South West Water

Our draft
Water Resources
Management Plan

5: Forecasting Our Supply Requirements

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5. Forecasting our supply

Document purpose

This chapter sets out our approach to forecasting our available supply. It presents our base-year and long-term forecasts for dry year annual average (DYAA) for all our WRZs and for the dry year critical period (DYCP) scenario for Bournemouth WRZ.

We explain how we have reconciled our forecasts with our previous ones and discuss the assumptions and the uncertainties associated with our forecasts.

Summary

Our approach to supply forecasting has assessed:

- The resilience of our water resources system to severe droughts; we must now be resilient to a 1 in 500 year drought by 2039, which is a step-change from the current 1 in 200 yr resilience in WRMP19.
- We have looked at the physical and operational constraints of our supply system, assessing how much water we can abstract and move water to where it is needed.
- How the changes from new development and new infrastructure impacts on availability of supply.
- Changes to our abstraction licenses
- Meeting our environmental objectives and providing long-term environmentally sustainable abstractions.
- The potential impacts of climate change.

Our supply modelling approach has been improved since WRMP19:

- We have used stochastically generated data to allow us to estimate the impacts of 1 in 500 year droughts.
- We have improved our methodology for estimating the impact of climate change and updated to the newest projections from UKCP18.
- We have developed rainfall runoff models to allow us to translate meteorological forecasts of the impact of severe droughts and climate change into the river flow and reservoir inflow data that we need to model our supply system response to these events.

The baseline deployable output before reductions has changed marginally from WRMP19. These changes are due to moving to a 1 in 500 yr drought resilience and other minor changes to infrastructure. Roadford and Wimbleball have reduced slightly < 2% change. Wimbleball has reduced by 11% since WRMP19.

We then undertook the following steps:

- Considered **raw water losses**, treatment **process losses** and **operational use** for each water resource zone.
- **Climate change vulnerability assessment**: As part of the West Country Water Resource Group (WCWRG) Regional Plan, HR Wallingford undertook the climate change vulnerability assessment. We have taken a consistent approach to climate change across the region and have therefore adopted a Tier 3 High vulnerability assessment across our WRZs.
  The impact of climate change on DO and WAFU by 2049/50 for the Medium emissions scenario (RCP6.0) vary from a reduction of 59 MLD in Bournemouth, to a reduction of circa 12 MLD in Colliford and Roadford and 6 MLD in Wimbleball.
- Completed an **outage assessment**.

Our final Water Available for Use (WAFU) for each WRZ in the base-year (2020/21) has changed marginally in all WRZs. There have been minor decreases in Roadford, Colliford, Wimbleball, from -2%, -3% and -5% changes in MLD for the Dry year annual average. For the DYCP for Bournemouth there is no change because this is still constrained by infrastructure (including treatment). The other changes are largely due to the increased 1 in 500 drought resilience.

1 Our approach to forecasting our supply

We have had regular engagement with the Environment Agency while developing our supply forecast, and it has been developed in accordance with their guidelines and other industry standard guidance.

We have assessed our ability to supply wholesome water against several different pressures:

- **The resilience of our water resources systems to severe droughts**. For WRMP19 and WRMP24 we have assessed our resilience to an estimate of what more severe droughts (than have occurred historically) might look like. For WRMP19 we planned to a 1 in 200 year drought and undertook analysis to consider our resilience to 1 in 500 year droughts. In this Plan we have planned to be resilient to a 1 in 500-year drought from 2039.
- **The current constraints in our supply system.** These include abstraction licence limits, the capacity of our infrastructure, the ability to move water to where it is needed within our area of operations and to transfer to and from other companies
- **Changes arising from development and new infrastructure**
- **Changes to our abstraction licences** to sustain supplies while **meeting our environmental objectives**
- Any issues arising from **pollution or contamination** of our sources
- **Potential future impacts from climate change.**

We have developed supply forecasts for the dry year annual average (DYAA) for the South West Water (SWW) supply area (Colliford, Roadford and Wimbleball WRZs), and for both the dry year annual average (DYAA) and the dry year critical period (DYCP) for our Bournemouth WRZ. Our base year is 2020/21 and we have developed forecasts out to 2049/50.

1.1 Links to our Drought Plan

This draft WRMP24 is influenced by and linked to many other plans and policy requirements. It is closely linked with our Drought Plan, which sets out how we will operate our systems during a drought. For example, long-term storage drawdowns for each of our strategic reservoirs were generated from historic river flows for our Drought Plan and in that plan we also considered the resilience of our water resources systems to a drought that is more severe than our worst historic drought.

In this draft WRMP24, we have determined our deployable outputs such that our system is resilient to a 0.2% annual chance of failure caused by a drought, using the supplementary guidance '*Planning to be resilient to a 1 in 500 drought (England)*' and to the supplementary guidance '*Stochastics*'.

To better understand the resilience of our water supply system, we have also analysed how our water resources might be affected by droughts outside of the historical record. We call these 'stochastic droughts' because they have been extracted from the stochastic drought datasets provided by Atkins (see Section 1.2.1). We have incorporated these into our MISER modelling to test the flexibility and resilience of our systems to these more extreme droughts.

We have assessed the return periods of historical and stochastic droughts following the methods described in the HR Wallingford guidance reports ('West Country Water Resource Group deployable output support – summary report', December 2021).

Through Summer 2022 we have been affected by an exceptional combination of low rainfall, record temperatures and related record demand as outlined in Annex 1.1. This experience has generated new data on the impacts of drought and we will reflect this learning further in our final WRMP24. We are also looking to implement supply actions from our drought plan as well as developing new engineering schemes which, while not yet constructed, will alter our base water-resource position when complete. We will reflect these changes within our final WRMP24 and set them out within our Statement of Response.

1.2 Baseline supply forecasting

The baseline supply forecast is made up of several components:

- The deployable output for each source, or group of sources
- Existing transfers and schemes where funding is already in place
- An allowance for outage
- Operational use of water and/or loss of water through the abstraction and treatment processes
- A supply forecast that combines all the elements described into WAFU

- Future changes that we are aware of that might affect any of these.

We forecast each of these components for our chosen base year, 2020/21. We consolidate the component forecasts to develop the baseline supply forecast.

While developing the baseline forecasts, we account for delivered and planned AMP7 supply interventions on the base year forecast. Future interventions for any supply-side drought or resilience measures beyond the base year, where funding or regulatory approvals are not already in place, are included as options within the supply-side options assessment process.

We do not currently supply any non-potable water but will continue to consider options for its appropriate use in the future.

1.2.1 Deployable output (DO)

The DO is the output of a commissioned source or group of sources for the chosen design drought as constrained by several different factors. We have included all these constraints in our calculations: hydrological yield; licensed quantities and constraints; key pumping equipment; well/aquifer properties; raw water main capacities; key treatment and transfer capacities and constraints; and water quality. It does not, however, include any demand or supply drought management measures such as temporary use bans (TUBs), non-essential use bans (NEUBs) drought permits or supply-side drought orders.

The calculations for each constraint have been undertaken in line with the UKWIR (2014) source yield handbook and the UKWIR (2016) risk-based planning guidance. The emergency storage requirements are calculated in line with the UKWIR (2012) Project WR27 and the UKWIR (2017) Handbook.

1.2.2 Development and infrastructure changes

We have accounted for significant development and infrastructure changes in our water supply forecast, e.g., our upgrades to the Alderney and Knapp Mill water treatment works in the Bournemouth WRZ, which will reduce treatment losses.

Further changes may be identified between the draft and final WRMP resulting from additional infrastructure constructed to support our 2022 drought response. Because we do not have a confirmed position of these resources for our dWRMP they are not included in our baseline supply forecast but we have included scenario tests in Chapter 7 to explore how our options programmes may change depending on delivery of our Drought and Resilience Programme.

1.2.3 Abstraction and the environment

We have considered the River Basin Management Plans in our assessment of future abstractions. We also account for how our environmental obligations and our environmental objectives will impact on abstractions and the associated licensing requirements.

1.2.4 Water transfers

There are small potable water transfers both between our WRZs and between SWW and its neighbouring water companies, which are presented in Section 2.6. We have agreed the assumed transfer volumes with Wessex Water, but these transfers are very small and do not materially affect our Water available for Use (WAFU). There are no raw water transfers and therefore there is no impact on any receiving area in terms of water quality.

1.2.5 Outage

Our outage allowance has been calculated using the 1995 UKWIR methodology. The outage assessment was undertaken by AECOM in their report ('South West Water Water Resources Plan 2024 Outage Assessment Report', September 2022) and is explained in Section 5.

1.2.6 Water Losses

We account for raw water losses, treatment process losses and operational use within each WRZ and these are deducted from our source DO to determine the WAFU as outlined in Section 3.5.

1.3 Changes in approach since WRMP19

We have used the latest available data in our analysis. Our process and data sources have not fundamentally changed since WRMP19 for our initial reference analysis of DO for the worst historic drought. However, the methodology and data sources have changed with regard to 1 in 500 year droughts and climate change analysis.

For the draft WRMP24

- We have used stochastically generated data to allow us to estimate the impacts of 1 in 500 year droughts.
- We have improved our methodology for estimating the impact of climate change and updated to the newest projections from UKCP18.
- We have developed rainfall runoff models to allow us to translate meteorological forecasts of the impact of severe droughts and climate change into the river flow and reservoir inflow data that we need to model our supply system response to these events.

1.4 Planning scenarios

We have produced forecasts for supply and demand as follows:

- SWW WRZs – dry year annual average (DYAA)
- Bournemouth WRZ – dry year annual average (DYAA) and dry year critical period (DYCP)

In the SWW supply area, none of our three WRZs is solely dependent on groundwater, river abstractions or limited by storage. These WRZs have substantial volumes of raw water stored in reservoirs and hence are not particularly sensitive to peak demand, but our modelling of the water resource system for the DYAA scenarios implicitly considers these peaks. The DYAA is therefore considered the appropriate planning forecast.

In contrast, the Bournemouth WRZ is dependent on river abstraction and has limited storage. Because there is limited storage, the period when supply and/or demand constraints will be experienced is the peak demand period which coincides with the lowest flow period. Hence it is more appropriate to use the DYCP forecast for this WRZ. A DYAA forecast has however also been produced as per the WRPG.

1.5 Drinking water quality

Our drinking water is of a high quality and meets the standards of the Drinking Water Directive. We comply with all legislation concerning the water quality of publicly supplied water including Section 68(i) and Section 86 of the Water Industry Act 1991 and Water Supply (Water Quality) Regulations 2000.

To safeguard our resources, our Plan supports the objectives for drinking water protected areas. We have developed our Plan in accordance with our overall Business Plan to meet our statutory drinking water obligations in full and ensure alignment across our work areas.

As part of ensuring long-term protection and sustainability of our drinking water quality, we have identified all our sources and applied a consistent approach across all WRZs to protect and improve the quality of our drinking water supplies. This includes how we intend to prevent any potential deterioration of water quality and reduce losses where possible. For example, we have installed a new reservoir mixer in our Wistlandpound Reservoir in North Devon and a new carbon dosing system at the upstream water treatment works, to reduce the risk of taste and odour issues. We are also undertaking investigations in the reservoir catchment area to understand what is causing these water quality issues in the reservoir. This is part of our wider Upstream Thinking initiative which is described below.

In our SWW supply area, our Upstream Thinking initiative encourages and supports a catchment management approach by tackling water pollution at the source through working with farmers and landowners in upstream areas of our water sources. This initiative also helps deliver the Water Framework Directive (WFD) objectives for our watercourses and groundwater bodies.

In our Bournemouth WRZ, we have carried out detailed investigations as part of the National Environment Programme (NEP) to identify the factors contributing to the risk of *Cryptosporidium* at a groundwater source. This has highlighted land use activities within Groundwater Protection Zones as the most likely contributors, and we are developing a strategy to mitigate the risk from farming activities and domestic wastewater systems.

Further guidance is provided in 'Long term planning for the quality of drinking water supplies – water resources and sufficiency of supplies'. [1]

[1] https://dwi-content.s3.eu-west-2.amazonaws.com/wp-content/uploads/2022/09/15114509/Long-term-planning-guidance-for-drinking-water-quality_Sept-2022.pdf

2 Our deployable output assessment

Our deployable output assessment has a technical Appendix 5.2 which provides additional details on how we have undertaken our assessment.

2.1 Water resource modelling

We use a water network model, developed in the MISER software, to calculate our DO for the SWW and supply areas. The model is a key tool for analysing and planning water resources availability and is used for both short-term operational and long-term strategic decision-making. Our modelling approach is consistent with that used for our Drought Plan and our operational planning.

Our MISER model is complex, representing both our raw water systems and our treated water system and distribution network to demand-zone level. It includes all our reservoirs; river abstraction points; groundwater sources; the links between these sources; the links between sources and Water Treatment Works (WTWs); pumped storage schemes; and our fisheries enhancement schemes. All our WTWs are included, as well as the treated water distribution network and the links between our water-demand zones. The model includes over 1,200 elements and allows us to fully represent our conjunctive use system.

We use specific demand patterns within the distribution network in our model to ensure that we simulate a representative demand for water in each of our WRZs across the year. These demand patterns account for increased water use due to tourism and warm dry weather during summer months, and other factors.

We also ensure our model reflects how we operate our system in practice to mitigate water quality issues. For example, when the River Exe is in spate after heavy rainfall we need to stop abstracting for the Wimbleball pumped storage scheme due to quality concerns, until the spate has passed. We model this by setting up the model to cease abstraction at flows above a specified rate. This rate has been determined through experience of operating this intake and the relationship between river flow and water quality.

At other river abstraction sites, where experience has shown that quality concerns prevent us from abstracting the daily licensed quantity throughout the year, we can set the model up so that it cannot abstract the full daily licensed volume. Setting up the water resources model in this way, to make allowance for abstraction constraints due to water quality concerns, ensures that the model best reflects our operational practice.

In our Bournemouth WRZ, our water supply is predominantly derived from two river systems and there are no impounding reservoirs. The planning constraint within the zone is the ability of the system to meet peak demands, so we therefore use a less complex modelling approach which compares peak demand to the output available in a spreadsheet mass balance model.

2.1.1 Defining our design 1 in 500 year drought

For our SWW supply area, we have calculated our dry year annual average DO for each WRZ using historically recorded flow series for the period of 1957 to 2021 for Wimbleball and Roadford WRZs and 1962 to 2021 for the Colliford WRZ. These are the earliest periods that have reliable flow records. They include several different types of historic droughts such as 1975/76 (multi-season drought), 1959, 1978, 1984, 1989 and 1995 (single season droughts).

For our Bournemouth WRZ, we have calculated both our dry year annual average DO and dry year critical period DO using reliable historically recorded river flows for the period of 1973 to 2021, which includes the historic drought 1975/76. Within our WRMP14, a river flow analysis using hindcast flow series back to 1883 was undertaken in order to determine the severity of historic droughts, including the 1934 drought. This analysis confirmed that the 1975/76 drought was the most severe historical drought experienced in Bournemouth WRZ.

The DO analysis for the worst drought in the historical flow record is a reference point we use to then define the design 1 in 500 events. We have considered stochastic drought datasets to identify droughts more severe than the worst historical event as described below:

- **Used a library of 400 spatially coherent stochastic rainfall time series** ('Regional Climate Data Tools Final Report', July 2020). This data was provided as part of a West Country Water Resources group project undertaken by Atkins. The purpose of these time series was to allow us to better estimate what a 1 in 500 year drought event might look like.
- **Analysed how rainfall might impact on river flows.** We developed rainfall-runoff models to understand how the stochastic rainfall and evaporation time series data would translate to river flows – which are the key input in our MISER model.

- **We identified a range of drought years to simulate a 1 in 500 year drought.** From the 400 stochastically generated flow sequences, we identified events which closely aligned to a 1 in 500 drought event across each WRZ to create a drought library.
- **Used the outputs of our analysis to inform impacts on supply for a 1 in 500 year drought**. We modelled the performance of our supply system in these estimated 1 in 500 year drought events and calculated our DO in each WRZ to understand whether we had a supply demand deficit.

2.2 DO assumptions for the Colliford WRZ

- **Colliford WRZ Emergency Storage:** There are no significant changes to the value for total emergency storage in the Colliford WRZ from WRMP19. Our current emergency storage in Colliford Reservoir is 2,854 Ml and the for the WRZ reservoir group is 4,473 Ml.
- **Water Transfer:** Our water resources model incorporates the small treated-water export from Colliford WRZ to Roadford WRZ in the Bude area, and the treated water import from Roadford WRZ to Colliford WRZ in the Saltash area
- **Colliford Fisheries Bank:** We have made an allowance for releases from the Colliford fisheries bank in accordance with the provisions of the Colliford WRZ Operating Agreement
- **Constraint on DO:** The Colliford WRZ DO is determined by abstraction licence and infrastructure, including treatment. The planning scenario is the dry year annual average.

2.3 DO assumptions for the Roadford WRZ

- **Roadford WRZ Emergency Storage:** There are no significant changes to the value for total emergency storage in the Roadford WRZ from WRMP19. Our current emergency storage in Roadford Reservoir is 5,370 Ml and for the WRZ reservoir group is 7,581 Ml.
- **Water Transfer:** Our water resources model incorporates the imports and exports below:
    - Saltash treated water transfer from Roadford WRZ to Colliford WRZ
    - Exeter to South Devon treated water transfer (from Wimbleball WRZ to Roadford WRZ)
    - Tiverton and Exeter to North Devon treated water transfers (from Wimbleball WRZ to Roadford WRZ)
- **Roadford Fisheries Bank:** We have made an allowance in these calculations for releases from the Roadford fisheries bank in accordance with the provisions of the Roadford WRZ Operating Agreement.
- **Constraint on DO:** The Roadford WRZ DO is determined by water available and infrastructure constraints, including treatment. The planning scenario used is dry year annual average.

2.4 DO assumptions for the Wimbleball WRZ

- **Wimbleball Reservoir Emergency Storage:** There are no significant changes to the value for total emergency storage in the Wimbleball WRZ fromWRMP19. Our current emergency storage in Wimbleball Reservoir is 2,132 Ml .
- **Conjunctive use of Groundwater Sources in the Wimbleball WRZ:** Our MISER water resources model uses monthly DO profiles for the groundwater sources which were updated in 2017 and are being updated in 2022. This approach has been supported by the Environment Agency for all Water Resources Management Plans since1999.
- **Water Transfer:** Our water resources model incorporates the imports and exports below:
    - Wessex Water abstractions from Wimbleball Reservoir for direct piped transfer
    - Exeter to South Devon treated water transfer (from Wimbleball WRZ to Roadford WRZ)
    - Tiverton and Exeter to North Devon treated water transfers (from Wimbleball WRZ to Roadford WRZ)
    - Small exports of treated water to Wessex Water
- **Wimbleball Fisheries and Conservation Water Bank:** We have made an allowance in these calculations for releases from the Wimbleball fisheries and conservation water bank in accordance with Clause 22 on licence number 14/45/02/2388.
- **Constraint on DO:** The Wimbleball WRZ DO is determined by water available and infrastructure constraints, including treatment. The planning scenario is dry year annual average.

2.5 DO assumptions for the Bournemouth WRZ

- **Water Transfer:** The Bournemouth WRZ has a strategic link with Wessex Water. However, this scheme is used to provide mutual resilience and there is zero Ml/d impact in terms of WAFU for either the Bournemouth WRZ or Wessex Water. This transfer option is therefore not included within the supply-demand balance. The previous transfer of up 1.27 Ml/d to Wessex Water has now been discontinued, so is no longer included in our forecasts after the base year. No other major infrastructure exists connecting our Bournemouth WRZ to any of the other water companies to which it borders.
- **Constraint on DO:** The Bournemouth WRZ DO for the dry year critical period is determined by infrastructure constraints including treatment. The critical period is defined by a peak week at the end of July. We also produce a dry year annual average scenario as per the WRPG.

2.6 Imports and exports

The SWW supply area has a very low number of exports due to the geographical constraints around most of our WRZs. Our main neighbouring company is Wessex Water and we provide a potable water export from our Wimbleball WRZ of 0.04 Ml/d. We also have several transfers between our SWW WRZs as outlined in Table 1.

Export WRZ	Import WRZ	Transfer Ml/d
Wimbleball	Wessex Water	0.04
Wimbleball	Roadford	0.42
Roadford	Colliford	2.65
Colliford	Roadford	0.10

Table 1 Overview of SWW WRZ and company transfers

2.7 Our baseline deployable output before reductions

Our baseline DOs for all our WRZs are presented in the dWRMP table 3. Table 2 below provides a summary of these baseline DOs for 2024/25 for each WRZ. The figures include sustainability reductions that came into effect before the end of 2024/25 or have already been agreed, but do not include any other reductions to the baseline DO.

Baseline DO in 2020/21 (Ml/d)	Bournemouth (DYCP)	Colliford (DYAA)	Roadford (DYAA)	Wimbleball (DYAA)
WRMP19	249.32	166.68	253.54	104.25
WRMP24	249.78	165.68	249.33	92.46
% change from WRMP19	+ 0.2%	-0.5%	-2%	-11%

Table 2: Draft WRMP24 Baseline DOs (Baseline Profile Without Reductions) for the 2020/21 Base Year for Each WRZ

The differences in the baseline DOs in the SWW supply area WRZs between WRMP19 and draft WRMP24 are mainly due to moving from a 1 in 200 year level of resilience to a 1 in 500 year level of resilience, as well as from reviewing the constraints within our water resources and treatment system. These have resulted in slight decreases in the baseline DO in Colliford and Roadford WRZs and a larger decrease in baseline DO in our Wimbleball WRZ.

3 Future abstraction changes to deployable output

3.1 Abstraction licence changes and renewals

The time-limited abstraction licences for our Park Lake and Stannon Lake sources, in the Colliford WRZ, are due for renewal in 2028. It has been assumed that both licences with be renewed. Both sources are subject to a programme of investigation into their environmental impact, which will inform the renewal process. Significant environmental monitoring and analysis has already taken place and is ongoing.

In the Wimbleball WRZ, two key groundwater time-limited licences covering six boreholes in the Otter Valley were renewed in 2017. The licences, along with a third licence in the same area, are due to be renewed again in 2025.

We are also working with the Environment Agency to identify the environmental impact of all current SWW abstractions in the Otter Valley and identifying the best licensing strategy to ensure compliance with River Basin Management Plan objectives including achieving Good Ecological Status by 2027.

In the Bournemouth WRZ a new licence for our abstraction at Longham came into effect on 1st April 2016. This includes a time-limited licence condition which takes effect in 2028 and will reduce the permitted abstraction. As this change is written into the licence already, we have included the impact of this reduction on our deployable output in our baseline supply forecasts

Our abstraction licence on the De Lank River will change as the result of a Water Industry National Environment Programme (WINEP) investigation into the risk of deterioration in the downstream waterbody from operating to the current licence conditions. Stricter licence conditions are proposed, and these will reduce our DO in Colliford WRZ during AMP8. We are currently expecting these licence changes to come into effect in 2028. See Section 3.2 for more information on WINEP and sustainable abstractions.

3.2 Sustainable abstraction

Through the WINEP, the Environment Agency has provided guidance and set expectations on the actions needed to contribute towards meeting environmental obligations.

Our WINEP19 consisted of investigations and improvements to existing SWW licences with delivery throughout the AMP7 (2020-25) period. Investigations have or are in the process of clarifying how our resources and their licensed use may affect the natural environment and whether any changes are required to ensure sustainable abstraction for public water supply. SWW are ensuring sustainable abstraction of existing water resources through the development, appraisal, and agreement of mitigation options with the Environment Agency and Natural England where a risk to the environment has been identified and confirmed.

For example, investigations have highlighted licence changes required to meet more stringent flow targets for our licence on the De Lank River in the Camel catchment to meet Common Standards Monitoring Guidance (CSMG). During the process of undertaking investigations on our Gammaton Reservoir and Roseworthy Stream licences, we have taken the proactive step to revoke these licences after initial analysis indicated that the licences in their current form could pose a risk of deterioration to the environment. We adopted a precautionary approach and revoked these licences to protect the environment.

Investigations are also underway to determine how our impounding reservoir assets may be impacting downstream waterbodies – often classed as Heavily Modified Water Bodies (HMWBs). Examples include Burrator and Stithians reservoirs. Potential issues of low flows downstream of the reservoirs when they are not spilling, fish passage constraints and habitat impacts are being explored within these investigations with a view to developing and delivering improvement schemes within AMP8 (2025-30) and beyond.

We have considered within our water resources forecasting where WINEP investigations with known outcomes are impacting on deployable output. At present this is only within the Colliford WRZ as a result of the De Lank River licence change. This licence change has an impact on Colliford WRZ DO and this impact is included in the baseline DO forecast from 2028/29.

The WINEP is an ongoing process. Several WINEP investigations and implementation projects have already been agreed or are in the process of being agreed with the Environment Agency. These will be undertaken in AMP8 (2025-30). At present the outcomes of these are unknown. Once any environmental risks have been identified, mitigation measures will be identified and agreed with the Environment Agency and any impact on WRZ DO will be assessed and incorporated into future revisions of our DO and WAFU forecasts.

The combination of internal/external engagement and ongoing delivery of WINEP19 through AMP7 is identifying licences / sites for further consideration within WINEP24 (AMP8 25-30). At present schemes for water resources associated environmental improvement can be classed as either:

1. improvement schemes with a preferred solution from the completed AMP7 Investigation
2. improvement schemes with a solution to be confirmed from an ongoing AMP7 Investigation
3. investigation schemes where there is a potential risk to the environment from an existing SWW licence.

Recognising the role and the diverse value of water resources, we will be planning to deliver investigation and improvement schemes in AMP8 onwards aligned to key regulatory drivers, both established and emerging. These include the Water Framework Directive (WFD), Habitats Directive (HD), Natural Environment and Rural Committees Act (NERC) and Environmental Destination. The list of AMP8 WINEP schemes is available on request.

Our ongoing WINEP programme supports the WFD and River Basin Management Plans for our supply areas in relation to water resources. All actions identified in the PR19 WINEP in relation to water resources are on target for completion by the end of the current Business Plan period.

3.3 Environmental destination

In developing our WRMP we have carefully considered the potential to adapt our supply systems and catchment ecosystems to improve resilience and achieve our Environmental Destination. We have outlined our approach to Environmental Destination in Chapter 4 and provide a summary of the impacts on DO for each source based on our assessment of BAU+ and enhanced environmental ambition.

3.4 Abstraction Incentive Mechanism (AIM)

We currently operate one AIM scheme in the SWW area, in East Devon. The Lower Otter catchment is assessed as having Poor Ecological Status by the Environment Agency to which the current level of local abstraction may contribute.

We agreed with our regulators to put in place an Otter Valley AIM scheme to reduce the annual volume abstracted at key groundwater sites during times of low groundwater level to protect river flows. However, since the implementation of the scheme three years ago it has yet to be triggered.

Following an AMP7 WINEP investigation, we are currently proposing an extension of the scheme which will seek to further-reduce the volumes abstracted. This proposal, along with other measures, will ensure compliance with current flow targets.

3.5 Raw water losses, treatment process losses and operational use

We have calculated raw water losses, treatment process losses and operational use within each WRZ for a dry year and show these values in our WRMP tables. It should be noted that in wetter years these values can be higher for operational and water-quality reasons. The losses are estimated by comparing; abstraction and water treatment work (WTW) output data to identify which sites may have losses; and through consultation with operational staff to identify losses in specific processes.

Table 3 provides a summary of raw water and treatment process losses, including operational use, for each WRZ.

WRZ	Bournemouth	Colliford	Roadford	Wimbleball
Losses and operational use 2020/21 (Ml/d)	21.74	1.23	4.20	0.00

Table 3: Losses and Operational Use in Base Year

4 Impacts of climate change on water supply

We have considered the impact of climate change on our water supply forecast in accordance with the Environment Agency guideline, the supplementary guidance on climate change and the '*Addendum on UKCP18*'. We have assessed the likely implications of climate change on the DO of our resources by the 2070s and our approach is detailed in Appendix 5.2.

4.1 Climate change vulnerability

To ensure that the level of our climate change analysis is proportionate to the risks each of our WRZs is facing, a climate change vulnerability assessment was undertaken. This assessment has been based on the most up-to-date information available from our previous WRMPs and Drought Plans.

HR Wallingford undertook the climate change vulnerability assessment for the West Country Water Resources Group, of which SWW is a member. Their assessment of the four mainland SWW WRZs is included in the "Regional Planning Climate Change Assessment – Climate Change Methodology" report (July 2021). Table 4 summarises the assessed vulnerability to climate change. However, note that:

- The assessment of Roadford WRZ was undertaken before funding was approved for a winter pumped storage scheme for Roadford Reservoir, and this scheme reduces the climate change vulnerability.
- The assessment of Bournemouth WRZ was undertaken before the level of sustainability reductions was known and this increases the vulnerability of Bournemouth WRZ to climate change.

We have sought to align our climate change methodology with the West Country Water Resource Group (WCWRG) regional plan to ensure a consistent approach to climate change across the region and have therefore adopted a Tier 3 High vulnerability assessment across our WRZs.

WRZ	Bournemouth	Colliford	Roadford	Wimbleball
Climate change vulnerability baseline 2021	Low (Tier 1)	Medium (Tier 2)	High (Tier 3)	Medium (Tier 2)

Table 4: Climate change vulnerability assessment

4.2 The impacts of climate change on the WRZ DO

We have followed the WRMP24 guidance and methodology when undertaking our assessment of the impact of climate change on our water supply forecast up to the 2070s using a range of evidence sources from UKCP18 which is required as part of a High vulnerability assessment.

4.2.1 Colliford, Roadford and Wimbleball WRZs

We used rainfall runoff models to produce river flow sequences which incorporate the impacts of climate change. We then use our water resource simulation model to calculate the Water Available for Use (WAFU) in each WRZ for each of the climate change projections. We have used WAFU since it allows us to take account of climate change impacts on the imports and exports between our WRZs.

4.2.2 Bournemouth WRZ

The climate change analysis for Bournemouth WRZ is based on the Wessex Basin Model assessments undertaken by Wood Consultants. This analysis showed that initially, under current licence conditions, there is no climate change impact on DO, however as licence conditions get reviewed under environmental destination, the WRZ changes from being infrastructure constrained to being water resource constrained and then climate change does impact on DO and WAFU.

4.2.3 All WRZ Results

This analysis produced estimates of climate change impacts in the 2070s under different emissions scenarios. These impacts are scaled through our planning horizon using the two part scaling relationship as outlined in the EA WRPG and described in Appendix 5.2.

Table 5 shows the impact of climate change on DO and WAFU by 2049/50 for the Medium emissions scenario (RCP6.0).

WRZ	Bournemouth	Colliford	Roadford	Wimbleball
Climate change impact on DO 2049/50 - Medium emissions scenario (Ml/d)	-58.57	-12.58	-12.11	-6.66

Table 5: Impact of Climate Change on DO and WAFU in 2049/50 (Medium emissions scenario)

5 Outage

It is necessary to make allowance for the non-availability of DO, which can occur at any time due to planned or unplanned events at water sources or water treatment works. Such events are termed ‘outage’ and are defined as “short-term losses of supply and source vulnerability”.

We contracted consultants AECOM Ltd to carry out an outage assessment on our behalf using current best-practice methodologies recommended by the Water Resources Planning guidelines, the Environment Agency WRMP24 supplementary guidance and supporting guidance in the UKWIR WR27 DO report (2012). See Appendix 5.1.

Outage values have been calculated for each individual WRZ based on the effect of outage events experienced at individual sources and WTWs in recent years. Outages have been classified as either planned or unplanned outages. Planned outages, along with their impact on water availability, were taken from records of scheduled activities at sources or WTWs. These include short-term routine maintenance as well as larger scale, usually longer-term, asset improvement projects. Any other events affecting water resource availability were considered unplanned.

5.1 Outage categories

The outage categories adopted for the analysis covering all four WRZs are shown in Table 6.

Category	Description
Power failure	Temporary loss in power resulting in reduced output or complete works shutdown
Plant failure	Failure in the treatment process resulting in reduced output or complete works shutdown not caused by a power failure
Turbidity	Source water turbidity resulting in reduced output or complete works shutdown
Plant failure following power failure	Failure of the treatment works caused directly by a power failure
Source Pollution	Pollution of water source requiring a cessation of supply

Table 6: SWW Outage categories

5.2 Total outage allowance for each WRZ

Outage values are generated by a Monte Carlo analysis which calculates values for differing levels of confidence. The outage values calculated by AECOM (Appendix 5.1) for each WRZ and for specified levels of confidence are shown in Table 7.

WRZ	Outage at 95% Confidence interval
Bournemouth	0.99
Colliford	0.23
Roadford	2.11
Wimbleball	3.66

Table 7: SWW Outage Allowance

The outage values taken forward into SWW's supply demand balance analysis for WRMP24 are based on the 95th percentile, i.e. values with a 5% risk of exceedance. As in our previous plan, where the calculated outage is less than 1 Ml/day we have adopted a *de minimus* value of 1 Ml/day. We have done this for Bournemouth and Colliford WRZ, adopting a value of 1 Ml/day for outage for both WRZs.

We will be reviewing and updating our estimates of outage to include the latest outage information for the final WRMP24.

5.3 Improving our understanding of outage events

Given the underlying levels of general unplanned outage and the flexibility of our system, outage is currently not a material water-resources planning risk. However, our supply-demand balance has some medium to long-term sensitivity to future uncertainties. As such, outage may become a more important water-resources planning risk in the future. To address this, we have developed an in-house tool to record all water resource and WTW outage events. The WTW Reliability Tracker captures daily events by type, duration, and impact on WTW output capacity. The recorded events are used to calculate outage in our WRZs.

As part of this detailed analysis of outage, we generate an annual outage report to describe our current outage level and interpret how asset reliability is influencing water availability.

In line with WRMP guidance we have considered whether any further improvements can be made for outage data analysis. We have not identified specific change to be made at the time of submitting our dWRMP, but continue to routinely review our approach, the software used and the options available for data collection. As technology improves and the cost of monitoring systems reduces, we envisage that evolutionary changes will be made in future years.

6 Water available for use

We have calculated our total WAFU in each WRZ considering changes to DO, transfers, operational use and outage as outlined throughout this section. We have not included benefits drawn from supply or demand drought measures, such as TUBS, NEUBs, drought permits and supply side drought orders, in our baseline supply forecast.

We have presented the total WAFU in the relevant tables of this WRMP. Table 8 gives an overview of the total WAFU per WRZ for our base year.

2020/21 Total WAFU (Ml/d)	Bournemouth (DYCP)	Colliford (DYAA)	Roadford (DYAA)	Wimbleball (DYAA)
WRMP19	225.77	165.79	245.11	90.29
WRMP24	225.77	161.97	238.12	86.21
% change since WRMP19	No change	-2%	-3%	-5%

Table 8: Total Baseline WAFU for the Base Year (2020/21)

The reductions in base-year total WAFU in Colliford, Roadford and Wimbleball WRZs between WRMP19 and this Plan are mainly due to increased 1 in 500 year drought resilience and larger climate change impacts on DO and WAFU.

The small increase in base-year total DYAA WAFU in Bournemouth WRZ between WRMP19 and this Plan is because of reviewing outage and losses. There is no change to the DYCP total WAFU in Bournemouth WRZ between WRMP19 and this Plan because DYCP is constrained by infrastructure, including treatment.

7 Reconciliation with previous plans

As noted in the above sections, all components of the DO and WAFU assessment have been reviewed and updated, with methodologies changing where necessary in line with changes to the Environment Agency's WRMP guidance between WRMP19 and this Plan. See the above sections for details.

The changes in DO and WAFU in Colliford, Roadford and Wimbleball WRZs between WRMP19 and this Plan are mainly due to moving from planning to a 1 in 200 year to planning to a 1 in 500-year level of resilience and increases in the impacts of climate change.

Bournemouth WRZ DO is initially not impacted by moving to a 1 in 500-year level of resilience and the new climate change assessments because the WRZ is infrastructure-constrained. However, after licence reductions to restore sustainable abstractions are implemented, 1 in 500-year level of resilience and climate change impacts have a bigger impact on DO and WAFU due to the WRZ becoming resource constrained.

8 Uncertainties in supply forecasting

Forecasts of long-term supply changes will always entail uncertainty. Factors that can impact our supply forecast include data uncertainties in measuring rainfall, evaporation and river flow, modelling uncertainty, assumptions in abstraction profiles and transfers, climate change, defining our 1 in 500, environmental requirements and their impacts. It is important to produce a plan that considers these uncertainties inherent within our supply forecasts and is robust to a wide range of plausible futures. We plan to undertake further work ahead of our final plan (see Section 9) to ensure our plan draws on the best available evidence and captures the full range of uncertainties.

In our dWRMP we have followed EA guidance and approached this uncertainty by including a headroom allowance as described in Chapter 7 as well as considering major uncertainties in the supply-demand balance within our adaptive plan and scenario tests described in Chapter 10.

9 Updates ahead of final plan

Our supply forecast outlined in this chapter will see further development ahead our Statement of Response and final plan for WRMP24.

- Our current approach to assessing our 1 in 500-year design drought event is our first DO assessment using stochastic datasets and rainfall runoff models. We will continue to refine our approach to ensure our assessment is robust and make best use of the available evidence. We want to ensure we assess droughts with durations that are different from our current critical drought duration analysis.

- Our approach to climate change currently makes use of multiple data sources from UKCP18 which have been used in combination with our historical and stochastic datasets. We plan to ensure we explore a greater combination of the UKCP18 projections with our stochastic drought datasets to ensure our assessment is as robust as possible.
- We plan to further investigate the expected impacts of Environmental Destination for our sources. Our assessment for our final WRMP will test the environmental destination scenarios across a wider range of design drought conditions.

South West Water

Bournemouth Water

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