love every drop anglianwater

WRMP24 Technical Document

Planning factors

April 2025

Planning Factors

1 WRMP24 Introduction

1.1 About our company

Anglian Water is the largest water and wastewater company in England and Wales geographically, covering 20% of the land area.

We operate in the East of England, the driest region in the UK, receiving two-thirds of the national average rainfall each year; that's approximately 600mm.

Our region has over 3,300km of rivers and is home to the UK's only wetland national park, the Norfolk Broads.

Between 2011 and 2021, our region experienced the highest population increase in England. Despite this, we are still putting less water into our network than we did in 1989.

1.2 Planning for the long term

Our company Purpose is “to bring environmental and social prosperity to the region we serve through our commitment to Love Every Drop”. This purpose is at the heart of our business, having been enshrined in our Articles of Association in 2019.

Central to delivering this purpose is planning for the long term; one of the strategic planning frameworks we use to achieve this is the Water Resources Management Plan (WRMP), which details how we will ensure resilient water supplies to our customers over the next 25 years.

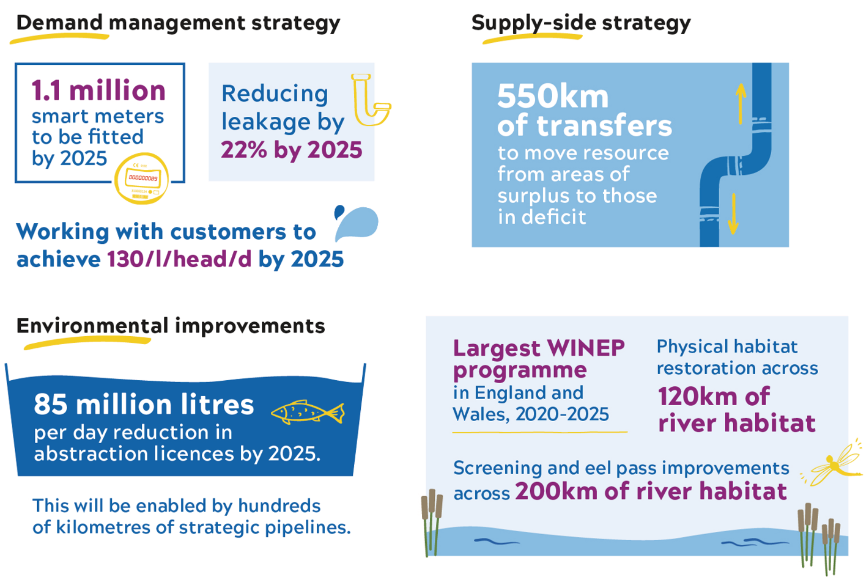
A WRMP looks for low regret investments[1] for our region, giving flexibility to adapt to future challenges and opportunities such as technological advances, climate change, demand variations, and abstraction reductions.

1.3 Water Resources Management Plan

We produce a WRMP every five years. It is a statutory document that sets out how a sustainable and secure supply of clean drinking water will be maintained for our customers. Crucially it takes a long-term view over 25 years, allowing us to plan an affordable, sustainable pathway that provides benefit to our customers, society and the environment.

Our previous WRMP, WRMP19, had an ambitious twin track strategy, combining an industry leading smart meter roll out and leakage ambition with a strategic pipeline across our region, bringing water from areas of surplus to areas of deficit. An overview of the WRMP19 strategy can be seen in Figure 1 below.

Figure 1 Our WRMP19 twin track approach



This WRMP focusses on the period 2025 to 2050, and is known as WRMP24. We have developed it by following the Water Resources Planning Guideline (WRPG)[2], as well as other relevant guidance, in order to meet our statutory requirements. This has ensured our WRMP24:

- Provides a sustainable and secure supply of clean drinking water for our customers.
- Demonstrates a long-term vision for reducing the amount of water taken from the environment, and shows how we will protect and improve it.

1 Investments that are likely to deliver outcomes efficiently under a wide range of plausible scenarios.
2 https://www.gov.uk/government/publications/water-resources-planning-guideline/water-resources-planning-guideline

- Is affordable.
- Maintains flexibility by being able to respond to new challenges.
- Complies with its legal duties.
- Incorporates national and regional planning; and
- Provides best value for the region and its customers.

1.4 Developing our WRMP

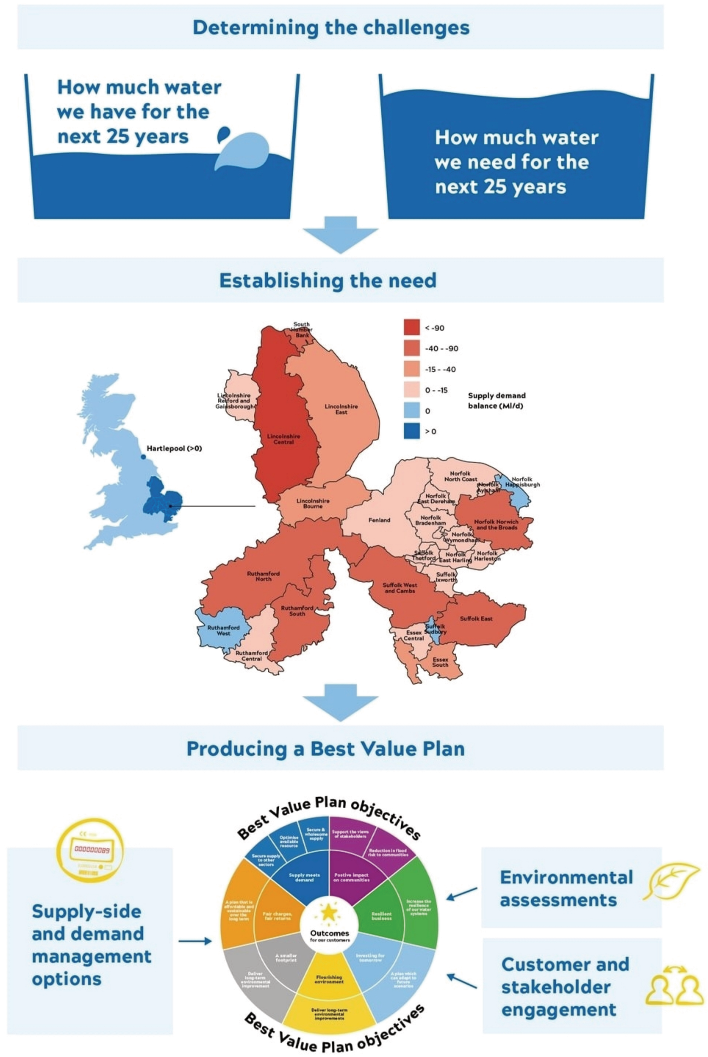
Our WRMP24 has been progressed following the processes detailed in the WRPG, as shown in Figure 2.

We start by determining the extent of the challenges we face between 2025 and 2050. We achieve this by developing forecasts to establish the amount of water available to use (supply forecast) and the amount of water needed (demand forecast) in our region. When these forecasts are combined, a baseline supply-demand balance is created. This tells us whether we have a surplus of water or a deficit, establishing our water needs for the planning period.

An appraisal for both demand management options and supply-side options is undertaken, starting with an unconstrained list of possible options which progresses through various assessments until a final constrained list is determined.

Demand management options aim to reduce the amount of water being used by our customers and lost in our water network. Examples of these options include smart metering and the promotion of water efficiency measures, such as reducing shower times. Supply-side options are also developed; these provide additional water to supply to customers. Examples of these options include new raw water storage reservoirs or water reuse treatment works.

Figure 2 A high level overview of our WRMP24 planning process



We environmentally assess both demand management and supply-side options so we can understand their potential environmental impacts and what could be put in place to mitigate these impacts; in some cases we exclude options from further consideration.

The next step is for the water savings associated with the chosen demand management option to be added into our baseline supply-demand balance to determine if our region's water needs are met. If the demand management options savings do not solve the need, supply-side options are added into the modelling process. This is undertaken in our Economics of Balancing Supply and Demand (EBSD) model which conducts numerous modelling runs, creating a range of plans that meet our objectives. These plans are also environmentally assessed.

We develop a best value plan from these different model runs and environmental assessments, encompassing the views of our customers and stakeholders who have been consulted throughout the plan's development.

1.5 Best value planning

To ensure we develop the right solution for our region's water needs, we have focused on 'best value'. To us, best value is looking beyond cost and seeking to deliver a benefit to customers and society, as well as the environment, whilst listening and acting on the views of our customers and stakeholders.

These views, from our customers and stakeholders, have helped build our best value framework, shown in Figure 3 which has been used as the basis for our decision making.

Figure 3 Our best value planning objectives

1.6 Our WRMP24

Our best value plan, has been produced following a public consultation on our draft WRMP24. This consultation ran from December 2022 to March 2023. Taking into account consultation feedback and our revised forecasts, we:

- Increased our leakage ambition from 24% to 30%.
- Included projected non-household demand for the South Humber Bank, in north Lincolnshire.
- Developed non-household demand management options.
- Recognised further opportunities to utilise the existing resource we have; and
- Removed abstractions from the supply forecast that are likely to be closed due to Habitats Regulations.

1.7 Strategic context of the WRMP24

Our WRMP24 aligns with our Purpose, as well as internal and external strategic plans and initiatives. We have worked collaboratively with internal and external stakeholders, regulators and other water abstractors to achieve this.

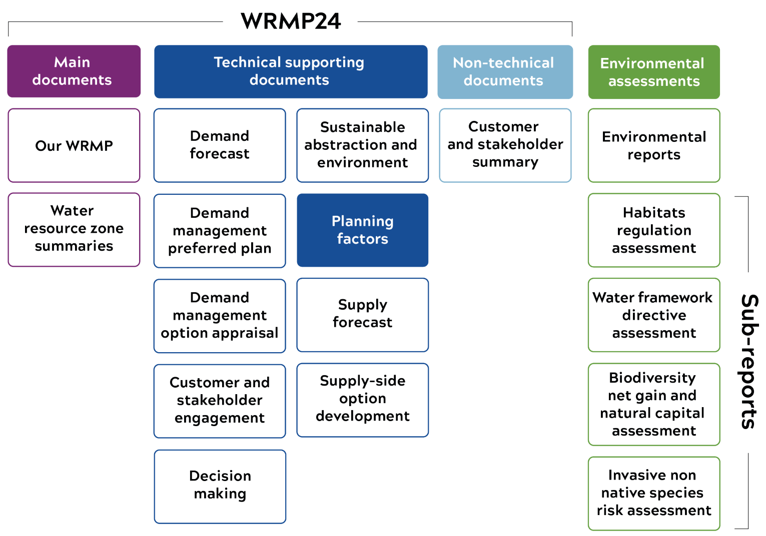
These interactions are highlighted throughout our WRMP24, showing the importance of collaborative planning. For instance, Regional Plans led by Water Resources East (WRE) and Water Resources North (WReN) have been significant in shaping our investment priorities and requirements, with WRE demonstrating the valve of the strategic regional options (SROs) at the regional, multi-sectoral level.

Our WRMP24 has helped shape our company investment strategy for the Price Review (PR24), as well as our Long Term Delivery Strategy. We have also maintained close links with the Drainage Wastewater Management Plan and our Drought Plan.

1.8 Guide to our WRMP24 submission

Our submission comprises a non-technical customer and stakeholder summary, our main report and nine technical supporting documents in Figure 4 below. These technical documents are supported by a suite of independent environmental assessments.

Figure 4 Our WRMP24 reports



This report is concerned with the development of the Planning Factors technical supporting document.

2 Headroom

2.1 Headroom Components

Headroom is a buffer between supply and demand. Actual or available headroom is the amount of water available minus demand. Target headroom is a minimum allowance - considering critical risks and uncertainties - required to maintain levels of services for the supply-demand situation with a given level of confidence. We are managing risk into the medium to long-term through our Adaptive Plan (See WRMP24 Decision making method technical supporting document), and some risks are managed through identification of robust options that cope well with uncertainty; others will be resolved or better understood within the next WRMP planning period, such as finalising our approach to Environmental Destination.

For this WRMP, we have continued to use our bespoke headroom model which was developed for WRMP19. The model allows clear identification of critical uncertainties and easy control of the risk glide-path. We have only included well-defined risks that we quantified and are critical to overall target headroom (tested through sensitivity analysis). Other uncertainties, such as sustainability reductions, were assessed in scenario testing.

Risks in headroom, we have continued to use those from WRMP19, include base year (demand-side) uncertainties; population (growth), consumption and weather-related leakage uncertainty; climate change; long-term point source pollution, and drought water quality constraints.

For WRMP24 we have developed two additional headroom components to account for supply-forecast uncertainty associated with abstraction metering accuracy and the extent of dead water storage (i.e. the proportion of water which cannot be abstracted from our reservoirs).

For our WRMP24 headroom assessment we have added one further component to account for supply-forecast uncertainty associated with the scale of impact of 1:500 drought on our deployable output. All components have been updated for WRMP24 to align with revisions to the supply and demand forecasts, as outlined in their respective reports. Table 1 provides an overview of the headroom components used for WRMP24.

Table 1 Headroom components overview

Type	Component	Description	Impact Distribution
Demand-side	Base-year household	Uncertainty in the base year split of demand components. Distribution derived using water balance MLE adjustment. Varies by WRZ.	Typically +/- 5.0%
	Base-year non-household		Typically +/- 2.7%
	Base-year leakage		Typically +/- 13.1%
	Population growth	Uncertainty in population growth; 5th and 95th percentile UKWIR factors[3], validated by upper and lower growth scenarios produced by Edge Analytics. Varies by WRZ	-11 to +3% by 2049/50
	Per-capita consumption	Uncertainty in household consumption, based on micro-component analysis.	-25 to 0% by 2049/50

3 UKWIR, 2015. WRMP19 Methods - Population, Household Property and Occupancy Forecasting: Guidance Manual. Report Ref. No. 15/WR/02/8. UK Water Industry Research, London.

Type	Component	Description	Impact Distribution
	Non-household forecast	Uncertainty in non-household consumptions, related to economic factors.	+/-1 to 2% by 2049/50
	Weather-related leakage	Uncertainty related to cold weather events that can increase leakage. Based on analysis of the 'Beast from the East' cold weather event of 2018.	+/- 0.4 to 0.7 % by 2049/50
	Climate change	Impact of climate change on demand; 10th and 90th percentile of average UKWIR model factors Extrapolated to 2049-50[4].	+ 0.5 to -0.6% by 2049/50
Supply-side	Long-term point source pollution	Risk to groundwater boreholes of pollution in relation to catastrophic or persistent pollution that cannot be remediated, technically or economically. Varies by WRZ depending on number of and risk to sources.	8% annual probability of loss of one source in region; weighted based on updated CRAGS[5].
	Drought water quality constraints	Risk associated with poorer water constraints quality in lower flow horizons and turbidity impacts in boreholes during a drought.	Impact limited due to other constraints on DO except for up to -2.7 Ml/d (during a 1:500 year drought) in Suffolk West Cambs WRZ
	Abstraction meter accuracy	New component added for WRMP24 to allow for uncertainty in abstraction metering accuracy.	+/-4%, based upon our calibration standard.
	Dead water storage uncertainty	New component added for WRMP24. Variability in the accuracy of reservoir dead water storage on deployable output has been assessed using AQUATOR modelling.	Up to between -1.1 and -1.5 % of deployable output in WRZs with winter storage reservoirs.
	Climate change	Conjunctive impact of climate change on surface and groundwater sources; high and low scenarios. Varies by WRZ depending on source vulnerability.	For WRMP24 we havechosen to exclude headroom climate change impacts from 2039/40 onwards, as this uncertainty component will be addressed via longer-term adaptive planning. Table 2 shows the variability associated with this component in the 2038/39 year.
	1:500 drought uncertainty	Variation in the scale of 1:500 drought. To assess the sensitivity of the selected 1:500 drought, two other droughts have been selected which show coherence across the Anglian Water geography supply area. These are Trace 52, which has a more severe drought than the Trace selected in the core plan, and Trace 208, which is slightly less severe.	See Table 3.

4 From Appendix 6 (Look-Up Tables for Regional Climate Change Water Demand Factors) of UKWIR, 2013. Impact of Climate Change on Water Demand - Main Report. Report Ref. No. 13/CL/04/12. UK Water Industry Research, London
5 Catchment Risk Assessment for Groundwater Sources

Table 2 Headroom components: supply-side climate change (impacted WRZs only)

WRZ	2038-39	
	High impact (Ml/d)	Low impact (Ml/d)
Essex South	-2.85	0.48
Fenland	-4.07	-0.15
Lincolnshire Central	-3.01	0
Ruthamford North	-16.57	8.55
Ruthamford South	-13.56	7.00
Suffolk East	-1.91	0.33
Suffolk West Cambridgeshire	-1.51	0.17

Table 3 Headroom components: supply-side 1:500 drought uncertainty (impacted WRZs only)

WRZ	2049-50	
	High impact (Ml/d)	Low impact (Ml/d)
Essex South	0	+1.45
Fenland	-0.75	+5.85
Ruthamford North	-50.6	+3.69
Ruthamford South	-41.4	+3.02
Suffolk East	-0.7	0
Suffolk West Cambridgeshire	-0.25	0

2.2 Headroom risk glidepaths

Headroom risk glidepaths describe our approach to managing variability within headroom throughout the forecast period. Headroom glidepaths are described in terms of percentiles, with 100% meaning that all the variability within the model output distribution is accounted for in the headroom allowance, and 50% meaning half of the variability within the model is accounted for in the headroom allowance.

In WRMP19, our headroom risk glidepath was reduced over the course of the forecast to ensure that headroom was no greater than 7.5% of baseline DI in AMP8-10 and 6.5% of baseline DI in AMP11.

We have updated our approach for WRMP24 to ensure it reflects the requirement to accept a higher level of risk further into the future as uncertainties become closer to being realised, and the time available to adapt increases.

For WRMP24 we have used a single headroom glidepath profile (as shown in Table 2). It is considered that a single profile is preferable because WRZ characteristics can change over time, and the key factor for headroom glidepaths is to ensure a higher level of risk is accepted further into the future as uncertainties reduce. The glidepath was kept stable at 90% for the first 10 years of the forecast, as this is the period before strategic regional options become deliverable.

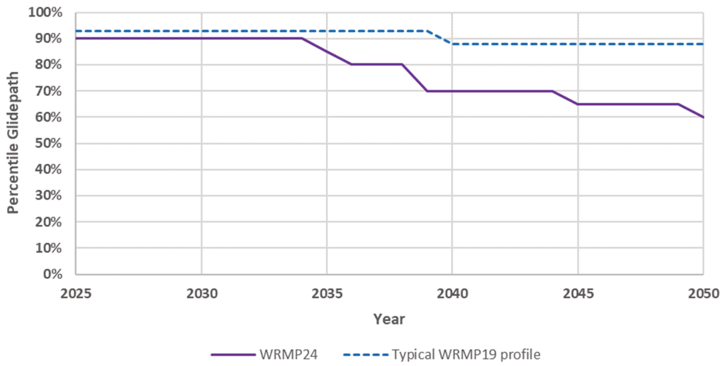
After 2035, our chosen glidepath decreases by a greater amount further into the future than was the case in WRMP19, as longer-term uncertainties will be integrated into our adaptive planning approach.

It should be noted that a decreasing headroom glidepath (or a lower headroom percentage) does not necessarily directly translate into an absolute reduction (or lower) headroom allowance, as some headroom factors such as climate change have temporal elements which mean that their range of variability increases over time, whilst factors such as pollution risk can be very different between WRZs (Table 4).

To further account for the adaptive nature of our plan, especially over longer-term time horizon, we have chosen to remove the climate change element of headroom from the post-2040 forecast as this will be managed through an iterative adaptive planning process as described in the

Decision making method technical supporting document The impact of climate change is also lower once we move to 1 in 500 year drought resilience.

Figure 5



2.3 Headroom allowance

Table 4 Headroom by WRZ at end of AMP8 and end of planning period

WRZ	2029-2030		2049-2050	
	Headroom (Ml/d)	Headroom (% baseline DI)	Headroom (Ml/d)	Headroom (% baseline DI)
Essex Central	0.4	4.0%	0.2	2.3%
Essex South	3.2	5.2%	1.1	1.8%
Fenland	4.2	7.3%	0.7	1.4%
Hartlepool	1.4	5.2%	0.6	2.3%
Lincolnshire Bourne	2.3	5.3%	2.0	4.9%
Lincolnshire Central	7.7	6.0%	4.9	4.1%
Lincolnshire East	7.4	6.9%	6.1	6.4%
Lincolnshire Retford & Gainsborough	0.9	4.4%	0.5	2.7%
Norfolk Aylsham	0.3	6.0%	0.2	5.8%
Norfolk Bradenham	0.3	4.1%	0.3	3.3%
Norfolk East Dereham	0.2	4.6%	0.3	7.2%
Norfolk East Harling	0.2	5.9%	0.1	3.1%
Norfolk Happisburgh	0.2	3.9%	0.1	2.9%
Norfolk Harleston	0.5	5.2%	0.6	8.5%
Norfolk North Coast	0.9	5.9%	0.8	5.5%
Norfolk Norwich & the Broads	3.0	4.3%	2.4	3.8%
Norfolk Wymondham	0.4	4.1%	0.3	3.3%
Ruthamford Central	2.1	2.9%	2.8	3.2%
Ruthamford North	10.4	4.9%	15.6	7.8%
Ruthamford South[6]	8.8	4.6%	12.1	5.0%
Ruthamford West	1.0	4.8%	1.0	5.5%
Suffolk East	3.5	5.2%	2.8	4.4%
Suffolk Ixworth	0.2	4.7%	0.2	4.4%
Suffolk Sudbury	0.4	6.3%	0.3	4.8%
Suffolk Thetford	0.6	6.1%	0.4	4.3%
Suffolk West & Cambs	5.0	8.2%	5.2	9.0%

6 UKWIR, 1995. Outage allowances for water resource planning: Operating methodology. UK Water Industry Research, London

Table 5 Proportion of uncapped headroom from climate change uncertainties

WRZ	% of total target headroom	
	2029-30	2049-50
Essex Central	0.3%	0%
Essex South	25.3%	0%
Fenland	34.3%	0%
Hartlepool	0.1%	0%
Lincolnshire Bourne	0.2%	0%
Lincolnshire Central	13.3%	0%
Lincolnshire East	0.3%	0%
Lincolnshire Retford and Gainsborough	0.3%	0%
Norfolk Aylsham	0.1%	0%
Norfolk Bradenham	0.3%	0%
Norfolk East Dereham	0.5%	0%
Norfolk East Harling	0.3%	0%
Norfolk Happisburgh	0.4%	0%
Norfolk Harleston	0.3%	0%
Norfolk North Coast	0.3%	0%
Norfolk Norwich & the Broads	0.3%	0%
Norfolk Wymondham	0.1%	0%
Ruthamford Central	0.2%	0%
Ruthamford North	33.6%	0%
Ruthamford South	33.7%	0%
Ruthamford West	0.1%	0%
Suffolk East	14.2%	0%
Suffolk Ixworth	0.0%	0%
Suffolk Sudbury	0.1%	0%
Suffolk Thetford	0.1%	0%
Suffolk West & Cambs	7.7%	0%

The uncertainty from climate change and other sources, and the combined uncertainty, is provided in the WRMP Tables. Detailed in Table 5 below are the proportion of headroom that is made up of supply and demand-side climate uncertainties. It is noted that for WRMP24 we have excluded climate change uncertainty from our post 2040 headroom allocation as variability from this year onwards will be managed through our adaptive plan.

Headroom in the critical period scenario was scaled according to the WRZ demand peaking factor (see the WRMP24 Demand forecast technical supporting document). The headroom glidepaths defined for the DYAA scenario were also applied.

Uncertainty in relation to options is described in the WRMP24 Supply-side option development technical supporting document. There is no headroom allowance relating to options at this stage, we will do further sensitivity analysis that also assesses the conjunctive impact of new and existing sources operating together.

Table 6 below shows the proportion of headroom allowance attributed to 1:500 drought uncertainty. As shown, 1:500 drought variability accounts for a large proportion of headroom in the Ruthamford area, and a significantly lower proportion in Suffolk East and Suffolk West & Cambs.

In Essex South and Fenland, the negative headroom values occur because based on the range of uncertainty (see Table 3) and the triangular probability distribution used, the baseline accounts for >65% of the variability (and the 65th percentile glidepath is applied in 2049/50).

Table 6 Proportion of headroom from 1:500 drought uncertainty

WRZ	% of target headroom (2049-50)
Essex South	-13%
Fenland	-68%
Ruthamford North	60%
Ruthamford South	61%
Suffolk East	8%
Suffolk West Cambridgeshire	2%

Headroom in the critical period scenario was scaled according to the WRZ demand peaking factor (see the WRMP24 Demand forecast technical supporting document). The headroom glidepaths defined for the DYAA scenario were also applied.

Uncertainty in relation to options is described in the WRMP24 Supply-Side option development technical supporting document. There is no headroom allowance relating to options at this stage. However, many of the options have been assessed for their DO benefit in severe and extreme drought scenarios, in addition to low and high climate change.

2.4 Headroom scenarios and sensitivity testing

For our adaptive planning scenarios (as described in the WRMP24 Decision making method technical supporting document), we have avoided the double counting of headroom uncertainty. For example, where plans have been stress-tested to high and low climate change scenarios, we have omitted the climate change elements in the associated headroom dataset used within the modelling.

Table 7 shows the changes made to the headroom forecast for each of the 'common reference scenarios', as set out in Ofwat's [7].

Table 7 Changes to headroom forecast for sensitivity testing and adaptive planning

Ofwat Common Reference Scenario	Change to headroom forecast
High demand	Exclude growth
Low demand	
High climate change	Exclude climate change
Low climate change	
Faster technology	No change
Slower technology	
High abstraction reductions	
Low abstraction reductions	
Benign (all benign scenarios combined)	Exclude growth and climate change
Adverse (all adverse scenarios combined)	

7 Long Term Delivery Strategies guidanceUKWIR, 2016. WRMP 2019 Methods - Risk Based Planning. Report Ref. No. 16/WR/02/11. UK Water Industry Research, London

3 Outage

3.1 Outage

Outage describes an allowance of water which represents the risk of short-term (less than 6 months) supply-side failure. This may be caused for example by pollution incidents or an unexpected need to repair a water treatment works. Such incidents rarely affect the amount of water available to go into supply because of spare capacity (redundancy) in resources and treatment. Short supply interruptions are further minimised by short-term storage in the distribution network. We have built resilience into our system through our dual source of supply resilience programme. More local failures, typically associated with bursts in pipes, are not considered as part of outage and are subject to separate investment drivers.

3.2 Outage forecast

WRMP24 Outage approach

For WRMP24, our outage assessment has followed a similar approach to WRMP19. This is based on the principles set out in the Outage Allowances guidance [8], whereby the distributions for each outage type and location are developed, describing duration and magnitude, and are then combined using 'Monte Carlo' simulation. This is consistent with the Basic 'reference' method described in the UKWIR Risk-Based planning guidance [9].

Outage is evaluated in relation to asset failure rates and resource failures due to pollution.

We have updated our approach to asset failure outage modelling for WRMP24 as we now have an enhanced dataset of historical outage events, which has been developed to provide evidence for monitoring against Ofwats' unplanned outage Outcome Delivery Incentive. This dataset improves on previously available data by including partial outage events, and events of less than 24 hours in duration. The dataset also includes outages which were caused by water quality events (other than point-source). At the time of writing, the dataset covers four full years of events. We have used the dataset to analyse and update the outage distributions which feed into our 'Monte Carlo' simulation.

The analysis demonstrated that asset failure related partial outage events can have reduced peak deployable output, without impacting on DYAA deployable output. As such, we have adjusted our outage model to differentiate between DYAA and DYCP in the maximum asset failure related outage component.

Planned outage and drought

We did not include planned outage in our forecast, but have adopted the 95th percentile of (unplanned) outage as a precautionary approach.

This decision is justified considering the three characteristic types of planned outage in turn:

1. Large outage schemes (e.g. taking a strategic asset out of supply). Major infrastructure projects such as these would be planned in advance within our 5-year business plan. We have no schemes of this scale in AMP8, so have not included an allowance for such outages.
2. Routine capital maintenance. These projects may have some longer term in-AMP planning, but are typically planned within a single year. The scheduling of such maintenance projects follows a situational risk-based decision making approach, considering the potential for impacts on customer supplies. Planned maintenance is typically scheduled for the lower demand winter period, where any impact of lost deployable output is minimised.
3. Routine capital maintenance of surface water abstraction systems. Planned maintenance in surface water abstraction systems could potentially affect the longer term water supply. For example, if planned outages during the winter period meant that reservoir storage during a period of increased demand was reduced. This would be particularly sensitive in a potential drought situation. We consider planned outages of this type as part of our drought management activities. Planned outages are incorporated into our more detailed reservoir forecasts as part of bi-annual prospects modelling which inform drought

8 UKWIR, 1995. Outage allowances for water resource planning: Operating methodology. UK Water Industry Research, London
9 UKWIR, 2016. WRMP 2019 Methods- Risk Base Planning. Report Ref. No. 16/WR/02/11. UK Water Industry Research, London

management decisions. A decision to schedule planned outage activities during drought management would be informed by a range of factors such as the scale and criticality of the activity and situation forecast.

We believe this position on planned outage should also be reflected in the Supply Demand Balance Index calculation which we undertake annually and report to the Environment Agency.

Outage components

The inputs to the outage modelling are described in Table 8. Pollution impacts on water quality are split into surface and groundwater risks. For WRMP24, we have updated the assessment for groundwater risks based on updated version of our Catchment Risk Assessment for Groundwater Sources (CRAGS). We have also revised the impact on deployable output and frequency of occurrence of events, following a review of historical events using the unplanned outage ODI dataset.

For WRMP24 we have added an additional component which accounts for water quality related outages of our surface water abstraction system. We have used available historical records of water quality impacts to raw water abstraction in Ruthamford (covering Rutland, Grafham and Pitsford Reservoirs), and also Covenham Reservoir. These historical distributions were averaged and integrated into Aquator Deployable Output modelling in order to create estimates of potential lost deployable output at water resource zone level against our WRMP24 baseline deployable output. The approach has been based on best available data at the time, and we intend to refine this outage component further as part of WRMP29.

Table 8 Outage components

Component	Description	Impact distribution
Point source pollution (groundwater)	Transient pollution event or where source can be effectively remediated. Also includes other raw water quality issues, such as blending requirements and weather-related turbidity. Varies by WRZ depending on number of sources.	2.4% reduction in source-works DO with a probability of occurring two times per year across all groundwater source-works in region; weighted based on updated CRAGS
Point source pollution (surface water - direct intake)	Transient pollution event or where source can be effectively remediated. Also includes other raw water quality issues, such as blending requirements and weather-related turbidity. Varies by WRZ depending on number of sources.	1% reduction in source-works DO with a probability of occurring 6.75 times per year across direct intake surface water source-works in region; weighted based on updated CRAGS
Point source pollution (surface water - winter storage reservoir systems)	Reduction in deployable output due to water quality related disruption to surface water abstraction for winter storage reservoirs in Ruthamford North, Ruthamford South, and Lincolnshire East.	LNE: up to 1.8% reduction in DO against baseline. RTN: up to 2.2% reduction in DO against baseline. RTS: up to 3.3 % reduction in DO against baseline.
Asset failure	Temporary breakdown in equipment at an intake, borehole or source-works that prevents source-works running at full capacity.	**% of source-works DO:** Minimum: 1 % Most likely 1.5% Maximum: 2% (DYAA), 2.5% (DYCP)

Outage is 0.9% of DO on average in DYAA, and 0.7% in DYCP, across the company.

Outage is recorded in the WRMP tables, and is summarised in Table 9 below.

Table 9 Outage by WRZ in the first forecast year

WRZ	2025-26 DYAA		2025-26 DYCP	
	Outage (Ml/d)	Outage (% of DO)	Outage (Ml/d)	Outage (% of DO)
Essex Central	0.06	0.6%	0.10	0.6%
Essex South	0.38	0.6%	0.52	0.6%
Fenland	0.72	1.5%	1.01	1.50%
Hartlepool	0.23	0.6%	0.29	0.6%
Lincolnshire Bourne	0.27	0.6%	0.37	0.7%
Lincolnshire Central	2.13	1.5%	2.85	1.2%
Lincolnshire East	2.84	1.9%	1.39	0.8%
Lincolnshire Retford and Gainsborough	0.14	0.6%	0.16	0.6%
Norfolk Aylsham	0.03	0.6%	0.04	0.6%
Norfolk Bradenham	0.05	0.6%	0.09	0.6%
Norfolk East Dereham	0.04	0.7%	0.05	0.6%
Norfolk East Harling	0.03	0.6%	0.06	0.6%
Norfolk Happisburgh*	N/A*	N/A*	N/A*	N/A*
Norfolk Harleston	0.05	0.6%	0.09	0.6%
Norfolk North Coast	0.11	0.6%	0.16	0.6%
Norfolk Norwich & the Broads	0.63	0.8%	0.94	0.8%
Norfolk Wymondham	0.07	0.6%	0.08	0.6%
Ruthamford Central*	N/A*	N/A*	N/A*	N/A*
Ruthamford North	6.66	2.1%	2.18	0.6%
Ruthamford South	7.58	3.00%	1.42	0.4%
Ruthamford West*	N/A*	N/A*	N/A*	N/A*
Suffolk East	0.41	0.6%	0.63	0.7%
Suffolk Ixworth	0.02	0.5%	0.06	0.7%
Suffolk Sudbury	0.06	0.6%	0.09	0.7%
Suffolk Thetford	0.07	0.7%	0.12	0.7%
Suffolk West & Cambs	0.49	0.9%	0.72	0.9%

Nb. Table 9 WRZs with an Asterix next to name (Norfolk Happisburgh, Ruthamford Central and Ruthamford West) have no deployable output and are supplied from adjacent zones.

3.3 Outage and WRMP24 options

Two of our WRMP24 feasible options involve investment to make direct intake surface water treatment resilient to variable and often poor water quality. These are RTS21 which ensures reliability of Clapham WTW (abstracts from the River Great Ouse), and LNC30, which ensues reliability of Hall WTW, (abstracts from the River Trent). Further detail of the investment included in these options is provided in the WRMP24 Supply-side option development technical supporting document.

The reliable deployable output from these treatment works has been reduced as part of the baseline supply forecast (see WRMP24 Supply forecast technical supporting document, section 4.7 for further details).

To avoid double counting of the baseline reliability of these works within the outage and supply forecasts, historical outages events associated with Hall and Clapham WTW have been modelled against their current reliable deployable output, rather than their historical WRMP19 deployable output.

Abstraction and DO are likely to remain fairly constant over the planning period (albeit with less groundwater and more surface water and alternatives). Further analysis of and how outage may change as a result of our changing supply composition will be carried out as part of WRMP29.

3.4 Future development of outage forecasting

For WRMP29 we intend to carry out further improvements to our Outage forecasting. As our historical outage dataset expands, we plan to further explore ways to improve the assessment and estimation of outage through system based modelling using PyWR and AQUATOR. This would involve running outage likelihoods and magnitudes in system simulation and potentially under a range of alternative scenarios. This would enable our outage forecast to capture the effect of WTWs dynamically responding to outage events, for example, where WTWs operate under shared group licences.

Furthermore, we plan to carry out further work on forecasting surface water reservoir abstraction outage. We have improved our recording of historical outage at our surface water abstractions, and as this dataset continues to grow, we will be able to integrate it into our system modelling to better understand the potential effect on deployable output under future scenarios.

4 Planning horizon

The principal planning horizon for our WRMP24 is the statutory minimum 2025-50 period. This decision has is due to modelling complexity. With 27 WRZs and over 200 options, carrying out a full options optimisation over a 50-year horizon to 2075 for all modelling runs would make run times too long to enable our Best Value Decision Making process to be carried out efficiently.

Despite this, our EBSD modelling algorithm does incorporate two-time horizons, which allows the longer term economic impact of options to be factored into the 25 year option optimization period, these are:

1. The typical 25 year EBSD time horizon where investments decisions are made to satisfy the supply-demand balance,
2. A second 80 year time-horizon to fully consider the financial implications of choices in the first time-horizon.

Costs are accounted over both time periods, whilst water demands are constant over the second time horizon, i.e. they are maintained at 2049/50 values. This means that although options are not selected to satisfy an 80 year supply-demand planning horizon, the long term capital and operating costs of the options selected between 2025 and 2050 are factored into the optimisation.

In addition, sensitivity tests have been carried out for key parts of the plan to understand the implication if a 2025-2075 optimisation time horizon was to be used. These are set out in the WRMP24 Decision making method technical supporting document, and did not show a significant impact to option selection.

love every drop
anglianwater

THE QUEEN'S AWARDS FOR ENTERPRISE: SUSTAINABLE DEVELOPMENT 2020

Anglian Water Services Limited

Lancaster House
Lancaster Way
Ermine Business Park
Huntingdon
Cambridgeshire
PE29 6XU

anglianwater.co.uk