7.69	6.78	5.95

Hartismere WRZ	2025/26	2030/31	2035/36	2040/41	2045/46
DO	8.65	8.65	8.65	8.65	8.65
Climate Change Impact	0	0	0	0	0
Sustainability Reductions	-2.27	-2.27	-2.27	-2.27	-2.27
Environmental Destination	0	0	0	-0.33	-0.65
Outage	-0.04	-0.04	-0.04	-0.04	-0.04
Process Losses	-0.30	-0.29	-0.29	-0.24	-0.20
WAFU (own sources)	6.04	6.04	6.04	6.04	6.04
Water Imported	2	1.46	1.46	1.09	0.73
Water Exported	-0.02	-0.02	-0.02	-0.02	-0.02
Total WAFU	8.02	7.49	7.49	6.84	6.20

Northern Central WRZ	2025/26	2030/31	2035/36	2040/41	2045/46
DO	77.25	77.25	77.25	77.25	77.25
Climate Change Impact	0	0	0	0	0
Sustainability Reductions	-0.80	-4.85	-6.85	-6.85	-6.85
Environmental Destination	0	0	0	-17.67	-35.35
Outage	-8.83	-8.83	-8.83	-8.83	-8.83
Process Losses	-8.75	-8.38	-8.23	-5.86	-3.49
WAFU (own sources)	58.87	55.19	53.34	38.04	22.73
Water Imported	1.35	1.35	1.35	1.35	1.35
Water Exported	-3.75	-3.20	-3.20	-2.40	-2.40
Total WAFU	56.47	53.34	51.49	36.99	21.68

*Outage under the 1 in 200 DYAA year scenario is 5.70 Ml/d. This is added as a positive number in 9.1FP.
**Chigwell WTW is now incorporated into our Essex WRZ system Aquator model, and so the bulk import of raw water is no longer added into line 2BL.

3.10. DRINKING WATER PROTECTED AREAS

Drinking Water Safety Plans and the risk assessments which inform them provide a means of identifying hazards and hazardous events that could arise in the catchment area, from the source up to the customer's tap. We have drinking water safety plans for all our existing supplies of water from source to tap. A Water Safety Plan risk assessment has been completed for all new supply options (See Appendix 1).

All new preferred plan assets (e.g., strategic mains, Water Reuse, new boreholes, new water treatment works) have been designed to be Drinking Water Inspectorate (DWI) compliant by using only DWI approved materials. Water from the new North Suffolk winter storage reservoir and from the Effluent Reuse schemes would be treated using spare treatment capacity at existing physio chemical water treatment works.

3.11. DRINKING WATER QUALITY

The regulatory framework for drinking water quality and sufficiency of supplies is established in the Water Industry Act 1991 and includes the following requirements.

- Section 86 which relates to the appointment and delegated powers of the Chief Inspector of Drinking Water. It includes reference to "such other powers and duties in relation to the quality and sufficiency of water supplied". This is particularly relevant to powers and duties relating to the protection of public health, and to resilience and contingency planning.
- Section 68 of the Act, the duty to supply wholesome water. This section states: "It shall be the duty of a water undertaker…so far as reasonably practicable, to ensure, in relation to each source or combination of sources from which water is so supplied, that there is, in general, No Deterioration in the quality of the water which is supplied from time to time from that source or combination of sources".

We have reviewed these duties in relation to existing transfers of water for supply (raw or treated).

Raw water quality data from samples collected at abstraction points over the 2012-2021 period has been processed to identify trends and forecast future threats to water quality. Where a deterioration has been identified and this is anticipated to be a water quality risk in the AMP8 or AMP9 period, appropriate interventions are being identified through our business planning process for PR24. This is in line with the Chief Inspector or Drinking Water Long term planning guidance (published July 2022, revised September 2022). As such we may propose two schemes at PR24, one to undertake catchment management activity to arrest deterioration in the long term but also to identify innovative solutions that are effective to mitigate any immediate risk. This is so that customers continue to receive a reliable and sufficient supply of water with no noticeable adverse change while the catchment solution delivers in the medium to longer term.

Deteriorating trends have been identified in the short term to medium term for the parameters of algae, Cryptosporidium, taste and odour compounds MIB and geosmin and nitrate. Options are being identified and costed to find optimal solutions that mitigate the risk of these water quality risks effectively.

The Water Reuse schemes in our preferred plan will use Reverse Osmosis technology and will essential removal all diffuse pollutants. The water will then be discharged into a receiving river or reservoir improving its quality. The North Suffolk reservoir will also act as bankside storage for our Waveney Water Treatment Works reducing outage caused by poor raw water quality.

3.12. ENVIRONMENTAL PERMITTING REGULATIONS

In 2023, government plans to move the abstraction and impoundment licensing regime into the Environmental Permitting Regulations which will lead to a more modern and consistent regulatory framework. Defra does not expect that this will impact water company licences. Likewise, we do not expect it to affect DO or WAFU.

3.13. INVASIVE NON-NATIVE SPECIES

Aquatic and riparian invasive non-native species (INNS) have significant adverse social, economic and environmental impacts. They can cause the ecological status of waterbodies to deteriorate or fail to achieve their ecological objectives. We have reviewed whether our current abstraction operations will risk spreading INNS or create pathways which increase the risk of spreading INNS.

Consideration of INNS within our WRMP24 is covered as part of our Integrated Environmental Assessment in section 9.

4. OUR BASELINE DEMAND FORECAST

For a detailed report on this section please refer to the **Demand Forecast technical report** which is available to download **here**.

4.1. OVERVIEW

A normal year baseline demand forecast has been produced following the Water Resources Planning Guidance (WRPG) for each of the water resource zones (WRZs) Essex, Blyth, Hartismere, Northern Central. The normal year demand forecast is the building block for the dry year and critical period forecasts and is adjusted to provide figures for two climate change scenarios.

The base building block for demand forecasting is the base year population served and the projected growth in population annually over the Water Resources Management Plan (WRMP). In line with the WRMP requirement, we have used Local Authority (LA) Plan housing growth evidence from all local authorities and have selected the Plan-based scenario as our central scenario. Forecasts have included assessments for household (HH) and non-household (NHH) water use, metering, changes in technology, weather patterns, climate change and the impact of Covid. These influences on demand enable us to make assumptions on future consumption. Our model is designed to produce these different outputs making all calculations and assumptions transparent.

Our demand forecasts are then segmented into measured and unmeasured HH and NHH consumption, leakage, miscellaneous use and exported water (including water use for New Appointments and Variations (NAVs)). They include assumptions and best estimates for areas such as savings associated with metering, customer behaviour changes, and the impact of Covid.

Forecasting the future of demand inherently includes uncertainty. For the long-term water demand forecasting we account for uncertainties including those from; population and housing growth, economic changes, behavioural changes, technological changes, NHH change in water use, weather, climate, government led interventions and private water supplies switching during drought conditions. To understand these uncertainties a suite of demand scenario forecasts has been built covering multiple metering, water efficiency, leakage and growth options.

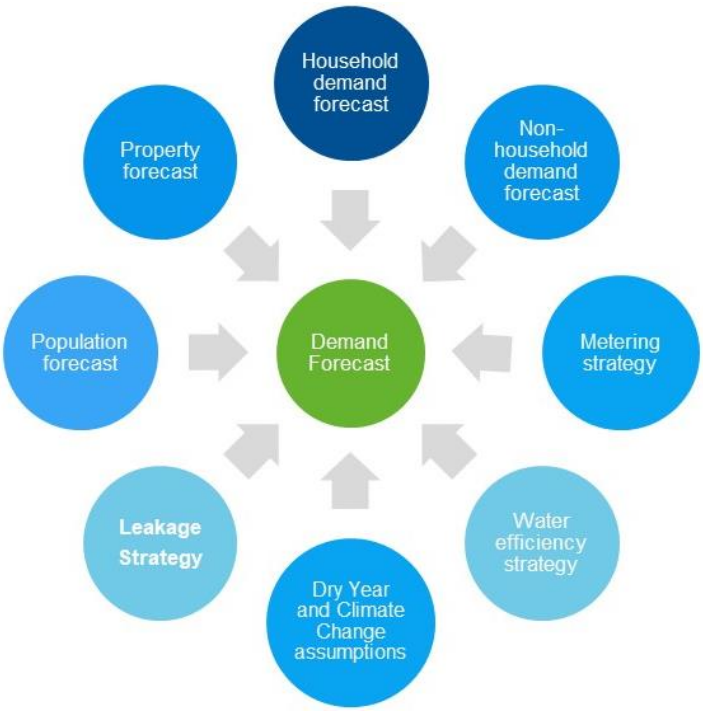


Figure 9: Inputs into a baseline demand forecast

4.2. OUR BASELINE DEMAND

Normal year forecasts have been made against a 2021/22 base year, which has been amended from the published Annual Regulatory report figures to incorporate the rebasing process for properties. This ensures a smooth projection from the base year into the forecast. The reported per capita consumption (PCC) for 2021/22 includes the impact of Covid.

The baseline demand forecast incorporates the following conditions:

- Customer demand without any further water efficiency or metering interventions from 2025/26 onwards
- Normal rates of optant, selective and meter replacements from 2025/26
- Leakage remains static from 2025/26
- Population and property growth forecast using LA Housing Planned growth medium scenario
- NHH growth forecast with service industries driven by LA Housing Planned growth and new large users requested volumes.
- The impact of climate change on customers' behaviour
- Government led interventions are not applied to household consumption
- New build properties PCC assumption of 115 l/hd/d

Baseline forecasts have been produced for the following conditions, Normal Year Annual Average (NYAA), Dry Year Annual Average (DYAA) and Dry Year Critical Period (DYCP).

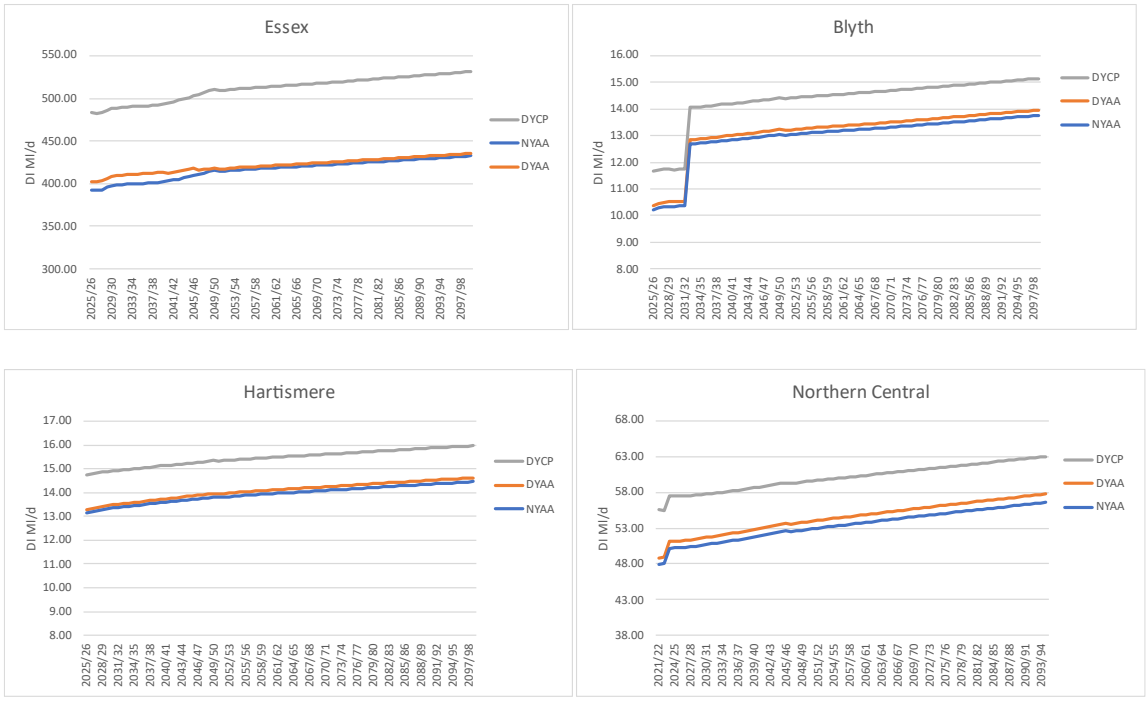


Figure 10: Baseline demand forecast distribution input (DI) for critical period (DYCP), dry year (DYAA) and normal year (NYAA) scenarios

4.3. FORECASTING OUR POPULATION, PROPERTIES AND OCCUPANCY

The foundation for demand forecasting is the base year population served and the projected growth of population across the planning horizon, this is a highly specialized fundamental part of the demand forecast, along with property growth. We commissioned specialist consultants Edge Analytics to prepare the population and property growth forecasts for each WRZ in line with best practice methodology following the requirements of the WRPG.

Edge Analytics has a particular expertise in demographic modelling and forecasting and use demographic datasets from Office for National Statistics (ONS), LAs and the latest Census (2021) in producing the population forecasts. Robust and timely data inputs are key to the forecasting process, including precise water company geographies; Local Plan evidence from all LAs; plus, historical and base-year demographic statistics.

4.3.1. Population Forecasting

The development of growth forecasts to inform Water Resources Management Plan 2024 (WRMP24) plans must be underpinned by evidence on Local Plan housing growth for those Local Planning Authorities (LPA) that overlap the WRZ geography. Water company geographies do not conform to the administrative areas for which population and other demographic statistics are typically available (e.g., district, ward, output area), so area-matching is a critical component of the forecasting framework.

Local Plan development process is often lengthy and complex, with each LPA at a different stage of plan development therefore Edge Analytics' Consilium database has been developed to enable the collection, processing, organisation and delivery of Local Plan evidence, for all LPAs across the UK (including National Parks and Development Corporations).

Edge Analytics' VICUS model combines all the data inputs within best practice forecasting methodologies to enable macro- and micro-level population and property growth scenarios to be derived for the regional group (WRE) and us, under a wide range of assumptions, for 71 scenario horizons that stretch to 2100. The forecasting framework integrates key housing-led scenarios, alongside complementary evidence produced by the ONS, the Greater London Authority (GLA) and the Welsh Government (WG).

Housing-Need, Housing-Requirement and Housing-Plan scenarios present the highest growth outcomes. At the lower end of the spectrum sit the Low ONS-18, Completions and Employment led scenarios.

Selected Scenarios

We have selected three scenarios from Edge Analytics VICUS model for a low, medium and high total population, household population and non-household population and property growth forecast. By selecting three scenarios this ensures we have adequately accounted for an uncertainty surrounding our central 'medium' scenario and allows any adaptive planning process to be achieved using a range of scenarios for population and property forecasting.

Medium: The central scenario of Housing Plan has been applied to the baseline forecast in line with WRMP guidelines. The Housing Plan scenario is a housing-led scenario, with population growth underpinned by each local authority's Local Plan housing growth trajectory. Following the final year of local authority data, projected housing growth in non-London areas returns to the ONS-14 & ONS-16 long-term annual growth average by 2050. For London Boroughs, housing growth returns to the GLA Central scenario long-term annual average by 2050.

Low: The ONS 18 Low P growth scenario has been selected for a low growth scenario. This is an ONS 2018-based Principal sub-national population projection (SNPP), using a five-year history (2013–2018) to derive local fertility and mortality assumptions and a low long-term UK net international migration assumption of +90k p.a. for the UK in total.

High: The Housing Need scenario has been selected for a high growth scenario. This is a Housing-led scenario, with population growth underpinned by the trajectory of housing growth associated with each local authority's Local Housing Need (LHN) or Objectively Assessed Housing Need (OAHN). Following the final year of data, projected housing growth returns to the ONS-18 long-term annual growth average by 2050.

Long Term Growth: A 'Principal' (P) long-term growth outlook is selected for the Housing Plan and ONS 18 Low scenarios, extending the scenario horizon to 2100. The principal long-term scenario incorporates the mortality and fertility assumptions of the ONS 2018-based National Population Projections (NPP) Principal scenario, plus its Principal net international migration assumption of +190k p.a. for the UK in total. It is the medium outlook of three long-term growth outlooks provided by Edge. The 'High' (H) long-term growth outlook has been selected for the Housing Need scenario. This incorporates the mortality and fertility assumptions of the ONS 2018-based NPP Principal scenario, plus a high net international migration assumption of +290k p.a. for the UK in total.

Additional sub-populations: Three migrant sub-populations are considered to sit outside the Census definition of 'usual resident' population, whilst potentially contributing to the water-using population within our geographical area of operation. These are short-term residents, irregular migrants and second homes populations. We have added both short-term residents and irregular migrants onto the total household population. In Suffolk WRZ's only have second addresses population been added.

Population forecast outputs

In all WRZ's overall population is forecast to increase. Low, medium and high scenario forecasts have been created to allow for changes in assumptions and uncertainty within the population forecasts. On average for Essex this has resulted in a 22% increase in total population to 2049/50 and for Suffolk a 13% increase.

Figure 11: The four above graphs show the total population for the three selected scenarios for each WRZ

4.3.2. Property Forecasting

Base year property figures are taken from our customer billing database. We have selected three scenarios from Edge Analytics suite of scenarios to give a low, medium and high property growth forecast. These scenarios are the same as the population scenarios.

The property forecasts include new properties (growth) from the Edge Analytics scenarios detailed above which has been updated to include data from the most recent Census 2021 and adjusted for projected annual disconnections and demolitions. These are based on the average disconnections and demolitions that have occurred over the last five years

and remain consistent over the forecast. Base year void property figures are taken from our customer billing database. The forecast number of household voids are a percentage of total household properties. We assume these percentages remain consistent through-out the planning horizon.

The number of properties is forecast to increase in all WRZ's. Low, medium and high scenario forecasts have been created to allow for changes in assumptions and uncertainty within the forecasts. On average for Essex this has resulted in a 29% increase over 25 years and for Suffolk a 21% increase in household properties.

We will continue to work closely with local planning authorities on property forecasts as follows:

- WRE demand group - meets monthly to facilitate ongoing discussions on demand forecasting in the region.
- East of England Local Authority Water Summit - provides a platform for water company, regional group and local authority working
- Local Planning Authority Liaison Officer - we are recruiting a team member of the team to facilitate closer working with local authorities.

We will provide an update on local authority liaison and demand forecasting in our WRMP Annual Review.

4.3.3. Occupancy Forecasting

An overall occupancy figure is determined by the Edge Analytics data through total population divided by the total number of billed households for a year to give the overall occupancy rate. However, an overall occupancy figure is at too high a level to be useful for each of the households directly. To ascertain what occupancy to assign to each household metering category[16] several occupancy data sources are used to ensure a best estimate for the base year.

We commissioned specialist consultants Ovarro DA Ltd (Ovarro) to forecast occupancy for the planning horizon by assigning the total household population between the various metering categories. The differences in occupancy between the metering categories are in general expected to reduce over time as properties change ownership and hence, for example, the bias towards low occupancy in optant properties is reduced.

The overall occupancy for all households steadily declines from 2.77 in 2021/22 down to 2.62 in 2049/50 in Essex (-5.6%) and 2.34 in 2020/21 down to 2.18 in 2049/50 in Suffolk (-6.9%).

4.4. FORECASTING OUR HOUSEHOLD CUSTOMER DEMAND

The household demand forecast has been developed by considering the population in the following five groups: Unmeasured customers, Existing metered customers, New Homes, Meter Optant customers and Selective / Compulsory metered customers. These groups have been chosen as their consumption characteristics are considered to be distinctly different.

A peer review of the household demand forecasts has been conducted by specialist consultants Crowder. This review has assured the micro-component forecasting method employed for household demand forecast follows the guidelines

[16] Measured (optant, new build, selective/compulsory, existing) and Unmeasured are the household meter type categories.

for WRMP. Amendments and recommendations following the peer review have been applied to the household demand forecasts.

In summary the baseline household consumption forecast is estimated to increase over the forecasting period which is predominantly driven by population and property growth. Measured consumption increases and unmeasured decreases due to the natural optant metering.

4.4.1. Unmeasured And Existing Metered Household Demand

A micro-component model provides the household consumption and PCC forecasts for unmeasured and existing metered households. Micro-components refer to the study of the smaller elements that make up a customer's water use, for example WC flushing, dishwashing, and garden watering, and are used to understand in greater detail the customer's water consumption.

It is important for us to understand the water use of our customers to be able to justify the current and forecasted household consumptions. To demonstrate we have understood our customer's use of water we survey a proportion of our customers on their household water use. For this WRMP we have conducted two surveys in April and October 2021 to ensure we fully understand the impact of Covid on changing behaviours and water use. In total we contacted 196,860 customers and received a total of 17,235 responses.

The results from these surveys give us ownership and frequency data for water using appliances, occupancy by meter household type and behaviours within the home and garden and these, combined with volume data (that of the market currently), allow us to calculate a litres per head per day consumption for measured and unmeasured households at a micro-component level of consumption.

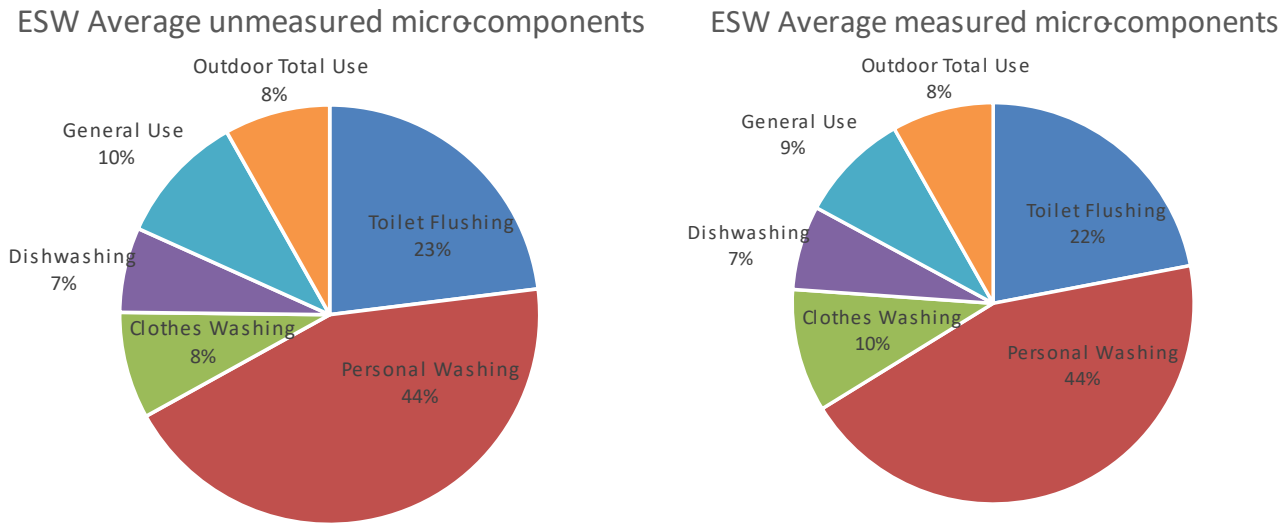


Figure 12: Average micro-component water uses for measured and unmeasured properties for the Essex & Suffolk Water

The results from the micro-components analysis are rebased to the actual measured and unmeasured per capita consumption (PCC) for the forecast base year (2021/22). The base year measured PCC comes from our billed volumes and the base year unmeasured PCC is calculated from our unmeasured consumption monitor.

The micro-components are then forecast using a well- established model based upon assumptions using market transformation analysis and the integration of behavioural change with scenarios to include government led interventions (water labelling) and also incorporating the impact of Covid on PCC. The start position and rate of change of the forecast is defined and applied to the duration of the planning horizon. For those components involving white goods, a range of manufactured models and their associated average volumes per use have been identified. Along with this are stated the assumed model lifespan and the dates when lower-volume technologies are expected to be introduced. There is a separate model for Essex and Suffolk.

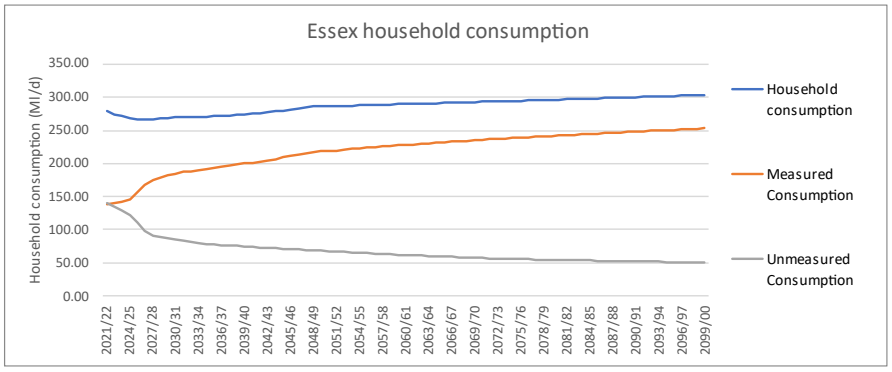
4.4.2. Measured Household Demand

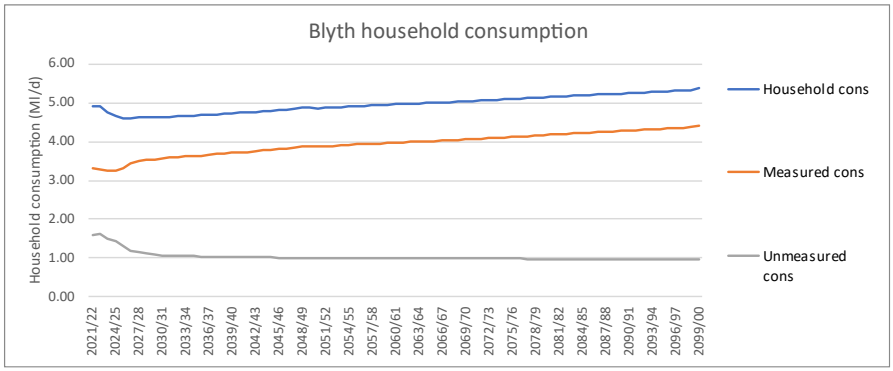
The micro-component model provides the PCC and household consumption for unmeasured and existing metered households. To determine the PCC and consumption for the remaining metered household types of optant, selective and compulsory an assumption (percentage saving) is applied to the unmeasured PCC. This saving is calculated from an analysis of the average consumption of these metered household types. New build households are assigned a PCC based upon the water efficiency standards in Part G of the Building Regulations as well as analysis of the current consumption we see from our new build properties and contact with Local Authorities' planning departments.

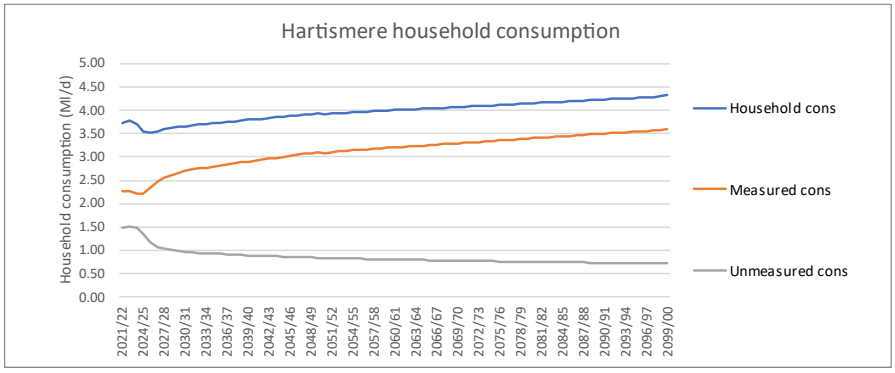
Smart metering is where a smart meter is installed by a water company to measure how much water a customer uses. The meter sends the water use data wirelessly to an in-home display as well as to the water company. Smart meters provide both the customer and water company with accurate and regular updates on how much water is being used and

when and eliminates the need for an on-site water meter read. Smart metering our water supplies is increasingly recognised as a crucial element in helping to manage water demand[17]. An additional saving on consumption can be attributed to the installation of a smart meter compared to a dumb meter.

[17] Waterwise and Arqiva (2021) Smart Metering and the Climate Emergency https://www.waterwise.org.uk/knowledge-base/smart-metering-and-the-climate-emergency-2021/







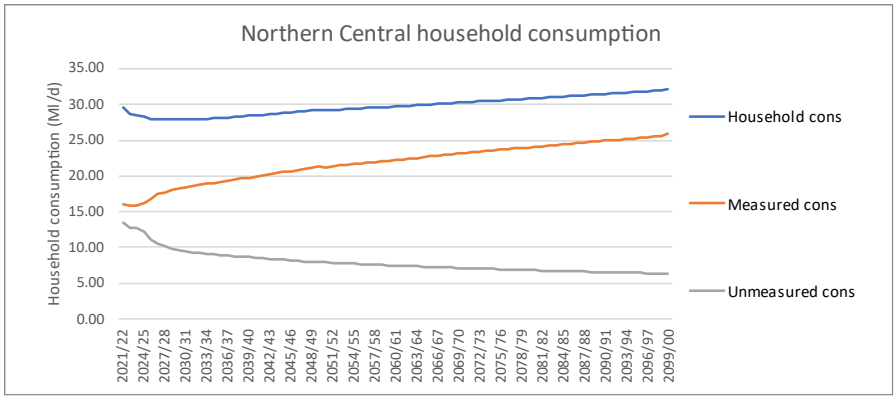
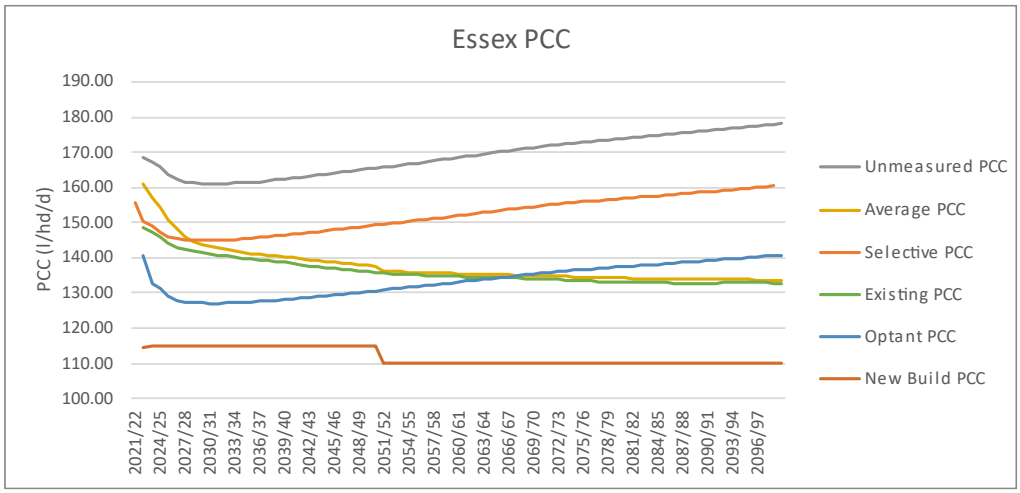


Figure 13: The above four graphs show household consumption, including the split between measured and unmeasured household consumption, for each WRZ

Using results from neighbouring water company's smart metering programmes and industry research, we have chosen an additional 3% saving for smart meters compared to dumb meters which relates specifically to behavioural changes in customers only and does not include plumbing loss or supply pipe leakage savings.

Meter under-registration (MUR) refers to the tendency for water meters installed to under record the amount of water passing through them. It is more prevalent in older, mechanical meters due to wear on internal components. This under-registration leads to an underestimation of consumption on metered properties. As a result, an estimation of under-registration is applied to the measured PCC to account for this. Water Resources Commission (WRc) has been running a collaborative program with a number of water companies, including ourselves, to provide annual updates of company specific MUR percentage values based on each participant's meter stock. For household customers MUR is 3.57% and non-household customers 4.09%. The resulting MUR is forecast to remain constant for the planning horizon.

The graphs that follow depict the changes in PCC for each meter household type over the forecast. Overall average PCC decreases over the planning horizon.



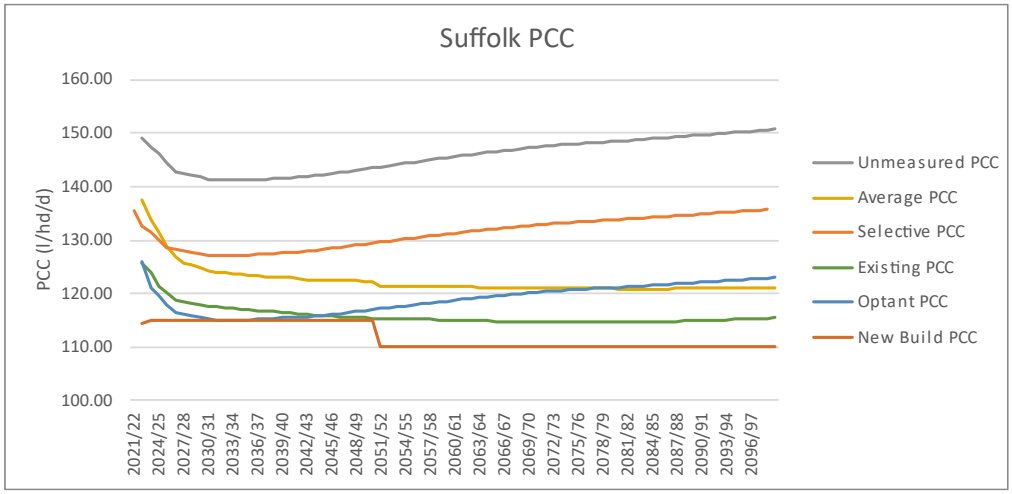


Figure 14: PCCs per meter household type for the planning horizon

4.4.3. Impact of Covid

The impact of the Covid-19 pandemic and the associated measures to reduce transmission continue to affect the activities of society and have had an unforeseen outcome within the water industry. The large impact on water consumption in homes and businesses as a result of restrictions and lockdowns, combined with the hot and dry weather of 2020 has resulted in some of the highest peaks in water demand we have ever seen.

The effect of the Covid-19 pandemic is expected to continue to affect PCC and demand in the short to medium term and could potentially cause permanent changes to demand and PCC. There are likely to be longer term impacts as a result of this pandemic such as working from home impacting the distribution and amount of water use during the day, increased hand washing and the staycation effect increasing tourism to areas.

We contributed to and collaborated with Artesia and the industry on a study into the impact of Covid-19[18]. As part of this study Artesia investigated the impact of Covid on demand at an individual company level and have estimated the continued impact of Covid-19 split by HH and NHH. Full lockdown conditions are predicted to produce the highest increase in consumption in HH's and the new normal is estimated to increase HH consumption by around 3%.

This modelled data from the Artesia study[19] shows that the PCC increase due to Covid is estimated to reduce to between 2-3% by 2025 compared to a 6-8% increase for 2021/22 (base year). These estimates give an idea of how consumption will vary for the remainder of the Asset Management Plan (AMP) regarding the effect of Covid-19 and have been applied to the micro-component PCC baseline demand forecasts.

4.5. FORECASTING OUR NON-HOUSEHOLD CUSTOMER DEMAND

NHHs refer to those premises where the primary use is for non-domestic purposes and can also be referred to as business customers. They also include the population living in communal establishments (for example care homes, hospices, prisons etc.)

In April 2017 there was a major change to the water industry with the creation of the non-household water retail market. Since then, our primary 'customers' for non-household market are the retailers who then in turn bill the end user or non-household customer. For simplicity where we use the term 'customer' will still refer to the end user rather than the retail companies.

All eligible business customers and public sector, charitable and not-for-profit organisations are able to choose their water supplier (retailer). However, as the incumbent water supplier, we are still responsible for delivering the water to the customer and have continued to plan for non-household customer demand in our area. We have ensured there is no double counting in our plan between this forecast and any bulk supply to an incumbent.

To understand our current and future NHH demand we began by analysing our current NHH demand at an industry sector level. We also contacted all Local Authorities located within our operating areas to request information they held

[18] Artesia Consulting (2020) Collaborative Study - The impact of COVID-19 on water consumption
[19] Artesia Consulting (2020) Collaborative Study - The impact of COVID-19 on water consumption

on new NHH developments and growth. In addition, we also contacted all our large users20 requesting the provision of expected changes to demand in the short and medium term. Our aim is to continue these conversations with Local Authorities, retailers and large users throughout the WRMP24 process and then into the planning horizon to ensure we have a timely awareness of local hot spots for NHH development.

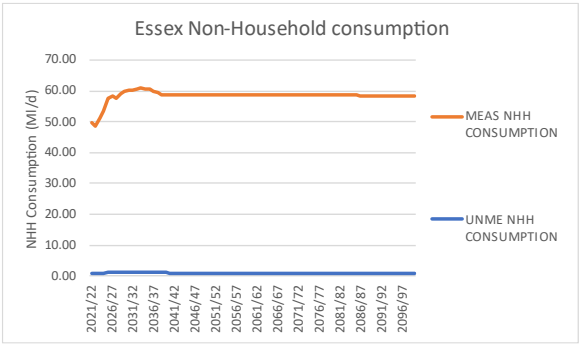
Specialist consultant Ovarro DA Ltd (Ovarro) were employed to provide a non-household demand forecast for each water resource zone using the Local Authority and Large User data we provided, together with our non-household consumption data from the last five years and our population and property forecasts. In addition to the data we provided, Ovarro used employment and Gross Value Added (GVA) ONS data along with large scale commercial project search data to create the demand forecasts. Ovarro used the consumption data for each WRZ, and this was split into three segments in order to analyse underlying trends in different industry sectors. Large known new demands likely to start in the next few years, such as the construction and operation of power generation plants have also been applied on top of the base forecast derived from historical consumption.

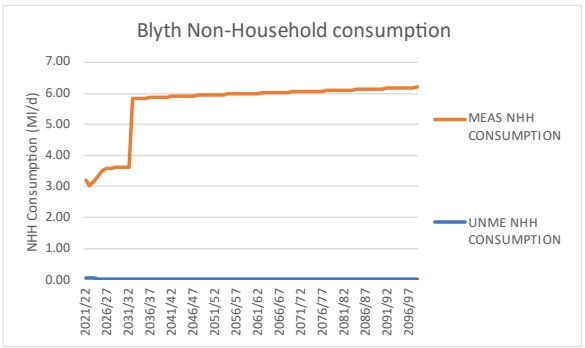
The impact of Covid on non-household demand was applied to the forecast using the model from the Artesia (2020) study[21] and sees non-household demand returning to pre-Covid levels by 2024/25.

The resulting forecast is considered the most appropriate central estimate of forward consumption for non-households to 2100. By adjusting the population and employment forecasts, along with large user requested level of consumption, additional scenarios were created to give a low demand and high demand scenario for non-household demand.

The Final Plan option for non-household demand sees measured new non-household large users demand delayed until the year 2032/33 in our Suffolk WRZ's only. This is due to the delay in supply available to these WRZ's.

The NHH demand forecasts produced by Ovarro DA Ltd have been fed into the regional plans. Ovarro DA Ltd also produced the NHH demand forecasts for other water companies within the regional group and this ensured methodologies aligned between companies and forecasts reflect the output of regional plans.





[20] A large user is defined as a premise using greater than 20,000 cubic meters per year.
[21] Artesia Consulting (2020) Collaborative Study - The impact of COVID-19 on water consumption

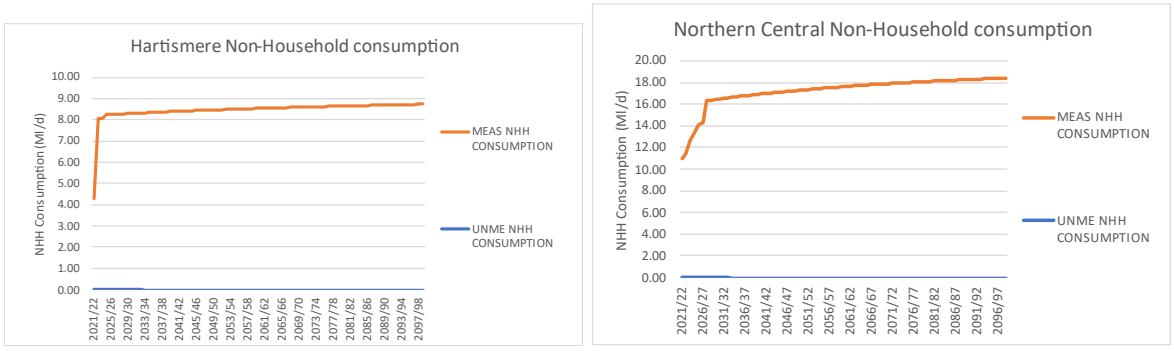


Figure 15: Non-household consumption baseline forecast split between measured and unmeasured per WRZ.

4.6. FORECASTING DEMAND FOR NEW APPOINTMENTS AND VARIATIONS

NAVs are limited companies which provide a water service to customers in an area which was previously provided by us, the incumbent monopoly provider. NAVs are increasing within our supply area with a total of 19 either already in place or expected in the near future in the Essex and Suffolk Water (ESW) area and the majority (95%) of NAV's are for new housing developments within specific areas. We have contacted all appointees in Autumn 2022 requesting their WRMP or relevant data regarding the NAVs they serve. This data have been used to create a demand forecast for each NAV, including a population and property forecast.

We have matched each NAV against their local plan, and those included in Edge Analytics data have then been excluded from our population and property forecast numbers. Our NAV demand forecast includes forecast growth from existing NAV sites. We have not included any growth assumptions regarding new NAVs which we are currently not aware of. Therefore, we have included all new household growth in our overall demand forecasts.

A bulk supply to the NAVs (the incumbent) is agreed based upon the size of the development (e.g., the number of houses on a site). This water is an export and therefore sits outside the household and non-household demand forecasts.

4.7. FORECASTING OUR LEAKAGE

We have conducted research into quantifying supply pipe leakage (SPL) to better understand this area of total leakage. Our base year total leakage is taken from the current reported actual leakage from our company water balance for the base year following the consistent reporting performance measures[22]. In line with the WRPG total leakage, including supply pipe leakage, is forecast to remain constant from for the planning horizon for our baseline forecast. The total leakage results for the base year are shown in Table 38.

[22] UKWIR (2017) Consistency in reporting performance measures

Please refer to Section 7.2.2 for discussion on all options for further leakage control that have been assessed.

Table 38: Total leakage 2021/22

WATER RESOURCE ZONE	TOTAL LEAKAGE 2021/22 (ML/D)	TOTAL LEAKAGE 2024-2050 (ML/D)
Essex	53.34	48.72
Blyth	1.93	1.54
Hartismere	1.32	0.75
Northern Central	2.71	2.78

4.8. FORECASTING OUR METERING

Our current strategy in both Essex and Suffolk areas is to install meters on customer optants and high-water users. In 1990 it became compulsory for all new homes to be fitted with a water meter.

Optant metering is where a customer requests a meter from the company and, assuming the meter can be installed at reasonable cost, the company is required to install a meter free of charge. The customer then pays for their water and sewage on a measured basis.

All water companies in England and Wales have powers to meter domestic properties that are deemed large water users. A high-water user mainly refers to customers who want to use a garden sprinkler, or similar non-handheld watering device, or properties where potable water is used to fill a swimming pool or large pond. This selective metering remains at very low totals (<6 p.a.) for the planning horizon.

For Water Resources Management Plan 2019 (WRMP19) in Essex we introduced 'Whole Area Metering' (WAM) which is the name given to a programme of installing meters in existing empty meter chambers, however, the customer will continue to pay on an unmeasured basis, but over a two-year period will be sent a dual water bill showing what they would have paid had they opted for a meter. This program is predicted to increase the natural optant rate, and therefore the total optants within the Essex area.

In Essex by the end of 2024/25 meter penetration is estimated to be 68.51% of domestic properties for our baseline forecast. By the end of the planning horizon (2100) the baseline meter penetration is forecast to be 89.79%.

In Suffolk by the end of 2024/25 meter penetration is estimated to be 73.10% of domestic properties for our baseline forecast. By the end of the planning horizon the baseline meter penetration is forecast to be 86.72%.

The baseline figures for measured (metered) and unmeasured (un-metered) customers have been derived from our water-balance data and the metering team. In line with the WRPG, customer metering is forecast with no further metering intervention from 2025. Table 39 and Table 40 present the annual baseline meter installs expected for optants through natural optant rates. The high optant rates in Essex in the first year of the plan relate to the optants from those meters installed through WAM in the last year of AMP7 (2024/25). The low number of installs in Suffolk reflect the natural optant rates expected in these smaller resource zones and the higher meter penetration already seen in Suffolk. The rate of

optant installs naturally decreases as more and more properties become metered over the planning horizon. 100% meters installed from 2025 onwards will be smart meters.

Please refer to 7.2.2 for discussion on all options for further metering interventions that have been assessed.

Table 39: Meter optant installations

OPTANTS	METER INSTALLED 2022-2024/25	METER INSTALLED AMP8	METER INSTALLED AMP9	METER INSTALLED AMP10
Essex	25,356	85,470	11,000	2,755
Blyth	297	1203	92	39
Hartismere	398	981	57	25
Northern Central	1600	6746	499	212

4.9. OTHER COMPONENTS OF OUR DEMAND

Operational and unbilled use continue to be assessed by the work carried out as part of annual regulatory reporting. The annual reported figure for operational use covers volumes used for treatment works' use, service reservoir and tower cleaning, third-party bursts, flushing, new mains and rehabilitation. The figure has been applied to the base year of the demand forecast and remains constant for the planning horizon. The annual reported figure for unbilled use includes both legally and illegally unbilled. The base year figure is the average of the last two reporting years and remains constant for the planning horizon. There are also some additional potable bulk supplies (both imports and exports) to the NAV demand that are included in the demand forecast and remain constant for the planning horizon.

Table 40: Other components of demand

OTHER COMPONENTS OF DEMAND	ESW ML/D
Operational Use	3.26
Unbilled Use	9.62
Bulk Supplies (excl. NAVs) (net export, including imports)	2.78

4.10. OUR DRY YEAR AND CRITICAL PERIOD UPLIFT

Demand should be forecast under a dry year scenario reassuring our customers that the actions we will take under a dry year scenario will meet their level of service. Our dry years have been selected using historic weather data and demand data that have been examined to identify conditions of a dry year. To estimate the dry year factor we have taken the difference between the household measured and unmeasured PCCs of the most recently determined dry year (2018) and the surrounding normal years (2016/17) and (2017/18) to that dry year. The Dry Year Annual Average is calculated by applying the dry year factor percentage increase to measured and unmeasured household PCCs for the forecast, therefore giving an increase from normal year to dry year. The dry year factor remains the same for the planning horizon.

We have included a critical period (CP) planning scenario within our demand forecast to account for a period of peak strain on our system as a result of high demand. For example, high demand because of; prolonged dry weather, high seasonal demand from holidaymakers, heatwaves and winter leakage. To ascertain the uplift to demand due to a CP we have followed the methodology from the UK Water Industry Research (UKWIR) Peak demand forecasting report[23] and the Artesia Water demand insights report[24]. We have calculated separate CP factors for unmeasured and measured households and non-households.

The critical period dry year is calculated by applying the critical period factor percentage increase to measured and unmeasured household consumption and where applicable the NHH demand for the forecast, therefore giving an increase to critical period. The critical period factor remains the same for the planning horizon. See graphs in Section 0 to see the difference in DI for a Dry Year and Critical Period scenario.

For a detailed report on this section, please refer to the Lessons Learnt from 2022 Drought Technical report which is available to download **here**.

4.11. IMPACTS OF CLIMATE CHANGE ON OUR DEMAND

The UKWIR 'Impact of Climate Change on Water Demand[25]' results have been used to calculate forecasts of climate change impacts on household water demand. This UKWIR project used statistical analysis on five case studies looking at household and micro-component water consumption and non-household water consumption. The weather- demand relationships developed from the case studies were used in combination with UK Climate Projections 2009 (UKCP09) climate projections to derive algorithms for calculating estimates of the impact of climate change of household water demand for each UK region in the format of look-up tables. These look-up tables present the estimated future impacts of climate change on household demand for any river basin between the years 2012-2040 and for a range of percentiles to reflect the uncertainty of the UKCP09 climate projections[26].

For the most-likely effects of climate change the 50th percentile has been chosen (a one in two chance of occurrence). To determine the least likely (maximum) effect of climate change of demand the 90th percentile was selected (a one in ten chance of occurrence). The look-up table values give the percentage change in demand between 2012 and 2040. As these look-up tables were not updated for WRMP24, the projections were extended along the same trajectory until 2100 to cover the demand forecasting horizon.

The UKWIR (2013) report employed the UKCP09 climate projections. Since the publication of this report a new set of climate projections has been released as part of UK Climate Projections 2018 (UKCP18). We contracted Hydrology UK to determine a method of applying a factor to the current look-up table results that would effectively incorporate the updated results from UKCP18. These factors where then applied to the UKCP09 annual demand projections under the average annual demand scenario.

[23] UKWIR (2006) Peak Demand Forecasting Methodology report 06/WR/01/7.
[24] Artesia Consulting (2020) Water demand insights from 2018.
[25] UKWIR (2013) Impact of Climate Change on Water Demand
[26] UKCPO9 data will be updated to UKCP18 data for our revised draft.

The report stated that household demand is the only component of demand affected by climate change. Non-household demand is not expected to be affected by climate change. The report also stated that it would be reasonable to assume that all additional water consumption in hotter or drier weather is for outdoor water uses.

Figure 16 shows the climate change impact to distribution input on a normal year annual average forecast.

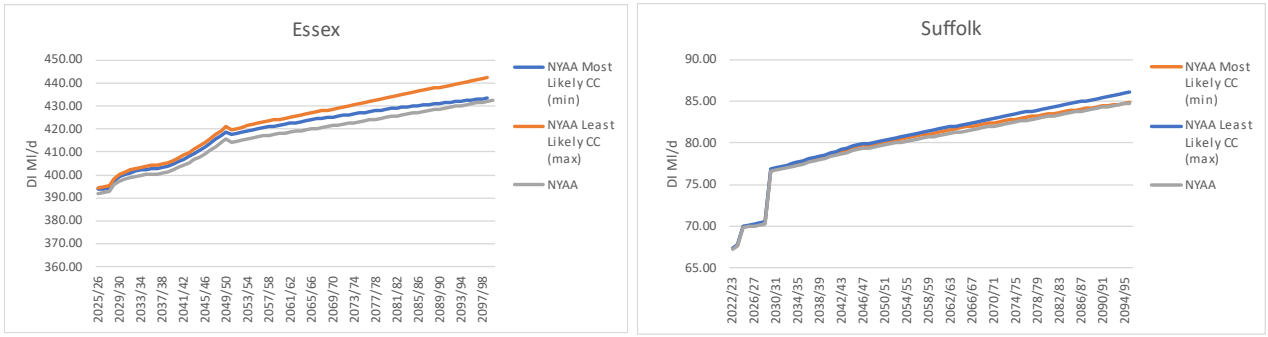


Figure 16: Difference between most likely and least likely climate change scenarios compared to normal year DI

5. ALLOWING FOR UNCERTAINTY

5.1. OVERVIEW

For our Water Resources Management Plan 2024 (WRMP24) submission, we have calculated the supply-demand balance (SDB) for each of our water resource zones (WRZs) over the next 75 years from 2025 to 2100 with a focus on the next 25 years from 2025 to 2050. There are a range of factors leading to uncertainty in our supply and demand forecasts. These include accuracy of meters measuring abstractions and distribution input, variation in our future demand forecasts, uncertainty in the future impacts of climate change, risks of future pollution impacts on supply availability, and risks of changes to our abstraction licences for sustainability or other reasons (see Table 41 below).

To allow for these factors, at an appropriate level of risk, we have followed industry standard practice by including a margin between supply and demand to allow for potential variations due to uncertainty. This margin is known as 'headroom', and we have calculated appropriate values of headroom for each planning scenario considered in WRMP24. The headroom value determined for each year across the planning horizon is termed the target headroom allowance. Our approach to the target headroom assessment, as outlined below, is in accordance with statutory guidelines.

5.2. TARGET HEADROOM METHODOLOGY

The aim of calculating a target headroom allowance is to provide a reasonable margin to cover the statistically combined impact of all the relevant uncertainty factors on the supply-demand balance, at a defined level of risk. The target headroom assessment is based on the methodology as outlined in 'An Improved Methodology for Assessing Headroom' (UKWIR, 2002) and referred to by the Environment Agency (EA) in their latest 'Water Resources Planning Guideline' (December 2021). Table 41 lists all uncertainty factors included within the original UK Water Industry Research (UKWIR) methodology; note however that some of these factors are excluded from the current assessment, for the reasons outlined below:

- Factors S1, S2 and S3: these are excluded in line with the 2021 EA guidance that water companies should not include any uncertainty allowance for these factors, and should incorporate future sustainability changes to abstractions within the supply-demand balance;
- Factor S7: this factor is no longer included in the headroom methodology, as it is considered to be an outage issue, but it is listed in Table 41 for completeness; and
- Factor D4: this factor relates to demand options selected for the final planning supply-demand balance and has been excluded from the baseline target headroom assessment; uncertainties surrounding selected demand options have been considered through the adaptive planning approach for the 2024 Water Resources Management Plan.

Table 41: Summary of supply-demand balance uncertainty factors

FACTOR	NAME	DESCRIPTION
S1	Vulnerable Surface water licences	Risk of future loss of deployable output (DO) due to sustainability changes to surface water abstraction licences for environmental reasons
S2	Vulnerable Groundwater licences	Risk of future loss of DO due to sustainability changes to groundwater abstraction licences for environmental reasons
S3	Time Limited Licences	Risk of future loss of deployable output due to non-renewal of time limited abstraction licences
S4	Bulk Imports	Risk of future loss of DO due to changes in bulk supply agreements (imports only)
S5	Gradual Pollution	Risk of future loss of DO due to pollution and/or water quality issues which cannot be mitigated or recovered
S6	Accuracy of Supply-Side Data	Uncertainty surrounding the accuracy of supply side data e.g., percentage accuracy of abstraction meters
S7	Single Source Dominance	(This factor is no longer used in the headroom methodology)
S8	Impact of Climate Change on Deployable output	Uncertainty surrounding the future impact of climate change on DO (varying estimates of loss depending on scenario)
S9	New Sources	Uncertainty surrounding the available yield of major new resource developments included in the final planning supply-demand balance
D1	Accuracy of Sub-component Demand Data	Uncertainty surrounding the accuracy of demand side data i.e., percentage accuracy of distribution input meters (generally located at service reservoirs)
D2	Demand Forecast Variation	Uncertainty surrounding future demand forecasts which may be higher or lower than assumed in the baseline supply-demand balance
D3	Impact of Climate Change on Demand	Risk of future increases in demand due to climate change impacts (varying estimates of demand effects depending on scenario)
D4	Demand Management Measures	Uncertainty surrounding the impact on future demand of demand management measures including leakage reduction, metering strategy and water efficiency activities.

The method involves defining suitable probability distributions for each relevant uncertainty factor, based on available data and appropriate assumptions as agreed through liaison between our Water Resources department and operational staff. These individual probability distributions are then statistically combined, using a standard technique called Monte Carlo simulation, into an overall headroom distribution for each resource zone and for each planning year. A profile of target headroom allowance can then be determined from these combined distributions at the required level of risk (e.g., for a 5% risk, the 95% headroom value would be taken).

The outputs of the Monte Carlo simulation are used to determine profiles of target headroom at selected probabilities. The UKWIR methodology (2002) and EA do not specify the level of risk which should be adopted, although the EA Water Resources Planning Guideline (December 2021) does state that regulators expect water companies to accept a higher level of risk in the later years of the planning period, as there is more time to address and plan for potential risks further into the future. For the WRMP24, our demand forecasts are relatively high, as they are based on Local Authority

plan projections, and so reductions in headroom are expected compared to previous plans. Additionally, regulatory feedback has indicated that water companies should take account of the fact that some of the key uncertainties within the supply-demand balance will be addressed through adaptive planning for this cycle of Water Resources Management Plans.

In accordance with the above, we have selected tapered probability profiles for each resource zone. The level of risk has been determined through industry benchmarking, collaborative working with other water companies and our own assessment of appropriate risk levels for each WRZ, relating to the characteristics and level of resilience to uncertainty of each individual zone.

Table 42 summarises the headroom risk profile adopted for each of our four resource zones and the main reasons for the selection in each case.

Table 42: Summary of selected headroom profiles by resource zone

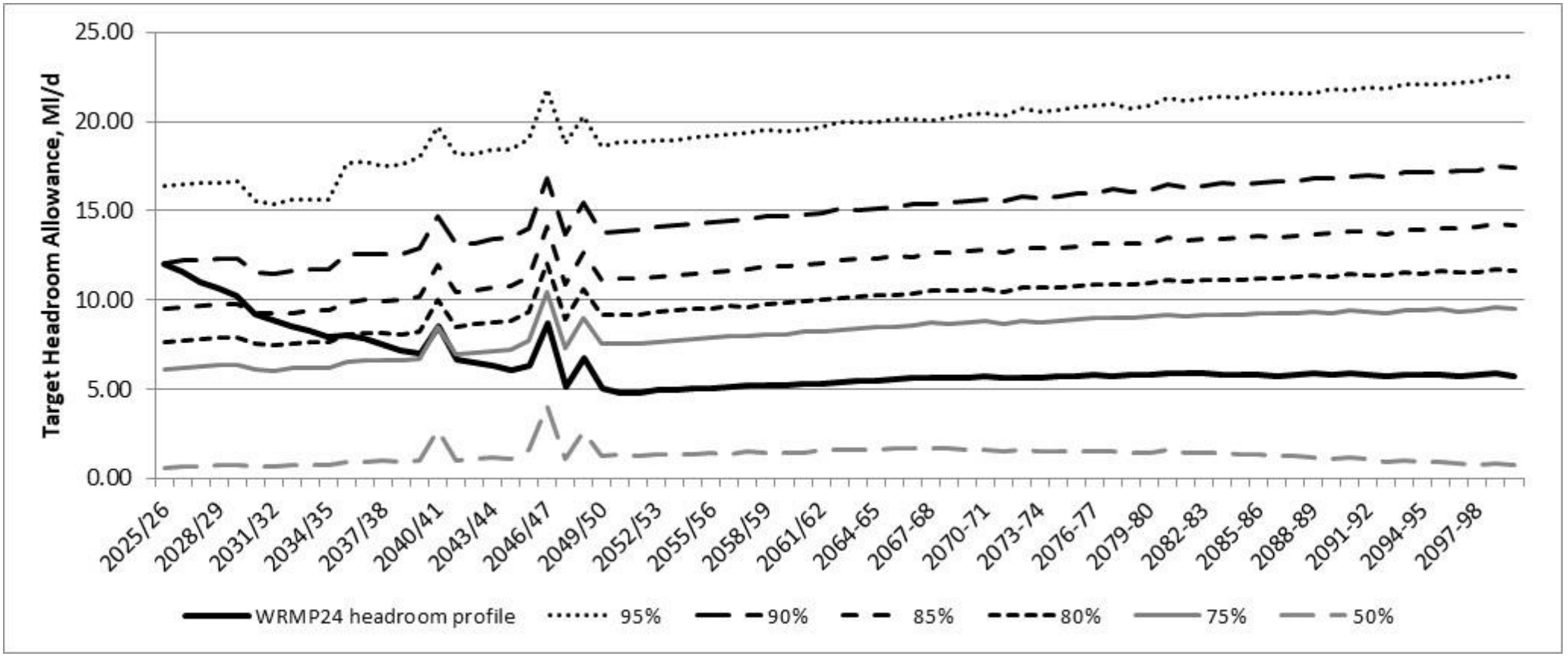
RESOURCE ZONE	HEADROOM PROFILE ADOPTED	MAIN REASONS FOR SELECTION
Essex	Medium resilience: 90% initially, reducing by 5% in each 5-year period to 2050 then remaining at 65%	The resource zone has a good degree of interconnectivity and flexibility in supply. From 2025 the Abberton raw water pipeline will provide us with an integrated raw water network in which Abberton Reservoir (2-year storage) will be combined with Hanningfield Reservoir (1-year storage) to provide overall storage of more than one year. The treated water network is also very well integrated compared to many other resource zones in the UK.
Suffolk Blyth	Medium resilience: 90% initially, reducing by 5% in each five-year period to 2050 then remaining at 65%	Estimated that there is no climate change impact on deployable output, however licence capping/sustainability reductions/Water Industry National Environment Programme (WINEP) outcomes driving uncertainty.
Suffolk Hartismere	Low resilience: 95% initially (2025), reducing by 5% in each ten-year period to 2045 then remaining at 85%	Some climate change impact and licence capping and licence capping/ sustainability reductions/WINEP outcomes driving uncertainty. Historically vulnerable to drought (1995-1997), although improvements have been implemented since that period (network improvements and new groundwater sources).
Suffolk Northern Central	Medium resilience: 90% initially, reducing by 5% in each five-year period to 2050 then remaining at 65%	Some climate change impact and licence capping and licence capping/ sustainability reductions /WINEP outcomes driving uncertainty.

5.3. TARGET HEADROOM RESULTS

The combined headroom distribution for our four WRZs is summarised in tabular form (at five yearly intervals) and graphs (for selected percentiles) for each resource zone. The baseline Dry Year Annual Average (DYAA) target headroom profile, at the selected annual level of risk, is highlighted on each table and graph.

Table 43: Headroom distribution for Essex Water Resource Zone - baseline Dry Year Annual Average scenario

Confidence level	2025/26 Ml/d	2030/31 Ml/d	2035/36 Ml/d	2040/41 Ml/d	2045/46 Ml/d	2050/51 Ml/d	2055/56 Ml/d	2060/61 Ml/d	2065/66 Ml/d	2070/71 Ml/d	2075/76 Ml/d	2080/81 Ml/d	2085/86 Ml/d	2090/91 Ml/d	2095/96 Ml/d	2099/100 Ml/d
0%	-34.77	-31.36	-32.28	-35.06	-34.82	-33.33	-36.65	-36.15	-35.28	-39.51	-37.32	-41.85	-42.49	-44.58	-42.76	-44.72
5%	-11.49	-11.67	-11.74	-10.34	-12.56	-13.14	-13.64	-14.11	-14.63	-15.38	-16.08	-16.82	-17.81	-18.71	-19.80	-20.55
10%	-8.88	-8.95	-8.99	-7.57	-9.47	-10.05	-10.40	-10.76	-11.14	-11.71	-12.39	-12.81	-13.82	-14.64	-15.54	-16.18
15%	-7.10	-7.14	-7.14	-5.59	-7.39	-7.91	-8.21	-8.46	-8.73	-9.22	-9.72	-10.14	-10.94	-11.75	-12.44	-13.14
20%	-5.68	-5.70	-5.65	-4.04	-5.69	-6.16	-6.43	-6.60	-6.80	-7.17	-7.61	-7.97	-8.66	-9.38	-9.96	-10.55
25%	-4.46	-4.46	-4.40	-2.73	-4.28	-4.70	-4.88	-5.03	-5.12	-5.45	-5.80	-6.12	-6.60	-7.34	-7.74	-8.35
30%	-3.34	-3.34	-3.25	-1.52	-2.99	-3.39	-3.51	-3.60	-3.62	-3.88	-4.19	-4.41	-4.85	-5.43	-5.84	-6.33
35%	-2.30	-2.28	-2.14	-0.41	-1.81	-2.15	-2.20	-2.28	-2.24	-2.43	-2.65	-2.80	-3.24	-3.65	-4.03	-4.44
40%	-1.34	-1.27	-1.12	0.66	-0.64	-0.96	-0.98	-0.98	-0.89	-1.08	-1.23	-1.28	-1.70	-1.99	-2.31	-2.64
45%	-0.38	-0.30	-0.07	1.70	0.49	0.21	0.22	0.26	0.38	0.27	0.17	0.18	-0.17	-0.38	-0.71	-0.91
50%	0.60	0.68	0.93	2.75	1.60	1.34	1.41	1.47	1.66	1.61	1.55	1.60	1.32	1.15	0.93	0.73
55%	1.58	1.65	1.92	3.78	2.71	2.47	2.58	2.72	2.92	2.96	2.93	3.03	2.79	2.69	2.53	2.37
60%	2.59	2.68	2.96	4.85	3.85	3.62	3.78	3.98	4.21	4.28	4.33	4.41	4.27	4.27	4.18	4.06
65%	3.65	3.74	4.07	5.97	5.06	4.82	5.04	5.30	5.54	5.70	5.76	5.93	5.83	5.88	5.83	5.74
70%	4.82	4.83	5.24	7.17	6.35	6.12	6.38	6.69	6.97	7.18	7.30	7.50	7.47	7.60	7.57	7.57
75%	6.13	6.07	6.55	8.50	7.75	7.55	7.89	8.22	8.51	8.80	8.95	9.20	9.23	9.46	9.52	9.51
80%	7.62	7.52	8.04	10.05	9.33	9.18	9.55	9.92	10.30	10.64	10.83	11.16	11.24	11.48	11.62	11.62
85%	9.48	9.23	9.89	11.97	11.31	11.17	11.57	12.01	12.45	12.81	12.99	13.48	13.58	13.83	14.00	14.16
90%	12.06	11.57	12.56	14.67	14.00	13.83	14.34	14.78	15.21	15.64	15.96	16.50	16.57	16.89	17.19	17.40
95%	16.36	15.54	17.69	19.71	19.01	18.85	19.23	19.53	20.12	20.47	20.78	21.33	21.54	21.76	22.09	22.53
100%	48.10	46.91	48.69	51.39	49.21	51.81	52.99	53.30	53.41	55.17	56.61	55.15	59.78	58.99	59.61	64.94
Selected	**12.06**	**9.23**	**8.04**	**8.50**	**6.35**	**4.82**	**5.04**	**5.30**	**5.54**	**5.70**	**5.76**	**5.93**	**5.83**	**5.88**	**5.83**	**5.74**
% of DI	*3%*	*2%*	*2%*	*2%*	*2%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*



- Figure 17: Target headroom profile for Essex Water Resource Zone - baseline Dry Year Annual Average scenario

Table 44: Headroom distribution for Blyth Water Resource Zone - baseline Dry Year Annual Average scenario

Confidence level	2025/26 Ml/d	2030/31 Ml/d	2035/36 Ml/d	2040/41 Ml/d	2045/46 Ml/d	2050/51 Ml/d	2055/56 Ml/d	2060/61 Ml/d	2065/66 Ml/d	2070/71 Ml/d	2075/76 Ml/d	2080/81 Ml/d	2085/86 Ml/d	2090/91 Ml/d	2095/96 Ml/d	2099/100 Ml/d
0%	-0.39	-0.33	-0.45	-0.44	-0.41	-0.47	-0.41	-0.43	-0.45	-0.42	-0.43	-0.43	-0.44	-0.45	-0.44	-0.50
5%	-0.14	-0.12	-0.16	-0.16	-0.16	-0.15	-0.15	-0.15	-0.15	-0.14	-0.15	-0.14	-0.15	-0.15	-0.15	-0.18
10%	-0.09	-0.08	-0.11	-0.11	-0.10	-0.10	-0.10	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.10	-0.12
15%	-0.06	-0.05	-0.07	-0.07	-0.07	-0.06	-0.06	-0.06	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.06	-0.08
20%	-0.04	-0.03	-0.04	-0.04	-0.04	-0.03	-0.03	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.05
25%	-0.02	0.00	-0.02	-0.02	-0.01	-0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-0.02
30%	0.00	0.02	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.01
35%	0.02	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.03
40%	0.04	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.05
45%	0.06	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.08
50%	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.12	0.12	0.12	0.12	0.13	0.13	0.12	0.10
55%	0.09	0.10	0.11	0.11	0.12	0.13	0.13	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.12
60%	0.11	0.12	0.13	0.14	0.14	0.15	0.15	0.16	0.16	0.17	0.17	0.17	0.17	0.17	0.17	0.14
65%	0.13	0.13	0.15	0.16	0.16	0.17	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.17
70%	0.15	0.15	0.18	0.18	0.19	0.19	0.20	0.21	0.21	0.21	0.22	0.22	0.22	0.22	0.22	0.19
75%	0.17	0.18	0.20	0.21	0.21	0.22	0.23	0.23	0.24	0.24	0.24	0.24	0.25	0.25	0.25	0.22
80%	0.20	0.20	0.23	0.24	0.24	0.25	0.26	0.26	0.27	0.27	0.27	0.28	0.28	0.28	0.28	0.25
85%	0.23	0.23	0.27	0.27	0.28	0.29	0.29	0.30	0.31	0.31	0.31	0.31	0.32	0.32	0.32	0.29
90%	0.27	0.27	0.32	0.32	0.33	0.34	0.34	0.35	0.36	0.36	0.36	0.37	0.37	0.37	0.37	0.35
95%	0.37	0.36	0.43	0.44	0.45	0.44	0.47	0.47	0.48	0.47	0.48	0.49	0.49	0.50	0.50	0.47
100%	10.96	5.60	6.25	5.68	6.31	5.60	5.45	5.63	5.29	6.53	5.64	5.71	6.33	6.13	5.51	5.35
Selected	**0.27**	**0.23**	**0.23**	**0.21**	**0.19**	**0.17**	**0.18**	**0.18**	**0.19**	**0.19**	**0.19**	**0.19**	**0.19**	**0.19**	**0.19**	**0.17**
% of DI	*3%*	*2%*	*2%*	*2%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*

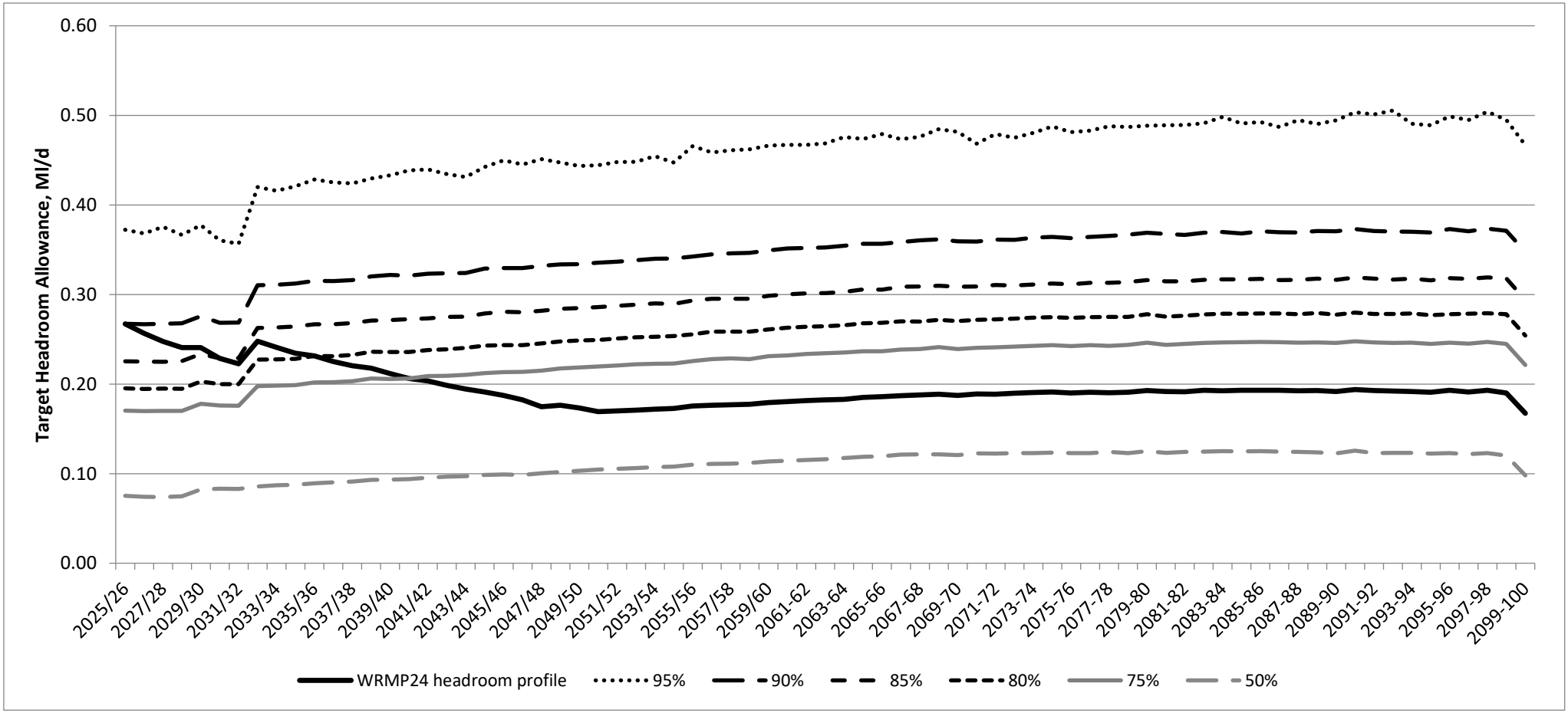


Figure 18: Target headroom profile for Blyth Water Resource Zone - baseline Dry Year Annual Average scenario

Table 45: Headroom distribution for Hartismere Water Resource Zone - baseline Dry Year Annual Average scenario

Confidence level	2025/26 Ml/d	2030/31 Ml/d	2035/36 Ml/d	2040/41 Ml/d	2045/46 Ml/d	2050/51 Ml/d	2055/56 Ml/d	2060/61 Ml/d	2065/66 Ml/d	2070/71 Ml/d	2075/76 Ml/d	2080/81 Ml/d	2085/86 Ml/d	2090/91 Ml/d	2095/96 Ml/d	2099/100 Ml/d
0%	-0.47	-0.46	-0.48	-0.46	-0.47	-0.50	-0.47	-0.47	-0.48	-0.47	-0.45	-0.46	-0.48	-0.50	-0.51	-0.52
5%	-0.23	-0.22	-0.22	-0.22	-0.22	-0.21	-0.21	-0.21	-0.21	-0.21	-0.21	-0.21	-0.21	-0.21	-0.21	-0.23
10%	-0.17	-0.17	-0.17	-0.17	-0.16	-0.16	-0.16	-0.16	-0.16	-0.15	-0.15	-0.15	-0.16	-0.16	-0.16	-0.17
15%	-0.14	-0.13	-0.13	-0.13	-0.12	-0.12	-0.12	-0.12	-0.12	-0.11	-0.11	-0.11	-0.12	-0.12	-0.12	-0.13
20%	-0.11	-0.11	-0.11	-0.11	-0.10	-0.10	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.10
25%	-0.09	-0.08	-0.08	-0.08	-0.07	-0.07	-0.07	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.07
30%	-0.06	-0.06	-0.05	-0.05	-0.05	-0.04	-0.04	-0.04	-0.04	-0.03	-0.03	-0.03	-0.03	-0.03	-0.04	-0.05
35%	-0.04	-0.03	-0.03	-0.03	-0.02	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02
40%	-0.02	-0.01	-0.01	-0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.00
45%	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.02
50%	0.02	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05
55%	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07
60%	0.06	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.11	0.10	0.10	0.09
65%	0.09	0.09	0.10	0.10	0.11	0.11	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.13	0.12
70%	0.11	0.12	0.12	0.13	0.13	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.14
75%	0.14	0.15	0.15	0.15	0.16	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.19	0.18	0.19	0.17
80%	0.17	0.18	0.18	0.19	0.19	0.20	0.20	0.21	0.21	0.21	0.22	0.22	0.22	0.22	0.22	0.21
85%	0.22	0.23	0.23	0.24	0.24	0.25	0.25	0.26	0.26	0.27	0.27	0.27	0.27	0.27	0.27	0.26
90%	0.29	0.29	0.29	0.30	0.31	0.31	0.32	0.33	0.33	0.33	0.34	0.34	0.34	0.34	0.34	0.33
95%	1.11	0.69	0.67	0.71	0.72	0.68	0.69	0.71	0.70	0.69	0.72	0.75	0.73	0.67	0.72	0.69
100%	6.09	4.70	4.82	4.75	4.83	4.76	4.69	4.75	5.16	4.90	4.78	4.74	5.20	4.76	5.56	4.70
Selected	**1.11**	**0.69**	**0.29**	**0.30**	**0.24**	**0.25**	**0.25**	**0.26**	**0.26**	**0.27**	**0.27**	**0.27**	**0.27**	**0.27**	**0.27**	**0.26**
% of DI	*8%*	*5%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*

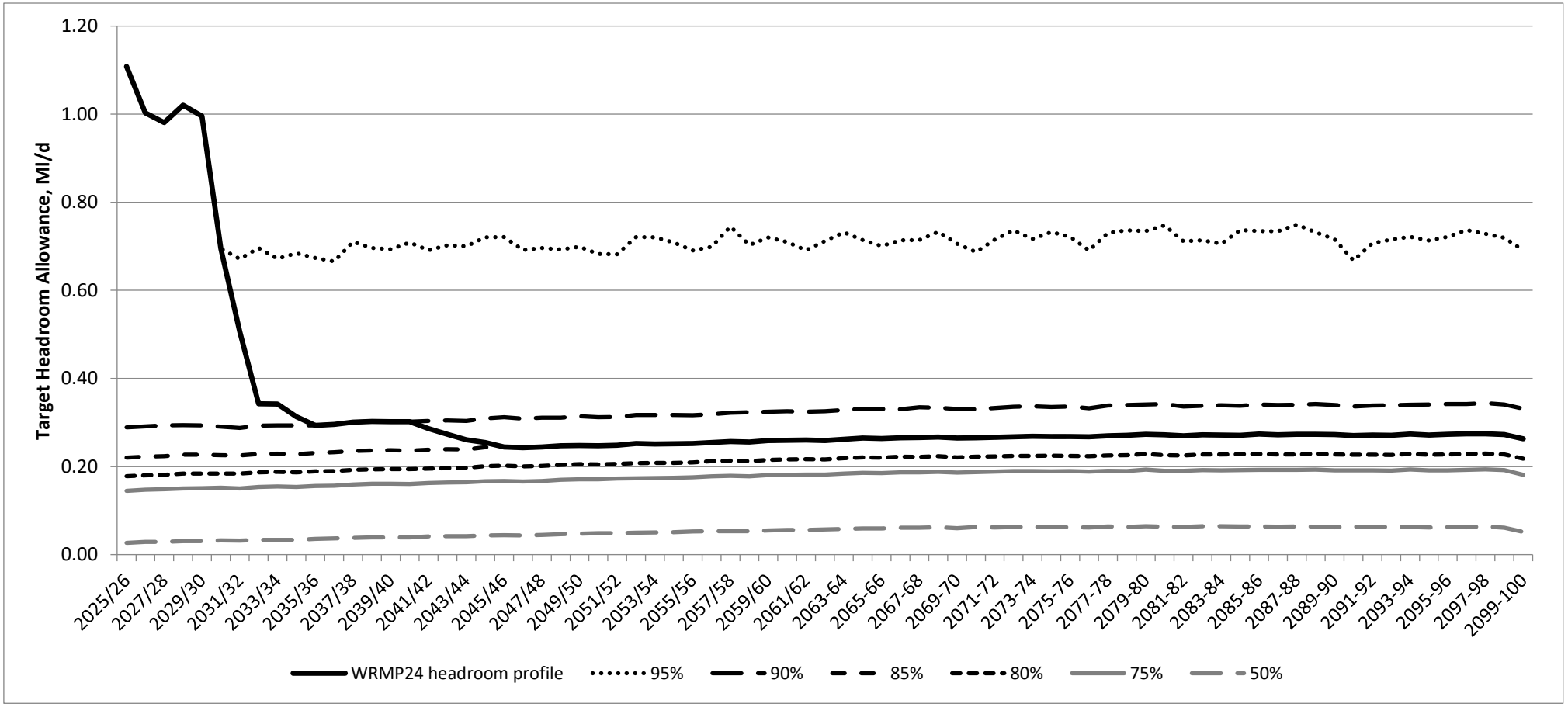


Figure 19: Target headroom profile for Hartismere Water Resource Zone - baseline Dry Year Annual Average scenario

Table 46: Headroom distribution for Northern Central Water Resource Zone - baseline Dry Year Annual Average scenario

Confidence level	2025/26 Ml/d	2030/31 Ml/d	2035/36 Ml/d	2040/41 Ml/d	2045/46 Ml/d	2050/51 Ml/d	2055/56 Ml/d	2060/61 Ml/d	2065/66 Ml/d	2070/71 Ml/d	2075/76 Ml/d	2080/81 Ml/d	2085/86 Ml/d	2090/91 Ml/d	2095/96 Ml/d	2099/100 Ml/d
0%	-1.92	-1.90	-2.11	-2.12	-1.93	-1.96	-1.93	-2.05	-2.12	-1.88	-1.91	-2.09	-2.32	-2.31	-2.11	-2.05
5%	-0.82	-0.81	-0.78	-0.78	-0.75	-0.73	-0.72	-0.69	-0.67	-0.66	-0.67	-0.67	-0.69	-0.70	-0.73	-0.80
10%	-0.62	-0.60	-0.57	-0.56	-0.53	-0.51	-0.49	-0.46	-0.44	-0.43	-0.44	-0.44	-0.45	-0.46	-0.48	-0.56
15%	-0.47	-0.45	-0.42	-0.40	-0.38	-0.35	-0.33	-0.30	-0.28	-0.27	-0.27	-0.27	-0.28	-0.29	-0.31	-0.39
20%	-0.35	-0.32	-0.30	-0.28	-0.25	-0.22	-0.21	-0.17	-0.15	-0.13	-0.13	-0.14	-0.14	-0.15	-0.16	-0.25
25%	-0.25	-0.21	-0.19	-0.17	-0.14	-0.11	-0.09	-0.06	-0.03	-0.02	-0.01	-0.02	-0.02	-0.03	-0.04	-0.12
30%	-0.16	-0.12	-0.09	-0.07	-0.04	0.00	0.02	0.05	0.08	0.09	0.09	0.09	0.09	0.08	0.07	-0.01
35%	-0.07	-0.02	0.00	0.03	0.06	0.09	0.12	0.15	0.18	0.19	0.19	0.20	0.19	0.19	0.18	0.10
40%	0.02	0.06	0.09	0.12	0.15	0.18	0.21	0.25	0.27	0.29	0.29	0.30	0.30	0.29	0.28	0.20
45%	0.10	0.15	0.18	0.21	0.24	0.28	0.30	0.34	0.37	0.38	0.39	0.39	0.39	0.39	0.39	0.30
50%	0.18	0.24	0.27	0.30	0.33	0.37	0.40	0.43	0.46	0.48	0.48	0.49	0.49	0.49	0.49	0.40
55%	0.27	0.32	0.36	0.39	0.43	0.46	0.49	0.53	0.56	0.58	0.58	0.59	0.60	0.59	0.59	0.51
60%	0.36	0.42	0.45	0.49	0.53	0.57	0.59	0.63	0.66	0.68	0.69	0.70	0.70	0.70	0.70	0.62
65%	0.46	0.52	0.55	0.60	0.63	0.67	0.70	0.74	0.77	0.79	0.80	0.81	0.82	0.81	0.81	0.73
70%	0.56	0.63	0.66	0.71	0.75	0.79	0.82	0.86	0.89	0.91	0.93	0.94	0.94	0.94	0.94	0.86
75%	0.69	0.76	0.80	0.85	0.88	0.93	0.96	1.00	1.04	1.06	1.07	1.08	1.09	1.09	1.10	1.01
80%	0.85	0.93	0.96	1.01	1.04	1.10	1.13	1.17	1.21	1.23	1.25	1.26	1.27	1.27	1.28	1.19
85%	1.10	1.17	1.20	1.25	1.28	1.34	1.37	1.41	1.46	1.49	1.49	1.51	1.52	1.52	1.54	1.45
90%	2.05	1.80	1.77	1.85	1.85	1.94	1.96	1.97	2.01	2.04	2.03	2.04	2.08	2.07	2.10	2.01
95%	4.43	4.20	4.08	4.21	4.18	4.49	4.29	4.31	4.25	4.30	4.30	4.30	4.34	4.29	4.42	4.36
100%	18.81	16.48	16.69	16.62	17.17	17.34	17.03	16.67	17.10	17.50	16.88	16.99	18.31	17.19	17.16	16.60
Selected	**2.05**	**1.17**	**0.96**	**0.85**	**0.75**	**0.67**	**0.70**	**0.74**	**0.77**	**0.79**	**0.80**	**0.81**	**0.82**	**0.81**	**0.81**	**0.73**
% of DI	*4%*	*2%*	*2%*	*2%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*

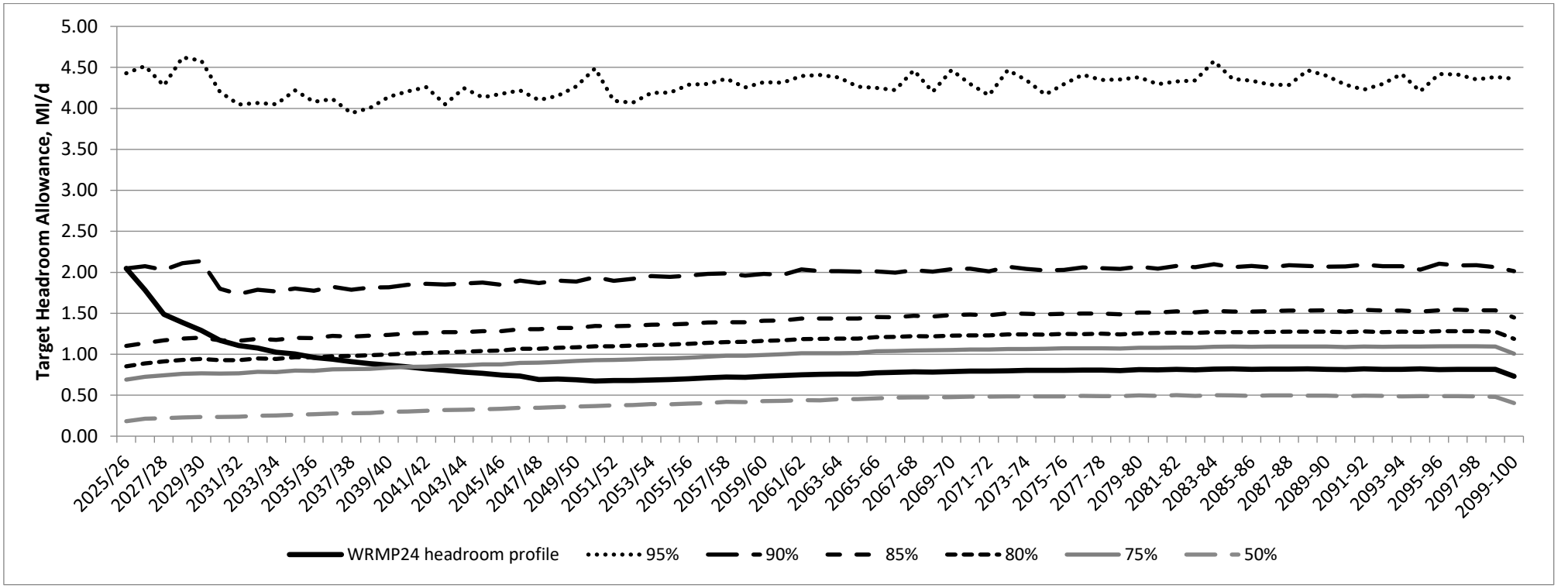


Figure 20: Target headroom profile for Northern Central Water Resource Zone - baseline Dry Year Annual Average scenario

We also calculated target headroom allowances for the Dry Year Critical Period (peak week) scenario, with supply and demand input parameters within the headroom probability distributions adjusted to reflect the relevant critical period forecast data and other changes to model assumptions as appropriate. In particular, most sources and/or supply systems are not impacted by climate change effects in the critical period, as it is generally licence and/or infrastructure constraints which define the DO values in this planning scenario.

The baseline target headroom profiles for both planning scenarios (Dry Year Annual Average or DYAA, and Dry Year Critical Period or DYCP) are summarised below. The selected risk level and associated target headroom allowance, for each of our resource zones, is presented at five yearly intervals across the planning period.

Table 47: Summary of target headroom allowance for all water resource zones

RESOURCE ZONE	HEADROOM VALUE	2025/26	2030/31	2035/36	2040/41	2045/46	2050/51	2055/56	2060/61	2065/66	2070/71	2075/76	2080/81	2085/86	2090/91	2095/96	2099/00
Essex	Risk level (%)	10%	15%	20%	25%	30%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
	DYAA target headroom allowance (Ml/d)	12.06	9.23	8.04	8.50	6.35	4.82	5.04	5.30	5.54	5.70	5.76	5.93	5.83	5.88	5.83	5.74
	DYCP target headroom allowance (Ml/d)	15.26	13.30	12.97	12.79	12.98	13.28	14.78	16.29	17.74	18.95	20.33	21.72	22.87	24.06	25.16	20.60
Suffolk Blyth	Risk level (%)	10%	15%	20%	25%	30%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
	DYAA target headroom allowance (Ml/d)	0.27	0.23	0.23	0.21	0.19	0.17	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.17
	DYCP target headroom allowance (Ml/d)	0.33	0.31	0.31	0.31	0.30	0.29	0.31	0.33	0.35	0.37	0.39	0.41	0.43	0.44	0.46	0.45
Suffolk Hartismere	Risk level (%)	5%	5%	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
	DYAA target headroom allowance (Ml/d)	1.11	0.69	0.29	0.30	0.24	0.25	0.25	0.26	0.26	0.27	0.27	0.27	0.27	0.27	0.27	0.26
	DYCP target headroom allowance (Ml/d)	1.31	1.28	0.36	0.38	0.32	0.34	0.36	0.38	0.40	0.41	0.43	0.44	0.46	0.48	0.50	0.49
Suffolk Northern Central	Risk level (%)	10%	15%	20%	25%	30%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
	DYAA target headroom allowance (Ml/d)	2.05	1.17	0.96	0.85	0.75	0.67	0.70	0.74	0.77	0.79	0.80	0.81	0.82	0.81	0.81	0.73
	DYCP target headroom allowance (Ml/d)	2.52	1.64	1.46	1.39	1.36	1.36	1.48	1.62	1.75	1.87	1.98	2.08	2.19	2.28	2.40	2.34

The target headroom allowance values are lower than those calculated for Water Resources Management Plan 2019 (WRMP19); the main drivers behind this decrease are reduced uncertainty ranges for the demand forecast variation, and for the Essex Water Resource Zone, which has a surface water-dominated supply system, reduced uncertainty ranges for the impacts of climate change on supply. The latest profiles of Dry Year Annual Average headroom allowances reflect a full review for the WRMP24 assessment, of model assumptions and distribution types, and updates to all input data used to determine model parameters. This has included a comprehensive review of water quality risks at all our groundwater sources, using data on the locations of potential pollution sources from the Ordnance Survey GIS layer combined with likelihood of pollution events for different categories of hazards taken from the EA's pollution events database.

For two of our resource zones, we have identified uncertainty surrounding the DO values of some of the supply schemes selected in our final plan (new borehole and water treatment works in the Essex Water Resource Zone, and North Suffolk Winter Storage Reservoir in the Northern Central Water Resource Zone). These were incorporated in component S9 ('new source uncertainty') of the target headroom assessment, and we have undertaken separate simulations for the Essex and Northern Central Water Resource Zones with component S9 included, to produce Final Plan target headroom assessments. The results of these assessments are summarised in Table 48, with the baseline results presented alongside the corresponding Final Plan results for comparison.

Table 48 :Target headroom allowance – Baseline and Final Plan

		Dry Year Annual Average Target Headroom Allowance (Ml/d) for year:					
Resource Zone	Assessment	2025/26	2030/31	2035/36	2040/41	2045/46	2050/51
Essex	Baseline	12.06	9.23	8.04	8.50	6.35	4.82
	Final Plan	12.11	11.61	10.39	10.86	8.54	7.10
Suffolk Northern Central	Baseline	2.05	1.17	0.96	0.85	0.75	0.67
	Final Plan	2.06	1.17	0.97	0.84	0.80	0.71

In line with regulator expectations for WRMP24, as set out in 'PR24 and beyond: Final guidance on long-term delivery strategies' (Ofwat, April 2022), we have also addressed some of the key uncertainties through an adaptive planning approach. The approach involves testing alternative scenarios and developing alternative pathways which may be implemented should any of these scenarios occur in future. The key uncertainties considered in this process include more extreme climate change impacts and a wider range of demand forecast variation. Further details are provided in Section 8.7 of this report.

6. BASELINE SUPPLY DEMAND BALANCE

6.1. OVERVIEW

Our baseline dry year supply and demand forecasts have been used to produce a Baseline Dry Year Supply Demand Balance for each of our Water Resource Zones (WRZs). All the known changes to the supply forecast and the known baseline demand management policies to 2025 have been included in these calculations.

The baseline supply demand balance calculation is used to identify whether a WRZ is predicted to have a supply deficit at any point over the planning horizon. For each WRZ, a supply demand balance graph has been prepared.

The supply forecast is a forecast of Water Available for Use (WAFU) and the demand forecast is a forecast of Distribution Input (DI).

The key features on each of the graphs are as follows:

- Demand Forecast (the blue line): This is known as DI and includes all household and non-household demand and among other aspects, an allowance for leakage from our network and from customer's homes.
- Target Headroom (THR) (the black dashed line): This is an allowance for uncertainties in both the supply and demand forecasts and has been added to the Distribution Input forecast.
- Supply Forecast (the orange line): This is known as WAFU and forecasts how much water is available for use to meet Distribution Input. It takes account of abstraction licence sustainability reductions and other reductions on deployable output (DO).

Climate change has been built into the supply, demand and target headroom forecasts as outlined earlier in this document.

Our Water Resources Management Plan 2024 (WRMP24) is based on a 25 year planning period. This is because:

- our preferred final plan supply schemes are primarily being driven by sustainability reductions by both 2030 (AMP7 WINEP outcomes) and 2040 in relation to Environmental Destination (ED).
- new non-household demand in AMP8. The vast majority of new non-household demand is forecast to start in AMP8 and AMP9 with no step changes in NHH demand forecast beyond that.

In terms of sustainability reductions, our central preferred plan uses the Business As Usual Plus (BAU+) Environmental Destination sustainability reductions scenario which, subject to AMP8 WINEP ED Investigations, we plan to implement in 2040. There is significant uncertainty as to the size of the ED sustainability reductions although they will be confirmed through both our AMP8 WINEP ED investigations and those undertaken by WRE. Consequently, even if further sustainability reductions were required post-2050, the level of certainty would be extremely low.

Our baseline WRMP24 supply and demand forecasts for our Essex and Hartismere WRZs result in a supply deficit when planning to provide a 1 in 500-year level of resilience, for the whole planning horizon. The forecasts for our Blyth and Northern Central WRZs result in deficits from 2026/27 and 2032/33 respectively. The supply deficits are caused by:

- Climate change: We have used the latest UK Climate Projections 2018 (UKCP18) which have had a more significant impact on summer river flows, and therefore DO, than the previous UK Climate Projections 2009 (UKCP09).
- Non-household (NHH) demand: Our latest non-household demand forecast includes new demand.
- New abstraction sustainability reductions: These are applied where a Water Industry National Environment Programme (WINEP) environmental investigation has concluded that an abstraction is not sustainable (i.e., it could have an adverse impact on the environment). Our baseline WRMP24 supply and demand forecasts have taken account of the conclusions of our Asset Management Plan 7 (AMP7) WINEP abstraction sustainability investigations.
- 1 in 500 supply resilience: We are required to plan for 1 in 500-year supply resilience from 2040 at the latest.
- Environmental Destination (ED) – a long term view of required further reductions in abstraction, to leave more water in the environment to ensure it is resilient to the effects of climate change.
- New methods: We have used new statistical methods for forecasting supply and demand, specifically the use of stochastics for supply forecasts.

The baseline supply demand balance graphs for each WRZ are presented in the following sections along with commentary on the key features of interest.

The Dry Year Critical Period (DYCP) baseline supply demand balances are presented in Section 6.3, to demonstrate our resilience under a period of peak strain on our systems. The following assumptions are included in our assessment of a peak week baseline demand and supply forecast:

- maximum capacity output from each WTWs, constrained by either daily licence or WTW maximum capacity (whichever is lowest).
- Process losses have been recalculated based on the DYCP output of each WTW
- Climate change impacts are not applied.
- Neither sustainability reductions nor Environmental Destination DO reductions are included as these are applied to the annual licence, not daily licence.
- Target Headroom has been assessed for the DYCP scenario.
- Outage has been assessed for the DYCP scenario.
- Level 1 Appeal for Restraint and Level 2 Temporary Use Bans drought actions will have been implemented in a DYCP, and therefore the benefit from demand side drought measures have been included our critical period supply demand balances.

6.1.1. WRMP19 and WRMP24 WAFU comparison

There are differences in our WAFU forecast between Water Resources Management Plan 2019 (WRMP19) and WRMP24 for the years 2025/26, and 2049/50. Table 49 shows a comparison for baseline WAFU components for

2025/26 andTable 50 shows the difference by the end of the WRMP24 planning horizon in 2049/50. The reasons for the key difference are:

- **Deployable Output:** There has been a reduction in the Essex WRZ due to a move to stochastic modelling along with increasing resilience from 1-200 to 1-500. We have also now included Chigwell, Stifford and Roding WTWs in the Essex WRZ Aquator model, so the DO includes the 91 Ml/d bulk import into Chigwell WTW previously entered into line 2BL of the planning tables.
- **Climate Change:** The increased impact of climate change in the Essex WRZ is due to a move from UKCP09 to UKCP18 projections.
- **Sustainability Reductions:** The sustainability reductions we are including in our WRMP24 are significantly higher than those included in our WRMP19.
- **Environmental Destination:** This is a new component of the WAFU calculation for WRMP24.
- **Outage:** The differences are due to changes to methodology to plan for a drought period.
- **Process losses:** The differences reflect use of the latest process loss data and are recalculated each time DO changes over the planning horizon due to sustainability changes. Process losses for the Essex WRZ are now incorporated into the Aquator system model.
- **Water exported:** We have used maximum contractual volumes for New Appointments and Variations (NAVs) in our WRMP24 whereas our WRMP19 forecast actual utilisation.
- **Target Headroom:** We have updated our assessment of component S5 – Gradual Pollution and have introduced a range of resilience profiles (high/medium/low).
- **DI:** The increase in per capita consumption (PCC) is mainly due to Covid and an increase in population (~20,000 additional people than forecast in Price Review 2019 (PR19)). The pandemic has affected a number of customer behaviours.

Table 49: WRMP19 and WRMP24 Baseline WAFU forecast comparison for 2025/26.

Baseline 2025/26	Essex WRZ		Blyth WRZ		Northern Central WRZ		Hartismere WRZ	
	WRMP19	WRMP24	WRMP19	WRMP24	WRMP19	WRMP24	WRMP19	WRMP24
DO	396.90	428.00	14.68	14.68	80.16	77.25	8.65	8.65
Climate Change	3.20	-16.73	0.00	0.00	-0.75	0.00	0.00	0.00
Sustainability reductions	0.00	0.00	-0.20	-1.92	-1.30	-0.80	0.00	-2.27
Environmental Destination	-	0.00	-	0.00	-	0.00	-	0.00
Process losses	-0.27	0.00	-0.69	-0.54	-3.14	-8.75	-0.30	-0.30
Outage	-29.93	0.00	-0.68	-0.68	-1.36	-8.83	-0.71	-0.04
Target Headroom	32.82	7.62	1.21	0.27	5.27	2.05	0.77	1.11
Water Imported	92.00	1.00	1.35	2.27	1.35	1.35	2.00	2.00
Water Exported	-24.92	-28.68	-1.39	-1.38	-4.09	-3.75	0.00	-0.02
DI	387.28	402.10	9.11	10.38	46.80	48.79	7.57	13.26
SDB	**16.88**	**-26.13**	**2.75**	**1.78**	**18.80**	**5.63**	**1.30**	**-6.35**
Change		-43.01		-0.97		-13.17		-7.65

Table 50: WRMP19 and WRMP24 Baseline WAFU forecast comparison for 2049/50.

Baseline 2049/50	Essex WRZ		Blyth WRZ		Northern Central WRZ		Hartismere WRZ	
	WRMP19	WRMP24	WRMP19	WRMP24	WRMP19	WRMP24	WRMP19	WRMP24
DO	396.90	428.00	14.68	14.68	80.16	77.25	8.65	8.65
Climate Change	4.70	-31.04	0.00	0.00	-1.10	0.00	0.00	0.00
Sustainability reductions	0.00	-5.00	-0.20	-6.00	-1.30	-6.85	0.00	-2.27
Environmental Destination	0.00	-2.00	0.00	-1.72	0.00	-35.35	0.00	-0.65
Process losses	-0.27	0.00	-0.69	-0.27	-2.90	-3.49	-0.30	-0.20
Outage	-29.93	0.00	-0.68	-0.68	-1.36	-8.83	-0.71	-0.04
Target Headroom	21.31	2.40	0.81	0.17	4.27	0.69	0.53	0.25
Water Imported	92.00	1.00	1.35	1.32	1.35	1.35	2.00	0.73
Water Exported	-5.67	-11.30	-1.39	-1.38	-4.09	-2.40	0.00	-0.02
DI	402.15	418.50	9.17	13.22	49.25	53.63	7.86	13.96
SDB	**34.27**	**-41.24**	**3.09**	**-7.44**	**17.24**	**-32.64**	**1.25**	**-8.01**
Change		-75.51		-10.53		-49.88		-9.26

6.2. BASELINE DRY YEAR ANNUAL AVERAGE (DYAA) SUPPLY DEMAND BALANCE

6.2.1. Essex WRZ DYAA

The baseline Dry Year Annual Average DYAA supply demand balance for the Essex WRZ is shown in Figure 21, with the figures for the last year in each AMP highlighted in Table 51.

The baseline supply demand balance graph shows that the Essex WRZ baseline DYAA forecast is a deficit for the whole planning horizon. The 20 Ml/d step up in 2035/36 of the Total WAFU is a result of our current water sharing agreement with Thames Water expiring.

Household and Non-household growth results in a gradual increase in Distribution Input from the early 2040s through to the end of the planning period.

The gradual decline in WAFU is due to climate change and a reduction in summer flows.

Our Best Value Plan is presented in Section 1 and confirms how we will reduce demand to meet all forecast demand and meet our obligation to implement sustainability reductions by 2030.

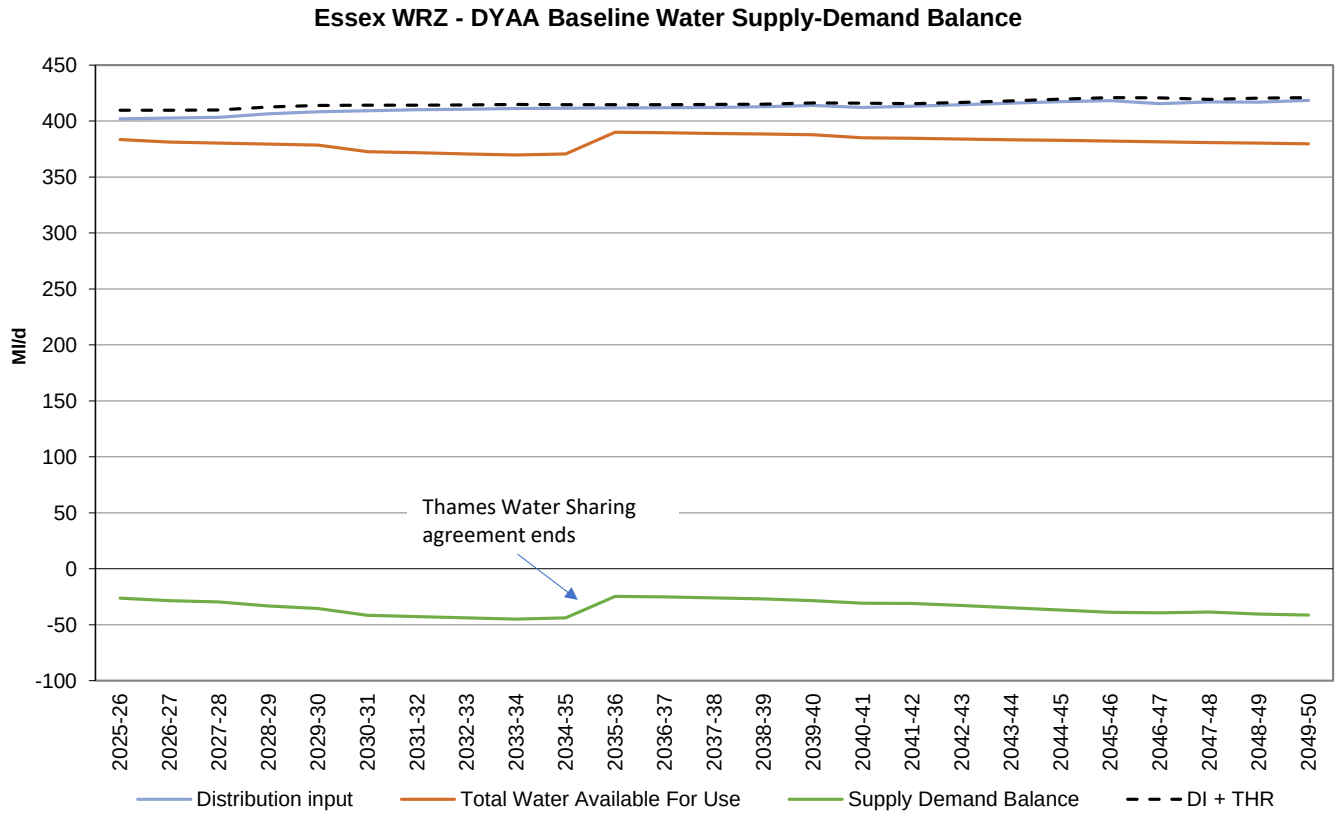


Figure 21: Essex WRZ DYAA supply demand balance graph

Table 51: Baseline DYAA supply demand balance figures for the Essex WRZ

ESSEX WATER RESOURCE ZONE	END OF AMP8	END OF AMP9	END OF AMP10	END OF AMP11	END OF AMP12
	2029/30	2034/35	2039/40	2044/45	2049/50
Supply Demand Balance	-35.51	-43.87	-28.42	-36.81	-41.24

6.2.2. Blyth WRZ DYAA

The baseline supply demand balance for the Blyth WRZ is shown in Figure 22, with the figures for the last year in each AMP highlighted in Table 52.

The supply demand balance graph starts with a supply surplus but only in the first year of the planning horizon. From 2026/27 the WRZ falls into deficit as a result of Water Framework Directive (WFD) No Deterioration Sustainability Reductions. This is because two of our time limited abstraction licences expire in 2026 and the EA has indicated that the annual licensed quantity will be capped to a recent actual utilisation level. This removes all of our supply headroom until our Best Value Plan demand management and supply options are operational.

The zone goes further into deficit in 2030/31 when AMP7 abstraction licences sustainability reductions are implemented, resulting in a total loss of 6 Ml/d of DO.

The deficit increases in 2032 due to a step increase in demand when we will start supplying Sizewell C with 2.2 Ml/d as an annual average and 2.8 Ml/d as a peak daily. It should be noted that this is a baseline deficit and that our final plan allows us to supply Sizewell C and forecasts a supply surplus.

The two further steps down in SDB in 2040 and 2045 result from the Business As Usual Plus (BAU+) Environmental Destination licence reductions being made.

Our Best Value Plan is presented in Section 8 and confirms how we will reduce demand and increase supplies to meet all forecast demand and meet our obligation to implement the sustainability reductions on our current groundwater sources.

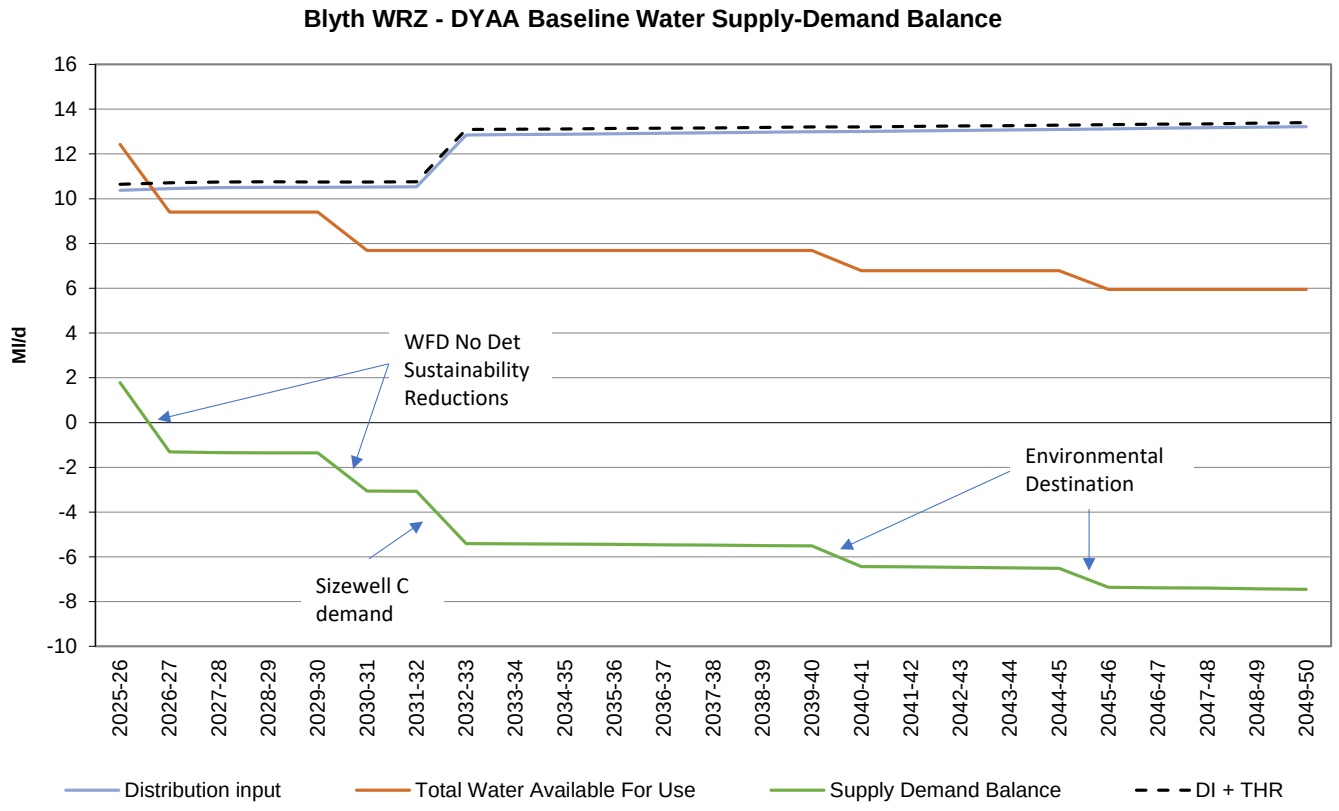


Figure 22: Blyth WRZ DYAA supply demand balance graph

Table 52: Baseline DYAA supply demand balance figures for the Blyth WRZ

BLYTH WATER RESOURCE ZONE	END OF AMP8	END OF AMP9	END OF AMP10	END OF AMP11	END OF AMP12
	2029/30	2034/35	2039/40	2044/45	2049/50
Supply Demand Balance	-1.35	-5.43	-5.51	-6.51	-7.45

6.2.3. Hartismere WRZ DYAA

The baseline supply demand balance for the Hartismere WRZ is shown in Figure 23, with the figures for the last year in each AMP highlighted in Table 53.

The zone is in deficit from the start of the planning period due to the inclusion of new requests for water from non-household businesses on Eye Industrial Estate. This results in a supply deficit for the whole planning horizon. The deficit is increased by 2.27 Ml/d by incorporation of WFD No Deterioration Sustainability Reductions, which are due to be implemented from the start of the planning horizon. This is because all of the Hartismere sources are covered by limited

abstraction licences, which expire before the start of AMP8 and the EA has indicated that these will be capped to recent utilisation levels on renewal.

Additionally, there are two further steps down in WAFU because of BAU+ Environmental Destination licence reductions in 2040 and 2045.

Our Best Value Plan (Section 8) confirms our preferred demand management and supply options that will enable us to meet all forecast demand and our obligation to implement abstraction licence sustainability reductions. However, for our Hartismere Water Resource Zone, it also requires both a moratorium on new non-household demand where the water is used for non-domestic purposes until 2032, and an exemption under Regulation 19 of the WFD to delay the implementation of sustainability reductions until replacement sources of water are available.

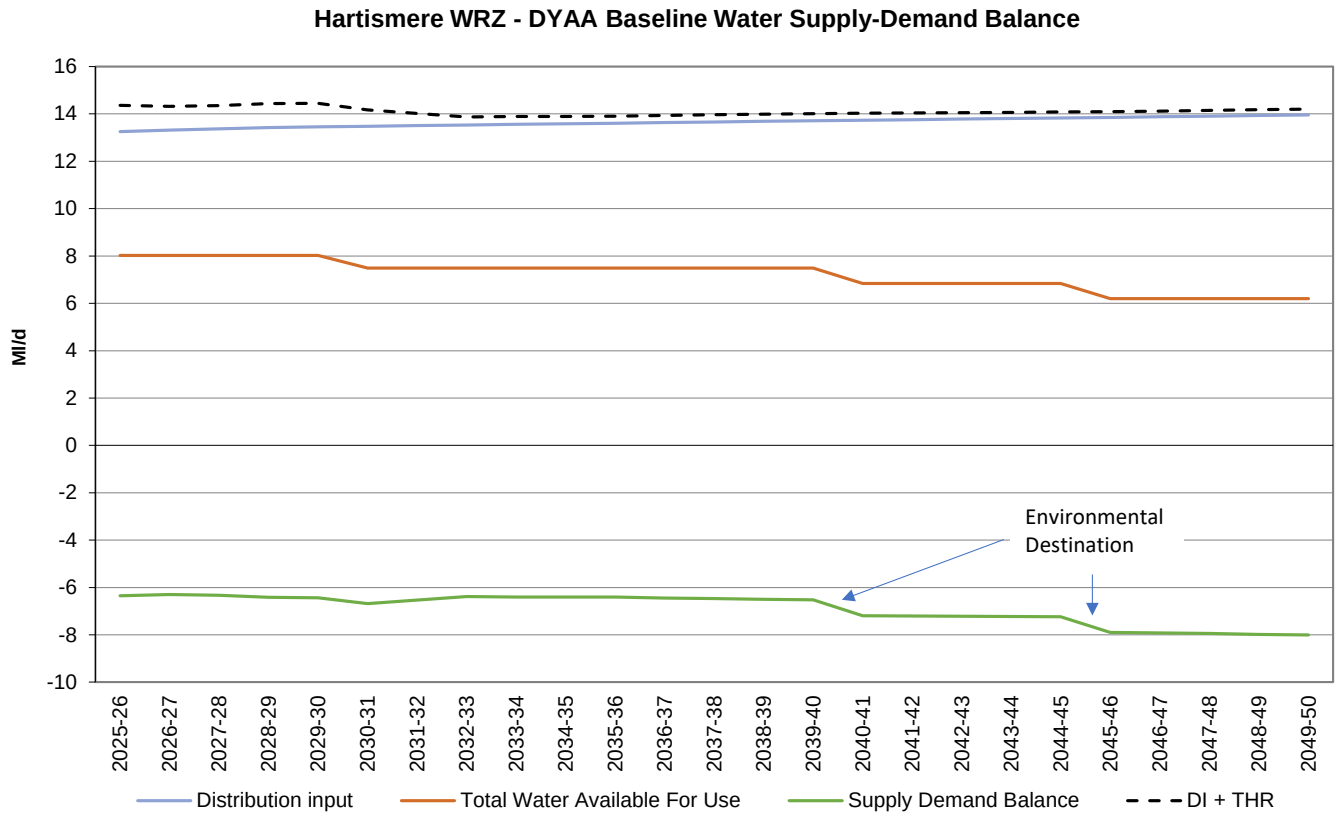


Figure 23: Hartismere WRZ DYAA supply demand balance graph

Table 53: Baseline DYAA supply demand balance figures for the Hartismere WRZ

HARTISMERE WATER RESOURCE ZONE	END OF AMP8	END OF AMP9	END OF AMP10	END OF AMP11	END OF AMP12
	2029/30	2034/35	2039/40	2044/45	2049/50

Supply Demand Balance	-6.43	-6.40	-6.52	-7.24	-8.01

6.2.4. Northern Central WRZ DYAA

The baseline supply demand balance for the Northern Central WRZ is shown in Figure 24 , with the figures for the last year in each AMP highlighted in Table 54.

The supply demand balance (SDB) graph shows a small surplus until 2031/32 and a deficit thereafter.

Forecast demand includes future increases in demand from food processing and cosmetics businesses.

There are five steps down in the Total WAFU, reflected in the SDB. The first in 2027/28 is because of an increase in non-household demand, the next two in 2030/31 and 2032/33 because of Sustainability Reductions and then a further two because of BAU+ Environmental Destination licence reductions in 2040 and 2045.

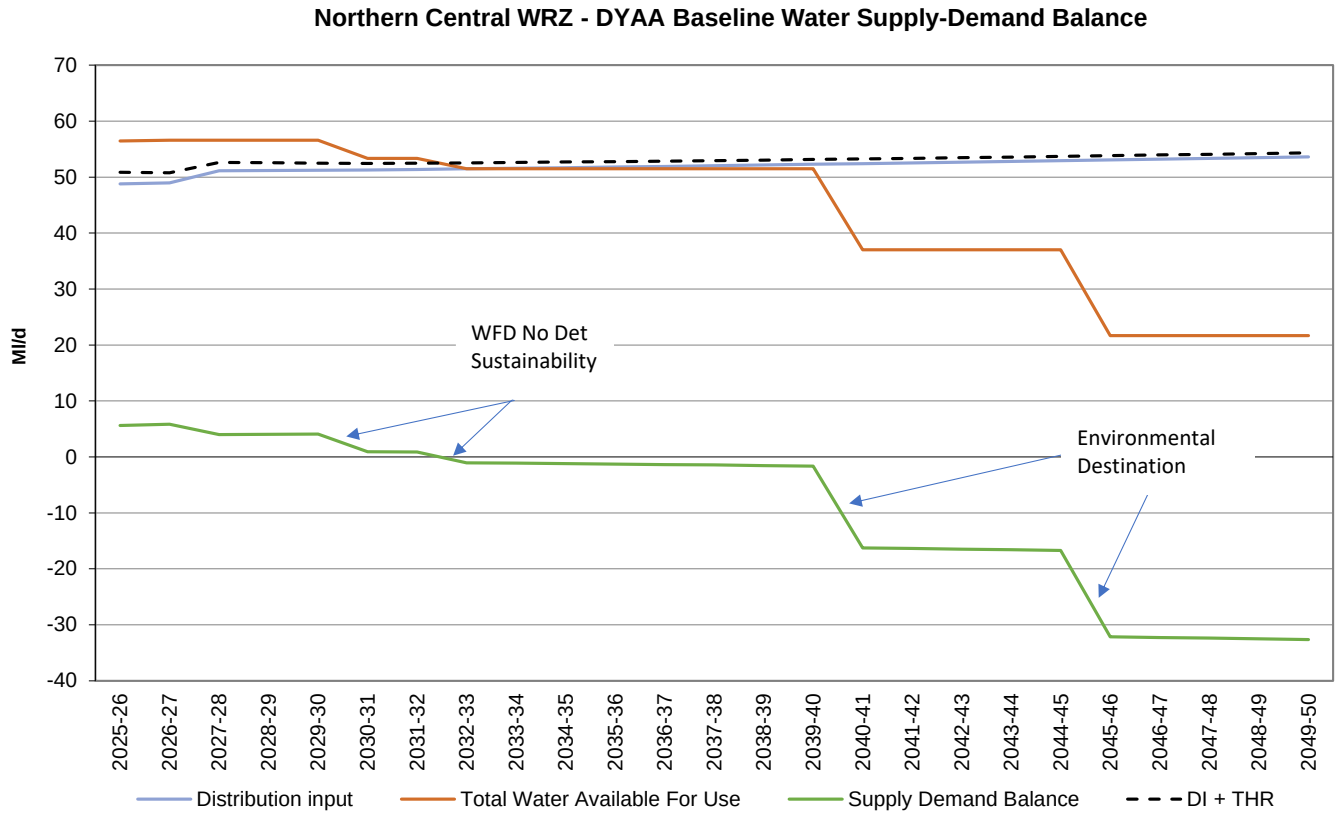


Figure 24: Northern Central WRZ DYAA supply demand balance graph

Table 54: Baseline DYAA supply demand balance figures for the Northern Central WRZ

NORTHERN CENTRAL WATER RESOURCE ZONE	END OF AMP8	END OF AMP9	END OF AMP10	END OF AMP11	END OF AMP12
	2029/30	2034/35	2039/40	2044/45	2049/50
Supply Demand Balance	4.08	-1.20	-1.66	-16.72	-32.63

6.3. BASELINE DRY YEAR CRITICAL PERIOD (DYCP) SUPPLY DEMAND BALANCE

6.3.1. Essex WRZ DYCP

The baseline DYCP supply demand balance for the Essex WRZ is shown in Figure 25, with the figures for the last year in each AMP highlighted in Table 55.

The supply demand balance graph shows that the Essex WRZ baseline DYCP forecast is in deficit for most of the planning horizon. The 20 Ml/d step up in 2035/36 of the Total WAFU is a result of our current water sharing agreement with Thames Water expiring.

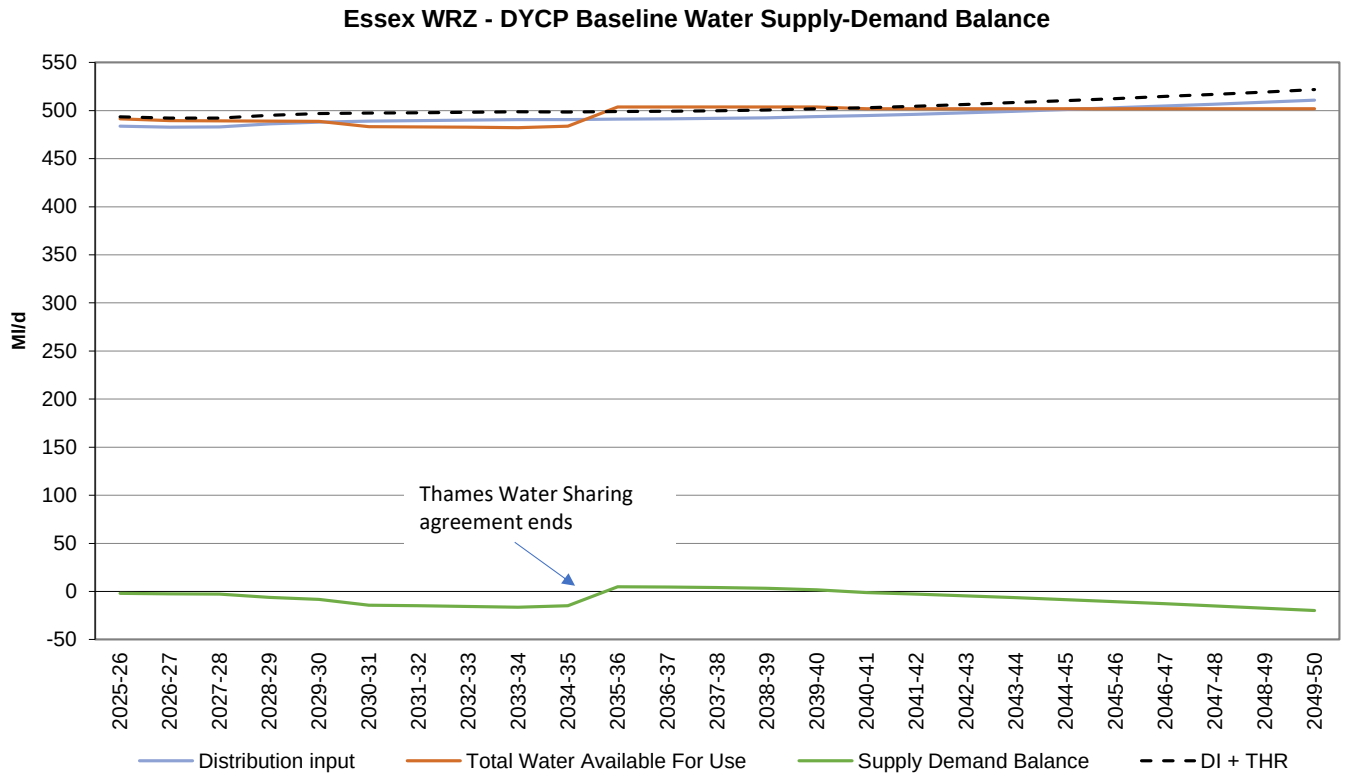


Figure 25: Essex WRZ baseline DYCP supply demand balance graph.

Table 55: Baseline DYCP supply demand balance figures for the Essex WRZ

ESSEX WATER RESOURCE ZONE	END OF AMP8	END OF AMP9	END OF AMP10	END OF AMP11	END OF AMP12
	2029/30	2034/35	2039/40	2044/45	2049/50
Supply Demand Balance	-8.19	-14.75	1.81	-8.48	-19.92

6.3.2. Blyth WRZ DYCP

The baseline DYCP supply demand balance for the Blyth WRZ is shown in Figure 26, with the figures for the last year in each AMP highlighted in Table 56.

The supply demand balance graph shows that the Blyth WRZ baseline DYCP forecast is a surplus for the whole planning horizon. There is an increase in forecasted demand, with associated step down in SDB, in 2032, which is the new supply to Sizewell C Nuclear Power Station of 2.2 Ml/d as an annual average and 2.8 Ml/d as a peak daily.

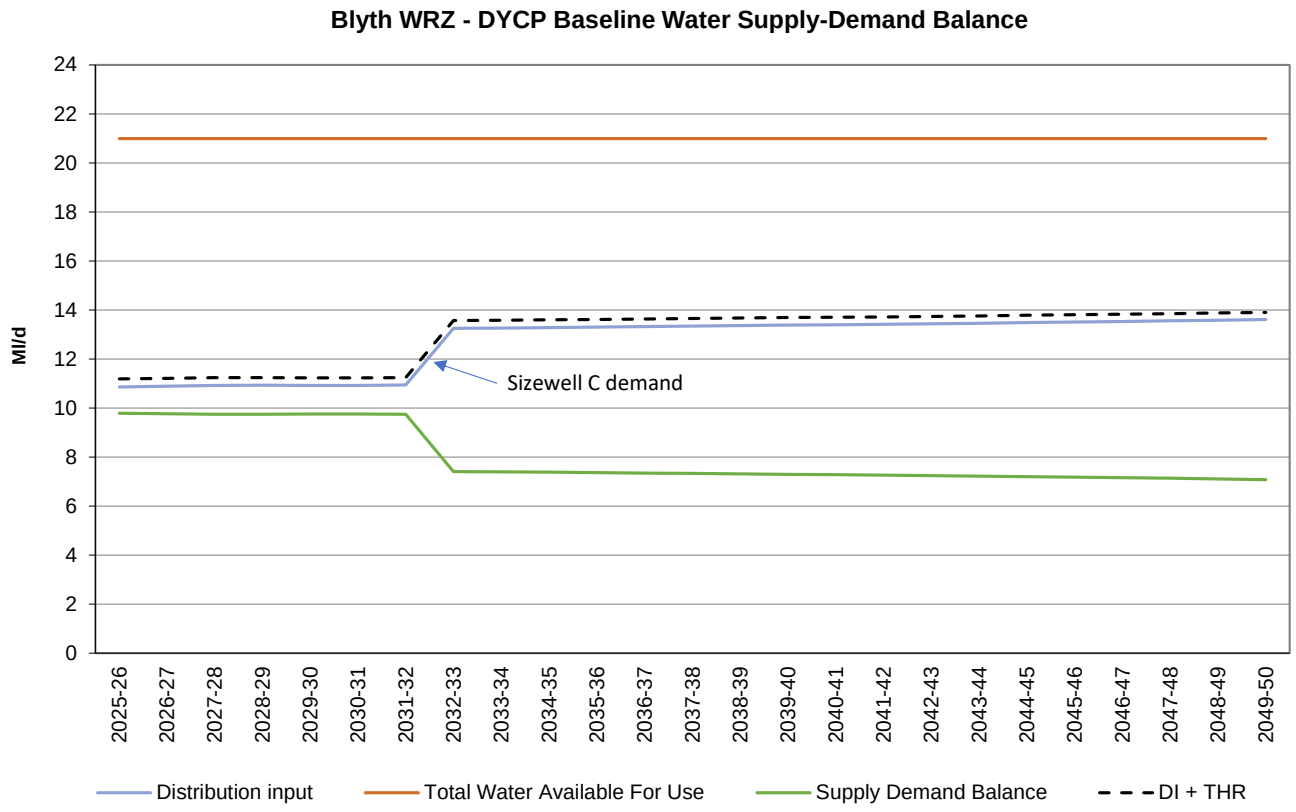


Figure 26: Blyth WRZ DYCP supply demand balance graph

Table 56: Baseline DYCP supply demand balance figures for the Blyth WRZ

BLYTH WATER RESOURCE ZONE	END OF AMP8	END OF AMP9	END OF AMP10	END OF AMP11	END OF AMP12
	2029/30	2034/35	2039/40	2044/45	2049/50
Supply Demand Balance	8.08	5.71	5.62	5.45	5.34

6.3.3. Hartismere WRZ DYCP

The baseline DYCP supply demand balance for the Hartismere WRZ is shown in Figure 27, with the figures for the last year in each AMP highlighted in Table 57. The supply demand balance graph shows that there is no additional headroom in the Hartismere WRZ baseline DYCP forecast until there is a small increase in 2032/33 resulting from a 0.67 Ml/d step down in Target Headroom. This step results from moving from the 95th percentile to the 90th percentile in the low resilience risk profile used for this WRZ, and also reflects the risk associated with the vulnerable groundwater sources early in the planning horizon. More detail on this can be found in our WRMP24 Allowing for Uncertainty Technical Report.

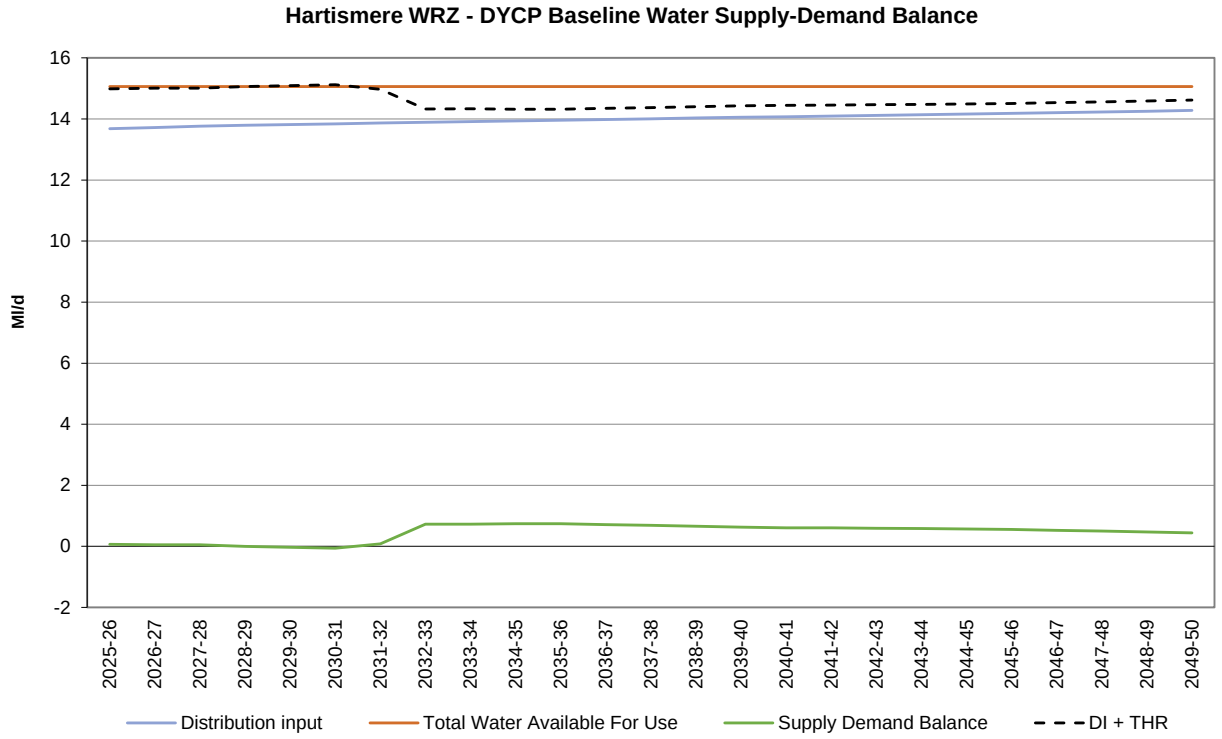


Figure 27: Hartismere WRZ baseline DYCP supply demand balance graph

Table 57: Baseline DYCP supply demand balance figures for the Hartismere WRZ

HARTISMERE WATER RESOURCE ZONE		END OF AMP8	END OF AMP9	END OF AMP10	END OF AMP11	END OF AMP12
		2029/30	2034/35	2039/40	2044/45	2049/50
Supply Balance	**Demand**	-1.09	-0.32	-0.43	-0.49	-0.62

6.3.4. Northern Central WRZ DYCP

The baseline DYCP supply demand balance for the Northern Central WRZ is shown in Figure 28, with the figures for the last year in each AMP highlighted in Table 58.

The supply demand balance graph shows a surplus for the whole planning horizon.

The DO of the River Waveney source is constrained in this scenario to 18 Ml/d from 2030/31, and to 16 Ml/d from 2032/33, which is the maximum abstraction rate that the EA have confirmed they will support with the operation of their Waveney Augmentation Groundwater Scheme (WAGS) as part of our AMP7 WINEP investigations.

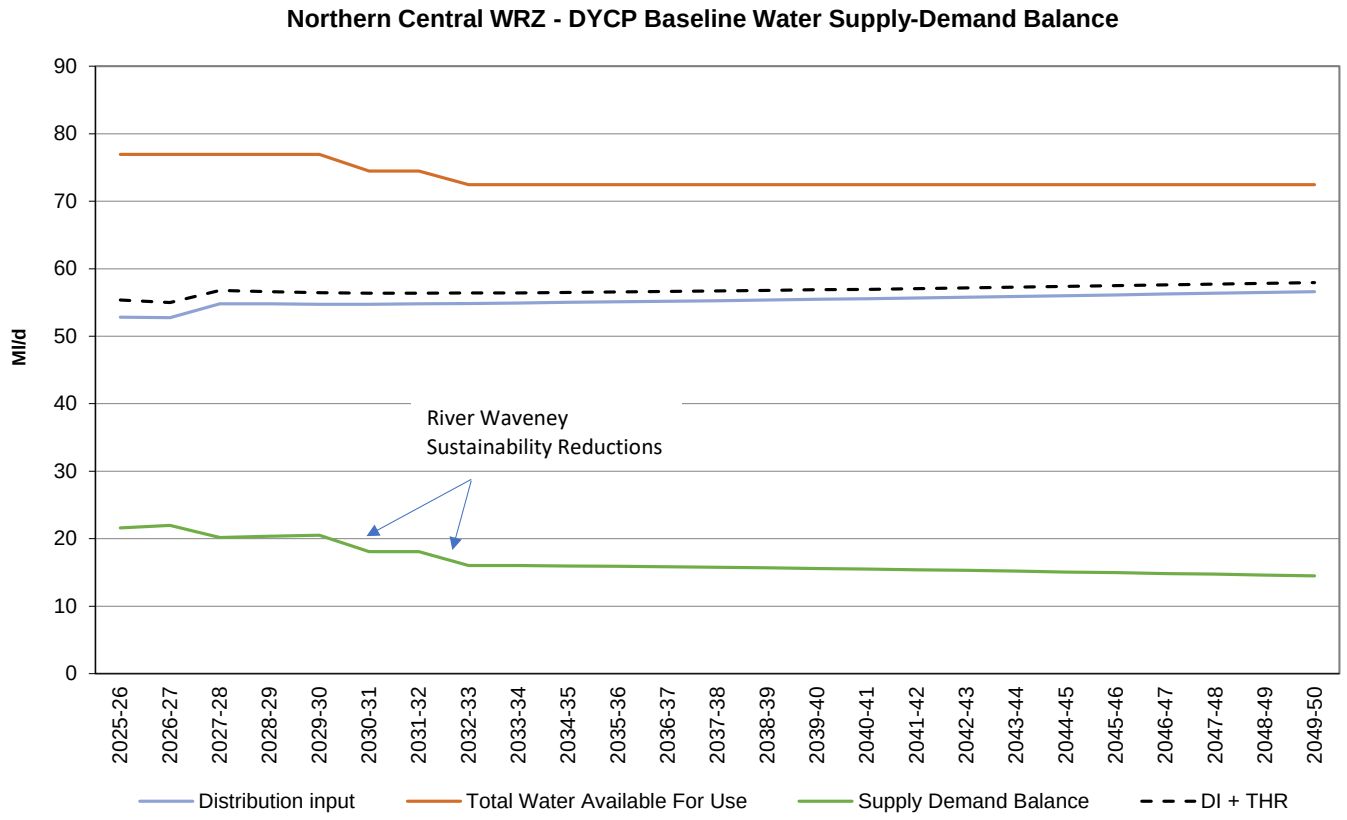


Figure 28: Northern Central WRZ DYCP supply demand balance graph

Table 58: Baseline DYCP supply demand balance figures for the Northern Central WRZ

NORTHERN CENTRAL WATER RESOURCE ZONE	END OF AMP8	END OF AMP9	END OF AMP10	END OF AMP11	END OF AMP12
	2029/30	2034/35	2039/40	2044/45	2049/50
Supply Demand Balance	17.78	13.22	12.84	12.33	11.76

7. IDENTIFYING POSSIBLE OPTIONS

7.1. OVERVIEW

We are required to identify possible options:

- Where we have a deficit in our supply-demand balance.
- To supply potential regional or national needs or supply other sectors.
- To address government expectations, concerns of your customers or local stakeholders.
- To ensure the efficient use of water.

As shown in Section 6, we have forecasted baseline supply deficits in our Essex and Suffolk water resource zones (WRZs) which will require new demand management and supply schemes.

We have identified demand management options (see Section 7.3) that will both meet and exceed government expectations with regards to leakage reduction, per capita consumption (PCC)and smart metering.

However, the forecast baseline supply demand deficits will also require new supply schemes to be developed in addition to our demand management options to restore a supply surplus across the planning horizon.

We have considered imports and exports with both Water Resources East (WRE) and Water Resources South East (WRSE) as well as with our neighbouring water companies including Anglian Water and Thames Water. These transfers were to address our own supply deficits as well as at a regional level, to supply regional and national need.

7.2. OPTIONS APPRAISAL METHODOLOGY

7.2.1. Overview

We have used the methodology outlined in Section 8 of the Water Resources Planning Guideline (EA, 2021) for identifying options to address a supply demand deficit. This is illustrated in Figure 29.

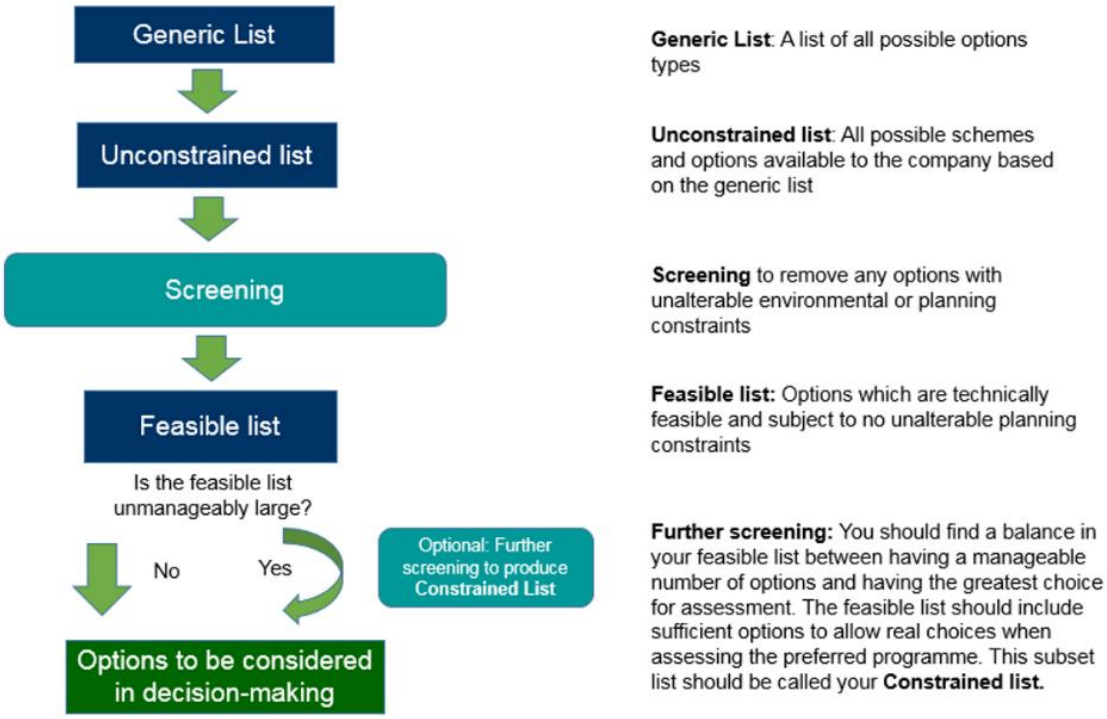


Figure 29: Options Appraisal Methodology

We have prepared an unconstrained list of all possible options that could contribute to deficit reduction and progressed them to the screening stage where they have been found to be technically feasible. This list was then screened to remove options with unalterable constraints that make them unsuitable. Options on the resulting feasible list have been further assessed to feed into programme appraisal and optimisation of a Best Value Plan.

7.2.2. Adaptive Approach and Methodology

The methodology followed in the identification, development, and screening of water supply options has been developed to align with the process as set out in the Water Resources Planning Guideline (WRPG).

The WRPG requires water companies to review all possible options that could contribute to deficit reduction and if they are likely to be technically feasible, they should be included on an unconstrained list. This list is screened to remove options with unalterable constraints that make them unsuitable for promotion. Options on the resulting feasible list are further assessed to feed into programme appraisal and optimisation of a best value plan. Figure 30 illustrates the process we have followed.

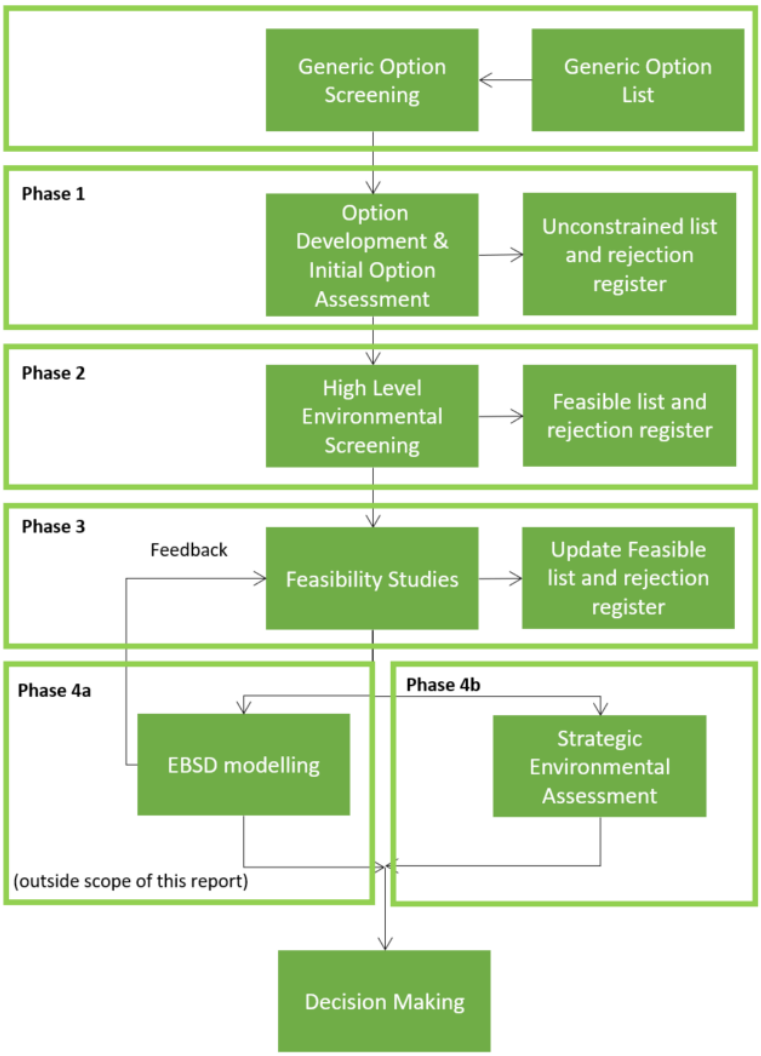


Figure 30: WRPG options appraisal process

7.2.2.1 GENERIC OPTION SCREENING

A generic option list was developed using UK Water Industry Research (UKWIR) guidance to identify all possible options available to each WRZ. To identify viable options, the generic option list was screened using the following criteria:

- Can the option be practically deployed i.e., is the source of water available in the WRZ?
- Is it possible to define the option spatially?
- Does the technology exist to develop the option (assumed to be post pilot study stage in the UK or a country with a similar regulatory regime)?
- Does the supply chain exist to deliver the option?
- Are there any other technical issues that prevent deployment of this option in the WRZ?
- Are there any environmental issues that prevent deployment of this option in the WRZ?

This process included the consideration of whether third parties could provide viable options or if there were opportunities for collaboration to develop supply or demand options. This was supported by our liaison with our neighbouring WRE water companies. These options were appraised against the same criteria as our own options. The options included in the generic options screening phase included:

- Transfers of water between us and neighbouring water companies and development of options to support transfers
- Abstraction licence trading
- The joint development of a new water resource option with a third party/other water company.
- The transfer of ownership of an existing water supply asset from a third party to ESW (including abstraction licence).
- The transfer of ownership of other associated water supply assets such as pipelines from a third party to ESW.
- A water efficiency scheme provided by a third party
- A water trade with a third party

Our water resources market information is presented on our website at **www.nwg.co.uk/wrmp**. Our website confirms that we are forecasting baseline supply deficits in both our Essex and Suffolk supply areas. We will update our Market Information page following publication of our Water Resources Management Plan 2024 (WRMP24).

As illustrated in Figure 31, we have also developed an online platform with Anglian Water and Wheatley Solutions called Watersource. This presents market information nationally using GIS style mapping. It is an intuitive and easy way for third parties to understand where we are forecasting supply deficits and where there are opportunities for third party bids for water efficiency schemes and trades.

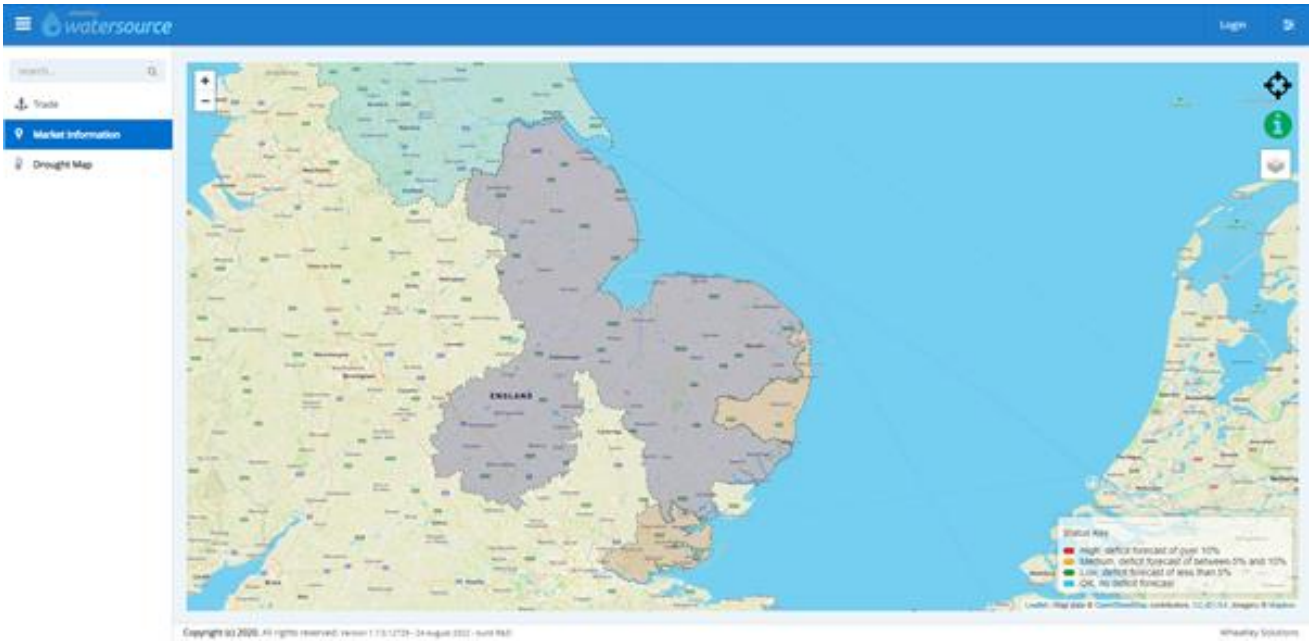


Figure 31: Watersource

We have worked with third parties in relation to barge desalination and sea tankering water from Norway, although this did not result in a formal bid. Additionally, in both cases, these options were not considered feasible.

7.2.2.2 PHASE 1: OPTION DEVELOPMENT AND INITIAL ASSESSMENT

Viable options from Generic Option Screening were further developed to form an unconstrained option list, with sufficient level of definition to allow Phase 2 High-Level Screening.

Option development in this phase focussed on defining specific options in terms of the location, maximum output, and spatial impact.

A basis of design/assumption was developed for each option considering the following factors.

- Industry best practices and standards
- Consider regional options
- Consider neighbouring water company options
- Availability of source water
- Resilience
- Water quality issues
- Impact on water bodies
- Environmental designations
- Availability of land (at this stage the review is limited to identifying undeveloped land, no assessment is made of competing development or ownership)
- Existing infrastructure
- Proximity to receiving WRZ / supply node
- Customer perception
- Stakeholder support / opposition.

Options that failed to satisfactorily meet these factors were rejected and added to the rejection register.

7.2.2.3 PHASE 2: HIGH-LEVEL ENVIRONMENTAL SCREENING

A Red-Amber-Green (RAG) approach against environmental topics was used to screen out options that are shown to have red flags against significant criteria. These criteria align with those applied for WRE high-level assessments.

Any options which were screened out at this stage were added to the rejection register.

7.2.2.4 PHASE 3: FEASIBILITY STUDIES

The purpose of this phase was to undertake detailed engineering design and costing to enable an assessment of the feasibility of proposed options.

All options that successfully passed High-Level Screening were then subject to further detailed engineering design and development of financial costs.

7.2.2.5 PHASE 4B: STRATEGIC ENVIRONMENTAL ASSESSMENT OF OPTIONS

Our detailed options level assessment approach was aligned with WRE's Integrated Environmental Assessment (IEA) process. This process has been developed through consultation with multiple stakeholders. This is aligned with regulator expectations around regional and water company planning.

Each option was assessed against the Strategic Environmental Assessment (SEA) objectives using defined effect assessment and evaluation criteria based on relevant spatial datasets and professional judgement. The assessment indicated whether the proposed option would help meet or prevent achievement of the SEA objectives. If it contributed to the SEA objectives, then it was considered a positive effect. If the option prevents the SEA objective being met, then it was considered a negative effect. The assessment focused on high-level issues as identified through the objectives, sub-objectives, and key receptors and assets. Note that it was not undertaken to the level of detail that an Environmental Impact Assessment (EIA) would be.

7.2.3. Outcome And Feasible Option List

Following the methodology described resulted in the identification and development of 41 water supply options for inclusion within Economics of Balancing Supply and Demand (EBSD) modelling and further decision making. These options are summarised in Section 7.4 below and described in Appendix 2.

7.3. DEMAND MANAGEMENT OPTIONS

We have identified demand management options that will both meet and exceed government expectations with regards to leakage, PCC and non-household (NHH) demand reduction as well as ensure the efficient use of water. In developing our demand management options, we have considered customers preferences which we confirmed through WRMP24 customer research. A primary consideration for our customers is for us to reduce leakage and to support them in reducing their own water use.

7.3.1. Leakage

For a detailed report on this section, please refer to the **Leakage technical report** which is available to download **here**.

In Asset Management Plan 6 (AMP6) the leakage target was set in line with the historic Sustainable Economic Level of Leakage (SELL) and remained static over the AMP. This was below an updated version of the SELL, but we wanted to maintain our industry leading performance and believed that leakage should not be allowed to increase. 2016/17 and 2017/18 were challenging years relating to the weather conditions, but overall performance was good, and the target was met on three out of the five years. Due to this approach and the water resource position in the South-East, Essex and Suffolk Water (ESW) have been a frontier company in leakage performance for several years, particularly using the l/prop/day metric.

For AMP7 we implemented the new Ofwat reporting guidelines, published in March 2018, which set out a consistent methodology for calculating leakage across all companies. We also went beyond the Ofwat requirement to reduce

leakage by 15% in 2024/25 from our base position, and committed to a 17.5% reduction, which meant that 2019/20 was the last year that we used the SELL as a target. Our baseline performance for WRMP24 is to maintain this lower level of leakage for the whole of the planning period. Future base funding will need to be sufficient to prevent deterioration of our existing network and to account for the additional growth in the network.

After a difficult first year in AMP7 we delivered a good leakage reduction in both of the following two years. This means that we met our performance commitment in 2022/23, based on a three-year rolling average, and puts us on track to deliver our 2024/25 target. Some of the key projects that are currently ongoing include:

- Water Balance Review – improve the accuracy of the six main demand components.
- Pressure Management – maintain and optimise the 207 existing pressure reducing valves (PRVs), identify any potential for new opportunities.
- Active Leakage Control – reduce leakage in our 500 DMAs by looking at new ways to identify and locate leaks using digital twins, acoustic loggers and satellite surveys.

We have looked at all the available options following the PALM process (Prevent, Aware, Locate and Mend), which is widely used in the industry to segregate the various stages in the “life of a leak”. It is important to look at the potential improvements in each of these stages to determine the optimum plan for reducing leakage.

Across all these stages, innovation will be a key enabler to deliver a step change in performance. ESW are actively working on several trials, and we have been very successful at acquiring funding from the Ofwat Innovation Competition. One of our biggest projects is the National Leakage Research Centre which will provide the facilities to accelerate new ideas in this space and help us towards our future goals.

It is expected that we will deliver the maximum potential benefit from some of these interventions over the next three years as we work towards our AMP7 targets so there may be no further scope for some of these activities in AMP8. For example, there is only a finite number of areas where we can reduce pressure without compromising customer levels of service.

The key options we have considered are increasing our active leakage control activities through the implementation of a smart network of permanently installed hydrophones and increasing the replacement rate of the distribution network to reduce background leakage.

As better data become available, including customer consumption profiles from our increasing stock of smart meters or trunk mains leakage estimates from flow balances, we will review our approach on a regular basis.

In line with the work done by the regional water resource groups, a range of leakage scenarios have been modelled based on the following criteria, as a percentage reduction from the original base position (2017/18):

- High demand, a 30% reduction in leakage by 2050
- Medium demand, a 40% reduction in leakage by 2050
- Low demand, a 50% reduction in leakage by 2050

Leakage which occurs on customer supply pipes is included within the total leakage figure but is reported separately within the Water Resources Management Plan (WRMP) tables. We estimate this volume based on the leakage allowances we apply to customer bills, and it currently accounts for about 20% of the reported leakage. For the WRMP forecast we have applied an equivalent percentage reduction in household supply pipe leakage to each of the three leakage scenarios.

Our supply pipe repair policy is that if a customer has a leak on their private supply pipe, we will advise them to fix it as soon as possible. Customers are required to repair the leak within 30 days of the leak being confirmed.

When installing a meter, we will check the supply pipe to establish if there is a leak. If a leak is detected in the supply pipe that can be repaired without additional excavation when the meter is installed, we will repair it at our expense. If, as a result of that check, a leak is detected that cannot be repaired without additional excavation, we will notify the customer.

Currently, we do not offer free repairs to our wider customer base. However, we will support repairing a leak where a customer is financially vulnerable.

In the Essex region only, where customers do not have insurance for fixing leaks, we can help them pay for the repair costs with a 12-month interest-free payment option.

While smart metering will enable many individual and societal benefits, including quicker leak visibility and, ultimately, leak repair, responsibility for water and supply pipes and repairs to these will not change in this scenario.

Smart meters will not provide universal visibility of supply pipe leakage as some meters will be installed internally, and some properties will be unmeterable. Where meters are installed externally, and leakage markers are flagged, we will proactively highlight this and investigate.

A common industry approach to customer supply pipe leakage will offer customers a consistent approach and improved experience by making it easier for them to know their rights and responsibilities than those of their water company.

We believe customers' continuing responsibility for their supply pipes provides the fairest and most balanced approach overall. It is the right approach that other companies should follow, particularly as more smart meters are installed throughout the country. However, we will provide additional support for customers unable to fund repairs themselves, supporting our commitment to eradicating water poverty.

In WRMP24 there are some minor changes to the leakage figures in Water Resources Management Plan 2019 (WRMP19) due to the final impact of moving to the consistent reporting guidelines in 2020/21. Also, there is a small change to the baseline position that was previously applied, moving from the 2019/20 performance commitment (PC) to the performance in 2017/18.

In WRMP19 we committed to a 10% reduction per AMP up to 2045, if this approach was extended by a further AMP, then the 50% reduction would be achieved by 2050. In WRMP24 we have replaced this with a glidepath to hit the different percentage reductions in 2050 from the 2017/18 base position. A glidepath profile was selected based on the affordability and deliverability of our plan. It would be more expensive to reduce leakage quicker and then maintain at a

lower level over the remaining planning period. The 17.5% target reduction in the current AMP is very challenging to meet and further reductions will only get harder and more expensive to deliver in future. There is some uncertainty around how the long-term targets can be achieved, as we try to drive beyond the unavoidable annual real losses (UARL), so an iterative approach is most appropriate to learn and improve our assumptions as we progress.

ESW has been a frontier company in leakage performance over several years, so this makes a 50% reduction much more difficult to achieve, and more expensive per unit, compared to the industry average. Our preferred plan is to aim for a 40% reduction by 2050, which when combined with a 55% reduction in NW gives a companywide reduction of 50%, meeting the national target. We believe this is a fair approach based on the current leakage performance in each region and the ability to deliver future targets.

We have considered alternative scenarios for leakage including a profile for reducing leakage faster in AMP8 to hit the interim 2032 target, with the remainder of the planning period to 2050 having a linear delivery profile. The demand savings and costs of this alternative scenario are summarised in Table 59.

Table 59: Alternative leakage scenario AMP8

SCENARIO	AMP8 DEMAND SAVING ML/D	AMP8 TOTEX £M	25 YEAR TOTEX £M
Central Preferred Plan	2.7	28.14	433.74
Higher AMP8 Reduction	4.2	110.83	536.54

We do not consider this feasible because:

- There is a significant additional cost in AMP8 and up to 2050, even though the end point is the same, a 40% reduction by 2050.
- Reflecting a linear delivery profile is important to maximise efficiency in terms of employing and training resources to enable and support additional find activity.

Our preferred final plan strategy is to continue with a linear leakage reduction delivery profile. Nevertheless, we recognise the importance of implementing sustainability reductions and lifting the Hartismere non-household moratorium as soon as possible. Consequently, we will strive to outperform our leakage target where feasible and efficient to do so and will work collaboratively to develop innovative approaches to reducing leakage.

7.3.2. Metering

For a detailed report on this section, please refer to the **Metering technical report** which is available to download **here**.

Household Metering

Reducing per capita consumption is a key deliverable in demand management and water meters are seen as one of the main tools in helping to reduce PCC.

Since 1989 all new properties are metered as the only way of charging for water and sewage services, as assigning new rateable values ceased. A number of diverse reasons drive the move from an unmeasured water supply, where the occupant is charged according to the rateable value of the property, to a metered supply. In both our Essex and Suffolk areas of supply, we have been running optant and selective discretionary usage metering schemes since the legislation was introduced to do so.

Additionally, until 2018, we operated a selective change of occupier metering scheme, whereby we would install a meter upon change of occupation of an unmeasured property and charge the new occupier by measured charges. This was in our Essex area of Supply only.

The change of occupier metering scheme was replaced by our whole area metering scheme, which commenced in 2021. Under this scheme we have been installing meters in existing boundary boxes on unmeasured supplies, however, the customers were not automatically be charged by the recorded metered consumption. These customers are issued six monthly comparison letters which compare their rateable value for the period to the value of the water their meter has recorded in that period to enable them to decide whether a measured tariff would be beneficial to them. If a customer opts to switch to a measured tariff, they have the same rights to revert to an unmeasured tariff within 2 years of them switching, as a customer applying via the optant process would. We have included whole area metering as an option for some scenarios in each of the WRZs for AMP8.

Recent customer research shows the predominant reason for electing for a meter is financial and customers who live in low occupancy premises with a high rateable value, tend to opt for a meter to lower their water and sewage bills. Due to high levels of uptake in optant metering in Essex and Suffolk in the earlier years of this legislation being introduced and a high level of selective metering in Essex, we have seen optant installations drop in AMP7 and we are not forecasting to meet our WRMP19 metering targets. However, to further drive demand for optant meter applications, we have started to run a series of targeted marketing campaigns to customers in Essex and Suffolk who would benefit the most from moving to a metered bill and, we are on track to deliver the optant installations as per the WRMP19.

We are still recovering from the slow start that we made to our metering programmes in 2020/21 which was largely driven by the effects of Covid-19. We continued to see supply chain constraints driven by Covid-19 and the war in Ukraine which has capped our install opportunity in the last year and led to a four-month slowdown in install volumes to mitigate wider meter stock shortages. This is an industry wide issue which has also affected smart installation activity at other water companies.

We delayed procurement of additional meter variants and the enduring smart communications network until we had signals from the market that the supply chain was improving. As a result of the supply chain issues, we have chosen to prioritise new installations over meter replacements due to higher demand savings on new installations. Therefore, we are not forecasting to achieve the number of proactive replacements as stated in our WRMP19 by the end of the AMP7.

In AMP7 we made a move to install only smart meters on all household premises and we propose to continue this through AMP8. Although every household meter now installed is smart, these are split into two categories: smart capable and smart active. A smart active meter is a meter that is connected to the network, and we are receiving hourly data. Smart capable meters, have the ability to be connected to the network at a later date, but are not currently activated, this is due to the meter being located in an area where the supporting infrastructure has not yet been installed. In the short term this will enable drive by or walk by reading to ensure customers on a meter will always receive bills based on a reading. Therefore, 100% of newly installed meters will be smart capable and 0% will be basic/AMR meters. Tables showing the percentage of smart and non-smart meters for each year across AMP 8 & 9, can be found in Section 3.2 of the Technical Report. By 2030 we aim to link all currently installed smart capable meters to a wide area network and by 2035 we aim to replace all existing basic/AMR meters to smart meters, meaning that by 2035 all of our meter stock will be smart.

For clarity, meter definitions are as follows:

Basic meters are meters that require manual reads of consumption data through direct access to the meter installation.

AMR meters are meters using automated meter reading (AMR) technology. This enables consumption data to be read remotely without having to directly access the meter or property for a manual reading.

AMI meters are meters using advanced metering infrastructure (AMI) technology. This enables consumption data to be read remotely without having to directly access the meter or property for a manual reading. Consumption data are transferred to the company through an integrated system of smart meters, communications networks, and data management systems. Such systems have the capability to:

- Record consumption, allowing customers and the company to access the data (directly or via contractors/agents) at near real time, with data updated daily at a minimum, and made available at a minimum granularity of 1-hour intervals, or greater frequency and/or granularity as reasonably requested by the customer or its contractors/agents;
- Enable automated leak alarms to be communicated to the customer and company; and
- Communicate with the internet.

Some AMI meters (known as AMI meters (capable)) are not currently able to provide the advanced metering technology due to the meter being in an area where the supporting infrastructure has not yet been installed. It is assumed that such meters will be operating as AMR meters.

AMI meters (active) are meters which are acting as AMI meters.

Whilst new property meter installations do not make up our demand management option (DMO) metering options, these do contribute to a large number of meter installations throughout the AMP. As mentioned above, every household meter now installed is smart capable and, in AMP8, all new properties will also have the smart point installed, so these meters will be smart active, as we will have coverage across both regions.

Within a region called Dagenham in Essex, these meters are already connected to a smart network, which enables us to receive consumption data daily into our meter data management system, along with leakage alarms. Having this frequency of data brings many benefits, most notably, a greater insight into consumption on unmeasured premises that we have not previously had available and being able to identify leaks at a much earlier stage than when we only receive meters reads via six monthly cyclical reading.

Smart meters connected to a communications network bring many benefits for both ESW and our customers. Work has been underway in AMP7 to enhance our existing customer app and web capability, to allow customers with a smart active meter to view their consumption over various time frames, receive alerts and alarms regarding consumption, alerts where there is suspected customer side leakage and get water saving tips.

Smart meters are an effective tool to influence customer behaviours, promote water efficiency and identify customer side leakage. As our smart meter network is built up, we will be able to manage leakage more efficiently, as it will be easier to determine what is consumption and what is being lost to leakage. Smart meters are not a ‘silver bullet’ and some customers are very reluctant to change behaviour, but at scale the evidence suggests that they have a positive impact.

In order to effectively manage supplies in an increasingly climate stressed world, we need to reduce water consumption and drive down leakage, both of which are a cost-effective way to contribute to achieving supply demand balance. We’re focussing on deploying smart meters to our most water stressed areas first such as our Suffolk Hartismere water resource zone.

With smart metering we move from six monthly consumption readings to 24 readings per day. Due to the significant volume of additional data that is now being captured by the smart meters, we are in the process of implementing a new meter data management system (MDMS). This will allow us to handle such large volumes of data much more efficiently.

Data security and supporting governance is a key priority for us and something we take seriously as an organisation. Hourly smart data will only be utilised for legitimate business use cases including proactive leakage detection, water balance calculation, accurate billing and helping our customers understand and take control of their consumption. Granular data will only be available to the registered bill payer. Smart meter data will not be used for other purposes without being subject to suitable aggregation and anonymisation, to ensure no individual customer can be identified from, this is something that is governed tightly within Northumbrian Water Limited (NWL).

As mentioned above, the additional consumption data will also greatly benefit the demand calculations, in particular on customers that have had a meter installed under the Whole Area Metering (WAM) approach where the customer has not switched, as this will give us far more consumption data on unmeasured properties than we have not had available previously.

The Essex and Suffolk water resources zones show a supply deficit in AMP8 and, as both of these areas are classed as seriously water stressed, for WRMP24 we have looked at six different metering demand management options, which can be seen in Table 60.

Table 60: Summary of metering options

OPTION NAME	OPTION DESCRIPTION
Option 1:	Optant and reactive replacement schemes are in place. This scenario assumes that there is no longer an ambition for all meters to be smart 'enabled' and as such there is no proactive replacement scheme. There is no promotional activity regarding meters and no selective installation schemes. The whole area metering scheme currently in place in AMP7 is not continued, however, there will still be customers who have had a meter installed as part of this scheme who choose to switch to measured billing, as well as customers moving into a property with a whole area meter installed who will automatically switch to measured billing at point of moving. The figures assume 50% of customers with a whole area meter installed in 2024/25 will switch to measured. Any change in occupation on these premises that have not switched to the measured tariff, will be automatically charged by the meter when a new occupier moves in.
Option 2:	This scenario is the same as Low impact with the addition of the whole area metering scheme and a proactive meter replacement scheme split over AMP8 and AMP9 to achieve the ambition for all meters to be smart enabled by 2035.
Option 3:	This scenario is identical to Medium Impact 1 in terms of schemes other than the proactive replacement programme is accelerated to achieve a fully smart meter portfolio by 2030. This is to achieve demand reduction benefits of smart enabled meters sooner.
Option 4:	This scenario is identical to Medium Impact 2 in terms of schemes and timescales to fully smart enabled meter portfolio. Medium Impact 3 includes an enhanced meter optant programme which will use promotional campaigns to encourage customer applications and increase meter penetration.
Option 5:	High impact scenarios include the addition of a compulsory metering scheme whereby all meterable properties will be selectively metered. There is therefore no standalone 'whole area metering' scheme, however, any customer who has previously had a meter installed as part of this programme and has chosen not to switch to measured bills will be automatically moved onto a measured tariff. Both the compulsory installation scheme and the proactive replacement scheme will be spread across AMP8 and AMP9 to achieve the ambition of all meters being smart 'enabled' by 2035. There will still be an element of promotional activity in an enhanced optant scheme to encourage customer sign up to meter installation
Option 6:	This scenario is identical to high impact 1 other than the compulsory installation and proactive replacement schemes are accelerated to achieve a fully measured and fully smart portfolio by 2030 so that demand reduction benefits can be achieved sooner. Also, in this scenario there is no enhanced optant programme as by 2030 all properties will have a meter anyway as part of the compulsory installation programme. In Essex and Suffolk separate metering strategies have been run since 2003/04.

Our preferred option for both our Essex and Suffolk areas of supply is option 5, due to showing a supply deficit in both areas in AMP8 and the reduction in optant uptake in AMP7. Option 6 was discounted as our preferred option, as it was felt that this was undeliverable from a supply chain and resource position and would also involve a higher proportion of funding in just one price control period, which would unnecessarily increase customer bills.

As we are moving to compulsory metering in AMP8, customers that have had a meter installed under the Whole Area Metering programme in AMP7 and who have not switched to measured billing, will be moved to measured billing in AMP8. Therefore, no properties will have a meter, without being charged by reference to volume.

In preparation for compulsory metering, we are reviewing all of our customer communications and supporting online guidance to ensure the remit for metering and the benefit for the customer, wider society and environment are clear. Support will be provided to ensure the transition from an un-metered to a metered bill is fair to all and to allow time for customers to adjust to any difference it will make to their bill.

We acknowledge that with introducing a compulsory metering scheme, there will be some customers who will see bill increases and may struggle to pay. Therefore, as part of the development of our business plan for AMP8, we are exploring a range of innovative tariff options including support for efficient water usage and higher occupancy households, incentivising reduced demand at peak times, and capping bills for customers with medical requirements.

Water pricing is an important tool for improving water efficiency and enhancing social equity. Increasing block tariffs are by far the most common charges for water services and they are used in countries where water has been historically scarce, such as Spain and the Middle East. Key questions we will explore through customer research and trials, include developing our understanding of the optimum number of blocks, the volume of water use associated with each block, and the prices to be charged for water use within these blocks.

The continued rollout of smart meter technology will provide applications to identify and reward customers for cutting down on their water usage at certain periods or times of day. This could help customers save money off their bills by helping to balance peaks and troughs in water demand during periods of increased usage or warmer weather. This has been successfully used in the energy sector with a quarter of eligible customers taking part to reduce their consumption.

From our current data, we have also identified higher occupancy households as being particularly susceptible to bill increases after having a meter installed. Options may include offering to cap household bills to the average bill of a four-person household where individual usage is within our target 110 per capita consumption level and we will explore the potential to work with the Department for Work and Pensions to share and maintain occupancy data for the purposes of reducing the complexity and overheads associated with operating a dynamic and bespoke scheme of this nature.

We are also working in partnership with Scope, the disability equality charity, to understand opportunities to support customers on low incomes, but not in receipt of benefits, who need to use more water for medical reasons, to develop a bespoke bill cap that encourages efficient water use without penalising for water used for medical purposes. This is similar to WaterSure but could expand eligibility.

We plan to support customers during the compulsory transition to smart meters by deploying water efficiency tips, household retrofits, and leakage detection repair to reduce customer bills. In addition, we want to use this opportunity to fully engage with the customers to increase what we know about our customers, so we can provide personalised and tailored advice and support on the best tariff for them alongside signposting to additional support, Priority Services

registration, and water efficiency advice. This will focus on those in water poverty and any worse off after the switch. We will also raise digital awareness by encouraging customers to sign up for our app to monitor usage. This will allow us to communicate more regularly with customers about their use of supporting water efficiency and affordability.

For demand management to succeed, we must invest in activities supporting behaviour change. To support the rollout of smart and compulsory metering, we need to have holistic conversations with customers covering the practicalities, affordability, water efficiency, and how to use and make the most of our digital services. These conversations need to take place before, during, and after the installation and we need to be available in person, in communities, and online. Customers need to understand what's changing, how it affects them, what they can do to save money, and what financial support is available.

In our demand management enhancement case, we are seeking funding to provide an all-encompassing customer engagement campaign and in-person community engagement aligned to the smart meter installation programme. With the smart rollout, the community presence will move area by area, providing information and affordability support for customers.

Our programme will also require new processes to ensure we can maximise benefits and positively manage customer expectations and satisfaction. We have identified activities and costs for key activities, including researching to gain better customer insight, enhancing our customer-facing processes, and educating and upskilling our staff to deliver the desired experiences.

Non- Household Metering

A change between our draft WRMP24 and our revised draft WRMP24 was that we are proposing to meter all currently unmeasured non-household (NHH) premises with a smart meter and replace all existing NHH basic/AMR meters with smart meters across AMP8 & AMP9. Further smart networks will be rolled out across our Essex and Suffolk regions over the remainder of AMP 7 and into AMP8. We plan to install/replace NHH meters where the network is switched on first to maximise the benefits of the additional data the smart network provides.

With the industry facing challenging targets to reduce non-household consumption by 9% by 2037/38, we support the National Meter Strategy on data sharing and will continue to be involved in industry discussions. Our meters will take data readings on an hourly basis with a 15-minute night line. There will be no charge for this data, although we need to agree how this data will be made available and shared. This will be decided once the NHH National Metering Strategy Projects delivers its recommendations at the end of March 2024. Initially, one billing reading per month will be uploaded to CMOS under the terms of the CP142 change proposal – this makes wholesalers responsible for meter reading submission for settlements purposes, where a smart meter is installed at the premise. We recognise that some NHH customers have chosen to have loggers fitted to their meters to provide more granular data and we will ensure that our future smart meters continue to allow this addition.

Furthermore, Northumbrian Water has joined with UK Power Networks, GitHub, Hewlett Packard Enterprise, LinkedIn, Microsoft and R2 Factory to make private sector data more accessible.

The Industry Data for Society Partnership (IDSP) is a first of its kind, and will see information shared, such as energy consumption, generation, and efficiency data, with the hope of better visualising and understanding how to address the global challenges such as advancing environmental sustainability and inclusive economic growth.

The pace of install in AMP 7 has been impacted by several factors:

- Covid – field resource stood down for a period of time, internal installs put on hold and customer demand for meters (optants) was significantly impacted in the first 2 years of the AMP.
- Global chip shortage – limited our ability to receive the volume of meters we had ordered which curtailed our install progress. The global supply chain did not recover until Q1 2023.
- Delay in procuring enduring communication infrastructure across Essex & Suffolk – this process was delayed by 12 months as early assessment of the market indicated that a number of emerging technologies such as LoRaWAN and NBIOT were still in their infancy and making an early decision on an enduring communication network would be premature in the absence of seeing these technologies progress as alternative technology choices.
- Communication infrastructure failure – we identified in March 2023 that the Arqiva network installed in Dagenham, Ilford and Romford had a coverage shadow. As a result, 5,318 properties where a smart meter had been installed were not connecting to the network. It took several months for Arqiva to correct this issue with the installation of additional communication masts and during that time our install opportunity was curtailed.

Due to the above points, the install plan has been re-optimised on a quarterly basis, often changing the mix of install types to work within the constraints highlighted. Our strategic intent has always been to endeavour to install meters proactively, only in places covered by an existing smart communication network to get the full value for our customers and NWG in granular AMI data. Having already capitalised on installing meters for un-measured customers with empty boundary boxes and exhausted the opportunities available within signal coverage, we have focused heavily in 2023-24 on proactive upgrades of traditional meters to smart meters in areas of high coverage. We have also run a series of targeted marketing campaigns to customers who would benefit the most from switching to a metered bill, which has driven an increase in inbound customer demand for meters.

As the rollout of the new Connexin network accelerates through 2024-25, we are able to widen our rollout of smart meters across larger areas of Essex and Suffolk and accelerate the impact. We have also taken the decision to focus our smart rollout efforts in Hartismere, which is our most water stressed WRZ, with the ambition to make this a fully smart metered WRZ for both HH and NHH customers by the end of AMP7, covering 12,000 properties.

Meter installation volumes are reported on a monthly basis and we hold quarterly review meetings to monitor progress against target and implement actions accordingly to increase installations, should we be falling behind target. This may include changes to the installation mix e.g. dialling up or dialling down proactive installs in the place of new installs, or trigger marketing campaign activity to drive inbound customer demand for meters. This drumbeat of progressive governance is already in place and effective in driving install mix optimisation. We will also keep in place our Smart Programme Board, which has membership of three of our Executive Leadership Team and key stakeholders from the

business, to ensure continued governance and oversight of performance. Progress will continue to be reported in our Annual Report.

The development of near real time data dashboards is in progress which will show the impact of smart meter installations on PCC, water demand and customer side leakage, allowing us to confidently report Ml/d benefits associated to smart meter installations.

We consider that our WRMP24 plans for rate of metering is deliverable and optimal. Whilst we are not forecasting to meet our WRMP19 targets for meter installations, we have demonstrated progressive year on year increases in install volumes, which provides confidence that we can scale our operational capability sufficiently to meet our AMP8 targets and, therefore, there is no plan to change the baseline plan for AMP8.

We have laid strong foundations in internal capability, system change, organisational design and partnerships to ensure we are in a strong position for success. We are also in the process of tendering for install partners framework contracts, which will deliver flexibility to scale resource and install volumes from the end of AMP7.

Following a competitive procurement exercise, we selected Connexin as our smart network service provider for Essex and Suffolk, utilising LoRaWAN (Long Range Wide Area Network). LoRaWAN provides flexibility to install gateways quickly and cheaply in a variety of different locations including street furniture, which increases the ability to capture AMI data from meters in boundary boxes. Other solutions such as Arqiva FlexNet and Suez Wize require a smaller number of base stations, but these are significantly more expensive to install and have much longer lead times. It is very straight forward to add additional LoRaWAN gateways in coverage 'black spots', but it is very difficult to in-fill with the large base-stations.

Of the vendors that provided LoRaWAN solutions, Connexin gave us the most confidence in their ability to meet our timelines, and to provide a quality service over the duration of the contract, backed by successful volume deployments with both Severn Trent and Yorkshire Water.

The LoRaWAN solution also gives exceptionally good battery life; being able to provide a 10-year warranty and 15-year expected life, whilst maintaining 30 reads (hourly & nightline) per day, transmitting up to 3 times per day.

To mitigate the meter supply chain issues encountered in the early years of AMP7, two meter suppliers (Itron and Diehl) have been selected to provide the preferred AMI capability for Essex and Suffolk. These meters have been chosen as they are interoperable on the enduring Connexin network, which provides the resilience that if supply chain issues are identified with the primary supplier, then NWL can very quickly switch to the secondary supplier with no impact on rollout or customer experience. Itron is our primary meter supplier chosen, due to a number of key features:

- The ability for the meter to operate in both AMI and AMR mode simultaneously, meaning that in the event of non-communication from the meter, we can collect a reading via walk by or drive by (not available from any other meter supplier).
- The ability to take both hourly readings and in addition, 15-minute readings across the nightline (2am – 4am), aiding more accurate customer side leakage detection (not available from any other meter supplier).

- Lowest minimum flow to trigger measurement.
- Integrated meter and smart point making installation easier and faster than meters with separate communication devices.
- Proved to be the cheapest per unit cost to meet our requirements.
- Offered the fastest lead time from order to delivery in the first year of the contract.

7.3.3. Water Efficiency

For a detailed report on this section, please refer to the **Water Efficiency technical report** which is available to download **here**.

As part of the Demand Management Options for ESW WRMP. Water Efficiency plays a key role in the strategy for PCC reduction across AMP7 and continues into AMP8.

We have been widely regarded as an industry leader in the field of water efficiency. This long-standing reputation is a result of the successful delivery of effective water efficiency strategies over the years, enhanced by sharing the various project outcomes with many stakeholders, including regulators and Government.

Water efficiency has remained a key strand of our demand management undertakings throughout AMP7. Having initiated the first water efficiency retrofit programme in 1997, we are able to demonstrate the successful delivery of industry-leading projects, schemes and initiatives spanning over twenty-five years. These activities have resulted in quantifiable water savings, unrivalled customer experiences and a significant contribution to the water efficiency evidence base. Our strategy has, and continues to be, designed to create water efficiency programmes that make genuine long-term savings in water, as cost effectively as possible.

Behavioural change engagement, incentivisation, flow regulation and a leap into the digital space for water efficiency support our option scenarios. We believe the options we have put forward allow us to ensure we are achieving sustainable high levels of water savings, the options will also allow us to increase the effectiveness of our water efficiency retrofit projects, put stronger emphasis on the measurement of water savings, develop interest in the sustainability of savings, and create determined focus on the delivery of sustained behaviour change across the industry. All while continuing to proactively share and disseminate the results, experience and learning far and wide.

Our key drivers for establishing a strong option plan as part of the WRMP for Price Review 2024 (PR24) emphasise and are driven by new ways of doing things with this current AMP and applying our learnings into 2025 and beyond. The key focus of the strategy is targeting our highest using customers to establish understanding and removal of barriers to efficient practices to maximise water savings, over a longer period.

Included in our plan are three core elements of water efficiency delivery, as outlined in the graphic below. The interventions are the output of fully cost options appraisals following the appropriate methodologies and guidelines

provided by the Environment Agency (EA). The graphic below outlines our commitments across both our Northumbrian Water and Essex & Suffolk Water operating regions combined. For a detailed report on this section please refer to the Water Efficiency technical report. The technical report includes the anticipated benefit for each option within the three core areas highlighted above. The method which has been used followed the guidelines produced by the EA.

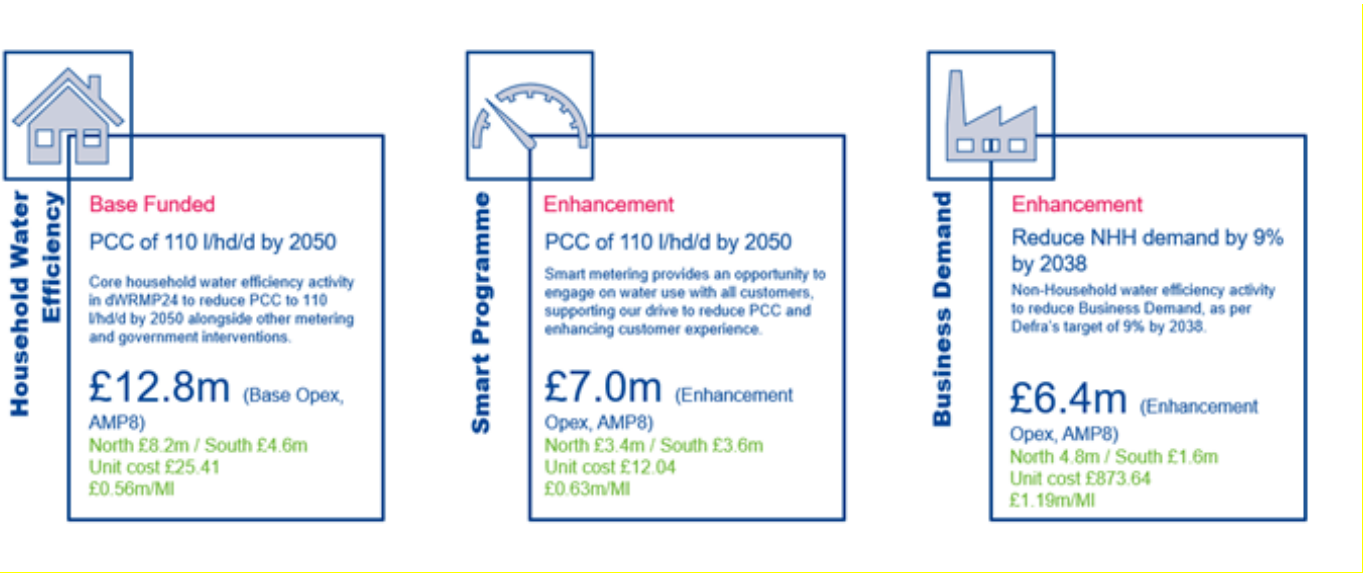


Figure 32: Water efficiency commitments across NWG

The Water Efficiency Strategy will support delivery of our long-term targets to reduce PCC to 110 litres per person per day by 2050 and reduce Business Demand by 9% (excluding growth) by 2038.

Water companies alone cannot deliver the deep reductions in household consumption and business demand. A range of key stakeholders need to play their part. The Government has a particularly important role in delivering what are indeed its own targets. We welcome the Government's Roadmap to Water Efficiency, in particular its commitment to deliver the mandatory water efficiency labelling scheme by 2025, the review of the Building Regulations 2010 and the desire to work across government to integrate water efficiency into energy efficiency advice and retrofit programmes. It is important to emphasise that such committed actions are crucial in delivering the goal of reducing PCC to 110 litres per person per day by 2050. Indeed, the impact (water savings) of such government interventions are built into the Water Balance and demand forecasts (lower estimate). Such policy change will support delivery of the deep demand reductions required. Without implementation, it will not be possible to achieve them.

We fully support the Waterwise Water Efficiency Strategy 2030 (published in September 2022) and played an active role in its creation. The national strategy clearly outlines the need for demand management and the important roles of various stakeholders including wholesale water companies, retail water companies, Government, regulators, environmental charities and other sectors. Our household and non-household water efficiency strategies align to the national strategy across several of the Strategic Objectives. We lead the working group for Strategic Objective 7 (water efficiency measures are included in building retrofit programmes) and are actively involved in working groups supporting delivery of other Strategic Objectives.

A consideration which will be actioned is collaboration across the water efficiency space amongst the water industry, this approach is fundamental to work with others to better our understanding and practices across the UK industry to learn and better our water saving potential. Working in partnership is key to driving deeper and sustainable water efficiency impact. Indeed, taking a collaborative approach with various partners and stakeholders will be fundamental to reducing both PCC to 110 litres per person per day and Business Demand by 9% by 2038 (excluding growth).

The general duty to promote the efficient use of water under Section 93A of the Water Industry Act 1991 applies to both us as the wholesaler, and the retailer. Consequently, we will continue to work with the retailers and non-households to ensure the promotion of water efficiency and demand management with all our customers.

As well as this, innovation will underpin all our water efficiency activity moving forward. Water efficiency has always played a key part in our Innovation Festivals with devoted sprints held each year focusing on various challenges around water efficiency. We have fully engaged with Ofwat's Water Breakthrough Challenge as it is a great opportunity to access funding for collaborative work to solve big challenges, receiving full funding for our Water Literacy programme. A shift further into customer engagement will also allow more effective and sustainable behaviour change while understanding customers further to benefit from sustained savings.

Please refer to our Annual Performance Report **here** for more detailed information about the impact of the Covid-19 pandemic.

7.3.4. Demand Management Options: Monitoring, Reporting and Interventions:

We recognise the importance of monitoring the performance of our demand management programmes, specifically in relation to leakage reduction and household and non-household consumption. Our Water Service Planning function is responsible for monitoring and reporting our outturn performance against Performance Commitments (PCs) and Outcome Delivery Incentives targets through weekly reporting and monthly and annual score cards. Monthly and annual performance information is reported to our Water Leadership Team and Executive Leadership team and importantly to our Strategy and Tactical teams who adjust our strategies and / or short and medium term tactical plans to rectify any under-performance. We have also made a commitment to the Environment Agency to discuss our latest leakage and consumption performance at our quarterly Environment Agency Liaison Meetings. Additionally:

- Leakage performance is monitored weekly against a target profile to assess the current position and to influence any changes required to operational delivery. The annual average level of leakage is reported to Ofwat as part of APR and compared to our performance commitments to identify whether we are on or off track to meet our target reductions. We are currently, alongside all water companies, providing quarterly updates on performance to Ofwat.
- Actual meter installation numbers against target numbers are reviewed monthly and reported to Metering and Customer leadership teams. As with leakage, our operational / tactical plans are adjusted to rectify any underperformance. For example, this may include changes to the installation mix e.g., dialling up or dialling down proactive installs in the place of new installs or trigger marketing campaign activity to drive inbound customer demand for meters. This drum beat of progressive governance is already in place and is effective in driving install mix optimisation.
- The development of near real time data dashboards is in progress which will show the impact of smart meter installations on PCC, water demand and customer side leakage allowing us to confidently report Ml/d benefits associated to smart meter installations.
- Performance of each water efficiency option, in terms of volume of activity and water saved, is monitored monthly in detail to ensure we remain on target. Progress also feeds into a PCC Tactical Plan which in turn is monitored monthly through our PCC Focus Group which is chaired by our Customer Director. On an annual basis, all volumes

of activities and water savings from water efficiency options are recorded in our Water Efficiency Target Tracker (WETT).

- Non-potable demands are reported as part of the Annual Review process, along with any changes to the available non-potable supply.

7.3.4.1 Household

Three Household Water Efficiency option scenarios were created as part of this process as shown below. Medium Enhanced was selected as the preferred option. This incorporates a focus on the highest water users, while also offering support to all customers through home flow restriction (flow controllers), Leaking toilet identification and repair, and Digital engagement while incorporating water efficiency action at the time of Smart Meter installation. The high option scenario increases the scale of four of the options that have not been delivered previously (Find and Fix Teams – bulk supply, Toilet Rebates, Home Flow Restrictions, and Unmeasured Property Engagement.)

Further information on each option and on our current and proposed educational interactions is presented in our WRMP24 Water Efficiency Technical Report (Section 3.3.1 onwards).

Table 61: Summary of water efficiency options

SCENARIOS	LOW	MEDIUM	HIGH	MEDIUM ENHANCED
Options within scenarios	Top 5% Highest Users Visits Unmeasured property engagement Internal leakage repair visits Find and Fix Teams - bulk supply New Homes - Flow restrictions Older Homes - Flow restrictions	Top 5% Highest Users Visits Unmeasured property engagement Internal leakage repair – education and visits Find and Fix Teams - bulk supply Educational interactions (Digital) Digital Engagement National Campaign Toilet Rebates Home Flow restrictions	Top 5% Highest Users Visits Unmeasured property engagement Internal leakage repair – education and visits Find and Fix Teams - bulk supply Educational interactions (Digital) Digital Engagement National Campaign Toilet Rebates Home Flow restrictions	Top 5% Highest Users Visits Unmeasured property engagement Internal leakage repair – education and visits Find and Fix Teams - bulk supply Educational interactions (Digital) Digital Engagement National Campaign Toilet Rebates Home Flow restrictions Home Doorstep Education – information & Engagement Water Saving Product Installation at Point of Meter Install
Annual Impact (l/hd/d)	0.49	0.97	1.08	1.31

7.3.4.2 Non-Household

We have developed a new non-household water efficiency strategy. Below we set out a summary of the Water Efficiency Strategy that will deliver a reduction in non-household demand of 9% by 2037/38 (excluding growth) against a 3-year average baseline taken in 2019/20. We have committed to a relative target (9% reduction excluding growth) instead of an absolute target (9% reduction of overall NHH demand). Our NHH demand growth forecasts are among the highest in the industry and therefore we have devised a programme of NHH interventions that will deliver a 9% reduction against a baseline excluding growth. We have not committed to anything beyond 2037/38 currently. We believe we will learn a lot of this period and will consider increasing our commitment post 2038 in future resource plans. Further detail can be found in the Water Efficiency Technical Report.

The first five years (AMP8) have a lower commitment before increasing in AMP9 and again into the first three years of AMP10. This will enable us to grow our understanding, learn from and collaborate with retailers/non-households/stakeholders, and iterate our plans while delivering options that are like the household domestic use. This all prepares us for a scaling up of activity in AMP9 and the first three years of AMP10.

We have engaged a range of organisations to develop our non-household water efficiency strategy. These include WRE, Market Operator Service Ltd (MOSL), water retailers, wholesale water companies and consultants. We will continue to build on these relationships, with a concerted effort on driving long-term and impactful relationships with water retailers.

We have shared our plans as they have developed with our two largest retailers, Wave and Everflow, who make up c.90% of our NHH connections. This is both to ensure alignment and avoid any barriers. Up to and after 2025 we will

continue to interact to identify the best ways of delivering together. Discussion focused on the relationships Retailers have with their customers could lead to a higher level of engagement, with funding required for Retailers to take this on over and above their current level of engagement. Decisions of how to best to manage this will be agreed ahead of delivery from April 2025 with Retailers involvement. We will continue to build on these relationships, with a concerted effort on driving long-term and impactful relationships with water retailers.

Table 62: Summary of water efficiency options

INTERVENTION	QUANTITY IN AMP8	SAVING IN AMP (ML/D)
5.2 Information Provision	555	0.06
5.3 Infrastructure and Leak Investigation	1200	0.27
5.4 Water Efficiency Solutions for Domestic-type Use	2867	0.50
5.5 Water Efficiency Solutions for Mixed-type Use	91	0.09
5.6 Consultancy for Industry	12	0.53

7.4. SUPPLY OPTIONS

Table 63 confirms the total number of options that have been assessed and of those, the number that have been rejected because they were not considered feasible, and the number that have proceeded to the least cost and best value decision-making process.

Table 63: Summary of Options

Option type	Option description	Total number of options assessed	Total number of options Rejected	Total number of options Progressed
Aquifer Storage and Recovery (ASR)	At times of water surplus, this option pumps at least partially treated raw water from rivers into the Chalk aquifer where it is stored until it is re-abstracted for use, for example, during the summer.	20	19	1
New Water Reuse Options	Treated effluent from coastal water recycling centres that would otherwise be discharged to sea is diverted to a water reuse plant where further treatment would take place using Reverse Osmosis (RO) technology. The resulting output from the Reuse plant would then be transferred by pipeline and discharge into a river upstream of our normal abstraction intake to augment river flows.	11	6	5
Existing Water Reuse Enhancements	Upgrade of our existing Langford Effluent Recycling Plant to increase its capacity.	1	-	1
New Reservoirs	Construction of winter storage reservoirs to store water abstracted from rivers during high flows for use in the summer.	3	2	1
Desalination	Water abstracted from the sea (full sea water desalination) or from an Estuary (Brackish water desalination) is treated using Reverse Osmosis (RO) membranes to remove minerals (salts). The output would then be used to augment water supplies.	14	2	12
Water Transfer	Moving water, via pipelines, pipelines or existing river channels, from an area with a water surplus to an area with a water shortage.	64	2	62
Groundwater Sources	The extraction of water from underground water bearing rocks. This uses a submersible pump and rising main installed in a well or borehole, the latter being a narrow, deeper version of a well.	3	1	2
Nitrate Treatment	Rivers contain nitrates from agriculture and sewerage effluent. When river nitrate concentrations are significantly above the 50mg/l drinking water standard and it is not possible to dilute the nitrates down using another source of water with lower nitrate concentrations, a water treatment works output might need to be reduced creating unplanned outage. A nitrate treatment plant removes the nitrates to ensure final treated water complies with the 50mg/l drinking water standard and therefore reduces unplanned outage.	6	-	6
Pump Options	Increasing the capacity of, for example, a raw water pumping station by increasing the size of pumps or the number of pumps.	2	-	2
Upgrade Options	New water treatment works processes to allow a works to treat water from a new / difference source and / or to address a deteriorating trend in raw water quality.	2	2	2
UV Treatment	Ultraviolet (UV) treatment to manage cryptosporidium and other bacteria.	1	-	1
Total Number		**127**	**32**	**95**

At the macro level, there is a limited number of feasible supply option types which reflects the significant challenge in East Anglia which is a serious Water Stressed Area, and which has the highest number of water dependant Sites of Special Scientific Interest (SSSI) in the country.

Consequently, there is no groundwater available for abstraction licensing and all our Norfolk and Suffolk groundwater licences are subject to sustainability reductions either at renewal for time limited licences else by 2030. Surface water is available but only at high flows which means new surface water abstractions must be developed with winter storage reservoirs. Aquifer Storage and Recharge (ASR) was discounted as a feasible for the Chalk and given they have similar groundwater sustainability challenges to us, there are no opportunities for importing water from neighbouring Anglian Water.

Our feasible options cover a range of different option types as well as different sizes of option types and have provided us with real choices in the selection of preferred Best Value Plan. Importantly, all options contribute to us meeting our WRMP24 objectives.

An important part of identifying options is assessing each options environmental effects both alone and in combination. This has been completed by undertaking an Integrated Environmental Assessment as outlined in Section 9.2 below.

8. OUR BEST VALUE PLAN

8.1. OVERVIEW

The aim of the Water Resources Management Plan (WRMP) is to present a long-term plan to ensure a secure supply of wholesome drinking water for customers and to protect and enhance the environment.

Figure 33 illustrates the process undertaken to develop this Water Resources Management Plan 2024 (WRMP24). Best Value Planning occurs after the following steps:

- development of a baseline supply demand forecast for the plan identifying that water resources zones are in deficit over the planning period; and
- options appraisal and development of feasible supply and demand options to address the deficit.

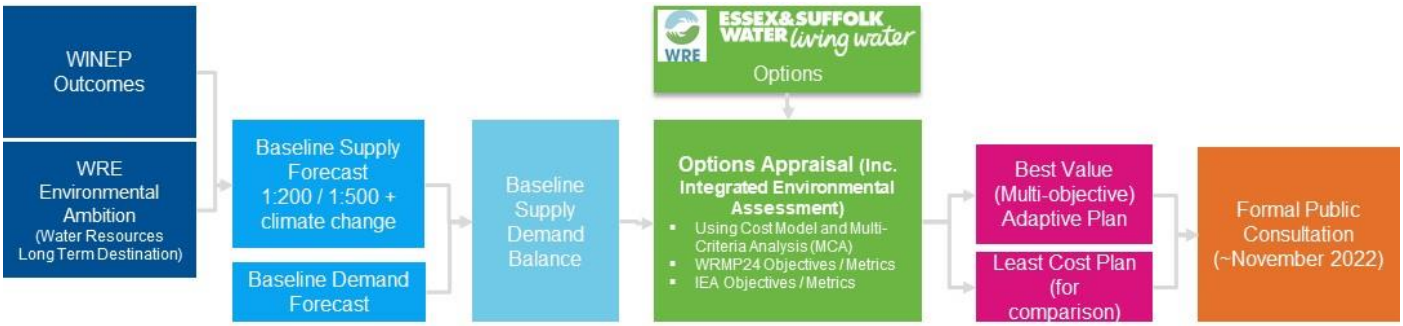


Figure 33: WRMP24 development process

We have used an Economics of Balancing Supply and Demand (EBSD) optimiser model to develop a least cost plan for WRMP24. The EBSD model considers the supply-demand balance for each water resource zone (WRZ) at annual timesteps and selects options to address deficits based on a cost per Ml/d and the earliest available date of supply for relevant options.

This tool does not consider other monetised criteria such as carbon or other societal and environmental impacts and benefits. As such the model results represent a least-cost plan with no optimisation.

Best Value Planning aims to determine whether the inclusion of further monetised and non-monetised criteria would identify a plan that delivers the best value, defined by the Water Resources Planning Guideline (WRPG) as 'one that considers factors alongside economic cost and seeks to achieve an outcome that increases the overall benefit to customers, the wider environment and overall society'.

8.2. DECISION-MAKING APPROACH

Figure 34 illustrates the steps undertaken to develop and determine the Best Value Plan. This has been developed to align with the Water Resources Planning Guideline 2021, which sets out the expectations of the regulators. In addition, reference has been made to UK Water Industry Research's (UKWIR) 2020 guidance 'Deriving a best value water

resources management plan'. For more detail on our Best Value Plan decision making approach please refer to Section 2 of our WRMP24 best Value Plan Technical Report.

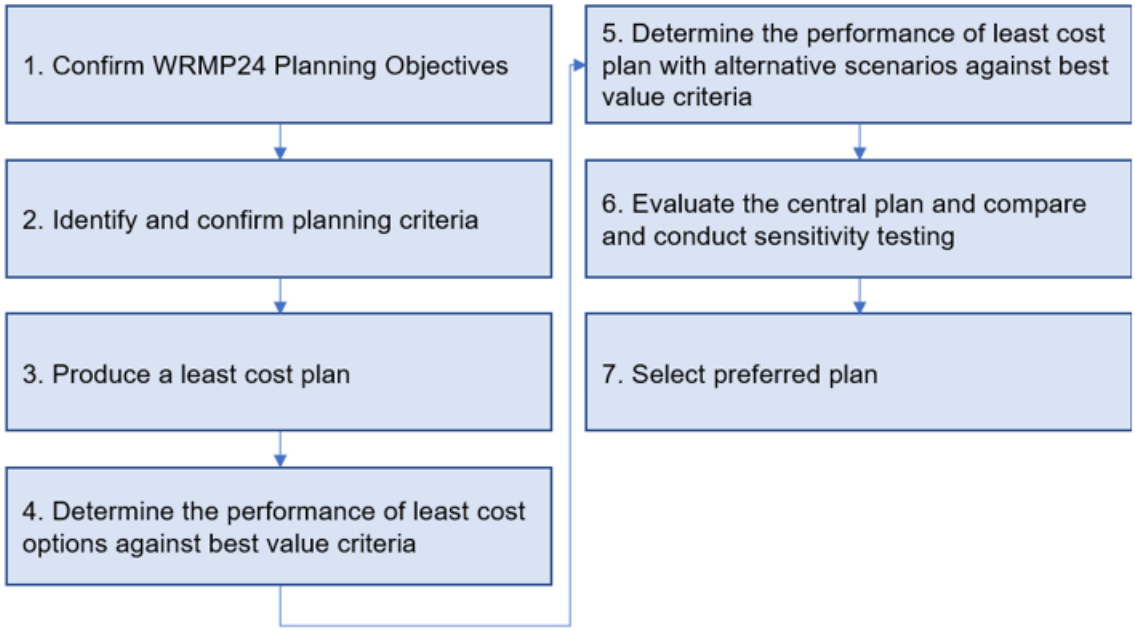


Figure 34: Overview of Best Value planning approach

8.2.1. Objectives

The objectives we aim to achieve in our WRMP24 Best Value Plan (BVP) are:

- Achieve a secure, resilient, and sustainable supply of water for our customers, moving to a 1 in 500 level of resilience by 2050.
- Protect and enhance the environment, ensuring our abstractions are sustainable both in the short and long term.
- Reduce leakage from our network and from customer's homes, contributing to a national target of 50% reduction from 2017/18 levels by 2050.
- Reduce customer demand to 110 l/head/day by 2050.
- Reduce non-household customer demand by 9% by 2037/38 (excluding growth).
- For all our meters to be smart meters by 2050.

Our objectives have been chosen because they align with:

- Our own Purpose, Vision and Values
- Our current performance commitments and Outcome delivery Incentives (ODIs)
- Water Resources East's (WRE) regional plan objectives
- Government expectations for water companies WRMP24s including outcomes of the 25 Year Environment Plan and our local River Basin Management Plans (RBMPs); and
- The overall requirements of the Price Review 2024 (PR24) Water Resources Planning Guideline.

Our Purpose is:

Caring for the essential needs of our communities and environment, now and for generations to come.

We do this by providing reliable and affordable water and wastewater services for our customers and by making a positive difference by operating efficiently and investing prudently, to maintain a sustainable and resilient business.

Our Vision is:

To be the national leader in the provision of sustainable water and wastewater services.

Our Values are:

Figure 35: Our values

8.2.2. Metrics

For each plan developed, and options selected, the criteria, informed by our objectives and summarised in

Table 64, have been used to assess whether plans and options deliver best value.

Table 64: Summary of Best Value assessment criteria

BEST VALUE CRITERIA DESCRIPTION	DESCRIPTION	METHODOLOGY	UNITS	CRITERION SOURCE
Cost of the plan	Total cost (TOTEX) of the programme	Water Supply Options costs use CAPEX and OPEX outputs from Essex and Suffolk Water (ESW) EBSD modelling. These costs have been converted into Net Present Value (NPV) for all water supply and demand management options for both CAPEX and OPEX following HM Treasury green book NPV guidance (a discount rate of 3.5% for the first 30 years, 3% for the next 45 years and then from year 75 onwards 2.5%).	£	Based on WRE BVP
PWS Drought resilience	Number of years over the planning period the PWS drought resilience to 1 in 500 is achieved	ESW plan to achieve a 1 in 500 year drought resilience from the year 2036 onwards, as such these criteria does not differentiate between scenarios.	Years	Based on WRE BVP (levels of service)
Biodiversity Net Gain (BNG)	Change in biodiversity units	This metric uses the outputs from the BNG assessment of all Water Resource Supply Options. The outcome shows the number of additional Biodiversity Habitat Units required to achieve Biodiversity Net Gain	Habitats Units (total restoration)	Based on WRE BVP
Natural Capital (NC)	Monetised (£NPV) impact of the option on natural capital e.g., changes to land use.	This metric uses the outputs from the NC assessment of all Water Resource Supply Options.	£	Based on WRE BVP
Leakage reduction	The volume of leakage reduction achieved over the planning period (Ml/d)	All scenarios use a central 40% reduction in leakage. The leakage reduction figure used is the difference between the total amount of forecast annual leakage in the final year of a time horizon compared to 2025.	Ml/d	ESW specific
Per capita consumption (PCC) reduction	The volume of PCC reduction achieved over the planning period (litres/head/day).	There are three demand reduction profiles used within scenarios. A central, a low PCC and a high PCC. The reduction figure used is the difference between the total forecast PCC in the final year of a time horizon compared to 2025.	l/h/d	ESW specific
Flood risk management (non-drought resilience)	Qualitative assessment based on Strategic Environment Assessment (SEA) objective to reduce	This metric uses the cumulative outputs of the SEA for Water Supply Options, this combines the positive and negative outcomes for the construction and operation of schemes to provide a comparative cumulative figure. This has been aggregated for individual plans.	Score	Based on WRE BVP

BEST VALUE CRITERIA DESCRIPTION	DESCRIPTION	METHODOLOGY	UNITS	CRITERION SOURCE
	and manage flood risk			
Multi-abstractor benefit	Qualitative assessment based on SEA objectives to maintain or improve the quality of waterbodies and to avoid adverse impacts on surface and groundwater levels and flows	This metric uses the cumulative outputs of the SEA assessment for Water Supply Options, this combines the positive and negative outcomes for the construction and operation of schemes to provide a comparative cumulative figure. This has been aggregated for individual plans.	Score	Based on WRE BVP
Carbon	Capital/embedded and operational total tCO2e of programme	This criterion uses the outputs from the WRMP24 Water Resource option assessment which developed carbon costs for each option. These have been included with CAPEX and OPEX to provide an Average Incremental Cost including carbon to enable comparison at both a plan and individual option level using carbon intensity as a proxy for the environmental impact of schemes.	tCO2e, £	Based on WRE BVP
Customer preferred option type	Options to be ranked based on customer preference survey data	This criterion uses the overall percentage preference for an option type (e.g., Water Reuse) multiplied by the % of total plan WAFU that an individual option contributes to enable comparison between plans. In practice, due to the limited range of options, there is little variation between customer preference scores. See **Error! Reference source not found.**	% Preference	ESW Specific
Human and social well-being	SEA objectives associated with human and social well-being	This metric uses the cumulative outputs of the SEA assessment for Water Supply Options, this combines the positive and negative outcomes for the construction and operation of schemes to provide a comparative cumulative figure. This has been aggregated for individual plans.	Score.	Based on WRE BVP
Option deliverability	Options scored for deliverability/cost confidence	This criterion uses an optimism bias percentage for an option type (e.g., Water Reuse) multiplied by the % of total plan WAFU that an individual option contributes to enable comparison between plans. See **Error! Reference source not found.**	% Optimism Bias	ESW Specific
The impact on designated sites	SEA objectives associated with impact upon statutory	This metric uses the cumulative outputs of the SEA assessment for Water Supply Options, this combines the positive and negative outcomes for the construction and operation of schemes to provide a comparative cumulative figure. This has been aggregated for individual plans.	Score.	Based on WRE BVP

BEST VALUE CRITERIA DESCRIPTION	DESCRIPTION	METHODOLOGY	UNITS	CRITERION SOURCE
	environmental designated sites			

8.2.3. Engagement

Developing our WRMP24 has involved a continuous process of engagement with Water Resources East and member water companies, as well as with our regulators and wider stakeholders.

Engagement with WRE has been though a Technical Steering Group, WRMP24 workstream groups and a weekly Alignment Group meeting. We are also a member of WRE's Board and Stakeholder Advisory Group (SAG).

We have engaged with stakeholders through WRE and through our Customer Challenge Group (known as our Water Forum) and through pre-consultation webinars.

We have held pre-consultation meetings with the Environment Agency (EA), Ofwat and Natural England. Additionally, we have discussed WRMP24 development at our bi-monthly EA / Natural England Liaison Meetings as well as through ad-hoc meetings when the need has arisen.

The following customer research has been undertaken with the results being used to inform the development of our Best Value Plan:

- **ESW WRMP Survey:** We have undertaken quantitative (online and face-to-face surveys) research regarding WRMP24 options with a total of 3,271 customers taking part. The results, presented in a report entitled "Essex & Suffolk Water Resources Management Plan Survey report" (July 2022), can be found here.
- **ESW Affordability and Acceptability Research: In 2023, we completed** Affordability and Acceptability (Qualitative) research which had 224 participants including Household customers, Non-Household customers, People Panels and Future customers.
- **Water Resources East:** We jointly funded further customer engagement as part of a Water Resources East club project. This comprised qualitative , reconvened online workshops with pre- and post- surveys (4 with ESW customers, 4 with Cambridge Water customers and 8 with Anglian Water customers). In-depth interviews were held with non-household customers and stakeholders with a total of 89 participants. The results can be found here.

In summary, customers strongly support leakage reduction and water efficiency and of the metering options, prefer traditional meters over smart meters. Customers prefer more traditional source of water such as groundwater, river abstractions and winter storage reservoirs and least prefer water reuse and desalination options.

The results of all three areas of research are presented in our Customer Research Report which can be downloaded here.

8.2.4. Resilience

We are forecasting baseline supply deficits in our Essex and Suffolk supply areas and so have identified demand management and supply options to restore a supply surplus.

Essex

We are planning to provide 1 in 200 year drought resilience in our Essex WRZ until 2030/31 and then 1 in 500-year drought resilience from 2031/32. To enable us to increase our resilience, we are planning to invest in Linford new WTWs and outage reduction schemes, including nitrate removal at Langham WTW, and both nitrate removal and UV treatment for cryptosporidium at Langford WTW. These schemes have been included in our Best Value Plan for delivery in Asset Management Plan 8 (AMP8) and will enable us to provide 1 in 500 year drought resilience. This investment will also support us in supplying future, unknown non-household demand along the Thames Estuary.

Suffolk

We are planning to provide 1 in 200 year drought resilience in our Suffolk WRZs until 2032/33 and then 1 in 500-year drought resilience from 2033/34. To do this, we are planning to invest in the following schemes in AMP8 (2025-230):

- Suffolk Strategic Pipelines
- Lowestoft Water Reuse
- Barsham nitrate removal
- Broome To Barsham Pipeline

However, in the short term, while the new supply schemes are delivered, we are planning to change our Level 1 and 2 planned levels of service as follows (see Section 2.5):

- Level 1 – Appeal for Restraint: 1 in 10 years to 1 in 5 years
- Level 2 – Temporary Use Ban: 1 in 20 years to 1 in 10 years

However, once demand savings are delivered through our preferred demand management options, and supply increases are delivered through our WRMP24 supply schemes, we will then be able to revert to our current planned Level 1 and 2 levels of service and provide 1 in 500 year drought resilience.

Our groundwater resources in Suffolk are resilient to drought and having assessed all our groundwater deployable outputs (DO) under drought scenarios with both 1 in 200 and 1 in 500 year return periods, we have determined that there is no change in DO when moving to provide 1 in 500 year drought resilience. The detail of this assessment can be found in our WRMP24 groundwater DO and climate change Technical Report.

Our resources feeding Ormesby WTW and Lound WTW are resilient because of the combined surface and groundwater inputs, and in addition, at Ormesby, DO is licence constrained rather than resource constrained. The River Waveney is now licence constrained also, with the implementation of a Water Framework Directive (WFD) No Deterioration

sustainability reduction, whereby the EA has confirmed that they will operate the Waveney Augmentation Groundwater Support (WAGS) boreholes to support our Shipmeadow abstraction to a maximum of 18 Ml/d until 2030/31, rather than the current yield of 20.5 Ml/d, which will then be further reduced to 16 Ml/d from 2032/33. This reduction in support means that there is no change in resource availability at Shipmeadow under a 1 in 500 year drought compared to a 1 in 200 year drought. This is described in more detail in Section 5.8 of our WRMP24 Supply Forecasting Technical Report.

In our Hartismere WRZ, we are forecasting a final plan supply deficit from the start of the planning horizon until 2028/29 when our new supply schemes come online. Consequently, to ensure we comply with the requirement to only put forward a Best Value Plan without supply deficits, we have taken two actions until our new WRMP24 schemes are in supply:

- In our WRMP24 Final Preferred Plan demand forecast, assumed a moratorium on new non-domestic demand.
- We have assumed that we will be granted a Regulation 19 derogation to delay the implementation of WFD No Deterioration sustainability reductions, due to be applied from the start of the planning horizon.

We have not needed to include the benefits of drought permits in our final plan.

8.2.5. Programme Appraisal

We have undertaken an appraisal of alternative programmes to compare against and justify our preferred Best Value Plan. We have undertaken scenario testing against Ofwat's common reference scenarios (see Section 8.7) to understand any tipping points which might affect our decision-making and programme content. We have also prepared alternative plans (see Section 8.9). In all cases, the programmes delivered our WRMP24 objectives.

Our Best Value Plan is based on EBSD modelling to 2050. However, we have also run the EBSD model for all scenarios to 2075 and 2100 (see Section 8.7) to understand how alternative supply demand deficits and longer planning horizons influence which options are selected by the EBSD model.

The costs of our best value plan and other programmes are presented in Section 1.

8.3. OUR BEST VALUE PLAN

8.3.1. Overview

Our Best Value Plan has been developed to address the deficits in our baseline supply demand balance forecast and to restore a final plan supply surplus. Specifically, our central baseline (and final plan) supply forecasts include the following sustainability reductions:

- Outcomes of AMP7 WINEP Investigations for delivery by 2030; and
- Long Term Environmental Destination for delivery in 2040 and 2045.

The EA has also asked us to allow for further sustainability reductions under the Habitats Regulations (Habs Regs) driver. However, the extent of these likely sustainability reductions will not be known until at least December 2024 once the EA has concluded its investigations. While we have agreed with the EA some likely worse case sustainability reduction values, we have not included them in our central supply forecast for our final plan given their uncertainty but have instead included them in the supply forecast of our Habs Regs adaptive programme (see Section 8.8.5). The additional sustainability reductions increase the size of the SDB deficits in our Northern Central and Hartismere WRZs and so further supply schemes, in addition to those in our current preferred final plan, are needed, namely:

- Caister Water Reuse; and
- a higher capacity potable water transfer from Holton WTW to Eye Airfield (ESW-TRA-019)

While the Best Value Plan, presented in the remainder of this section, is currently our preferred final plan, it is increasingly likely that we will need to move to the Habitats Regulation Adaptive Programme. However, given EA investigations have not concluded, we do not consider it appropriate to move to the adaptive programme now as this would make our plan more uncertain. Instead, we have included an additional funding allowance in our AMP8 core plan to allow us to undertake further feasibility and detailed design of the Caister Reuse scheme. Subject to regulatory approval, we will commence this work in Year 5 of AMP7 so that the scheme is closer to being construction ready should it be required.

8.3.2. Our Planned Demand Management

Our preferred demand management options are summarised in Table 65, with the base investment proportion of the AMP7 and AMP8 costs detailed in Table 66.

Table 65: Our preferred demand management options

SCHEME	AMP8 COST (£M)
Leakage Active Leakage Control to reduce leakage by 40% by 2049/50	28.14
Metering High Impact optant and compulsory metering programme Fully smart by 2035	123.76
Water Efficiency Programme Using in home interventions and digital engagement to reduce PCC to 110l/head/day by 2050 Non-household water efficiency to reduce Business Demand by 9% by 2037/38 (excluding growth)	26.2
TOTAL	178.10

Table 66: Our preferred demand management options base costs

AMP	LEAKAGE PROGRAMME		OPTANT METERING PROGRAMME		SMART METERING PROGRAMME		HOUSEHOLD WATER EFFICIENCY PROGRAMME	
	Opex (£M)	Capex (£M)	Opex (£M)	Capex (£M)	Opex (£M)	Capex (£M)	Opex (£M)	Capex (£M)
AMP7	75.45	54.64	£0	£0	£0	£11.25	2.86	0
AMP8	79.00	63.97	£0	£0	£0	£39.64	4.56	0

Leakage

We are proud that overall leakage from our network and from our customers' homes is at one of the lowest levels in the water industry. Our preferred plan for leakage reduction is to reduce leakage by 40% from the 2017/18 performance level by 2050. This is because the 50% reduction is a target for the industry as a whole and not for individual water companies. Our current leakage performance is near industry leading, and we have already exhausted the cheaper leakage reduction options. To achieve a further 50% reduction we would need to replace significant proportion of our distribution network, placing an unfair cost burden on our customers. We also do not believe that it is technically feasible for us to reduce leakage by 50% by 2050 in some parts of our supply area as leakage would need to be reduced to a level never achieved in the UK or Europe.

The difference in cost between 2025 and 2050 between the 40% and 50% leakage reduction options is £323.39 million (40% reduction = £433.74m and 50% reduction = £757.13m).

Metering

We have selected metering option 5, a high impact optant and compulsory metering programme which achieves fully smart metering by 2035. The majority of our customers, nearly 70%, now have a water meter and are charged by how much they use and so we think it is now fair that all of our customers are metered. Our plan is for all customer water meters to be smart by 2035. They have many benefits and will provide information to customers so that they can make more informed choices about how they use water. They will also help customers identify when they might have a leaking pipe or toilet and will help us support high water usage customers to become more water efficient. The demand savings from using smart meters has been incorporated into out PCC forecast.

Water efficiency

A medium water efficiency activity option achieving 0.97 l/hd/d saving has also been chosen to reduce PCC to 110 l/hd/d by 2050. We will upscale our water efficiency work from 2025 to help our customers use less water. These schemes along with our smart metering programme and government interventions in relation to mandatory water efficiency labelling and Updating Building Regulations will enable us to meet our PCC target of 110l/hd/d by 2050.

We have developed a new water efficiency strategy to help reduce non-household demand by 9% by 2037/38 (excluding growth).

The demand management options identified and described above that we have included in our best value plan will both meet and exceed the government expectations with regards to leakage, PCC and non-household (NHH) demand reduction. There is also an ambition from Defra to reduce distribution input by 20% by 2037/38 nationally from a 2019/20 baseline. In our ESW region we achieve a 22% reduction in normal year distribution input (DI) by 2037/38 and 21% reduction in DI under a dry year scenario.

8.3.3. Supporting Customers

While many customers will find they can financially benefit from moving to a water meter, for some there is a risk that they will be worse off, and we will take a holistic and customer-centric approach to the installation of water meters and the range of support we offer. We know from our Vulnerability Research in 2016 that awareness of the extra support available is very low in our customer base, so this support may not be reaching customers who need it most. We have done a lot since then to ensure customers are receiving all the support they can get, and we need to do more in 2025-30 if we introduce a compulsory metering scheme.

To support customers, we will proactively communicate what has been planned for metering in an area, clearly stating why, how, and when any installations will be undertaken, what having a meter means for bills and the way they pay, and what financial and non-financial support options are available. Communication will be share across a range of different channels, and in multiple languages, and we will engage with local minority, community, consumer groups, and local authorities to ensure we can access hard-to-reach customer groups and support all key demographics and ethnicities.

We will review opportunities to create a dedicated, multi-disciplinary, team to support the experience for customers and provide a single point of access to the range of services we offer. Colleagues will engage with customers in the community to offer free water-saving advice, water saving kits, and home audits, provide information and guidance on support tariffs, and advise and educate customers on accessing digital resources such as our mobile app and website. Additionally, we will proactively communicate information where we suspect leakage and support customers with free supply-pipe repairs where relevant.

To support the elderly and those with visible and non-visible disabilities we will offer alternative meter placement if the location would result in the customer being otherwise unable to access and read a meter for themselves and targeted financial support will be given to customers in financial hardship through schemes like social tariffs and WaterSure, which is a scheme intended to assist customers who may use higher than average amounts of water. We will also use tariffs, and investigate opportunities for new, innovative, tariffs to support households, especially multi-generational households, and provide peace of mind through investigating options to offer additional value-add services. We will research options to postpone switching to measured bills if this would help customers budget improve overall affordability and we will work to understand additional opportunities arising from the Digital Economy Act which may enable us to provide further support to hard-to-reach customers.

8.3.4. Our Planned New Supply Options

The Best Value Plan assessment has found that the Least Cost Central Plan as identified by the EBSD model is also the Best Value Plan. This is based on a comparison between alternative plans and a review of alternative options not being selected by the 2050 Central Plan.

Table 67: Best Value and Least Cost 2050 central plan[27]

YEAR SELECTED	WRZ	OPTION	OPTION REF	OPTION TYPE	AMP
2027/2028	Essex	Linford New WTW 10	ESW-ABS-003	New WTW and borehole(s) (with raw water transfer)	AMP8
2029/2030		Langford Nitrate Scheme	ESW-NIT-005	Nitrate removal	AMP8
2029/2030		Langford UV	ESW-UVC-001	Cryptosporidium removal	AMP8
2029/2030		Langham Nitrate Scheme	ESW-NIT-006	Nitrate removal	AMP8
2030/2031		Abberton RWPS and Langford Clarifiers	ESW-PMP-001A	Raw water pumping station and clarifier upgrade	AMP8
2028/2029	Blyth	Barsham WTW to Saxmundham Tower	ESW-TRA-001	Potable Water Transfer	AMP8
2028/2029	Hartismere	Holton WTW Eye Airfield	ESW-TRA-019	Potable Water Transfer	AMP8
2029/2030	Northern Central	Barsham Nitrate Scheme	ESW-NIT-004	Nitrate removal	AMP8
2030/2031		Bungay wells to Broome WTW transfer and Broome to Barsham WTW transfer	ESW-TRA-018 and ESW-TRA-023	Raw water transfer	AMP8
2030/2031		Lowestoft Water Reuse for Ellingham Mill and Transfer	ESW-EFR-002A	Water Reuse	AMP9
2040/2041		North Suffolk Winter Storage 7500 and Transfer	ESW-RES-002C	New Reservoir (with raw water transfer)	AMP11

A change between our revised draft WRMP24 (rdWRMP24) and final WRMP24 is that we will deliver Lowestoft Reuse in 2030/31, subject to detailed design prior to the 2027 adaptive programme review point confirming this is possible. This will enable the Hartismere WRZ non-domestic moratorium to be lifted once Lowestoft Reuse is operational. This is also prudent to do given the uncertainty of Habs Regs sustainability reductions which will not be confirmed by the EA until late 2024/25.

Since publishing our draft WRMP24 (dWRMP24), we have progressed operational interventions (options) to reduce unplanned outage which increases Water Available for Use (WAFU). These options were not sufficiently developed for our dWRMP24 and at that point in time, were not considered feasible. However, the options, including nitrate reduction schemes for Barsham, Langham and Langford WTWs and a UV scheme for cryptosporidium management at Langford WTWs, are now all considered feasible and following least cost modelling and Best Value assessments, are now included in our rdWRMP24 preferred final plan. These schemes are enhancement expenditure because we need to add an additional treatment process to our water treatment works in response to:

- An upward trend in raw water nitrate concentrations and cryptosporidium risk; and

[27] During our Concept and Definition Phase of our Project Delivery Process, we liaised with our consultant organisations to understand the impact of our proposals. This includes where appropriate, archaeological assessments, heritage assessments, visual Impact assessments and ecological assessments. The output of these assessments influences our proposals prior to closing out the Concept and Definition Phase of the project as they may for example, influence the route or a pipeline, or the architectural finish of a building.

- sustainability reductions which are being applied to our groundwater sources (with low nitrate concentrations) which we currently use for blending nitrates down to below drinking water standards

Both of the above points are beyond our control.

Since consulting on our dWRMP24, the EA has asked us to consider if the proposed Lowestoft Reuse option and the North Suffolk reservoir option could be used as a conjunctive use system to increase resilience or the DO. While both schemes are selected in both the core plan and the Habitats Regulation adaptive pathway, they are not selected at the same time with Lowestoft Reuse being selected in 2032/33 and North Suffolk Reservoir being selected in 2040/41 (driven by Environmental Destination). Both schemes have an individual WAFU gain although at this stage, we do not consider that there would be a conjunctive use WAFU gain. Once both schemes are in supply, Lowestoft Reuse could discharge into the reservoir as this will dilute nitrate concentrations which are likely to be elevated given the reservoir will be filled with high flow river water predominantly in the autumn and winter.

The process of developing WRE's Best Value Plan has informed the development of our own Best Value Plan:

- The same baseline supply and demand forecasts have been used for both plans.
- All feasible WRE options have been considered in our decision-making process for selecting our Best Value Plan.
- Our Best value Plan options are all included in WRE's Best Value Plan which is illustrated in Figure 5 in Section 1.

We have considered imports from both Thames Water and Anglian Water. We have agreed with Thames Water that our 20 Ml/d trade agreement that ends in 2035 will not be renewed. Additionally, Thames Water confirmed that the trade agreement could not be terminated early as it will not have sufficient supply surplus to enable that to happen until 2035, the year the agreement ends.

Based on our rdWRMP24 supply and demand forecasts, once our new supply options are operational and we are 1 in 500 year resilient, it is possible that the 20 Ml/d raw water trade agreement could be extended. This is illustrated in Figure 36. However, there is uncertainty in the supply forecast from 2040 regarding the size of required Environmental Destination sustainability reductions. Consequently, the supply headroom may be needed should higher (Enhanced scenario) environmental destination sustainability reductions be required than under the central Business As Usual Plus (BAU+) scenario. Should this turn out to be the case, all our core plan schemes are still required in AMP8 and AMP9.

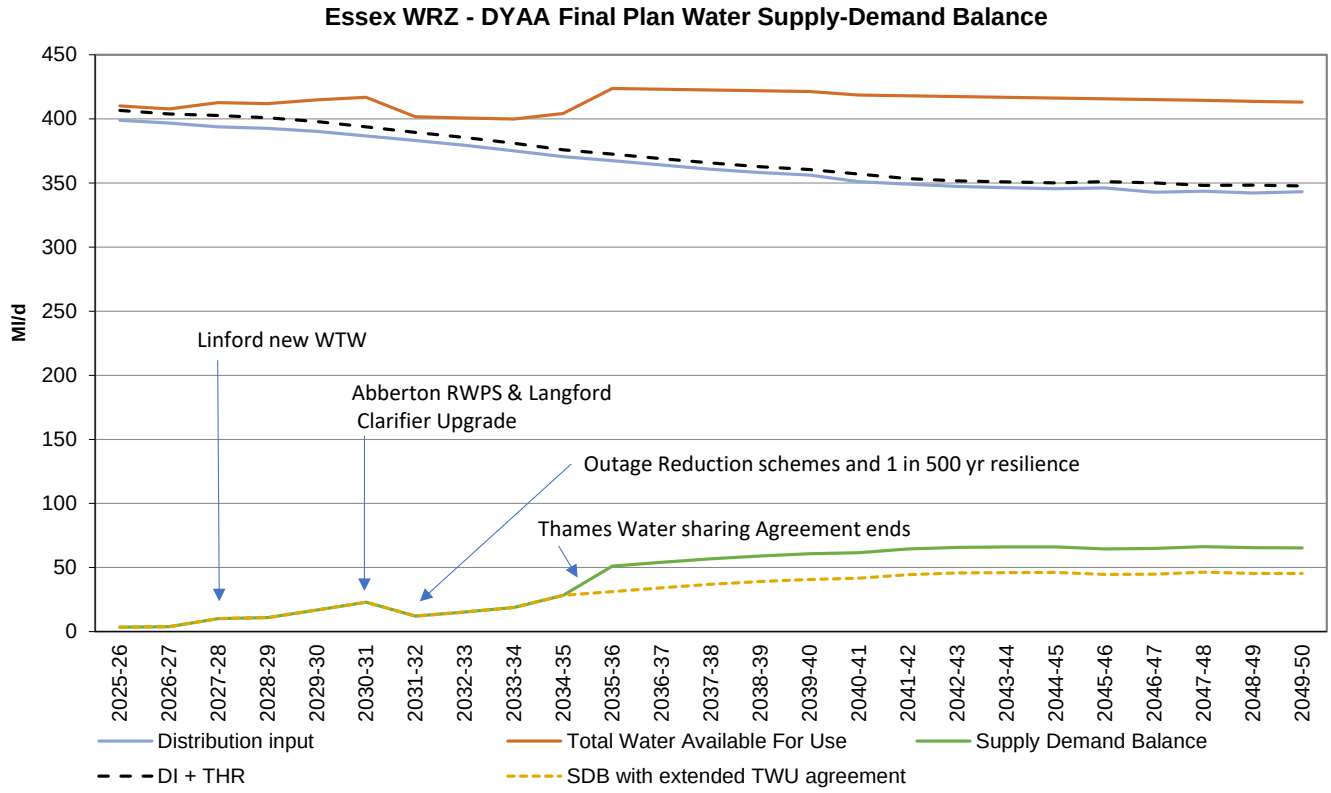


Figure 36: Essex WRZ BVP supply demand balance with extended Thames Water sharing agreement.

We have appraised various import options with Anglian Water including an Essex “Put” and Suffolk “Take” option which would have utilised their strategic network. We have also appraised an import from Norwich into our Northern Central Zone. However, in all cases, the options were screened out as part of the option appraisal process.

Accelerated Infrastructure Delivery Funding

In order to bring forward supply options, following publication of our draft plan, we applied for early funding through Ofwat’s Accelerated Infrastructure Delivery project. Subject to review of our progress on our AMP7 enhancement programme, Ofwat has allowed PR24 transition expenditure funding for four of our supply schemes including Linford new WTW, Suffolk Strategic Network Enhancements, Lowestoft Reuse and North Suffolk Reservoirs. This means the earliest delivery date for the following schemes will be two years earlier than our draft plan indicated as follows:

- Suffolk Strategic Mains: 2028/29
- Lowestoft Reuse: 2030/31 although now not selected until 2032/33 given Barsham nitrate reduction scheme is now included in our preferred final plan; and
- North Suffolk Reservoir: 2033/34 although it is not selected until 2040/41 when further Environmental destination sustainability reductions are implemented.

The delivery date for Linford New WTW remains at 2027/28 because our dWRMP24 assumed detailed engineering design would start in 2023 and not in 2025 as is the case for the other schemes.

Of all the supply side schemes, the most likely option for co-development is the North Suffolk reservoir which, subject to co-delivery funding, could be made marginally bigger. The agricultural sector is the most likely to co-deliver a marginally larger reservoir and we will work with the East Suffolk Abstractor Group to explore this further as part of the Accelerated Infrastructure Delivery project. We have considered whether any of our demand management options meet the requirements for delivery through the Direct Procurement for Customers (DPC) process but have concluded that they do not. Section 8 of our rdWRMP24 has been updated to reflect the latest position.

New Habitats Regulations Options

Between preparation of our revised draft and draft final WRMP24, we took the opportunity to review our WRMP24 unconstrained options list in light of the latest information we have on the Habitats Regulations (Habs Regs) sustainability reductions process and the greater clarity we have from the EA on which of our abstraction licences will be affected.

We have identified two new supply options that could be used to address supply deficits caused by Habs Regs sustainability reductions, namely Bacton Desalination Scheme and a [Norfolk] Broads winter storage reservoir, both of which are described below.

Bacton Desalination Scheme

Anglian Water Services (AWS) has been asked by Defra to further consider the implications of the Habs Regs investigations in Norfolk. As a result, AWS has asked for further funding in AMP8 to develop the Bacton desalination scheme on the north east coast of Norfolk. Following Defra direction, we met with AWS to discuss the option and have since agreed that it could be sized to address some of the Suffolk supply deficits driven by our Habs Regs sustainability reductions. Subsequently, AWS has included a funding allowance in its AMP8 core plan that will allow it to progress the design stages of the Bacton Desalination Scheme along with early work on pipelines to Norwich. We have agreed that we will include a funding allowance in our AMP8 core plan to progress the design stages of a pipeline from Norwich to our Barsham WTW, where it could then connect into the Suffolk Strategic potable water transfer mains (Barsham WTW to Saxmundham Tower - ESW-TRA-001, and Holton WTW to Eye Airfield - ESW-TRA-019), which are enhancements in our WRMP24 preferred final plan. The Norwich to Barsham WTW pipeline was costed for our initial options appraisal process at £40.5 m and so we have included a £2.4 m funding allowance (6% of capex) in our PR24 Business Plan core plan to progress detailed design. This will ensure the scheme is progressed in a timely manner in the increasingly likely event that we will need to move to the Habs Regs Adaptive Pathway.

The Bacton desalination scheme was previously discounted as a feasible option for AMP8 delivery in our WRMP24 by both us and AWS. This was because, given its location, the scheme was only considered feasible if AWS also needed it and, in their case, it was not required until the 2040s to make up for environmental destination sustainability reductions.

Broads Winter Storage Reservoir

We currently have an abstraction intake on Ormesby Broad, part of the Trinity Broads system, which eventually discharges to the River Bure via an Internal Drainage Board (IDB) pumping station. However, Habs Regs sustainability reductions could result in the partial or full loss of our Ormesby Broad abstraction licence. We have identified a new option to construct a new winter storage reservoir, which the IDB pumping station could discharge into. The reservoir would be filled during the winter and subject to further modelling, could remove all summer Public Water Supply (PWS) abstraction from the Trinity Broads system. For clarity, this would not allow the licensing of new abstraction from the Trinity Broads for non-PWS purposes. We have discussed this option with both the EA and

Natural England who are both supportive of us investigating it as a solution to replace the loss of direct abstraction from Ormesby Broad. The scheme would also include a raw water pipeline from the reservoir back to Ormesby WTW.

We propose that the reservoir has a storage capacity of 7,500Ml (the same size as the North Suffolk Reservoir). The capex cost (based on the North Suffolk Reservoir) is £214.8 million and so we have included a £12.9 m funding allowance (6% of capex) in the core plan of our PR24 Business Plan to progress detailed design. As with the Bacton desalination scheme, this will ensure this scheme is progressed in a timely manner in the increasingly likely event that we will need to move to the Habs Regs adaptive pathway.

Outline Programme

We have identified an outline programme to progress the feasibility of the Bacton Desalination Scheme and the Broads Winter Storage Reservoir options. This programme will allow us to investigate these options such that they are sufficiently well developed once EA investigations have concluded, to consider as part of the Habs Regs Adaptive Programme options appraisal, which in turn will feed into the Water Resources Management Plan 2029 (WRMP29) options appraisal process.

It is anticipated that the project scopes will evolve as the solution becomes more defined through the progression of feasibility work.

Indicative workstream activities

Programme Management	Initial mobilisation, financial control, risk management, programme delivery, and governance.
Commercial	Procurement of supply chain to support delivery of the gated process. Consideration and selection of preferred commercial and procurement models for infrastructure delivery and enduring trading arrangements.
Engineering	Development of engineering solutions and associated design work. Estimation of solution costs.
Modelling	Water resource modelling to determine deployable outputs associated with transfer options along with projected utilisation patterns.
Environmental	Data gathering and analysis to inform environmental assessments including INNS, SEA, HRA WFD, NC and BNG. Also water quality monitoring and reporting to inform solution design.
Operational	Managing interfaces with existing operational assets and consideration of system operation.
Planning	Identification of preferred planning routes and engagement with relevant planning authorities.
Stakeholder	Engagement with stakeholders including local and regional groups and regulators. Customer research, including customer acceptability.
Legal	Development of legal provisions, including joint memorandum of understanding, and for Bacton Desalination Scheme, enduring trading arrangements such as bulk supply agreements.

8.3.5. Longer Term Planning

We have assessed our Best Value Plan over longer time horizons, until 2075 and 2100. The supply options selected for all our Ofwat scenarios, sensitivity scenarios, Adaptive Programmes and Alternative Plans are presented in our

WRMP24 Least Cost Technical Report. Key findings are summarised in Section 8.7, and a detailed comparison of the impact on the associated costs for each scenario is presented in our WRMP24 Best Value Plan Technical Report.

8.4. BEST VALUE PLAN SUPPLY DEMAND BALANCE

A final plan supply demand balance has been prepared for each of the WRZs which accounts for the demand savings and supply gains from our preferred Best Value Plan. A final planning scenario supply demand balance (SDB) graph and tabled summary data is presented for each WRZ, under the Dry Year Annual Average (DYAA) scenario, in the following sections.

8.4.1. Dry Year Annual Average

ESSEX WRZ

A final planning scenario supply demand balance graph and tabled summary data for the Essex WRZ is presented in Figure 37 and Table 68 respectively. It incorporates the following assumptions and options:

- The 1 in 200-year deployable output (DO) until 2030/31, and the 1 in 500-year DO thereafter (including demand reductions from Levels 1, 2 and 3 drought actions).
- A 'high resilience' Target Headroom profile that reflects the resilience of the WRZ.
- Medium climate change impact on DO.
- Sustainability reductions of groundwater abstraction licences.
- AMP7 Water Industry National Environment Programme (WINEP) investigation Hands off Flow (HOF) conditions.
- BAU+ Environmental Destination (ED) DO reductions.
- DYAA outage allowance – 90th percentile.
- Our preferred Demand Management Options (DMOs) for leakage, metering, and water efficiency.
- Proposed new supply-side resource option.
- Proposed outage reduction schemes.

The SDB shows the increase in surplus resulting from Linford new WTW in 2027/28, and then the upgrade to the Abberton RWPS and clarifiers at Langford WTW in 2030/31. This ensures that we can always treat Abberton reservoir raw water at Langford WTWs and maximise the capacity of the Layer WTW to Langford WTW pipeline, the construction of which will be completed in AMP7.

The Essex WRZ SDB benefits from the outage reduction schemes from 2029/30, although their principal purpose is not gain in WAFU, but for resilience under normal year and critical periods, as well as DYAA, to ensure that the water we have forecasted to be available to us, will be, and not unusable due to poor water quality. These schemes will also minimise the need for Ely Ouse Essex Transfers, reducing pumping and thereby carbon emissions.

All of the above options are required for 1 in 500 year resilience to be achieved, which we have forecasted to be from 2031/32. Whilst the Linford supply option is not needed to achieve surplus under the 1 in 200 year resilience scenario,

without it, the surplus in 2027/28 would only be 0.13 Ml/d. If PCC outturns higher than our central forecast, there is a risk of a supply deficit and so we consider it important to progress Linford new WTW and new Borehole.

The SDB shows a 20 Ml/d step up in 2035/36 when our water sharing agreement with Thames Water comes to an end.

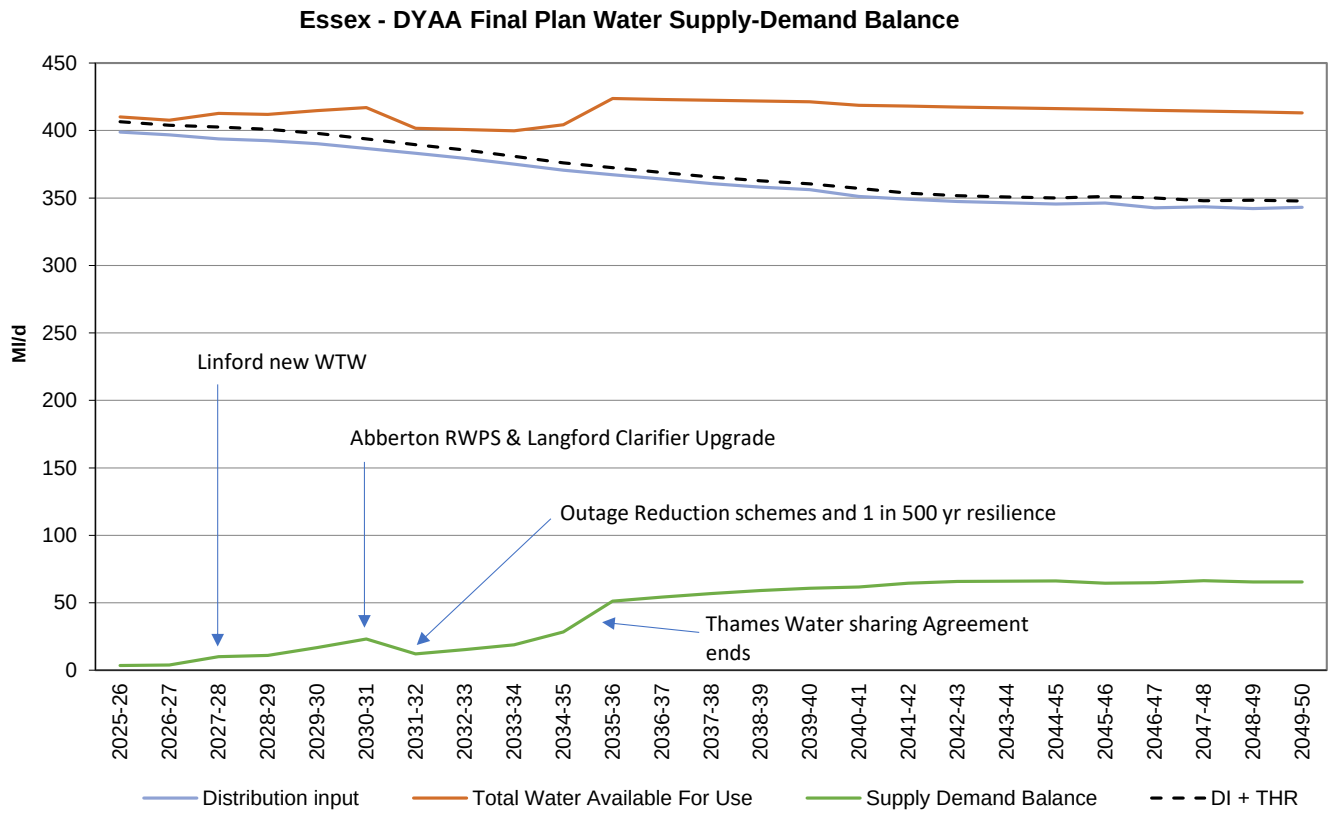


Figure 37: BVP DYAA supply demand balance graph for Essex WRZ

Table 68: BVP DYAA supply demand balance figures for the Essex WRZ

ESSEX WATER RESOURCE ZONE	END OF AMP8	END OF AMP9	END OF AMP10	END OF AMP11	END OF AMP12
	2029/30	2034/35	2039/40	2044/45	2049/50
Supply Demand Balance	16.99	16.99	16.99	16.99	16.99

BLYTH WRZ

A final planning scenario supply demand balance graph and tabled summary data for the Blyth WRZ is presented in Figure 38 and Table 69 respectively. The final plan for the Blyth WRZ incorporates the following assumptions and options:

- 1 in 500-year resilience from 2033/34.
- Benefit from demand side drought measures (Level 1 and 2).
- A 'medium resilience' Target Headroom profile that reflects the resilience of the WRZ.
- Sustainability reductions implemented in two phases, some in 2026/27, with the majority in 2030/31.
- BAU+ ED deployable output reductions.
- DYAA outage allowance – 90th percentile.
- Our preferred DMOs for leakage, metering, and water efficiency.
- A strategic pipeline which links the Blyth and Northern Central WRZs.

The initial surplus is eliminated in 2026-27 due to the sustainability reductions to Holton & Halesworth, Walpole and Little Glemham abstraction licences, which come in on 31 March 2026, requiring the construction of a new potable water transfer. This strategic pipeline allows a transfer of water from the Northern Central Zone to Blyth from 2028/29, initially utilising the baseline surplus in the Northern Central WRZ, and then the new resources provided by the Bungay wells to Broome WTW and Broome to Barsham WTW transfers, Lowestoft Water Reuse, and the North Suffolk Winter Storage Reservoir. The water imported through the new pipeline meets the subsequent sustainability reductions in 2030/31, and in the 2040s due to Environmental Destination.

For two years before the new transfer is operational (2026/27 – 2027/28), the deficit has been resolved by a small decrease of 0.6 Ml/d in the assumed volume of potable water exported from Walpole WTW in Blyth to the Halesworth area of distribution in the Northern Central WRZ.

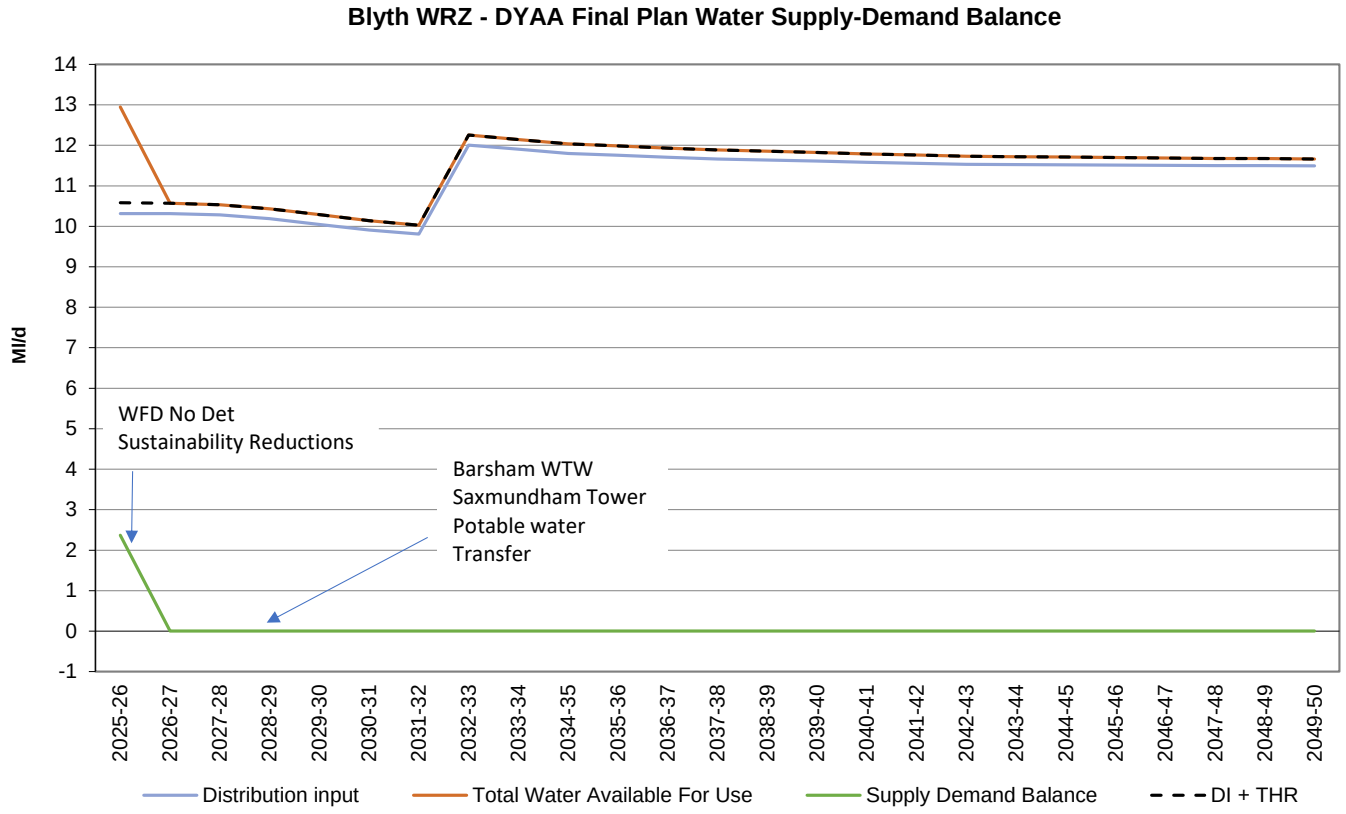


Figure 38: BVP DYAA supply demand balance graph for Blyth WRZ

Table 69: BVP DYAA supply demand balance figures for the Blyth WRZ

BLYTH WATER RESOURCE ZONE	END OF AMP8	END OF AMP9	END OF AMP10	END OF AMP11	END OF AMP12
	2029/30	2034/35	2039/40	2044/45	2049/50
Supply Demand Balance	0	0	0	0	0

HARTISMERE WRZ

A final planning scenario supply demand balance graph and tabled summary data for the Hartismere WRZ is presented in Figure 39 and Table 68 respectively. The final plan for the Hartismere WRZ incorporates the following assumptions and options:

- 1 in 500-year resilience from 2033/34.
- Benefit from demand side drought measures (Level 1 and 2).
- A 'low resilience' Target Headroom profile that reflects the resilience of the WRZ.
- Sustainability reductions implemented in 2030/31.
- BAU+ ED deployable output reductions.

- DYAA outage allowance including planned outage – 90th percentile.
- Our preferred DMOs for leakage, metering, and water efficiency.
- A strategic pipeline which links the Hartismere and Northern Central WRZs.

The new supply option for the Hartismere WRZ is pipeline that allows a transfer of water from the Northern Central Zone to Hartismere, initially utilising the baseline surplus in the Northern Central WRZ, and then the new resources provided by the Bungay wells to Broome WTW and Broome to Barsham WTW transfers, Lowestoft Water Reuse, and the North Suffolk Winter Storage Reservoir.

In addition to the above, we know from our dWRMP work that for our Hartismere WRZ final plan to not be in supply deficit, from the start of the planning period until the new strategic pipeline provides additional resource from 2028/29, we will need to maintain a moratorium on new non-household demand where the water is used for non-domestic purposes. This is incorporated into our WRMP24 Final Preferred Plan demand forecast.

However, even with the moratorium in place, sustainability reductions imposed from the start of the planning horizon, push the WRZ into deficit, as detailed in Section 3.3. To resolve that deficit, our only option is to challenge the timing of the imposition of these sustainability reductions via an application for an exemption to Regulation 19 of the WFD on the grounds of Overriding Public Interest (OPI). This is reflected in 6.3FP of the ESWHRT Table 3b WRMP planning tables.

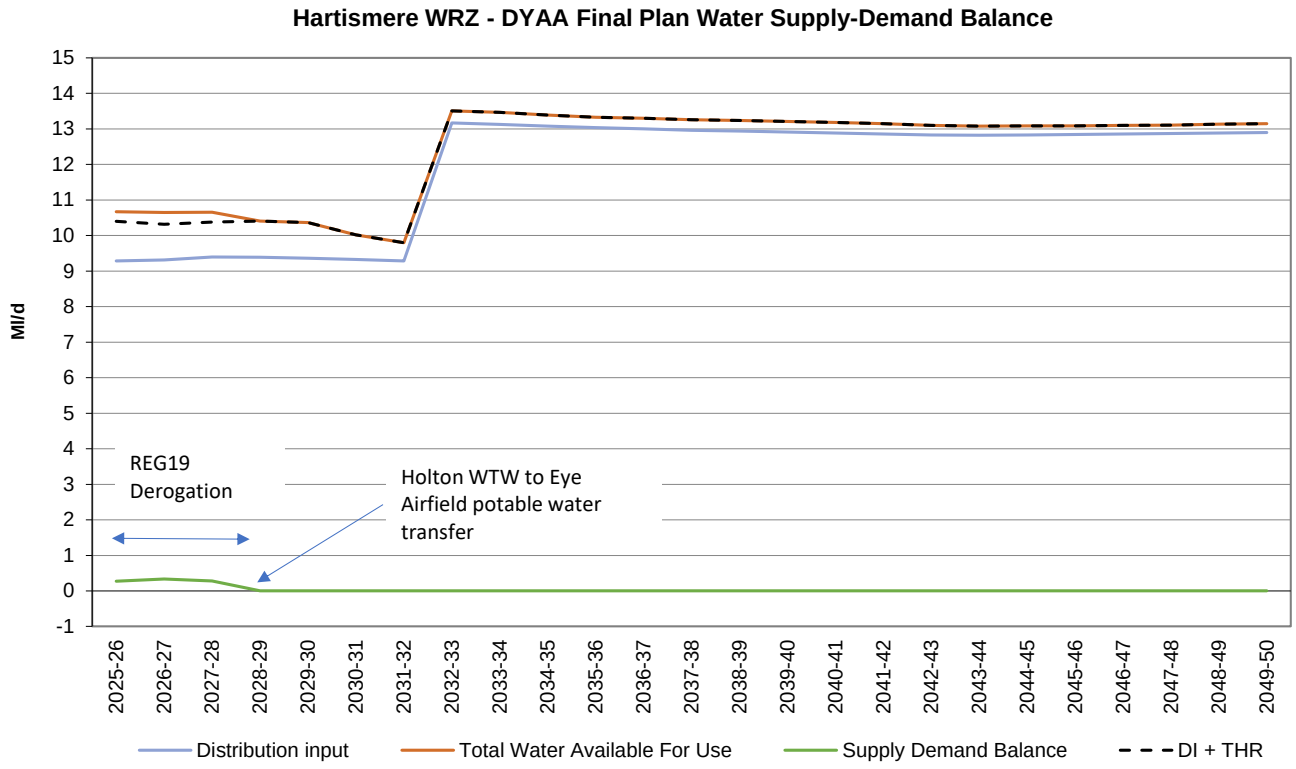


Figure 39: BVP DYAA supply demand balance graph for Hartismere WRZ

Table 70: BVP DYAA supply demand balance figures for the Hartismere WRZ

HARTISMERE WATER RESOURCE ZONE	END OF AMP8	END OF AMP9	END OF AMP10	END OF AMP11	END OF AMP12
	2029/30	2034/35	2039/40	2044/45	2049/50
Supply Demand Balance	0	0	0	0	0

NORTHERN CENTRAL WRZ

A final planning scenario supply demand balance graph and tabled summary data for the Northern Central WRZ is presented in Figure 40 and Table 71 respectively. The final plan for the Northern Central WRZ incorporates the following assumptions and options:

- 1 in 500-year resilience from 2033/34.
- Benefit from demand side drought measures (Level 1 and 2).
- A 'medium resilience' Target Headroom profile that reflects the resilience of the WRZ.
- Sustainability reductions implemented from the start of the planning horizon, and additional reductions in 2030/31 and 2032/33.
- BAU+ ED deployable output reductions.
- DYAA outage allowance – 90th percentile.
- Our preferred DMOs for leakage, metering, and water efficiency.
- Proposed new supply-side resource options – Bungay wells to Broome WTW and Broome to Barsham WTW transfers, Lowestoft Water Reuse, and the North Suffolk Winter Storage Reservoir.
- Two strategic pipelines which export water from the Northern Central WRZ to the Hartismere and Northern Central WRZs.
- WAGS support for the abstraction at the Shipmeadow intake on the River Waveney reduced from 20.5 Ml/d to 18 Ml/d from 2030/31, and then to 16 Ml/d from 2032/33.

The initial surplus in the Northern Central WRZ is used to resolve the deficits in Blyth and Hartismere via the new strategic pipelines when it becomes operational in 2028/29. This supply is supported by the Barsham nitrate reduction scheme from 2029/30, the principal purpose of which is not gain in Water Available for Use (WAFU), but for resilience under normal year and critical periods, as well as DYAA, to ensure that the water we have forecasted to be available to us, will be, and not unusable due to poor water quality. This is further supported from 2030/31 by the 1 Ml/d provided by the Bungay wells to Broome WTW and Broome to Barsham WTW transfers.

Additional resources are then required in the Northern Central WRZ to meet its own demand, plus that in Blyth and Hartismere WRZs, via the new potable water transfers. These resources are Lowestoft Water Reuse in 2032/33, and the North Suffolk Winter Storage Reservoir in 2040/41.

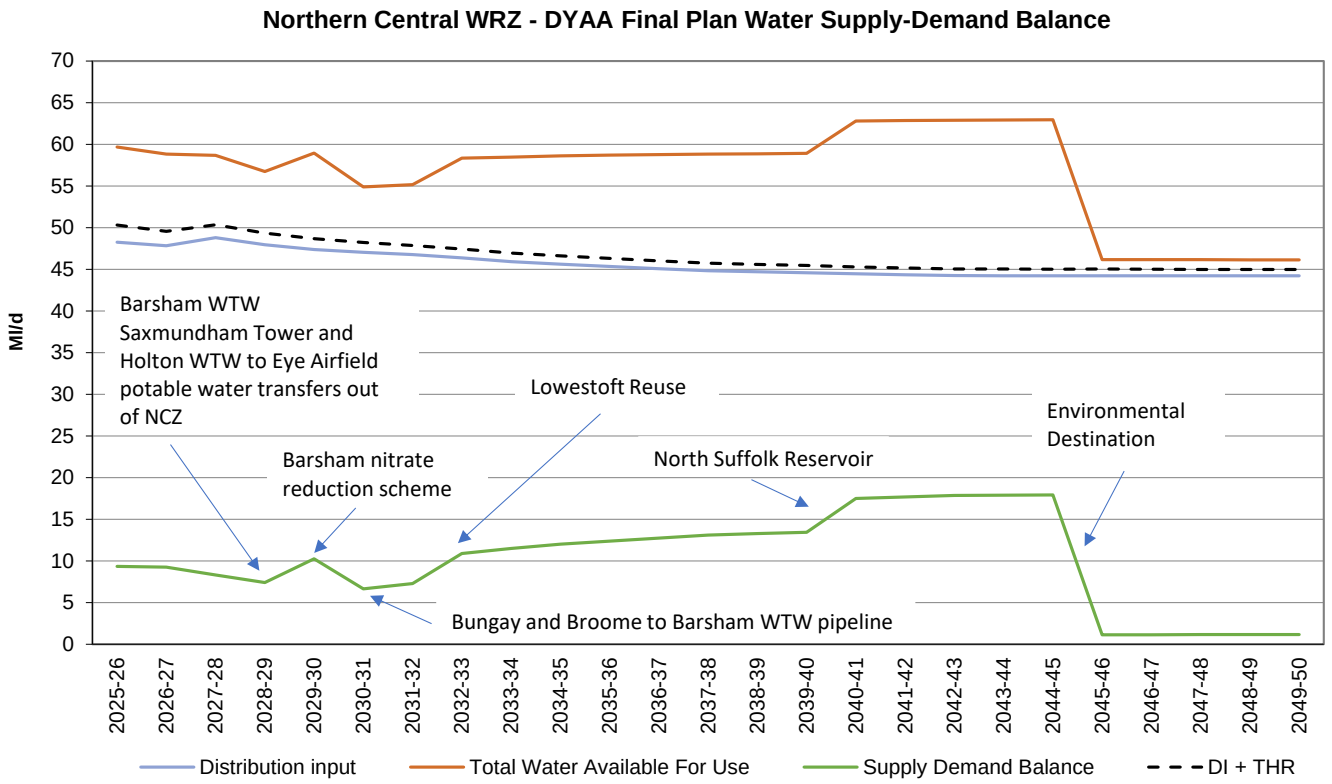


Figure 40: BVP DYAA supply demand balance graph for Northern Central WRZ

Table 71: BVP DYAA supply demand balance figures for Northern Central WRZ

NORTHERN CENTRAL WATER RESOURCE ZONE	END OF AMP8	END OF AMP9	END OF AMP10	END OF AMP11	END OF AMP12
	2029/30	2034/35	2039/40	2044/45	2049/50
Supply Demand Balance	10.26	12.01	13.45	17.93	1.17

8.4.2. Dry Year Critical Period

We have developed a critical period supply demand balance to demonstrate our resilience under a period of peak strain on our systems. This is based on a peak week demand and supply forecast. The Best Value Plan critical period supply demand balances for each WRZ are presented below.

ESSEX WRZ

A final planning scenario supply demand balance graph and tabled summary data for the Essex WRZ is presented in Figure 41 and Table 72 respectively. There is a forecasted surplus for the whole planning horizon under the Dry Year Critical Period (DYCP) scenario. The assessment of critical period includes the assumption that our water sharing

agreement with Thames Water, which expires in 2035/36, would be in operation. This aligns with the assumption that Thames Water have made in their WRMP.

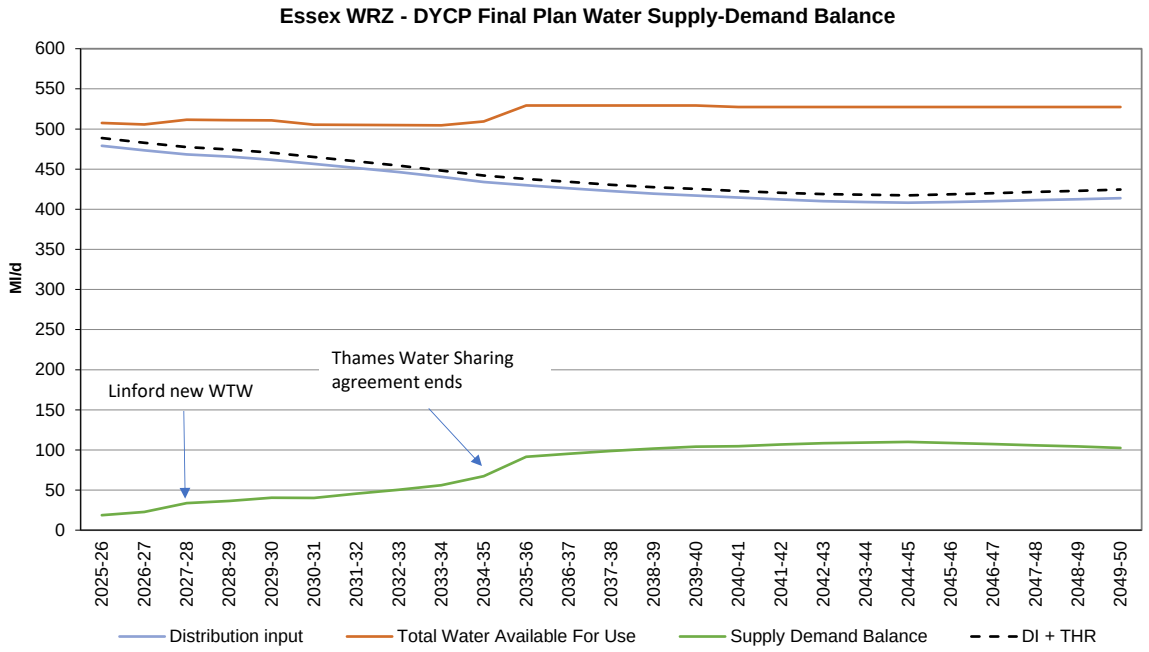


Figure 41: BVP DYCP supply demand balance graph for the Essex WRZ

Table 72: BVP DYCP supply demand balance figures for the Essex WRZ

ESSEX WATER RESOURCE ZONE	END OF AMP8	END OF AMP9	END OF AMP10	END OF AMP11	END OF AMP12
	2029/30	2034/35	2039/40	2044/45	2049/50
Supply Demand Balance	40.39	67.38	104.03	109.99	102.65

BLYTH WRZ

A final planning scenario supply demand balance graph and tabled summary data for the Northern Central WRZ is presented in Figure 42 and Table 73 respectively. There is a forecasted surplus for the whole planning horizon under the Dry Year Critical Period scenario.

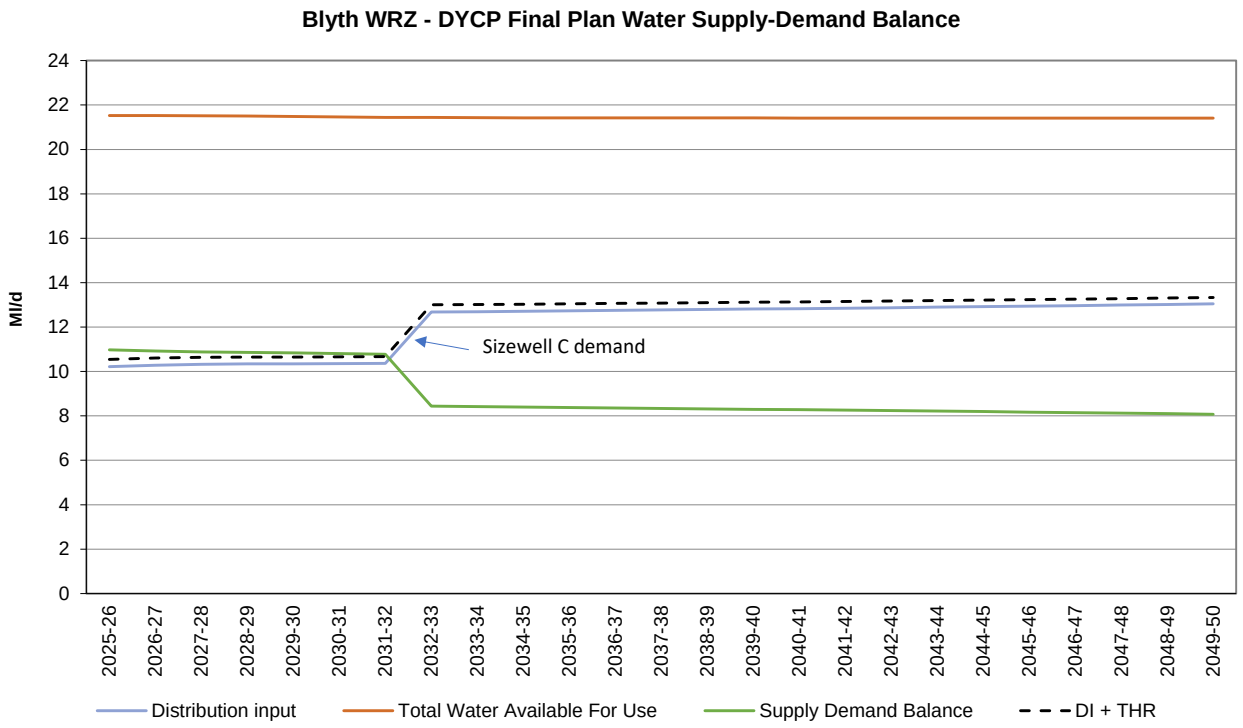


Figure 42: BVP DYCP supply demand balance graph for the Blyth WRZ

Table 73: BVP DYCP supply demand balance figures for the Blyth WRZ

BLYTH WATER RESOURCE ZONE	END OF AMP8	END OF AMP9	END OF AMP10	END OF AMP11	END OF AMP12
	2029/30	2034/35	2039/40	2044/45	2049/50
Supply Demand Balance	7.78	5.93	6.17	6.29	6.34

HARTISMERE WRZ

A final planning scenario supply demand balance graph and tabled summary data for the Hartismere WRZ is presented in Figure 43 and Table 74 respectively. There is a forecasted surplus for the whole planning horizon under the DYCP scenario. This includes the delay to new non-household demands until 2032 as in the DYAA scenario.

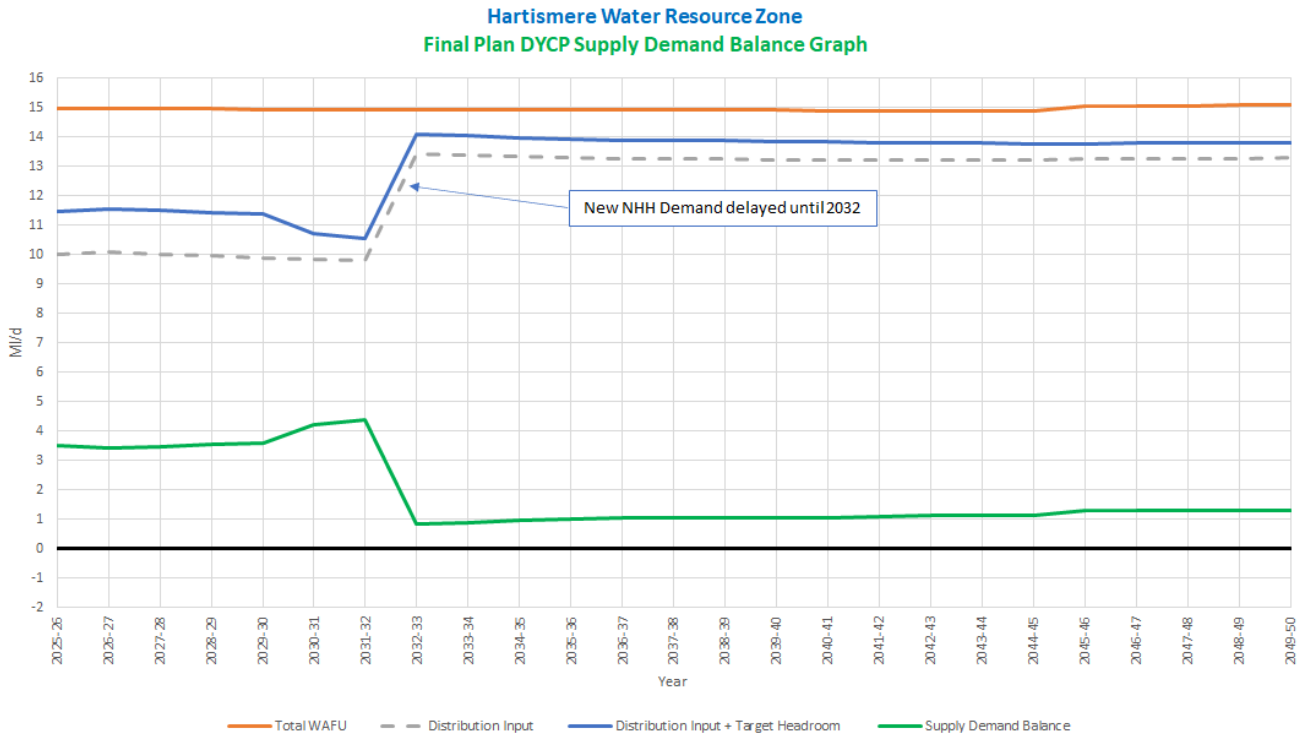


Figure 43: BVP DYCP supply demand balance graph for the Hartismere WRZ

Table 74: BVP DYCP supply demand balance figures for the Hartismere WRZ

HARTISMERE WATER RESOURCE ZONE	END OF AMP8	END OF AMP9	END OF AMP10	END OF AMP11	END OF AMP12
	2029/30	2034/35	2039/40	2044/45	2049/50
Supply Demand Balance	3.56	0.94	1.05	1.13	1.27

NORTHERN CENTRAL WRZ

A final planning scenario supply demand balance graph and tabled summary data for the Northern Central WRZ is presented in Figure 44 and Table 75 respectively. There is a forecasted surplus for the whole planning horizon under the DYCP scenario. The gain in WAFU from the planned schemes is not included in the SDB for the critical period. The DO is calculated using maximum WTWs capacities, and the new resources just enable those maximum capacities to be achieved.

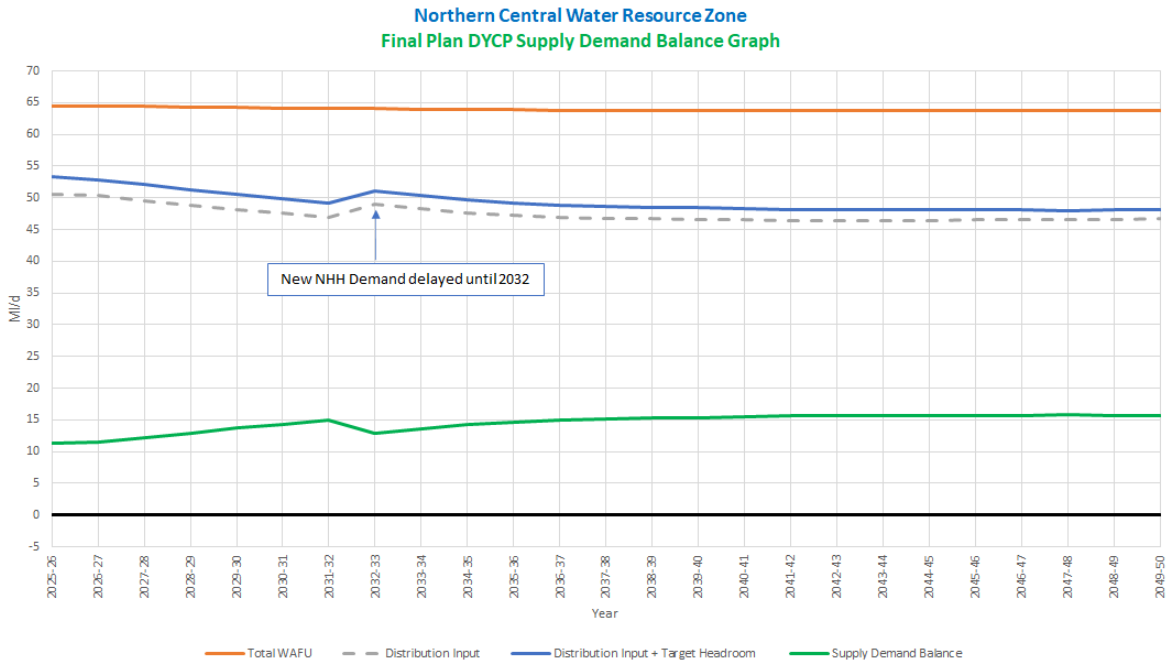


Figure 44: BVP DYCP supply demand balance graph for the Northern Central WRZ

Table 75: BVP DYCP supply demand balance figures for the Northern Central WRZ

NORTHERN CENTRAL WATER RESOURCE ZONE	END OF AMP8	END OF AMP9	END OF AMP10	END OF AMP11	END OF AMP12
	2029/30	2034/35	2039/40	2044/45	2049/2050
Supply Demand Balance	13.69	14.20	15.39	15.72	15.69

8.4.3. Non-drought Dry Year Critical Period Sensitivity Testing

The EA asked us to confirm we have a critical period surplus in each WRZ, whilst excluding the benefit of demand side drought measures (i.e. where we might experience a critical period but not in a drought year when we would have implemented our Level 1 (Appeal for Restraint) and Level 2 (Temporary Use Ban) demand side drought measures). Therefore, we have prepared a final plan DYCP SDB for each WRZ with 'Benefits from demand side drought measures' (Line 7.02FP in the data tables) removed.

We have included the full outage allowance, which includes both historical planned and unplanned outage, in each of our Suffolk WRZ SDBs to represent this scenario. In the Essex WRZ, due to the interconnected nature and high level of resilience that provides, we have assumed that most but not all unplanned outages would be occurring under this scenario. So, we have included 75% (100.52 Ml/d) of total outage allowance to reflect this.

In the Essex WRZ, as this scenario represents a non-drought critical period, we have removed the 20 Ml/d export to Thames water, which represents our current water sharing agreement.

Our assessment confirms that all our WRZs remain in surplus under these assumptions, as shown in

Figure 45: Non-drought DYCP final plan supply demand balance graph for the Essex WRZ

to Figure 48.

Our routine Coordination Planning process, which is an NWL quality procedure ensuring all applicable planned work has been communicated to and given full consideration by all relevant parties for risk, conflict, historical events, impact, and mitigation prior to the planned work taking place, would be the process by which we monitor for, identify, and trigger the need to delay planned outage as mitigation during critical periods. A postponement of as much planned outage as necessary would occur if a peak demand period is expected, which for all ESW WRZs is during a hot summer (as opposed to freeze/thaw winter events).

In addition, further resilience is provided by treated water storage, which in our Essex network is ~310Ml (i.e. if all the WTWs in Essex were to cease output, we would have 310 Ml of treated water in storage), enabling peak customer demands to be met for an average of 15.5 hours (with duration varying depending on area within the WRZ). This is our resilience time against 'reserve demand', 'reserve demand' being the second highest demand we have experienced in the previous 10 year period. It is important to note that treated water storage is not allowed for in the WRMP data tables.

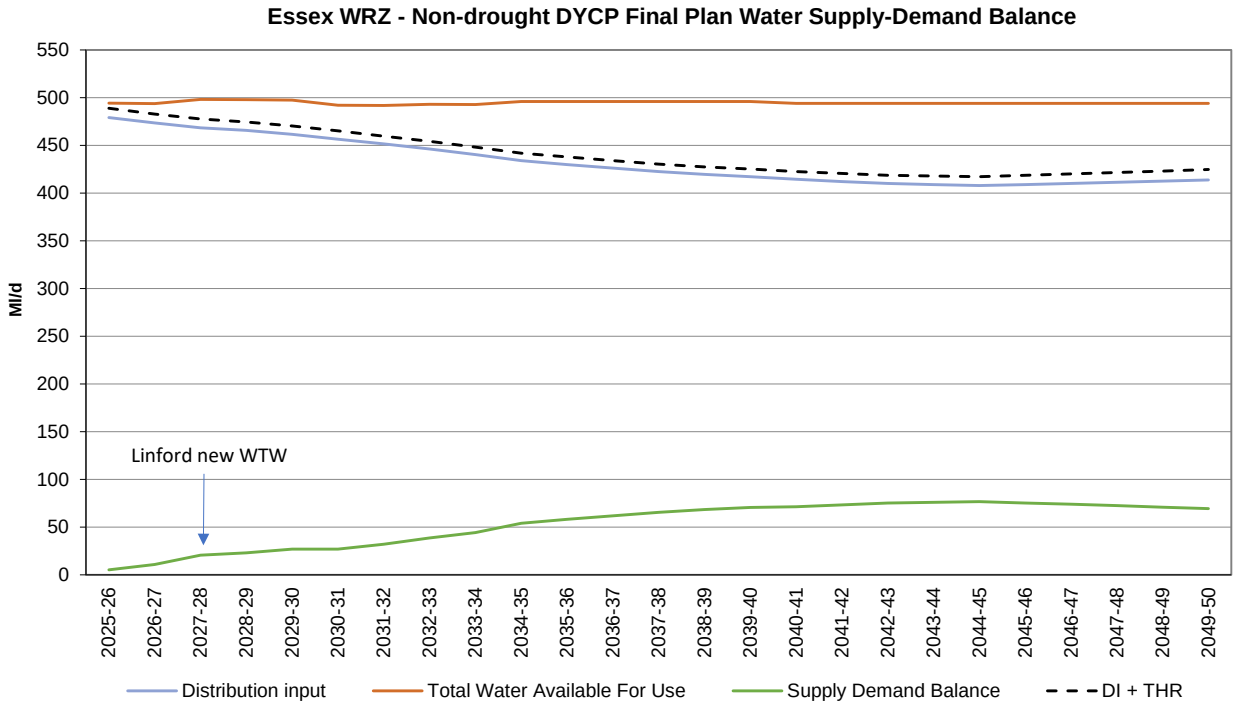


Figure 45: Non-drought DYCP final plan supply demand balance graph for the Essex WRZ

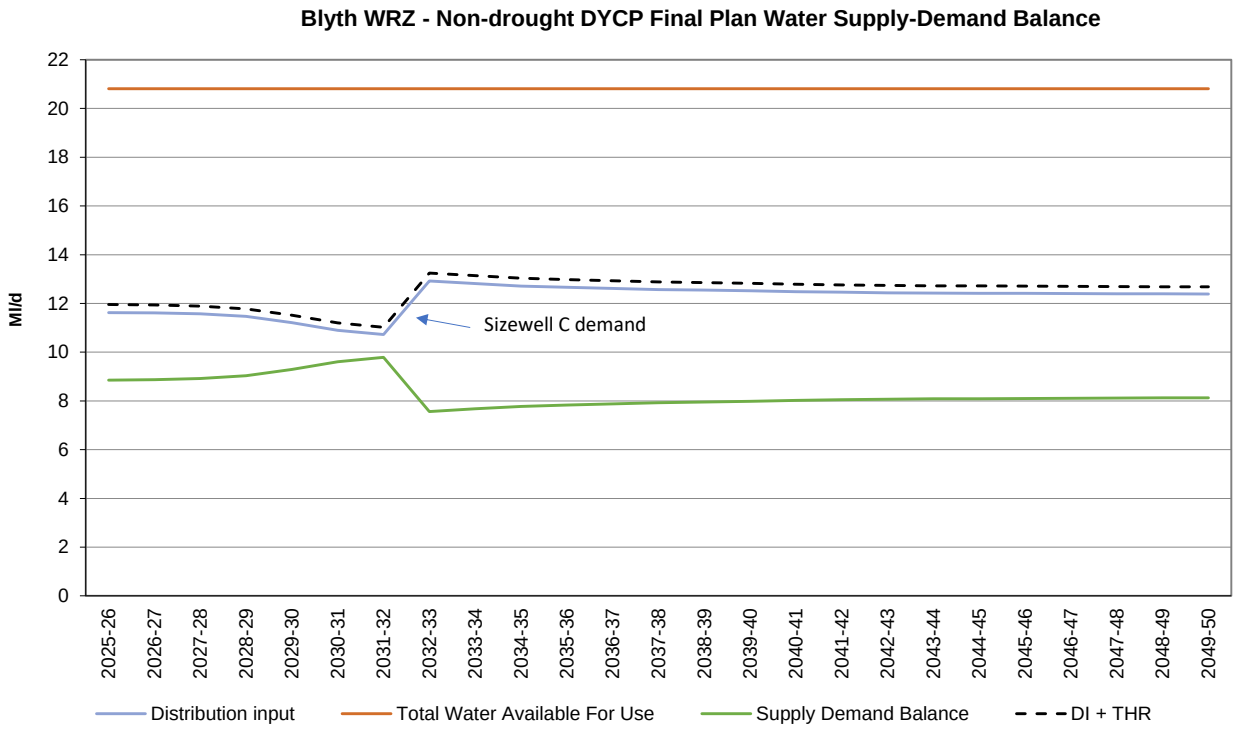


Figure 46: Non-drought DYCP final plan supply demand balance graph for the Blyth WRZ

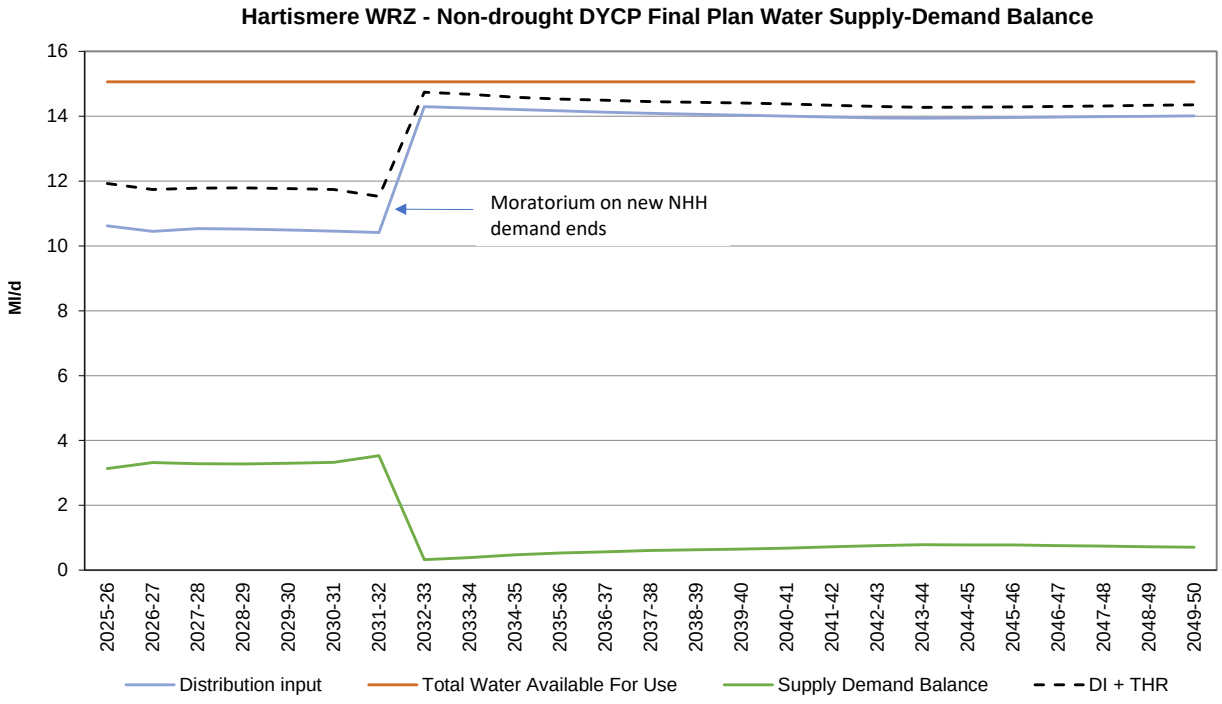


Figure 47: Non-drought DYCP final plan supply demand balance graph for the Hartismere WRZ

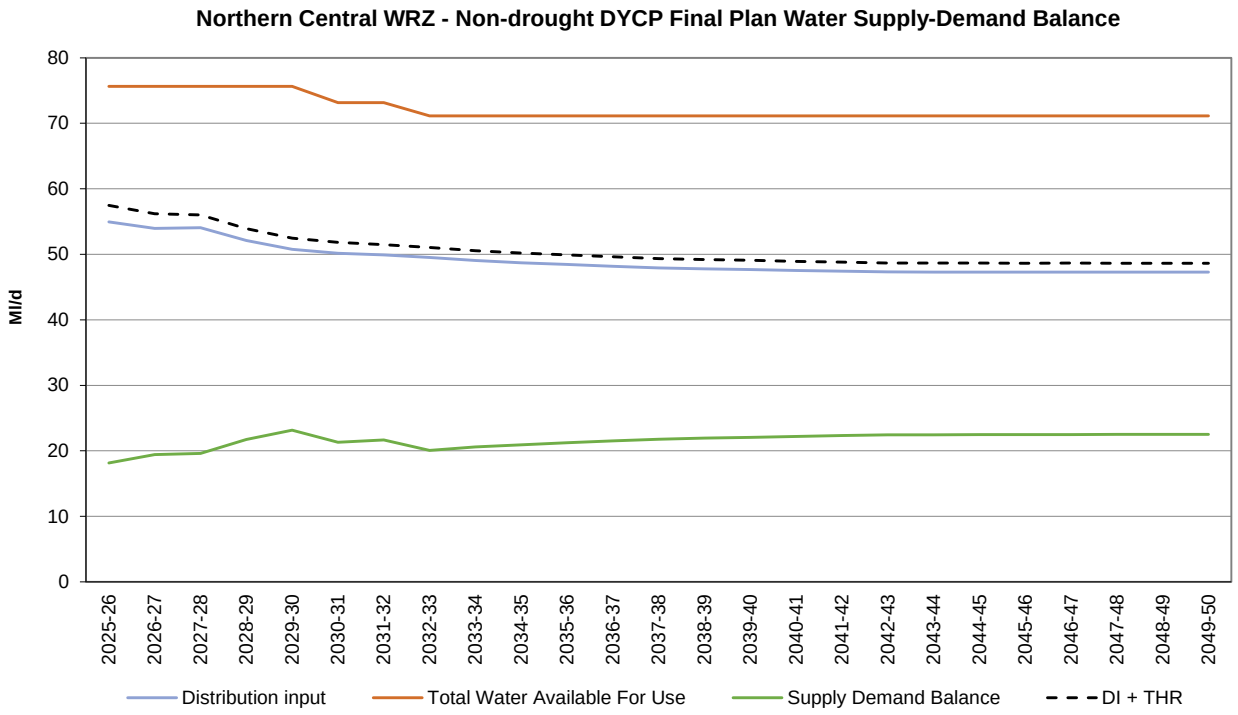


Figure 48: BVP Non-drought DYCP supply demand balance graph for the Northern Central WRZ

8.5. HARTISMERE WATER RESOURCE ZONE: NON-DOMESTIC MAINS WATER MORATORIUM

We have implemented a moratorium on providing new mains water supplies in our Hartismere water resource zone where the water will be used for non-domestic purposes.

We envisage the moratorium will remain in place until 2032 when all new supply schemes to support development in the area are operational. In the meantime, this means that where mains water will be used for non-domestic purposes, we are unable to agree to:

- increase supplies above existing levels (where there is an existing mains water connection); or
- new mains water connections.

Consequently, businesses should not plan to increase their mains water use if it is for non-domestic purposes.

Providing an exhaustive list of non-domestic uses of mains water is difficult although we are committed to working with Babergh & Mid-Suffolk Council and East Suffolk Council on this. However, non-domestic uses include but not limited to where mains water is used for:

- manufacturing and processing
- livestock production
- irrigation of plants
- cooling

It is easier to confirm what domestic use is and to assume that all other uses is non-domestic. Domestic use is water that is used in a residential dwelling, in a business or public place (e.g., school, hospital, library) for welfare including but not limited to for staff / public toilets, staff / public bath / showers and staff kitchens / canteens.

The non-domestic mains water moratorium is needed because:

- supply headroom in our Hartismere water resource zone is limited due to growth in non-household demand over the previous five years;
- sustainability reductions will be applied to the annual licensed quantity on our abstraction licences in the Hartismere water resource zone in 2030, or sooner where part or all of an abstraction licence is time limited.
- our baseline supply headroom is constrained by the EA's No Deterioration policy which requires us to maintain groundwater abstraction at or below recent actual levels. Hartismere abstraction licences have been investigated in our part of the WINEP which has concluded that all Hartismere abstraction licence annual licensed quantities should be reduced to an agreed sustainable level in 2030 or before where the licence is time limited.
- we are forecasting a significant increase in new non-domestic demand which is equivalent to a 35% increase in overall household and non-household demand although new supply schemes will not be delivered until 2028/29 and 2032/33 respectively. Consequently, the moratorium is required to protect mains water supplies to existing customers and businesses and to avoid unsustainable abstraction.
- to submit a preferred final plan with no forecast supply deficits.

Suffolk is a serious water stressed area with limited supply headroom and we will work with businesses to consider water efficiency and water recycling in order to minimise their mains water needs. From 2025, we plan to support existing business to reduce their water use by 9% by 2038 through the provision of water efficiency advice. However, in terms of new development between now and 2030 when our new supply schemes come on line, it is the developer's responsibility to identify solutions for ensuring that they are mains water neutral.

We will make all reasonable endeavours to provide supply headroom across Suffolk to allow new development and will accelerate our demand management options including:

- replacing existing customer meters with smart meters by 2035.
- compulsory metering all unmeasured customers with smart meters by 2030.
- reducing leakage from our network.

- water efficiency programmes for both our household customers and businesses. We will work with businesses to help them identify how they can reduce their mains water requirements through water efficiency and recycling of water.

Our WRMP24 Best Value Plan includes the following new supply schemes that will enable us to supply all forecast demand in the Hartismere Water Resource Zone:

- Suffolk Strategic Pipelines (operational in 2028/29)
- Barsham Nitrate Removal Scheme (operational in 2030/31)
- Bungay wells to Broome WTW and Broome to Barsham WTW transfers (Operational in 2030/31)
- Lowestoft Water Reuse (operation in 2032/33)

Once the Suffolk Strategic Pipelines are operational in 2028/29, this will enable a partial lifting of the moratorium, and will allow us to increase mains water supplies to businesses on a first come first served basis. However, a full lifting of the moratorium will not be possible until 2032/33 once all our supply schemes are operational. Nevertheless, we will make all reasonable endeavours to meet the non-domestic demand in Hartismere earlier than 2032.

Subject to review of our progress on our AMP 7 enhancement programme, Ofwat has allowed PR24 transition expenditure funding for a number of our supply schemes including the Lowestoft Water Reuse scheme. This means that we can start the detailed engineering stage of this project now rather than wait until 2025. Consequently, it is possible that this scheme can be delivered by 2030/31, in which case, we would fully remove the mains water moratorium in that year.

We have considered other options to increase available supplies in the Hartismere WRZ between now and 2032. These include importing water using new pipelines and pumping stations from our Blyth WRZ and imports from Anglian Water. The EA confirmed that it would not support these schemes because they would increase groundwater abstraction above recent actual rates in other water stressed areas and so would not comply with its No Deterioration policy.

8.6. DROUGHT PERMITS AND ORDERS

We have several Drought Plan drought permit options in both our Essex and Suffolk supply areas although we have never needed to use them. The last time we imposed a Temporary Use Ban was in 1998 although we did need to implement our Level 1 Appeal for Restraint drought action in summer 2022, given the exceptionally dry weather.

We have not included the DO gain from drought permits in our final plan supply demand balance forecasts. We intend to increase the return period of needing Level 3 drought actions (i.e., plan on needing them less frequently) from 2032 once our WRMP supply schemes are in supply.

8.7. PREFERRED FINAL PLAN SCENARIO TESTING

8.7.1. OVERVIEW

We have carried out sensitivity analysis of our central (most likely) supply and demand balance forecasts to establish:

- whether our final preferred plan is sensitive to changes to any of the supply and demand forecast components, and if so, how this affects the selected schemes within the preferred final plan to address supply deficits;
- which of our preferred final plan schemes are selected in the final plans for other scenarios in order to demonstrate that our preferred final plan schemes selected for delivery during AMP8 are low regrets;
- if increasing the planning period to 50 years and 75 years to determine if this influences the range of options being selected as the EBSD model seeks to minimise TOTEX cost.
- to identify the need for adaptive programme (see Section 8,2) to address potential supply deficits where supply demand forecasts outturn differently to central (most likely) forecasts.

Our Best Value Plan uses central (most likely) forecasts for supply and demand. However, for the sensitivity testing, among others, we have used Ofwat's common reference scenarios with high and low parameters for climate change, demand, technology, and Environmental Destination (see Table 10). These have been used to develop alternative plans across three time horizons (2050,2075 and 2100).

In undertaking this assessment, we have only considered one change at a time. For example, for the low climate change scenario, we have used low climate change assumptions in our supply forecast while central planning assumptions are used for all other components of the supply demand balance forecasts. Each scenario may result in a different supply demand balance which may require different supply schemes to restore a supply surplus.

This assessment has informed our adaptive plan by allowing us to understand how alternative supply demand deficits and longer planning horizons influence which options are selected by the Economics of Balancing Supply and Demand (EBSD) model. The supply side and demand side assumptions that have been made in each scenario is detailed in Table 76 and a description of each scenario is given in Table 77.

Table 76: Sensitivity scenario assumptions

Best Value Plan Testing Scenarios	Scenario reference	Supply Forecast	Demand forecast scenario name	DMOs						Climate Change scenario		Environmental Destination scenario	Sustainability Reductions	New NHH Demand
				Leakage	Metering	Water Efficiency (HH)	Water Efficiency (NHH)	Growth	Government led interventions incl Y/N	Supply Forecast	DI Component			
Central Plan	CntrlPln	Central plan	WRMP24 Final Preferred Plan	Medium	Option 5 (high - compulsory)	Medium Enhanced	9%	Local Authority	Y	RCP8.5 scaled to RCP6	Scenario Forecast	BAU+	When expected to be applied	Delayed to 2031/32 in Hartismere
OFWAT Climate change	CC_Low	Low CC	WRMP24 Final Preferred Plan	Medium	Option 5 (high - compulsory)	Medium Enhanced	9%	Local Authority	Y	RCP2.6	Most Likely / Minimum	BAU+		
	CC_High	High CC	WRMP24 Final Preferred Plan	Medium	Option 5 (high - compulsory)	Medium Enhanced	9%	Local Authority	Y	RCP8.5	Least Likely / Maximum	BAU+		
OFWAT Technology	Tech_Slow	Central plan	Ofwat Scenario 1	Low 30%	Option 1 (Low impact)	Low	2%	Local Authority	N	RCP8.5 scaled to RCP6	Scenario Forecast	BAU+		
	Tech_Fast	Central plan	Ofwat Scenario 8 enhanced WE	High 50%	Option 5 (high - compulsory)	High Enhanced	9%	ONS	Y	RCP8.5 scaled to RCP6	Scenario Forecast	BAU+		
OFWAT Demand	Demand_Low	Central plan	WRMP24 Final -Low demand, L Growth, HWE enhanced, H Met, H Leak	High 50%	Option 5 (high - compulsory)	High Enhanced	9%	ONS	Y	RCP8.5 scaled to RCP6	Scenario Forecast	BAU+		
	Demand_High	Central plan	WRMP24 Final -High demand, H Growth, LWE, L Met, L Leak	Low 30%	Option 1 (Low impact)	Low	2%	Housing Need	Y	RCP8.5 scaled to RCP6	Scenario Forecast	BAU+		
OFWAT Abstraction Reductions	ED_Low	Low ED	WRMP24 Final Preferred Plan	Medium	Option 5 (high - compulsory)	Medium Enhanced	9%	Local Authority	Y	RCP8.5 scaled to RCP6	Scenario Forecast	BAU		
	ED_High	High ED	WRMP24 Final Preferred Plan	Medium	Option 5 (high - compulsory)	Medium Enhanced	9%	Local Authority	Y	RCP8.5 scaled to RCP6	Scenario Forecast	Enhanced		
PCC	PCC_Low	Central plan	WRMP24 Final - High WE (Opt 5/2) enhanced WE	Medium	Option 5 (high - compulsory)	High Enhanced	9%	Local Authority	Y	RCP8.5 scaled to RCP6	Scenario Forecast	BAU+		
	PCC_High	Central plan	WRMP24 Final - Low WE (Opt 5/2)	Medium	Option 5 (high - compulsory)	Low	2%	Local Authority	Y	RCP8.5 scaled to RCP6	Scenario Forecast	BAU+		
Best Environment & Society	Best_Env	High ED	WRMP24 Final - Leakage ESW 50 NW 55%	High 50%	Option 5 (high - compulsory)	Medium Enhanced	9%	Local Authority	Y	RCP8.5 scaled to RCP6	Scenario Forecast	Enhanced		
Habs Regs SR	HabsRegs	HabsRegs	WRMP24 Final Preferred Plan	Medium	Option 5 (high - compulsory)	Medium Enhanced	9%	Local Authority	Y	RCP8.5 scaled to RCP6	Scenario Forecast	BAU+	Reg19/64 Derogation until 2031/32	
North Suffolk Reservoir	NSR_2033	Central plan	WRMP24 Final Preferred Plan	Medium	Option 5 (high - compulsory)	Medium Enhanced	9%	Local Authority	Y	RCP8.5 scaled to RCP6	Scenario Forecast	BAU+	When expected to be applied	Delayed to 2032/33 in Hartismere

Note: green colour indicated variable is same as central plna, and red colour indicates variance from central plan.

Table 77: Sensitivity scenario descriptions

	SCENARIO REFERENCE	DESCRIPTION	SCENARIO TYPE
Central Plan	Central Plan	Central estimates for demand and supply factors	
Ofwat Climate Change	Low climate change (impacts)	Lower climate change impact forecasts for supply and demand.	Sensitivity testing
	High climate change (impacts)	Higher climate change impact forecasts for supply and demand.	Sensitivity testing
Ofwat Technology	Tech slow	Assume slow adoption of water efficiency technology and a higher demand forecast	Sensitivity testing
	Tech fast	Assume fast adoption of water efficiency technology and a higher demand forecast	Sensitivity testing
Ofwat Demand	Low demand	Assumes implementation of higher demand management options to reduce demand	Sensitivity testing
	High demand	Assumes implementation of lower demand management options resulting in higher demand	Sensitivity testing
Ofwat Abstraction	Low environment destination	Assumes reductions in abstraction licences as a result of a business-as-usual environmental destination scenario.	Sensitivity testing
	High environment destination	Assumes highest reduction in abstraction licences as a result of an Enhanced environmental destination scenario	Adaptive Programme
Per Capita Consumption (PCC)	Low PCC	Assumes that demand is reduced below that of the central plan through enhanced water efficiency measures	Sensitivity testing
	High PCC	Assumes that demand is higher than in the central plan based on a lower rate of deployment of water efficiency measures	Adaptive Programme
	Best Environment & Society	This scenario minimises abstraction from the environment through assuming high environment destination licence reductions, 50% leakage reduction and high water efficiency measures to reduce PCC	Alternative plan
	North Suffolk Reservoir (NSR)	This scenario forces the EBSD model to select the NSR as soon as this becomes available to assess the impact upon this on the overall plan. Two variations of this have been included: 1) the model is free to pick any size for the reservoir and 2) the model is forced to pick the largest reservoir size.	Adaptive Programme
	Habitat regulations sustainability reductions	This scenario assume full sustainable reductions in licence are implement driven by habitat regulations	Adaptive Programme

8.7.2. RESULTS OF SENSITIVITY TESTING

The supply options selected in each scenario are shown in Table 78 A detailed comparison of the impact on the associated costs presented in our WRMP24 Best Value Plan Technical Report. This illustrates that there is significant alignment between the options selected in our Best Value Plan and those selected in the other scenarios. This provides confidence that the proposed investment in AMP8 (our core plan) is low regret.

Table 78: Supply options selected in sensitivity scenarios

Planning horizon: 2050				Benign Scenarios					Central Preferred Plan, Least cost & BVP*	Adverse Scenarios				Alternative Plan	Adaptive Programmes		
					OFWAT Common Reference Scenarios					OFWAT Common Reference Scenarios							
WRZ	Option name	ESW Option Reference	Gain in WAFU (Ml/d)	Low PCC	Low Demand	Fast Technology	Low Climate Change	Low Abstraction Reductions (Low ED)		High Climate Change	High Demand	Slow Technology	High Abstraction Reductions (High ED)**	Best Environment	High PCC	North Suffolk Reservoir	Habs Regs SR
Essex	Langford UV	ESW-UVC-001	0.2	✓				✓	✓	✓	✓	✓	✓		✓	✓	✓
	Langham Nitrate Scheme	ESW-NIT-006	0.9	✓				✓	✓	✓	✓	✓	✓		✓	✓	✓
	Langford Nitrate Scheme	ESW-NIT-005	2.8	✓			✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
	AbbertonRWPS and Langford Clarifier	ESW-PMP-001A	8.0	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Linford New WTW 10	ESW-ABS-003	10.0	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Southend Water Reuse Phase A and Transfer	ESW-EFR-001A	20.5							✓	✓	✓			✓		
	Southend Water Reuse and Transfer	ESW-EFR-001	40.5										✓	✓			
	Canvey Island Desalination 190 and Transfer	ESW-DES-001	190.0										✓	✓			
Blyth	Barsham WTW Saxmundham Tower	ESW-TRA-001	15.0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Hartismere	HoltonWTW EyeAirfield	ESW-TRA-019	8.5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Northern Central	Bungay to Broome WTW and Broome to Barsham WTW transfers	ESW-TRA-018 & 23	1.0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Barsham Nitrate Scheme	ESW-NIT-004	2.2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Corton Desal Infiltration Gallery and Transfer	ESW-DES-008-IG	5.6				✓			✓							
	Corton Desal Beach Well and Transfer	ESW-DES-008-BW	10.1								✓		✓	✓	✓		
	Lowestoft Water Reuse for Ellingham Mill and Transfer Holton	ESW-EFR-002A	11.0				✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
	CaliforniaCaister Desal IG and Transfer Caister Tower	ESW-DES-004-IG	14.0	✓	✓	✓						✓					
	North Suffolk Winter Storage 3500 and Transfer	ESW-RES-002A	16.2													✓	✓
	Caister Water Reuse and Ormesby Transfer	03b0478B	16.4	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
	North Suffolk Winter Storage 7500 and Transfer	ESW-RE-S002C	19.9						✓								

* Following our best value assessment, our Least Cost Plan remains our Best Value Plan. Green ticks indicate options included in the OFWAT Core Plan.

**Also an Adaptive Programme

The cost of each of the Adaptive Programmes is summarised in Table 79.

Table 79: Cost comparison between central plan and sensitivity scenarios

Supply Option costs Planning horizon: 2050		Benign scenarios					Central Least Cost Plan[1]	Adverse scenarios				Alternative Plan	Adaptive Programmes		
EBSD Model Results (£000)		Low PCC	OFWAT Scenarios					OFWAT Scenarios				Best Environment	High PCC	North Suffolk Reservoir	Habs Regs SR[3]
			Low Demand	Fast Technology	Low Abstraction Reductions (Low ED)	Low Climate Change		High Climate Change	Slow Technology	High Demand	High Abstraction Reductions (High ED)[2]				
AMP8	CAPEX	228,861	122,958	157,157	228,861	185,416	228,861	228,861	228,861	228,861	228,861	122,958	228,861	228,861	228,861
	OPEX	7,570	617	1,399	7,571	5,721	7,571	7,574	7,570	7,568	7,571	661	7,581	7,571	8,203
	TOTEX	236,431	123,575	158,556	236,432	191,137	236,432	236,435	236,431	236,429	236,432	123,619	236,442	236,432	237,064
AMP9	CAPEX	99,601	8,214	8,214	90,139	90,139	90,139	197,615	197,615	197,615	90,139	115,685	197,615	207,939	157,866
	OPEX	30,583	4,023	4,716	21,805	17,857	21,805	50,701	56,498	49,185	21,805	15,304	47,211	13,960	43,541
	TOTEX	130,184	12,237	12,930	111,944	107,996	111,944	248,316	254,113	246,800	111,944	130,989	244,826	221,899	201,407
AMP10	CAPEX	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	OPEX	36,832	3,675	4,393	20,337	20,350	20,337	48,859	49,835	49,336	20,337	19,457	49,293	6,562	43,164
	TOTEX	36,832	3,675	4,393	20,337	20,350	20,337	48,859	49,835	49,336	20,337	19,457	49,293	6,562	43,164
AMP11	CAPEX	0	67,727	67,727	0	83,166	221,912	83,166	67,727	67,727	965,011	965,011	67,727	0	191,072
	OPEX	40,783	26,015	26,730	21,747	37,339	23,085	66,298	72,203	71,677	488,750	486,364	71,658	9,882	45,756
	TOTEX	40,783	93,742	94,457	21,747	120,505	244,997	149,464	139,930	139,404	1,453,761	1,451,375	139,385	9,882	236,828
AMP12	CAPEX	67,727	82,734	82,734	67,727	67,727	0	67,727	82,734	99,994	252,868	261,521	99,994	67,727	0
	OPEX	63,862	59,227	59,937	43,278	61,350	29,315	90,376	105,803	98,030	621,056	606,378	97,984	32,555	49,317
	TOTEX	131,589	141,961	142,671	111,005	129,077	29,315	158,103	188,537	198,024	873,924	867,899	197,978	100,282	49,317
Total	CAPEX	396,189	281,633	315,832	386,727	426,448	540,912	577,369	576,937	594,197	1,536,879	1,465,175	594,197	504,527	577,799
	OPEX	179,630	93,557	97,175	114,738	142,619	102,114	263,809	291,909	275,797	1,159,520	1,128,164	273,727	70,530	189,979
	TOTEX	575,819	375,190	413,007	501,465	569,067	643,026	841,177	868,846	869,993	2,696,399	2,593,339	867,924	575,057	767,778
% TOTEX of Central Plan		89.5%	58.3%	64.2%	78.0%	88.5%	100.0%	130.8%	135.1%	135.3%	419.3%	403.3%	135.0%	89.4%	119.4%

[1]Bold outline identifies OFWAT Core Plan costs.

[2]Also an Adaptive Programme.

[3]A REG19/64 Derogation is required to meet unresolved deficit in this scenario.

8.7.3. SENSITIVITY OF PREFERRED FINAL PLAN TO DURATION OF PLANNING PERIOD

A comparison of the options selected for our Central Best Value Plan scenario for each of the three time horizons is shown in Table 80. The 2050 planning horizon incorporates all the significant reductions in WAFU resulting from sustainability reductions, and our planned implementation of Environmental Destination by 2045/46. After this point, there is a gradual increase in forecasted demand in each water resource zone (WRZ). Therefore, when the EBSD model is run over longer time periods, it will select a combination of options with combined capacity to satisfy forecasted demand, at the lowest TOTEX, at the end of each planning horizon.

The Ofwat Core Plan remains the same for all three periods. However, the options selected in the 2040s changes between 2050 and the two longer planning horizons. The deficit by the end the 2075 and 2100 planning horizons, is too large for the North Suffolk Reservoir 7500 option to meet. Therefore, an additional scheme is required. The combined TOTEX for Caister Water Reuse and Corton Desalination is lower than that for the North Suffolk Reservoir plus another option, either a reuse or desalination scheme. Whilst OPEX is higher for the 2075 and 2100 plans, the total CAPEX to of Caister Reuse and Corton Desalination is notably less than the North Suffolk Reservoir.

Table 80: Comparison of selected options for best value plan over three time horizons.

WRZ	OPTION NAME	OPTION REFERENCE	OPTION MAXIMUM GAIN IN WAFU (ML/D)	PLANNING HORIZON*		
				2050	2075	2100
Essex	Linford New WTW 10	ESW-ABS-003	10	✓	✓	✓
	Langford Nitrate Scheme	ESW-NIT-005	2.8	✓	✓	✓
	Langford UV	ESW-UVC-001	0.2	✓	✓	✓
	Langham Nitrate Scheme	ESW-NIT-006	0.9	✓	✓	✓
	Abberton RWPS and Langford Clarifiers	ESW-UVC-01	8.0	✓	✓	✓
Blyth	Barsham WTW Saxmundham Tower	ESW-TRA-001	15.0	✓	✓	✓
Hartismere	Holton WTW Eye Airfield	ESW-TRA-019	8.5	✓	✓	✓
Northern Central	Barsham Nitrate Scheme	ESW-NIT-004	2.2	✓	✓	✓
	Bungay wells to Broome WTW and Broome to Barsham WTW transfers	ESW-TRA-018 and ESW-TRA-023	1	✓	✓	✓
	Lowestoft Water Reuse for Ellingham Mill and Transfer	ESW-EFR-002A	11	✓	✓	✓
	North Suffolk Winter Storage 7500 and Transfer	ESW-RES-002C	19.9	✓		
	Caister Water Reuse and Ormesby Transfer	03b0478B	16.4		✓	✓
	Corton Desal Beach Well and Transfer	ESW-DES-008BW	10.1		✓	✓

*Green ticks indicate Ofwat Core Plan.

The key findings from the assessment of options selected through EBSD modelling using least cost criteria under alternative scenarios over the 2075 and 2100 planning horizons are summarised below.

50 YEAR PLANNING PERIOD TO 2075

Key observations for extending the time horizon from 2050 to 2075 are as follows:

- The Central Plan no longer selects the North Suffolk Reservoir in the 2040s, choosing Corton Desalination and Caister Water Reuse instead. However, it is worth noting that when the ESBD model is forced to choose the North Suffolk Reservoir in Asset Management Plan 9 (AMP9), which is the scenario presented in our North Suffolk Reservoir Adaptive Programme, this results in a cheaper TOTEX plan (84.1% and 85.5% of the Central Plan). This supports the need to confirm earliest delivery date for the reservoir to determine if the criteria to trigger this Adaptive Programme have been met.
- The Low PCC scenario has a lower TOTEX than the Central Plan (91.4% of Central Plan TOTEX).

75 YEAR PLANNING PERIOD TO 2100

Extending the planning horizon to 2100 results in plans that are significantly more costly and show greater variation in option selection, driven primarily by the increased OPEX associated with the 75-year timeline. Key impacts of the longer planning horizon on TOTEX are:

- As seen in the 2075 horizon, in the 2100 horizon, the Central Plan no longer selects the North Suffolk Reservoir, choosing Corton Desalination instead. TOTEX difference between the two reservoir size plans also close over this time period, 84% of Central Plan TOTEX with a 3500 Ml reservoir and 84.7% for the 7500 Ml option - this would support construction of the largest sized reservoir available to ensure long term plan efficiency. This further supports the need to confirm option benefit, costs, and earliest start date for the reservoir.
- The High PCC scenario results in a plan that has a TOTEX figure 171% of the Central Plan. This is driven by the larger deficits resulting in the EBSD model selecting Canvey Island Desalination at 65 Ml/d in 2032.
- The Low PCC scenario has a lower TOTEX than the Central Plan (92% of Central Plan TOTEX).

8.7.4. 1 IN 500 YEAR DROUGHT RESILIENCE

We are planning to provide 1 in 500 year drought resilience in Essex and Suffolk from 2031/32 in Essex and 2033/34 in Suffolk once forecast demand savings have been made and new supply schemes are in supply. We are planning to provide 1 in 500 year drought resilience from 2031/32 in Essex and 2033/34 in Suffolk once forecast demand savings have been made and new supply schemes are in supply.

We are forecasting significant baseline supply deficits in all four of our water resources zones when using the 1 in 200 and 1 in 500 year supply forecasts in AMP8. These are driven by statutory abstraction licence sustainability reductions, new non-household demand and in Essex, climate change. Consequently, in addition to the demand management and supply options in our final plan, the only way we are able to provide a final plan supply surplus in AMP8 is by keeping our Level 4 level of service at 1 in 200 years until our new WRMP24 supply schemes are operational in AMP9. Additionally, in Suffolk, we have:

- reduced our Level 1 and Level 2 drought action levels of service from 1 in 10 years to 1 in 5 years and 1 in 20 years to 1 in 10 years respectively; and
- implemented a moratorium on new applications for mains water supplies where the water will be used for non-domestic purposes. This will be lifted once new WRMP24 supply schemes are operational.

We have considered whether we could provide 1 in 500 year drought resilience later than planned. However, we have concluded that there is no benefit because:

- Statutory sustainability reductions and new non-household demand are driving the demand management and supply schemes in our Core Plan and not 1 in 500 resilience; and
- Given we are needing to develop new supply schemes to meet forecast demand, it makes sense that these are sized to provide 1 in 500 year resilience. This is particularly the case should we progress with the North Suffolk Winter Storage Reservoir.

8.8. ADAPTIVE PROGRAMMES

8.8.1. OVERVIEW

There are uncertainties associated with preparation of both baseline and final plan supply and demand forecasts including:

- How water company and government measures will reduce PCC over time.
- How quickly the climate will change and as it does, how this will affect rainfall patterns, rainfall totals, river flows, reservoir refill and groundwater recharge.
- How resilient the environment will be to climate change and whether water company abstraction licences will need to be reduced further in the future.

The sensitivity testing we have undertaken (see Section 8.7 above), has identified that our central supply demand balance forecast and preferred final plan are sensitive to:

- **Customer demand (per capita consumption or PCC):** Our forecast assumes a downward trajectory over the next 25 years with a PCC of 110 l/head/day being achieved by 2050. However, as well as our own water efficiency and smart metering strategies, this depends on the Government delivering demand savings through changes to building regulations and from white goods labelling. While these Government interventions are now gaining traction, there is still significant uncertainty.
- **Environmental Destination Abstraction Licence Sustainability Reductions:** Our supply forecast assumes further abstraction sustainability reductions in from 2040. However, 2025-30 WINEP investigations may result in the changes to the numbers assumed. This could result in the High (Enhanced) scenario sustainability reductions being required instead of the central (Business As Usual Plus) scenario.
- **Habitats Regulations sustainability reductions:** The EA's investigations to confirm the size of sustainability reductions that will be applied to our groundwater and surface water catchments in the Norfolk Broads will conclude in 2024/25. If these conclude that sustainability reductions, similar to the assumptions we have used for this scenario, are required, then this would cause a 1 in 200 year supply deficit and require additional investment to restore a supply surplus.
- **The lead in time for delivering the North Suffolk Reservoir:** Our preference is to develop the North Suffolk Reservoir, which is a low energy and carbon scheme with significant opportunity for environmental gain, instead of Lowestoft Reuse, which is a high energy and carbon scheme with a brine discharge. If the detailed engineering design stage (commencing Autumn 2023) confirms that the Norfolk Suffolk Reservoir can be delivered one year earlier than currently is the case, then we would look to deliver it rather than Lowestoft Reuse.

Defra and the EA expect water companies to adopt an adaptive planning approach where:

- There is significant uncertainty, particularly in the first five to ten years of the planning period;
- A strategic decision needs to be made in the plan's medium term but where there is a long lead in time; or
- There is large long-term uncertainty which might lead to consideration of different preferred options.

Given the uncertainties we have identified, our Best Value Plan is an adaptive plan and comprises:

- A central pathway and preferred programme representing the most likely future in terms of customer demand and available water supplies; and
- the following Adaptive Programmes:
    - North Suffolk Reservoir
    - High PCC
    - High Environmental Destination
    - Habitat Regulations Sustainability Reductions.

Our central preferred plan and adaptive programmes are illustrated in Figure 49.

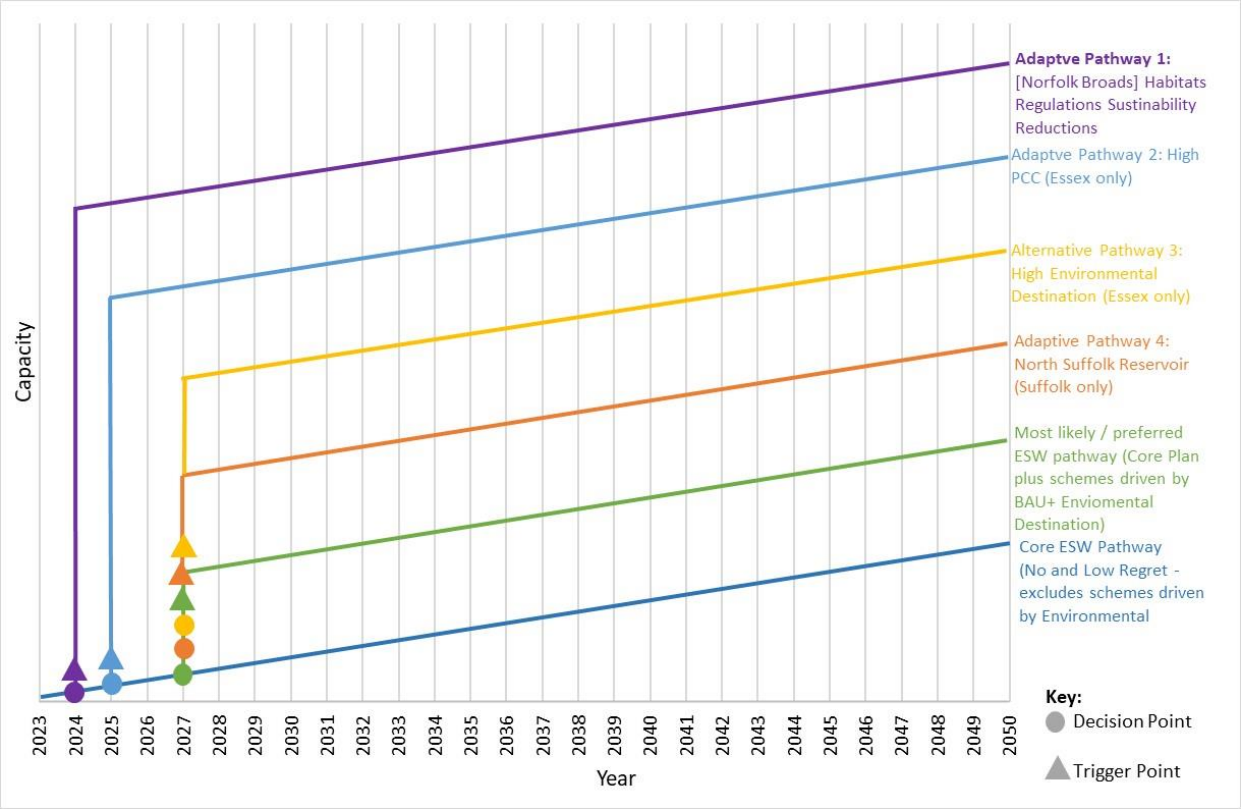


Figure 49: ESW Best Value Plan Adaptive Programmes

A description of each of the adaptive programmes is provided below.

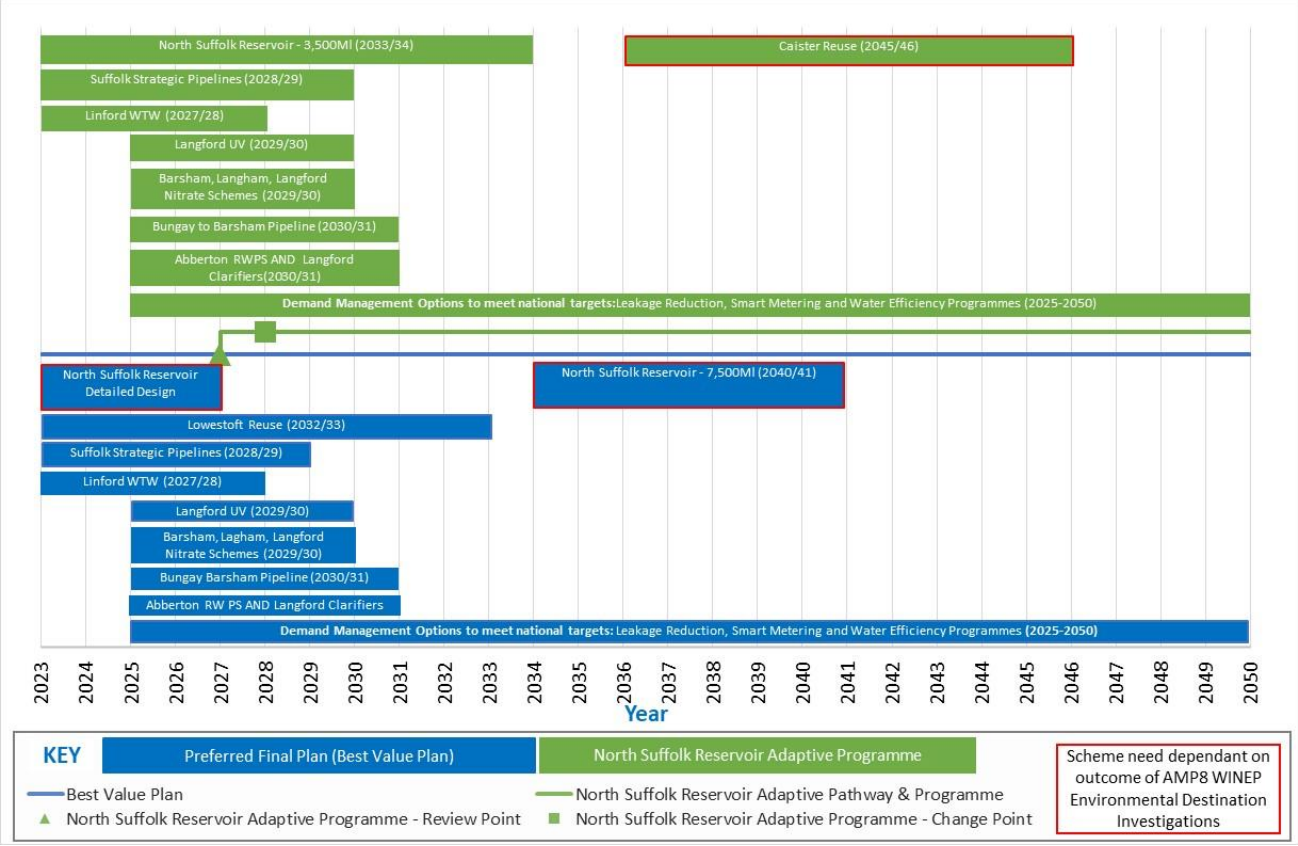
8.8.2. NORTH SUFFOLK RESERVOIR ADAPTIVE PROGRAMME

Our final plan includes the Lowestoft Water Reuse scheme. It is primarily chosen because it can be delivered more quickly than North Suffolk Reservoir and so minimises the duration of the moratorium on new non-domestic water supplies in our Hartismere WRZ. However, our preference would be to deliver the North Suffolk Reservoir instead of Lowestoft Reuse because the latter has high operational energy and carbon costs and produces a brine discharge while

the North Suffolk Reservoir has lower energy and carbon costs and has significant potential to build in environmental gain.

Subject to review of our progress with delivery of our AMP7 enhancement programme, Ofwat has allowed PR24 transition expenditure funding to undertake detailed engineering design for the North Suffolk Reservoir. This next phase of the project commenced in Autumn 2023 and will develop the scheme so that it is "near construction ready" by April 2027. If at that point it is concluded that the North Suffolk Reservoir provides better value than Lowestoft Reuse (i.e., it can be delivered as quickly as Lowestoft Reuse so as not to lengthen the Hartismere WRZ moratorium), then we would immediately move to the North Suffolk Reservoir adaptive pathway and programme.

Figure 50 illustrates the adaptive programme we would deliver should further detailed design conclude that the North Suffolk winter storage reservoir can be delivered more quickly than is currently assumed.



Likelihood of Needing	Metric to be Monitored	Frequency of Monitoring
High	We will monitor the delivery date of the North Suffolk Reservoir regularly during the detailed engineering design stage of the project which we expect to conclude in 2026/27. If future revisions to our least cost and best value assessments conclude that North Suffolk Reservoir provides better value than Lowestoft Water Reuse, then we will move to the North Suffolk Reservoir Adaptive Programme.	Every six months during the detailed engineering design stage with a final decision in 2026/27.

Figure 50: Adaptive programme for North Suffolk Reservoir

To achieve SDB, the current Hartismere WRZ non-domestic moratorium would be required until 2033/34 following delivery of the North Suffolk Reservoir in the same year, just two years later than in our preferred best value plan. Figure 51 shows the Supply Demand Balance for the Northern Central WRZ under this scenario.

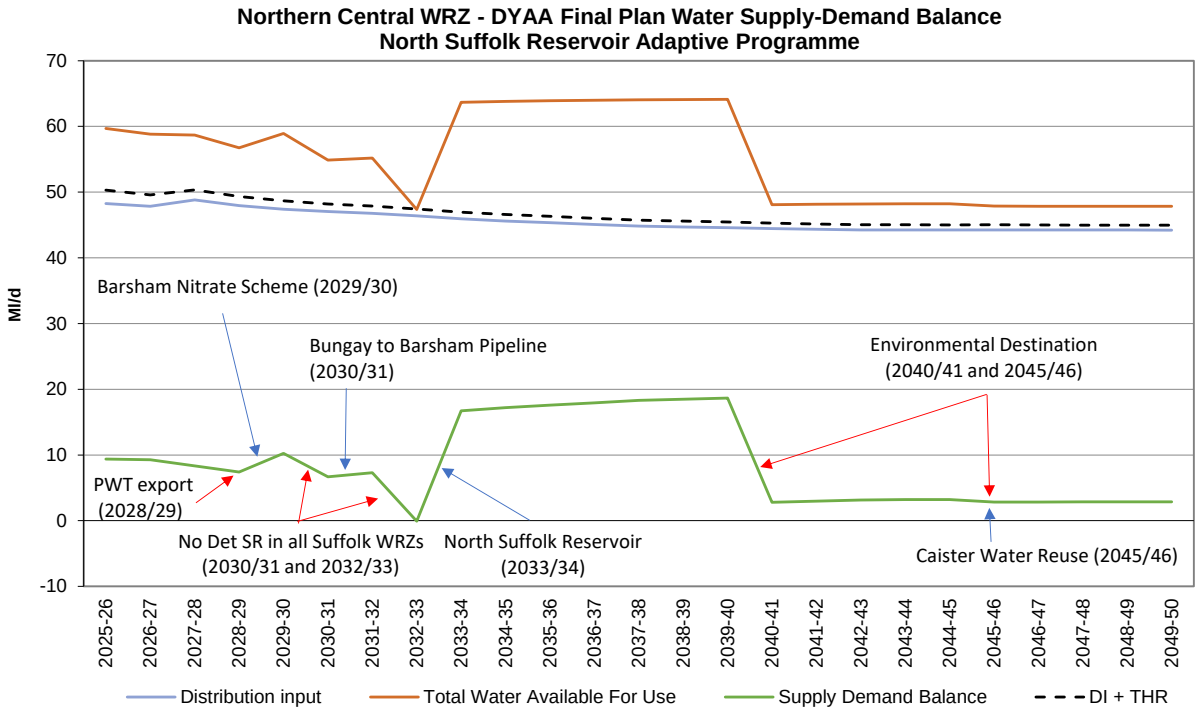


Figure 51: North Suffolk Reservoir adaptive programme supply demand balance

The North Suffolk Reservoir meets demand from 2033/34, instead of Lowestoft Reuse Scheme, as in our preferred best value plan, and provides a sufficient gain in WAFU to meet the first half of the BAU+ Environmental Destination sustainability reductions in 2040. Caister Reuse scheme is then selected to replace the lost resource resulting from the remaining half of the ED sustainability reduction from 2045.

8.8.3. HIGH PCC ADAPTIVE PROGRAMME

Our central (most likely) demand forecast assumes a downward trajectory over the next 25 years with a PCC of 110l/head/day being achieved by 2050. As well as our own water efficiency and smart metering strategies, this depends on changes to building regulations to adopt the 110l/head/day PCC target and the timely implementation by Government of mandatory water labelling.

However, there is uncertainty as to whether PCC will reduce as forecast. Consequently, our Best Value Plan includes an adaptive programme should PCC outturn in line with our High PCC forecast.

Essex water Resource Zone

The High PCC Adaptive Programme also assumes we provide 1 in 500 year drought resilience in Essex from 2031/32, as is the case in our central plan.

However, as illustrated in the Essex WRZ DYAA final plan supply demand balance in Figure 52, this drives the Southend Water Reuse Scheme in Essex in addition to our Core plan.

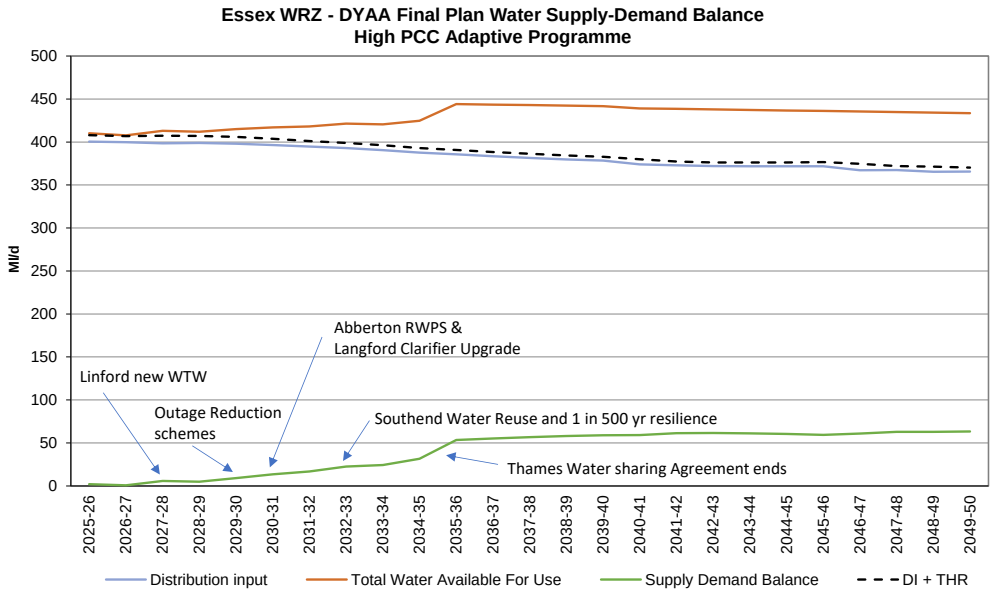


Figure 52: High PCC Adaptive Programme Essex WRZ DYAA Final Plan Supply Demand Balance

Given we do not have to provide 1 in 500 year drought resilience until 2040/41, we have tested a further High PCC scenario where by 1 in 500 year drought resilience is not provided until 2035/36 when our 20 Ml/d raw water trade agreement with Thames Water ends. As is illustrated in Figure 53, under this scenario, a supply surplus is then maintained.

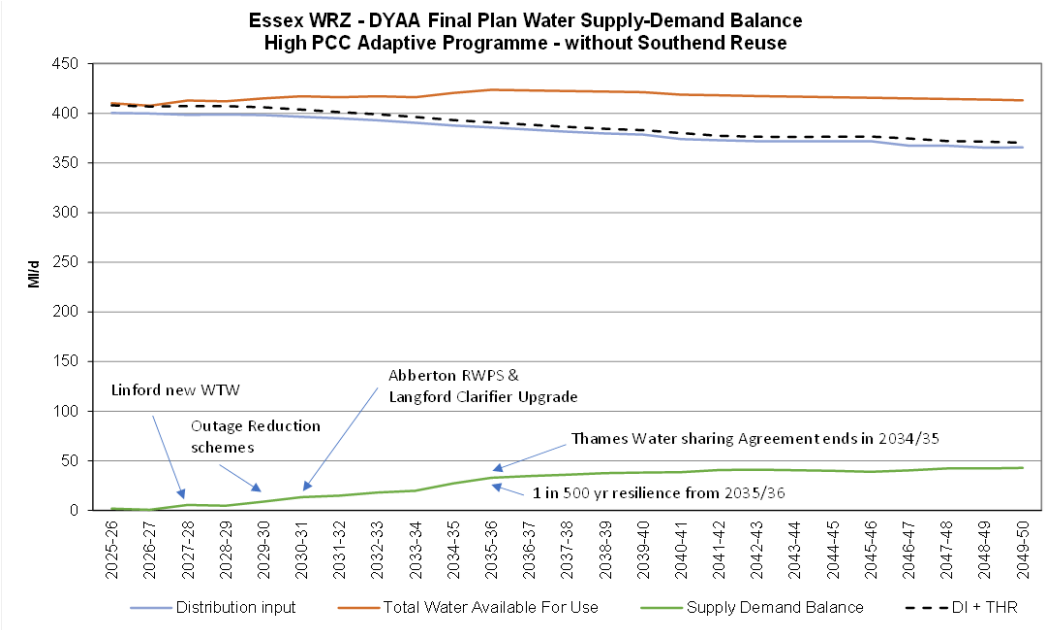


Figure 53: High PCC Adaptive Programme Essex WRZ DYAA Final Plan Supply Demand Balance - without Southend reuse

Consequently, if PCC outturns in line the high forecast, it is more likely that we will move the date which we supply 1 in 500 year resilience from 2031/32 to 2035/36 rather than develop the Southend Reuse scheme. However, for illustrative purposes only, we have included the Southend Reuse scheme in the High PCC adaptive programme in the WRMP Planning Tables.

Suffolk Water Resource Zones

The option selection under the High PCC scenario is different in the Northern Central WRZ, with Corton Desalination and Caister Water Reuse being selected in favour of the North Suffolk Reservoir to enable Environmental Destination sustainability reductions to be made in 2040/41 and 2045/46 respectively. This is because the North Suffolk Reservoir alone cannot meet demand under this scenario, and therefore an additional option is required. The resulting set of options selected has a higher OPEX, but due to the lower total CAPEX, represents the lowest TOTEX plan. No additional options are required for Blyth and Hartismere WRZs as the new Suffolk Strategic Pipelines in our core plan have sufficient capacity to meet demand under this scenario.

The DYAA final plan supply demand balance for the Northern Central WRZ is shown in Figure 54.

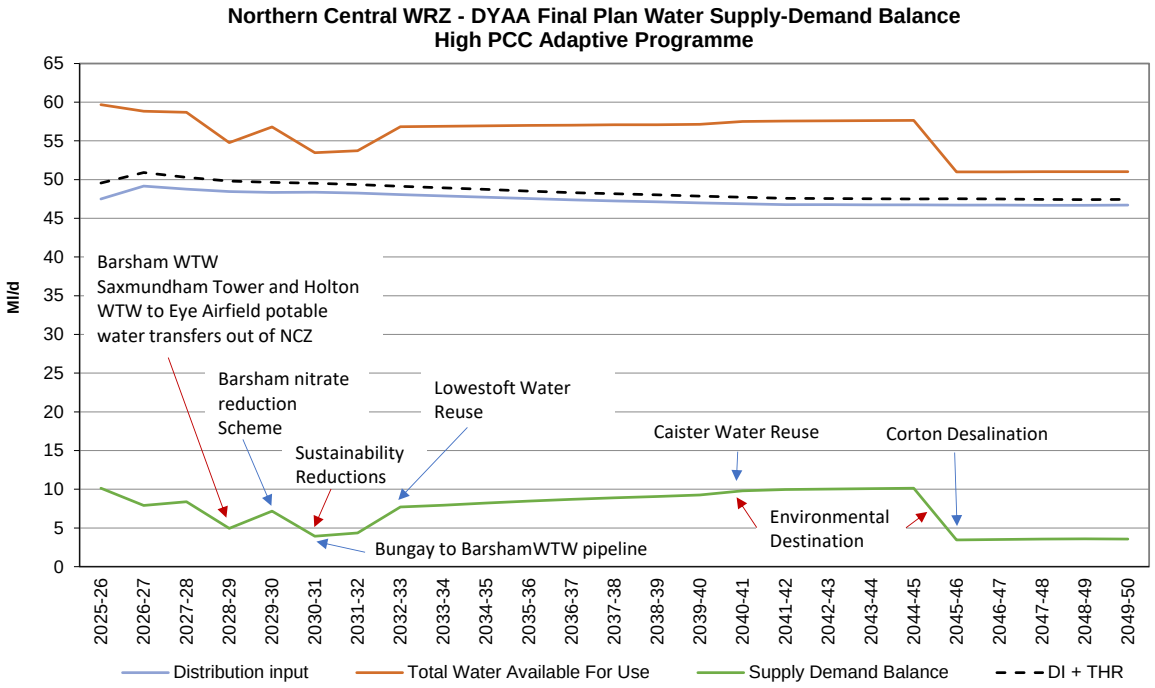
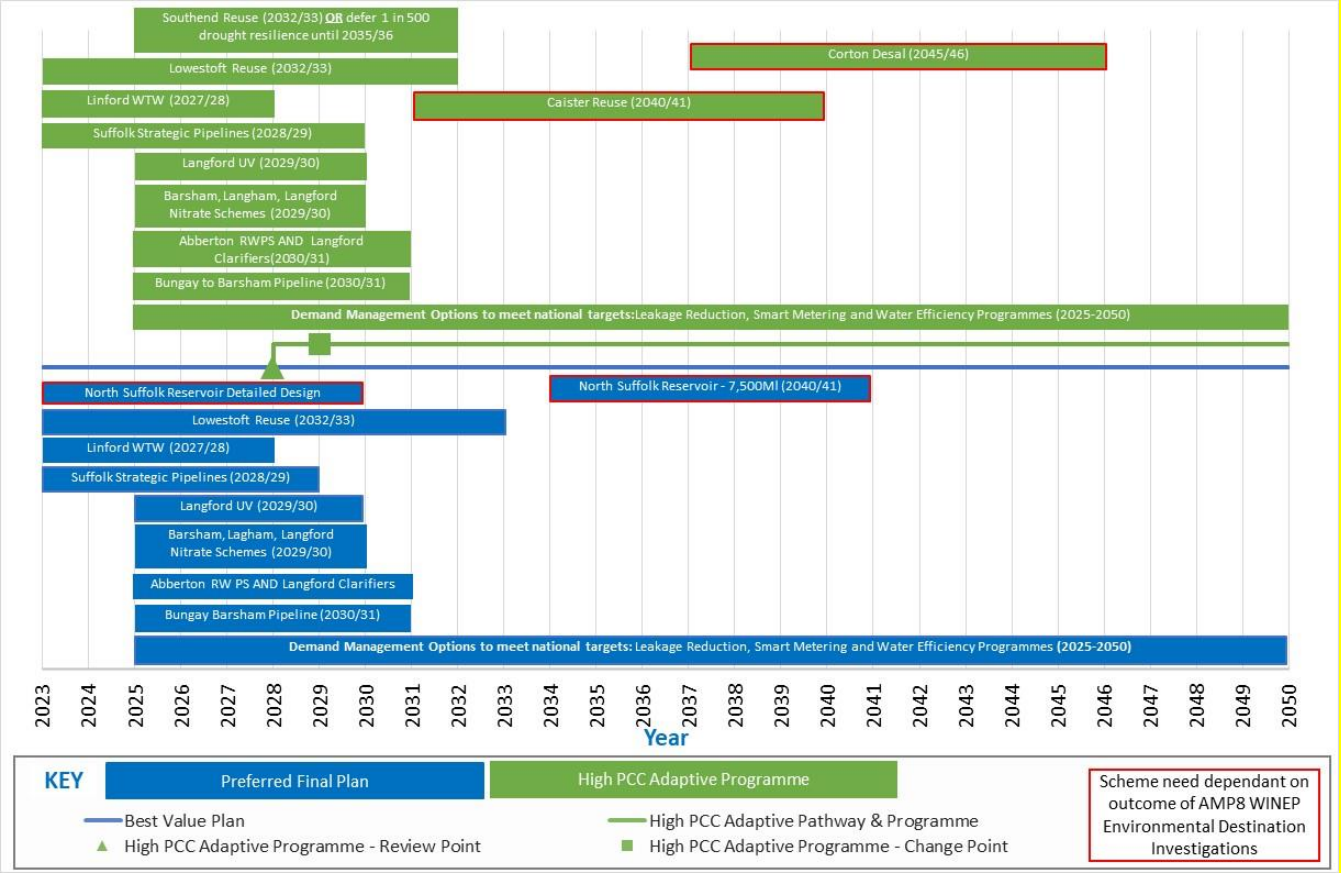


Figure 54: High PCC Adaptive Programme Northern Central WRZ DYAA Final Plan Supply Demand Balance

Figure 55 illustrates the adaptive programme that would be required if PCC out-turns in line with our High PCC forecast instead of the lower Central (most likely) scenario.



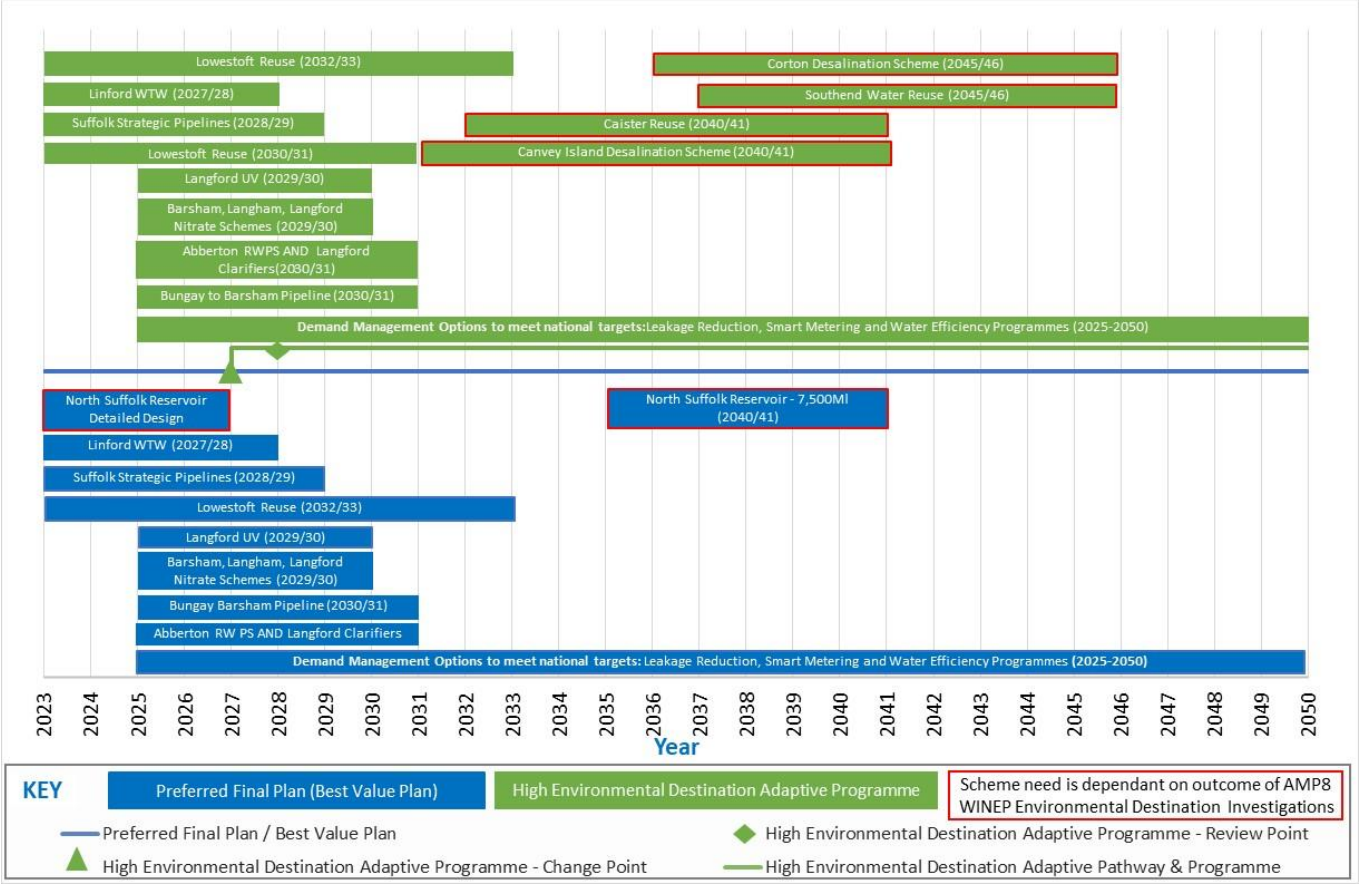
Likelihood of Needing	Metric to be Monitored	Frequency of Monitoring
Low	The need to move to the High PCC adaptive programme will be monitored and reported as part of the WRMP Annual Review process which we will submit to regulators every June. This will include monitoring water resource zone PCC; abstraction; and non-household demand, particularly that of large users. For the Essex WRZ, as confirmed below, this scenario is sensitive to the date of providing 1 in 500 year drought resilience in the Essex WRZ. However, when we defer 1 in 500 year drought resilience to 2035/36, this means that the Southend Water Reuse scheme is no longer required. Consequently, if PCC outturns in line the high forecast, then we will move the date which we supply 1 in 500 year resilience from 2031/32 to 2035/36. We have set a: • trigger date of 2027/28 which will depend on the outcome of the draft WRMP29 and consider 2026/27 outturn PCC; and • change date of 2028/29 once the WRMP29 has been approved. For the Suffolk WRZs, the High PCC scenario changes the options needed to enable Environmental Destination Sustainability Reductions to be applied in 2040/41 and 2045/46. However, the lead in time for these schemes does not start until 2030/31 and 2036/37 respectively. Consequently, we have set the: • review point date to be 2027/28 following completion of AMP8 WINEP Environment Destination investigations and to tie in with the PR29 process; and • change point date of 2028/29 once the WRMP29 has been approved.	Every June

Figure 55: Adaptive programme for High PCC

8.8.4. HIGH ENVIRONMENTAL DESTINATION ADAPTIVE PROGRAMME

We have an adaptive programme should our AMP8 WINEP Environmental Destination investigations conclude that a higher-level of abstraction sustainability reductions are required (i.e., Enhanced scenario) than our central forecast (BAU+) from 2040. This would result in the loss of nearly 70% of our Essex deployable output.

Figure 56 illustrates the adaptive programme that would be needed under this scenario.



Likelihood of Needing	Metric to be Monitored	Frequency of Monitoring
Low	We will review the outcomes of our AMP8 WINEP ED investigations. A deliverable will be a technical report which will conclude what the ED sustainability reductions should be for each abstraction licence. We will then apply these reductions to our baseline draft WRMP29 (dWRMP29) supply forecast in 2026/27. We would agree the adaptive pathway change year as part of our dWRMP29.	This will be a one off review on completion of the AMP8 WINEP ED investigations. However, it might be that further WINEP ED investigations are required in future AMPs in which case we would review the outcomes of those investigations during preparation of each subsequent dWRMP supply forecasts.

Figure 56: High Environmental Destination Adaptive programme

Both Southend Water Reuse scheme and a 190 Ml/d Canvey Island desalination plant would be required at a capital cost approaching £1.5b. No additional options are required for Blyth and Hartismere WRZs because the new potable water transfers under our preferred best value plan have sufficient capacity to meet demand under this scenario.

The DYAA final plan supply demand balance for the Essex WRZ and Northern Central WRZ are show in Figure 57 and Figure 58.

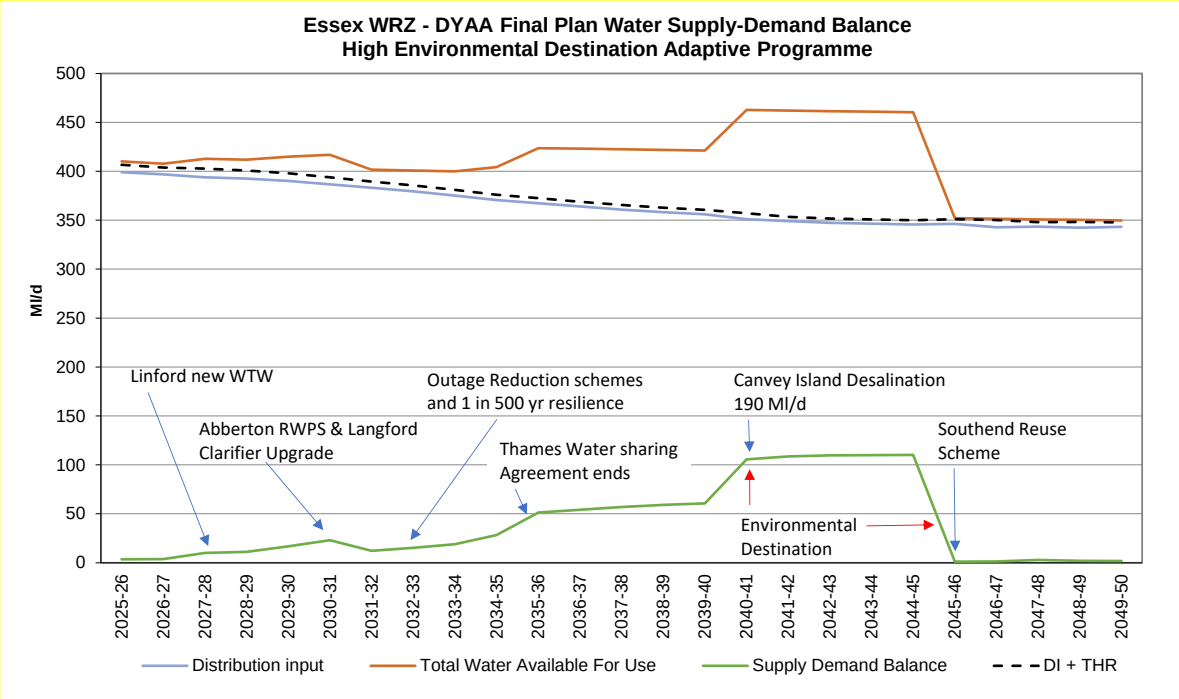


Figure 57: High ED Adaptive Programme Essex WRZ DYAA Final Plan Supply Demand Balance

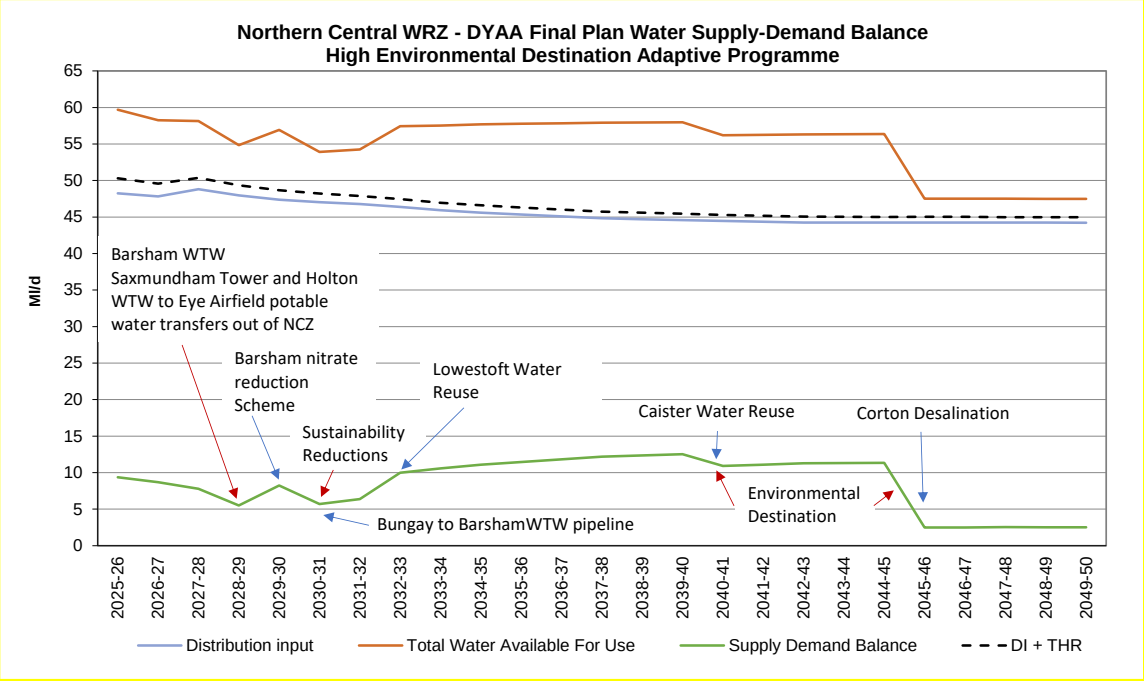


Figure 58: High ED Adaptive Programme Northern Central WRZ DYAA Final Plan Supply Demand Balance

As detailed in our WRMP24 Environmental Destination Technical Report, we expect that as part of the WINEP investigations options appraisal process, alternatives to the indicative abstraction licence reductions provided by high level regional modelling, will be identified, such as HOFs, which will be more effective at meeting environmental objectives, whilst reducing the impact on WRZ DO.

8.8.5. HABITATS REGULATIONS SUSTAINABILITY REDUCTIONS ADAPTIVE PROGRAMME

As described in Section 8.3.1 we are including an Adaptive Programme within our WRMP24 due to the uncertainty around the application of EA advised sustainability reductions and/or stricter HOF conditions by 2026/7 for up to eleven groundwater and surface water sources in our Northern Central and Hartismere WRZs, to meet the requirements of the Conservation of Habitats and Species Regulations 2017 (the Habitats Regulations), due to the effects of abstraction on the Broads Special Area of Conservation (SAC) and the Waveney and Little Ouse Valley Fens SAC.

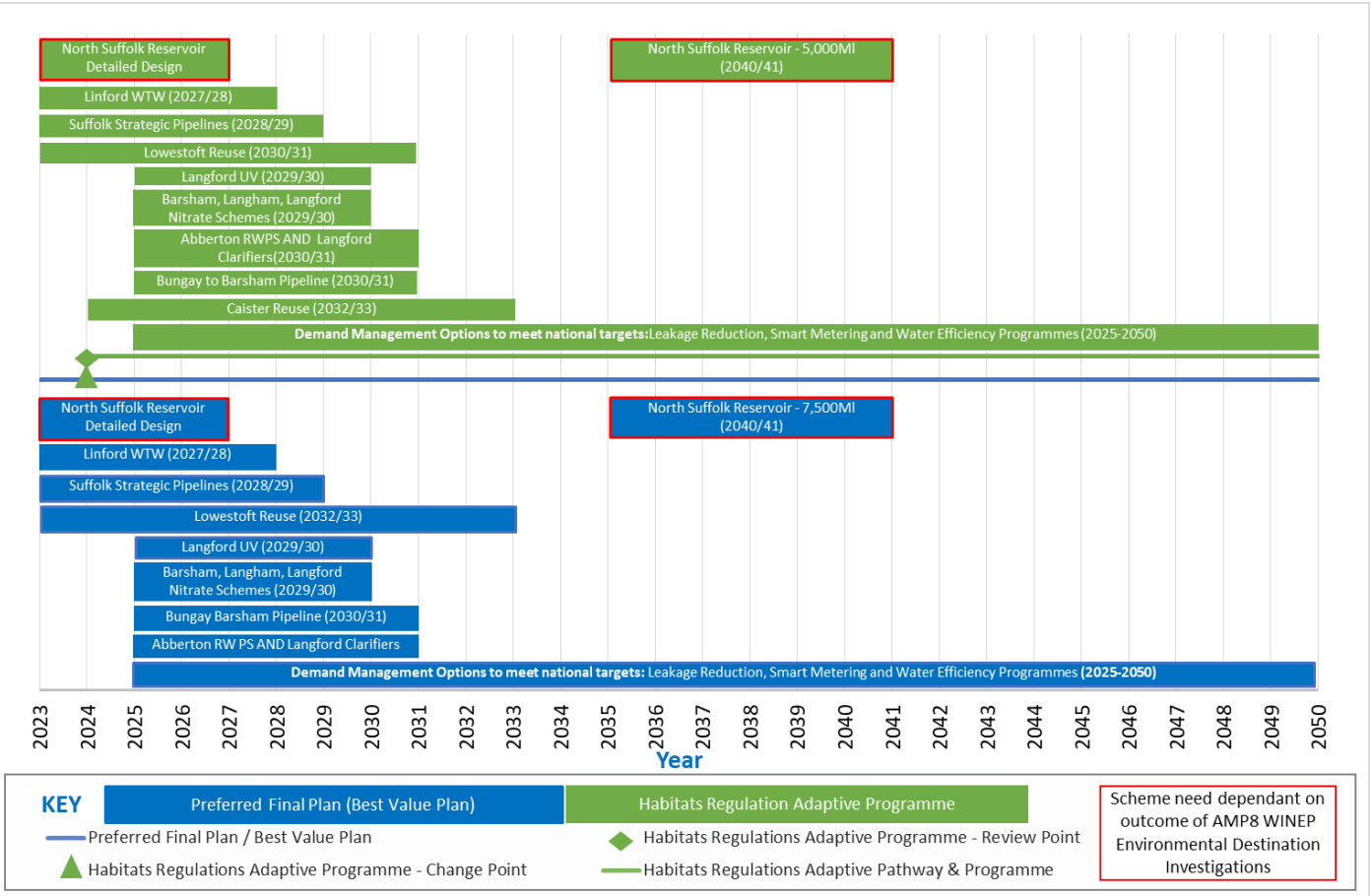
The severity of these likely Habitats Regulations (Habs Regs) sustainability reductions is not yet known, as the EA has an ongoing investigation to determine this. We have therefore worked with the EA to agree some likely sustainability reduction values in our WRMP24 as an Adaptive Programme. These licence changes are detailed in Section 3.7 of our WRMP24 Sustainability Reductions Technical Report.

We expect that, if the scale of licence reductions under the Habs Regs is as severe as we anticipate, this will put our Northern Central WRZ and Hartismere WRZ into deficit when these are applied in 2026/7, as shown in Figure 60.

Our Least cost modelling has selected Lowestoft Reuse and Caister Reuse schemes to meet the deficit, as these have shorter lead-in times than the North Suffolk Reservoir. We anticipate that we would work with the EA to develop a ‘glidepath’ of sustainability reductions and compensatory measures between 2026/27 and the date by when we are able to deliver sufficient demand reductions and/or supply side schemes to replace the lost DO.

For the part of the sustainability reductions that we are not able to deliver in 2026/27, we would likely need to request a delay to the imposition of these caps via an application for a derogation to Regulation 64(5) of the Habs Regs on the grounds of Imperative Reasons of Overriding Public Interest (IROPI).

Figure 59 illustrates this adaptive programme and Figure 61 shows the final plan supply demand balance for the Northern Central WRZ.



Likelihood of Needing	Metric to be Monitored	Frequency of Monitoring
High	Outcomes of the EA's Habitat Regulations investigations. A deliverable will be a technical report which will conclude what the Habs Regs sustainability reductions should be for each of our Broadland abstraction licences. We will then apply these reductions to our baseline supply forecast in 2024/25 and if required, will agree the adaptive pathway change year with the EA.	This will be a one off review on completion of the EA's Habitat Regulations investigations.

Figure 59: Habitats Regulations Adaptive Programme

The EA wrote to us in September 2023 informing us that we should allow for further Habs Regs sustainability reductions in our final WRMP24 in relation to abstractions from boreholes that supply two of our Hartismere WRZ WTWs. These sources are within the Waveney and Little Ouse Valley Fens SAC, which has fenland habitats very similar to those in The Broads SAC, and so Natural England has instructed the EA to treat them in the same way. While the EA is not currently able to provide any specific information we have assumed a possible scenario in which we would lose the full annual licensed quantity on two of the abstraction points (Hartismere 5 and Hartismere 6) within these two licences. If this is the outcome, then the Holton WTW to Eye Airfield potable water transfer (ESW-TRA-019) will need to be marginally larger than its current maximum capacity. Based on least cost optimiser modelling, the maximum utilisation is increased from 7.5 Mld to 9.13 Ml/d (+1.63 M/d) by the end of the planning horizon. This represents an estimated increase in costs of c.£35m, which results from a larger service reservoir at Eye Airfield, and an additional pumping station and distribution main from Eye Airfield into the potable network, and additional Opex associated with pumping energy requirements.

Additionally, in this updated Habs Regs Adaptive Programme, the medium sized (5000Ml) North Suffolk Reservoir is now required instead of the smallest (3500Ml). Subject to support by the EA, Ofwat and Defra, we would be open to constructing the largest feasible reservoir, given a winter storage reservoir is a long term asset (i.e. significantly greater than a 25-year planning horizon). Our North Suffolk Reservoir Accelerated Infrastructure Delivery project is necessarily considering different reservoir sizes to account for the current uncertainty around the licence conditions that the EA will apply to a new River Waveney abstraction, but also to ensure we have choices once Habitats Regulation sustainability reductions are confirmed.

If we move to the Habitat Regulations Adaptive Programme in 2024/25, then, subject to detailed engineering design over the next three years, we will still prefer to deliver North Suffolk Reservoir instead of Lowestoft Reuse. However, this may be more challenging because under the Habs Regs Adaptive Programme, Lowestoft Reuse is required by 2030/31 while the delivery date for the North Suffolk Reservoir is 2033/34. Consequently, this would mean extending the Hartismere non-domestic mains water moratorium and deferring at least some of the Habs Regs sustainability reductions by a further three years until 2033/34.

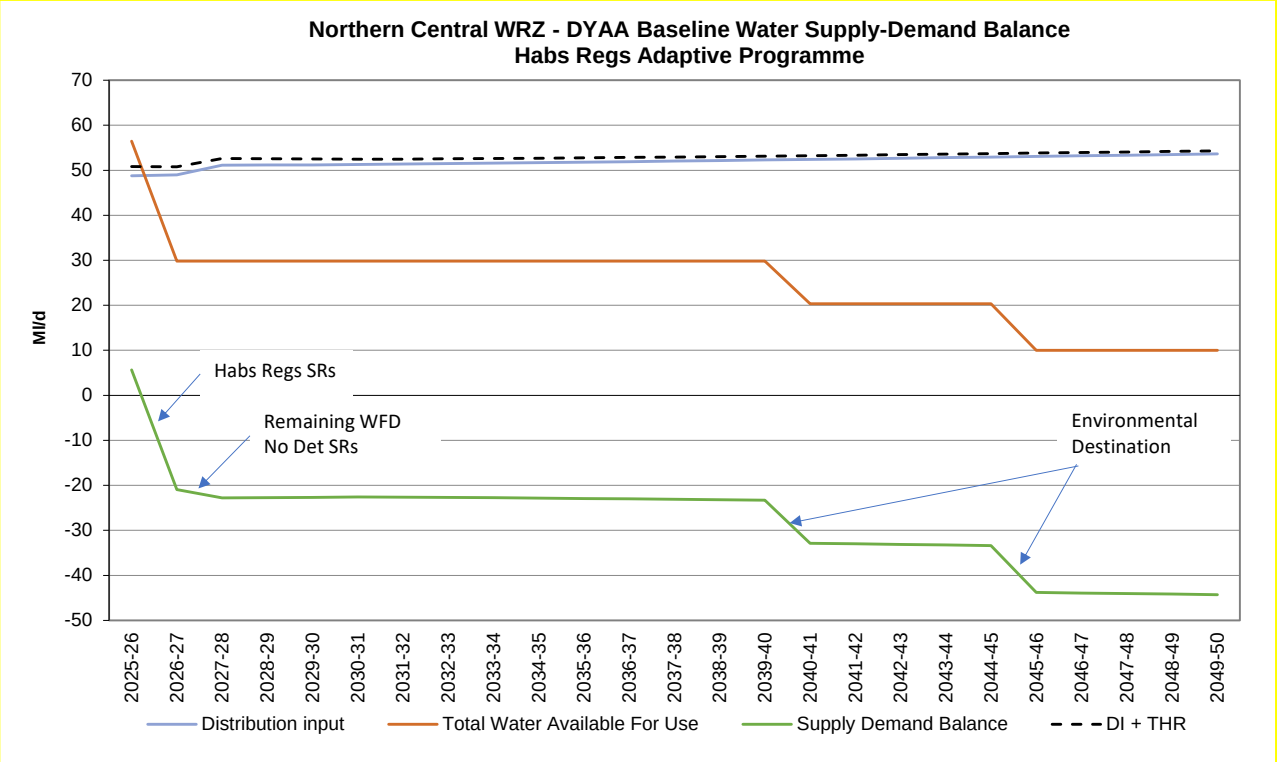


Figure 60: Habitats Regulations Adaptive Programme - Northern Central WRZ Baseline Supply Demand Balance

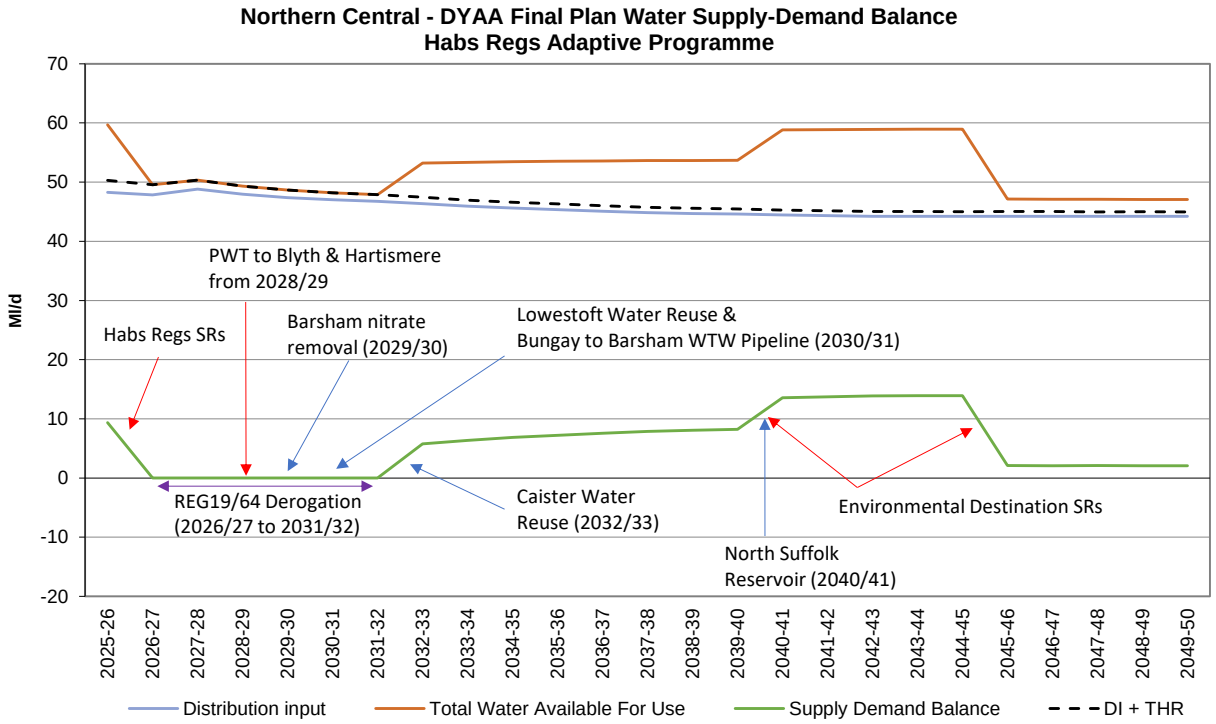


Figure 61: Habitats Regulation Adaptive Programme - Northern Central WRZ Final Plan Supply Demand Balance

8.9. ALTERNATIVE PLANS

8.9.1. OVERVIEW

In this section, we present the following plans for comparison against our Best Value Plan:

- Least Cost Plan
- Ofwat Core Plan
- Best Environment & Society Plan

The Best Value Plan and alternative plans all solve supply deficits that have been calculated using an agreed set of baseline planning assumptions. A key core planning assumption for the baseline supply forecast is that all Asset Management Plan 7 (AMP7) abstraction licence sustainability reductions will be made from 2030 and longer-term Environmental Destination (ED) sustainability reduction will be made from 2040.

8.9.2. LEAST COST PLAN

A Least Cost Plan (see

Table 81 and Figure 62 has been prepared as a benchmark to appraise other programmes against including our Preferred Best Value Plan, Ofwat Core Plan, and Best Environment & Society Alternative Plan.

The least cost plan meets our statutory requirements and has been informed by our Integrated Environmental Assessment which includes our Strategic Environmental Assessment (SEA) and Habitats Regulations Assessment (HRA). It includes policy expectations around demand management including leakage reduction and per capita consumption (PCC) targets.

Whereas the Best Value Plan considers wider metrics, the Least Cost Plan has been determined using only economic cost information and is the plan with the lowest cost to restore a supply surplus in all years of the planning period, should there have been a baseline supply deficit forecast.

However, our Least Cost Plan and our Best Value Plan are the same. The supply demand balance (SDB) for each water resource zone (WRZ) under our Least Cost and Best Value Plan are present in Section 8.4.

Table 81: Least Cost Plan (and Best Value Plan) supply options

YEAR SELECTED	WATER RESOURCE ZONE	OPTION	OPTION REF	OPTION TYPE	AMP
2027/2028	Essex	Linford New WTW 10	ESW_ABS_003	New WTW and borehole(s) (with raw water transfer)	AMP8
2029/2030		Langford Nitrate Scheme	ESW-NIT-005	Nitrate removal	AMP8
2029/2030		Langford UV	ESW-UVC-001	Cryptosporidium removal	AMP8
2029/2030		Langham Nitrate Scheme	ESW-NIT-006	Nitrate removal	AMP8
2030/2031		Abberton RWPS and Langford Clarifiers	ESW-PMP-001A	Raw water pumping station and clarifier upgrade	AMP8
2028/2029	Blyth	Barsham WTW Saxmundham Tower	ESW-TRA-001	Potable Water Transfer	AMP8
2028/2029	Hartismere	Holton WTW Eye Airfield	ESW-TRA-019	Potable Water Transfer	AMP8
2029/2030	Northern Central	Barsham Nitrate Scheme	ESW-NIT-004	Nitrate removal	AMP8
2030/2031		Bungay wells to Broome WTW and Broome to Barsham WTW transfers	ESW-TRA-018 and ESW-TRA-023	Raw water transfer	AMP8
2032/2033		Lowestoft Water Reuse for Ellingham Mill and Transfer	ESW-EFR-002A	Water Reuse	AMP9
2040/2041		North Suffolk Winter Storage 7500 and Transfer	ESW-RES-002C	New Reservoir (with raw water transfer)	AMP11

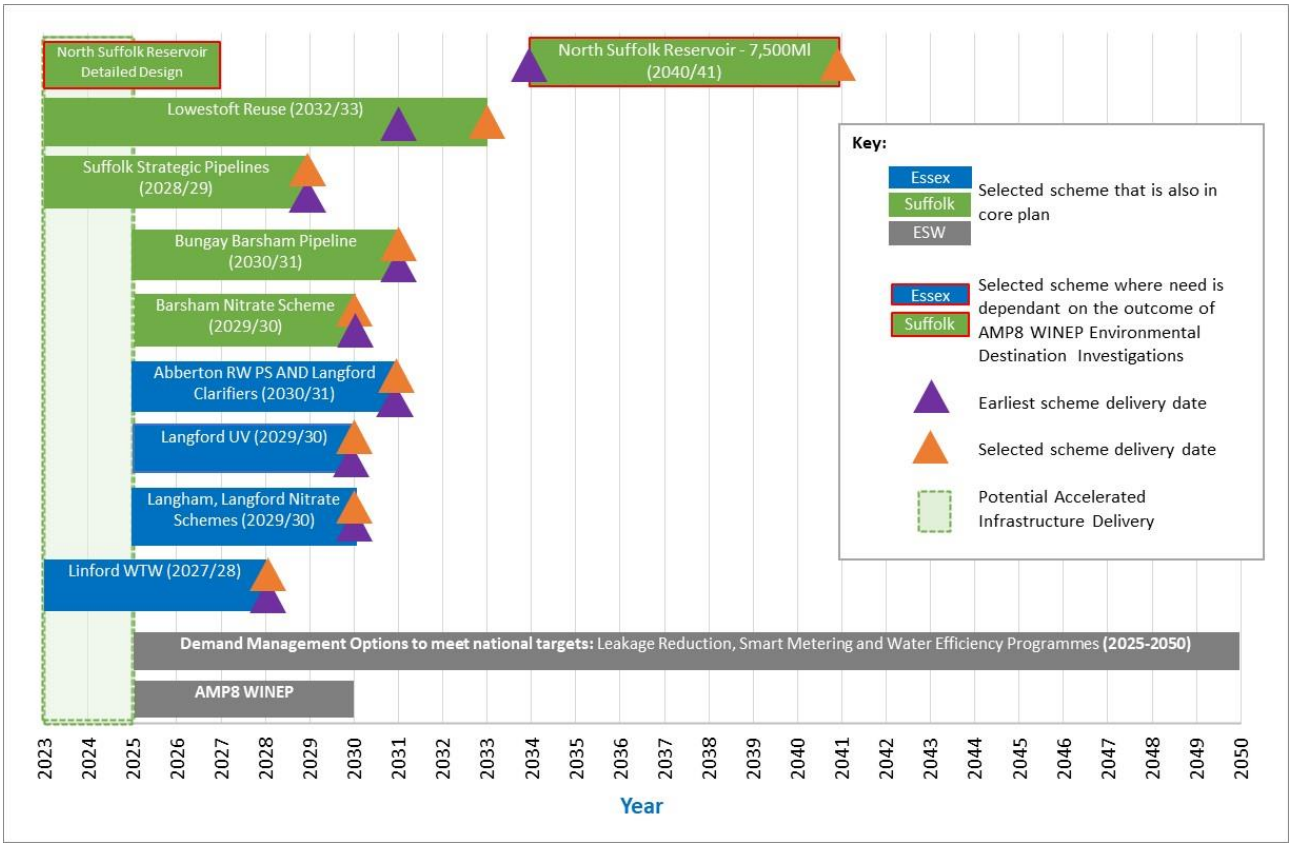


Figure 62: Least Cost Plan programme

The only difference between our Least Cost Plan and the Core Plan presented below, is that the Least Cost Plan includes delivery of the North Suffolk Reservoir in 2040/41.

8.9.3. OFWAT CORE PLAN

Our Ofwat Core Plan represents no or low regret options that are required to maintain a supply surplus in all years of the planning period and to meet government expectations on demand management. The core plan includes all the Best Value Plan Options that are needed in AMP8 and 9 but does not include those Best Value Plan options that are driven by Environmental Destination abstraction sustainability reductions in the 2040s. This is because there is a low level of certainty regarding the size of the abstraction licence sustainability reductions, thus why they will be included in our AMP8 Water Industry National Environment Programme (WINEP) for further investigation.

Our Ofwat Core Plan preferred options are presented in Table 82 and Figure 63.

Table 82: Ofwat Core Plan options

YEAR SELECTED	WATER RESOURCE ZONE	OPTION	OPTION REF	OPTION TYPE	AMP
2027/2028	Essex	Linford New WTW 10	ESW-ABS-003	New WTW and borehole(s) (with raw water transfer)	AMP8
2029/2030		Langford Nitrate Scheme	ESW-NIT-005	Nitrate removal	AMP8
2029/2030		Langford UV	ESW-UVC-001	Cryptosporidium removal	AMP8
2029/2030		Langham Nitrate Scheme	ESW-NIT-006	Nitrate removal	AMP8
2030/2031		Abberton RWPS and Langford Clarifiers	ESW-PMP-001A	Raw water pumping station and clarifier upgrade	AMP8
2028/2029	Blyth	Barsham WTW Saxmundham Tower	ESW-TRA-001	Potable Water Transfer	AMP8
2028/2029	Hartismere	Holton WTW Eye Airfield	ESW-TRA-019	Potable Water Transfer	AMP8
2029/2030	Northern Central	Barsham Nitrate Scheme	ESW-NIT-004	Nitrate removal	AMP8
2030/2031		Bungay wells to Broome WTW and Broome to Barsham WTW transfers	ESW-TRA-018 and ESW-TRA-023	Raw water transfer	AMP8
2032/2033		Lowestoft Water Reuse for Ellingham Mill and Transfer	ESW-EFR-002A	Water Reuse	AMP9

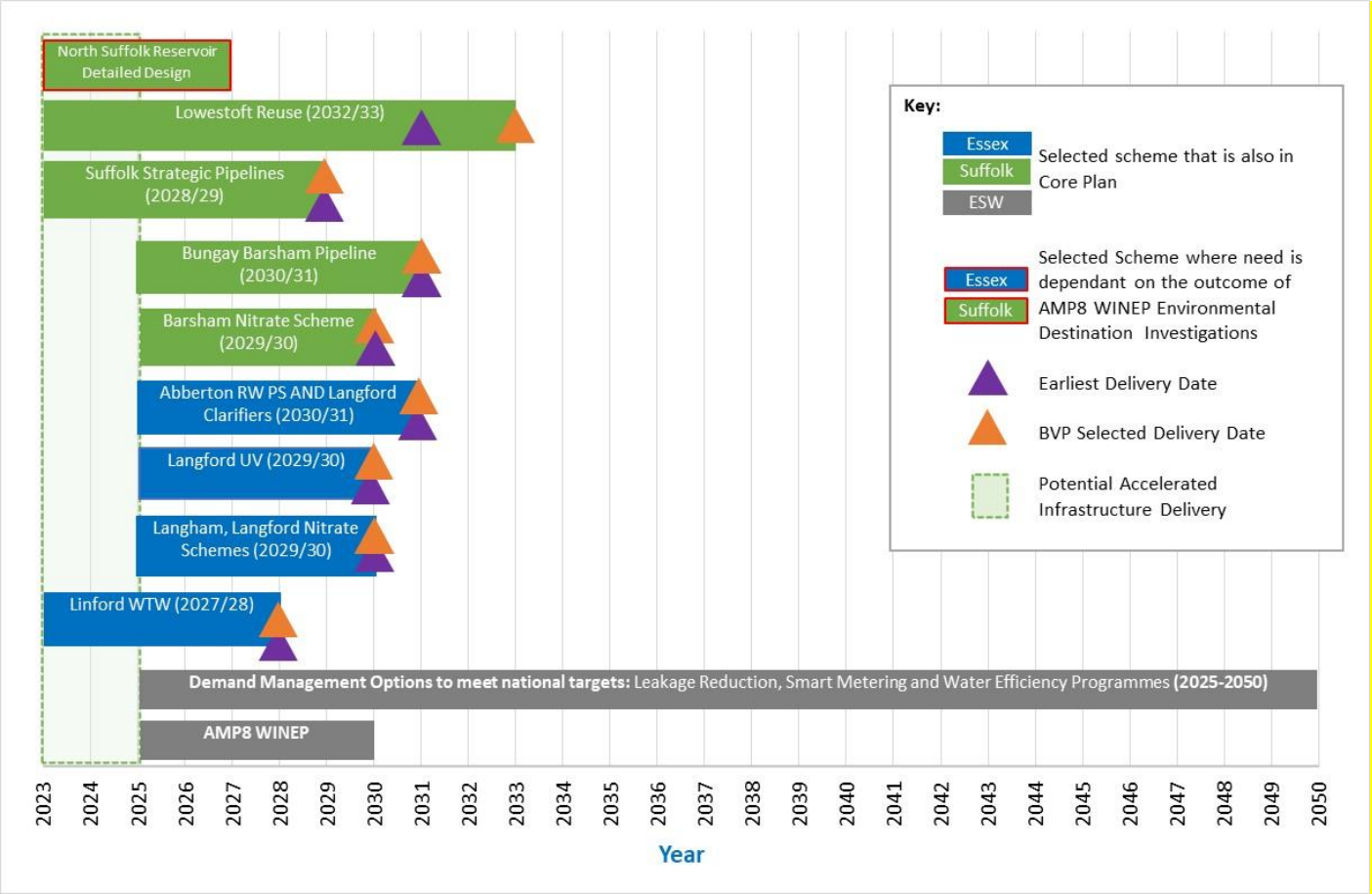


Figure 63: Ofwat Core Plan

8.9.4. BEST ENVIRONMENT & SOCIETY ALTERNATIVE PLAN

The WRPG requires that we present a Best Environment & Society Alternative Plan, alongside our Least Cost Plan, to support the justification of our preferred plan. We have chosen to incorporate the lowest level of abstraction from existing sources (Enhanced ED scenario) and the highest level of leakage reduction (50%) to formulate our Best Environment & Society Alternative Plan.

However, our overall leakage from our network and from our customers' homes is at one of the lowest levels in the water industry. Our current leakage performance is near industry leading, and we have already exhausted the cheaper leakage reduction options. To achieve a further 50% reduction we would need to replace significant proportion of our distribution network, placing an unfair cost burden on our customers. We also do not believe that it is technically feasible for us to reduce leakage by 50% by 2050 in some parts of our supply area as leakage would need to be reduced to a level never achieved in the UK or Europe.

The impact of the 50% leakage reduction assumption on the plan is that the Essex outage reduction schemes are not selected in the least costs modelling. However, the principal benefit of these schemes is resilience rather than DO. These schemes will also minimise the need for Ely Ouse Essex Transfers, reducing pumping and thereby carbon emissions.

Despite the marginal savings by reducing leakage by 50% by 2050, the high ED scenario abstraction licence sustainability reductions result in a loss of nearly 70% of our DO. This means that in addition to all our Best Value Plan Schemes, a 190 Ml/d Desalination plant and Southend Reuse Scheme is also required in Essex. In Suffolk, the Enhanced Environmental Destination scenario results in the North Suffolk Reservoir being replaced by Caister Reuse and Corton Desalination.

We do not believe this would be a good outcome for the Environment or our customers as the desalination schemes come with increased environmental impact, and high costs. In the case of Canvey Island desalination, there is also delivery uncertainty given the scale of the plant. Desalination:

- has the highest carbon and operational costs given the process has the highest electricity demands (kwh/Ml/d of water produced) of all the supply options to power the reverse osmosis units;
- produces a large brine effluent that would need to be discharged to sea; and
- has a significant capital cost approaching £1 billion for the Canvey Island scheme.

Our Best Environment & Society Plan options are presented in Table 83 and Figure 64.

Table 83: Best Environment & Society Plan options

YEAR SELECTED	WATER RESOURCE ZONE	OPTION	OPTION REF	INPUT TYPE	AMP
2031/2032	Essex	Linford New WTW 10	ESW-ABS-003	New WTW and borehole(s) (with raw water transfer)	AMP9
2040/2041		Canvey Island Desalination 190 and Transfer	ESW-DES-001	Desalination	AMP10
2045/2046		Abberton RWPS and Langford Clarifiers	ESW-PMP-001A	Raw water pumping station and clarifier upgrade	AMP11
2045/2046		Southend Water Reuse and Transfer	ESW-EFR-001	Water Reuse	AMP11
2028 /2029	Blyth	Barsham WTW Saxmundham Tower	ESW-TRA-001	Potable Water Transfer	AMP8
2028 /2029	Hartismere	Holton WTW Eye Airfield	ESW-TRA-019	Potable Water Transfer	AMP8
2029/2030	Northern Central	Barsham Nitrate Scheme	ESW-NIT-004	Nitrate removal	AMP8
2030/2031		Bungay wells to Broome WTW and Broome to Barsham WTW transfers	ESW-TRA-018 and ESW-TRA-023	Raw water transfer	AMP8
2032/2033		Lowestoft Water Reuse for Ellingham Mill and Transfer	ESW-EFR-002A	Water Reuse	AMP9
2040/2041		Caister Water Reuse and Ormesby Transfer	03b0478B	Water Reuse	AMP10
2045/2046		Corton Desal Beach Well and Transfer	ESW-DES-008BWA	Desalination	AMP11

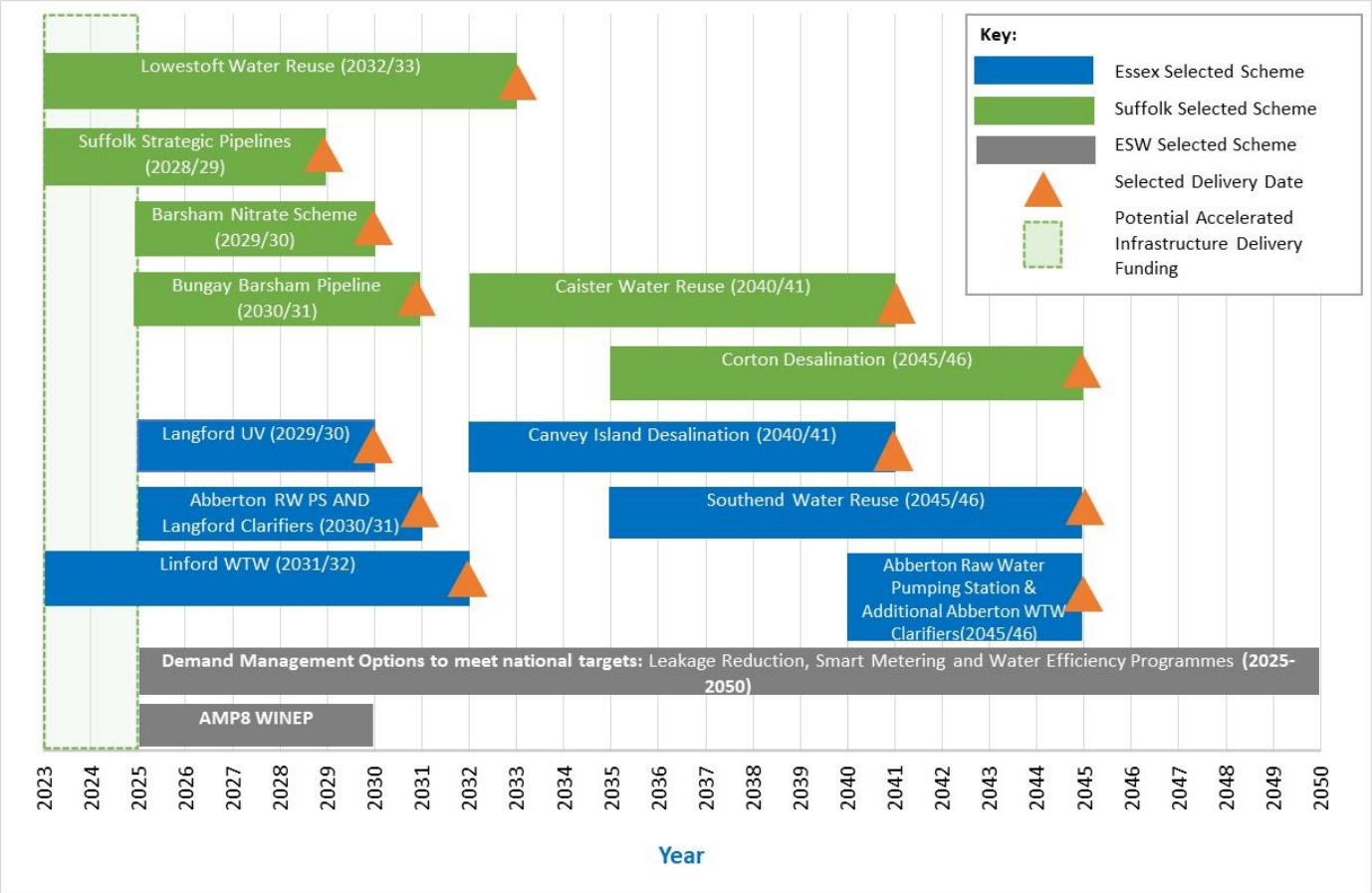


Figure 64: Best Environment & Society Alterative Plan

We have presented our Best Environment & Society Plan as an alternative plan because we consider the Environmental Destination sustainability reductions to have a low level of certainty. Consequently, we have included all our surface water abstraction licences in our AMP8 WINEP under the Environmental Destination driver. The outcome of these investigations will then be incorporated into our dWRMP29 in 2027.

Additionally, this alternative plan draws significantly on desalination schemes which we do not consider to be best for the environment in terms of their high energy and carbon costs and brine discharges to the environment.

8.9.5. PLAN COSTS

The cost of each Alternative plan is presented in Table 84, and the cost of each of our Adaptive Programmes is presented in Table 85. Our Least Cost and Best Value Plan include the same options selected in the same years and therefore the costs are the same for these two plans. The lower cost for the Core Plan reflects the inclusion of our no/low regret options and exclusion of the options planned in the longer term to resolve the deficits resulting from the implementation of Environmental Destination. Our Best Environment & Society Plan assumes a high (Enhanced) Environmental Destination scenario and 50% reduction in leakage by 2050.

Table 84: Alternative Plan costs

PLAN	SUPPLY OPTIONS			DEMAND MANAGEMENT OPTIONS			TOTAL PLAN COST		
	CAPEX (£M)	OPEX (£M PA)	TOTEX (CAPEX + NPV OPEX) (£M)	CAPEX (£M)	OPEX (£M PA)	TOTEX (CAPEX + NPV OPEX) (£M)	CAPEX (£M)	OPEX (£M PA)	TOTEX (CAPEX + NPV OPEX) (£M)
Core Plan	323.50	10.67	401.74	406.71	129.67	536.38	730.21	140.34	938.11
Best Value Plan	545.41	11.59	546.10	406.71	129.67	536.38	952.12	141.26	1082.48
Least Cost Plan	545.41	11.59	546.10	406.71	129.67	536.38	952.12	141.26	1082.48
Best Environment & Society Plan	1469.67	118.04	1355.60	631.72	147.22	778.94	2101.39	265.26	2134.54

Table 85: Adaptive programmes costs

ADAPTIVE PROGRAMME	SUPPLY OPTIONS			DEMAND MANAGEMENT OPTIONS			TOTAL PLAN COST		
	CAPEX (£M)	OPEX (£M PA)	TOTEX (CAPEX + NPV OPEX) (£M)	CAPEX (£M)	OPEX (£M PA)	TOTEX (CAPEX + NPV OPEX) (£M)	CAPEX (£M)	OPEX (£M PA)	TOTEX (CAPEX + NPV OPEX) (£M)
North Suffolk Reservoir	509.03	12.77	505.67	406.71	129.67	536.38	915.73	142.43	1042.05
High PCC	644.09	27.26	666.24	406.71	99.79	506.50	1050.80	127.06	1172.74
High Environ-mental Destination	1541.38	120.63	1475.21	406.71	129.67	536.38	1948.09	250.30	2011.59
Habs Regs	516.02	16.20	632.24	406.71	129.67	536.38	922.72	145.87	1168.61

Table 86 summarises any overlap between base and enhancement funding within our WRMP24 plan for AMP8. All the costs associated with our supply-side options to address supply-side needs, meet the enhancement funding criteria in full. We did not include any investment relating to the maintenance of existing infrastructure or restoring any capacity (for example, by replacing aging infrastructure).

Appendix 3 provides a summary of the key factors driving our water supply investment needs, which support decisions in the apportionment of base and enhancement funding.

Table 86: Summary of AMP8 Base and Enhancement Investments

	Supply-side schemes [1]	Leakage costs to deliver 2.7 Ml/d reduction	Metering (Option 5)	Water Efficiency
Enhancement (£m)	352.520	16.088 [2]	89.676	5.129
Base (£m)	0.000	12.052	40.116	4.601
Totex	352.520	28.140	129.792	9.730

[1] Includes potable water transfers ('interconnectors'), nitrate and crypto removal schemes, Abberton RWPS and Langford clarifier upgrade.

[2] Enhancement costs of £16.088 are directly linked to delivering ESW's overall AMP8 leakage target. Enhancement costs were calculated using ESW's overall AMP8 base costs of £131.447m.

8.10. OUR PLAN JUSTIFICATION

8.10.1. Overview

This section summarises how we have met key requirements for developing our Best Value Plan.

Our Best Value Plan has been developed using a decision-making process that is consistent with the Water Resources Planning Guideline (see Section 8.2).

We have accounted for the impact of uncertainty and undertaken sensitivity analysis (see Section 8.7).

We have considered the costs and benefits of long-term environmental destination by comparing our Core Plan (without Environmental Destination) with our Best Value Plan.

Further justification of our Best Value Plan is presented below.

8.10.2. Delivering Our Plans Affordably

We have developed an efficient Best Value Plan using a best practice decision making process involving EBSD cost modelling and multi-criteria assessment.

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

We know that this is a difficult time for customers with the current cost of living pressures that we are experiencing. Alongside our WRMP24 we continue to work hard to make sure that our bills remain affordable for all. We were the first company in the industry to commit to reaching zero water poverty by 2030, a target that we are currently ahead of, and we are proud to have the lowest bills in England. We are committed to intergenerational equity, and we will ensure that there is no cross subsidy between current customers and future customers.

There is a lot more that water companies need to do in the future than has been delivered in the past meaning we require a much larger investment across all areas of our business, for example, meeting the Government's targets to reduce storm overflows will represent 'the largest infrastructure project to restore the environment in water company history'.

We are working hard with our partners to meet the challenge, but the scale of new work is substantial. We have developed our plans with our customers in mind to manage the impact on customer bills while making sure there will be enough water in the region in the future. We will consult customer and stakeholders to understand their preferences and priorities on the final WRMP January 2023 and then the draft PR24 Business Plan as a whole 'acceptability research programme' later in the year. We will be able to give a more holistic view of the possible impact on bills across all services so we can build future plans that meet those priorities and balance the need for investment with affordability.

The impact of the 'best value plan' that we are proposing would be around an 11% impact on charges in the region.

As the cost of living and utility bills rise, we understand it's a difficult time for many. If customers are struggling to pay their bills or falling into debt, we ask that they get in touch. There are many ways we can help our customers, from payment breaks and low-income discounts to advice on saving water which can help lower your energy bills too.

8.10.3. Have we met Our WRMP24 Objectives?

Table 87 reproduces the objectives and summarises how we believe our Best Value Plan will deliver them.

Table 87: Achieving our WRMP24 objectives

WRMP24 BEST VALUE PLAN OBJECTIVE	ACHIEVED?	
Achieve a secure, resilient and sustainable supply of water for our customers, moving to a 1 in 500 level of resilience by 2040	✓	Our Best Value Plan delivers 1 in 500 supply resilience from 2035 once our new supply schemes are operational.
Protect and enhance the environment, ensuring our abstractions are sustainable both in the short and long term	✓	We have included all AMP7 WINEP abstraction sustainability reductions in our baseline supply forecast including early reductions on Time Limited Licences. Our final plan allows these reductions to be implemented in 2030 as required by the EA. Likewise, we have also included longer term Environmental Destination sustainability reductions that we have agreed with WRE in two phases from 2040 and 2045. The five-year water resources planning process provides an important review point and will allow the outcomes of AMP8 Environmental Destination investigation to be considered.
Reduce leakage from our network and from customer's homes, contributing to a national target of 50% reduction from 2017/18 levels by 2050	✓	Our Best Value Plan is to reduce leakage by 40% by 2050. We have clearly set out our justification and explained why we have not planned for a 50% reduction. A 40% reduction is still ambitious given our already near industry leaking performance.
Reduce customer demand to 110l/head/day by 2050 and non-household customer demand by 9% by 2037/38.	✓	Our Best Value Plan meets government expectations and includes water efficiency activities which along with our smart metering programme and government interventions (white good labelling), should reduce customer demand to 110l/head/day by 2049/50. We have developed a new non-household water efficiency strategy to reduce business demand by 9% by 2038 (excluding growth).
For all our meters to be smart meters by 2035	✓	Our Best Value Plan includes a metering strategy whereby all new and replacement meters will be smart meters.

8.10.4. Have we met Government Expectations?

A further check in justifying our Best Value Plan is whether we have met government expectations. These are reproduced in Table 88 along with a statement on how they have been met.

Table 88: Meeting government expectations

GOVERNMENT EXPECTATIONS	ACHIEVED?	
Provide a secure and clean water supply as expected by customers in a way that provides value for customers, society and the environment over the long term.	✓	We will continue to invest in our existing source to tap assets to ensure we continue to provide a secure and clean water supply. Our preferred Best Value Plan includes demand management and supply schemes to ensure 1 in 500 resilience can be achieved by 2035. We will continue to monitor the effect of our abstractions on the environment and will ensure any required changes are made in a timely way.
Improve supply resilience by planning to raise customer levels of service for a Level 4 drought plan restrictions (standpipes and rota cuts) from 1 in 200 years to 1 in 500 years by 2040.	✓	Our Best Value Plan delivers 1 in 500 supply resilience from 2031/32 in our Essex WRZ, and from 2033/34 in our Suffolk WRZ.
Reduce household Per Capita Consumption (PPC) to 110l/head/day by 2050 as well as working with retailers to implement actions to reduce Business Demand by 9% by 2038.	✓	Our Best Value Plan meets government expectations and includes water efficiency activities which along with our smart metering programme and government interventions (mandatory water efficiency labelling), should reduce customer demand to 110 l/head/day by 2049/50. We have developed a new non-household water efficiency strategy to reduce business demand by 9% by 2038 (excluding growth).
Reduce leakage by 50% from 2017/18 levels by 2050 with water companies helping customers reduce water demand and water lost through leaks by adopting consistent approaches to support repair and replacement of supply pipes.	✓	Our Best Value Plan is to reduce leakage by 40% by 2050. We have clearly set out our justification and explained why we have not planned for a 50% reduction. A 40% reduction is still ambitious given our already near industry leaking performance.
Reduce distribution input by 20% by 2037/38.	✓	Our Best Value Plan is to reduce DI by 22% by 2037/38.
Install smart meters as a standard.	✓	Our Best Value Plan includes a metering strategy whereby all new and replacement meters will be smart meters.
Consider compulsory metering in regions assessed by the EA to be a Serious Water Stressed Area.	✓	Our Best Value Plan includes a metering strategy that requires compulsory metering of all customers.

Adapt to climate change	✓	Our baseline supply and demand forecasts assume a must likely level of climate change over the planning period. This results in drier summers which mean there will be less water available than would otherwise be the case. This has resulted in a reduction in the DO of some of our surface water sources. However, our final plan includes demand management and supply options which provides 1 in 500 resilience by 2035. Based on our current operations, we are on track to be Carbon Net Zero by 2027. Our demand management options will reduce the amount of water that leaks from our network and our customers use of water. This means we will use less energy, and therefore produce fewer carbon emissions, in abstracting, treating and distributing water into our customer homes than otherwise would be the case. Our new supply schemes will increase our carbon emissions from 2027 and we have set out our strategy for offsetting these.
Demonstrate a step change in rectifying overreliance on unsustainable water sources	✓	We have included all AMP7 WINEP abstraction sustainability reductions in our baseline supply forecast including early reductions on Time Limited Licences. Our final plan allows these reductions to be implemented in 2030 as required by the EA. Likewise, we have also included longer term Environmental Destination sustainability reductions that we have agreed with WRE in two phases from 2040 and 2045.

8.10.5. Environment Improvement Plan Interim Targets

Table 89 shows how our best value plan performs against the government's Environment Improvement Plan (EIP) interim targets in relation to demand management.

Table 89: Meeting EIP interim targets

ENVIRONMENT IMPROVEMENT PLAN	INTERIM TARGETS ACHIEVED?
Reduce per capita consumption (PCC) to 122 litres per head per day by 2038 and 110 litres per head per day by 2050.	<table><tr><td></td><td>2038</td><td>2050</td></tr><tr><td>NWG dry year annual average PCC</td><td>122 l/hd/d</td><td>110 l/hd/d</td></tr></table> We meet these interim targets for PCC under a dry year annual average scenario at a NWG level.

Reduce leakage by 16% by 2025, 20% by 2027, 30% by 2032. 37% by 2038 and 50% by 2050.	

	2025	2027	2032	2038	2050
ESW leakage reduction	18%	19%	23%	28%	40%

We have committed to a 50% leakage reduction by 2050 across our combined operating regions of Northumbrian and Essex & Suffolk Water. We do not meet the interim targets due to the reduction glidepath we have applied, which is more cost effective and allows for incremental improvements each year.

Reduce non-household water use by 9% by 2038 and 15% by 2050.	

	2038	2050
ESW non-household use reduction	9%	9%

We have committed to reduce business demand by 9% by 2038 (excluding growth) based on 2019/20 baseline contributing to Defra's ambition. We have not committed to anything beyond 2037/38 currently. We believe we will learn a lot of this period and will consider increasing our commitment post 2038 in future resource plans.

Reduce the use of public water supply in England per head of population by 9% by 2027, 14% by 2032 and 20% by 2038.	

	2027	2032	2038
ESW demand reduction	10%	16%	22%

Our best value plan meets these interim targets for reducing public water supply under a dry year annual average scenario.

8.10.6. Does Our Best Value Plan Reflect WRE's Regional Plan?

The process of developing WRE's Best Value Plan has informed the development of our own Best Value Plan. The same baseline supply and demand forecasts have been used for both plans. All feasible WRE options have been considered in our decision-making process for selecting our Best Value Plan. Our Best value Plan options are all included in WRE's Best Value Plan which is illustrated in Figure 3 in Section 1.

8.10.7. Board Engagement In Developing Our Best Value Plan

We have engaged with our Board at key milestones in the development of our Best Value Plan and adaptive programmes including review of our baseline supply demand balance forecasts and development of demand management and supply options. Our Board is keen that we continue to develop the North Suffolk Winter Storage option and that we have an adaptive pathway to develop should we conclude that it provides better value than the Lowestoft Water Reuse scheme. It also has a full understanding that:

- our core plan includes new supply schemes (in addition to demand management options) that are needed to allow abstraction licence sustainability reductions (SR) in 2030. These SRs are an outcome of our AMP7 WINEP abstraction sustainability investigations; and

- our preferred final plan includes new supply schemes (in addition to demand management options) that are needed to allow abstraction licence SRs in the 2040's - these being the likely outcome of AMP8 WINEP Environmental Destination Investigations.

Since publishing our dWRMP24, we have been asked by the EA to allow for further SRs in relation to our abstraction licences in the Norfolk Broads. The size of the SRs will be determined by EA investigations which will be undertaken over the next 12 months. Given the uncertainty regarding the size of the SRs, they have been included as an adaptive programme. Our Board understands that if we move to this adaptive programme, in addition to our core plan, we will need to:

- bring forward and develop the North Suffolk reservoir - this currently required in 2040
- develop a further Water Reuse scheme at Caister near Great Yarmouth.

Our Board understands that enhancement funding will be provided to deliver these schemes. Our Board Assurance Statement can be found on page 9 of this report.

8.10.8. Our Planned Per Capita Consumption

The selected demand management options for our final preferred plan have ensured we meet the national PCC target of 110 l/hd/d by 2050 at combined company level (NWG) and at an ESW level[28]. By 2049/50 the normal year average PCC for ESW is 109 l/hd/d and the dry year average PCC is 110 l/hd/d. Table 90 gives an overview of the PCC results, and the PCC forecast is shown in the graph that follows.

Table 90: Preferred plan PCC results (normal year)

AVERAGE PCC (L/HD/D)	PCC IN 2025/26	PCC IN 2049/50	DIFFERENCE L/HD/D	PERCENTAGE DECREASE
Essex	146.69	111.09	-35.60	-24%
Suffolk	124.94	94.34	-30.60	-24%
Blyth	128.74	97.92	-30.82	-24%
Hartismere	129.07	104.51	-24.56	-19%
Northern Central	123.84	92.43	-31.40	-25%
ESW	143.72	108.92	-34.80	-24%
NWG	144.16	108.03	-36.13	-25%

[28] Combined company refers to an NWG PCC which is the average PCC for Northumbrian Water and Essex & Suffolk Water combined.

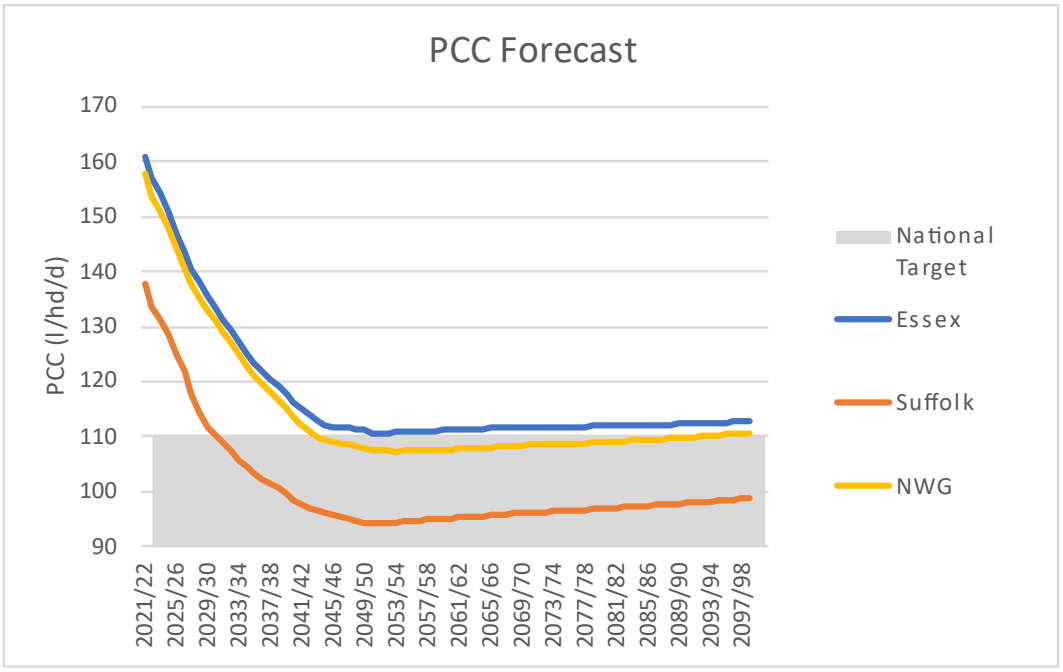


Figure 65: Preferred plan PCC forecast

8.10.9. Ofwat Public Value Principles

Ofwat has developed a set of principles to help guide water companies in exploring and delivering better social and environmental outcomes. The principles, known as Public Value Principles are intended to support water companies in developing the best solutions.

Table 91 describes how we have taken account of these principles in developing our preferred final plan.

Table 91: Ofwat Public Value Principles

	Ofwat Principle Description	How are preferred final plan support Ofwat's Public Value Principles
Principle 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.	As part of our PR24 WINEP, we have put forward schemes under the 25 Year Environment Plan driver. As part of this, we plan to collaborate and where appropriate, partner with third parties to lever in additional funding to deliver greater benefits for the environment and our customers. We have planned to make further abstraction licence sustainability reductions to meet our Business As Usual Plus (BAU+) Environmental Destination commitment. This will allow us to reduce the amount of water we abstract from our existing groundwater sources and will ensure that the environment's long term water needs, taking account of climate change, are met. The North Suffolk Reservoir is included in: - our preferred final plan but not until the 2040s, which as described above, is when we plan to make further sustainability reductions; and - in our North Suffolk Reservoir adaptive programme. Subject to further detailed engineering design and reducing the length of the delivery programme, we would prefer to bring forward delivery of the North Suffolk Reservoir and to construct it instead of Lowestoft Reuse. This is primarily because the North Suffolk Reservoir has lower energy and carbon costs than Lowestoft Reuse and has greater potential to create further social and particularly environmental value.
Principle 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 central preferred final plan includes a wider programme of demand management options which we forecast will reduced leakage by 40% by 2050, reduce PCC to 110l/head/day by 2050 and reduce non-household demand by 9% by 2038. As with our leakage reduction programme, this will reduce the amount of water we abstract from rivers, reservoirs and groundwater, treat at our water treatment works and pump through our network resulting in reduced chemical and energy use, and therefore operational costs, and reduced carbon emissions. We consider this to be a measurable and lasting environmental benefit. Our customer research concluded that customers strongly support reducing leakage from our water network and reducing demand through our water efficiency programmes. However, customer's views of metering are mixed with there being more support for traditional water meters over smart water meters. However, we still need to include our smart meter programme in our preferred plan otherwise we will not achieve the demand savings necessary to meet PCC targets. We do not have an alternative option to smart metering that would deliver the same demand savings.
Principle 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 measure our performance against the national leakage and demand reduction targets annually and report these in our WRMP Annual Review report which we submit to the EA and Ofwat by 30 June of each year. We will also publish our performance in our Annual Performance Report and it is made available in comparison to all other water and wastewater companies in England and Wales at DiscoverWater (en-GB)

	Ofwat Principle Description	How are preferred final plan support Ofwat's Public Value Principles
Principle 4	Delivery of social and environmental value outcomes should not come at greater cost to customers without customer support.	Our Least Cost Plan and Best Value Plan select the same options. Additionally, our Core Plan includes all AMP8 demand management and supply schemes, all of which are considered low regrets. Our demand management options are all needed to meet national targets for leakage and demand reduction. Our customer research concluded that customers strongly support reducing leakage from our water network and reducing demand through our water efficiency programmes. However, customer's views of metering are mixed with there being more support for traditional water meters over smart water meters. However, we still need to include our smart meter programme in our preferred plan otherwise we will not achieve the demand savings necessary to meet PCC targets. Additionally, in the case of our smart metering programme, we are not seeking it to deliver wider social and environmental benefits over and above reducing customer PCC which in turn will help reduce their water bills. Any wider environmental gain is from reduced PCC and reduce abstraction, treatment and distribution, is coincidental. The Government has signalled that they will introduce legislation to bring in water labelling (a Government-led intervention for water efficiency) from 2024 and promote more water efficient water using products. Therefore we have included a reduction in the household consumption demand profile to reflect this. This is at no additional cost for us as is funded by the Government.
Principle 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.	Stakeholder collaboration has been central to the PR24 water resources planning process. Both our WRMP24 and Water Resources East's regional plan have been developed in parallel with the regional plan helping to inform our final preferred plan. For example, we have agreed at a regional level targets for leakage and demand reduction and Environmental Destination. Where opportunities are identified, we will continue to work collaboratively to deliver environmental schemes in our part of the AMP8 WINEP, leveraging a fair share of third-party contributions to maximise social and environmental benefits. Collaborative working is already business as usual for us with examples including our agri-catchment partnerships and the long running Trinity Broads Partnership in the Norfolk Broads. We will work collaboratively on our household Water Efficiency programme and will support regional groups and environmental NGOs with their own water efficiency campaigns to encourage behavioural change regarding water use. Of all our supply side schemes, the North Suffolk Reservoir provides the greatest opportunity to work collaboratively with other stakeholders. For example, the reservoir storage capacity could be marginally increased to supply farm businesses (e.g., for irrigation), albeit that the marginal increase in cost would need to be funded by the beneficiaries. We will continue this discussion at future agri-sector WRE meetings and will work with local abstractor groups to understand whether there are opportunities for it to provide multi-sector benefits.
Principle 6	Companies should take account of their capability, performance and circumstances in considering the scope for delivering greater social and environmental value.	In developing our WRMP24, we have considered our capability, performance and circumstances with respect to delivering greater social and environmental value. Deliverability has been a key consideration given the size of our WRMP24. We will work collaboratively in reducing non-household demand in order to meet the national target of reducing non-household demand by 9% by 2038. In doing so, we will actively pursue alternative funding sources that will help reduce NHH demand inline or quicker than our forecasts and to deliver wider benefits. A similar approach will be taken with the 25 Year Environment Plan schemes in our WINEP and particularly so where a holistic water management approach is required that could deliver multiple social and environmental benefits.

8.10.10. Our Plan and Customer Support

Section 8.2 above provides an overview of the customer research that we have undertaken to understand customers' preferences regarding types of demand management and supply option types. We have used this information to help inform the development of our Best Value Plan.

Table 92 below presents a comparison of the options chosen in our Best Value Plan against the views of our customers.

Table 92: Customer views of Best Value Plan options

Option Type	Option Name / Target	Customer view	Preferred Final Plan Considerations
Demand Management	40% reduction in Leakage by 2050	Leakage reduction tends to come out as a high or mid priority when ESW customers are asked what is important to them.	The national target is to reduce leakage by 50% by 2050. While we will reduce leakage by 40% by 2050 in our ESW supply area, we will be reducing leakage by 55% by 2050 in our Northumbrian Water region. At a group level, this means we will reduce leakage by 50% by 2050. Customers support leakage reduction.
Demand Management	Compulsory Metering by 2030 in Suffolk and 2035 in Essex to support a reduction in PCC to 110/litres/head/day by 2050	When metering is presented as part of an overall water efficiency package (e.g., as in our pre-acceptability (2023) research) it is considered a high priority, however when we test it in isolation (e.g., as in our WRMP company and regional research) support is lower.	We consider it a necessary component of our preferred final plan to reduce household consumption and meet national PCC targets. Additionally, from an environmental perspective given our region is a serious water stressed area and many of our existing groundwater abstractions, if fully utilised, would be unsustainable.
Demand Management	Fully smart metered by 2035 to support a reduction in PCC to 110/litres/head/day by 2050	When metering is presented as part of an overall water efficiency package (e.g., as in our pre-acceptability (2023) research) it is considered a high priority. However, when we test it in isolation (e.g., as in our WRMP options research) support drops.	We consider it a necessary component of our preferred final plan. Smart metering provides the largest demand savings and without it, we would not be able to meet the national PCC targets. Additionally, from an environmental perspective, it will help reduce demand and therefore abstraction which is also important given our region is a serious water stressed area and many of our existing groundwater abstractions, if fully utilised, would be unsustainable.
Demand Management	Household and Non-household water efficiency programme to support a reduction in PCC to 110/l/hd/d by 2050 and a reduction in business demand of 9% by 2038	Our customer research suggests that PCC is a mid-low priority relative to other measures.	Although water efficiency programmes are a mid to low priority for our customers, they are important in reducing both household and business water demand and are required in order to meet national targets

Option Type	Option Name / Target	Customer view	Preferred Final Plan Considerations
Supply	Linford New WTW 10	Customers prefer more traditional source of water such as groundwater, river abstractions and winter storage reservoirs	Selected in least cost and best value plan and supported by customers.
Supply	Barsham, Langham and Langford Nitrate Schemes	Participants found this option difficult to understand and it received lower levels of support than other options presented. However, 61% of participants supported nitrate removal at any level ('definite' or 'possible' support). There was significantly higher levels of support from non-household participants (75%).	Selected in least cost and best value plan. The majority of customers still supported this scheme even though it was considered a lower priority. We consider it an important scheme in our final plan because it can be delivered relatively quickly and will reduce the amount of unplanned water quality outage. This will mean that we can at least partially lift the mains water non-domestic use moratorium in the Hartismere water resource zones earlier than otherwise would have been the case.
Supply	Abberton RWPS and Langford Clarifiers	No evidence	Selected in least cost and best value plans to resolve near term supply deficits.
Supply	Suffolk Strategic Pipelines	No evidence	Selected in least cost and best value plans to resolve near term supply deficits.
Supply	Lowestoft Water Reuse	Participants are open to water recycling and it receives relatively high levels of support. Reassurances would be required about the quality of recycled water and the impact of water recycling on the environment.	Selected in least cost and best value plans to resolve near term supply deficits. Supported by customers.
Supply	North Suffolk Winter Storage 7500 and Transfer	Winter storage reservoirs have high support because of their minimal impact on the environment and the long-term benefits they bring to communities	Selected in least cost and best value plans to resolve near term supply deficits. Supported by customers.

The results of all three areas of research are presented in our Customer Research Report which can be downloaded here.

9. ENVIRONMENT AND SOCIETY

9.1. OVERVIEW

The sections below outline how we have considered the environment and society in developing our Water Resources Management Plan 2024 (WRMP24). We have done this by completing various environmental assessments, including Strategic Environmental Assessment (SEA), Habitats Regulations Assessments (HRA), Water Framework Directive (WFD) Assessments, Biodiversity Net Gain (BNG) assessments, Natural Capital (NC) assessments and Invasive Non-Native Species (INNS) assessments. We have used these assessments to aid our decision-making on mitigation requirements, options development, and the selection of preferred options within our WRMP24, with the aim of developing a Water Resources Management Plan (WRMP) that meets legislative requirements and provides environmental net gain.

9.2. INTEGRATED ENVIRONMENTAL ASSESSMENT

9.2.1. Strategic environmental assessment

We have completed a Strategic Environmental Assessment (SEA) and prepared an Environmental Report, for our WRMP24, including assessing our individual demand and supply side options and our plan as a whole, in accordance with the requirements of the SEA Directive. Given our supply demand balance position it is clear that there will be challenges with regards to balancing the relative impacts of providing water to our customers over both the near and longer term. All the options included within our Best Value Plan, Alternative Plans and Adaptive Programmes have been assessed at their current 'concept' stage for their environmental impacts and benefits. As the detailed design of the options progresses the environmental assessments and potential mitigations will be revisited as more detail is worked through for each scheme. It is at the detailed design stage where we will revisit opportunities to support local strategic partnerships, Local Nature Recovery Networks, consideration of county wildlife sites and opportunities for using nature-based solutions and other more holistic and partnership approaches.

The Environmental Report is provided in the accompanying document ‘Strategic Environmental Assessment – Environment Report – Main Report’ (Mott Macdonald April 2024) and reviews the feasible options for our WRMP24 and the reasonable alternatives, to identify any potential positive or negative environmental effects.

Our approach to SEA aligns with that of our regional water resources group, Water Resources East (WRE).

The scoping stage of our SEA set the context and scope for our SEA and Environmental Report. We issued our ESW WRMP24 SEA Scoping Report for consultation in March 2022 and received responses from the EA, Natural England, Historic England and Norfolk County Council. Our SEA Scoping Report set out our SEA Objectives, presented a review of the policies, plans and programmes relevant to our WRMP24 and included a review of current baseline environmental and socioeconomic information for our region, under the topic headings of biodiversity, flora and fauna; water; flood risk; soil; air; climatic factors; population, human health and economy; historic environment; landscape; material assets and

natural capital. We have considered the responses received from the consultation on our SEA Scoping Report in the development of our WRMP24 SEA.

As a precursor to the SEA, high-level environmental screening (HLS) assessments for the ESW WRMP24 supply side options were completed in January and February 2022. These were undertaken to highlight environmental risks and constraints at an early stage in the options development process, in accordance with UK Water Industry Research (UKWIR) guidance[29]. The environmental screening findings were used to inform rejection of options to avoid potentially significant environmental effects, and to identify suitable mitigation measures to be incorporated into option development. The results were also taken forward into the WRMP SEA and HRA assessments.

Our detailed supply side options-level assessment approach was aligned with WRE's Integrated Environmental Assessment (IEA) process. Each option was assessed against the SEA objectives using defined effect assessment and evaluation criteria based on relevant spatial datasets and professional judgement. The assessment indicated whether the proposed option would help meet or prevent achievement of the SEA objectives. If it contributed to the SEA objectives, then it was considered a positive effect. If the option prevents the SEA objective being met, then it was considered a negative effect. The assessment focused on high-level issues as identified through the objectives, sub-objectives, and key receptors and assets. Note that it was not undertaken to the level of detail that an Environmental Impact Assessment (EIA) would be. The assessment was split into construction effects and operational effects. An option may have both positive and negative effects under a SEA objective, and rather than combining these effects to cancel each other out, both positive and negative effects were reported separately. The level of effect was assigned using a qualitative scale ranging from positive effects (minor, moderate, major) to negative effects (minor, moderate, major), with neutral used for no or negligible effects and a narrative justification was provided to support the assessment using this scale. Where potential negative effects were revealed, mitigation measures (measures to avoid, reduce or offset negative effects) were identified as part of the assessment process and fed back into iterative option development. The effects of each option were assessed pre-mitigation and post-mitigation (residual effects).

The SEA process produced a series of four metrics for each supply side option summarising the output information. The four metrics were positive construction, negative construction, positive operation, and negative operation. Other assessments and studies being undertaken as part of the wider WRMP24 environmental assessments, (HRA, WFD, BNG, NC and INNS) were also used to inform the SEA options assessment. The results from our SEA, for the options included in our Best Value Plan, our Alternative Plans and Adaptive Programmes are summarised in Table 93 and Table 94 below, which can also be found in Section 5.5 of our Environment Report, with further information in the SEA Matrices Assessment Sheets in Appendix K of our Environment Report.

Summary results for the other options considered, alongside more detailed information regarding the results of the individual discipline assessments, can be found in Appendix E of the main Environment Report. Maps with specific locations of our water resource options cannot be provided for security reasons.

[29] Environmental Assessments for Water Resources Planning (21/WR/02/15) UKWIR (March 2021)

Table 93: Summary of construction phase SEA results[30]

		Topic																				
		Biodiversity				Soil	Water					Air	Climatic Factors		Landscape	Historic Environment	Population and Human Health				Material Assets	
Option ID		1.1	1.2	1.3	1.4	2.1	3.1	3.2	3.3	3.4	3.5	4.1	5.1	5.2	6.1	7.1	8.1	8.2	8.3	8.4	9.1	9.2
New Linford Water Treatment Works (WTW) (10Ml/d) (ESW-ABS-003C)	Positive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Negative	--	-	0	0	-	-	0	-	-	0	-	-	0	-	-	-	0	-	-	-	-
Barsham WTW to Blyth Transfer (ESW-TRA-001)	Positive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0
	Negative	-	-	0	0	-	-	-	0	0	0	-	-	0	0	-	-	0	0	-	-	-
Transfer from Holton WTW to Eye Airfield (ESW-TRA-019)	Positive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0
	Negative	-	-	0	0	-	-	0	0	0	0	0	-	0	-	--	-	0	0	-	-	-
Langford Nitrate Removal + Pipeline (ESW-NIT-005)	Positive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0
	Negative	-	-	0	0	0	-	0	0	-	0	-	--	0	-	-	-	0	-	-	--	-
Langford UV Crypto (ESW-UVC-001)	Positive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Negative	-	0	0	0	0	-	0	0	0	0	-	-	0	-	-	0	0	-	-	-	0
Langham Nitrate Removal + Pipeline (ESW-NIT-006)	Positive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0
	Negative	-	-	0	0	-	-	0	0	-	0	-	--	0	-	-	-	0	-	-	--	-
Barsham Nitrate Removal + Pipeline (ESW-NIT-004)	Positive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0
	Negative	-	-	0	0	-	-	0	0	-	0	-	--	0	-	-	-	0	-	-	--	-
Langford WTW upgrade + Abberton RWPS Pump Replacement (ESW-PMP-001A)	Positive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Negative	-	-	0	0	0	0	0	0	-	0	0	-	0	-	0	-	0	-	-	-	-
	Positive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

[30] Data from Section 5.5 in Mott Macdonald (2024) ESW – WRMP 2024 Environmental Report

Topic

		Biodiversity				Soil	Water					Air	Climatic Factors		Landscape	Historic Environment	Population and Human Health				Material Assets	
Option ID		1.1	1.2	1.3	1.4	2.1	3.1	3.2	3.3	3.4	3.5	4.1	5.1	5.2	6.1	7.1	8.1	8.2	8.3	8.4	9.1	9.2
Broome to Barsham Transfer (ESW-TRA-023)	Negative	-	-	0	0	-	-	0	0	0	0	-	-	0	-	-	-	0	-	-	--	-
Transfer from Bungay Wells to Broome WTW (ESW-TRA-018)	Positive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0
	Negative	-	--	0	0	0	-	0	0	0	0	-	-	0	--	-	-	0	0	-	-	-
Effluent Re-use at Caister and transfer to Ormesby (03b0478B)	Positive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0
	Negative	-	--	0	0	-	-	0	0	0	0	-	-	0	-	-	-	0	-	-	-	-
Lowestoft Water Re-use to Ellingham Mill (ESW-EFR-002A)	Positive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0
	Negative	--	--	0	0	-	-	0	0	0	0	-	-	0	-	--	-	0	-	-	-	-
North Suffolk Winter Storage Reservoir + Barsham River Works Upgrade (ESW-RES-002C1)	Positive	0	+++	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Negative	---	-	--	0	-	-	-	-	-	0	-	-	0	-	-	-	0	-	-	-	-
Corton beach well desalination (ESW-DES-008)	Positive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0
	Negative	--	--	--	0	-	-	-	0	-	0	-	-	0	-	-	-	0	0	-	-	-
California beach desalination (ESW-DES-004)	Positive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0
	Negative	--	-	-	0	-	-	-	0	-	0	-	-	0	-	-	-	0	0	-	-	-
Canvey Island Terrestrial Desalination (ESW-DES-001)	Positive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0
	Negative	-	--	-	0	-	-	-	0	-	0	-	-	0	-	-	-	0	0	-	-	-
Southend-on-Sea desalination (ESW-EFR-001)	Positive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0
	Negative	--	--	0	0	--	-	0	0	-	0	-	-	0	-	-	-	0	-	-	-	-
Demand Management Strategy Medium (Preferred) (ESW-DMO-Preferred)	Positive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Negative	-	0	0	-	-	0	-	-	0	0	-	-	0	-	-	-	0	0	0	-	-

Table 94: Summary of operational phase SEA results[31]

		Topic																				
		Biodiversity				Soil	Water					Air	Climatic Factors		Landscape	Historic Environment	Population and Human Health				Material Assets	
Option ID		1.1	1.2	1.3	1.4	2.1	3.1	3.2	3.3	3.4	3.5	4.1	5.1	5.2	6.1	7.1	8.1	8.2	8.3	8.4	9.1	9.2
New Linford Water Treatment Works (WTW) (10Ml/d) (ESW-ABS-003C)	Positive	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0	0	+	0	0	0	0
	Negative	--	0	0	0	0	0	0	0	--	0	0	-	0	0	0	0	0	0	0	-	0
Barsham WTW to Blyth Transfer (ESW-TRA-001)	Positive	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0	0	0	0	0	0	0
	Negative	-	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0
Transfer from Holton WTW to Eye Airfield (ESW-TRA-019)	Positive	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0	0	0	0	0	0	0
	Negative	0	0	0	0	0	0	0	0	0	0	0	-	0	0	-	0	0	0	0	0	0
Langford Nitrate Removal + Pipeline (ESW-NIT-005)	Positive	0	0	0	0	0	0	+	0	0	+	0	0	0	0	0	0	+	0	0	0	0
	Negative	0	0	0	0	0	0	0	0	-	0	0	-	0	0	0	0	0	0	0	-	0
Langford UV (Crypto) ESW-UVC-001	Positive	0	0	0	0	0	0	0	0	0	+	0	0	+	0	0	+	+	0	0	0	0
	Negative	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	-	0	-	0
Langham Nitrate Removal + Pipeline (ESW-NIT-006)	Positive	0	0	0	0	0	0	+	0	0	+	0	0	0	0	0	0	+	0	0	0	0
	Negative	-	0	0	0	0	0	0	0	-	0	0	-	0	-	0	0	0	0	0	-	0
Barsham Nitrate Removal + Pipeline (ESW-NIT-004)	Positive	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0	0	+	0	0	0	0
	Negative	0	0	0	0	0	0	0	0	-	0	0	-	0	0	0	0	0	0	0	-	0
Langford WTW upgrade + Abberton RWPS Pump Replacement (ESW-PMP-001A)	Positive	0	+	0	0	0	+	0	0	0	++	0	0	+	0	0	0	+	0	0	0	0
	Negative	-	0	0	0	0	0	0	0	-	0	0	-	0	0	0	0	0	0	0	-	0
	Positive	0	0	0	0	0	0	0	0	0	+	0	0	+	0	0	0	+	0	0	0	0

[31] Data from Section 5.5 in Mott Macdonald (2024) ESW – WRMP 2024 Environmental Report

		Topic																				
		Biodiversity				Soil	Water					Air	Climatic Factors		Landscape	Historic Environment	Population and Human Health				Material Assets	
Option ID		1.1	1.2	1.3	1.4	2.1	3.1	3.2	3.3	3.4	3.5	4.1	5.1	5.2	6.1	7.1	8.1	8.2	8.3	8.4	9.1	9.2
Broome to Barsham Transfer (ESW-TRA-023)	Negative	0	0	0	0	0	0	0	0	0	-	0	-	0	0	0	0	0	0	0	0	0
Transfer from Bungay Wells to Broome WTW (ESW-TRA-018)	Positive	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0	0	0	+	0	0	0
	Negative	0	0	0	0	0	0	0	0	-	0	0	-	0	0	0	0	0	0	0	0	0
Effluent Re-use at Caister and transfer to Ormesby (03b0478B)	Positive	0	0	0	0	0	0	0	0	0	+	0	0	+	0	0	0	+	0	0	0	0
	Negative	-	-	0	0	0	0	-	0	0	0	0	-	--	0	0	0	0	0	-	0	0
Lowestoft Water Re-use to Ellingham Mill (ESW-EFR-002A)	Positive	0	0	0	0	0	0	0	0	0	+	0	0	+	0	0	0	0	0	0	0	0
	Negative	-	-	0	0	0	0	-	0	0	0	0	-	--	0	0	0	0	0	0	0	0
North Suffolk Winter Storage Reservoir + Barsham River Works Upgrade (ESW-RES-002C1)	Positive	0	+	0	0	0	0	0	0	0	++	0	0	+	0	0	+	+	+	+	0	0
	Negative	-	0	-	0	-	0	-	0	---	-	0	-	0	0	0	0	0	0	0	-	0
Corton beach well desalination (ESW-DES-008)	Positive	0	0	0	0	0	0	0	0	0	++	0	0	+	0	0	+	0	0	0	0	0
	Negative	--	--	-	0	0	0	0	0	--	0	0	--	-	0	0	0	0	0	0	-	0
California beach desalination (ESW-DES-004)	Positive	0	0	0	0	0	0	0	0	0	++	0	0	+	0	0	+	0	0	0	0	0
	Negative	--	-	--	0	0	0	0	0	-	0	0	--	-	-	-	0	0	0	0	-	0
Canvey Island Terrestrial Desalination (ESW-DES-001)	Positive	0	0	0	0	0	0	0	0	0	++	0	0	+	0	0	+	0	0	0	0	0
	Negative	-	-	-	0	0	-	0	0	-	0	0	--	-	0	0	0	0	0	0	-	0
Southend-on-Sea Water Re-use (ESW-EFR-001)	Positive	0	0	0	0	0	0	0	0	0	+	0	0	+	0	0	0	0	0	0	0	0
	Negative	0	0	0	0	0	0	-	0	-	0	0	-	--	0	0	0	0	0	0	0	0
Demand Management Strategy Medium (Preferred) (ESW-DMO-Preferred)	Positive	+	+	0	+	0	0	+	+	+	+	0	+	++	+	0	+	++	++	0	0	0
	Negative	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

9.2.1.1 SEA Summary - Construction Phase

During the construction phase, significant potential negative effects are anticipated to SEA objectives for 13 of the options. None of the options have anticipated significant residual positive effects to SEA objectives.

Nine options are anticipated to have significant residual negative effects to Biodiversity objectives during construction. These are options: ESW-ABS-003C; ESW-TRA-018; 03b-0478B; ESW-EFR-002A; ESW-RES-002C; ESW-DES-008; ESW-DES-004; ESW-DES-001; and ESW-EFR-001. A number of the options yield high percentage loss of habitat, however the total amount of habitat units lost are relatively small and are considered to be straightforward to replace and therefore a minor negative impact has been recorded for these options; ESW-ABS-003, ESW-TRA-001, ESW-TRA-019, ESW-NIT-005, ESW-NIT-006, ESW-NIT-004, ESW-PMP-001A, and ESW-TRA-023.

For the ESW-ABS-003 option, significant negative effects are anticipated for the objective, based on, to protect designated sites and their qualifying features. This is based on the outcomes of the test of likely significance (ToLS) assessments and therefore without considering mitigation. The HRA ToLS for this option identified likely significant effects (LSE) for two Natura 2000 sites that could be affected during construction due to non-physical disturbance and biological disturbance.

ESW-TRA-018 is anticipated to have significant negative effects for the objective to deliver BNG, protect biodiversity, priority species and vulnerable habitats. This is as a result of a potential loss of habitat during the construction phase (-61.73% change).

03b-0478B is anticipated to have significant negative effects for the objective to deliver BNG, protect biodiversity, priority species and vulnerable habitats. This is as a result of a potential loss of habitat during the construction phase (-33.95% change).

ESW-EFR-002A is anticipated to have significant negatives effects to two biodiversity objectives. Firstly, significant negative effects are anticipated for the objective to protect designated sites and their qualifying features. This is based on the outcomes of the ToLS assessments and therefore without considering mitigation. The HRA ToLS for this option identified likely significant effects (LSE) for seven Natura 2000 sites that could be affected during construction due to non-physical disturbance and biological disturbance. Secondly, significant negative effects are anticipated for the objective to deliver BNG, protect biodiversity, priority species and vulnerable habitats. This is as a result of a potential loss of habitat during the construction phase (-19.91% change).

ESW-RES-002C is anticipated to have significant negatives effects to two biodiversity objectives. Firstly, significant negative effects are anticipated for the objective to protect designated sites and their qualifying features. This is based on the outcomes of the ToLS assessments and therefore without considering mitigation. The HRA ToLS for this option identified LSE for five Natura 2000 sites that could be affected during construction due to potential for non-physical disturbance, biological disturbance, toxic contamination, and non-toxic contamination. Secondly, significant negative effects are anticipated for the objective to avoid spreading and, where required, manage INNS. This is as a result of the physical transfer of untreated water between two locations assumed currently unconnected, potentially resulting in the spread of INNS from the River Waveney to the reservoir along the two new pipeline routes.

ESW-DES-008 is anticipated to have significant negatives effects to three biodiversity objectives. Firstly, significant negative effects are anticipated for the objective to protect designated sites and their qualifying features. This is based on the outcomes of the ToLS assessments and therefore without considering mitigation. The HRA ToLS for this option identified LSE for five Natura 2000 sites that could be affected during construction due to non-physical disturbance, toxic contamination, non-toxic contamination, biological disturbance, physical damage, and physical loss. Secondly, significant negative effects are anticipated for the objective to deliver BNG, protect biodiversity, priority species and vulnerable habitats. This is as a result of a potential loss of habitat during the construction phase (-40.20% change). Thirdly, significant negative effects are anticipated for the objective to avoid spreading and, where required, manage INNS. This is as a result of potential for pipe bursts to cause untreated source water to be released to the environment during transfer to the desalination plant (creating pathway for the transfer of INNS).

ESW-DES-001 is anticipated to have significant negative effects for the objective to deliver BNG, protect biodiversity, priority species and vulnerable habitats. This is as a result of a potential loss of habitat during the construction phase (-53.47% change).

ESW-EFR-001 is anticipated to have significant negative effects to two biodiversity objectives. Firstly, significant negative effects are anticipated for the objective to protect designated sites and their qualifying features. This is based on the outcomes of the ToLS assessments and therefore without considering mitigation. The HRA ToLS for this option identified likely significant effects (LSE) for 10 Natura 2000 sites that could be affected during construction due to non-physical disturbance, biological disturbance, toxic contamination, non-toxic contamination, physical damage, and physical loss. Secondly, significant negative effects are anticipated for the objective to deliver BNG, protect biodiversity, priority species and vulnerable habitats. This is as a result of a potential loss of habitat during the construction phase (-29.39% change).

Where HRA ToLS has identified LSE for Natura 2000 sites as a result of the construction of an option, HRA Appropriate Assessments (AA) are detailed within Appendix F of the accompanying Environment Report and detail the anticipated effects, as well as recommending appropriate mitigation and monitoring.

One option, ESW-EFR-001, is anticipated to have significant residual negative effects to Soil objectives during construction. For this option, significant negative effects are anticipated for the objective to protect and enhance the functionality and quality of soils, including the protection of high-grade agricultural land, and geodiversity.

One option, ESW-TRA-018, is anticipated to have significant residual negative effects to Landscape objectives during construction. For this option, significant negative effects are anticipated for the objective to conserve, protect and enhance landscape and townscape character and visual amenity.

Three options are anticipated to have significant residual negative effects to Climatic Factors and Material Assets objectives during construction. These are options: ESW-NIT-005; ESW-NIT-006; and ESW-TRA-023. For these options, significant negative effects are anticipated for both the Climatic Factors objective to minimise/reduce embodied and operational carbon emissions, and the Material Assets objective to minimise resource use and waste production. This is as a result of the embodied carbon emissions, resource use, and waste production that would be associated with these options. These options will require new infrastructure, such as pipelines and treatment facilities, to be built, thus

construction is likely to require a significant quantity of materials and produce waste. Construction activities will also generate emissions through associated machinery movements for required earthworks, vehicle movements for transporting materials, as well as emissions coming from other construction related activities.

9.2.1.2 SEA Summary - Operation Phase

During the operational phase, significant residual negative effects are anticipated to SEA objectives for eight of the options. Significant residual positive effects are anticipated to SEA objectives for five of the options.

Three options are anticipated to have significant residual negative effects to Biodiversity objectives during operation. These are options: ESW-ABS-003; ESW-DES-004 and ESW-DES-008. This is based on the outcomes of the ToLS assessments and therefore without considering mitigation.

For the ESW-ABS-003 option, significant negative effects are anticipated for the objective to protect designated sites and their qualifying features. The HRA ToLS for this option identified LSE for two Natura 2000 sites that could be affected during operation due to physical damage, physical loss, toxic contamination, non-toxic contamination, and biological disturbance.

ESW-DES-008 is anticipated to have significant negatives effects to two biodiversity objectives. Firstly, significant negative effects are anticipated for the objective to protect designated sites and their qualifying features. The HRA ToLS for this option identified LSE for one Natura 2000 site that could be affected during operation due to physical loss of intertidal habitat where wells/galleries and pipelines are installed. Secondly, significant negative effects are anticipated for the objective to deliver BNG, protect biodiversity, priority species and vulnerable habitats. This is also as a result of the HRA ToLS results for this option outlined above.

EWS-DES-004 is anticipated to have significant negative effects on the objective to protect designated sites and their qualifying features. The HRA ToLS for this option identified likely significant effects (LSE) for nine sites due to operational effects from hydrological links. Desalination options require discharge of saline solution and well abstraction works. This may lead to adverse effects to designated sites during operation. ESW-DES-004 is also anticipated to have significant negative effects on the objective to avoid spreading and, where required, manage invasive and non-native species (INNS). As source water is untreated, there is a moderate risk of INNS transfer from source and potential for pipe bursts to cause water to be released to the environment (creating pathway for the transfer of INNS).

Where HRA ToLS has identified LSE for Natura 2000 sites as a result of the operation of an option, HRA AA are detailed within Appendix F of the accompanying Environment Report and detail the anticipated effects, as well as recommending appropriate mitigation and monitoring.

For the ESW-RES-002C option, significant positive effects are anticipated for the objective to deliver BNG, protect biodiversity, priority species and vulnerable habitats. This is as a result of a significant gain in BNG units due to the creation of new open water habitat (+89.52% change).

Three options are anticipated to have significant residual negative effects to Water objectives during operation. These are options: ESW-ABS-003; ESW-RES-002C; and ESW-DES-008. This is based on the WFD screening exercise which does not consider mitigation.

For the ESW-ABS-003 option, significant negative effects are anticipated for the objective to meet WFD objectives and support the achievement of environmental objectives set out in River Basin Management Plans (RBMPs). Out of the four waterbodies considered during WFD Phase 1 assessment for this option, a high level of effect was determined for two waterbodies during operation as a result of new or increased groundwater abstraction, with low or new effects identified on all four watercourses during the operational phase.

ESW-RES-002C is anticipated to have significant negative effects for the objective to meet WFD objectives and support the achievement of environmental objectives set out in River Basin Management Plans. Out of the three waterbodies considered during WFD Phase 1 assessment for this option, a high level of effect was determined for all three waterbodies due to the creation of a new winter storage reservoir. High impacts are also anticipated specifically for Waveney (Ellingham Mill - Burgh St. Peter) due to new or increased surface water extraction.

ESW-DES-008 is anticipated to have significant negative effects for the objective to meet WFD objectives and support the achievement of environmental objectives set out in River Basin Management Plans. Out of the four waterbodies considered during WFD Phase 1 assessment for this option, a high level of effect was determined for two waterbodies. For Bure & Waveney & Yare & Lothing this was due to the new discharge of highly saline water, and for Waveney and East Suffolk Chalk & Crag (groundwater) this was due to new or increased surface water abstraction.

Where WFD Phase 1 assessment has identified a high level of effect to a waterbody as a result of the operation of an option, WFD Level 2 assessments are detailed in Appendix G of the accompanying Environment Report and confirm the potential for impacts and recommend mitigation and monitoring.

Four options are anticipated to have significant positive residual effects to Water objectives during operation. These are options: ESW-PMP-001A; ESW-RES-002C; ESW-DES-008; and ESW-DES-001.

For all four options, significant positive effects are anticipated for the objective to increase water efficiency and increase resilience of water supplies and natural systems to droughts. Both ESW-DES-008 and ESW-DES-001 will have positive effects to water supply resilience as the proposed desalination plants will be able to provide water supply without having to rely on freshwater sources, thus enabling a base supply even during drought conditions.

Six options are anticipated to have significant residual negative effects to Climatic Factors objectives during operation. These are options: 03b-0478B; ESW-EFR-002A; ESW-DES-008; ESW-DES-004; ESW-DES-001; and ESW-EFR-001.

Options 3b-0478B, ESW-EFR-002A, and ESW-EFR-001, significant negative effects are anticipated for the objective to introduce climate mitigation where required and improve the climate resilience of assets and natural systems. For all three of these options, this is due to potential effects to natural systems through possible changes in water levels as water is diverted from waterbodies for treatment.

Options ESW-DES-008, ESW-DES-004 and ESW-DES-001 have significant negative effects anticipated for the objective to minimise / reduce embodied and operational carbon emissions. This is due to the energy intensive desalination process that would be used during operation.

ESW-DMO-Preferred option is anticipated to result in a moderate positive effect during the operation stage due to water efficiency improvements and leakage resolution leading to less water being extracted from the natural environment and greater resilience to climate change impacts such as drought and also more secure water supplies for the community. In addition positive effects may arise from water efficiency advice and behavioural changes leading to greater awareness and education of the community on water supply issues.

More details of the significant potential negative and positive effects of each option and consideration of mitigation can be found in Appendix K of the Environment Report.

In addition to the SEA, other environmental assessments were undertaken. The results of these assessments are summarised here and can be found in Section 5.6 of the Environmental Report.

9.2.2. Water Framework Directive Regulations

The WFD assessment is a statutory requirement, but also feeds into the SEA objectives on biodiversity and water. The WFD assessments were undertaken following the All Companies Working Group (ACWG) WFD Assessment Guidelines and using the ACWG Assessment Spreadsheet. The first stage of the process (Level 1 – Basic Screening) identifies any water bodies where the construction or operation of the option could lead to WFD impacts which needed to be 'screened in' and taken forward to the second stage of the process (Level 2 – Detailed Impact Screening).

An initial WFD appraisal formed part of the high-level screening methodology (described in Section 8.3.1 above) and was completed for all ESW options. The results from the Level 1 WFD assessments for the options within our BVP and adaptive pathways are shown in Table 95.

Table 95: WFD level 1 assessment results

OPTION ID	OPTION NAME	NUMBER OF WATERBODIES REQUIRING FURTHER WFD ASSESSMENT
ESW-ABS-003	Linford New WTW 10	2
ESW-DES-001	Canvey Island Desalination 190 and Transfer	2
ESW-EFR-001	Southend Water Reuse and Transfer	3
ESW-EFR-002A	Lowestoft Water Reuse for Ellingham Mill and Transfer	0
ESW-RES-002C	North Suffolk Winter Storage 7500 and Transfer	2
ESW-TRA-001	Barsham WTW Saxmundham Tower	0
ESW-TRA-019	Holton WTW Eye Airfield	0
03b-0478	Caister Water Reuse and Ormesby Transfer	1

ESW-TRA-023[32]	Broome to Barsham WTW Transfer	0
ESW-TRA-018	Bungay wells to Broome WTW Transfer	2
ESW-UVC-001	Langford UV	0
ESW-NIT-004	Barsham Nitrate Scheme	0
ESW-NIT-005	Langford Nitrate Scheme	2
ESW-NIT-006	Langham Nitrate Scheme	0
ESW-PMP-001A	Abberton RWPS and Langford Clarifiers	0
ESW-DES-008BW	Corton Desal Beach well and Transfer	2
ESW-DES-004IG	Caister Water Reuse and Ormesby Transfer	3

The Level 1 WFD assessments indicated that most options are anticipated to have very low risks of being non-compliant with WFD objectives, and do not require further assessment.

Level 2 WFD assessments are required for nine of the options. The level 2 assessments are more detailed and determine whether there are any residual significant impacts once mitigation has been considered. These are set out in Section 3 of Appendix G of the Environmental Report.

The majority of the options assessed as part of these plans have only been subject to concept level design at this stage and if they are taken forward would require additional design and assessment as they progress to next stage of optioneering. Due to this, the confidence in the option design has been rated as low throughout all of the Level 2 assessments undertaken.

The findings indicate that there are precautionary WFD compliance risks for surface water bodies associated primarily with the operation of additional/new abstractions and new or ceased discharges. The potential hydrological effects of these activities, among several other varying impacts, could conflict with achieving WFD status objectives. This is particularly the case where hydrology/river flow is an existing limiting factor, recorded in WFD baseline data as a 'reason for not achieving good'. The potential biological effects, particularly on fish, and physio-chemical changes (for example, reduced dilution as a result of a new or increased abstraction) would require further assessment to improve certainty of the scale of effects.

Deterioration risks on coastal or transitional waterbodies were generally attributed to the intake and discharge of water for desalination projects, leading to changes in biological status elements, morphology, and water quality.

For groundwater bodies deterioration risks were primarily associated with either changes to quantitative and chemical saline intrusion and chemical drinking water protected area status, as a result of new groundwater abstractions, or construction of below ground structures close to groundwater dependent terrestrial ecosystems (GWDTE).

For new or modified intakes, it is recognised that appropriate fish and eel screening would be required to prevent entrainment. At this stage, this has been considered as likely mitigation. The same approach has been taken with other

[32] The ESW-TRA-023 Bungay to Barsham option reported in the BVP refers to a combined option of ESW-TRA-018: Bungay to Broome, and ESW-TRA-023: Broome to Barsham. Both options have been reported separately in this report, and where ESW-TRA-023 has been selected by NWL for their Best Value Plan or Alternatives, ESW-TRA-018 has also been selected and the cumulative effects of the two options considered.

likely mitigation such as using trenchless methods to cross larger watercourses where feasible or discharging construction dewatering into a watercourse to maintain flow.

Subject to their progression through the approvals process, of the supply options which have been assessed at Level 2, it was determined that further WFD mitigation and assessment would be required for two options: ESW-RES-002C1, and ESW-DES-001. Level 2 assessments have assessed a potential risk of deterioration to some water bodies due to these options. As a result, it was determined that further investigations and information would be required to improve the certainty of WFD risk, and these are set out in Section 3 of Appendix G. Following such further investigations, design and mitigation development, it is anticipated that the WFD non-compliance risk can be reduced to minor localised (impact score 1) for these waterbodies, and therefore the options would be considered to be WFD compliant.

9.2.3. Habitats Regulations Assessment

HRA is, on its own, a statutory requirement, but also feeds into the SEA biodiversity objective on designated sites. The stages of HRA include the ToLS, AA (if required from the ToLS), and Consideration of Alternatives (should AA findings conclude effects on site integrity cannot be adequately mitigated).

An initial HRA appraisal formed part of the high-level screening methodology (described in Section 9.2.1 above). The results of this assessment, namely the options affecting sites where potential likely significant effects cannot be ruled out, for the options considered as part of the BVP, adaptive programmes and alternative plans, are presented in Table 96.

Table 96: HRA test of likely significance results

OPTION ID	OPTION NAME	SITES WITH POTENTIAL LIKELY SIGNIFICANT EFFECTS (APPROX. DISTANCE)
ESW-ABS-003	Linford New WTW 10	• Thames Estuary & Marshes Special Protection Area (SPA) (UK9012021) (approx. 0km) • Thames Estuary & Marshes Ramsar (UK11069) (approx. 0km)
ESW-EFR-001	Southend Water Reuse and Transfer	• Crouch & Roach Estuaries (Mid-Essex Coast Phase 3) Ramsar (UK UK11058) (0km) • Crouch & Roach Estuaries (Mid-Essex Coast Phase 3) SPA (UK9009244) (approx. 0km) • Essex Estuaries Special Area of Conservation (SAC) (UK0013690) (approx. 0km) • Foulness (Mid-Essex Coast Phase 5) Ramsar (UK11026) (approx. 7km) • Foulness (Mid-Essex Coast Phase 5) SPA (UK9009246) (approx. 7km) • Outer Thames Estuary SPA (UK9020309) (approx. 0km) • Benfleet and Southend Marshes Ramsar (UK11006) (approx. 3km) • Benfleet and Southend Marshes (SPA)(UK9009171) (approx. 3km)
ESW-EFR-002A	Lowestoft Water Reuse for Ellingham Mill and Transfer	• Broadland SPA (UK9009253) (approx. 0.4km) • Broadland Ramsar (UK11010) (approx. 0.4km) • The Broads SAC (UK0013577) (approx. 0.4km) • Southern North Sea SAC (UK0030395) (approx. 0.55km) • Outer Thames Estuary SPA (UK9020309) (approx. 0.55km) • Breydon Water Ramsar (UK11008) (approx. 3.5km) • Breydon Water SPA (UK9009181) (approx. 3.5km)

OPTION ID	OPTION NAME	SITES WITH POTENTIAL LIKELY SIGNIFICANT EFFECTS (APPROX. DISTANCE)
ESW-RES-002C	North Suffolk Winter Storage 7500 and Transfer	• Broadland SPA (UK9009253) (approx. 1.1km) • Broadland Ramsar (UK11010) (approx. 1.1km) • The Broads SAC (UK0013577) (approx. 1.1km) • Breydon Water Ramsar (UK11008) (approx. 12.5km) • Breydon Water SPA (UK9009181) (approx. 12.5km)
ESW TRA-001	Barsham WTW Saxmundham Tower	• Dew's Ponds SAC (UK0030133) (approx. 0.49km) • The Broads SAC (UK0013577) (approx. 2.1km) • Broadland Ramsar (UK110100) (approx. 2.1km) • Broadland SPA (UK9009243) (approx. 2.1km) • Minsmere-Walberswick SPA (UK9009101) (approx. 3.5km) • Minsmere to Walberswick Heaths & Marshes SAC (UK0012809) (approx. 3.5km) • Minsmere to Walberswick Ramsar (UK11044) (approx. 4km) • Alde-Ore & Butley Estuaries SAC (UK0030076) (approx. 5.5km) • Alde-Ore Estuary Ramsar (UK11002) (approx. 5.5km) • Alde-Ore SPA (UK9009112) (approx. 5.5km) • Outer Thames Estuary SPA (UK9020309) (approx. 8km) • Southern North Sea SAC (UK0030395) (approx. 8km)
ESW-TRA-019	Holton WTW Eye Airfield	• Minsmere-Walberswick SPA (UK9009101) (approx. 5km) • Minsmere to Walberswick Ramsar (UK11044) (approx. 5km) • Outer Thames Estuary SPA (UK9020309) (approx. 9.9km) • Southern North Sea SAC (UK0030395) (approx. 9.9km)
ESW-DES-001	Canvey Island Desalination 190 and Transfer	• Thames Estuary & Marshes SPA (UK9012021) (approx. 1.5km) • Thames Estuary and Marshes Ramsar (UK11069) (approx. 1.5km) • Outer Thames Estuary SPA (UK9020309) (approx. 7.5km) • Benfleet and Southend Marshes Ramsar (UK11006) (approx. 0.5km) • Benfleet and Southend Marshes (SPA)(UK9009171) (approx. 0.5km) • Crouch & Roach Estuaries (Mid-Essex Coast Phase 3) Ramsar (UK UK11058) (approx. 1.3km) • Crouch & Roach Estuaries (Mid-Essex Coast Phase 3) SPA (UK9009244) (approx. 1.3km) • Essex Estuaries SAC (UK0013690) (approx. 1.3km) • Medway Estuary & Marshes Ramsar (UK11040) (approx. 8km) • Medway Estuary & Marshes SPA (UK9012031) (approx. 8km)
03b-0478	Caister Water Reuse and Ormesby Transfer	• The Broads SAC (UK0013577) (approx. 0.2km) • Broadland SPA (UK9009253) (approx. 0.6km) • Broadland Ramsar (UK11010) (approx. 0.6km)
ESW-TRA-023[33]	Broome to Barsham WTW Transfer	• Broadland SPA (UK9009253) (approx. 1.5km) • Broadland Ramsar (UK110100) (approx. 1.5km) • The Broads SAC (UK0013577) (approx. 1.5km)

[33] The ESW-TRA-023 Bungay to Barsham option reported in the BVP refers to a combined option of ESW-TRA-018: Bungay to Broome, and ESW-TRA-023: Broome to Barsham. Both options have been reported separately in this report, and where ESW-TRA-023 has been selected by NWL for their Best Value Plan or Alternatives, ESW-TRA-018 has also been selected and the cumulative effects of the two options considered.

OPTION ID	OPTION NAME	SITES WITH POTENTIAL LIKELY SIGNIFICANT EFFECTS (APPROX. DISTANCE)
ESW-TRA-018	Bungay wells to Broome WTW Transfer	• Broadland SPA (UK9009253) (approx. 3.7km) • Broadland Ramsar (UK11010) (approx. 3.7km) • The Broads SAC (UK0013577) (approx. 3.7km)
ESW-UVC-001	Langford UV	• Essex Estuaries SAC (UK0013690) (approx. 2.5km) • Blackwater Estuary Ramsar (UK11007) (approx. 2.5km) • Blackwater Estuary SPA (UK9009245) (approx. 2.5km)
ESW-NIT-004	Barsham Nitrate Scheme	• Broadland SPA (UK9009253) (approx. 2km) • Broadland Ramsar (UK110100) (approx. 2km) • The Broads SAC (UK0013577) (approx. 2km)
ESW-NIT-005	Langford Nitrate Scheme	• Blackwater Estuary Ramsar (UK11007) (approx. 0.08km) • Essex Estuaries SAC (UK0013690) (approx. 0.08km) • Blackwater Estuary SPA (UK9009245) (approx. 0.08km)
ESW-NIT-006	Langham Nitrate Scheme	• Colne Estuary Ramsar (UK11015) (approx. 3.5km) • Colne Estuary SPA (UK9009243) (approx. 3.5km) • Essex Estuaries SAC (UK013690) (approx. 3.5km)
ESW-PMP-001A	Abberton RWPS and Langford Clarifiers	• Abberton Reservoir SPA (UK9009141) (0km) • Abberton Reservoir Ramsar (UK11001) (0km) • Essex Estuaries SAC (UK0013690) (approx. 2.2km) • Blackwater Estuary (Mid-Essex Coast Phase 4) SPA (UK9009245) (approx. 2.2km) • Blackwater Estuary (Mid-Essex Coast Phase 4) Ramsar (UK11007) (approx. 2.2km) • Colne Estuary (Mid-Essex Coast Phase 2) Ramsar (UK11015) (approx. 3km) • Colne Estuary (Mid-Essex Coast Phase 2) SPA (UK9009243) (approx. 3km)
ESW-DES-008-BW	Corton Desal Beachwell and Transfer	• Broadland SPA (UK9009253) (approx. 0.05km) • Broadland Ramsar (UK11010) (approx. 0.05km) • The Broads SAC (UK0013577) (approx. 0.05km) • Southern North Sea SAC (UK0030395) (approx. 0.0km) • Outer Thames Estuary SPA (UK9020309) (approx. 0.0km)
ESW-DES-004-IG	Caister Water Reuse and Ormesby Transfer	• Broadland SPA (UK9009253) (approx. 0.05km) • Broadland Ramsar (UK11010) (approx. 0.05km) • The Broads SAC (UK0013577) (approx. 0.05km) • Southern North Sea SAC (UK0030395) (approx. 0.0km) • Greater Wash SPA (UK9020329) (approx. 0.0km) • Outer Thames Estuary SPA (UK9020309) (approx. 0.0km) • Breydon Water Ramsar (UK11008) (approx. 1.8km) • Breydon Water SPA (UK9009181) (approx. 1.8km) • Great Yarmouth North Denes SPA (UK9009271) (approx. 0.0km)

HRA Appropriate Assessments for the above-mentioned sites identified as having potential for LSE have been undertaken to determine whether the construction and/or operation of the options will result in adverse effects to their site integrity. Following Stage 2 Appropriate Assessment, it is concluded that assuming all proposed monitoring and mitigation measures are implemented, there will not be a significant change to the extent and distribution of qualifying

species, to the structure and function of habitats and qualifying species, and to the supporting processes on which habitats of qualifying species rely; avoiding and/or mitigating any potential effect.

All assessments have been undertaken on concept designs of options. The results of the assessments, including mitigation and monitoring currently proposed will be re-visited at a project level, as the projects progress through detailed design. Based on the current level of detail available for the final WRMP24, a number of established mitigation and monitoring measures are given which can be assumed for all options, this is detailed within Appendix F – *Habitats Regulations Assessment*. These measures are defined as industry-wide best practice measures to address common risks in the construction and development sectors and thus are proven to reduce the risk of the identified effects as far as is reasonably possible. Option specific mitigation and monitoring measures are also outlined. In-combination these measures will be applied to the construction of the final option and constitute mitigation to avoid or reduce adverse effects on Habitats Site integrity and therefore are only mentioned at the AA stage and are outlined within Appendix F – *Habitats Regulations Assessment*.

9.2.4. Natural Capital

The results of the Natural Capital Assessments (NCA) provided a quantitative basis for qualitative professional judgements made throughout the SEA, thereby feeding into several SEA objectives. The outputs of the NCA were also used to inform option selection and to further feed into decision making as part of the Best Value Planning process. Expected changes in natural capital stocks were assessed for each option, along with implications for five ecosystem services outlined in the 'Water Resources Planning Guideline (WRPG) Environmental and Society Supplementary Guidance' – biodiversity and habitat, climate regulation, natural hazard regulation, water purification, and water regulation. Note that biodiversity and habitat services were assessed using the BNG methodology outlined below.

The NCA methodology was updated to incorporate active floodplain as a consideration. The areas for each option identified as Active Floodplain were run using the data sources used for the natural capital mapping. This identified that almost the entire area of active floodplains were made up of arable and pastoral land. Areas of active floodplain that did not overlap with the environmental datasets currently used within the WRE mapping methodology were supplemented using the 'Corine land cover map 2018', to identify habitats within the gaps and link them with the natural capital stocks named within the NCA assessments. NCA assessments now include both the area of natural capital stocks as well as the area of active floodplain that sits on top of these stocks. These options therefore show a larger area than the option boundary. However, double counting was avoided because active floodplain is not included within the Ecosystem Services Assessment (ESA) and works in synergy with the primary habitats it sits within. As such, a trade-off of stocks is not required.

A summary of the outputs of the NCA assessment for the options included within our BVP, adaptive programmes and alternative plans are presented in Table 97.

Table 97: NCA results for BVP, adaptive programmes and alternative plans supply options

Option ID	Option Name	Natural Capital	Ecosystem Services
ESW-ABS-003C	New Linford WTW (10Ml/d Option)	-£384.49	The option is likely to generate the temporary and permanent loss of natural capital stocks during construction. However, habitat expected to be reinstated/compensated to pre-construction conditions following best practice technique will likely have no permanent impact to the provision of ecosystem services. Broadleaved/mixed/yew/priority/coniferous/urban woodland have a significant maturity time with a delay of 30 years. Therefore, this delay is considered within potential future provision of this stock through the ecosystem services assessment. This can be accounted to the tree mortality rate presumed after woodland areas are replanted. Construction impacts include the release of CO_2 due to habitat clearance, loss of natural hazard management, loss of food production, loss of air pollutant removal and a reduction in water purification. However, it is not expected to affect the future value as stocks are expected to be reinstated. There is no change anticipated to water flow regulation.
ESW-DES-001	Canvey Island Terrestrial Desalination (Maximum Capacity)	-£42,652.13	The option is likely to generate the loss of natural capital stocks during construction. However, habitat expected to be reinstated/compensated to pre-construction conditions following best practice technique will likely have no permanent impact to the provision of ecosystem services. Broadleaved/mixed/yew/priority/coniferous/urban woodland have a significant maturity time with a delay of 30 years. Therefore, this delay is considered within potential future provision of this stock through the ecosystem services assessment. This can be accounted to the tree mortality rate presumed after woodland areas are replanted. Construction impacts include the release of CO_2 due to habitat clearance, loss of natural hazard management, a reduction in food production services, a reduction in recreational and amenity services, and a reduction in water purification. However, it is not expected to affect the future value as stocks are expected to be reinstated. There is some change anticipated in water flow regulation.
ESW-DES-004	California Caister beach desalination	-£2,541.09	The option is likely to generate the temporary and permanent loss of natural capital stocks during construction. However, most habitat expected to be reinstated/compensated to pre-construction conditions following best practice technique will likely have no permanent impact to the provision of ecosystem services. Broadleaved/mixed/yew/priority/coniferous/urban woodland have a significant maturity time with a delay of 30 years. Therefore, this delay is considered within potential future provision of this stock through the ecosystem services assessment. This can be accounted to the tree mortality rate presumed after woodland areas are replanted. Construction impacts include the release of CO_2 due to habitat clearance, loss of natural hazard management and a reduction in water purification. However, it is not expected to affect the future value as stocks are expected to be reinstated. There is no change anticipated to water flow regulation. Permanent loss of arable and pastoral stocks will likely affect agricultural ecosystem services.
ESW-DES-008	Corton Beach Well Desalination	-£2,367.11	The option is likely to generate the temporary and permanent loss of natural capital stocks during construction. However, most habitat expected to be reinstated/compensated to pre-construction conditions following best practice technique will likely have no permanent impact to the provision of ecosystem services. Broadleaved/mixed/yew/priority/coniferous/urban woodland have a significant maturity time with a delay of 30 years. Therefore, this delay is considered within potential future provision of this stock through the ecosystem services assessment. This can be accounted to the tree mortality rate presumed after woodland areas are replanted. Construction impacts include the release of CO_2 due to habitat clearance, loss of natural hazard management and a reduction in water purification. However, it is not expected to affect the future value as stocks are expected to be reinstated. There is no change anticipated to water flow regulation. Permanent loss of arable and pastoral stocks will likely impact agricultural ecosystem services e.g., food production.
ESW-EFR-001	Southend-on-Sea Effluent Re-use (max capacity)	-£11,271.62	The option is likely to generate the loss of natural capital stocks during construction. However, habitat expected to be reinstated/compensated to pre-construction conditions following best practice technique will likely have no permanent impact to the provision of ecosystem services. Broadleaved/mixed/yew/priority/coniferous/urban woodland have a significant maturity time with a delay of 30 years. Therefore, this delay is considered within potential future provision of this stock through the ecosystem services assessment. This can be accounted to the tree mortality rate presumed after woodland areas are replanted. Construction impacts include the release of CO_2 due to habitat clearance, loss of natural hazard management and a reduction in water purification. However, it is not expected to affect the future value as stocks are expected to be reinstated. There is no change anticipated to water flow regulation. Permanent loss of arable stocks due to option construction hence loss of associated ecosystem services expected.

Option ID	Option Name	Natural Capital	Ecosystem Services
ESW-EFR-002A	Lowestoft water re-use (transfer to River Waveney)	-£3,016.16	The option is likely to generate the temporary loss of most natural capital stocks and permanent loss of arable and ancient woodland stocks during construction. However, most habitat that is expected to be reinstated/compensated to pre-construction conditions following best practice technique will likely have no permanent impact to the provision of ecosystem services. Broadleaved/mixed/yew/priority/coniferous/urban woodland have a significant maturity time with a delay of 30 years. Therefore, this delay is considered within potential future provision of this stock through the ecosystem services assessment. This can be accounted to the tree mortality rate presumed after woodland areas are replanted. Construction impacts include the release of CO_2 due to habitat clearance, loss of natural hazard management and a reduction in water purification. The permanent loss of arable stocks will lead to loss of food production services. Permanent loss of ancient woodland stock will result in the reduction in water purification, loss of carbon sequestration and loss of natural hazard management services. There is no change anticipated to water flow regulation however any potential impacts will be covered in the WFD.
03b0478B	Water Re-use Treatment at Caister EFR (AW) and transfer from Caister to Ormesby Raw Water Tank	-£739.02	The option is likely to generate the loss of natural capital stocks during construction. Permanent loss is expected within flood plain and as such the provision of natural hazard management. Broadleaved, mixed and yew woodland have a significant maturity time with a delay of 30 years. Therefore, this delay is considered within potential future provision of this stock through the ecosystem services assessment. This can be accounted to the tree mortality rate presumed after woodland areas are replanted through offsetting. Habitat is expected to be reinstated/compensated to pre-construction conditions following best practice techniques where possible, and as such will likely have no permanent impact to the provision of ecosystem services. Major construction impacts include the loss of water purification, loss of natural hazard regulation and release of CO_2 due to habitat clearance. The option is anticipated to retain the provision of water regulation during construction.
ESW-NIT-004	Barsham EDR Nitrate Removal + Pipeline	-£588.84	The option is likely to generate the loss of natural capital stocks during construction. However, habitat expected to be reinstated/compensated to pre-construction conditions following best practice technique will likely have no permanent impact to the provision of ecosystem services. Broadleaved/mixed/yew/priority/coniferous/urban woodland have a significant maturity time with a delay of 30 years. Therefore, this delay is considered within potential future provision of this stock through the ecosystem services assessment. This can be accounted to the tree mortality rate presumed after woodland areas are replanted. Construction impacts include the release of CO_2 due to habitat clearance, loss of air pollutant removal, loss of natural hazard management and a reduction in water purification. However, it is not expected to affect the future value as stocks are expected to be reinstated. There is no change anticipated to water flow regulation.
ESW-NIT-005	Langford EDR Nitrate Removal + Pipeline	-£737.96	The option is likely to generate the temporary and permanent loss of natural capital stocks during construction. However, habitat expected to be reinstated/compensated to pre-construction conditions following best practice technique will likely have no permanent impact to the provision of ecosystem services. Broadleaved/mixed/yew/priority/coniferous/urban woodland have a significant maturity time with a delay of 30 years. Therefore, this delay is considered within potential future provision of this stock through the ecosystem services assessment. This can be accounted to the tree mortality rate presumed after woodland areas are replanted. Construction impacts include the release of CO_2 due to habitat clearance, loss of natural hazard management, reduction in air quality, and a reduction in water purification. However, it is not expected to affect the future value as stocks are expected to be reinstated. There is no change anticipated to water flow regulation.
ESW-NIT-006	Langham EDR Nitrate Removal + Pipeline	-£950.89	The option is likely to generate the temporary and permanent loss of natural capital stocks during construction. However, habitat expected to be reinstated/compensated to pre-construction conditions following best practice technique will likely have no permanent impact to the provision of ecosystem services. Broadleaved/mixed/yew/priority/coniferous/urban woodland have a significant maturity time with a delay of 30 years. Therefore, this delay is considered within potential future provision of this stock through the ecosystem services assessment. This can be accounted to the tree mortality rate presumed after woodland areas are replanted. Construction impacts include the release of CO_2 due to habitat clearance, loss of food production, loss of air pollutant removal, loss of natural hazard management and a reduction in water purification. However, it is not expected to affect the future value as stocks are expected to be reinstated. There is no change anticipated to water flow regulation.
ESW-PMP-001A	Abberton RWPS	-£457.30	The option is likely to generate the temporary and permanent loss of natural capital stocks during construction. However, habitat expected to be reinstated/compensated to pre-construction conditions following best practice technique will likely have no permanent impact to the provision of ecosystem services. Broadleaved/mixed/yew/priority/coniferous/urban woodland have a significant maturity time with a delay of 30 years. Therefore, this delay is considered within potential future provision of this stock through the ecosystem services assessment. This can be accounted to the tree mortality rate presumed after woodland areas are replanted.

Option ID	Option Name	Natural Capital	Ecosystem Services
			Construction impacts include the release of CO_2 due to habitat clearance, loss of natural hazard management, loss of food production, loss of air pollutant removal and a reduction in water purification. However, it is not expected to affect the future value as stocks are expected to be reinstated. There is no change anticipated to water flow regulation.
ESW-RES-002C1	North Suffolk Winter Storage Reservoir	-£55,665.83	The option is likely to generate the temporary and permanent loss of natural capital stocks during construction. However, habitat expected to be reinstated/compensated to pre-construction conditions following best practice technique will likely have no permanent impact to the provision of ecosystem services. Broadleaved/mixed/yew/priority/coniferous/urban woodland have a significant maturity time with a delay of 30 years. Therefore, this delay is considered within potential future provision of this stock through the ecosystem services assessment. This can be accounted to the tree mortality rate presumed after woodland areas are replanted. Construction impacts include the release of CO_2 due to habitat clearance, loss of natural hazard management, loss of food production and a reduction in water purification. However, it is not expected to affect the future value as stocks are expected to be reinstated. There is a positive change anticipated to water flow regulation due to the addition of the reservoir.
ESW-TRA-001	Barsham to Blyth Transfer Main	-£758.01	The option is likely to generate the temporary and permanent loss of natural capital stocks during construction. However, habitat expected to be reinstated/compensated to pre-construction conditions following best practice technique will likely have no permanent impact to the provision of ecosystem services. Broadleaved/mixed/yew/priority woodland have a significant maturity time with a delay of 30 years. Therefore, this delay is considered within potential future provision of this stock through the ecosystem services assessment. This can be accounted to the tree mortality rate presumed after woodland areas are replanted. Construction impacts include the permanent loss of stocks which will result in the permanent release of CO_2 due to habitat clearance, permanent loss of natural hazard management, and a permanent reduction in water purification services. There is no change anticipated to water flow regulation.
ESW-TRA-018	Bungay Wells to Broome WTW Transfer	-£118.17	The option is likely to generate the temporary loss of natural capital stocks during construction. However, all habitat expected to be reinstated/compensated to pre-construction conditions following best practice technique will likely have no permanent impact to the provision of ecosystem services. Broadleaved/mixed/yew/priority woodland have a significant maturity time with a delay of 30 years. Therefore, this delay is considered within potential future provision of this stock through the ecosystem services assessment. This can be accounted to the tree mortality rate presumed after woodland areas are replanted. Construction impacts include the release of CO_2 due to habitat clearance, loss of natural hazard management and a reduction in water purification. However, it is not expected to affect the future value as stocks are expected to be reinstated. There is no change anticipated to water flow regulation.
ESW-TRA-019	Transfer from Holton WTW to Eye Airfield	-£360.92	The option is likely to generate the temporary loss of natural capital stocks during construction. However, habitat expected to be reinstated/compensated to pre-construction conditions following best practice technique will likely have no permanent impact to the provision of ecosystem services. Broadleaved/mixed/yew/priority woodland has a significant maturity time with a delay of 30 years. Therefore, this delay is considered within potential future provision of this stock through the ecosystem services assessment. This can be accounted to the tree mortality rate presumed after woodland areas are replanted. Construction impacts include the release of CO_2 due to habitat clearance, loss of natural hazard management and a reduction in water purification. However, it is not expected to affect the future value as stocks are expected to be reinstated. There is no change anticipated to water flow regulation.
ESW-TRA-023	Broome to Barsham Transfer	-£517.41	The option is likely to generate the loss of natural capital stocks during construction. However, habitat expected to be reinstated/compensated to pre-construction conditions following best practice technique will likely have no permanent impact to the provision of ecosystem services. Broadleaved/mixed/yew/priority/coniferous/urban woodland have a significant maturity time with a delay of 30 years. Therefore, this delay is considered within potential future provision of this stock through the ecosystem services assessment. This can be accounted to the tree mortality rate presumed after woodland areas are replanted. Construction impacts include the release of CO_2 due to habitat clearance, loss of natural hazard management, loss of air quality, loss of food production and a reduction in water purification. However, it is not expected to affect the future value as stocks are expected to be reinstated. There is no change anticipated to water flow regulation.
ESW-UVC-001	Langford UV (Crypto)	-£334.73	The option is likely to generate the permanent loss of natural capital stocks during construction. Permanent impacts include the loss of food production, carbon storage and air pollutant removal.

9.2.5. Biodiversity Net Gain

The Environment Act 2021 requires all new developments which are subject to planning to deliver a minimum of 10% BNG, and therefore, all new options delivered as part of the WRMP24, which require planning permission, will be required to demonstrate at least 10% BNG, subject to the requirements of individual local planning authorities that may be higher than 10% BNG. Some of the mechanisms for delivering BNG, such as the purchase of biodiversity credits, as well as the individual requirements set by various local planning authorities (LPAs) are still being developed. Furthermore, the WRMP24 options are at the concept stage of design and are not currently supported by survey data, and therefore it is not possible to develop detailed mitigation and enhancement proposals for delivering 10% BNG (or more than 10%) at this stage. The BNG assessments undertaken for each option have been used to inform the WRMP24 Best Value Plan, and thus have contributed to the overall reduction in potential impact on biodiversity units. Any decisions regarding over-delivering against statutory requirements, where this will add costs to our overall programme or to individual schemes, need to be balanced against the additional environmental benefit gained and the impact on bills to our customers.

The results of the BNG Assessment fed into the SEA objective on protecting biodiversity, priority species, and habitats. BNG was considered at both the option and programme level. Each option looked to report the expected impacts on BNG and excluded any required biodiversity impact mitigation, in order to achieve a 10% net gain. A biodiversity baseline was developed from spatial datasets of habitat inventories and assessed in line with the Defra BNG 3.0 metric, which assesses BNG based on land use change associated with each option. By quantifying the spatial extents of habitats and applying habitat-specific metrics, the approach aligned with the methodology of the WRPG Environmental and Society supplementary guidance. In this way, the approach also allowed consideration of biodiversity and habitat as an ecosystem service in the NCAs. Anticipated changes in land use due to option construction were used to assess change in the BNG scores. The BNG methodology was amended to incorporate active floodplain as a consideration. Active floodplain was considered as noted above in paragraph 8.3.2. The BNG assessments include the new stocks identified and therefore will equate to the total area of the option boundary. Note that the BNG tool does not include active floodplain as a habitat.

The BNG scores for the supply options included in our BVP, adaptive programmes and alternative plans are presented in Table 98. The option designs are currently at concept stage and as the detailed design of the options progresses the environmental assessments and potential mitigations, as well as opportunities to incorporate additional environmental enhancements and link with local strategic priorities, will be revisited.

Table 98: BNG scores for BVP, adaptive programmes and alternative plans supply options

Option ID	Option Name	BNG Score	BNG Units
ESW-ABS-003	New Linford WTW (10 Ml/d Option)	-10.92%	-5.26
ESW-DES-001	Canvey Island Desalination 190 and Transfer	-52.56%	-113.97
ESW-DES-004	California beach desalination	-28.99%	-90.80
ESW-DES-008	Corton Desal Beach Well and Transfer	-25.40%	-58.51
ESW-EFR-001	Southend Water Reuse and Transfer	-29.39%	-48.75
ESW-EFR-002A	Lowestoft Water Reuse for Ellingham Mill and Transfer	-33.95%	-15.97
03b-0478B	Caister Water Reuse and Ormesby Transfer	-19.96%	-5.92
ESW-NIT-004	Barsham Nitrate Scheme	-51.57%	-9.17
ESW-NIT-005	Langford Nitrate Scheme	-49.21%	-4.58
ESW-NIT-006	Langham Nitrate Scheme	-18.32%	-6.36
ESW-PMP-001A	Abberton RWPS and Langford Clarifiers	-26.44%	-0.64
ESW-RES-002C	North Suffolk Winter Storage 7500 and Transfer	89.52%	205.89
ESW-TRA-001	Barsham WTW Saxmundham Tower	-14.17%	-23.52
ESW-TRA-018	Bungay Wells to Broome WTW Transfer	-61.73%	-22.39
ESW-TRA-019	Holton WTW Eye Airfield	-10.42%	-14.91
ESW-TRA-023	Broome to Barsham WTW Transfer	-42.41%	-23.03
ESW-UVC-001	Langford UV	-100%	-0.10

9.2.6. Invasive Non-Native Species

The results of the INNS assessment fed into the SEA objectives on Biodiversity and Water. INNS information sheets were used to inform option development. Mitigation options appraisals were conducted for those options determined as of high risk for the potential spread of INNS. This involved reviewing known mitigation technologies and determining their effectiveness with regard to species type, transmission pathway and feasibility.

The results of the INNS Assessment for the options considered as part of the Best Value Plan, alternative plans and adaptive programmes are presented in Table 99. Four options scored as ‘Low’, ‘Moderate’ or ‘High’. Three of these, ESW-TRA-023, ESW-DES-001, ESW. DES-008, and ESW-DES-002C1 have been subject to Level 2 assessment. ESW-DES-004 has not been progressed to a Level 2 assessment as it is not selected by the BVP, the alternative plans or the adaptive programmes.

Table 99: INNS risk categories for supply options

RISK SCORE	OPTIONS
0 = None	ESW-UVC-001, ESW-NIT-004, ESW-NIT-005, ESW-NIT-006, ESW-PMP-001A
1 = Very Low	ESW-ABS-003, ESW-EFR-001, ESW-TRA-001, ESW-TRA-018, ESW-TRA-019, 03b-0478, ESW-EFR-002A
3 = Low	ESW-DES-001, ESW-TRA-023[34]
4 = Moderate	ESW-DES-008, ESW-DES-004
6 = High	ESW-RES-002C

9.2.7. Assessment Of Alternative Plans And Adaptive Programmes

As well as our Best Value Plan we have also developed a Least Cost Plan. These two plans are identical and therefore the SEA results of the two plans are identical.

Our Best Environment and Society plan is broadly similar to our BVP and Least Cost plans, with the notable exceptions that:

- In Essex it also includes Southend Water Reuse and Canvey Island Desalination options, in order to deliver the High Environmental Destination (ED) element of the plan; and
- In Northern Central it includes both Corton Desalination and Caister Water Reuse options instead of the North Suffolk Winter Storage Reservoir. This difference in options selected is dependent on the timing of deficits and when options can be selected, therefore resolving deficits earlier will require reuse and desalination options as they are available before the reservoir.

More detail regarding the environmental assessment of our Best Environment and Society plan can be found in Section 6 of our Environment Report. The option designs are currently at concept stage and as the detailed design of the options progresses the environmental assessments and potential mitigations, as well as opportunities to incorporate additional environmental enhancements and link with local strategic priorities, will be revisited.

We have also considered four adaptive programmes alongside our BVP: North Suffolk Reservoir, High ED (High abstraction reductions), High PCC and Habitats Regulations Sustainability Reductions programmes.

The North Suffolk Reservoir adaptive programme requires the same new supply options as the BVP across Essex, Blyth and Hartismere. In Northern Central, the North Suffolk Reservoir adaptive programme includes a smaller variant of the North Suffolk Reservoir with Caister Water Reuse instead of Lowestoft Water Reuse with the larger variant of the North Suffolk Reservoir.

The Habitats Regulations Sustainability Reductions Adaptive Programme has been included to address the uncertainty around the scale of abstraction licence reductions required to meet the requirements of the Habitats Regulations in the Broads and Upper Waveney and Little Ouse area. The options selected are the same as the BVP in AMP8, although

[34] The ESW-TRA-023 Bungay to Barsham option reported in the BVP refers to a combined option of ESW-TRA-018: Bungay to Broome, and ESW-TRA-023: Broome to Barsham. Both options have been reported separately in this report, and where ESW-TRA-023 has been selected by NWL for their Best Value Plan or Alternatives, ESW-TRA-018 has also been selected and the cumulative effects of the two options considered.

ESW-TRA-019 is a variant with 9.13 Ml/d capacity. However, in AMP9, Lowestoft Re-use is required earlier in the AMP and Caister Re-use (03b0478B) is also required, plus the medium variant of ESW-RES-002C1 option, option ESW-RES-002B. Where smaller variants of options are selected by plans, this assessment has utilised a consistent assessment of the largest size to present a "worst case scenario".

The High PCC adaptive programme requires the same options as the BVP, with the addition of the Southend Water Reuse option in Essex and Lowestoft Water Reuse in Northern Central. Compared to the BVP it also selects Caister Water Reuse instead of the larger variant of the North Suffolk Reservoir.

Finally, the High ED adaptive programme, which attempts to deliver the 'Enhanced' Environmental Destination scenario, requires Southend Water Reuse, Canvey Island Desalination and Corton Desalination options in addition to those selected in the BVP and also selects Caister Water Reuse instead of the North Suffolk Reservoir.

The difference in options selected across these programmes is generally dependent on the timing of deficits and when options can be selected: early deficits will always be resolved with reuse and desalination options as these are available before the North Suffolk Reservoir.

We have completed SEA and other environmental assessments for each of our adaptive programmes and alternative plans, in comparison with our BVP. The construction and operation phase outcomes of these are provided in Section 6 of our Environment Report.

9.2.8. Cumulative Effects Assessment

The options which make up the Best Value Plan, the Best Environment and Society plan and the four adaptive programmes have been reviewed as a whole plan against the SEA objectives. This approach is considered to be an efficient and proportionate approach to the cumulative effects assessment, which is cognisant of the work being undertaken for the Regional Plan and other WRMPs. There is no standard approach to the assessment of interrelationships between effects. Effects are very rarely additive, but rather a collection of impacts on a receptor that need to be drawn together. Consideration also needs to be given to the potential for 'synergistic' effects whereby different types of impact affecting a receptor may interact together and increase their effect.

Where more than one option is considered to a have a residual (post-mitigation) effect on an SEA objective (positive or negative), these options are assessed against the criteria to determine whether they would result in more significant effects. Temporal and spatial dimensions of the proposed options are considered and where options are located in close proximity to one another or are to be delivered with overlapping timescales, they are considered to have potential cumulative effects. For certain SEA objectives, environmental receptors, which are used to indicate an effect on a particular SEA objective (for example designated sites for Biodiversity objectives), are then considered to determine whether more than one option would have an effect on a receptor. Professional judgement, following the SEA framework, is used to determine the significance of the effects identified; neutral, minor, moderate or major positive or negative.

The Best Value Plan comprises the following options; ESW-ABS-003, ESW-TRA-001, ESW-TRA-019, ESW-NIT-005, ESW-UVC-001, ESW-NIT-006, ESW-NIT-004, ESW-PMP-001A, ESW-TRA-023, ESW-TRA-018, ESW-EFR-002A,

and ESW-RES-002C. A high-level summary of the cumulative effects expected from the options within the BVP is presented in Table 100.

Table 100: BVP cumulative effects[35]

Theme	No.	Objective	Construction phase impacts	Operational Phase Impacts
Biodiversity	1.1	To protect designated sites and their qualifying features.	A number of the proposed options have potential effects on designated biodiversity sites and their qualifying features. In particular, options ESW-TRA-001 and ESW-EFR-002A which both potentially impact Titsal Wood Ancient Woodland and SSSI. These options are due to be delivered in 2028/2029 and 2030/2031, therefore there is low potential for cumulative construction effects. In-combination effects on Natura 2000 sites are considered in the HRA AA Appendix F. The sites with potential adverse effects are; The Broads SAC, Broadlands SPA and Broadland Ramsar. There is potential for cumulative permanent construction phase effects to the aforementioned sensitives sites. It is anticipated that there would be a **moderate negative** cumulative effect on this SEA objective during the construction phase.	A number of options have potential effects on designated biodiversity sites and their qualifying features. Whilst ESW-TRA-001 and ESW-EFR-002A both potentially impact Titsal Wood Ancient Woodland, it is anticipated that the impacts arising as a result of ESW-TRA-001 are temporary in nature. Therefore there are not anticipated to be in-combination effects on this receptor during the operational phase. In-combination effects on Natura 2000 sites are considered in the HRA AA Appendix F. The sites with potential adverse effects are; The Broads SAC, Broadlands SPA and Broadland Ramsar. The HRA AA considers many of these effects to be reduced by applying best practice mitigation however there may still be residual operational phase effects. It is anticipated that there would be a **minor negative** cumulative effect on this SEA objective.
	1.2	To deliver BNG, protect biodiversity, priority species and vulnerable habitats such as chalk rivers.	A number of the options considered as part of this plan are considered to have moderate negative effects during the construction phase on the ability of the plan to deliver BNG, protect biodiversity, priority species and vulnerable habitats. This is as a result of negative BNG scores for the options included in the plan resulting from construction of the options however this score doesn't take into consideration opportunities for BNG enhancement. As 10% BNG will be mandatory for each option taken forward, this is a measure of the difficulty of achieving 10%. The proposed options are also all either spatially or temporally diverse. Options with moderate negative effects include; ESW-TRA-018 and ESW-EFR-002A, whilst ESW-RES-002C is anticipated to result in major positive effects. These options are to be constructed in the same WRZ, Northern Central, and they are all due to be delivered between 2030 and 2041, which reduces the potential for in-combination effects. It is anticipated that there would be a **minor negative** cumulative effect on this SEA objective during the construction phase.	During the operational phase, options ESW-PMP-001A, ESW-RES-002C and ESW-DMO_Med are considered to have potential minor positive operational effects, on the ability to delivery BNG and long-term habitat enhancement. Although these options are located within different WRZs, they will all be operational eventually. Therefore, it is anticipated that would be a **minor positive** cumulative effect on this SEA objective during the operational phase.
	1.3	To avoid spreading and, where required, manage invasive and non-native species (INNS).	No construction phase cumulative effects are anticipated for this SEA objective.	No operational phase cumulative effects are anticipated for this SEA objective.
	1.4	To meet WFD objectives relating to biodiversity.	No construction phase cumulative effects are anticipated for this SEA objective.	No operational phase cumulative effects are anticipated for this SEA objective.

[35] Data from Section 7 of Mott Macdonald (2024) ESW – WRMP 2024 Environmental Report

Theme	No.	Objective	Construction phase impacts	Operational Phase Impacts
Soil	2.1	To protect and enhance the functionality and quality of soils, including the protection of high-grade agricultural land, and geodiversity.	There are several instances of where two or more options pass through the same area of Provisional Grade 2 agricultural land. ESW-ABS-003 and ESW-NIT-006 are in the Essex WRZ, and ESW-RES-002C, ESW-TRA-023 and ESW-TRA-018 are located in the Northern Central WRZ. Despite being delivered under different timescales, there is potential for permanent construction effects due to loss of good quality agricultural land. ESW-EFR-002A, ESW-TRA-001 and ESW-TRA-019 all interact with Holton Pit Historic Landfill Site. ESW-TRA-001 and ESW-TRA-019 are both to be delivered in 2028-2029, therefore will be potential for cumulative effects on this historic landfill site. Similarly, ESW-EFR-002A, ESW-RES-002C and ESW-TRA-001 all interact with Site at Ringsfield Historic Landfill Site. Despite being delivered under different timescales, there is potential for permanent construction effects on soil quality and contamination. It is anticipated that there would be a **moderate negative** cumulative effect on this SEA objective during the construction phase.	No operational phase cumulative effects are anticipated for this SEA objective.
Water	3.1	To reduce or manage flood risk, taking climate change into account.	Options included in this plan are mostly located in Flood Zone 1, however options also pass through Flood Zones 2 and 3. However, due to the spatial and temporal diversity between the options and considering flood risk mitigation and management applied during the construction phase, these effects can be lessened. It is anticipated that there would be a **minor negative** cumulative effect on this SEA objective.	No operational phase cumulative effects are anticipated for this SEA objective.
	3.2	To enhance or maintain surface water quality, flows and quantity.	Minor negative effects were identified for ESW-TRA-001, ESW-RES-002C and ESW-DMO-Preferred, due to be delivered during 2028-2029, 2032-2033 and ongoing respectively. Therefore, no construction phase cumulative effects are anticipated for this SEA objective.	ESW-NIT-005 and ESW-NIT-006 are considered to have potential minor positive effects due to water quality improvements due to the nature of options proposed. These options both fall within Essex WRZ and will be operational during the same time period. It is anticipated that there would be a **minor positive** cumulative effect on this SEA objective during the operation phase.
	3.3	To enhance or maintain groundwater quality and resources.	Minor negative effects were identified for ESW-ABS-003, ESW-RES-002C and ESW-DMO-Preferred, due to be delivered during 2027-2028, 2032-2033 and ongoing respectively. Therefore, no construction phase cumulative effects are anticipated for this SEA objective.	No operational phase cumulative effects are anticipated for this SEA objective.
	3.4	To meet WFD objectives and support the achievement of environmental objectives set	Many of the proposed options interact with waterbodies. The WFD Assessment Appendix G identified 10 waterbodies which are impacted by more than one BVP option. Of these water bodies, one, GB105034045903: Waveney (Ellingham Mill - Burgh St. Peter), was assessed to have potential to increase risk of WFD deterioration due to cumulation of multiple options, which are ESW-RES-002C1,	The WFD Assessment Appendix G identified 10 waterbodies which are impact by more than one BVP option. Of these water bodies, one, GB105034045903: Waveney (Ellingham Mill - Burgh St. Peter), was assessed to have potential to increase risk of WFD deterioration due interaction with multiple options, which are: ESW-RES-002C1, ESW-TRA-023, ESW-TRA-001, ESW-NIT-004, ESW-EFR-002A. It

Theme	No.	Objective	Construction phase impacts	Operational Phase Impacts
		out in River Basin Management Plans.	ESW-TRA-023, ESW-TRA-001, ESW-NIT-004, ESW-EFR-002A. Further assessment, specifically for option ESW-RES-002C1, is required to confirm these impacts. Therefore, it is anticipated that there would be a **minor negative** cumulative effect on this SEA objective during the construction phase.	is anticipated that there would be a **minor negative** cumulative effect on this SEA objective during the operational phase.
	3.5	To increase water efficiency and increase resilience of water supplies and natural systems to droughts.	No construction phase cumulative effects are anticipated for this SEA objective.	ESW-NIT-005 and ESW-NIT-006 are considered to have potential minor positive effects due to the anticipated level of increase in water supplies. These options will be operation during the same timescale however they are located within different WRZs. All other options, including the ESW-DMO-Preferred scenario, are expected to have minor positive effects due to the anticipated increase in water supplies. The plan as a whole is aimed at ensuring the resilience of the water supplies for the next 100 years and thus it is anticipated that there would be a **moderate positive** cumulative effect on this SEA objective during the operation phase.
Air	4.1	To reduce and minimise air emissions during construction and operation.	Each option is predicted to result in minor effects to local air quality resulting from construction activity. ESW-NIT-005, ESW-UVC-001 and ESW-NIT-006 are all located within Essex and due to be delivered during 2029-2030. However, effects are anticipated to be local and short-term in nature and provided mitigation as recommended is put in place, it is anticipated that there would be **no cumulative effects** on this SEA objective during the construction phase.	No operational phase cumulative effects are anticipated for this SEA objective.
Climatic Factors	5.1	To minimise/reduce embodied and operational carbon emissions	Each option requires built infrastructure to varying degrees. Emissions related to construction activities are local and short-term and are not anticipated to result in cumulative effects on this SEA objective. However, whilst the options are spatially and temporally diverse, nine out of the eleven options are due to be delivered in the UK's Fifth Carbon Budget and a further one will be delivered in the UK's Sixth Carbon Budget, and a final option beyond this. Embodied emissions associated with the construction of these options may lead to cumulative effects. It is anticipated that there would be a **moderate negative** cumulative effect on this SEA objective during the construction phase.	A number of the options will require energy-intensive processes during the operational phase. Carbon emissions associated with the operation of the proposed options, specifically those with operational energy requirements such as effluent reuse and abstraction processes, are likely to contribute to the UK's Fifth Carbon Budget and beyond and emissions targets are likely to become more stringent over the long term. At present, there are no confirmed opportunities to supply the options with renewable energy during the operational phase however, these should be investigated as part of further design development. As the energy grid is decarbonised, greener energy will be available. It is anticipated that there would be a **moderate negative** cumulative effect on this SEA objective during the operation phase.
	5.2	To introduce climate mitigation where required and improve the climate resilience of assets and natural systems.	No construction phase cumulative effects are anticipated for this SEA objective.	ESW-TRA-023, ESW-TRA-019, ESW-RES-002C, ESW-PMP-001A, ESW-UVC-001 and ESW-EFR-002A will transfer water from an area of surplus to an area of deficit, thus improving the resilience of local water supplies during potential future drought scenarios. This could, however, have a detrimental effect to the resilience of natural systems during operation if drought conditions coincide with

Theme	No.	Objective	Construction phase impacts	Operational Phase Impacts
				consistently high rates of transfer. It is anticipated that there would be a **minor positive** cumulative effect on this SEA objective during the operational phase.
Landscape	6.1	To conserve, protect and enhance landscape and townscape character and visual amenity.	Each option will have a local and temporary effect on landscape and visual amenity through construction activities and traffic. Best practice mitigation measures can be applied to reduce this impact. Whilst the options are spatially and temporally diverse, ESW-EFR-002A, ESW-RES-002C, ESW-TRA-023 and ESW-TRA-018 all have the potential to affect The Broads National Park, while ESW-NIT-004 and ESW-TRA-001 lie within 500m. Although these options are all to be delivered under different timescales, there is still potential for cumulative construction effects. It is anticipated that there would be a **moderate negative** cumulative effects on this SEA objective during the construction phase.	No operational phase cumulative effects are anticipated for this SEA objective.
Historic Environment	7.1	To conserve/Protect and enhance the historic environment including the significance of designated and non-designated cultural heritage (including archaeology and built heritage), including any contribution made to that significance by setting.	Each option has the potential to affect the historic environment as a result of construction activities. However, in most cases, the options are spatially and temporally diverse. Three of the five options proposed in Essex WRZ are to be delivered over 2029-2030, therefore there is potential for cumulative construction effects. ESW-EFR-002A and ESW-TRA-001 are both within 500m of two Scheduled Monuments, 'Moated site and associated earthworks at Westend Farms', and 'Moated site at Moat Farm'. Similarly, ESW-NIT-005, ESW-UVC-001 and ESW-PMP-001A are all within 500m of a Scheduled Monument, 'Pumping station'. For the latter, these will be delivered under overlapping timescales, with potential for cumulative construction effects. There is also potential for unknown buried archaeology, however further study is likely required to confirm the potential risk. Best practice mitigation measures can be implemented during construction. It is anticipated that there would be a **moderate negative** cumulative effect on this SEA objective during the construction phase.	No operational phase cumulative effects are anticipated for this SEA objective.
Population and Human Health	8.1	To maintain and enhance the health and wellbeing of the local community, including economic and social wellbeing.	Options proposed as part of this plan have the potential to affect health and wellbeing of local communities. Many of the options pose a potential risk to community facilities such as golf courses, religious grounds, playing fields etc. Best practice construction measures can also be implemented to reduce local effects to the health and wellbeing of the local community. Furthermore, many of the options result in minor positive effects resulting from potential contributions to the local economy during the construction phase. It is anticipated that there would be **both minor negative and minor positive**	Minor positive effects were identified for ESW-UVC-001, ESW-RES-002C and ESW-DMO-Preferred, due to be delivered during 2029-2030, 2040-2041 and ongoing respectively. Although these options will eventually be operational at the same time, they are located within different WRZs. Therefore, no operational cumulative effects are anticipated for this SEA objective.

Theme	No.	Objective	Construction phase impacts	Operational Phase Impacts
			cumulative effects on this SEA objective during the construction phase.	
	8.2	To secure resilient water supplies for the health and wellbeing of customers.	No construction phase cumulative effects are anticipated for this SEA objective.	All options are aimed at providing resilient water supplies to customers across the region. The majority of the options predicted to have a minor positive effect are due to be operational during similar timescales. It is anticipated that there would be a **moderate positive** cumulative effect on this SEA objective during the operational phase.
	8.3	To increase access and connect customers to the natural environment, provide education or information resources for the public.	Each of these options have the potential to cause temporary disruption to walk and cycling routes and public rights of way. None of the options propose opportunities associated with environmental or recreational benefits for local communities during the construction phase. ESW-NIT-005, ESW-NIT-006 and ESW-PMP-001A are all located within Essex WRZ and have overlapping delivery timescales and therefore have the potential to cause cumulative effects through disruption to the same communities. Best practice measures can be implemented to reduce construction phase disruption. It is anticipated that there would be a **minor negative** cumulative effect on this SEA objective during the construction phase.	Minor positive effects were identified for ESW-NIT-001 and ESW-RES-002C, and moderate positive effects were identified for ESW-DMO-Preferred, due to be delivered in 2029-2030, 2040-2041 and ongoing respectively. Although these options will eventually be operational at the same time, they are located within different WRZs. Therefore, no operational cumulative effects are anticipated for this SEA objective.
	8.4	Maintain and enhance tourism and recreation	Each of these options have the potential to cause temporary disruption to tourism and recreation opportunities for local communities. None of the options propose opportunities associated with environmental or recreational benefits for local communities during construction. A number of options are located within Essex WRZ and Northern Central WRZ and have overlapping timescales for delivery. Therefore, have the potential to causes cumulative effects through disruption to the same communities. Best practice measures can be implemented to reduce construction phase disruption. It is anticipated that there would be a **minor negative** cumulative effect on this SEA objective during the construction phase.	No operational phase cumulative effects are anticipated for this SEA objective.
Material Assets	9.1	Minimise resource use and waste production	New infrastructure will be required for all options. ESW-ABS-003, ESW-NIT-005, ESW-UVC-001, ESW-NIT-006 and ESW-PMP-001A are all located within the Essex WRZ and ESW-NIT-004, ESW-TRA-023, ESW-TRA-018, ESW-EFR-002A and ESW-RES-002C are all located within the Northern Central WRZ. ESW-NIT-005 and ESW-NIT-006 are both anticipated to require a significant amount of material during construction and are both located within Essex WRZ and due to be delivered during 2029-2030. There is potential for material resource use required for construction of the options and limited opportunities for reuse or recycling of	Energy consumption will be required for a number of the options, for activities including operating WTWs, pumping and treating water and for periodic maintenance works. ESW-NIT-005, ESW-UVC-001, ESW-NIT-006 and ESW-PMP-001A are all located within Essex WRZ with the same, or overlapping, timescales for delivery. It is anticipated that there would be a **minor negative** cumulative effect on this SEA objective during the construction phase.

Theme	No.	Objective	Construction phase impacts	Operational Phase Impacts
			waste materials have been identified currently, however this could be investigated further during later design stages. It is anticipated that there would be a **moderate negative** cumulative effect on this SEA objective during the construction phase.	
	9.2	Avoid negative effects on built assets and infrastructure	Many of the options cross railway lines, major roads and the National Cycle Network, therefore there is likely to be disruption to build assets and infrastructure during the construction phase. ESW-TRA-001, ESW-EFR-002A and ESW-RES-002C all cross National Cycle Network No.1, however, are due to be delivering under different timescales. Similarly, ESW-TRA-001 and ESW-EFR-002A intersect the same area of railway tracks, however, are due to be delivered under different timescales. Best practice measures included a plan wide Traffic Management Plan could be implemented to minimise disruption and whilst the options are temporally diverse, this could lead to extended disruption over a long period of time. It is anticipated that there would be a **minor negative** cumulative effect on this SEA objective during the construction phase.	No operational phase cumulative effects are anticipated for this SEA objective.

Further consideration of the cumulative SEA effects of the adaptive programmes associated with the Best Value Plan, OFWAT core plan and the Best Environment and Society alternative plan, overall and in respect of HRA, WFD, BNG and NCA and cumulative and in-combination effects with other plans, programmes and projects are presented in Sections 6 and 7 of the Environment Report. A two-stage approach was taken to determine the Inter-Plan Effects. The first stage comprised a strategic review across other water company draft WRMP24s, Regional Water Resource Plans, other companies Drought Plans (where applicable) and RBMPs to identify the potential for any cumulative effects. The second stage comprised a plan based cumulative effects assessment considering plans, programmes and strategic projects including large existing and emerging Local Plan allocations, NSIPs, hybrid bills, Transport and Works Act Orders and minerals and waste applications. The results of this review are presented in Section 7.2 of the Environment Report.

9.2.9. Mitigation Measures and Enhancement Opportunities

Mitigation and enhancement measures were identified as part of the SEA options assessment process. These measures have been recorded and collated into a register (see section 8.1 in the Environment Report, with further information in Appendix K of the Environment Report for individual options). The outcome of the assessments (reported above and in Sections 5, 6 and 7 of the Environment Report) are the residual effects, which means that it is assumed that the identified mitigation has been applied (to the option) and the reported effects are those that remain. It is noted that the HRA Appropriate Assessment – within Environment Report Appendix F – *Habitats Regulations Assessment;* and WFD Level 2 assessment – within Environment Report Appendix G – *Water Framework Directive Assessment*, for specific supply side options contain additional description of mitigation relevant to the focus of those assessments, which can be found in the relevant Sections of those reports.

The identified mitigation generally falls into two categories. The first is primary (or embedded) mitigation; generally, actions that are taken to avoid impacts occurring by incorporating them into the options development process. For example, pipeline re-routing and directional drilling to avoid significant effects on designated sites and heritage assets. Incorporation of these measures at this early strategic stage will help deliver a WRMP that benefits the environment and reduces the risk of significant negative effects and cost-prohibitive mitigation measures further down the line during detailed design of specific options. The second type of mitigation is secondary (or reductive) mitigation. This is where an impact cannot be avoided, and the focus is on reducing the impact or providing some form of compensation. For example, using renewable energy to reduce carbon emissions. Additional actions such as further investigations and risk assessments can also form and lead to actions which are secondary mitigation.

How the secondary mitigation is secured will depend on the type of mitigation and the consenting route. For some projects, EIAs will require a systematic review of impacts and the appropriate mitigation. The actions to mitigate the impacts will be identified and documented, for example, in a CEMP. Statutory stakeholders such as the EA, Natural England and Historic England will also seek to secure mitigation, through engagement in the consenting process, with the local planning authority and/or planning inspectorate. The granting of consent will include the mitigation (for example, a schedule of commitments, planning conditions, etc.) and ESW will be required to discharge those requirements.

Note that the selected options are those which at this stage of option development have the lowest / acceptable environmental impacts. Any options with unacceptable environmental impacts were considered unfeasible. However, as detailed design progresses for the selected options and more information becomes available, if environmental compliance issues emerge, and, identified mitigation is not considered sufficient, or mitigation is unlikely to sufficiently mitigate significant effects, then previously rejected, alternative supply side options would be re-visited.

9.2.10. Monitoring

Monitoring the effects of implementing the WRMP is an essential on-going element of the SEA process. Monitoring helps ensure that the identified SEA objectives are being achieved, is required to track environmental effects to show whether they arise as anticipated in the SEA appraisal, to help identify any adverse effects and trigger deployment of any of the mitigation measures.

The need and triggers for monitoring will vary. Some of the monitoring is already collected by ESW and reported to Ofwat and the EA. Some of the monitoring information is available from publicly available sources and can be used by ESW to identify sensitivities in particular locations. It is likely that the need for detailed monitoring will be determined on a case-by-case basis as projects (options) identified in the final WRMP24 come forward for development. The magnitude of changes and sensitivity of receptors will inform a proportionate approach to monitoring based on the mitigation measures in place and the potential for negative environmental and social effects.

As options are brought forward for development, further requirements may be set out in planning applications, or in any ESW voluntary best-practice monitoring plans accompanying scheme development. Monitoring proposals will be discussed with relevant key regulatory bodies and stakeholders to agree monitoring activities that will be proportionate to the anticipated environmental risks, including their geographical and temporal scope. Monitoring as currently envisaged is presented in Section 9 of the Environment Report.

9.2.11. Next steps

Following adoption of the final WRMP24, a Post-Adoption statement will be produced which outlines how the SEA process has influenced the development of the WRMP, how consultation comments were taken into consideration and how the WRMP will be monitored. This summary will include information regarding how the final WRMP24 was influenced as a result of the SEA process and consultation.

9.3. CLIMATE CHANGE AND GREEN HOUSE GAS EMISSIONS

9.3.1. Resilient Water Supplies

Our climate is changing and so we recognise the importance of taking a proactive approach to mitigating and adapting to climate change to both protect the environment and to maintain resilient water supplies.

Although we are aiming to reduce our emissions in line with the Paris Agreement goals, this will not be enough to mitigate the impacts of climate change. The 2023 IPCC report on climate change warns with high confidence that it is likely that heating will exceed 1.5°C, and that current global commitments may be insufficient to limit heating below 2°C. The impacts from extreme weather in the UK over recent years highlight the urgency of adapting to climate change. As a result, managing risk in the face of climate change involves planning for the worst-case scenario. So, we are adapting to a world that is 2°C warmer in 2050 and preparing for 4°C by the end of the century.

Across our business, we are committed to continue delivering reliable and resilient services by anticipating change, planning ahead, and by making the right long-term decisions. This is set out in our Climate Adaptation Report[1], and our long-term strategies and plans. We use latest the latest climate information and scenarios (UKCP18) to understand and plan for the effects of increased drought, flood risk and other climate impacts on our assets and services.

In developing this preferred plan, we have accounted for the effects of climate change on forecast supply and demand following the methods set out in the Water Resources Planning Guideline. Our supply and demand forecasts have assumed a most likely (central) level of climate change using the Representative Concentration Pathway 6.5 (RCP6.5) scenario from UK Climate Projections 2018 (UKCP18). In many cases, climate change does not have a significant effect on groundwater recharge and so does not impact the deployable output (DO) of our groundwater sources. However, climate change does impact our surface water sources and has reduces DO across our Essex and Suffolk water resource zones by 34.64Ml/d by 2049/50.

We have adopted a twin track approach where we have an ambitious plan to reduce overall demand (including leakage from our network) and then develop new water supplies.

Reducing water company and customer side leakage, customer demand (PCC) and non-household will benefit the environment as it means we will abstract less water from the environment, particularly during dry weather when river flows are lower, leaving more water in rivers, reservoirs and groundwater aquifers. Our preferred Best Value Plan demand management options including leakage reduction, water efficiency and metering are presented in Section 8.

However, demand management alone will not be sufficient to maintain a supply surplus across the longer term planning period and so supply-side options are also required. Our preferred Best Value Plan supply options are presented in Section 8 below.

We are currently working with our regulators and environmental stakeholders to identify if there are further river restoration schemes that could be included in our Price Review 2024 (PR24) Water Industry National Environment Programme (WINEP) and that would result in greater resilience to future climate change.

9.3.2. GHG Emissions From Current Operations

Since 2008, we have reported our annual greenhouse gas emissions which arise from our operations at a group level (i.e., Northumbrian Water and Essex & Suffolk Water). Figure 66 shows a trend of consistent emissions reductions.

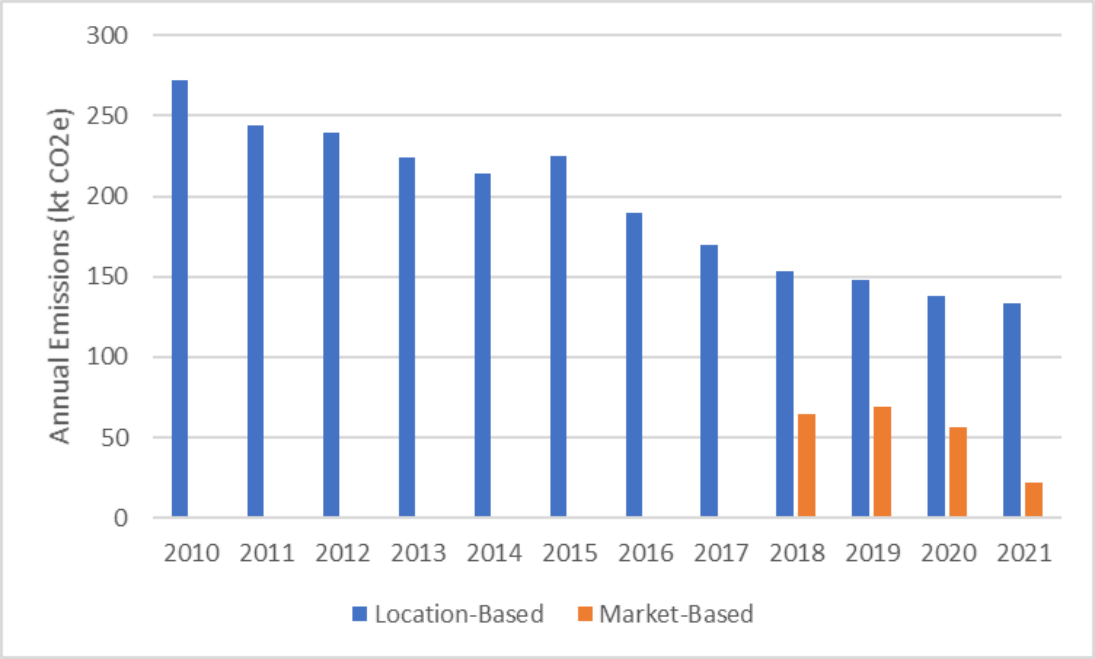


Figure 66: Northumbrian Water and Essex & Suffolk Water operational emissions 2010-2021

This reduction reflects a structured approach to emissions management through the implementation of a Net Zero plan, initiated in 2009 and updated annually. Figure 66 shows two types of emissions measurement – "Location-Based" and "Market-Based" with the latter reflecting where we have purchased fully renewable energy. In 2021/22, our operational emissions were 133ktCO_2e and 22ktCO_2e on a location and market basis respectively.

The significant reductions shown in Figure 66 have been achieved through a range of innovative energy and efficiency actions.

In 2022, new solar arrays have been added at sites in our Northumbrian Water (NW) operating region, with a sixth expected in early 2023. This will add a total of 13GWh per year of green energy generation to the 25GWh of renewables already at our sites. With the addition of these sites, we will generate 27GWh of renewable electricity in 2022/3, rising to 40GWh in 2023/4 – equivalent to that needed to power more than 12,000 homes. This is in addition to injecting a further 135GWh of green gas into the grid every year, which is enough to heat a further 8,000 homes.

The investment in renewables is helping us take a step closer to our ambitious goal of achieving Net Zero in 2027, having helped our carbon emissions fall more than 90% since 2010.

As well as solar, our Northumbrian Water reservoirs and water treatment works are also home to nine hydroelectric power stations, three of which are operated by third parties.

Additionally, we were the first and are still the only water company to use 100% of our Northumbrian Water sewage sludge to create green energy. Through a process called Advanced Anaerobic Digestion (AAD) at treatment works in

North Tyneside and Teesside, energy generated through AAD is injected into the gas grid as renewable gas. Other work that has helped it achieve its carbon reductions to date has included:

- Using a first of its kind ten-year deal to source around 30% of our electricity demand from offshore wind farms; and
- Powering all 1,886 of our Northumbrian Water and Essex and Suffolk Water sites using renewable electricity, through which we achieve 77,000 tonnes of CO2 savings each year.

9.3.3. Emissions of greenhouse gases from WRMP24 final plan options

In accordance with section 37A(3)(b), we present in Table 101 and Table 102 emissions of greenhouse gases which are likely to arise as a result of our demand and supply final plan options.

Table 101: Greenhouse gas emissions from our Final Plan Demand Management Options (tCO2e)

Option	Description	Carbon Impact (tCO2e)				
		AMP8	AMP9	AMP10	AMP11	AMP12
Smart Metering	Includes embodied carbon of meter and average 10km journey in a diesel van per install.	30,259	12,209	-	-	-
Intensive ALC	Includes embodied carbon of 2m excavation around pipe, encapsulation collar and average 10km journey in a diesel van per leak repair.	1,884	3,767	5,651	5,651	5,651
Permanent Acoustic Logging	Modelled as per smart meter, assumption that logger and meter will have similar embodied carbon and similar journey distance.	-	359	472	472	472
Mains Renewal	Includes excavation, pipe replacement (including material and transport of pipe), reinstatement and materials transport and disposal of surplus excavated material.	11,164	11,808	12,531	81,495	87,181
Water Efficiency	Includes average 10km journey in a diesel van for each water efficiency visit.	185	186	186	186	186
Total		43,493	28,330	18,840	87,803	93,489

The following approach was used to assess carbon emissions:

- Key activities associated with each intervention that are likely to generate significant carbon emissions were identified.
- Focus on capital and embodied carbon emissions covering cradle to built asset boundary, e.g., embodied carbon of materials, transport, construction effort and waste disposal. Operational emissions for these interventions are likely to be comparatively small and further work is required to identify the specific additional operational emissions impact and how much of the additional transport for meter reading/maintenance will be covered within existing fleet transport distances.

- Emissions factor data from Inventory of Carbon and Energy for construction materials, DEFRA annual conversion components for transport, CESMM4 cost and carbon price book for construction activities and material disposal.
- Carbon assessment has inherent uncertainty in regard to the representativeness of the emissions factors used compared to the actual carbon intensity of material and activities and also the top-down nature of the scope captured for each of the DMO interventions. However, the assessment does provide a good comparative assessment on the scale of expected emissions from each of these interventions at a programme level.

Table 102 confirms the greenhouse gas emissions from our final plan supply options including both embodied emissions (those predominantly arising from the construction of the option, and therefore occur once during the asset lifetime) and the operational emissions (those which occur annually resulting from the operation and maintenance of the option).

Table 102: Greenhouse gas emissions from our final plan supply options

OPTION	EMBODIED GHG EMISSIONS (TCO_2E)	OPERATIONAL GHG EMISSIONS [MAX UTILISATION]
Linford New WTW 10	6,808.80	82.94
Barsham Nitrate Scheme	2,541.73	51.51
Langford Nitrate Scheme	2,272.28	62.74
Langham Nitrate Scheme	4,212.11	37.87
Abberton RWPS & Langford Clarifiers	47.78	28.99
Langford UV	61.92	24.97
Lowestoft Water Reuse for Ellingham Mill and Transfer	26,346	1,779
North Suffolk Winter Storage 7500 and Transfer	34,965	-
Barsham WTW to Saxmundham Tower	48,639	215
Holton WTW Eye Airfield	39,148	226
Bungay wells to Broome WTW transfer and Broome to Barsham WTW transfer	7,289	88
Total	**10,797,909**	**2,231**

The GHG impact of our WRMP options was considered as part of the feasibility assessment stage with GHG emissions estimates being derived for each option by aligning individual project activities to Mott MacDonald's carbon model standards. Emissions are based on specific drivers for each project activity. Carbon intensity values ($kgCO_2e/£$) are used for options comparison purposes as they reflect the average estimated capital carbon emission per total capex of the option type. The whole life carbon assessment undertaken for the shortlist options, includes:

- Capital carbon emissions associated with construction activities required to deliver each of the options;
- Capital replacement emissions based on standard water resources asset life categories from the ACWG cost consistency report; and
- Operational carbon emissions associated with power consumption.

Operational maintenance and staff carbon impacts have not been included within the estimate at this stage, as these are likely to have significantly lower impact than power in the whole life carbon emissions and are therefore, unlikely to differentiate between options.

Emissions data are also reported in Appendix E (Integrated Environmental Assessment Report) which is available is available to download here.

9.3.4. How greenhouse gas emissions from WRMP24 final plan options will contribute individually and collectively to greenhouse gas emissions overall

Table 102 confirms the greenhouse gas emissions from our final plan supply options including both embodied emissions (those predominantly arising from the construction of the option, and therefore occur once during the asset lifetime) and the operational emissions (those which occur annually resulting from the operation and maintenance of the option).

Our current emissions (scope 1, 2 and 3) are in the region of 230,000 tonnes CO_2e/annum on a location basis.

Total AMP8 emissions from our final preferred plan demand management options have been calculated to be 49,493 tCO2e.

The total embodied GHG emissions from the supply schemes in our preferred final plan is 10,797,909 TCO_2E.

The annual operational GHG emissions [assuming max utilisation] would be 2,231 TCO_2E/annum

9.3.5. Delivering net zero greenhouse gas emissions targets and commitments

This section describes the steps we will take to reduce greenhouse gas emissions and how they will support the delivery of our net zero greenhouse gas emissions commitment and the UK government's net zero greenhouse gas emissions targets and commitments.

Our focus is to achieving Net Zero Scope 1, 2 and 3 emissions by 2050. Our Northumbrian Water Group strategy is to do this by:

- reducing greenhouse gas (GHG) emissions from our own activities; and
- working in partnership to reduce GHG emissions across our supply chain.

In its consultation response on our draft WRMP24 (dWRMP24), the EA commented that we should fully account for increased carbon emission from EA assets and pumping in our plan and set out how we will work with it to achieve net zero for transfer activities by 2030. We have not been able to do this for this revised draft WRMP24 (rdWRMP24) but have tabled it for discussion at an EA meeting. However, in order to provide indicative changes to carbon emissions, we have used our Essex Aquator model to calculate the volume of water required from the EOETS to achieve our 1-500 DO, along with carbon emission data (tCO2e), we have estimated that to operate the EOETS to meet a demand equal to our 1-500 DO we would produce 4,132 tCO2e /annum.

We commit to working with the EA through the Ely Ouse Operator's Group and EA / ESW Senior Managers Meeting to consider how and by when, net zero can be achieved for transfer activities.

Minimising greenhouse gas emissions from our activities

The water industry was among the first sectors in the country to develop a route map in support of Net Zero. Through Water UK, water companies pledged in 2019 to reach Net Zero operational GHG emissions by 2030. This covers our own direct emissions as well as indirect emissions from purchased energy (scope 1 and 2 as shown in Figure 67).

The GHG protocol categorises the entirety of an organisation's emissions into three high level scopes:

- Scope 1 – Direct emissions from company owned or controlled sources;
- Scope 2 – Indirect emissions from purchased energy; and
- Scope 3 – Indirect value chain emissions (purchased upstream/sold downstream).

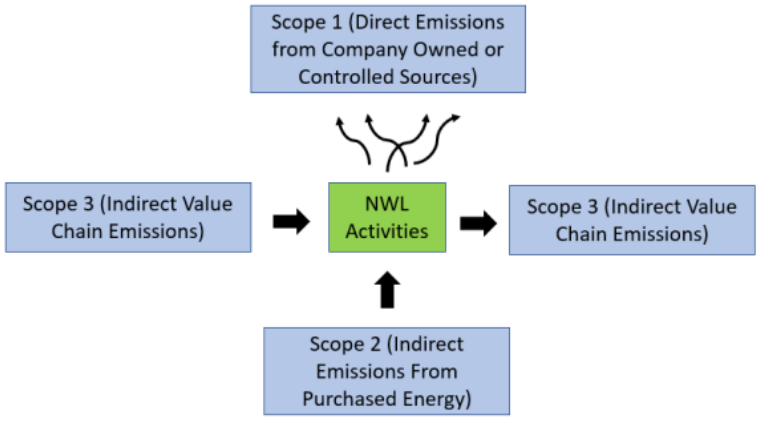


Figure 67: GHG Protocol

Our operational emissions have dropped from over 250,000 tonnes CO_2e in 2008 to just 23,000 tonnes CO_2e in 2022. As a result, we are on-track to meet the Water UK pledge several years early. We have achieved these reductions through intense and sustained efforts across many areas, including being the first water company to use 100% of our sewage sludge to create energy and obtaining 100% of our purchased energy from renewable supplies since 2018. This is outlined in the case study below.

Case Study: Creating Green Energy (Effective climate action, Valuing resources and eliminating waste)

At NWG, we are industry leaders in using our customers' waste to create green energy.

We were the first, and are still the only, water company to use 100% of the sludge from our wastewater treatment to create energy, literally power from poo – and this is a significant part of how we are already well on our way to Net Zero.

Advanced Anaerobic Digestion plants on Tyneside and Teesside process around 2 million cubic metres of sludge to generate 135GWh of green gas that we inject into the grid every year, which is enough to heat 8,000 homes.

The residual inert "cake" is then transported to be used as fertiliser. The switch from moving liquid sludge to transporting solids has also meant 90,000 tankers per annum have been replaced by 10,000 trailers, reducing our carbon emissions even further.

Both sites also utilise gas-to-grid plants to pass energy produced into the National Grid.

In line with the UK-wide target established in the 2008 Climate Change Act, we have set ourselves an even more ambitious commitment to achieve Net Zero across all our emissions (Scope 1, 2 and 3) by 2050. Currently, our wider emissions are in the region of 230,000 tonnes CO_2e per year, so this target is extremely challenging, especially given the nature of the service we provide (GHG emissions are a natural by-product of wastewater treatment), the additional regulatory requirements we must meet, which will increase the need for carbon intensive treatment processes and expected growth in our regions.

Our commitment is to:

- reduce process emissions of methane and nitrous oxide in the most efficient and affordable way;
- accelerate the timeline for phasing out fossil fuel vehicles, aiming for no new fossil fuel HGVs by 2035 and other vehicles by 2030; and
- 100% of our electricity will come from additional renewable generation by 2040.

We're looking at what commitments we will be making towards reaching Net Zero and will confirm that in our Environment Strategy.

As the National Grid decarbonises and emissions from electricity use fall, process emissions of nitrous oxide and methane from water and wastewater treatment make up a larger proportion of our total emissions. These emissions present a great challenge, as at present there are limited feasible or affordable alternatives to our current treatment methods, and capturing these emissions is expensive. We will focus our innovation efforts to identify the best approaches to reduce our process emissions, working closely with others as we do.

As part of our journey to Net Zero we will decarbonise our fleet of vehicles. In 2020, we began this transformation with Nissan EV200s being added to our fleet and will continue adding more elective vehicles in place of conventional vehicles. After 2030, as part of the Government's plan to reduce emissions, no new petrol and diesel cars and vans will be sold in the UK. The technology to support the transformation of HGVs is more complex, but we are aiming for all new HGVs to be fossil fuel free by 2035.

We are proud to be an industry leader in the generation of renewable energy. Our investment in offshore wind since 2018 enables us to power all of our 1,886 sites and around 30% of our total electricity demand using this source of renewable energy. We will maintain a focus on this area as we work towards our 2040 renewable generation goal, having committed to adding 30MW of new renewable generation to our asset base by 2027, including solar (six new solar arrays are being installed and commissioned in 2022/23, adding 13.3GWh per year of green energy generation to the 25GWh of renewables already at our sites).

We also aim to achieve ISO50001 accreditation to sustain improvements in energy efficiency and reductions in GHG emissions (our emissions reporting has already achieved ISO14064-1 accreditation – demonstrating accurate and transparent reporting). Our commitment to continual improvement is real and we want to have systems in place to support our path to achieving Net Zero and ensure we are accountable to our commitments. For this reason, we also plan to adopt the PAS2080 standard for managing carbon in building and infrastructure by 2025. This looks at the whole value chain and aims to reduce carbon and cost through intelligent design, construction, and use.

Working in partnership to reduce emissions from others

We commit to reduce embodied carbon by 50% for new assets by 2050 (compared to 2020 levels). To continue to provide world class water and wastewater services while also protecting and regenerating the natural environment, we are planning to deliver a large investment programme. This new investment will result in embodied carbon – the GHG emissions associated with materials, manufacturing, construction, transportation and installation. We are constantly looking for innovative opportunities to ensure our investment programme minimises the amount of both embodied and operational (for example from ongoing energy requirements) emissions. Through partnerships with contractors, suppliers, and others, we will work towards reducing embodied carbon associated with new assets by 50%.

We will also actively seek opportunities to sequester and lock-in carbon by using catchment and nature-based solutions where possible. We will continue to work with others, such as our contribution to the Peatscapes partnership, to enhance carbon storage. As peatlands store carbon indefinitely, restoring upland and lowland peatlands to a natural condition is vital, particularly as healthy functioning peatlands also deliver many wider benefits for society.

Understanding and reporting carbon is fundamental to managing and reducing emissions, and we are committed to transparency in emissions reporting as we work towards our Net Zero goal. We aim to have 95% of our scope 3 emissions reported by 2026. Addressing Scope 3 emissions requires considerable supply chain engagement and full life cycle analysis. The greater the scope of reporting, the more elements of a company's value chain are engaged with emissions awareness and by extension, reduction.

9.4. WATER INDUSTRY NATIONAL ENVIRONMENT PROGRAMME

9.4.1. Overview

As part of our five-year planning process, we agree with our regulators a list of actions we will take to further improve the environment. This is known as the WINEP. The WINEP is designed to protect the environment around the rivers and aquifers from which we abstract water, the reservoirs we use to store water, the environments we discharge to, and our land holdings.

9.4.2. AMP7 WINEP (2020 TO 2025)

In the current planning period, known as Asset Management Plan 7 (AMP7), we have undertaken a number of investigations to better understand the effect of our operations on the environment and to make changes where needed. The locations and scope of these investigations were agreed with the Environment Agency (EA), and the resulting changes to our operations have the EA's approval. We have agreed to:

- Install screens on our river abstraction intakes to ensure eels do not become entrapped;
- Build fish passes on structures (e.g., weirs) that we own which currently prevent fish from moving naturally up and down rivers;
- Increase the amount of priority habitat that we own and manage;
- Provide grants to partner organisations, charities and local groups to create and restore priority habitat and to tackle invasive non-native species in our region.

We continue to work closely with land managers and farmers to improve the quality of water at our abstractions as better-quality water requires less treatment and requires less energy and chemicals. In AMP7 we have focused particularly on reducing pesticides, nitrates and cryptosporidium in our raw water. In AMP7 we have:

- Engaged with farmers through events and one-to-one visits, and offered grants to support them to make changes to their farm infrastructure or change their farming practices to minimise the loss of nitrates and pesticides from their land; and
- Supported partner organisations to deliver projects which take a holistic approach to improving river habitat, increasing biodiversity and addressing the impacts of climate change, focusing on the River Blackwater catchment in Essex.

INNS are a threat locally and nationally. We are working with regulators and stakeholders to reduce the risk of spreading INNS by monitoring for them, undertaking risk assessments for existing and proposed new operations, installing washdown facilities at reservoirs with public access and ensuring we follow appropriate biosecurity measures in all our operations.

9.4.3. AMP8 WINEP (2025 to 2030)

We have worked closely with our regulators and stakeholders to identify what needs to be included in the WINEP for delivery in 2025 to 2030. We have been challenged by our regulators to aim for even more ambitious environmental outcomes for AMP8, and we have been 'thinking big' around how we can deliver more for our water environments and for our customers. Some of our proposals build on investigations we have undertaken in AMP7, while others build on our success in supporting partners to deliver holistic environmental projects.

From a water resources perspective, our overall aim is to create resilience in rivers and aquifers so they are able to support healthy habitats and diverse and abundant wildlife in the face of climate pressures, as well as providing for the water needs of our customers. We are working closely with other environmental organisations to identify the opportunities to develop bigger and better projects which will deliver multiple benefits for the environment. By aligning our aims and ambitions with those of others we will be able to deliver far more than we could alone and working in this way means our spending can be used to lever additional funding to deliver more for our environment and for people.

As part of our agreed AMP8 WINEP we have an ambitious programme of river enhancement and restoration schemes planned, which will complement the planned abstraction reductions. We also have investigations planned to explore opportunities to take a more holistic approach to water management in key catchments. Our catchment team will continue to work with the farming community in all our catchment areas during AMP8 to deliver improvements to water management on farm and to improve the water quality reaching our rivers. Within our AMP8 WINEP we have included a scheme to work across our area to contribute to delivering the Strategic Plans for water resources and nature conservation through participation in partnership projects. This is in addition to our existing Branch Out grant scheme which funds delivery of a wide range of environmental improvement schemes via grants to third parties.

As our AMP8 WINEP has not yet received final approval from all regulators, we are not able to include further detail in our rdWRMP24 at this stage. Our AMP8 WINEP will be included in full within our PR24 Business Plan.

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