South West Water

Our draft Water Resources Management Plan

6:Forecasting Demand

Contents

6 Forecasting Demand

Document purpose:

This chapter sets out our approach to forecasting demand.

It presents our baseline and long-term forecasts for peak, dry years and other scenarios.

We reconcile forecasts with our previous ones and discuss the assumptions and the uncertainties associated with our forecasts.

The main assumptions made in the analysis are stated as we discuss the modelling undertaken.

The uncertainties are discussed in the final sub-section.

Summary:

We have built upon the approach used for WRMP19 and aligned it with the latest guidance on forecasting demographics, consumption, and demand. Our approach is consistent with our problem characterisation – which showed a medium level of planning complexity.

We have undertaken a reconciliation of our demand in 2020/21 to account for the water balance gap but recognise that the pandemic has introduced some additional uncertainty. From March 2020 onwards, water-use behaviour was significantly impacted by the Coronavirus pandemic and the measures implemented to control the spread of the disease. This means that there is additional uncertainty within the water balance, with many of the assumptions we use to calculate it being developed during more normal years. We will continue to analyse the impacts experienced, both during and after the pandemic, to better understand any changes.

Household Consumption: We have forecast our household consumption, using a micro-component approach (aligned with our problem characterisation). We have used property forecasts from Experian based on Office for National Statistics trends and local development plan data (Appendix 6.2) and used research undertaken by Ovarro to inform future demand changes (Appendix 6.1). Our dry-year impact on household consumption has been informed by the work by Ovarro – this will be updated in the next version of this plan based on insights from drought 2022. The analysis undertaken by Ovarro and Experian was undertaken in collaboration with our West Country Water Resources Group (WCWRG) partners.

Non-Household Consumption: Our non-household demand forecasts have been developed from econometric modelling undertaken by Experian (Appendix 6.4). This modelling was a collaborative project with WCWRG partners.

Leakage estimate: Our base-year leakage estimate is taken from reported APR data and is compliant with leakage reporting guidance produced by Ofwat and Water UK[1]. Leakage includes both leakage on our network and on the customer side.

Baseline total demand forecast: We consolidated the component forecasts to develop the baseline total demand forecast. In developing the baseline forecasts, we have considered

- That AMP7 leakage targets will be met, with levels then continuing at the 2024/25 level (as part of this we have assumed a continuation of current customer supply pipe leakage policies)
- That PCC will be 2% above AMP7 PCC forecasts due to the changes in household demand that have occurred since the Coronavirus pandemic.[1]
- No further water-efficiency activities beyond AMP7
- A metering programme beyond AMP7 consisting only of the long-established meter optant programme
- Forecast population and housing growth
- The impact of climate change on customer behaviour

The Coronavirus pandemic and the drought of 2022 have introduced additional uncertainty around our baseline forecasts, with current demand being circa 8% above previous WRMP19 forecasts. We have currently considered these uncertainties as part of our scenarios and sensitivity testing in Chapter 10. However, our revised draft plan will include revised PCC and leakage baselines.

1 Our approach to demand forecasting

We have built upon the approach we used for WRMP19, and our demand forecasting process follows the latest Water Resources Planning Guidelines and UKWIR guidance for forecasting demographics, consumption, demand, and climate change.

Our methodologies have been developed in consideration of the results of our problem characterisation, which is described in Chapter 1. 'Problem characterisation' is an approach to assessing the complexity of the planning problem that a WRMP is aiming to solve and was introduced in UKWIR's 2016 report "WRMP19 methods – risk-based planning". It showed that we had a 'medium' level of planning complexity. The methods used in our previous WRMP were consistent with this level of complexity, and we have continued to use these for this plan.

We have used several sources of guidance and information to develop our methods, including

- WRMP19 methods – Household consumption forecasting (UKWIR 2016)
- WRMP19 methods – Population, household property and occupancy forecasting (UKWIR 2016)
- Integration of behavioural change into demand forecasting and water efficiency practices (UKWIR 2016)
- Customer behaviour and water use – a good practice manual and roadmap for household consumption forecasting (UKWIR 2012)
- Peak water demand forecasting methodology (UKWIR 2006)

Our methodology is comprehensive and covers all the water required from our water treatment works and the important factors that impact the total demand forecast, namely,

- Government policy and expectations as described in the "*Government Expectations for Water Resources Planning*"
- Collaboration with Bristol Water and Wessex Water and a range of national and regional stakeholders to ensure alignment with the national and regional plans and forecasts
- Population growth and distribution, housing developments, changes in occupancy and changes in the use of properties (eg, second homes being let through AirBNB etc)
- The impact of the economy, other sectors and businesses such as the energy sector
- The significant impact that tourism has on our region (typically 10 million visitors a year; additionally, the Covid pandemic saw an increase in visitor numbers but we a reversion to more normal levels)
- Changes in household and non-household water use behaviour, including the impact of new water using devices
- Climate change impacts, including changes in customer behaviours during extreme events such as periods of dry weather and droughts (to do this we followed the guidance in the UKWIR "Household consumption forecasting" report)
- Initial analysis of Covid19 and how this impacted customer and business behaviour
- The findings of the Artesia report "Water Demand Insights from 2018" in helping to develop our understanding of demand during dry weather
- Changing leakage, water efficiency and sustainable water use practices and the adoption of new technologies
- Our strategy and plans for metering and smart metering
- Other sources of demand and losses

In the SWW supply area, none of our three WRZs are solely dependent on groundwater, river abstractions or storage. They are not particularly sensitive to peak demand, but we do carry out detailed modelling of the water resource system which implicitly considers these peaks. We have therefore developed demand forecasts for the dry year annual average (DYAA) for the Colliford, Roadford and Wimbleball WRZs.

The Bournemouth WRZ is largely dependent on run-of-river abstraction and has limited storage. Therefore, we plan on a Dry Year Critical Period (DYCP) basis, with the critical period being the peak week, but we do also produce DYAA forecasts.

Our base year for demographic forecasts is 2020/21 but, due to the changes in consumption that occurred because of the Covid pandemic from March 2020, we have based our demand forecasts on 2019/20, adjusting as required to account for longer-term impacts. We have made forecasts to 2049/50.

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

1.1 Changes in approach since WRMP19

Our overall methodology remains largely the same as that used in WRMP19. Our process and data sources have not fundamentally changed since WRMP19, but they have been updated to include the newer data.

We have developed a better understanding of alternative scenarios of demographic growth and forecast demand and will present this in our final Plan as part of our adaptive planning and scenario testing.

1.2 Water balance and demand in the base year

Before producing forecasts of future demand, it is important to have robust estimates of water consumption in the base year. A water balance is completed each year and we produce this in line with Ofwat's latest guidance for leakage and PCC reporting consistency[1]. This includes an assessment of the amount of water that we output from our water treatment works (WTWs), compared with eight different components of demand listed below:

- Measured household consumption
- Unmeasured household consumption
- Measured non-household consumption
- Unmeasured non-household consumption
- Leakage
- Distribution system operational use
- Water taken legally unbilled
- Water taken illegally unbilled

The difference between the sum of the estimated components and the output of our WTWs leaves a residual. This must be accounted for to produce robust estimates for future forecasts.

To account for the residual (termed the 'water balance gap', or WBG) and reconcile our estimates of demand with WTW outputs, we used the Maximum Likelihood Estimation (MLE) methodology. MLE is a statistical technique which redistributes the WBG to the components of demand, with more of the gap being assigned to the large, less certain components. It is these redistributed estimates that were used as the basis of our Plan.

South West Water and Bournemouth's WBGs for 2020/21 of -4.15 Ml/d and -5.37 Ml/d respectively have been redistributed as shown in **Table 1**. From Mar 2020 onwards, water-use behaviour was significantly impacted by the Coronavirus pandemic and the measures implemented to control the spread of the disease. This means that there is additional uncertainty within the base-year water balance, with many of the assumptions we use to calculate it being developed during more normal years. We will continue to analyse the impacts, both during and after the pandemic, to better understand any changes.

[1] UKWIR Consistency of reporting performance measures https://ukwir.org/e51eb0dd-ea96-4943-a056-9183d78c454d-f-180567-349b9a58-5c95-4b37-977b-3326c376e7af (July 2017)
Reporting guidance - per capita consumption - Ofwat (March 2018)
Reporting guidance - leakage (March 2018)

	SWW			BW		
Demand component	**Estimate (Ml/d)**	**Adjustment (Ml/d)**	**Reconciled estimate (Ml/d)**	**Estimate (Ml/d)**	**Adjustment (Ml/d)**	**Reconciled estimate (Ml/d)**
Measured household consumption	178.55	-0.50	178.06	50.32	-0.50	49.82
Measured non-households consumption	79.04	-0.29	78.75	57.29	-0.58	56.71
Unmeasured households consumption	78.69	-0.95	77.74	30.59	-1.43	29.16
Unmeasured non-household consumption	1.40	-0.02	1.38	1.10	-0.06	1.04
Leakage	119.30	-1.22	118.08	18.50	-0.71	17.79
Distribution System Operational Use	5.32	-0.06	5.26	1.21	-0.05	1.16
Water Taken Legally Unbilled	16.56	-0.11	16.46	0.96	-0.04	0.92
Water Taken Illegally Unbilled	4.57	-0.26	4.31	0.00	0.00	0.00
Sum of Components	483.43	-3.40	480.03	159.97	-3.37	156.60
Distribution Input	479.28	0.75	480.03	154.60	2.00	156.60

Table 1 : Reconciliation of South West Water and BW Demand Components in the Base Year (2020/21)

1.3 Forecasting household consumption

To forecast household consumption, we firstly determine the current population and future growth, the property numbers and the average household occupancy, using the latest Office for National Statistics (ONS) forecasts. These forecasts are made at a local authority level, so we then use data from Local Authority Development Plans to assign the growth to sites identified within these plans. This information is geographically processed into Water Into Supply (WIS) zones, and ultimately to the relevant Water Resource Zone (WRZ). Refer to Appendix 6,2: Experian population and properties forecast (Feb 22) for further detail.

We use a micro-component modelling approach like that used in WRMP19 to forecast future per property consumption. Micro-component models quantify the water used for different activities within the home, for example, showering, bathing, toilet flushing, dishwashing and garden watering. They then forecast how each of these components are likely to change in the future.

Different types of household customers exhibit different behaviours and consumption levels and so we segment these into four distinct categories:

- **Existing Measured**: Properties that were already metered in the base year. A property in this category will remain in it for the duration of the planning period.
- **Unmeasured**: Properties that remain unmetered. The metering programme is assumed to run for the duration of the Plan, and so members of this group will migrate to the 'meter optant' category.
- **Meter Switchers**: In the base year there are no properties in this category; as and when a household switches to metered billing, it joins this category.
- **New Build**: There are no properties in this category in the base year.

1.3.1 Base year measured and unmeasured consumption estimation

Currently 84% of our household properties are metered. We calculate the water delivered to measured households from the meter readings logged on our billing system. We divide the total annual water delivered by the number of measured households to work out how much water an average household uses. We deduct the estimated leakage from customers' pipes (i.e., customer side leakage). This gives us the amount of water used by each measured household.

We use this to calculate the per capita consumption (PCC) by dividing the average household consumption by an average household occupancy rate.

Base year new connection PCC is calculated using recorded consumption data from our billing system.

While metered consumption is measured, other components of consumption are reliant on assumptions. We produce estimates of average unmeasured household consumption for each of our WRZs using our unmeasured consumption monitor. Since 2016, we have installed data loggers on our consumption monitor properties which has given us a greatly improved understanding of consumption patterns. This has allowed us to more accurately understand where member properties have supply pipe leakage that should be excluded from our PHC estimation, and where high flows are the result of actual consumption. Prior to 2016, properties with high flows were assumed to have a supply pipe leak, and excluded from the calculation of unmeasured PHC, but the logger data has shown that several of these high flows are not the result of leakage but genuine consumption, and so should be included. As a result of this investment in loggers we have been able to improve our understanding of unmeasured household consumption and our estimation of PHC.

Our household consumption monitors are very important to our understanding of customer consumption, and we will continue to operate these to allow us to collect data for the future.

Over recent years, the proportion of household customers paying measured bills led us to start a parallel measured household consumption monitor in the SWW supply area. We use this data to cross-check with our estimates derived from the billing information.

As we continue to increase the number of customers who are metered, and begin to collect more smart meter data, our data quality continues to improve.

1.3.2 Selecting our household forecasting methodology

Our problem characterisation is set out in Annex A of Chapter 1 (completed with reference to the UWKIR guidance[2]) and shows that our mainland WRZs have a medium level of planning complexity. We have continued to use a microcomponent-based household forecasting methodology as in the last WRMP UKWIR guidance[3]; this is an appropriate approach for this level of planning complexity.

While we continue to improve our data on individual household consumption, we see the micro-component modelling approach as most suitable for WRMP24.

1.3.3 Forecasting future micro-component consumption

To forecast our future household demand we use a micro-component model produced by Ovarro Consulting as part of a collaborative project with our WCWRG partners: Wessex Water and Bristol Water. Ovarro's report detailing the work it did is included in Appendix 6.1. This approach considered the guidance from UKWIR (2012 & 2016) on behavioural change[4]. Our APR data is input into the micro-component model as the base data to generate total measured and unmeasured consumption.

Micro-component models quantify the water used for different activities within the home, for example showering, bathing, toilet flushing, dishwashing and garden watering. They then forecast how each of these components is likely to change in the future.

The following sources were provided to Ovarro to inform the micro-component consumption estimates and forecasts:

- PR19 micro-component analysis carried out on behalf of SWW and the other WCWRG member companies
- The Wessex Water Home Check (HC) data collected in 2016-2019 using in-home surveys
- The Wessex Water GetWaterFit (GWF) dataset collected in 2020-2021 on a self-reported basis
- Published industry research, notably the 2018 Energy Saving Trust (EST) report on water labelling options that collated previous evidence

We applied the standard Ownership, Frequency and Volume (OFV) micro-component forecasting approach as previously used by WCWRG member companies and described in UKWIR's Customer Behaviour and Water Use report[5].

[2] UKWIR (2016) WRMP19 methods – risk-based planning

[3] UKWIR (2016) WRMP19 methods – Household consumption forecasting

[4] UKWIR (2016) Integration of behavioural change into demand forecasting and water efficiency practices

[5] UKWIR (2012) Customer behaviour and water use – a good practice manual and roadmap for household consumption forecasting

Forecasts of total population and total property count were also provided to Ovarro using the data provided by Experian (Appendix 6.2: Experian Population and Properties forecast: Feb 2022) and Appendix 6.1: Ovarro Household demand forecast 2021-22.

Ovarro produced forecasts of micro-component scenarios covering climate change and water efficiency that might affect future demand. Three climate change scenarios (None, Medium and High) were provided based on UKWIR research (Impact of climate change on water demand, 13/CL/04/12) and three PCC micro-component trends (Low, Medium, and High). Two micro-component models were created for each WRZ zone using medium PCC micro-component trends and both Medium and High Climate Change, giving us a total of eight models.

Ovarro considered 12 different micro-components in their forecasts, and these were grouped into larger categories to populate table 2b in the data tables. The grouping is shown in Table 2.

Table 2b microcomponent group	Ovarro study microcomponents
Toilet flushing	Toilet flushing
Personal washing	Baths
	Showers
Clothes washing	Washing machine
Dish washing	Dishwasher
	Handwash
Miscellaneous internal use	Plumbing losses
	Other miscellaneous use
External use	Garden watering - hosepipe
	Garden watering – irrigation/pressure washer
	Watering can
	Miscellaneous external use

Table 2 : Grouping of Ovarro microcomponents into WRMP data tables table 2b.

To forecast our baseline future consumption for the draft WRMP we used the medium climate change and medium PCC trend profiles.

The micro-component model from Ovarro directly provided measured and unmeasured demand for both Normal Year Annual Average (NYAA), Dry Year Annual Average (DYAA) across Bournemouth, Colliford, Roadford and Wimbleball and a Peak Week (Critical Period) calculation for Bournemouth.

Frequency factors in the micro-component modelling were adjusted across the model to align the Per Capita Consumption (PCC) for each WRZ with the base year.

1.3.4 Dry year impact on household consumption

We have assessed how the weather affects household consumption, particularly in a dry year when pressures on water resources are at their most acute.

2018/19 was a warm, dry year in the SWW region. The dry-year factors have been obtained from the ratio of the observed 2018/19 consumption to the equivalent normal year value. This gives factors of 1.068 for unmeasured households and 1.063 for measured households.

The Bournemouth WRZ requires an estimate of DYCP consumption. Analysis for historical consumption data indicates that a 7-day critical period is appropriate. The week beginning 31-Jul-2019 is the highest 7-day period of consumption observed in the consumption monitor. The DYCP factors have been obtained from the ratio of the observed consumption during this week to the equivalent NYAA value. This gives factors of 1.444 for unmeasured households and 1.405 for measured households.

In summary, the following DYAA and DYCP uplift factors have been used for household consumption (Appendix 15.8 , Ovarro Household demand forecast):

	Unmeasured	Measured
DYAA / NYAA uplift	6.8%	6.3%
DYCP (week) / NYAA uplift	44.4%	40.5%
DYCP (month) / NYAA uplift	44.4%	40.5%

Table 3: Household NY to DY uplift factors

We have initiated work with Ovarro to update our dry-year analysis using data from 2022, and this will be reported in our final WRMP24.

1.4 Forecasting non-household consumption

Non-household customers are defined as such in accordance with Ofwat's eligibility guidance. Consumption forecasts have been prepared as part of a collaborative WCWRG project undertaken by Experian for Wessex Water, Bristol Water, and SWW. Experian's report detailing the work it did for us is included in Appendix 6.4.

Non-household customers have the option to switch to metered billing, although some of the costs of doing so may be passed on to them. The proportion of non-household properties where it is too difficult or uneconomic to install meters is lower than it is for household properties. This is illustrated by our current non-household metering level of around 96%, which we forecast will reach 99% by 2050. This provides an extensive set of data, which enables a forecast of non-household consumption to be made from a robust base-year understanding.

Non-household consumption is heavily influenced by economic factors, and so we have used and developed econometric models for each WRZ to support the future forecasting of consumption. We model several different sectors, economic drivers and the impacts of our metering and water efficiency initiatives. The models have been calibrated against historic data and tested for forecasting accuracy – we also have the opportunity to engage stakeholders to sense check and review. The regional economy is dominated by service industries, the most important of which is tourism, and is essential to the region's prosperity. Agriculture also forms a large part of the non-service sector, with livestock and small arable farms forming the majority. There is little reliance on agricultural irrigation within the region, so farms moving to potable water irrigation are not considered likely to materially impact demand.

None of the WRZs in the SWW supply area have a strong reliance on other non-service industries. However, the Bournemouth WRZ contains one very large industrial customer which accounts for around two-thirds of non-household consumption. Due to the significance of this customer, we forecast its consumption independently.

To forecast future unmeasured non-household consumption, we assume that the unmeasured customers will change their average consumption at the same rate as the measured ones. We also assume that each year some of the unmeasured non-household customers will opt to have a meter installed.

We consulted on our forecasts of future demand with retailers operating in our supply area, but this did not yield information which affected our forecasts. Retailers were, however, keen to engage on potential non-household water efficiency activities, which are discussed in Chapter 9.

At this time there are no NAVs providing water supply to customers in our supply area, so consultation was not required.

1.5 Leakage estimation

Our base-year leakage estimate is taken from reported APR data and is compliant with consistency reporting guidance. We use information obtained from meters on our network to calculate leakage using the approach outlined in leakage reporting guidance produced by Ofwat and Water UK[6]. Leakage includes both leakage on our network and customer side.

Our leakage control is based on continuous monitoring of night-flow data across our WRZs. The flow data is automatically imported into our leakage software which provides reports on DMA prioritisation and data collection problems and is the reporting tool for regulatory returns. We calculate the level of leakage by analysing DMA night flows, from which we subtract the domestic and commercial night use of the properties in the area. The night-flow readings are converted into daily leakage figures by adjusting for the different pressure regimes that occur in the DMA between day and night. A weekly leakage figure is calculated using an average of the individual daily values for each DMA. These figures can be aggregated to the WIS zones, WRZs, and ultimately into a regional figure for our entire supply area.

Trunk mains DMAs are included within the SWW supply area reporting network, and either reported using the leakage calculation methodology detailed above or given a leakage estimate based on an industry-standard methodology. In the Bournemouth WRZ, trunk mains DMAs sit outside the normal DMA reporting coverage and so estimates are used. Service reservoirs are accounted for separately as part of our leakage control strategy. Losses are monitored by volumetrically comparing inlet and outlet flows at each reservoir. Trunk main and service reservoir losses are added to the leakage figures, and the weekly figures averaged to calculate the reported annual leakage.

1.6 Baseline demand forecasting

The baseline demand forecast is made up of several components:

- Measured and un-measured household consumption
- Measured and un-measured non-household consumption
- Leakage from our network and customers pipework
- Other minor components of demand and/or losses

We consolidate the component forecasts to develop the baseline total demand forecast.

In developing the baseline forecasts, we have considered

- That AMP7 leakage targets will be met, with levels then continuing at the 2024/25 level (as part of this we have assumed a continuation of current customer supply pipe leakage policies)
- That PCC will be 2% above AMP7 PCC forecasts due to the changes in household demand that have occurred since the Coronavirus pandemic.[7]
- No further water-efficiency activities beyond AMP7
- A metering programme beyond AMP7 consisting only of the long-established meter optant programme
- Forecast population and housing growth
- The impact of climate change on customer behaviour

The Coronavirus pandemic and the drought of 2022 have introduced additional uncertainty around our baseline forecasts. These are discussed further in Section 10.

1.7 Long-term demand forecasting

We start with each of the component base year forecasts, estimate how each of these may change over the period to 2050, and how this will impact on the total demand forecast. We have produced forecasts for each year from 2024/25 to 2049/50.

[6] Reporting-guidance-leakage.pdf (ofwat.gov.uk) March 2018
https://ukwir.org/Consistency-of-Reporting-Performance-Measures

[7] Note that appendix 1.1 Insights from Drought, shows that we have had high demand in recent years, above our PCC targets. There is therefore uncertainty around whether we will achieve our AMP7 PCC at time of submitting our draft WRMP. We have incorporated sensitivity tests (chapter 10) to test for this uncertainty.

2 Demographic forecasts

2.1 Our region

SWW supplies 1.8 million people in Cornwall, Devon and some parts of Somerset and Dorset. The area is largely rural with a sizable proportion of the population living in small communities, and almost a third living in the major urban areas; Plymouth, Exeter and Torbay.

Our BW supply area is also largely rural and covers parts of Dorset, Hampshire and Wiltshire, and is around a tenth of the size of the SWW supply area, with a population of about a quarter of SWW's supply area. Bournemouth is the major town in the area with about 40% of the total population.

2.2 Demographic forecasts

Our forecasts of population and housing growth were produced by Experian, using ONS, Local Authority and SWW's Developer Services team's development database data (report Appendix 6.2 "Population and properties forecasts: South West Water, Feb 2022"). As in WRMP19, we consider these primary sources of data to be the most appropriate available.

A range of projections covering

- Population,
- Communal Population,
- Households,
- Total Dwellings,
- Vacant Dwellings,
- Household Population
- Average Household Size

were provided using four different modelling methods (as shown in *Table 4*):

Modelling Method	Notes
Trend Based	Based on ONS projections
Plan Based	Based on the number of dwellings the local authority expects will be built over the lifetime of their plan, also incorporates data from our Developer Services team
Econometric Based	Uses Experian's own econometric forecasting approach using assumptions on natural population change and household formation
Hybrid	Takes elements of all three approaches

Table 4: Population and properties modelling methods.

These forecasts were provided at 'lower-layer super output area' (LSOA) level. LSOAs are geographic areas used in census reporting that comprise between 400 and 1,200 households. Using GIS analysis we translated these data into our WRZs.

Our growth forecasts have been compiled using both local plan and ONS trend data. We have used local plan data to identify the location of likely future development and allow us to ensure that we do not constrain this planned growth. We have then used ONS trend data to set the overall level of growth to plausible levels in each year.

The reason for selecting this approach is that trend-based forecasts perform well at a macro level. In their Population, Properties and Occupancy forecasting guidance (2016) UKWIR highlights that trend-based projections are widely used, derived by well-established and reliable statistical methods, and the assumptions have been subject to expert panel review. They are therefore likely to help produce a balanced view of likely growth.

The data was then used to calculate:

- New connections (year on year change in households)
- Population increases (year on year change in Population)

To produce our forecast populations and properties projections the Experian data for new-connections (year on year difference in Households) and household population increase (year-on-year difference in household population) was calculated to 2050 from the latest 20/21 APR data.

2.2.1 Housing forecasts

We have compared the overall historic rate of housing growth in our supply area with those predicted by both local authority plans and Office for National Statistics (ONS) trend-based forecasts . We have reconciled the variation in forecasts and past actuals to create a pragmatic forward program which does not include a boom in house building.

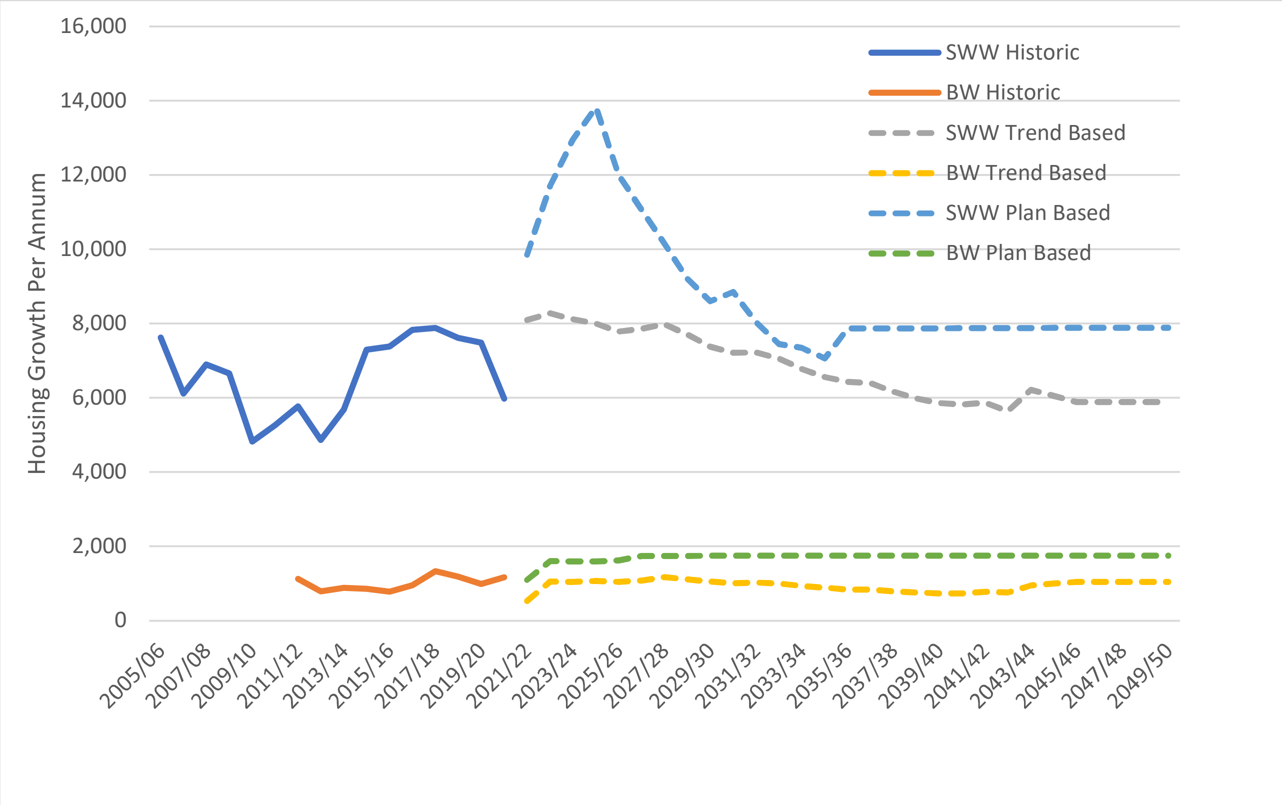

Figure 1: Housing Growth Forecasts for SWW

The local authority plans show a much higher rate of development over the next decade than has been achieved historically, while the ONS projections more closely match historic levels of development.

The local authority forecasts for the period to 2035 are on average over 30% higher than current levels of new connections. Experience has shown that the rate of new connections suggested by the local authority plans are typically overly optimistic and are unlikely to be achieved on time.

There are no indications of increases in new connections beyond the recent level, and we assume that this represents the highest development level that the local economy can support. We have therefore assumed a level of development in line with the ONS growth forecasts. The local plan data has been used to capture the likely location growth points, which combined with considering higher demand scenarios in our adaptative planning ensures that our WRMP does not constrain future growth.

Figures 2 and 3 show our forecast of the number of household properties connected to the SWW and BW supply area networks for the planning period. In 2020/21 there were 0.79m household properties connected to the SWW supply area network and 0.20m connected to the Bournemouth WRZ network. This is forecast to reach 0.99m and 0.22m respectively in 2049/2050.

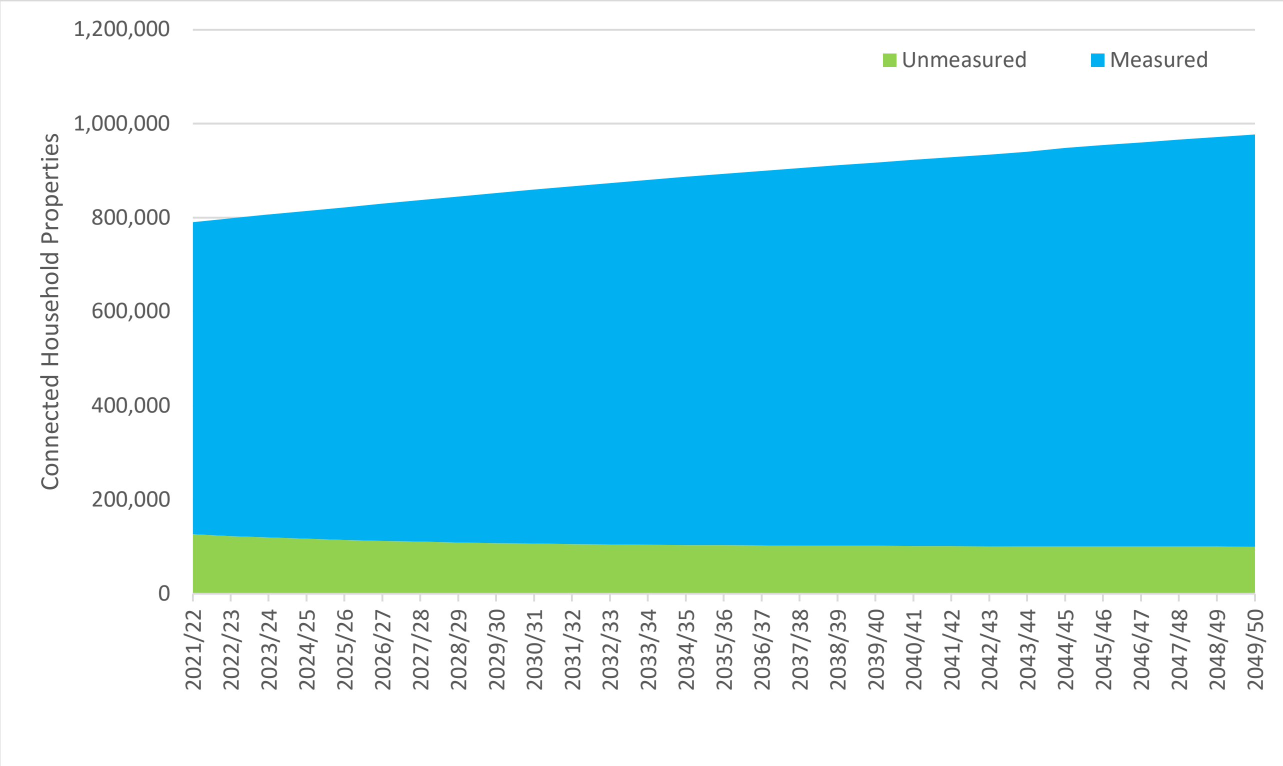

Figure 2: Total Household Properties Connected to the SWW Supply Area

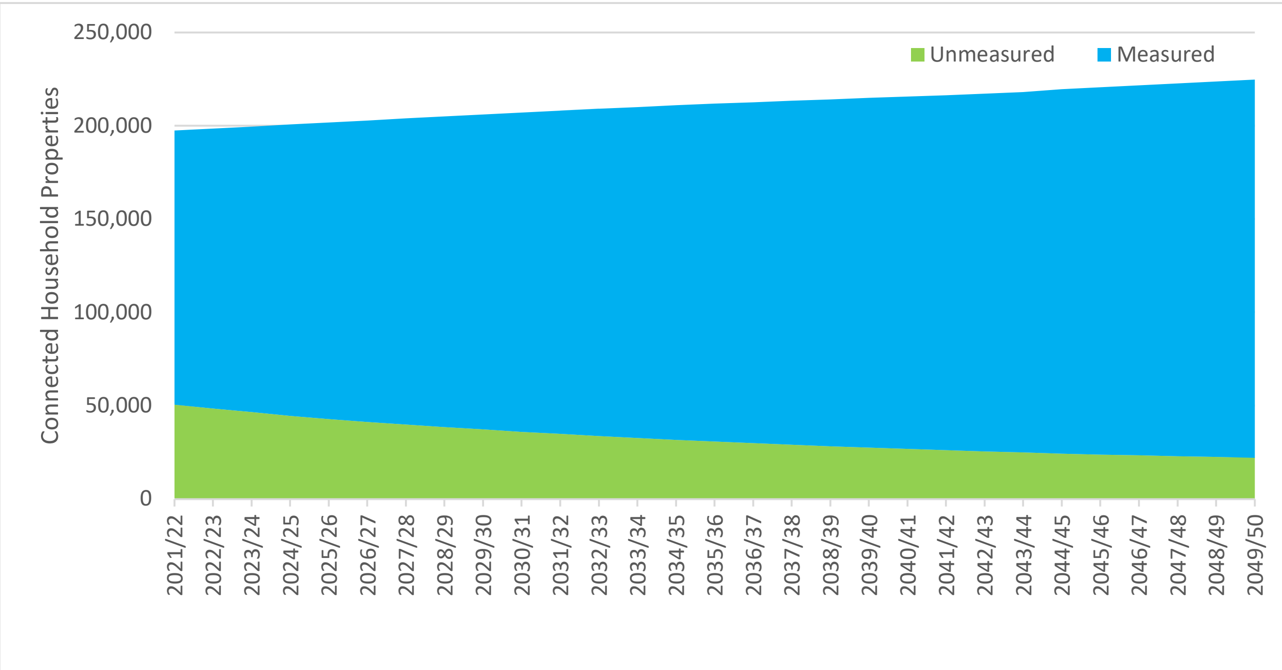

Figure 3: Total Household Properties Connected to the BW Supply Area

Some of the properties connected to our supply system are not billed because they are unoccupied. We obtained the number of these void properties in the base year from our billing system. In 2020/21, 0.5% of metered households were void compared to 2.1% of unmeasured households, with an overall household void rate of 0.8%. We have assumed a continuation of the measured and unmeasured void rates but, as meter opting and new connections add to the measured customer base, the overall household void rate is projected to fall slightly to 0.7% by 2049/50.

We will continue to monitor published local plans in the future to ensure that our demand forecast for each zone is tailored to the development activities as they start to materialise and require intervention.

2.2.2 Population forecasts

The primary sources of data for our population projections is from the latest Office of National Statistics (ONS) but, when it comes to property growth, we also consider local plan data in our forecasts. We have used the latest data available which is 2020 mid-year population estimates, and 2018-based projections.

We use GIS analysis to assign population to our WIS zones and ultimately to our WRZs. We link these to our billing information, which enables a detailed understanding of the population distribution and developments.

We have used ONS estimates of the communal population that reside in non-household properties, such as barracks, nursing homes, and boarding schools. We estimate that this currently accounts for around 2.0% of the population connected to our water supply.

The School of Geography at the University of Leeds identified that some migrants; visitors overstaying their permitted time in the Country; and victims of human trafficking were not included in the ONS data. They estimated that 12,000 people not included in ONS forecasts are resident in the area and should be included in our population estimates.

Some of the resident population will be connected to private water supplies. We contacted all the local authorities in the SWW supply area, who are responsible for ensuring the safety of private water supplies, to ask how many sources they monitor. Their responses allowed us to estimate that approximately 1.3% of the population in the SWW area had private water supplies. We have not obtained this data for the Bournemouth region and assume all resident population there are connected to our water supply.

The population we serve for water in the SWW supply area has been estimated to be 1.78 million, and 0.46 million in the Bournemouth WRZ in 2020/21. This is forecast to grow to 2.09 million and 0.48 million respectively by 2049/50, Figure 4.

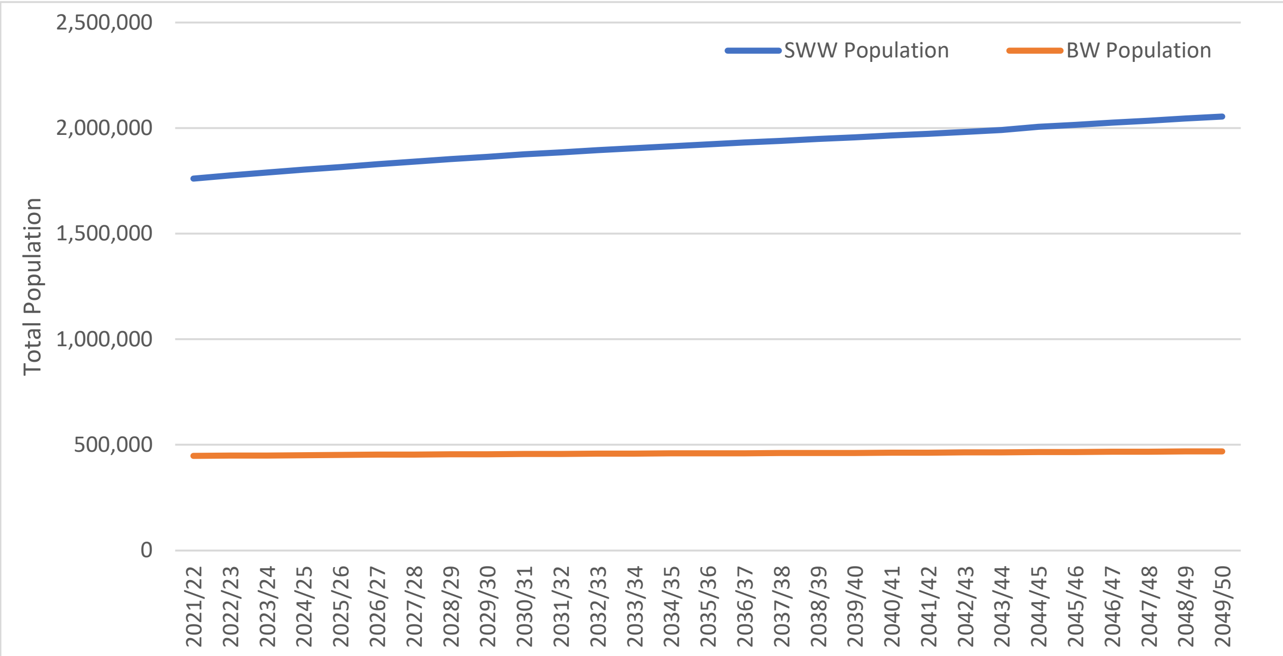

Figure 4: Growth of the Resident Population

2.2.3 Average household occupancy

In recent decades, the average household size (AHS) has fallen; ONS data shows that nationally it has dropped from 3.0 people per household in 1961 to 2.4 currently. We expect this trend to continue, predicting that the AHS in the region will drop slightly from its current value of 2.2 people per household to 2.1 in 2049/50.

While the average household occupancy rate can be determined by dividing the population by the number of household properties, this does not provide information on how it differs between measured and unmeasured properties. To estimate the AHS of measured and unmeasured properties for the base year, we used household occupancy data obtained from CACI. Each property is mapped via a unique property reference number (UPRN) to our billing database by our customer service team. We use this and property billing status to estimate AHS for measured and unmeasured properties.

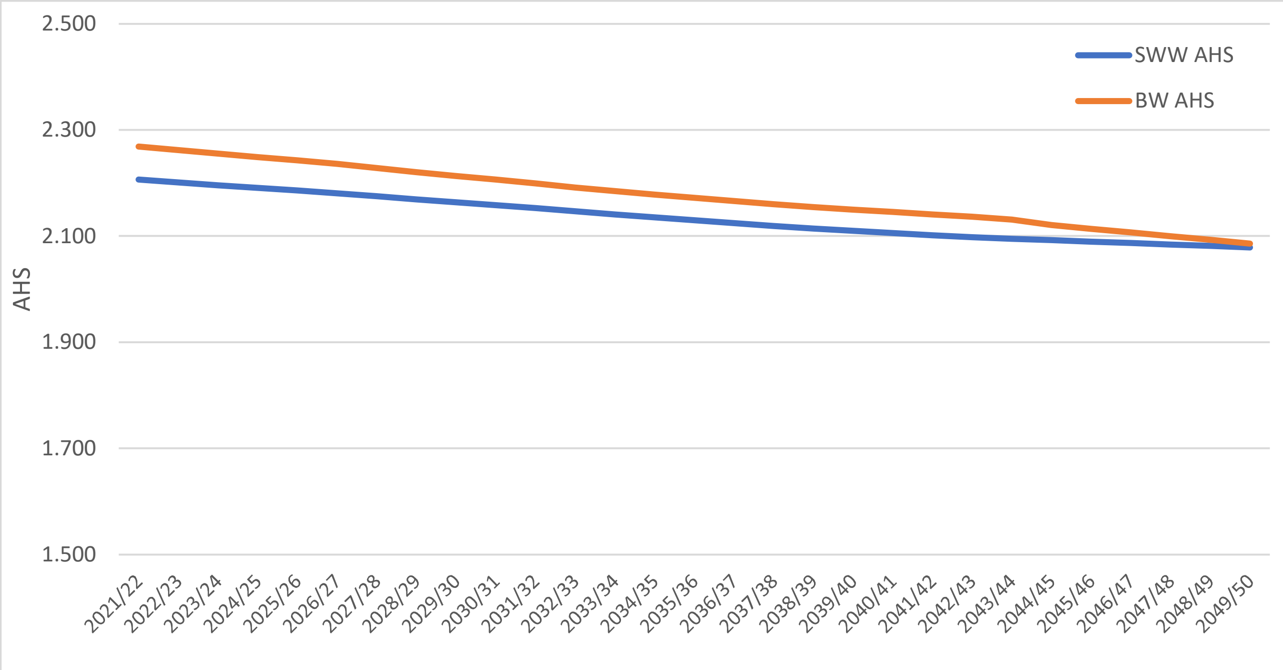

Figure 5: Forecast Change in Average Household Occupancy

3 Household consumption

3.1 Historic per capita consumption

The PCC in our whole area in 2020/21 was 152.6 litres/head/day, which was elevated in comparison the previous years by the Coronavirus pandemic and the measures brought in to control its spread, such as the 'stay at home' order and school closures. This resulted in consumption that would normally occur in non-household properties such as places of work, and educational establishments moving into household consumption, and a corresponding rise in PCC. As movement restrictions were lifted, we also saw a rise in visitor numbers, some of whom stayed in household properties such as second homes and holiday rental properties, which also increased PCC.

To support our annual performance reporting, we commissioned research from demographic experts including Edge Analytics and Quod to understand the impact the pandemic had on population movement and therefore household consumption and PCC. The results of this research allowed us to estimate an adjusted PCC with the pandemic impacts removed. The results presented below are consistent with those we published in 2020/21 and 2021/22 Annual Performance Reports.

Despite the exceptional circumstances, we were able to meet the target set by Ofwat and, with life now returning to normality, we assume that PCC will move back towards the levels we predicted in our 2019 WRMP. We are continuing to collect data on the impacts of COVID on demand and the extent to which consumption will revert to pre-pandemic levels – changes will be reflected in our final WRMP.

PCC over the current AMP period our performance against our Ofwat target is shown below, Table 5

PCC (l/p/d)	2020/21	2021/22	2022/23	2023/24	2024/25
In-year					
Average	152.6	161.0	-	-	-
Adjusted to reflect impacts of Covid pandemic	138.6	143.6	-	-	-
3-year average					
Outturn	144.9	142.1	-	-	-
Ofwat target	144.4	142.6	140.7	138.7	136.9

Table 5: Performance against current Ofwat PCC target

3.2 Household PCC forecasts

The micro-component model supplied by Ovarro provides the basis for our household consumption forecasts.

Our baseline PCC forecasts for the SWW and BW supply areas are shown in **Figure 6** and **Figure 7**. These forecasts show that under a continuation of existing water efficiency and metering activities, we expect the average PCC to fall throughout the planning period in our baseline plan. The key drivers in this forecast are

- The baseline optant metering policy continuing to encourage more water efficient behaviour among those who switch to measured billing
- Continuing replacement of water using appliances such as washing machines and dishwashers with more efficient models (a continuation in the trend towards manufacturers producing more efficient appliances is part of this)
- Replacement of older, less water efficient bathroom fixtures and fittings with more modern ones
- Climate change potentially driving a small increase in average outdoor water use

In the SWW supply area, we forecast that, under the baseline scenario (no intervention), average PCC in a normal year will reduce from 143 to 135 litres/head/day by 2049/50. (This equates to 152 to 145 litres/head/day in a dry year). This is our baseline forecast which assumes we take no further action to drive demand-side reductions.

For the Bournemouth supply area, we expect to see a reduction from 158 to 152 litres/head/day (169 to 163 litres/head/day in a dry year) in the baseline forecast.

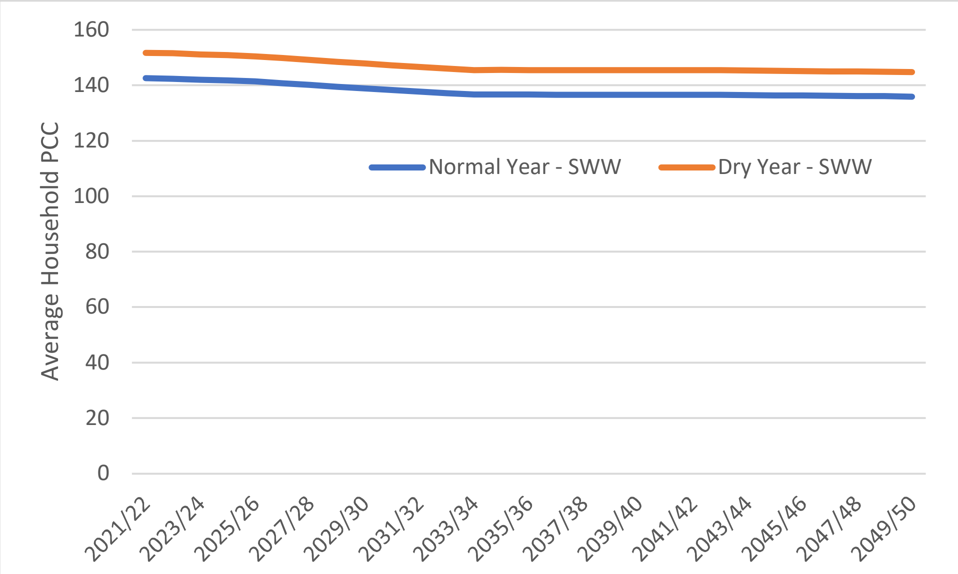

Figure 6: PCC Forecasts for the SWW Supply Area

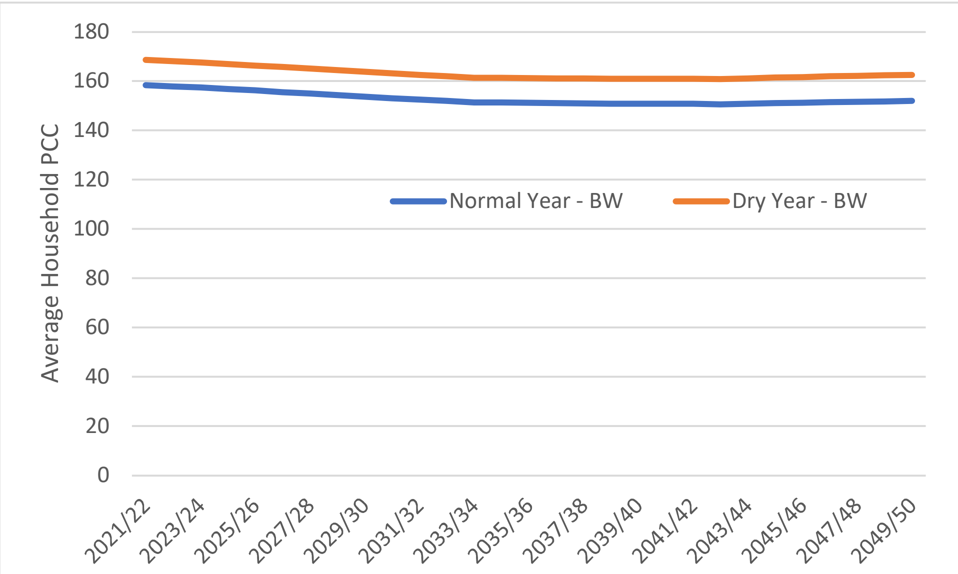

Figure 7: PCC Forecasts for the Bournemouth Supply Area

Since the Coronavirus pandemic hit in 2020, we have seen a change in demand patterns in our region. We will review the latest evidence available to understand whether these changes are likely to endure and will include this within our final Plan.

While we expect to see average PCC fall over the planning period, population growth will apply upward pressure on total demand, ***(Figure 8)***. In a normal year we predict that household consumption in the SWW supply area will rise from 251 Ml/d currently to 279 Ml/d by 2049/50. In the Bournemouth WRZ, we don't expect to see household consumption rise in the same way as in the SWW area, with it remaining at 71 Ml/d over the period. This is because of a combination of factors including lower forecast population and housing growth than in Devon and Cornwall, and initially lower levels of metering allowing the baseline meter optant programme to provide more benefit. Overall this means that growth there is counteracted by a reduction in average consumption to a greater extent than in the SWW region.

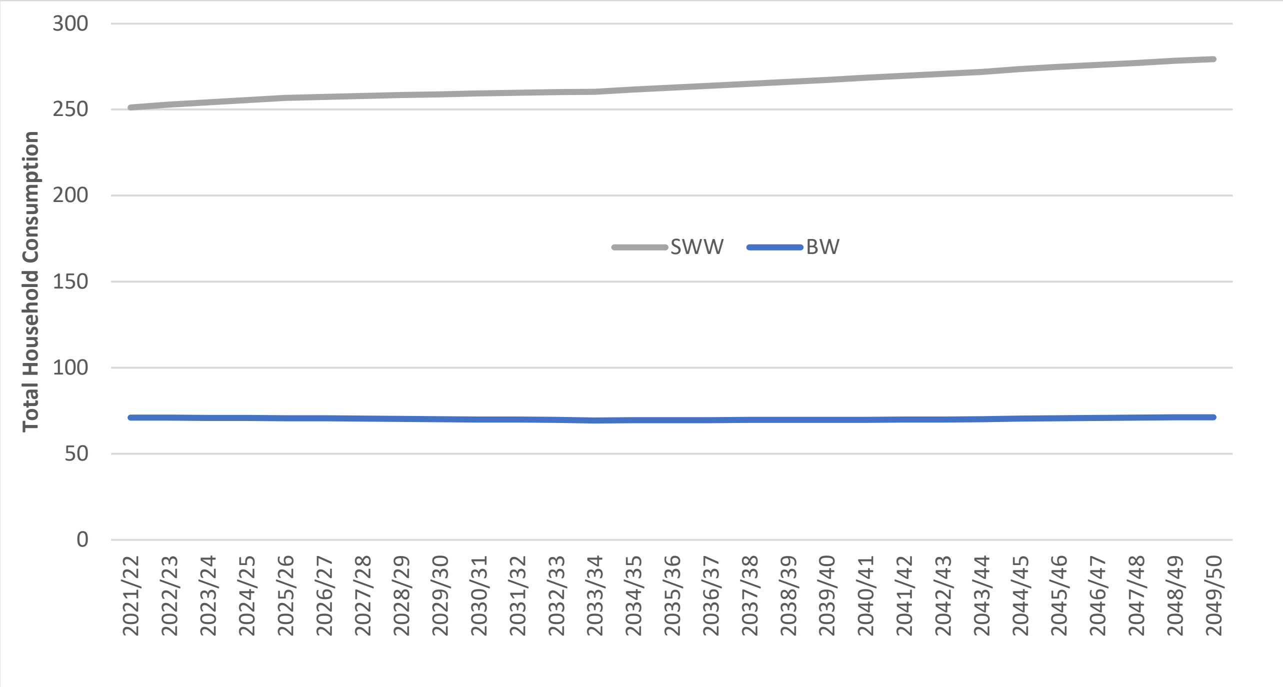

Figure 8: Total Household Consumption

3.3 The effect of metering

We currently have high levels of customer metering, with around 84% of South West Water's and 74% of Bournemouth Water's household customers paying by metered billing.

96% of non-household customers are metered.

For around 20 years, our unmeasured household customers have had the option of switching to pay according to the amount of water that they use, without being charged to make this change. This option remains popular and has helped the level of metering to increase rapidly to its current level.

Under regulations published by the Secretary of State for the Environment, we have the right to install meters at household properties with high discretionary use. In the SWW supply area, we have exercised this right since 1990 when we asked sprinkler and swimming pool owners to register with us. This resulted in meters being installed at 5,700 properties. We continue to install meters at properties which have sprinklers or swimming pools, but with most of these properties now being metered, the number of new meter installs for this reason is now very small and not material for forecasting.

Our baseline forecasts have been prepared assuming that our current meter optant programme continues for the duration of the planning period. As metered customers have a financial incentive to reduce their water consumption, those who opt to have a water meter installed generally reduce their consumption. Using industry studies as well as our own data, we estimate that unmeasured households save an average of 15% of their consumption when they opt to switch to metered billing.

In addition to the benefit of reducing customer consumption, measured households on average suffer a lower level of leakage from their supply pipes than unmeasured ones. This is because any leaks on the section of supply pipe downstream of a meter are more noticeable through the meter. In our forecasts, we have therefore assumed that supply pipe leakage is reduced when customers switch to metered billing. Based on data from our annual performance report we assume that when a customer switches to metered billing, supply pipe leakage is reduced by 45% in the case of households and 48% for non-households.

3.4 The effect of water efficiency

We have based our baseline demand forecasts on our AMP7 PCC reduction targets. Meeting this target has been made more challenging by the impacts of the Covid pandemic and the increases in household demand that we have seen since this time, so we have uplifted our baseline household demand by 2% to account for the additional household demand we expect to see continuing, but we are pursuing an ambitious range of activities to reduce PCC.

Water efficiency and customer engagements were difficult during 2020/21 and 2021/22 due to Covid-19 restrictions reducing our traditional in-person home water audits and community events. However, we were quick to move our home water efficiency audits to virtual visits, and we have significantly increased our customer engagements during the summer of 2022. We will continue this and hope to see the benefits of it in this reporting year. Efforts in 2021/22 to reduce demand have been stepped up in 2022/23, and a summary of our activity is listed below:

- Our Community Fund for water saving initiatives was established in 2021/22. We had 63 applicants which converted into 22 projects being completed, totalling a £75,000 investment in community water demand reduction schemes.
- We appointed a dedicated community education officer to provide proactive delivery of educational packages to schools and community groups on the value of water. The roll out of these education packages will continue.
- Our Roadford education centre was opened by our CEO in 2021 and we have had 1,700 visitors since opening.
- Our Water Efficiency Community events got back up and running in 2022 (these were paused during Covid-19). We hosted 10 community events with a focus on water efficiency messaging to customers and tourists and undertook a dedicated campaign aimed at reducing tourism demands on the Isles of Scilly. This activity will be focused in Cornwall ahead of summer 2023.
- We spent more than £100,000 on home water audits in 2021/22 with a focus on targeting high water users. These audits included the free provision and installation of water savings devices for our customers. It is our ambition to offer this service to all customers in Cornwall
- In 2021/22 we provided subsidised water butts to 755 customers with assumed saving of a total of 996,600 litres of water annually. We have already significantly increased our offering through the provision of free water butts to all customers in 2022/23. Uptake so far has been very positive with 18,000 delivered to date and further 48,000 scheduled for deployment.
- Efforts to increase our communications to customers increased in 2021/22. Our 5-Litre Challenge was well promoted with additional collateral and advertising on billboards, newspapers, back of buses and other public spaces. This activity level is continuing in 2022/23 onwards.
- We also know we can do more as a business, which is why we have been challenging our own operations to be more water efficient. Four WWTWs have been adapted to use final effluent within their processes rather than potable water - providing a saving of 1.1Ml/d. For 2022/23 we have already identified schemes offering reductions of an additional 0.1 Ml/d.
- Our 'community fund' contributed more than £75,000 to 22 community groups in 2022 to support local water efficiency schemes. For example, the provision of rainwater harvesting systems to local business or allotments that would otherwise use potable water.

Meeting our AMP7 PCC reduction targets will be challenging, so we have assessed the impacts on our plan should we not meet these targets. This is discussed in more detail in Chapter 10.

4 Non-household consumption

4.1 Non-household consumption forecasts

Our forecasts of non-household demand only relate to those businesses that are connected to our supply system. Non-households that obtain their water from private supplies are not included within this plan but are considered as part of the West Country Water Resources Group Regional Plan.

Forecasts to 2049/50 were produced by Experian using an econometric method which modelled historic consumption trends against explanatory factors including gross value added, and employment rates. Future forecasts of these factors were then used in the models to understand how future consumption might change. Experian considered the Coronavirus pandemic and how this may impact future demand within its forecasts.

The forecasts show demand in the non-services, accommodation, food and recreation sectors is set to rise, but this is offset by private services and agricultural demand, which is forecast to decrease. Overall, non-household normal year demand in the SWW supply area is forecast to fall from 95 Ml/d to 81 Ml/d by 2049/50. In the Bournemouth WRZ, we expect a slight increase from 61 Ml/d to 64 Ml/d over the same period (**Figure 9**).

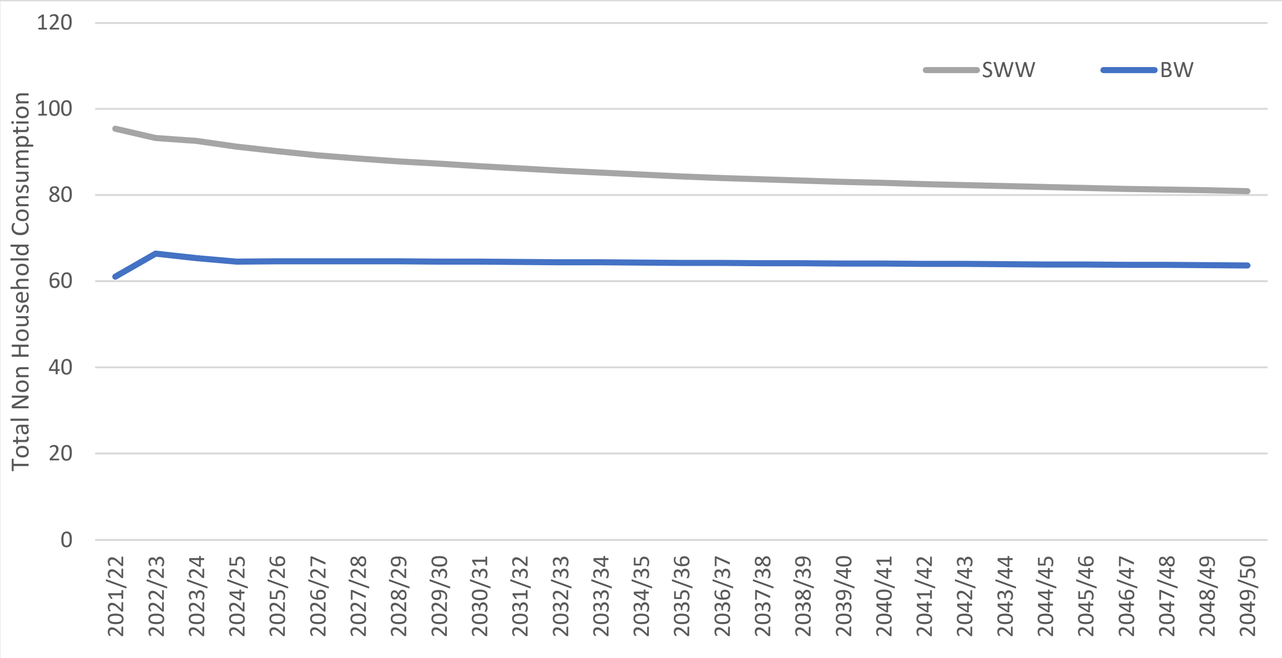

Figure 9: Forecast non-household consumption

Due to the size of one large non-household customer we supply in the Bournemouth WRZ, and the potential impact changes in their consumption could make to our strategy, we regularly liaise with them. As a result, we have forecast a 10% reduction in their water use by 2024/25 with consumption remaining at this level until 2049/50.

Our 21/22 measured non-household consumption was forecast to be lower in the Bournemouth WRZ than our pre-covid 19/20 levels, due to continued impacts of the pandemic, with a recovery in the following year. SWW non-household demand was assumed to be more resilient, with an earlier recovery driven in part by tourism.

We forecast that unmeasured non-household consumption will change at the same rate as the average measured non-household consumption, with some migration of this demand to the measured category as businesses continue to opt to switch to metered billing.

We do not have different levels of service for non-household customers compared to household ones.

4.1.1 Dry year and critical period impact on non-household consumption

Experian provided non-household consumption forecasts for the years between 2022 and 2050. As mentioned above, 2018/19 was a warm, dry year for SWW so we compared the Experian forecast consumption to actual recorded annual consumption to derive a DYAA uplift of 6% for non-household customers.

The DYCP non-household uplift was calculated by updating the analysis undertaken by Ovarro to support our previous WRMP using peak week demand that we have experienced more recently. This provides an uplift of 31% compared to NYAA data.

These uplift factors are not applied to the consumption of the major non-household customer in the Bournemouth WRZ, as its consumption is not strongly dependant on weather conditions nor does it exhibit significant peaks.

5 Leakage

Our baseline leakage forecasts have assumed that we will maintain leakage at our targeted 2024/25 leakage level of 85.3 Ml/d in the SWW supply area, and 13.0 Ml/d in the Bournemouth WRZ. With the continued housing growth and the resultant expansion of our network, maintaining this level will require reductions in both the average leakage per property served and the average leakage per kilometre of main.

As we acknowledged in our Annual Performance Report 2021/22, we continued from our increased investment levels in 2020/21, with significantly higher investment towards finding, fixing and preventing leaks on our network this year.

This put us in good stead as our network was once more tested throughout the year by very high demand due to changes in customer behaviour during the Covid pandemic (an influx of visitors during holiday and summer periods and a higher-than-normal resident population due to the large proportion of second-home ownership in our region). Following the record number of leaks found in 2020/21, we increased this again in 2021/22 by a further 10%.

We also significantly reduced our ‘workbasket’ of leak repairs (leaks found and awaiting repair) by increasing the number of repair crews directed towards leakage related activities. This activity more than halved the number of jobs in our repair workbasket at any one time.

Most importantly, during 2021 we instigated a major leakage recovery plan across all key areas of leakage related activity to reduce our reported leakage significantly. Areas of intensive focus include

- CEO led governance and assurance meetings to monitor progress
- Realignment of leakage related structures and processes to provide an optimal business framework
- Employing extra repair crews to reduce the basket of outstanding leak repair jobs. This has more than halved the backlog of jobs and therefore similarly reduced the volume of leakage contained within that job backlog
- Employed extra leak detection staff to find more leaks
- Significant investment in technology and equipment, acquiring more leak detection equipment for our technicians and increasing the number of leak sensors installed permanently within our water network
- We have increased our use of technology which analyses satellite imagery for a treated potable water ‘signature’ to derive points of interest for further leak detection. Analysis covers large areas quickly
- Extensive investment in pressure management and ‘network-calming’ activities to control excess pressures that lead to more leaks and bursts and higher leakage
- Collaboration/knowledge-sharing with other water companies and leakage experts to establish and implement best practice
- Software/business intelligence tools – enhancing the platforms that we use to report on leakage and target leak detection
- Water-use audits on our own sites – surveys on our own sites to find leaks, wasting water or inefficient water-use

This activity puts us in a good position to deliver on our AMP7 leakage reduction targets.

We do not have reliable estimates of leakage in our Isles of Scilly WRZ. Therefore, company leakage totals shown in the WRMP data tables 2a, 2d, and 2e do not include leakage on the Islands prior to 2020/21.

6 Other components of demand

6.1 Water taken unbilled

Our assessment of water taken unbilled is based on APR reported data.

Water taken unbilled can be either legal or illegal. Around 95% of the water taken legally unbilled is used in the operation of our wastewater treatment works, with the small remainder being used for activities such as firefighting and highway washing. We meter over 60% of our wastewater treatment works, with any site serving more than 2,000 properties measured, to ensure our analysis of volumes used by our WWTWs is accurate and representative.

Examples of illegal use are connections that have been made to our distribution system without permission, and the consumption at void properties which have been occupied without us having been informed. Where we have evidence of water being taken illegally, we investigate and bring prosecutions where necessary.

We will continue to seek ways of improving the methods we use to inform our assessment of water taken unbilled and have assumed that the level of water taken unbilled remains at the same level for the duration of the planning period.

6.2 Distribution system operational use

Our assessment of distribution system operational use is based on APR reported data.

This component of demand covers the water that we use in the operation and maintenance of our distribution system for purposes such as mains flushing and service reservoir cleaning. Our distribution technicians use portable flow meters and hydrants fitted with flow meters to record operational activities such as mains flushing so we can monitor our network activities to ensure we are being efficient.

We will continue to seek ways of improving the methods we use to inform our assessment of distribution system operational use and have assumed that the volume of water we use for these purposes will remain at the current level for the duration of the planning period.

6.3 Overall forecast of other components

The total forecast of these other components is shown in Figure 10.

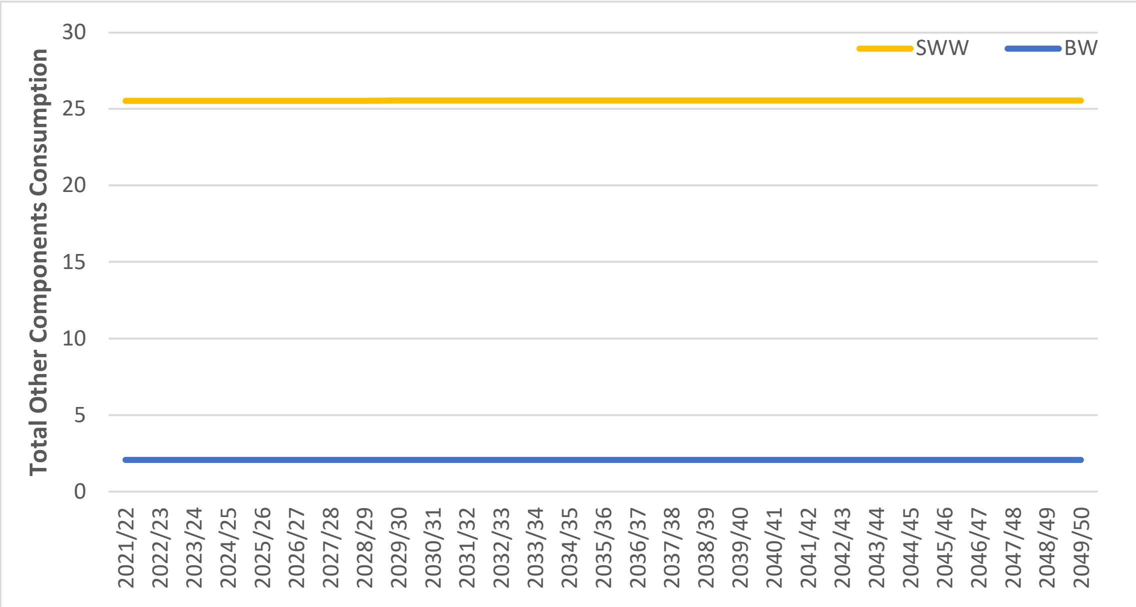

Figure 10: Forecast of Other Components of Demand (MLD)

7 Total demand – distribution input

7.1 Summary of forecast baseline demand

Our baseline demand forecast has been prepared in accordance with our WRMP guidance, assuming that we continue our current optant-only metering programme and maintain leakage at our targeted 2024/25 leakage level of 85 Ml/d in the SWW supply area and 13 Ml/d in the Bournemouth WRZ.

We have also assumed a continuation of our existing capital maintenance and mains renewal policies. We do not envisage that the total demand will be materially affected by any changes brought about by the non-household retail market or other possible market developments in our WRZs.

We predict that total demand will initially fall slightly, driven by household water savings. With a high-level of metering in the base year, additional water savings will become more difficult without new promotion, meaning that continued population growth will then drive demand upwards.

We forecast that, after initial reductions, demand in the SWW area will increase slightly from its current level to 471 Ml/d, while Bournemouth demand will remain relatively flat at around 149 Ml/d in the Bournemouth WRZ, (**Figure 11**).

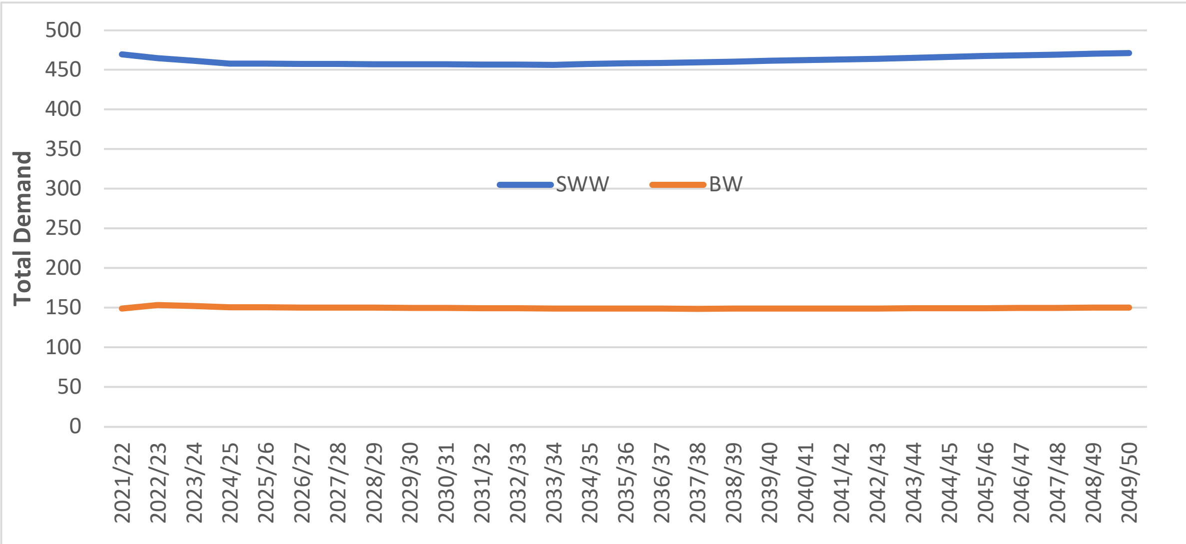

Figure 11: Total Baseline Demand Forecast

To ensure we correctly account for the forecast annual average demand in our modelling, we apply weekly demand profiles to capture the seasonal variability we see. This ensures that our models reflect the right balance of demand through the year, between summer and winter. The profiles we use were updated early in 2022 to ensure that they reflected seasonal demand trends through recent years, particularly the last dry year of 2018. We will review them for the next version of this plan to include data from 2022.

8 Comparison with WRMP19 demand forecasts

8.1 Household Consumption

Our last WRMP was prepared against a 2017/18 base year, and much has changed between then and now. **Figure 12** below shows how the household forecasts we made at that time compare to those in this Plan.

Figure 12: Comparison of household consumption (MLD) forecasts with WRMP19

Previous forecasts reflected the relatively flat historic trend in household consumption up to that time, combined with reductions facilitated by our water efficiency programme. However, that year marked a turning point in the trend, with consumption starting to rise.

Some of that increase related to the ongoing work on complying with Ofwat's reporting consistency guidance, which required us to collect more detailed data. This showed that that the high volumes of water delivered to some of our unmeasured household consumption monitor customers, which we had previously excluded as likely to be from leakage, was consumption. Not excluding these properties from our analysis led to an increase in our estimate of unmeasured household consumption.

A key factor affecting our base year was the Covid-19 pandemic and the measures taken to control its spread. Factors such as the 'stay at home' order imposed by the Government increased levels of working from home, and school closures led to people spending much more time in their homes rather than in workplaces. This transferred some of the demand we normally expect from business customers to households.

As movement restrictions were relaxed, foreign travel remained difficult, and this resulted in many people choosing to spend their holidays in the West Country. Higher than normal visitor numbers, some of whom would be staying in household properties such as B&Bs and holiday cottages, led to increased consumption.

These factors combine to result in a baseline forecast that starts higher than that in our WRMP19.

8.2 Non-household consumption forecasts

While non-household consumption in the base year was suppressed by the measures to control the spread of Covid-19, the preceding rise and an expected return to a more normal position has led to higher forecasts than those in WRMP19 (**Figure 13**).

Since our non-household analysis was completed, more challenging economic conditions have emerged and we will update our final Plan forecasts to reflect this.

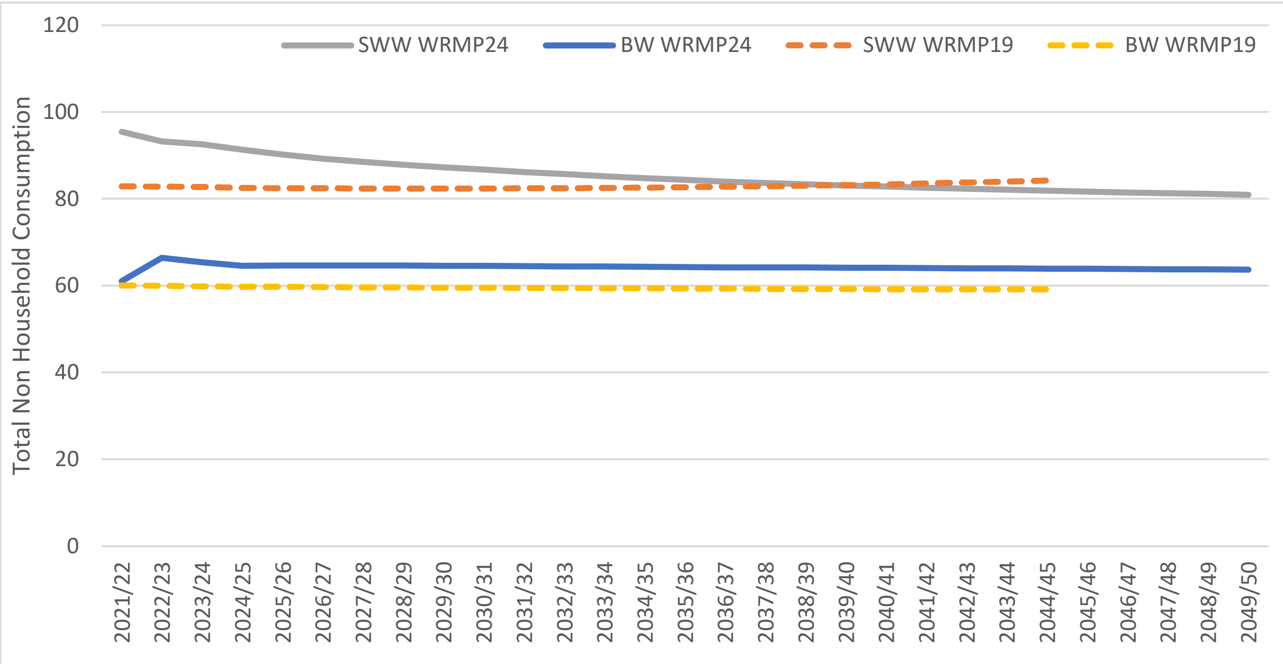

*Figure **13**: Comparison of Non-Household Consumption Forecasts with WRMP19*

8.3 Baseline Demand Forecasts

The changes in household and non-household consumption forecasts described above result in higher baseline forecasts of demand compared to those in our 2019 WRMP (**Figure 14**).

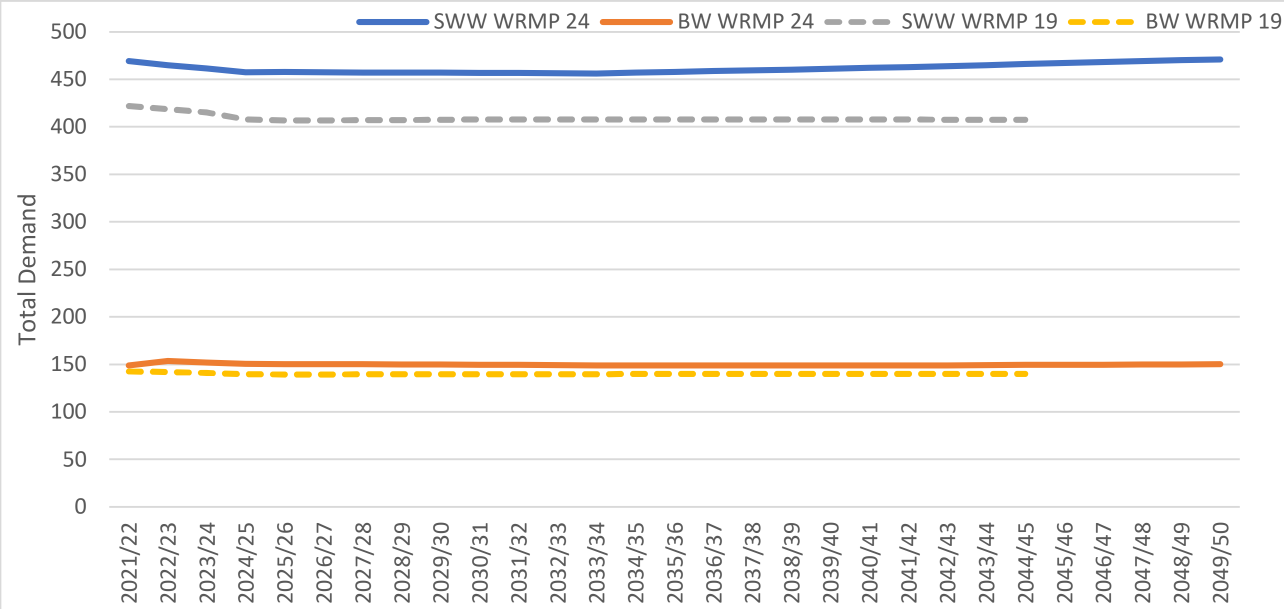

Figure 14: Comparison of total baseline demand forecast with WRMP19

9 Extreme events and resilience

There have been some extreme events since WRMP19 that could potentially impact on the planning process. They may have distorted the situation during the last five years, and they may impact on the future. The areas that are investigated to determine the impacts are Covid19 and the recent weather conditions resulting from climate change.

9.1 Covid-19

The Covid-19 pandemic has resulted in some changes to working patterns, with more people spending some of their time working from home (WFH). Levels of WFH peaked during the early stages of the pandemic, and gradually subsided to lower levels, but levels which are still above those experienced prior to the pandemic. There is a lot of uncertainty around what level of WFH will become 'the new normal' and therefore the level of impact this will have on our consumption forecasts.

As part of our review of the impact of the pandemic on demand we took part in Artesia's collaborative studies "Understanding changes in domestic water consumption associated with COVID-19 in England and Wales" and "The impact of COVID-19 on water consumption during February to October 2020". These reports highlighted the major impact on demand in the SWW region during the pandemic. They provided an initial view of the period to October 2020 so are useful in understanding what had happened, but of less use in understanding any changes in ongoing consumption. We used our billing data and household consumption monitor data to help us form an understanding of these persisting changes.

Our analysis showed that at the end of the 2020/21 base year WFH was increasing household consumption by 4% compared to pre-pandemic levels. As part of their work for us on forecasting non-household consumption Experian provided an assessment that they were expecting levels of WFH to halve in comparison to those in early 2021. We have therefore assumed that future household consumption will be increased by 2%, and this is consistent with the assumptions used in our non-household forecasts.

This 2% uplift is not sufficient to significantly impact our Plan but, in our final version, we will update the assumptions using the latest available data and undertake scenario analysis to show the impact they have on the Plan. To achieve this, we are commissioning updates of both our household and non-household demand forecasts and will be providing the most recent consumption data to the teams delivering these updates. Combining this data with a wide range other additional evidence around things such as demographic changes, and changes in working practices will provide an update on our current assumptions.

9.2 Impacts of climate change

The impacts of climate change on demand are relatively small in comparison to those on our sources of supply, however we have fully considered these within our forecasts.

9.2.1 The effect of climate change on household consumption

As in out 2019 WRMP the impact of climate change was built into our forecasts in accordance with the *Impact of climate change on water demand* report (UKWIR, 2013). Our forecasts are based on a medium climate change emissions pathway (RCP6.0) and this was included in both our household and non-household analyses.

The impact of climate change on household demand in the DYAA planning scenario is estimated to be an 0.84% increase in 2049/50, and for the DYCP consumption used in the Bournemouth WRZ a 2.33% increase.

9.2.2 The effect of climate change on non-household demand

The most recent evidence on how climate change will affect non-household demand is contained within the report *Impact of climate change on water demand* (UKWIR, 2013). One of the report's conclusions was:

"*The analysis of non-household water demand concluded that, except in the case study of agriculture and horticulture in South East England, there is inadequate consistent evidence to justify making any allowance for climate change impacts on non-household demand*."

Analysis undertaken in the production of our non-household demand forecasts suggests that the likely impact of climate change on non-household demand is small. An uplift of 0.1% in 2049/50 has been applied, which is similar to that used in WRMP19.

9.3 Switching of demand from private water supplies

As part of the work undertaken in support of the WCWRG regional Group, ARUP analysed the potential for demand on the public water supply system to increase through users of private water supplies seeking connections to our network. We have included this report in Appendix 6.3. The resilience of private supplies to climate change is not well understood, and increasingly severe weather could prompt users to connect to our network to ensure continued supply during drought.

The study concluded that the uncertainties around this are currently too great to draw meaningful conclusions: the number of supplies, the demand from them and their resilience to climate change are all unknown. The uncertainties are currently too great to understand the risks, but the study did highlight that effort at a national level is required to understand this risk. For this Plan, we consider that the risk of additional demand through potential future connections from users of private supplies is considered within the high-demand scenarios considered in the development of our plan.

10 Uncertainties in demand forecasting

10.1.1 Shorter-term uncertainties

Events of the past few years have increased uncertainty around the base-year demand and likely demand for the rest of the current AMP period, with the Coronavirus pandemic and the drought of 2022 testing our water resources systems.

The Coronavirus pandemic, Government measures introduced to control its spread, and the societal changes that these drove, have added uncertainty around the current position. Compared to previous WRMPs this has increased uncertainty around both the current demand position and the likely position at the end of the AMP7 period.

Demand increased during the pandemic and has not returned to pre-Covid levels, this may have been driven by increased levels of home working and increased tourism within the region. We don't yet have a full understanding of whether demand will return to previous levels, or over what timescale any reduction will occur, and given the unprecedented nature of recent event this will only become clear over time. We are continuing work to further our understanding but, in the meantime, this increases uncertainty around demand early in the planning period.

The increased levels of demand experienced since the pandemic have been a major factor in the water supply issues we have seen in the SWW region over 2022. As part of our response to the drought we are seeking to introduce new sources of supply to reinforce our system, and work continues to develop these. At this time, we cannot be certain over which, if any, of the options we are pursuing will be delivered given factors such as engineering feasibility and environmental sustainability so we cannot include them in our baseline supply forecasts. Appendix 1.1 of this draft Plan details how the drought affected us, the lessons we have learned from it, and the actions we are taking to assist the recovery of our sources.

We have undertaken scenario analysis around these uncertainties to help inform our adaptive plan, and this is described more fully in chapter 10 and 11.

10.1.2 Long term uncertainties

Forecasts of long-term demand changes will always entail uncertainty. Factors that can impact consumption include population growth, housing development, customer behaviour, development of new technology, the state of the economy and a changing climate. It is important to produce a plan that considers these uncertainties inherent within our demand forecasts and is robust to a wide range of plausible futures.

To account for this uncertainty, we have added headroom to our demand forecasts, providing a safety buffer should our forecasts underestimate future demand (See Chapter 7, Section 2.). Also, in Chapter 10 we describe the scenario testing we have undertaken to assess our plan against changing factors in the future that might impact our programme.

South West Water

Bournemouth Water

South West Water Limited, Peninsula House, Rydon Lane, Exeter EX2 7HR, Registered in England No 02366665

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