South West Water

Our draft
Water Resources
Management Plan

Appendix 1: Supply Forecast

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5. Forecasting our supply

1 Introduction

This appendix outlines our assessment of each water resource zone's (WRZ) supply forecasts for our Water Resources Management Plan 2024 (WRMP24). Our approach to forecasting future supply has been informed by the latest regulatory guidelines, best practice and engagement with our regulators. Our supply forecast follows the principles set out by the Environment Agency (EA) in their Water Resources Planning Guideline (WRPG - Environment Agency, 2021).

In developing our supply forecast we have followed guidance and best practice wherever possible including:

- Water Resources Planning Guideline Supplementary Guidance – Resource Zone Integrity (Environment Agency, 2021)
- Water Resources Planning Guideline Supplementary Guidance – Outage (Environment Agency, 2021)
- Water Resources Planning Guideline Supplementary Guidance – 1 in 500 (Environment Agency, 2021)
- Water Resources Planning Guideline Supplementary Guidance – Stochastics (Environment Agency, 2021)
- Water Resources Planning Guideline Supplementary Guidance – Climate Change (Environment Agency 2021)
- Water Resources Planning Guideline Supplementary Guidance – Long-Term Environmental Destination (Environment Agency, 2020)
- WRMP19 Methods – Risk Based Planning (UKWIR, WRMP 2019 - Methods - Risk Based Planning [16/WR/02/11], 2016)
- WR27a Handbook of Source Yield Methodologies (UKWIR, 2014)
- Outage Allowances for Water Resource Planning (UKWIR, 1995)
- Long-term planning for the quality of drinking water supplies (Drinking Water Inspectorate, 2020)
- Resilience of water supplies in water resource planning (a supplementary note to long-term planning for the quality of drinking water supplies) (Drinking Water Inspectorate, 2021).

2 Developing our supply forecast

2.1 Planning scenarios

We have five Water Resource Zones (WRZs) in our region, all of which are conjunctive water supply systems. This means they use water from a range of different sources including rivers, groundwater, reservoirs and desalination. For three of these, Colliford, Roadford and Wimbleball, water supplies are limited by their available reservoir storage. For these, we have produced forecasts for supply and demand for the dry year annual average (DYAA) only.

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 and 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 summer peak demand period which coincides with the lowest flow period. Hence it is more appropriate to use the Dry Year Critical Period (DYCP) supply forecast for this WRZ.

In the Isles of Scilly WRZ a mix of groundwater and desalination is used to supply our customers. The key planning driver is the seasonal tourism demand peak. It is therefore our peak water availability and production capacity which constrain the water availability, so it is appropriate to use the DYCP forecast for planning.

In both the Bournemouth and Isles of Scilly WRZs we have, however, also produced a DYAA forecast in accordance with the regulators' current Water Resources Planning Guidance (WRPG).

2.2 Water resource updates since WRMP19

2.2.1 Bournemouth WRZ

In our WRMP19, our Bournemouth WRZ was considered to have had a healthy surplus in its supply-demand balance and at one stage, it was considered a potential 'donor' WRZ to provide its surplus supply to help resolve regional planning problems in the South East.

However, since the Environment Agency (EA) published its National Framework for Water Resources and the requirement to develop an 'Environmental Destination' for the Bournemouth WRZ, it faces a particularly acute challenge for water supply planning. The Environmental Destination for Bournemouth WRZ requires the River Avon Special Area of Conservation (SAC) to be better protected from abstraction pressures and means there's loss of more than half of our available water resource during a drought situation.

Our two main water treatment works in the Bournemouth WRZ, Alderney and Knapp Mill, both have significant development works planned for the remainder of AMP7 and the beginning of AMP8. The upgrade programmes for both water treatment works will make our water processing operations more efficient which means we will reduce the overall process losses. These upgrades have been represented in our supply forecast as beneficial reductions in process losses.

2.2.2 Colliford WRZ

Of all our WRZs, Colliford experienced the most severe impact on its water supply during the 2022/23 drought. Colliford reservoir experienced a record drawdown in response to unprecedented demand driven by the record high temperatures and very low rainfall. One of the driving factors is that it is prone to multi-season impacts where the reservoir does not fully refill over winter and it was only around 80% full at the start of 2022.

To increase the resilience of the Colliford WRZ to drought, we need to have a greater diversity of sources so that the WRZ can be managed as an improved conjunctive system to reduce the dependency on Colliford Reservoir throughout the year. In direct response to the experience of the drought of 2022, we have developed a number of new sources and these will be in place by 2025. We have included these as part of our baseline supply forecast. These sources include:

- Porth Rialton: A new water treatment works at Coswarth. This will treat water abstracted from the River Porth at Rialton, which can be supported by releases from Porth Reservoir. This source will provide a local resource for the Newquay area which otherwise would be supplied from Colliford Reservoir during the summer. This source has been re-commissioned following the findings of our AMP7 WINEP investigation.
- Desalination: A new desalination plant at Par in Cornwall. This will provide a climate-independent source of water guaranteeing a supply during any drought event. The seawater will be desalinated at Par before being piped to our existing Restormel water treatment works. It can be used to support the areas currently served from Colliford Reservoir, reducing pressure on its storage.
- Blackpool Quarry: This is a former, naturalised quarry from which stored water will be taken and treated at our existing Restormel water treatment works. Like the desalination scheme at Par, this will alleviate pressure on Colliford Reservoir.
- Hawks Tor: This is a former, naturalised quarry which can provide additional water to "top up" Colliford Reservoir and in effect increases the overall size and catchment area of Colliford Reservoir.

Desalination, Blackpool Quarry and Porth Rialton will directly alleviate the pressure on Colliford Reservoir storage. They provide additional advantages by reducing abstraction from the River Fowey at Restormel which will give greater headroom in our abstraction licence which we can then utilise over winter months to pump-store water back into Colliford Reservoir. This leads to two-fold benefits:

1 – additional resources to support Colliford WRZ during drought, and

2 – an enhanced resilience of Colliford Reservoir through increased pump-storage and mitigation of the multi-season drought impacts that are currently experienced.

2.2.3 Isles of Scilly WRZ

We took responsibility for the water and wastewater services on the Isles of Scilly in April 2020, assuming ownership from the local councils (St Mary's and Bryher), The Duchy of Cornwall (St Martins and St Agnes) and Tresco Estates (Tresco). The Isles of Scilly is now regulated like the rest of England by OFWAT, EA and DWI and this is the first WRMP ever developed for the Isles.

Early water quality testing by the DWI identified several issues with the quality of the drinking water, including finding traces of radon and tritium. This has resulted in improvement notices across all five islands.

In response to these challenges, we have reviewed the potential mitigation options that could be suitable to overcome the water quality issues and identified that new water treatment works are required across the islands. However, the new treatment technology would have much higher raw water losses meaning that our groundwater abstractions would need to increase substantially.

Recognising the risks that this poses to the environment and the resilience of water supply on the islands, we have reviewed the position and determined that desalination is the only option that can guarantee the quality and reliability of the water supply to our customers.

Our existing groundwater assets will be retained, except for a few boreholes that are of lower quality and lower reliability and these will be used to supplement the water from desalination. This will ensure the resilience of our water supply in the event of any longer outage risks that desalination could pose. We are taking steps in the short term to improve the existing treatment of our groundwater sources to mitigate the DWI identified risks whilst we develop the desalination solution. Our plan for the longer term is to improve groundwater quality prior to blending with the desalinated water.

2.2.4 Roadford WRZ

Roadford WRZ also experienced a significant drawdown of Roadford Reservoir during the 2022/23 drought, although the impacts were not as severe as in the Colliford WRZ. Roadford Reservoir has historically also experienced multi-season drought impacts as seen during the recovery from the 2022 drought where Roadford reservoir only recharged to around 70% before the 2023 drawdown period began.

Tto mitigate the impacts of multi-season events, a new pump storage scheme has been developed on the River Lyd. This became operational in Spring 2023 and allows up to 40 Ml/d to be pumped into Roadford Reservoir between November and March. In addition, a second pump storage scheme is being developed on the River Tamar at Gatherley. It is being funded by the Green Recovery Programme. This scheme was planned prior to the 2022 drought but we have accelerated its delivery so that it will be operational in 2024 to add further resilience to Roadford Reservoir. The Gatherley scheme does not provide a 'Water Available for Use' (WAFU) benefit on its own because there are other system constraints. However, Gatherley will provide a significant increase in storage in Roadford Reservoir, so our investment programme in the Roadford WRZ is focused on system changes which "unlock" this new resource.

We are also investing in our Avon, Meldon and Tottiford water treatment works so that they can operate at a lower output at some times of the year. This means that when plenty of water is available from other resources, we can use less water from these water treatment works which preserves their sources for use at other times. This will provide a greater flexibility in the operation of our Roadford WRZ system and provides a small benefit to the WRZ WAFU through improved conjunctive use.

2.2.5 Wimbleball WRZ

Our Wimbleball WRZ also experienced a large drawdown during the 2022 drought event but the existing pump storage scheme on the River Exe ensured that the storage position was fully recovered over winter 2022/23. We worked with Wessex Water throughout the 2022 drought to manage our joint Wimbleball Reservoir resource. Our WRMP24 operational assumptions have been updated to reflect our latest agreed position.

The main change in the water resource position for the WRMP24 is a reduction in transfers from Wimbleball WRZ to Roadford WRZ. This change in assumptions is required to mitigate future supply-demand deficits in the Wimbleball WRZ. The forecast supply-demand deficit in our WRMP24 plan is driven by Licence Capping, Environmental Destination and a move to 1 in 500 year drought resilience. We will still utilise these transfers year to year but we are assuming that under a future severe drought the available export will reduce.

3 Baseline deployable output

As part of developing the supply-demand balance, we are required to estimate the yield of our resource zones in terms of deployable output (DO). DO is the output of a commissioned source or group of sources for the design drought that a water resource zone is assessed against, 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 capacity
- Treatment works capacity
- Water quality

The EA's Water Resources Planning Guideline (WRPG) requires water companies to be resilient to a drought with an annual probability of occurrence of 0.2%. This is commonly referred to as the '1 in 500 year' level of drought resilience. Water companies must plan to meet this level of resilience by 2039 at the latest. The WRPG states that the 1 in 500 year event characteristic should not be derived from the historical record alone and that stochastic weather datasets should be used to create sequences from which the 1 in 500 year drought can be more reliably derived.

3.1 Overview of approach

3.1.1 Colliford, Roadford and Wimbleball WRZs

Our Colliford, Roadford and Wimbleball WRZs follow a similar overall methodology to how we assess WRZ deployable output. We use our MISER water resources model (outlined in section 3.2.1) to simulate the water resources infrastructure such as reservoirs, rivers and water treatment works to understand our WRZ deployable output. We have used historical naturalised inflow sequences and rainfall-runoff model simulations to provide river flow inputs to MISER (outlined in section 3.3). Our 1 in 500 year deployable output assessment (outlined in section 0) uses stochastic datasets from the WCWRG which were produced following a nationally consistent approach. These were input into our rainfall-runoff models to produce long sequences of weather data to test our MISER models against. Our MISER models cannot simulate the full stochastics sequences and we have used Extreme Value Analysis (EVA) to develop a 'drought library' for each WRZ which contains different drought events, covering a range of drought severities.

3.1.2 Bournemouth WRZ

Historically our Bournemouth WRZ has been constrained by our WTW capacity and therefore our deployable output assessment has been relatively simple. For dWRMP24 because of the scale of Environmental Destination impact in Bournemouth WRZ we have developed an event-based mass balance which allows us to test licence capping, Environmental Destination and climate change assumptions for specific deployable output scenarios. To develop the scenarios, WCWRG used the EA's Wessex Basin groundwater model to develop stochastic drought scenarios for Wessex Water groundwater sources in the upper catchment, and river flows at our abstraction points (see section 3.3.4).

3.1.3 Isles of Scilly WRZ

The Isles of Scilly will primarily be served by desalination from 2025 which provides a drought and climate change resilient source of water. The deployable output we can achieve from each of the desalination schemes is fixed by its design capacity. Our groundwater sources on the islands are being retained and we have undertaken a preliminary review of the yield of each source for our dWRMP24 but we are currently constrained by the availability of historical data. We have agreed a groundwater monitoring plan with the Environment Agency to improve this understanding of our groundwater sources and we are in the process of undertaking a formal deployable output assessment for each source. This will be available for inclusion in our final plan. To mitigate the risk around our limited understanding of the reliability of our groundwater sources we have also included a "no groundwater" WAFU scenario in our dWRMP24 which only includes desalination.

3.2 Water resources modelling

3.2.1 MISER Overview

Our MISER model includes Colliford, Roadford and Wimbleball WRZs and is a complex water resource modelling system. It represents our raw water systems, abstraction licences, treated water systems, distribution networks and demands. It includes all our reservoirs, river abstraction points, groundwater sources, the links between these sources, the links between sources and water demand zones, Water Treatment Works (WTWs), our pumped storage schemes and our fisheries enhancement schemes. The model includes over 1,200 elements and allows us to fully represent the operation and behaviour of our conjunctive use system.

Our modelling uses specific demand patterns within the distribution network to ensure 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.

Our model includes assumptions which try to accurately reflect how the system operates in practice. For example, we model the fisheries bank volumes which are released from our reservoirs to ensure they are accounted for in our deployable output calculation.

3.2.2 Emergency Storage Assumptions

Emergency storages for all our raw water reservoirs have been calculated following the methodology outlined in the UKWIR Project WR27 *Water Resources Planning Tools* (2012) and UKWIR Project WR27a *Handbook of source yield methodologies* (2014).

The concept of emergency storage was introduced in the 1997 Reassessment of Water Company Yields method (Environment Agency, 1998) and has been updated in WR27. Emergency storage is defined as:

"A reserve store aimed at accommodating the operational uncertainty for the duration of a particular drought. The value of the reserve store should be agreed with the regulators and should be reflected in the level of risk a water company is taking across the planning period."

Emergency storage = demands on system x number of days – reservoir inflow

Emergency storage for each reservoir has been calculated as the volume required to provide 30 days of minimum output (including WTW losses and reservoir compensation releases), given a reservoir inflow equal to 30 days at the flow rate experienced in the lowest flow week in the historic period of record. WRZ emergency storage is the sum of the emergency storages calculated for each reservoir in that WRZ.

WRZ	Strategic Reservoir Emergency Storage (Ml)	WRZ Group Emergency Storage (Ml)
Colliford	2,854	4,473
Roadford	5,370	7,581
Wimbleball	2,132	2,132

Table 1 Summary of reservoir emergency storage

3.2.3 Fisheries Bank Assumptions

A fisheries water bank is a volume of water in a reservoir that is reserved for fisheries and/or other environmental reasons. This volume of water is not available for supply. Some of our raw water reservoirs have fisheries banks, including Colliford, Roadford and Wimbleball reservoirs. The fisheries water bank volumes and conditions for releases of water from these banks are specified on abstraction licences and/or in the relevant WRZ Operating Agreement and/or Operating Manual. Requests for releases of water from the fisheries water banks are made by the Environment Agency and they specify the timing, flow rate and duration of each release. These releases are typically made to encourage migration of salmonids, although they may also be made for other reasons. Fisheries water bank volume conditions include when the water bank volumes reset, for example every three years or when the reservoir has fully refilled and spilled after the previous drawdown period, whichever is sooner.

As noted in Section 3.2.1., all mandatory fisheries water banks are included in our MISER water resource modelling system. They are modelled as releases at appropriate times of year and ensure that the full water bank volume is released over the appropriate time period in line with the water bank conditions. This ensures that the volumes contained in these fisheries water banks are not available for supply and hence are accounted for in our deployable output calculation.

3.3 Water resources input datasets

3.3.1 Rainfall

We used the Met Office HadUK (Hollis et al, 2019) rainfall dataset to provide rainfall data across all our WRZs. Data from 1890 to 2020 has been used to develop our rainfall-runoff models.

3.3.2 Evaporation

We have used the new Environment Agency Potential Evaporation (PET) data which also includes a version of PET which includes a rainfall interception component (PETI). This dataset is available from 1961. Prior to 1961 we have used a relationship between temperature and PET to hindcast the PET datasets to 1900 (HR Wallingford, 2021a).

3.3.3 Rainfall-runoff modelling

Our previous WRMPs used historical river flow records to determine our worst historical DO. To better understand our resilience to drought and 1 in 500 DO we developed new rainfall-runoff models to support our WRMP24 DO assessment.

Our rainfall-runoff modelling uses the URMOD rainfall-runoff model (Fidal and Kjeldsen, 2020). URMOD is a conceptual rainfall-runoff model that uses mathematical models with calibrated parameters to translate rainfall and evaporation to simulated river flow. It is similar in approach to other widely used industry models (for example, CatchMOD, GR6J, PDM).

Model calibration was undertaken against naturalised flows using a range of evaluation metrics and visual inspection of hydrographs and flow-duration curves. Additional checks were made using reservoir mass balances to compare the historical reservoir drawdown with the drawdown achieved using simulated inflows.

For WRMP24, our focus has been on developing rainfall-runoff models at key reservoir locations across the Colliford, Roadford and Wimbleball WRZs. We focused on our reservoir catchments because these are the most critical in understanding our DO. The reservoirs used for rainfall-runoff modelling and DO calculations in each WRZ are shown below in Table 2.

Colliford WRZ	Roadford WRZ	Wimbleball WRZ
Colliford Siblyback Stithians	Fernworthy Meldon Roadford Upper Tamar Lake Venford Wistlandpound	Wimbleball

Table 2 Overview of rainfall-runoff models by WRZ.

3.3.4 Wessex Basin Groundwater model

The Bournemouth WRZ DO assessment is underpinned by the EA's Wessex Basin groundwater and river flow models. This assessment was undertaken by Woods/WSP on behalf of WCWRG to include the assessment of Wessex Water's groundwater sources in the upper River Avon and the river flows on the lower River Avon at our Matchams and Knapp Mill abstractions. The Wessex Basin model was used to simulate droughts from the historical period and a subset of the WCWRG stochastics datasets to inform a 1 in 500 year drought assessment. It also considered the impacts of climate change using WCWRG climate change scenarios derived from UKCP18 RCM and GCM projections.

At the time of this assessment (summer 2022) the MODFLOW 6 Wessex Basin model calibration was being reviewed by the Environment Agency and water companies, so for this drought and climate change work the existing approved MODFLOW 6 regulatory version has been used. However, the libraries of climate data held by the water companies for the historical and stochastic droughts, and the factors to be applied for alternative climate change scenarios are all based on the HadUK rainfall and EA PET input datasets. These datasets were therefore used as the inputs to run through the 4R recharge model and MODFLOW 6 groundwater base models, using an approach for the adjustment of the soil moisture model parameterisation for silt-pasture which covers much of Salisbury Plain. This has been discussed with the Environment Agency and successfully applied to maintain an acceptable calibration for the MODFLOW 6 model.

The Wessex Basin model includes abstraction and discharge profiles within the model which means that the simulated river flows reflect these influences. These can be varied to allow testing of different scenarios which included both Fully Licenced scenarios and a Recent Actual scenario which constrains abstractions to recent operating practice.

The outputs from the Wessex Basin model were used to understand the impacts of Environmental Destination for the River Avon which is the most significant driver of change in the Bournemouth WRZ WAFU.

3.3.5 Groundwater yield assessment

We have several groundwater sources in each of our WRZs but Wimbleball, Bournemouth and Isles of Scilly WRZs have the largest proportions of groundwater compared with other sources of supply. We assess the yield of our sources following the UKWIR Source Yield Handbook (UKWIR, 2014) by deriving source yield diagrams from which we determine our dry year reliable output. This assessment has been updated in early 2023 to include learnings from the drought of 2022 and to account for the latest asset and licence constraints for each source. We use annual groundwater DO profiles of our groundwater sources within our water resources modelling to determine the conjunctive use DO of the whole WRZ supply system.

Modelling studies undertaken for our previous WRMPs have demonstrated that our groundwater sources are generally resilient to drought and/or constrained by asset constraints and licences. But we recognise the need to improve our approach to our groundwater DO assessment to ensure it is resilient to 1 in 500 year drought and robust to a range of future climate change scenarios. We have outlined our commitment to improving this approach ahead of WRMP29 as outlined in section 10 of the Technical Document.

For our Isles of Scilly groundwater sources we have undertaken a preliminary review of the yield of each source for our dWRMP24 but we are currently constrained by the availability of historical data (outlined in section 0). We have agreed a groundwater monitoring plan with the Environment Agency to improve this understanding of our groundwater sources and we are in the process of undertaking a formal deployable output assessment for each source. This will be available for inclusion in our final plan.

3.4 Historical assessment

Our approach to historical DO assessment is consistent with the approach we used for the WRMP19. It uses naturalised river flow sequences as inflows to our MISER model. The historically recorded flow series is available for the period from 1957 to 2022 for Wimbleball and Roadford WRZs, and from 1962 to 2022 for the Colliford WRZ. These are the earliest periods for which we have reliable flow records. They include several different types of historic droughts such as the 1975/76 multi-season drought and the 1959, 1978, 1984, 1989 and 1995 single season droughts.

For our Bournemouth WRZ, we calculated both the Dry Year Annual Average (DYAA) DO and the Dry Year Critical Period (DYCP) DO using simulated river flows from the Wessex Basin groundwater model (see section 3.3.4) for the period of 1973 to 2021. This includes the 1975/76 historic drought. This analysis also included an assessment of the WCWRG stochastic drought dataset which confirmed that the historical 1975/76 drought was the most severe historical drought experienced in Bournemouth WRZ.

Table 3, below, sets out our analysis of the drought severity for each mainland WRZ and the implications for the DO.

Zone	Planning Scenario	Historical Year	DO (Ml/d)
Bournemouth	DYCP	1975/76	232.28
Colliford	DYAA	1975/76	177.92
Roadford	DYAA	1975/76	246.50
Wimbleball	DYAA	1975/76	97.00

Table 3 Deployable Output (DO) in the worst historical year

3.5 1 in 500 assessment

Since WRMP19, our mainland WRZs have moved from a position of supply-demand surplus to a supply-demand deficit. The change to this position has materialised part way through the WRMP planning process, driven by the requirements of meeting the Environmental Destination (ED) for each WRZ. The ED means that water needed to sustain the natural environment, including for each water dependent Special Protection Area (SPA), Site of Special Scientific Interest (SSSI) and groundwater bodies can no longer be abstracted to meet the needs of water consumers. It is designed to ensure the protection of these areas to 2050 and beyond. We are also required to consider 1 in 500 year drought resilience and ensure we maintain supply to our customers without the use of extreme drought measures.

To respond to both of these challenges in WRMP24, we have prioritised the development of new rainfall-runoff models to better inform our understanding of drought resilience and reflect the greater risks to the security of our supplies. This has allowed us to use stochastic approaches to support our assessment of a 1 in 500 DO and better understand the impacts of ED and climate change.

Improvements to our capability in rainfall-runoff modelling has resulted in a step change in our ability to explore hydrological drought using stochastic datasets. However, our MISER model cannot readily assess the full stochastic datasets in a DO assessment like other modelling platforms such as Aquator or Pywr. To explore and understand the sensitivity of our systems to drought, we used a drought library approach to explore targeted subsets of the full stochastics datasets to undertake our 1 in 500 assessment. For the Wimbleball WRZ we developed a simple emulator model that allowed an assessment using the full stochastic dataset to better target our 1 in 500 assessment.

We have plans to develop our water resources modelling capacity ahead of WRMP29 which will allow us to undertake a full stochastic assessment. The WCWRG has commissioned a regional Pywr model which will include all of our WRZs, with the exception of Isles of Scilly and is due for completion in 2024.

3.5.1 Stochastics dataset

Stochastic weather datasets are sequences of rainfall and evaporation that have been created using statistical models and relationships. The purpose is to extend our ability to explore and understand different patterns beyond relatively short historical datasets. The WCWRG commissioned Atkins to develop a regionally coherent stochastic weather dataset (Atkins, 2021) which follows the same approach as the other regional water resources planning groups.

Atkins generated daily rainfall sequences for a number of key rain-gauge locations across the South West of England using data for a period of 1950-1997. In total 400 sequences, each of 48 years, were created providing 19,200 years of data. Temporally coherent evaporation data (PET/PETI) was provided by sampling the historical datasets to find historical months which match equivalent total monthly rainfall in the stochastics.

3.5.2 Rainfall-runoff modelling of stochastics

The Atkins stochastic dataset provides rainfall sequences at key rain gauges across the south west region. These point locations are used to create a catchment average time series for each of our rainfall-runoff models (see Table 2) using Thiessen polygons to apportion weights. The areal-weighted timeseries derived from the stochastic rain gauges was compared with the HadUK catchment-average timeseries and an adjustment factor was derived based on annual total rainfall as recommended by Atkins (2021). The adjustment factor compensates for differences in the underlying datasets resulting from factors such as altitude or topography. The adjustment factor is applied to all 400 stochastic areal-weighted rainfall sequences.

The stochastic evaporation dataset for each rainfall-runoff model was provided directly on a catchment average basis based on resampling each catchment's historical record.

URMOD was used to simulate river flows from the rainfall and evaporation time series to create 19,200 years of river flow data for each model to underpin our assessment.

3.5.3 WRZ Drought Library

We created a 'drought library' of events for each WRZ. This meant we could target the stochastic design drought events for detailed MISER water resources modelling within our DO assessment. Each WRZ's drought library was selected based on extreme value analysis (EVA) of historical river flows which we then used to sample stochastic design events. We undertook this for all rainfall-runoff models in each WRZ creating a unique drought library.

EVA was undertaken for the critical duration of a drought for the river flows in each WRZ. Colliford and Roadford had a multi-season vulnerability with 18 month critical drought durations from April year 1 to September year 2. Wimbleball is a single season vulnerable system with a 12-month critical duration from November to October. For these critical durations, total river flow was calculated for each year in the historical record. EVA was undertaken on the historical record from 1900 to 2020, covering 120 years of data. Following the methods outlined in the EA's Drought Vulnerability Framework (DVF) guidance (UKWIR, 2017), we tested different approaches to fitting statistical distribution to the critical duration flows. An example for Colliford reservoir is show in Figure 1.

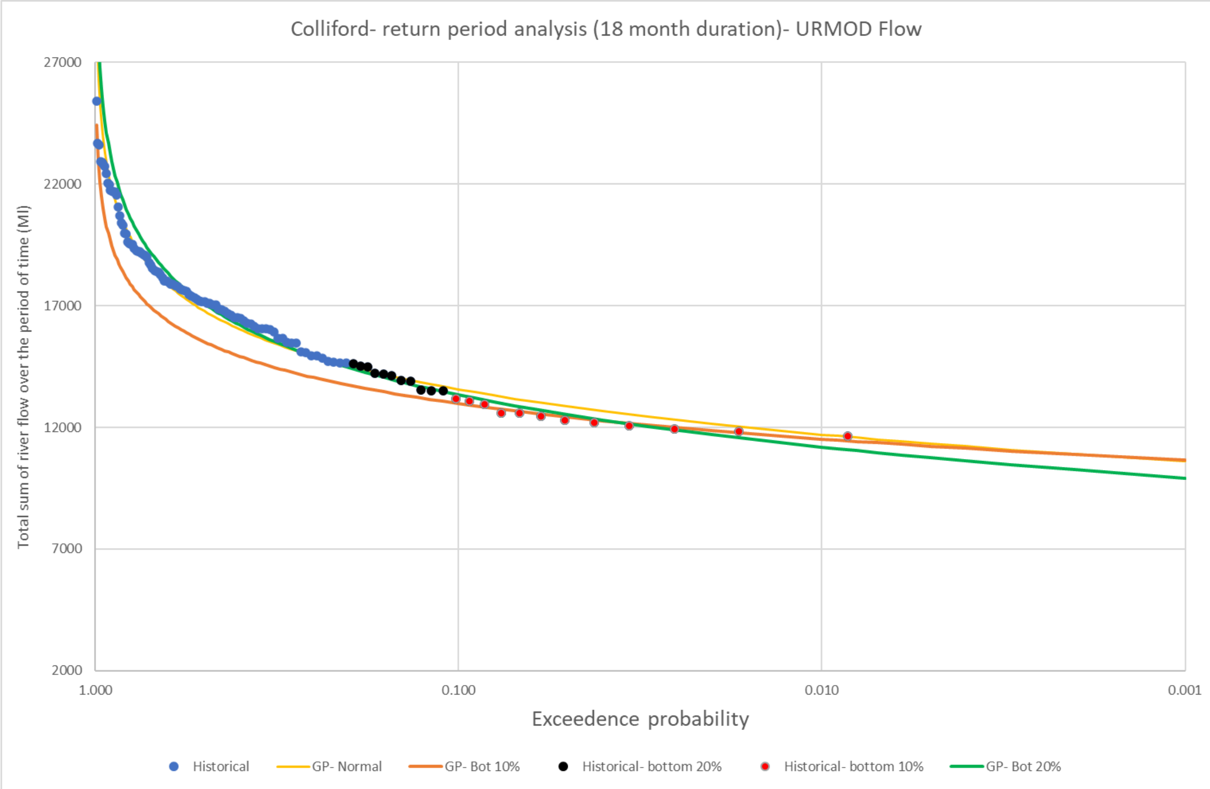

Figure 1 EVA for Colliford catchment. Compares diferent approaches to fitting statistical distributions to the critical duration flows. The y-axis shows the total flow over 18 months. The x-axis shows the exceedance probability which is equivalent to a return period where 0.01 is 1 in 100

The EVA analysis provides an estimate of the design 1 in 500 river flow volume for each rainfall-runoff model. We then used the 19,200 years of stochastic river flows to identify stochastic events with flows of an equivalent critical duration flow volume. This was repeated for each catchment within a WRZ. The drought library contains all of these events.

The process is summarised in the steps below for each WRZ:

- Undertake EVA on the historical simulated river flows for critical duration
- Derive a 1 in 500 return period and associated total flow volume
- Analyse 19,200 years of stochastic data to identify events with a similar flow volume
- Select a sample of stochastic events for each catchment model
- Combine events for all catchments in a WRZ into a single drought library.

Each WRZ drought library contains a range of events that are 1 in 500 river flow-return periods in at least one of the catchments in the WRZ. The deployable output of each stochastic event in the WRZ drought library is determined by increasing demand to the point at which the storage in the WRZ strategic reservoir would reach emergency storage as outlined in Section 3.2.2. There is a degree of variability in the performance of the stochastics across our region, with a balance to strike between the performance of our smaller reservoir systems and our larger strategic reservoirs. Our 1 in 500 design event in each WRZ was selected based on the water supply system performance across the WRZ and the design return period of flow across all of the WRZ sub-catchments. For our Bournemouth WRZ, we used a slightly different drought library approach aligned with work undertaken by the WCWRG with Wessex Water which identified a common 1 in 500 year event within the stochastics dataset across the Wessex Basin Model as outlined in section 3.3.4.

3.5.4 Wimbleball WRZ Emulator Analysis

For Colliford and Roadford WRZs, the WRZ DO for a range of 1 in 500 year stochastic droughts in the respective WRZ drought libraries were similar because their WRZ resource availability is typically constrained by our infrastructure assets and not raw water availability.

However, for Wimbleball WRZ, for the stochastic events in the drought library the difference between the design drought WRZ DO and the 1 in 500 year total flow volume stochastic drought event DO ranged from 0 to -33 Ml/d. Also, one of the 1 in 200 year total flow volume stochastic drought events in the drought library showed a bigger impact on WRZ DO than the worst 1 in 500 year event in the drought library. This demonstrated that the flow EVA analysis did not adequately represent the Wimbleball WRZ dynamics and further analysis was required to identify an appropriate 1 in 500 year supply system drought event. A simplified water resources system model was developed in Excel to emulate the key elements of the WRZ supply system and identify 1 in 500 year supply system drought events.

Key drivers for Wimbleball WRZ DO are:

- The number of days when river flows are sufficiently low to require Wimbleball Reservoir augmentation releases to be made to support downstream abstraction from the River Exe for supply
- The amount of available abstraction from the River Exe in the winter for transfer into Wimbleball Reservoir to boost natural winter recharge

In this simplified water resources system model, the stochastic flows for the River Exe and reservoir inflow time series for Wimbleball Reservoir were used as inputs. WRZ DI was set to the level of demand that resulted in Wimbleball Reservoir just emptying in the worst stochastic year. This enabled the ranking of the driest years in terms of impact on the supply system. The resulting simulated minimum reservoir storages for all years in the stochastic record were ranked from lowest to highest and a small selection of stochastic events clustered around the 1 in 500 year event (in terms of minimum reservoir storage and hence supply system) were then modelled in the full water resources system MISER model and the WRZ DO assessed for each. The event with the largest impact on WRZ DO was selected as the 1 in 500 year supply system drought event.

This analysis also indicated that:

- the 1 in 200 and 1 in 500 year stochastic events selected in the 'Drought Library' analysis were very extreme supply system droughts, worse than 1 in 500 system impact return period events
- Wimbleball Reservoir only fails to refill in droughts that are worse than 1 in 500 year return period drought events

3.5.5 1 in 500 deployable output results

A summary of our WRZ 1 in 500 year deployable output is provided in Table 4 which outlines the source of our 1 in 500 year drought and its associated deployable output. In all instances the WCWRG stochastics datasets provides the original underlying dataset but approaches to assessing the 1 in 500 year return period drought varies by WRZ as outlined in previous sections.

WRZ	Planning Scenario	Source	DO (Ml/d)
Bournemouth	DYCP	Wessex Basin Modelling	232.28
Colliford	DYAA	Stochastic Drought Library	175.92
Roadford	DYAA	Stochastic Drought Library	246.50
Wimbleball	DYAA	Stochastic Emulator Analysis	87.00

Table 4 Overview of WRZ 1 in 500 DO

3.6 Isles of Scilly

The desalination schemes that are being developed are outlined in Table 5. The design capacity is based on peak summer rates with a plan to turn down the units over winter to meet the lower levels of winter resident demand. From a Deployable Output position, this winter turn down does not reflect the deployable output of the desalination because if required it could run at a much higher rate. We have therefore used the dry year critical period (DYCP) deployable output with a 10% reduction allowed for maintenance requirements as the winter period deployable output.

Island	Planned Operational Output		Deployable Output	
	Winter	Summer	DYAA	DYCP
St Marys	0.255	0.880	0.836	0.880
Tresco	0.031	0.176	0.167	0.176
St Martins	0.020	0.075	0.071	0.075
Bryher	0.020	0.075	0.071	0.075
St Agnes	0.010	0.038	0.036	0.038
Total	**0.336**	**1.244**	**1.181**	**1.244**

Table 5 Overview of desalination capacity

For our groundwater sources the annual returns information for 2022 was used to calculate an annual average abstraction and a peak week abstraction rate. These figures were used directly as the annual deployable output (ADO) and peak deployable output (PDO).

These represent the abstractions required to meet demand as opposed to deployable output based on the source hydro-geological constraints. Work is ongoing to undertake a formal source-yield assessment and this will be available for inclusion in our final plan. The role of groundwater in the Isles of Scilly supply-demand balance means that the risks around the uncertainty of the groundwater yield is low because desalination alone can meet 100% of the future demand.

The overall DO for the Isles of Scilly WRZ is outlined in Table 6 for the DYAA and DYCP scenarios and for the scenario which does not include any groundwater abstractions.

Name	Desal	Groundwater	Deployable Output Ml/d
DYAA	ADO	ADO	1.60
DYCP	PDO	PDO	1.98
DYAA No Groundwater	ADO	None	1.18
DYCP No Groundwater	PDO	None	1.24

Table 6 Overview of Isles of Scilly Deployable Output

4 Our role in achieving Sustainable Abstraction

4.1 Background to Sustainable Abstraction

We are the largest abstractor of water from the environment in our operational areas. To ensure our continued abstractions are sustainable, we are fully committed to meeting the challenges set out in the EA's Water Industry National Environment Programme (WINEP), the National Framework for Water Resources, River Basin Management Plans and the Government's 25-Year Plan for the Environment.

Sustainable Abstraction means there is enough water remaining in the water body after permitted abstractions to protect, enhance and meet the needs of the environment. The EU Water Framework Directive (WFD – now UK legislation[1] following Brexit) outlines an assessment approach to determine this. WFD objectives are delivered by the EA via River Basin Management Plans (RBMPs). The WFD approach assesses the ecological "health" of discrete hydrological units, called "water bodies", and reports which of the following classifications they fall into:

- High

[1] The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (legislation.gov.uk)

- Good
- Moderate
- Poor
- Bad

"No Deterioration" is a key WFD objective. This means that a waterbody should not decrease from its existing classification in the latest RBMP. In the longer term, each waterbody has an "attainment objective", which means it should reach "Good" status by 2027. The purpose is therefore to either maintain an existing Good status or restore a waterbody to a better position than at present.

The ecological status of a waterbody is not necessarily linked only to the volume of water it contains. Rather it is related to its water quality, levels of all types of pollution, as well as any degradation of the habitat that has been caused by human activity. Therefore, our abstraction from a waterbody is only one of the factors that affect its status. However, without detailed investigation (usually through the water company's WINEP agreed with the EA), it is assumed that the volume of water and our abstractions are a significant contributing factor to the water body's ecological status.

Each waterbody has Environmental Flow Indicators (EFIs) which are calculated to identify the minimum volume of water required within the waterbody to support the environment. The EFIs vary depending on the environmental sensitivity of the waterbody. Further, each waterbody is assigned an Abstraction Sensitivity Band (ASB) by the EA which states the amount the flow in the waterbody is allowed to vary from its natural position – which means flow without abstractions.

Type	Q30	Q50	Q70	Q95
CSMG – WFD high hydrology (ASB6)	10%	10%	10%	5%
CSMG – Headwater (ASB5)	15%	15%	10%	5%
CSMG – River (ASB4)	10%	20%	15%	10%
ENHANCED Salmon/ Chalk /GWDTE water bodies AND WRGIS ASB3 rivers	24%	20%	15%	10%
WRGIS ASB2 rivers	26%	24%	20%	15%
WRGIS ASB1 rivers	30%	26%	24%	20%

Table 7 Overview of abstraction sensitivity bands as used in the National Framework. % deviation allowed from natural river flow

The waterbody EFIs are compared with Recent Actual and Fully Licensed abstraction scenarios to determine the flow surplus/deficit within the current abstraction position of a waterbody. Where there is a deficit in the flow volume compared with the EFIs it means:

- that the catchment is licensed to take more from the waterbody than is needed to maintain or improve its WFD status - called a Fully Licensed scenario deficit
- the current abstractions within the catchment are too high and not sustainable – the Recent Actual scenario deficit.

The EA has provided guidance to water companies outlining the framework for achieving Sustainable Abstraction. Firstly, in the shorter term, the WINEP[2] seeks to address immediate "no deterioration" risks through identifying potential changes that are required to existing licences. To focus WINEP investigations that are scheduled for AMP8, and in part pre-empt the outcome, the EA has provided guidance on Licence Capping assumptions that water companies should follow within WRMP24. Licence Capping is a voluntary agreement that we make with the EA to limit abstraction from a water body to a level that will not cause a deterioration in its status through increasing our abstraction. Secondly, in the longer term, the National Framework for Water Resources sets the expectations and timescales for meeting the stated Environmental Destination to ensure our abstractions are totally sustainable and account for climate change risks by 2050.

[2] Water industry national environment programme (WINEP) methodology - GOV.UK (www.gov.uk)

4.2 Sustainability reductions and WINEP

In the short to medium term for AMP7 (2020 – 2025) and AMP8 (2025 - 2030) our WINEP programme focuses on the water bodies at greatest risk of deterioration and investigating whether our abstractions are causing damage to the environment. Our priority is to ensure that abstractions are sustainable and we have developed, in collaboration with the EA, a comprehensive WINEP that covers all areas at risk of deterioration. This section outlines our progress to date in AMP7, how these studies are accounted for in the revised WRMP24, and outlines how our AMP8 programme will ensure our abstractions are sustainable and that the environment is protected.

4.2.1 AMP7 WINEP Investigations

We have been working closely with the EA throughout AMP7 (2020-2025) on a number of WINEP investigations into potential changes to our licences to ensure they are sustainable. These include:

- Otter Valley groundwater
- De Lank River in the River Camel SAC
- River Porth at Rialton and the Porth Reservoir

Otter Valley Groundwater (Wimbleball WRZ)

The Otter Valley groundwater sources provide local supplies in the east of the Wimbleball WRZ. The groundwater sources reduce the requirement to direct water from the River Exe and Wimbleball into this part of our network. The AMP7 WINEP Investigation into the Otter Valley groundwater body and the associated surface waterbody demonstrated an EFI failure at Q95 (the flow that is exceeded 95% of the time) for a Recent Actual scenario of ~4 Ml/d. In this assessment the groundwater abstractions are demonstrated to directly impact on the River Otter available river flow and the groundwater abstractions therefore need to be reduced to mitigate this impact. The sustainability change to our groundwater licences to provide 4 Ml/d benefit to the River Otter does not impact on the Wimbleball WRZ WAFU because more conservative groundwater yield profiles are already assumed in our baseline DO assessment. WINEP delivery work is planned in AMP8 to implement this sustainability change and identify any further mitigation options.

De Lank River – River Camel (Colliford WRZ)

We abstract directly from the De Lank river to our De Lank water treatment works. This offsets the requirement to abstract more water from Colliford Reservoir. However, the De Lank river is part of the headwaters of the River Camel SAC (Special Area of Conservation) which is an internationally designated site of environmental importance. We also abstract from the upper River Camel into the Crowdy Reservoir and Stannon Lake, although these lie outside of the SAC. The SAC designation means that the EFI standards that must be met through the majority of the catchment are the highest and most stringent level, known as the Common Standards Monitoring Guidance (CSMG). The AMP7 WINEP investigation will see a change in the De Lank abstraction licence to preserve more water for the environment. The change to the licence will lead to a 4 Ml/d reduction in Colliford WRZ WAFU. WINEP delivery work is planned in AMP8 to implement this sustainability change and identify any further mitigation options.

River Porth at Rialton and Porth Reservoir (Colliford WRZ)

Porth Reservoir is located within the River Porth catchment, North Cornwall. Historically, this reservoir has provided supply to the Newquay area of the Colliford WRZ but it has not been in use since 1999. However, we still retain a licence for abstraction on the River Porth at Rialton. The AMP7 WINEP scheme investigated the potential impact of using the existing licence on the River Porth and to identify new licence conditions which would allow for a sustainable abstraction going forward if the source is brought back into service. This has directly fed into our response to the drought of 2022 which is bringing Porth Reservoir back into service. There is no impact of the WINEP investigation on WRZ WAFU because the source is not currently utilised. The new WAFU benefit of the Porth Reservoir scheme already accounts for this assessment.

Stoke Canon and Brampford Speke Boreholes (Wimbleball WRZ)

Stoke Canon and Brampford Speke boreholes are located in the River Exe catchment, Wimbleball WRZ. Although licensed abstractions, they aren’t currently used as water resource sources. The AMP7 WINEP schemes for these sites investigated the potential impact of using the existing licences on the surrounding River Exe catchment based on the existing licence conditions and also alternate options to promote sustainability. The investigation assessed whether the boreholes could be used to partially replace the augmentation release from Wimbleball Reservoir, which is abstracted from the River Exe at our licensed abstraction sites further downstream. Operating the boreholes to support augmentation in the catchment will help to conserve Wimbleball Reservoir storage. The investigation for AMP7 is now complete, however prior to any future use of the boreholes further sustainability investigative work is required in the wider Exe catchment, this is planned in the AMP8 WINEP programme.

AMP7 Scheme	WRZ	Licence Change	WAFU Reduction	Year
Otter Valley	Wimbleball	4 Ml/d	0 Ml/d	2028
De Lank River	Colliford	TBC	4 Ml/d	2028
River Porth at Rialton	Colliford	n/a	n/a	2025
Stoke Canon and Brampford Speke	Wimbleball	TBC	n/a	2030

Table 8 Overview of AMP7 WINEP Sustainable Abstraction Investigations

4.2.2 AMP8 / PR24 WINEP Investigations

SWW has worked closely with environmental regulators (the EA and where required NE) to develop a comprehensive water resources WINEP programme for AMP8. A five step process was followed to develop the programme, summarised in figure 2:

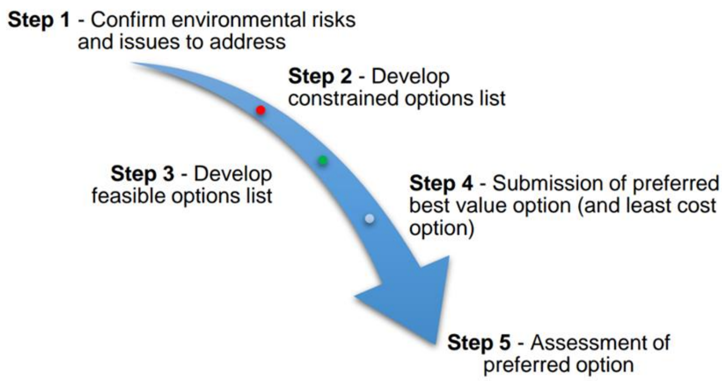

Figure 2 – PR24 WINEP development process

Our WINEP programme includes investigations designed to ensure our abstractions are compliant with current environmental requirements, for example the Water Environment Regulations. For AMP8 a new 'Environmental Destination' driver has been added – this considers the sustainability of our water resource sources with future pressures, particularly climate change and population growth.

Water Resource Investigations in PR24

Our programme of works covering current sustainability is linked to statutory WINEP drivers; WFD_ND_WRFLOW, which assesses sustainability of abstraction from surface waterbodies, WFDGW_NDINV, which assesses sustainability of abstraction from groundwater waterbodies, and HD_INV, which assesses risk to water dependent protected sites (i.e., Special Areas of Conservation, SACs) as a result of abstraction. These investigations link directly to obligations in the River Basin Management Plan (RBMP) to prevent deterioration to the environment because of our activities and deliver against Water Resource Management Plan objectives to nurture the environment while providing resilient water resources to meet the needs of our customer base. Where required, these investigations will include options appraisals to improve sustainability at our sites, which will inform future iterations of the WRMP.

Our programme of current sustainability investigations is summarised in table 9 below:

Action ID	Component	Driver Code Primary	Action Name
08SW100029	a	HD_INV	Kit Brook abstraction
08SW100067	a	WFDGW_NDINV	Longham
08SW100068	a	HD_INV	River Avon Abstraction
08SW100070	a	HD_INV	Tidal River Avon and tidal River Stour
08SW102970	a	HD_INV	Swincombe, Venford Res, Devonport Leat flow EFI and CSMG
08SW102971	a	HD_INV	Harford Moor, Erme
08SW102972	a	HD_INV	Tavy at Lopwell Dam and Abbey Weir – Lower River Tavy
08SW102973	a	HD_INV	Tavy Cleave and Hill Bridge - Upper River Tavy
08SW100016	e	WFD_NDINV_WRFlow	Bray (Source to Hole Water)
08SW100016	b	WFD_NDINV_WRFlow	Dart at Littlehempston
08SW100016	c	WFD_NDINV_WRFlow	Lower River Fowey

08SW100016	g	WFD_NDINV_WRFlow	River Exe Flow Investigation
08SW100016	a	WFD_NDINV_WRFlow	Upper Cober and Lower Cober and The Loe
08SW100016	f	WFD_NDINV_WRFlow	Upper River Yeo (Barnstaple)
08SW100061	b	WFD_NDINV_WRFlow	Wimborne/Longham
08SW100064	a	WFDGW_NDINV	Ampress - Lymington River
08SW100067	b	HD_INV	Ibsley Water

Table 9 - PR24 Water Resource Investigations into current sustainability

Sustainability implementation schemes in AMP8

Across the SWW and Bournemouth area we have 7 sustainability implementation lines within the AMP8 WINEP programme. Five of these sites are discussed in detail in section 4.2.1; the Otter Valley, De Lank, Stoke Canon, Brampford Speke and Porth / Rialton schemes are implementation schemes following on from AMP7 investigations. The remaining two schemes are in the Hampshire Avon catchment, which is discussed in section 4.3 below.

4.2.3 Abstraction incentive mechanism

The Abstraction Incentive Mechanism (AIM) is a means by which the EA incentivises water companies to reduce abstractions from environmentally sensitive water sources when river flows are low. We currently operate one AIM scheme in East Devon in the Lower Otter catchment. It is assessed as having Poor Ecological Status by the EA to which the current level of local abstraction may contribute.

The Otter Valley AIM scheme, agreed with the EA, reduces the annual volume we abstract from key groundwater sites during times of low groundwater levels to protect river flows. However, since the scheme was implemented three years ago, groundwater levels have been relatively high and it has yet to be triggered.

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

4.3 River Avon SAC

4.3.1 Overview of River Avon SAC

The River Avon is a large (1,700 km^2) lowland river in Hampshire reaching the sea on the south coast at Bournemouth. It runs through chalk, greensand and clay creating a unique river habitat. It is a European designated Special Area of Conservation (SAC) due to its unique environmental characteristics and the habitats and species it supports. The SAC designation means that Sustainable Abstraction must ensure that the river flows meet CSMG flow standards which currently it does not. This means that we must reduce our abstraction from the River Avon, particularly during periods of lower flows in the summer, to ensure enough water remains in the environment.

4.3.2 Overview of current abstractions

The River Avon is one of South West Water’s largest sources of raw water providing approximately 120 Ml/d of supply to our Bournemouth WRZ. We have two abstraction points on the River Avon, at Matchams and Knapp Mill, both of which are treated at our Knapp Mill treatment works. Additionally, water from Matchams can be transferred to Longham lakes for treatment at Alderney treatment works. The current licences at Matchams and Knapp Mill are summarised in Table 10.

Abstraction	Daily Licence	Annual Licence
Matchams	63.64 Ml/d	23,230 Ml
Knapp Mill	113.65 Ml/d	33,186 Ml

Table 10 Overview of existing abstraction licences in the River Avon

4.3.3 Our role in protecting the Hampshire River Avon SAC

We recognise the important role we play in protecting the unique environment of the River Avon - both now and in a future where we must take the additional risks of climate change and population growth into account. We have worked closely with the EA and Natural England to identify the actions we can take immediately to benefit the Avon and to develop a longer term plan to allow us to reduce our abstractions whilst maintaining reliable water supplies for our customers.

In the short term we have agreed to reduce our existing abstraction licences on the Avon. This will ensure that our abstraction does not grow to service the demands of new development and growth in the Bournemouth WRZ. From 2025, our River Avon licences for Matchams and Knapp Mill will reduce from an annual aggregate licence equivalent to 154.6 Ml/d on average, down to 121.5 Ml/d on average, a reduction of 33.1 Ml/d. There will also be a daily peak reduction at Knapp Mill only from 113.65 Ml/d down to 106 Ml/d, a reduction of 7.65 Ml/d.

In the longer term our Environmental Destination for the River Avon, which has been undertaken by Wood, on behalf of the WCWRG, indicates that we will need to reduce our peak summer abstractions by around 85 Ml/d in addition to the licence reductions outlined previously.

4.4 Time limited licences

Most of our abstraction licences are granted with perpetuity which means we can expect to continue abstracting water on an ongoing basis as long as we take due account of our obligations to ensure it is sustainable. Time limited licences have an expiry date which means that they must be renewed to allow continued abstraction. These are typically in places where ongoing monitoring of the environmental impact of our abstractions is required and such time limited licences may be renewed with the same or different abstraction limits, or not renewed at all.

4.4.1 Otter Valley Groundwater

A number of our groundwater licences in the River Otter catchment are time limited and due for renewal over the end of AMP7 and start of AMP8. The work done on the AMP7 WINEP has identified the actions we need to take to ensure our abstractions in this catchment are sustainable. We therefore anticipate that these licences will need to be renewed in line with the conclusions of the WINEP investigation.

4.4.2 River Stour at Longham

Our abstraction licence on the River Stour at Longham includes a time limited component of 12.5 Ml/d. This expires in 2028 when we must reduce our total daily average abstraction to 31.82 Ml/d. We have assumed that this component will not be renewed because of the risk of deterioration in the WFD status classification and EFI deficits in the River Stour.

4.4.3 Isles of Scilly

Our groundwater licences on the Isles of Scilly were issued in 2021 and are time limited to 2030. We have agreed a groundwater monitoring plan with the EA, currently underway, which will develop and provide the evidence base we need to determine the impact of our abstractions on the environment. As noted in Section 0, we have developed a deployable output scenario in our WRMP24 where we demonstrate the implications if these are not renewed.

4.5 Developing our Environmental Destination

4.5.1 Guidance and Requirements

The Government's 25 year Environment Plan[3], published by Defra in 2018, set out targets for Sustainable Abstraction. This resulted in the EA's National Framework for Water Resources[4] which outlines the risks to the future water environment from climate change if our approach to water abstraction continues as it is today. The National Framework mandates the production of Regional Water Resource Plans to ensure abstractions are sustainable to protect the water environment from the pressures of climate change. Our initial assessment of the Environmental Destination was undertaken as part of our regional WCWRG following the direction of the National Framework.

In addition, the EA issued further guidance on "preventing deterioration" which outlined the requirement to ensure there is "no deterioration" in water bodies from the present day WINEP and the 2050 target outlined in the National Framework. Capping abstraction licences at the most recent abstraction rate is the mechanism designed to prevent the risk of further environmental deterioration and ensure there is no future growth in abstractions.

We have worked closely with the EA to develop our Environmental Destination and ensure we have used the most up to date evidence that reflects the status of water bodies and abstractions as we understand them today.

[3] 25 Year Environment Plan - GOV.UK (www.gov.uk)
[4] Meeting our future water needs: a national framework for water resources - GOV.UK (www.gov.uk)

4.5.2 Licence capping

We have been working closely with the EA to identify which of our abstraction licences are in water bodies that are at risk of deterioration. The assessment has used the most up to date view on Fully Licensed and Recent Actual scenarios from the EA's WRGIS. This provides a more up to date view than that used in the National Framework and therefore our assessment of licence capping risks identifies more licences than we considered in our original Environmental Destination assessment. The most notable updates are the inclusion of our licences on the River Exe, River Fowey and River Stour which previously did not form part of our Environmental Destination.

In total there are 28 water supply licences in water bodies with a risk of deterioration which have now been included in our licence capping assessment. The most recent six years (2017-2022) of either an average annual abstraction or a peak annual abstraction have been used in the assessment to determine the licence cap volume. The results are summarised in Table 11.

WRZ	Licence Number	Source	Cap Type	Cap Year	Annual Loss Ml	Daily Rate Loss Ml/d
Bou	13/43/028/S/051 13/43/028/S/052	River Avon	Peak	2022	12,045	33.1
Col	15/48/232/S/014	River Cober at Wendron	Average	NA	0	0.0
	15/48/018/S/040	River Fowey at Restormel	Peak	2022	0	0.0
	15/48/018/S/032	River Fowey at Trekievesteps	Peak	2022	2,178	6.0
	15/47/141/S/026	Withey Brook at Bastreet	Peak	2021	860	2.4
Roa	14/50/008/0536	River Yeo	Peak	2022	1,737	4.8
	14/46/004/0586	River Dart	Peak	2017	1,099	3.0
	14/46/004/0651	River Swincombe	Peak	2022	1,797	4.9
	15/47/041/S/039	River Tavy at Lopwell	Peak	2021	26,731	73.2
	14/46/004/0558	Devonport Leat Intakes	Peak	2019	0	0.0
	14/46/004/0572	Littlehempston	Peak	2018	2,075	5.7
	14/50/008/0694	Bray at Leehamford	Peak	2017	2,884	7.9
Wim	14/45/002/2019	River Exe at Northbridge	Peak	2022	7,074	19.4
	14/45/002/1861	River Exe at Northbridge	Peak	2019	0	0.0
	14/45/002/2388	River Exe at Exebridge	Peak	2017	7,098	19.4
	14/45/002/2336	River Exe at Bolham	Peak	2022	2,352	6.4
	14/45/002/2342	River Exe at Bolham (Leat)	Peak	2019	0	0.0
	14/45/000/0676	Hook and Cotley Springs	Peak	2018	11	0.0
	14/45/001/0426	Greatwell 1, 2, 3	Average	NA	871	2.4
	14/45/001/0505	Greatwell 5	Average	NA	528	1.4
	SW/045/0001/008/R01	Greatwell 4B	Average	NA	365	1.0
	SW/045/0001/014/R01	Greatwell 6P	Average	NA	376	1.0
	14/45/001/0478	Colaton Raleigh	Average	NA	189	0.5
	14/45/001/0518	Harpford	Average	NA	350	1.0
	14/45/001/0520	Dotton 4, 5	Average	NA	1,044	2.9
	SW/045/0001/016/R01	Dotton 1, 2, 3, 7	Average	NA	0	0.0
	SW/045/0001/017/R01	Otterton	Average	NA	972	2.7
				Total	72,661	199

Table 11 Summary of licence caps

We used the licence cap volumes to update the licence constraints in MISER and our DO assessment was repeated. The impact of licence capping was assessed at a WRZ level by comparing the DO in the licence capping scenario with the DO in the baseline assessment. The most significant impact of licence capping is in the Bournemouth WRZ where the licence reduction has a direct equivalent reduction in WAFU of 33.1 Ml/d but only in a DYAA scenario. DYCP WAFU is not affected because the peak licence cap does not reduce total abstractions below the existing WAFU constraint of water treatment works capacity. The Wimbleball WRZ has a reduction in WAFU of 6 Ml/d, primarily driven by reductions on the River Exe, and the Roadford WRZ has a reduction in WAFU of 2 Ml/d linked to the River Dart. Licence capping has no impact on the Colliford WRZ because the existing system constraint of Restormel water treatment works is reached before the licence capping constraints.

We have assumed that Licence Capping reductions in WAFU are in place from AMP9 (2030) onwards to align with the expected outcomes from AMP8 WINEP investigations. The exception to this is Bournemouth WRZ where we have already agreed the licence reduction from the start of AMP8 (2025).

WRZ	Annual Reduction Ml	Daily Rate Ml/d	WAFU Ml/d
Colliford	3,039	8.3	0.0
Roadford	36,323	99.5	2.0
Wimbleball	21,230	58.2	6.0
Bournemouth	12,070	33.1	33.1
Total	72,661	199.1	41.1

Table 12 WRZ summary of licence capping impacts on WAFU

4.5.3 Longer term reductions

Our longer term Environmental Destination was initially informed from the National Framework analysis. The National Framework undertook analysis on a catchment scale to identify EFI deficits in 2050 under climate change. To resolve these deficits licence changes are required to mitigate the impacts which forms the basis for Environmental Destination. The WCWRG commissioned Wood/WSP to undertake analysis to translate the National Framework analysis to licence impacts on a WFD waterbody scale. The assessment for WCWRG is based on the following scenarios:

- **Business As Usual Plus (BAU+)**: The same percentage of natural flow needed for the environment that currently applies continues into the future. Uneconomic waterbodies, where reducing abstraction would imply a significant investment, were initially discarded. However, an additional scenario (BAU+) which includes them has been subsequently incorporated.
- **Enhanced**: this scenario identified waterbodies where an enhanced level of environmental projection could be required. These fell into two categories:
    - Assigning ASB3 to waterbodies which were perceived as having sensitive fisheries, chalk stream reaches or groundwater dependent terrestrial ecosystems (see Table 7)
    - Assigning the CSMG targets to waterbodies which impact Natura 2000 sites - the European network of protected areas of the most valuable and threatened species and habitats (see Table 7).

Wood/WSP confirmed that our BAU+ and Enhanced scenarios result in the same volume of licence reductions and therefore we do need to provide more differentiation between these scenarios.

The National Framework analysis had some limitations in its methods which means it does not effectively or entirely represent the impacts of reservoirs and complex abstractions. It was also based on historical RBMP EFI and abstraction data which has been updated in the intervening periods. This means that there were particular omissions in the National Framework outputs and which were highlighted by responses to our consultation on the draft WRMP, notably in the River Exe, River Fowey and River Stour.

We have been working with the EA to understand our licence capping position as outlined in section 4.5.2. An initial assessment with the EA to test our joint assumptions looked at differing time periods over which to assess Recent Actual abstractions. This initial assessment generated larger licence reductions and WAFU deficits in our Colliford WRZ than the final licence capping position presented above. We have therefore used this analysis to inform our longer-term ED position in the River Fowey as a precautionary approach ahead of further investigations into ED in AMP8. For the River Stour, the EA have undertaken analysis to inform the ED position of both Wessex Water and South West Water and we updated our Bournemouth WRZ ED to account for this. The River Exe already has a large licence capping impact (around 6 Ml/d) and no additional longer term ED impact has been added. We believe this is a proportionate approach because the AMP8 WINEP assessment will likely result in a licence change which will have a small impact on WAFU and therefore adding additional longer term ED reductions risks overstating these impacts.

Many of the licences that fall within our longer-term ED analysis also have a licence cap reduction. Where licences are subject to earlier licence capping assumptions, we have ensured that the licence cap reduction is removed from the longer term ED reduction and is not being double counted. These are summarised in Table 13 with the original ED assessment in the first column and the revised assessment which considers any licence capping assumptions. A WRZ summary of the licence impacts and subsequent WAFU impact is provided in Table 14.

We have assumed that our ED reductions will be implemented from AMP10 (2035) onwards as our baseline assumption, noting that our preferred plan delivers this early in some WRZs. This follows the licence cap reductions we have assumed from AMP9 (2030) onwards. Due to the scale of the deficits in our Bournemouth WRZ we have added additional scenarios to test phasing the ED reductions in equal measures in AMP11 (2040) and AMP12 (2045) because we do not have options available early enough to mitigate the licence reduction sooner in our DYCP planning scenario.

WRZ	Licence Number	Source	Licence reduction Ml/d	Revised Licence Reduction Ml/d	Link to licence capping assumptions
Bou	13/43/037/S/029	River Stour	24.24	24.24	No Cap
	13/43/028/S/051	River Avon at Knapp Mill	117.69	**84.19**	Cap < ED
	13/43/035/G/109	Stanbridge	2.50	2.50	No Cap
Col	15/49/283/S/003	De Lank River	3.24	0.00	AMP7 WINEP
	15/48/232/S/014	River Cober at Wendron	1.97	1.97	Cap = Licence
	15/48/018/S/040	River Fowey at Restormel	11.96	11.96	Cap = Licence
	15/47/141/S/026	Withey Brook at Bastreet	2.40	**0.00**	Cap > ED
Roa	14/50/008/0536	River Yeo	1.58	**0.00**	Cap > ED
	14/46/004/0586	River Dart	25.00	**16.99**	ED > Cap
	14/46/004/0651	River Swincombe	5.37	**0.00**	Cap > ED
	15/47/041/S/039	River Tavy at Lopwell	91.00	**18.00**	ED > Cap
	15/47/001/S/025	River Yealm	0.32	**0.00**	Disused
	14/46/004/0558	Devonport Leat Intakes	3.17	3.17	Cap = Licence
	14/46/004/0572	Littlehempston	4.67	**0.00**	Cap > ED
	15/47/013/S/020	River Tamar at Gunnislake	44.40	44.40	No Cap
Wim	14/45/000/0676	Hook and Cotley Springs	1.73	1.73	Cap = Licence
	14/45/001/0426	Greatwell 1, 2, 3	2.62	2.62	ED > Cap
	14/45/001/0505	Greatwell 5	1.01	1.01	ED > Cap
	SW/045/0001/008/R01	Greatwell 4B	0.69	0.69	ED > Cap
	SW/045/0001/014/R01	Greatwell 6P	0.81	0.81	ED > Cap
	14/45/001/0478	Colaton Raleigh	1.55	1.55	ED > Cap
	14/45/001/0518	Harpford	2.82	2.82	ED > Cap
	SW/045/0001/016/R01	Dotton 1, 2, 3, 7	6.44	6.44	Cap = Licence

Table 13 Overview of Environmental Destination licence reductions for each licence. Licence reductions are daily rate equivalent based on annual reductions. The Licence Reduction is the ED assessment prior to accounting for licence capping assumptions which are updated in the Revised Licence Reduction column.

WRZ	Revised Licence Reduction Ml/d	WAFU Reduction Ml/d
Bournemouth DYCP	108.43	108.43
Colliford	13.93	9.97
Roadford	82.56	26.25
Wimbleball	17.66	8.00
Total	222.58	152.65

Table 14 WRZ summary of Environmental Destination licence reductions and their associated impact on WAFU

4.5.4 Environmental Destination Investigations in PR24

Our programme of investigations assessing water resource sustainability against future pressures is being delivered under the new environmental destination (ED) driver. These investigations will consider the impact of climate change, population growth and land use change on our water resource sources up to 2050 and assess whether sustainability changes will be required.

Our aspirations for long-term water resources resilience and security for our customers, society and the environment has led to us developing a comprehensive ED Investigation programme in PR24. Using the Options Appraisal guidance, the ED investigations have been decided based upon a regional / wider catchment approach using the following approach:

- Include all abstractions within the same river catchment in an ED investigation to reduce uncertainty with water availability and allow for options to improve the efficiency of interaction with the water cycle in catchments.
- Link cross-catchment abstractions where there are known water transfers to potentially offset deployable output. However, in some cases it was not possible to link all known water transfers, as this would result in too large an area to investigate. In these cases, the links between the ED investigations have been identified and will be considered during the investigations.
- For areas with fewer abstractions, the ED investigations have considered the abstractions across regions, to allow for potential options for new water transfers or the identification of new supply sources.
- Revoked and drought permit schemes have been incorporated within each relevant ED investigation to understand whether these sources of supply could provide a potential offset to deployable output reductions associated with the ED reductions.
- Our licences on the Isles of Scilly have not been included within the ED work to allow time for environmental monitoring to take place which will inform our view of any current environmental pressures linked to abstraction.

In addition to our catchment based ED investigations, we are also delivering a statutory investigation into our contribution to meeting future water resource challenges at a regional level.

Table 15 below summarises licence grouping for our ED schemes in PR24.

WRZ	ED Catchment	Licences
Roadford	Dart	Blackbrook; Cowsic; West Dart; Swincombe; Venford Reservoir; Dart at Littlehempston; Littlehempston radial collectors
Roadford	Tavy & Meavy	Burrator Reservoir, Meavy at Stanlake; Tavy at Lopwell Dam; Tavy at Abbey Weir; Tavy at Tavy Cleave; Tavy at Hill Bridge; Willsworthy Brook (Mine Leat); Wheal Jewel Leat
Roadford	Tamar	Upper Tamar Lake; Lower Tamar Lake (revoked); Roadford Reservoir, Gunnislake; Lyd; Gatherley (option)
Roadford	Meldon & West Okement	Meldon Reservoir; West Okement
Roadford	Yealm, Avon & Erme	Avon Reservoir; Yealm at Dendles Wood; Erme at Hartford Moor; Broadall Lake (revoked); Ford Brook (revoked); Left Lake (revoked); Red Lake (revoked)
Roadford	Teign	Kennick, Tottiford & Trenchford reservoirs; Fernworthy Reservoir; disused quarry next to Fernworthy (option)
Roadford	North Devon abstractions	Bray at Leehamford; Wistlandpound Reservoir; Brockenburrow; Challacombe Reservoir (option); Upper Slade Reservoir; Lower Slade Reservoir; River Yeo at Loxhore

Colliford	North Cornwall	De Lank; Crowdy Reservoir; Stannon Lake; Rialton intake & Porth Reservoir
Colliford	Fowey & Withey Brook	Restormel; Trekievesteps; Siblyback Reservoir; Colliford Reservoir; Withey Brook; Park Lake; Hawks Tor Pit (option), Warleggan (option); Blackpool Pit (option)
Colliford	Fal and far west Cornwall	Drift Reservoir; Cober at Wendron; Stithians Reservoir; Kennal Vale; Roseworthy Stream (revoked); Argal Reservoir; College Reservoir; Well at Hayle STW; River Hayle (revoked); Wheal Jayne (revoked); Leswidden Pool (option)
Wimbleball	Exe	Wimbleball Reservoir; Exe at Bolham; Exe at Northbridge; Exe at Exebridge; Brampford Speke borehole; Stoke Canon borehole; Aller Springs; Vennbridge borehole; Duckaller borehole; Pynes Leat
Wimbleball	Axe	Hook & Cotley Springs, Kit Brook; Wilmington Springs; Bovey Lane borehole
Wimbleball	Otter	Greatwell boreholes; Colaton Raleigh boreholes; Harpford boreholes; Otterton boreholes; Dotton boreholes; Kersbrook boreholes
Bournemouth	Avon	Avon at Knapp Mill; Avon at Matchams; Wood Green, Hale
Bournemouth	Stour	Longham river abstraction; Longham Gravels; Long Crichel; Gussage All Saints; Wyke Down; Stanbridge; Stour
Bournemouth	Lymington	Ampress boreholes
ALL	Company contribution to Regional Plan environmental destination	Company Wide – Regional Plan

Table 15 - Summary of ED schemes in PR24

4.6 Summary of Sustainable Abstraction

A summary of the baseline WAFU impacts for each WRZ resulting from all elements of our commitment to achieving Sustainable Abstraction are outlined in Table 16. In our preferred plan, outlined in section 10 of our Technical Summary, we deliver longer term ED reductions earlier than outlined in our baseline table below.

WRZ	AMP8	AMP9	AMP10 onwards
Bournemouth DYCP	8.18	8.18	116.61
Bournemouth DYAA	41.25	41.25	70.13
Colliford	4.00	4.00	13.97
Roadford	0.00	2.00	28.25
Wimbleball	0.00	6.00	14.00
Total	**45.25***	**20.18^**	**172.83^**

* Total equals Bournemouth DYAA + Colliford + Roadford + Wimbleball, ^ Total equals Bournemouth DYCP + Colliford + Roadford + Wimbleball

Table 16 Summary of WAFU impacts (Ml/d) per WRZ as a cumulative total across AMP8 to AMP10 onwards

Each of the subsequent sections provides a WRZ summary of all our assumptions to ensure we achieve Sustainable Abstraction.

4.6.1 Bournemouth WRZ

We have agreed a licence cap on the River Avon from 2025 as outlined in section 4.3 to ensure our abstractions do not grow to meet local growth in population. This reduces our annual average licence by 33.5 Ml/d and our peak daily licence by 7.65 Ml/d. We assume our time limited licence on the River Stour will end in 2028 which is a reduction of 12.5 Ml/d in our licence. In the long term our Environmental Destination sees reductions totalling 108.43 Ml/d to ensure we achieve sustainable abstraction under climate change as outlined in section 0. This longer term ED is driven in a larger part by the River Avon but also includes reductions on the River Stour and Stanbridge groundwater. In total Bournemouth WRZ DYCP WAFU is reduced by 116.61 Ml/d across the WRMP24 planning period.

4.6.2 Colliford WRZ

We have a WAFU reduction due to WINEP at De Lank of 4 Ml/d from 2028. We have tested licence capping assumptions in the WRZ but this did not impact upon our overall WRZ WAFU because DO is constrained by our Restormel water treatment works capacity. Our longer term ED is centred on the River Fowey and River Cober resulting in an overall impact of 9.97 Ml/d on WRZ WAFU. In total Colliford WRZ WAFU is reduced by 13.97 Ml/d across the WRMP24 planning period.

4.6.3 Roadford WRZ

Licence capping has a large impact reducing the volume of licenced water in the WRZ by nearly 100 Ml/d. However a number of these sources are not highly utilised and the subsequent impact on WRZ WAFU is 2 Ml/d. The longer term impacts of ED drive large reductions in both licensed abstraction and WRZ WAFU, totalling 26.25 Ml/d, which is primarily linked to abstraction reductions on the River Dart. The reductions in the River Dart mean we do not have enough local resource to meet demand which means the longer term WRZ strategy needs to include options to move more water into this area of Roadford WRZ to allow ED to be delivered. In total Roadford WRZ WAFU is reduced by 28.25 Ml/d across the WRMP24 planning period.

4.6.4 Wimbleball WRZ

We have a WINEP reduction of 4 Ml/d on the Otter groundwater licences but this does not impact on our WRZ WAFU because of the conjunctive use of the resources in the WRZ. Licence capping has a large reduction in the available abstraction in the WRZ, most notable reducing the resource available on the River Exe in our DO assessment. This leads to reduction in WAFU of 6 Ml/d. The longer ED in the WRZ is linked to the East Devon groundwater sources with further reductions in WAFU of 8 Ml/d. In total Wimbleball WRZ WAFU is reduced by 14.00 Ml/d across the WRMP24 planning period.

4.6.5 Isles of Scilly WRZ

Our existing groundwater licences on the Isles of Scilly are time limited and due for renewal in 2030. We have agreed a groundwater monitoring plan with the EA and are in the process of implementing this in the remainder of AMP7. This will provide us with the evidence base we need to support the review of licences ahead of renewal and ensure our abstractions remain sustainable.

5 Climate change

We considered the impact of climate change on our water supply forecast in accordance with the Environment Agency's guidelines, 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.

5.1 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 we are 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). For our revised WRMP24 we have revised this assessment to account for the changes in our planning constraints in each WRZ.

We have aligned 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. With the exception of Isles of Scilly, we have therefore adopted a Tier 3 High vulnerability assessment across our WRZs.

WRZ	dWRMP24	Revised dWRMP24	Commentary on changes
Bournemouth	Low	High	Scale of ED in WRZ increases risks from climate change.
Colliford	Medium	Medium	
Isles of Scilly		Low	Dependency on desalination is climate independent.
Roadford	High	Medium	Lyd and Gatherley reduce climate change vulnerability.
Wimbleball	Medium	Medium	

Table 17 Overview of climate change vulnerability assessment

The Isles of Scilly WRZ does not have any further analysis of climate change in WRMP24. Our main source of water from 2025 will be desalination and it is not impacted by drought risk and/or climate change. For the groundwater assets that we will retain, we do not yet have the evidence base to undertake a formal yield assessment and therefore we cannot model the additional impacts of climate change beyond this. We are currently undertaking the yield assessment and will include this in our final plan. However, the climate change assessment will require lumped groundwater models to be developed following the yield assessment and this will not be in time for WRMP24. To ensure this does have a material impact on our preferred WRMP24 programme for the Isles of Scilly we have considered a “no groundwater” scenario to mitigate this risk. As part of our roadmap for WRMP29 we will ensure we have the required data and models to undertake this assessment (see section 10 of the Technical Document).

5.2 UKCP18 Datasets

UKCP18 provides a combination of evidence sources which we considered in our WRMP as outlined in Table 18. These datasets have been derived from UKCP18 in a consistent approach for all WCWRG companies (HR Wallingford, 2021b). The regional climate model (RCM) and global climate model (GCM) projections are only available from UKCP18 for RCP8.5, which is the highest emissions scenario, so we have also used UKCP18 probabilistic data for RCP6.0 the medium emissions scenario to understand the sensitivity of our DO to a range of projections.

For a Tier 3 high-vulnerability assessment, we considered multiple climate change evidence sources from UKCP18 and simulated the impacts of these climate change scenarios using rainfall-runoff models and water resources models to determine the impacts on DO. We used all the projections to undertake a historical climate change assessment to compare the range of impacts across the evidence sources and only the RCM datasets in our 1 in 500 year stochastic drought assessment.

Table 18 UKCP18 evidence sources

UKCP18 Dataset	Emissions Scenario	Historical	Stochastics
RCMs	RCP8.5	Y	Y
GCMs	RCP8.5	Y	
Probabilistic	RCP6.0	Y	

5.3 Climate change and deployable output

5.3.1 Climate change impacts modelling

We repeated our DO assessment as outlined in section 3 using inflow sequences which reflect the impacts of climate change derived from UKCP18. These were created by applying climate change factors to the rainfall and evaporation datasets that are used in URMOD and provide simulated river flows to MISER which simulates the water resources system under these scenario impacts.

The 1 in 500 year drought assessment under climate change used the 12 UKCP18 RCM projections in combination with our baseline stochastics dataset to estimate a DO for each of the 12 climate change projections. These 12 scenarios represent the highest possible impacts of climate change within UKCP18. Work undertaken by Atkins for a number of Water Resources Regional Planning groups recommended using the RCM scenarios because they provide the clearest signal of the impacts of climate change. A temperature scaling approach can then be used to translate the highest impacts to different emissions scenarios and UKCP18 data products. See example factors in Table 19. We have calculated the DO impacts of the 12 RCM projections using our MISER model and then used the central impact from this analysis for the basis of our planning assumptions. The Atkins scaling factors have then been used to translate these impacts from RCP8.5 to RCP6.0 for use in our central planning scenario. We have used the original RCP8.5 RCM results to inform our scenario under a high climate change future and an additional RCP2.6 low climate change scenario was calculated using the low emission Atkins scaling factors.

The range of the 12 RCM scenarios, scaled to RCP6.0, was used to inform our target headroom assessment, whereas the different emission scenarios were used to represent different futures in our scenario testing and development of our adaptive plan.

	Warming °C[3]	Prob.	GCM	Probabilistic				GCM
UKCP River Basin	RCP 8.5 bc (3.7°C)	RCP 2.6 (1.3°C)	RCP 2.6 (1.7°C)	RCP 4.5 (1.8°C)	RCP6.0 (1.9°C)	A1b (2°C)	RCP8.5 (2.3 °C)	RCP8.5 (2.7°C)
Anglian	3.9	34%	47%	47%	48%	52%	70%	89%
Dee	3.6	34%	46%	47%	49%	53%	71%	90%
Humber	3.7	34%	47%	47%	49%	52%	70%	89%
Northumbria	3.5	34%	46%	48%	49%	53%	71%	90%
NW England	3.6	34%	46%	47%	49%	53%	71%	90%
SE England	4.0	34%	47%	47%	48%	52%	70%	89%
Severn	3.8	34%	47%	47%	49%	52%	70%	89%
SW England	3.7	34%	47%	47%	49%	53%	70%	89%
Thames	4.0	34%	47%	47%	48%	52%	69%	89%
W Wales	3.5	34%	46%	48%	49%	53%	71%	90%
Median	**3.7**	**34%**	**46%**	**48%**	**49%**	**53%**	**71%**	**90%**

Table 19 Atkins climate change impact scaling factors based on median rates of warming compared to RCM RCP8.5 for the 2070s

5.3.2 Climate change time scaling

The impacts of climate change derived from the UKCP18 projections are for a future period of 2061-2080 relative to a baseline period of 1981-2000. To incorporate the climate change impacts within our 25-year WRMP, we applied a linear scaling to climate change impacts as per the planning guidelines. We assumed a two-part scaling relationship such that climate impacts are tapered slightly in the first 5 years of our plan (2025-2030), with linearly scaled impacts reported from the 2030s onwards.

5.3.3 Climate change results

Our central climate change impact from UKCP18 for RCP2.6, RCP6.0 and RCP8.5 on each WRZs DO at the end of the plan (2049/50) is outlined in Table 20.

	Bournemouth	Colliford	Roadford	Wimbleball
UKCP18 RCP2.6	0.00	-4.26	-2.01	-3.76
UKCP18 RCP6.0	0.00	-6.14	-2.89	-5.42
UKCP18 RCP8.5	0.00	-12.54	-5.90	-11.06

Table 20 Central climate change impact on DO in 2049/50

6 Water transfers

Our 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 0.03 Ml/d. We also have several transfers between our SWW WRZs as outlined in Table 21.

Export WRZ	Import WRZ	Transfer Ml/d
Wimbleball	Wessex Water	0.03
Roadford	Colliford	2.65
Colliford	Roadford	0.10

Table 21 Overview of WRZ transfers

We have additional transfers between WRZs which we can use in a normal year and have reported in previous WRMPs. However, due to the particular water resource constraints in the Wimbleball WRZ during a 1 in 500 year drought, transfers have been assumed not to operate in a dry year because the resource is required in the WRZ.

7 Outage

Our supply forecast needs to make an allowance for outages. These are short-term reductions in DO due to planned or unplanned events at water sources or water treatment works. Outages can occur for a variety of reasons such as pollution, asset failure and routine maintenance.

We contracted AECOM 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). Since our draft WRMP24, we have updated our Outage assessment with the latest available information. See Appendix 1.2. Our approach to Outage reflects the relatively small size of outage as a component of WAFU in each of our WRZs and the methodology we have adopted is proportionate to this.

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.

The Isles of Scilly was not included in the AECOM assessment because we have limited historical outage information to inform our current assessment. We are working to improve this ahead of WRMP29 and outages on the Islands are being recorded in line with our other WRZs to develop the evidence base for future assessments. For this WRMP, we have used our Wimbleball WRZ analysis to develop an Outage figure as a percentage of DO and then applied this percentage to the Isles of Scilly. Wimbleball WRZ has been chosen because the outage in this WRZ is primarily associated with groundwater sources, similar to the Isles of Scilly, and because we have taken a precautionary approach of using the highest outage as percentage of WRZ DO.

7.1 Outage categories

The outage categories adopted for the analysis covering all four WRZs are shown in Table 22.

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 22 Summary of outage categories

7.2 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 23.

The Wimbleball WRZ outage is 3.73% of the 2021/22 DO and this percentage has been applied to the Isles of Scilly to derive an Outage figure of 0.074 Ml/d.

WRZ	Outage at 95% Confidence interval Ml/d
Bournemouth	2.38
Colliford	1.00* (0.14)
Isles of Scilly	0.07
Roadford	2.91
Wimbleball	3.36

Table 23 WRZ outage in Ml/d   ** de minimus value of 1 Ml/d assumed*

The outage values taken forward into our supply demand balance analysis for the WRMP are based on the 95th percentile, which are values with a 5% risk of exceedance. We choose the 95th percentile to ensure we adequately capture the risks that outage might pose whilst noting that outage is still a relatively small component in our overall WRZ WAFU. 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. For the Colliford WRZ, we have adopted a value of 1 Ml/day for outage.

8 Raw water and process losses

Raw water losses and process losses represent a loss of water from the point we abstract it from the environment through to the point that water leaves our water treatment works and enters water distribution. We have reviewed our raw water and water treatments works processes across our WRZs as part of WRMP24 assessment.

We have calculated our raw and treatment works process losses within each WRZ for a dry year. Losses are identified by a combination of:

- A mass balance comparison of raw water abstraction, inlet flow to our water treatment works and water treatment works output data to identify where there may be raw and/or treatment process losses
- site surveys and consultation with operational site managers to identify water usage in the water treatment process that is not returned to the start of the treatment process and is therefore a process loss.

WRZ	DYAA Losses Ml/d
Bournemouth	19.86 (16.90*)
Colliford	5.47
Isles of Scilly	0.06
Roadford	2.95
Wimbleball	0.00

* 2026/27 once Alderney and Knapp Mill works have been upgraded.

Table 24 Raw water and process losses for DYAA in 2024/25

Our highest losses are in the Bournemouth WRZ at Alderney and Knapp Mill water treatment works which use slow sand filters and are associated with high losses. We have upgrades planned for both Alderney and Knapp Mill in 2025/26 and 2026/27 respectively. We have reflected these changes in our planning assumptions by reducing losses from 19.86 Ml/d to 16.90 Ml/d.

Our Wimbleball WRZ has the lowest losses at 0 Ml/d. We have reviewed all our water treatment works and confirmed that all water used during the process of treating water is returned to the start of the treatment process and is not lost.

9 Water available for use

The Water Available for Use (WAFU) is the amount of water we have available to put into the water supply system to meet demand. It is calculated by taking the WRZ Deployable Output and accounting for transfers, losses, operational use and outage.

Our WAFU for each WRZ is summarised in Table 25 for the start of each AMP period in the WRMP planning period. This represents the timing of licence capping and ED adopted in our final preferred plan.

WRZ	2025/26	2030/31	2035/36	2040/41	2045/46
Bournemouth DYCP	210.04	176.86	126.86	126.86	93.43
Colliford	169.21	153.87	153.34	152.82	152.30
Isles of Scilly DYCP	1.80	1.80	1.80	1.80	1.80
Roadford	236.16	224.87	207.64	207.39	207.15
Wimbleball	81.93	73.97	65.51	65.05	64.59

Table 25 Overview of WRZ baseline WAFU reflecting the final timings of licence capping and environmental destination in our preferred plan

10 Supply side drought measures

During a drought, in accordance with our drought plan, we can use drought permits to temporarily increase the amount of water we can abstract from the environment. Some of our permits are variations to our existing sources and some permits utilise new sources of water that we don't regularly abstract from. In the development of our Best Value Plan our drought permits appear as options and can be selected alongside permanent demand and supply options and drought demand options.

The drought permit options we have assumed in our WRMP24 are outlined in Table 26. The Ml/d benefit we expect to achieve from each permit has been reviewed following the 2022 drought based on our understanding of how these sources would be used in practice. The options are each associated with a drought level (1-3) which is defined in our drought plan and this ordering is applied to their selection within a given options program.

One notable drought permit that has been omitted in our WRMP24 is for Upper Tamar Lake. As outlined in our WRZ Integrity Assessment (Appendix 11) we have improved the connectivity of this part of Roadford WRZ to allow additional supply from Northcombe water treatment works. In our demand forecast we do not envisage a localised supply-demand pressure in this part of the WRZ.

We have not assumed any benefit is available from supply-side actions in the DYCP scenario in our Best Value Plan because it would not be possible to obtain the required drought permits in sufficient time to enable use in a peak week.

Drought Plan ref.	Drought action	Level	Benefit (Ml/d)	Period of use	DYAA benefit (Ml/d)
Bournemouth					
B1	Wimborne	L2	2.00	3 months	0.50
B2	Stanbridge	L3	12.50	1-2 months	1.44
Colliford					
C1	Restormel licence	L1	6.00	6 months	3.00
C2	Stannon Lake	L2	4.00	3 months	1.00
C3	Porth & Rialton	L3	4.00	6 months	2.00
Roadford					
R1	River Lyd (April/May)	L1	0.00	2 months	0.00
R2	Slade Reservoir	L2	1.50	6 months	0.25
R3	Challacombe Reservoir	L3	1.50	2-3 months	0.33
R4	Meldon/Vellake to Roadford	L3	5.00	6 months	2.50
R5	Lee Moor Quarries	L3	4.00	6 months	2.00
Wimbleball					
W1	Brampford Speke & Stoke Canon BHs	L1	8.00	6 months	4.00
W2	Hook Springs	L2	1.20	3 months	0.40
W3	Wilmington Springs	L2	0.80	3 months	0.20
W4	Wimbleball comp flow	L3	9.09	4 months	4.00

Table 26 Overview of drought permits considered in WRMP24

11 Drinking water protected areas

Under the Water Framework Directive (WFD) rivers, lakes and groundwater from which we abstract water are in areas that are designated as Drinking Water Protected Areas (DrWPAs). The objective of DrWPAs is to ensure that drinking water can be produced to meet the requirements of Water Supply (Water Quality) Regulations 2016 and reduce the level of treatment that is needed to ensure water is fit for consumption. The Environment Agency is required to monitor the water quality in DrWPAs. Where necessary, to improve the water quality or to ensure it does not deteriorate, the EA can establish safeguard zones.

11.1 Source protection zones and safeguard zones

All our groundwater sources have source protection zones to ensure that the water we abstract meets the water quality requirements we plan for in our water treatment processes. We have worked with the Environment Agency to establish safeguard zones where necessary, covering both surface water and groundwater water sources. We have worked collaboratively with the EA to develop Safeguard Zone Action Plans. These outline the water quality impacts and their sources and outline the actions and measures the Environment Agency and South West Water are taking. The Safeguard Zone Action Plans are non-statutory and can require voluntary actions from third parties, such as farmer or commercial industries, to meet water quality objectives. We are working closely with third parties, with examples provided in the next section.

11.2 Catchment and nature based solutions

11.2.1 Example - Farm water efficiency and resilience

We have been collaborating with key stakeholders from the agrifood sector (NFU, land management organisations/advisors, landowners, regulators, water retailers, environmental NGOs, practitioners) to establish a working group that will co-design a water resources management approach for the 'agrifood' sector across the South West region.

The 'agrifood' sector (agriculture, horticulture, food and drink supply-chain businesses) is a vital contributor to the South West Region's economy, but it also represents a key group of stakeholders in the management of water resources. As a large group of non-household water users, these users have the potential (individually and collectively) to make a significant contribution to the delivery of water resources management outcomes.

At present, this potential contribution is most significant in relation to demand-side outcomes, for example, reduced reliance on potable water use, water efficiency or increased resilience to drought, but the sector also has huge impact potential in relation to supply-side outcomes such as nature-based solutions, effluent re-use and decentralised water storage. This sector can also significantly complement our environmental ambitions of increased resilience, biodiversity enhancements and carbon sequestration.

We recognise how important it is to engage and collaborate with these stakeholders and with their water retailers to develop a clear understanding of their issues and concerns, and to explore with them how they may be able to contribute to both the design and delivery of our water resources plans.

As a result of this focused collaboration, these stakeholders are now highly engaged, especially the NFU and National Trust. They clearly see both the WRMP and WC Regional Plan as an opportunity to become involved and make a significant contribution to water resources planning across the region. This collaboration has the potential to be highly mutually beneficial and is well aligned with our ambition for the water resources plans to be 'multi-sector'. It can also provide access to a wider array of other stakeholders and networks that we may not otherwise be able to engage.

During the development of our non-household customer water efficiency strategy, and our unconstrained list of demand-management options, particularly those focused on the agrifood sector, the potential of ponds or similar offline water storage features to provide multiple benefits for water resources management has repeatedly surfaced in the discussions. It is our belief that, thanks to their abundance, heterogeneity, biodiversity value, biogeochemical potential and water storage capacity, ponds could have a crucial role to play in catchments, biodiversity gain, landscapes, and in the water resource management system.

Building on this concept, we are now leading the co-development of an initiative to create a network of farm-ponds or reservoirs and intend to evaluate their potential to act as a decentralised water resource option and deliver a myriad of co-benefits in the landscape such as non-household water efficiency savings, natural capital/biodiversity gains, downstream ecological benefits, farm business resilience and carbon savings.

We have secured firm support from our partners and environmental groups, agriculture sector, land management bodies, government agencies, local government partners and internal colleagues to co-design and initiate this scheme.

This includes early conversations with large riparian landowners who are keen to engage with us and develop potential schemes ahead of our final WRMP.

A further direct outcome from these conversations has been the co-development of the Water Net Gain initiative between ourselves and the Westcountry Rivers Trust. The aim of the Water Net Gain Project, submitted as a £1m proposal to the Ofwat Breakthrough Challenge Fund, is to explore the governance and technical aspects of planning, designing, creating and trading of a water bank through a distributive network of ecologically connected ponds and other nature-based solutions. These features could increase resilience by passively contributing to base flows, deliver demand management benefits or actively release water to the river to dilute pollution and deliver supply-side benefits.

11.2.2 Upstream Thinking Catchment Management

The Upstream Thinking Project is our flagship programme of environmental improvements designed to improve water quality in river catchments to reduce water treatment costs. The programme includes restoring peatlands, advice and grants for farmers, help with obtaining enhanced environmental stewardship schemes and soil tests along with payments for ecosystems services.

The programme is implemented through our delivery partners - the Westcountry Rivers Trust, Devon Wildlife Trust, Cornwall Wildlife Trust, the Farming and Wildlife Advisory Group, the Peatland Partnership, and the University of Exeter. The partnership works closely with the EA, Natural England, the NFU, local catchment partnerships and many other key stakeholders.

In the 2015-2020 business planning period, our catchment management programme benefited water passing through 15 water treatment works across Devon and Cornwall and involved work across 10 catchments. Upstream Thinking for AMP7 comprises 16 Schemes and five investigations in 18 catchments. Expenditure is focused on delivering the programme and exceeding the new OFWAT Biodiversity Improvement ODI (Outcome Delivery Incentive) "Hectares of new catchment management" across the AMP7 period alongside the WINEP Investigations.

The current 5-year programme is a combination of new Catchment Management Schemes and Investigations as specified by the EA's WINEP, and is the continuation of ongoing AMP5/6 work in the South West Water and Bournemouth Water areas. The outcomes contribute to

- Improved raw water quality and supply and long-term business resilience
- The new Biodiversity Improvement ODI 'Hectares of new catchment management'
- The Pennon Sustainability and Natural Capital commitments of year-on-year 3% improvement from a 2020 baseline
- Water UK carbon mitigation commitments (Peatland restoration and tree planting)
- The programme is designed to combat deterioration in soil and address nutrient and water management in the farmed landscape of catchments abstracted for drinking water supply. There are potential long-term resilience benefits including:
    - new treatment investment deferment at treatment works
    - reduced power, chemicals, maintenance costs and carbon emissions
    - reduced risk of WTW shut down and DWI penalties
    - water resources benefits, increased baseflow in rivers and resilience of the water environment.

The engagement of Delivery Partners and environmental stakeholders in the South West region and their match funding contributions is a key aspect of the programme, as are the Natural Capital outcomes. These are aligned with Ofwat and EA expectations and our own ambitions to become a leading company in environmental delivery.

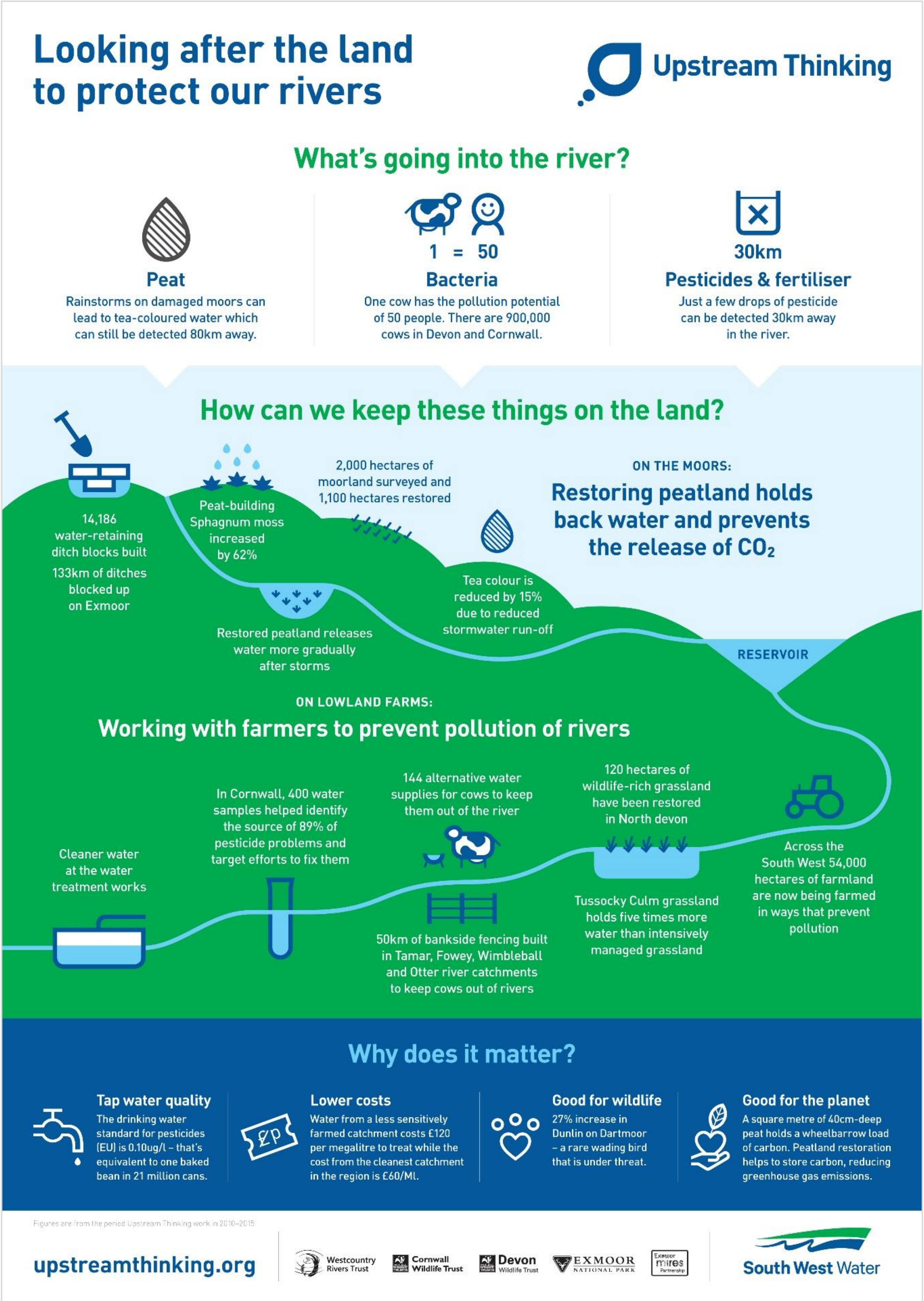

Figure 3 - The Upstream Thinking Catchment Management initiative

12 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. It has been developed in accordance with our overall Business Plan to ensure alignment across our work areas and to meet our statutory drinking water obligations in full.

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 including preventing any potential deterioration in water quality and reducing losses where possible. Examples of this include:

- installing 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 Wistlandpound catchment area to better understand what is causing these water quality issues in the reservoir.
- carrying out detailed investigations in the Bournemouth WRZ 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. We are developing a strategy to mitigate the risk from farming activities and domestic wastewater systems.

Further guidance is provided by the DWI in 'Long term planning for the quality of drinking water supplies – water resources and sufficiency of supplies'. [5]

13 Invasive non-native species

An Invasive Non-Native Species risk assessment has been undertaken to identify the potential risk of INNS transfer. A two-level approach has been taken. The first level screening methodology is informed by the EA's position statement on managing the risk of INNS through raw water transfers. This methodology is focused on the pathways that water resource management options create during operation, and the potential impact of these pathways, rather than current INNS distribution.

The second level assessment methodology utilises the SRO aquatic INNS risk assessment tool (SAI-RAT) developed by an external consultancy, APEM, on behalf of the EA to quantify the INNS risk associated with WRMP options, based on the conceptual design information available.

More information on these stages along with the findings are detailed in 'Section 9.13 INNS Assessment Findings' of the South West Water Revised Draft WRMP 2024 Strategic Environmental Assessment (SEA) Environmental Report.

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[5] 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

South West Water

Bournemouth Water

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